

TURTLE MANAGEMENT PLAN

REDEVELOPMENT OF LOT 2 RP 82146, MON REPOS ROAD

For



TURTLE SANDS HOLIDAY PARK

DECEMBER 2018

DOCUMENT CONTROL

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1. Introduction

1.1 Preamble

Blandeen Pty Ltd was commissioned by Turtle Sands Holiday Park (TSHP) to prepare this Turtle Management Plan.

This plan has been prepared to accompany the application for redevelopment of TSHP to the Bundaberg Regional Council, and referral to the Commonwealth Department of Environment due to identified species being listed under the Environment Protection and Biodiversity Conservation Act 1999.

Turtle Sands Holiday Park is located directly adjacent to the Queensland Government Mon Repos Conservation Park. The proponents recognise the importance and sensitivity of the site and the detrimental impact of artificial light on marine turtles. The proponents offer the mitigation measures listed within this management plan to ensure a more controlled outcome to the refurbishment park than what currently exists.

This Turtle Management Plan (TMP) contains:

- Threatened species profiles;
- Site specific threat analysis and mitigation strategies; and
- Significant Impact Criteria assessment.¹

1.2 Aims

The aims of this management plan are to:

- Create a profile for the species that occur on and adjacent to the TSHP that are listed as Endangered and Vulnerable under the *Environment Protection and Biodiversity Conservation Act 1999*;
- Summarise potential threats at the population and site-specific levels;
- Provide a proactive mitigation and management strategy to eliminate and reduce identified potential threats;
- Assess the potential impacts using the 'Significant Impact Criteria'.¹

Whilst four (4) species of marine turtle are known to nest on Mon Repos beach, of which three (3) are considered in this document, the endangered Loggerhead turtle (*Caretta caretta*) is of particular focus due to the importance of the location as 'habitat critical to survival' of the species in Eastern Australia.⁵

1.3 Site Location

The subject site is located at the eastern end of Mon Repos Road, and is described as Lot 2 on RP82146.

Turtle Sands Holiday Park is located at Mon Repos Beach, approximately 13km North-east of Bundaberg, Queensland.

The site frontage is on Mon Repos Road, with the Mon Repos Conservation Park adjoining the park on the entire western and northern boundaries. The eastern boundary is 300m long, adjoining Mon Repos beach along the dune.

Refer to Appendix A for Site Location and Aerial.

1.4 Site Characteristics

Turtle Sands Holiday Park is approximately 5.12ha in size and is generally dominated by maintained lawn with scattered mature trees across the site. The hind dune is predominately mature Sheoaks (*Casuarina* spp) surrounded by dune grasses up to the maintained lawn area used for beachside camping.

The existing cabins are located on a sandy ridge through the centre of the site (north to south), with the remainder of the site gently undulating (+/- 0.5m AHD) to the west.

The site is located within the Bundaberg Regional Council local government area, in the Southeast Queensland bioregion, and the Burnett – Curtis Coastal Lowlands subregion. The property is regarded as Coastal within the Burrum Catchment.

Mon Repos beach is located along the rocky coastline between the Burnett and Elliot Rivers, and is the largest of eight nesting beaches made up of Holocene sand deposits forming the Woongarra coastline.²

Mon Repos beach is a designated area (Mon Repos Marine Turtle Designated Area) within the Great Sandy Marine Park. The designated area allows the beach to be closed to the public between 6pm and 6am, restricts vehicle and domestic animal access and torchlight used must be less than three volts to minimise light impacts to nesting and hatchling turtles during turtle season.

There are three vegetation types mapped on site by the Queensland Department of Natural Resources:

- 0.84ha of remnant Regional Ecosystem 12.2.11 – *Corymbia tessellaris* +/- *Eucalyptus tereticornis*, *C. intermedia* and *Livistona decora* woodland on beach ridges in northern half of bioregion
- 0.91ha of non-remnant regrowth within 50metres of a watercourse or drainage feature in the Great Barrier Reef catchment areas
- 3.42ha of non-remnant regrowth vegetation

The entire 0.84ha of RE 12.2.11 will be retained along with the 0.91ha of non-remnant regrowth within 50m of the drainage line on site.

Revegetation of the frontal dunes within the adjacent Mon Repos Conservation Park occurred as a collaboration between the Queensland Government and the Woongarra Shire Council in the early 1980's to reduce coastal lighting impacts.³

Refer to Appendix B, C and D for site photographs, current layout and proposal details.

1.5 Proposal Details

Turtle Sands Holiday Park currently hosts 106 sites across the 5.12ha area. Since 2011, the holiday park has primarily catered for group style bookings including, but not limited to, groups of families and friends, school groups and caravan clubs.⁴ The park operated as a full-time caravan park from 1974 through to 2011, averaging between 70 – 80% capacity through the year with peaks during school holidays and turtle season. The park currently operates at 100% capacity during peak holiday periods.

The recent investment of \$16 million into development and expansion of the adjacent Mon Repos Visitor Centre has been a catalyst for redevelopment planning to cater for increased patronage to the Visitor Centre, increased patronage of the turtle rookery generally and consequentially increased tourist accommodation demands for the locality.

The redevelopment proposes to increase the number of sites and capacity from the level at which it is currently operating as summarised in Table 1.

Table 1: Current and Proposed Site Capacity

Current Site Operation	Proposed Site Operation
106 Sites 330 Person capacity	127 Sites 416 Person capacity
6 cabins 65 serviced sites 35 un-serviced sites	37 cabins 69 serviced sites 9 glamping tents 12 (4 berth) dorm rooms

Refer to Appendix C and D for current and proposed site layouts.

1.6 Town Planning and Lawful Fettered Use

The holiday park was established in 1974, predating the former 1976 Woongarra Shire Planning Scheme. InsiteSJC, Town Planners and Surveyors, advise the 1976 Planning Scheme was the first town planning instrument for the then Woongarra Shire Council and that the holiday park is therefore a lawful fettered use.

The park was lawfully established and does not have any Local, State or Commonwealth Government conditions attached to the land or to the use of the land. Therefore, so long as the development footprint does not alter, TSHP can continue to operate in perpetuity without the need to seek town planning approval.

InsiteSJC further advises that it is unaware of any Local, State or Federal Government head of power which guides the operation of the holiday park or the level of artificial light use on site.

The current level of artificial light on site is substantially determined by the practices of the current park operator, being that of a low intensity, low scale and low ecological footprint holiday experience for guests. This management plan has been prepared to provide a proactive approach to control and management of artificial light on site.

1.7 Turtle Sands Holiday Park History

Turtle Sands Holiday Park commenced operation in 1974, six years after the commencement of formal turtle research on Mon Repos beach by the Queensland Turtle Conservation Project, led by Dr Colin Limpus from the Kelvin Grove Teachers' College. The TSHP provided accommodation to tourists visiting the region to observe the nesting turtles.

In its first years of operation TSHP provided accommodation and a research base to the Queensland Turtle Conservation Project, most notably, during the marked hatchling studies undertaken by Dr Limpus which redefined scientific understanding of marine turtle life cycles.

The commitment to turtle conservation has been enduring through to the current owners. There is a number of informal agreements in place to ensure a good neighbour approach to both turtle conservation and tourism is honoured.

Each year at the commencement and completion of research activities the owners of TSHP and Dr Limpus (now Queensland Department of Environment and Science (DES)) meet to

update TSHP on the current and ongoing research priorities and results as well as to discuss long-standing (22 years) agreements for:

- DES, its employees, volunteers and visitors, to access the dune of TSHP for the purpose of turtle research, data collection and environmental education;
- TSHP patrons to sit on the top of the dune monitoring the beach for nesting turtles, and are permitted to join the DES turtle programs to view nesting and hatchling turtles within 300 metres of the TSHP boundary; and
- New and ongoing research undertaken by university students under the supervision of Dr Limpus (DES) and permission to access, and in some cases alter the landscape of TSHP for research purposes.

In addition to the above, operationally, TSHP have a number of existing processes in place regarding nesting on Mon Repos beach:

- Guests are provided with informal guidance on management of light (shading of external and internal lights from the beach);
- DES 'Cut the Glow' campaign pamphlet is attached to each guest's booking receipt;
- Guests are notified at the time of booking of the beach closure (below high water) from 6pm – 6am; and
- Guests have the opportunity to attend on-site marine turtle presentations by DES Rangers during peak school holiday periods.

2. Relevant Legislation

All six (6) species of marine turtle occurring in Queensland are listed as threatened under State and Commonwealth legislation. Four (4) species of marine turtle have been recorded breeding at Mon Repos beach.

The *Nature Conservation Act 1992* (NCA) protects flora and fauna species in Queensland. The Act is administered by the Department of Environment and Science.

The Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) is the central legislation for protection of nationally significant environmental values in Australia. The Act is administered by the Department of Environment (DOE). Any action that will have a significant impact to protected species is assessed to determine if the action is to be prohibited or controlled under the legislation (approved subject to conditions).

Australia is a signatory to a range of international agreements and conventions. The Convention on the Conservation of Migratory Species of Wild Animals (CMS) is particularly relevant to this plan as CMS adopted the Single Species Action Plan (SSAP) for the Loggerhead Turtle (*Caretta caretta*) in the South Pacific Ocean. The SSAP is not legally binding, but provides a framework and actions for the recovery of the Loggerhead turtle nesting at Mon Repos. Australia is a member of the International Union for Conservation of Nature (IUCN). Refer to Table 2 for relevant marine turtle conservation status.

Table 2. Conservation status of marine turtles

Species	Scientific Name	State <i>Nature Conservation Act 1992</i> (NCA)	Commonwealth <i>Environment Protection and Biodiversity Conservation Act 1999</i> (EPBC Act)	International International Union for Conservation of Nature (IUCN)
Loggerhead	<i>Caretta caretta</i>	Endangered	Endangered	Vulnerable (Global) Critically Endangered (South Pacific)
Flatback	<i>Natator depressus</i>	Vulnerable	Vulnerable	Data deficient
Green	<i>Chelona mydas</i>	Vulnerable	Vulnerable	Endangered
Leatherback	<i>Dermochelys coriacea</i>	Endangered	Endangered	Endangered

3. Species Profile

Four (4) species of marine turtle have been recorded breeding at Mon Repos Beach. The status, habitat and distribution are discussed by species below. Threats identified for each species in the Recovery Plan for Marine Turtles of Australia will be addressed through a site-specific assessment in section 5.4.⁵

The last recorded nesting event on the east coast of Queensland for the Leatherback turtle was in 1996 and it is understood that the nesting population of Leatherbacks in eastern Australia is likely to be functionally extinct.^{6,7} Leatherback nesting is therefore considered to be unlikely to recommence at Mon Repos, and is not considered within this management plan.

3.1 Loggerhead Turtle (*Caretta caretta*)

3.1.1 Current Status

The Loggerhead turtle nesting has been monitored at Mon Repos beach since 1968, with a long history of observations prior to this date. The nesting population declined by 86% between the mid 1970's and 1999 and is classified as 'in early stages of decline' in the Recovery Plan for Marine Turtles of Australia.^{5,8}

Between 400 - 480 turtles currently nest annually at Mon Repos between October and March.³ The Loggerhead turtles nesting at Mon Repos form part of the south-west Pacific (swPac) genetic stock.⁹

3.1.2 Habitat and Distribution

Nesting by turtles from the Loggerhead swPac genetic stock occurs on sandy beaches of almost exclusively in Australia and New Caledonia.⁹ Greater than 80% of nesting by this genetic stock occurs in protected areas under management of the Queensland Government.⁹

Mon Repos beach is one of three index beaches used to monitor the population since 1969.³ The mainland coast from Mon Repos north to Wreck Rock is the major rookery for the swPac genetic stock. Mon Repos beach is identified as 'habitat critical to survival' for the species within the Recovery Plan for Marine Turtles in Australia.⁵

3.1.3 Threats to the Population

The Commonwealth Recovery Plan for Marine Turtles in Australia (Commonwealth of Australia, 2017) identifies that the major threats to the swPac genetic stock of Loggerhead turtle are:

1. Fisheries bycatch – international
2. Climate change and variability
3. Marine debris – entanglement and ingestion
4. Light pollution

The Convention on the Conservation of Migratory Species of Wild Animals in 2014 developed a Single Species Action Plan for Loggerhead Turtles (*Caretta caretta*) in the South Pacific Ocean (SSAP).¹⁰ The SSAP states the *Very High* risk threats to the population are:

1. Terrestrial predators
2. Fisheries by catch
3. Marine debris
4. Lower water table
5. Changed light horizons
6. Climate change/ variability

Ten additional threats were identified as *Moderate* or *Low* risk for the population (e.g. Tourism) within the SSAP.

Seven (7) actions are suggested within the SSAP to achieve the objective of ‘managing coastal lighting at significant loggerhead turtle nesting beaches to create a dark coastline’. Six (6) of the seven (7) actions relate to practical design elements that can be incorporated into coastal development at Loggerhead turtle nesting beaches.

All six (6) actions have been implemented in the development of this management plan:

1. Turn off all lighting at recreational areas within 100 m of the nesting beaches after 8:00 pm until daylight during nesting and hatching season (October to May);
2. Prohibit the use of vertical illumination of buildings, other structures and vegetation using lighting that shines into the sky within 1.5 km of the nesting beaches during the nesting and hatching season;
3. Fit 25 cm deep vertical shades to all street lights within 1.5 km of the nesting beaches, and possibly others that remain visible from the beach;
4. Activate lighting required on stairs and access areas for safety purpose with proximity sensors or motion detectors with an associated deactivation of lighting after 10 minutes;
5. Explore the feasibility of using lines of road-surface mounted LED lights in place of street lights; and
6. For buildings visible from nesting beaches, interior lighting should be blocked from shining from the interior of the building towards the respective nesting beaches during the nesting and hatching season.

The final recommended action ‘*Continue to investigate new options for lighting that does not have a negative impact on turtle population function*’ relates to the opportunity for research and development, which is outside the scope of this management plan.

3.2 Flatback Turtle (*Natator depressus*)

3.2.1 Current Status

The Flatback turtle has been observed nesting at Mon Repos beach since 1968, and in that time the total nesting population has fluctuated annually between 2 and 14 individuals.¹¹ Mon Repos is an index beach for Flatback turtles in eastern Australia.

The Flatback turtles nesting at Mon Repos form part of the eastern Queensland genetic stock and are classified as ‘Stable’ in the Recovery Plan for Marine Turtles of Australia.⁵ Further, Flatback nesting along the Woongarra coastline (of which Mon Repos beach is a component) has also been identified as ‘Stable’.¹³

3.2.2 Habitat and Distribution

Breeding for the Eastern Queensland Flatback turtle occurs between Bundaberg and Townsville and is centred on continental islands in inshore areas; Peak, Wild Duck, Avoid, Facing and Curtis Islands, with the remainder made up of low-density nesting on mainland beaches.¹¹

Mon Repos is identified as a minor rookery and has been monitored as an index beach for the population since 1968.¹¹

3.2.3 Threats to the Population

The Commonwealth Recovery Plan for Marine Turtles in Australia states that the major threats to the Eastern Queensland Flatback turtle are:⁵

1. Climate change and variability
2. Light pollution

3.3 Green Turtle (*Chelonia mydas*)

3.3.1 Current Status

Green Turtles nesting at Mon Repos beach are identified as part of the southern Great Barrier Reef (sGBR) genetic stock which has been assessed as recovering.¹³ The population of Green turtles at Mon Repos has less than ten (10) individuals nesting annually.¹⁴

3.3.2 Habitat and Distribution

The majority of nesting for the sGBR Green turtle is located on the Southern Great Barrier reef islands with index beaches located at Heron, Wreck, North West and Lady Musgrave Islands.¹⁴ Mon Repos beach (as part of the mainland coast from Bustard Head to Bundaberg) is identified as a minor nesting beach for the sGBR Green turtle.¹⁴

3.3.3 Threats to the Population

The Commonwealth Recovery Plan for Marine Turtles in Australia states that the major threats to the sGBR Green turtle are:⁵

1. Climate change and variability
2. Marine debris – ingestion
3. Chemical and terrestrial discharge – chronic

4. Site Specific Threats and Mitigation Strategies

Site specific threats and mitigation strategies for the entire site and specific to precincts within the redevelopment are identified in the sections below. For the purpose of this report and the mitigation strategies tied to the timeframe; 'turtle season' is defined as the period of time where turtle nesting and hatching occurs at Mon Repos, as notified by DES annually on commencement of nesting and completion of hatchling emergence.

4.1 Artificial Light at Night

Artificial light disrupts critical breeding activities for both nesting and hatchling turtles.

- Nesting turtles are known to avoid nesting habitat that is polluted with artificial light.¹⁵
- Hatchling turtles are both disorientated and misorientated by artificial light, which can result in increased predation, depleted energy resources and results in an overall reduction in survivorship.^{15,9}
- Darkness remains as the best management outcome for marine turtle nesting beaches, as turtles require natural illumination of nesting beaches for successful nesting and sea finding behaviour.^{16,17}

There is clear evidence that in its current state, artificial light negatively influences turtle behaviour on the Woongarra coastline:

- The Woongarra coast was identified as one of the two most light-polluted areas along the Australian coastline in a study by Kamrowski *et al* using satellite imagery of night illumination¹⁸
- Observations of hatchlings exiting the water to crawl on the sand towards the Bargara sky glow at the southern end of the beach (Queensland Turtle Research Project, unpublished data)
- There is also evidence that nesting turtles are deserting illuminated beaches, for example, a decrease in nesting has been documented at the nearby Kellys Beach since 1985³
- The illuminated sky glow from the cumulative effect of lighting in nearby towns to Mon Repos is now visible more than three kilometres out to sea³

The current status of artificial light impacts along the Woongarra coastline reinforces the need for a collective approach by the relevant Local, State and Commonwealth authorities and peak community bodies (Such as the Urban Development Institute of Australia (Wide Bay Branch). Despite there being no statutory control on artificial light, the wider community (in particular the groups mentioned above) should also be committed to providing best practice management of artificial light to ensure the long-term sustainability of Mon Repos for both environmental and economic reasons. Guidelines for the management of light pollution on turtle nesting beaches are currently in development by the Commonwealth Government.

The impact of artificial light on important populations is only detectable over long periods (decades) due to the long life cycles.⁵ Continued long term monitoring of the impact of artificial light on the behaviour and orientation of both adult and hatchling turtles on site is critical.

Despite being marketed as 'Turtle friendly', amber LEDs are proven to disrupt turtle ocean-finding behaviour.¹⁷ Notwithstanding this, artificial light is required within TSHP for the purposes of navigation and safety. Amber LED's remain the best commercially available product in the absence of a proven 'turtle friendly' luminaire.

The majority of clutches emerge between 8pm and midnight.¹⁹ The SSAP has adopted 8pm as a suitable time for coastal lighting to be extinguished, as such, the use of outdoor lighting

at TSHP will be largely managed by an 8pm curfew where outdoor lights will be extinguished, dimmed or motion activated.¹⁰ We understand that the practice of extinguishing and motion activation of outdoor recreational facility lighting after 8pm has been adopted by both Bundaberg and Sunshine Coast Regional Councils as best practice around turtle nesting beaches.¹⁶

The redevelopment proposes to add purposeful light to the buildings on site at levels as low as is reasonably practical, designed to reduce both direct light and contribution to sky glow. In full operation, both permanent and temporary lighting will be used on site. Permanent lighting, light which is fixed to building structures as part of this refurbishment, is mitigated by the measures as listed in section 4.1 of this plan. Temporary lighting, that which is brought onto and leaves the site with guests, is primarily managed by measures listed in section 4.2 of this plan.

The following measures are proposed on the TSHP site during turtle season to reduce overall impact of artificial light:

- A light curfew imposed from 8pm across the site (exclusions as listed within this TMP);
- Smart controls will be used to manage artificial light in a coordinated and efficient way from a central location within TSHP. All outdoor lights will be switched off or motion-activated during the curfew period (depending on location and use), with an associated deactivation time of a maximum of five minutes;
- Intermittent flashing lights (as per the Mon Repos Conservation Park) will be used on site to mark intersections, pedestrian walkways, beach access pathways, points of interest and hazards;
- All lights permanently installed on site will be:
 - Amber LEDs with a correlated colour temperature (CCT) equal to or lower than 2700K (outdoors) and 3000K (indoors);
 - Will achieve an upward waste light output ratio (ULR) of 0%;
 - Will be recessed inside of roof structures, buildings or have a minimum of 30cm shielding applied;
 - Luminaires will be mounted as low as possible using asymmetrical distribution, minimising the angle of incidence and reflectance; and
 - Not directly visible from the nesting habitat.
- Exterior and interior finishes on all buildings will be matte, dark in colour and have a maximum reflective value of 30%; and
- Dune vegetation and site topography will be maintained in the current state;
- Roof height windows facing the beach have been removed;
- No skylights installed anywhere on site to avoid contribution to sky glow;
- All glass (windows/doors/balustrades) visible from the beach will have a tint applied with a visible light transmittance value of 15% for beach facing windows and less than 25% for all other glass;
- All glass (windows/doors) visible from the beach will have opaque (block-out) blinds/curtains fitted to reduce light spill at night; and
- All stand-alone windows will have a timber framed awning angled downwards to reduce any horizontal or upward light spill.

The proposed artificial light project footprint is summarised in Table 3. Note that the output of light for particular buildings will be finalised as part of the building application process.

Table 3: Project footprint - Artificial Light

Name	Type*	Total number estimate (subject to detailed design)	Location	Orientation and mitigation*	8pm – dawn curfew activity level
Outdoor accommodation	Amber LED; CCT = <2700K; ULR = 0%; FCOL.	47 (1 per accommodation building)	Outside cabins and studios, glamping tents.	DSL; 30SH.	Extinguished
Indoor accommodation	CCT = <3000K; ULR = 0%; FCOL.	As low as reasonably practical	Located within cabins, studio, reception and managers' residence, glamping tents and dorm rooms.	DSL; WT<25; BO; NONREF.	As required by user.
Intermittent flashing lights	As per Mon Repos Conservation Park	Pending detailed design	Road intersections, pedestrian/vehicle conflict zones, Beach access points, hazards and other way finding locations.	Nil.	On
Toilet facilities building lights	Amber LED	3 (inclusive of push activated light for accessibility ramp)	Fixed to building used at night	Mounted low at entrances and on ramp; 30SH.	Motion activated, manually activated for ramp.
Recreational/Reception/Bunkhouse Precinct lights (external)	Amber LED; CCT = <2700K; ULR = 0%; FCOL.	Pool lounge: 4 (1 per deck on building); Camp Kitchen: 4 in outdoor dining and cooking; Pool and Playground: 6 bollard lights Reception: 3 (East, south and west sides of building) Bunkhouse: 2 per level per building, 4 in outdoor undercover deck. Workshop: 1 light located on outside of building	Pool lounge, Camp kitchen, Reception and Bunkhouse: Recessed within the roof of outside deck areas with associated shielding to the east. Pool and Playground: Low Bollard lighting with substantial opaque shielding towards the nesting habitat.	DSL; 30SH,	Pool Lounge: Deck lighting extinguished. Camp Kitchen: 50% Dimmed from 8 – 10pm and extinguished after 10pm. Pool and Playground: 50% Dimmed from 8 – 10pm and extinguished after 10pm. Reception: Motion activated after 8pm to provide wayfinding to reception. Deactivation after a maximum of 5 minutes. Bunkhouse: Motion activated after 8pm to provide wayfinding to rooms. Deactivation after maximum of 5 minutes. Workshop: Extinguished except during emergency work.
Recreational/Reception and Bunkhouse Precinct lights (internal)	CCT = <3000K; ULR = 0%; FCOL.	As low as reasonably practical	Located within buildings used at night.	DSL, WT<25; BO; NONREF;	Recreational and Bunkhouse: 50% dimmed from 8 – 10pm and motion activated after 10pm. Reception: As required at night.
Accessibility lighting	Amber LED strip or bead; CCT = <2700K	As required to fulfil compliance with AS1482: Australian cont. Standard design for	Embedded within ramps or mounted at appropriate heights with substantial shielding.	DSL	Manual activation at top and bottom of ramps with associated deactivation after 5 minutes.

Name	Type*	Total number estimate (subject to detailed design)	Location	Orientation and mitigation*	8pm – dawn curfew activity level
		access and mobility			
Entrance road lighting	Amber LED road mounted bead lights	Pending detailed design	Embedded within the road up to the boom gate at entrance, and from boom gate to road at exit.		On or headlight activated.
<p>*ULR: Upward Light Output Ratio FCOL: Full cut-off luminaire DLSB: Direct Light Source is shielded from the beach through architectural features or vegetation screening, 30SH: Minimum of 30cm shielding applied on the beach side of the luminaire, WT<25: Tinting with a light transmittance value of less than 15% for glass visible from nesting habitat and 25% elsewhere in the park , BO: Block-out curtains NONREF: Non-reflective surfaces and paint</p>					

New outdoor lighting installation

If, in the operational phase of this project, a public safety hazard is identified that can only be mitigated through the use of artificial light, additional lighting may be required. Consultation and written support from DES representatives are required prior to any new light installation.

Exemptions

The following types of outdoor lighting installations are permitted in the park and are not subject to the other conditions of this TMP:

- Lighting installations required by the Commonwealth, State or Local law;
- Lighting installations required temporarily for emergency tasks (such as evacuation) at the discretion of the park manager;
- Where colour rendition is required for cooking (eg. over BBQ areas in camp kitchen, bunkhouse kitchen or within cabins/glamping kitchens), however, these will be motion activated after 8pm with an associated deactivation period of no more than five minutes;
- Where required to fulfil the requirements of AS1482: Australian Standard design for access and mobility; and
- Low intensity ‘holiday lighting’ whose use is specific to events prior to 8pm (e.g. Christmas).

4.1.1 Internal roads

All streets, driveways, service areas and parking bays have been designed to minimise the impact of headlights on Mon Repos beach.

Under the Australian Standard AS/NZS1158.3.1-2005, Clause 1.2 states the following when deciding when to apply road lighting design standards

“Subject to the requirements of applicable laws, the choice of whether to install a scheme of road or public space lighting in compliance with this Standard and, if so, which subcategory of lighting is appropriate, rests with the client (usually the applicable local government authority). This decision is typically based on factors such as night-time pedestrian traffic flows and other patterns of use.”

There is currently no road lighting installed at TSHP and due to the significance of the marine turtle populations at Mon Repos, we propose no additional installation of road lighting

through the redevelopment. Mitigation elements listed below are sufficient to manage the potential conflict between pedestrians and vehicles on site.

The existing residential development to the west of TSHP on Harmony Road at Mon Repos, developed in mid to late 1980's, sets a precedent that residential developments can occur in ecologically sensitive locations with no impact to threatened turtles. The development has no street lighting and no outdoor entertainment lighting after 8pm on the residential properties whilst still providing adequate residential facilities to its occupants.

This proposal to not install road lighting supports action 13.1.5 of the CMS SSAP for the Loggerhead turtle, which is to explore the feasibility of using lines of road-surface mounted LED lights in place of street lights.

For all internal roads, the following suite of elements will be implemented in a coordinated approach to eliminate street lights on internal roads:

- A maximum vehicle speed of eight (8) kilometres per hour and a 'shared zone' designation where vehicles must give way to pedestrians;
- Reflective beacons (cat's eyes) on all roads;
- Traffic calming devices such as separation kerbs, speed humps or cushions and other devices to reduce speed;
- Intermittent flashing lights (short flash, long lull) to mark intersections;
- Reflective signage at t-intersections;
- Road surface materials will be dark in colour and selected to minimise reflectance;
- Reflective paint and posts used on and at the side of the road to delineate designated pedestrian areas;
- Vehicle/pedestrian conflict zone crossing areas may also be identified by reflective signage, roadside fencing/ barriers and wayfinding signage;
- At the entrance to the park, road-surface mounted LED stud lights may be used to provide road users a gradual adjustment to the road treatments within the park; and
- Where high pedestrian/vehicle conflict zones are identified and are unable to be managed using other mitigation tools, manual activation of a shielded light may be used to ensure guests' safety when crossing the internal road, with an associated deactivation period after less than five minutes.

It is strongly recommended that the proponent engage a lighting engineer at operational works stage to conduct a detailed design and site-specific lighting risk assessment to further understand the risk and public liability elements.

4.1.2 Beach access points

Existing beach access pathways will be formalised up to the nesting habitat, and maintained as natural pathways to the beach to identify wayfinding to the beach, increase guest safety and minimise disturbance of nesting habitat. Beach access pathways will be indirect, ensuring that vegetation is used to block and filter any light from reaching the beach. In addition to the above, beach access points will not be located in line with internal roads in order to reduce potential for headlights to shine directly onto the nesting habitat.

Beach access pathways will be identified by an intermittent flashing light, in keeping with pedestrian navigational lighting used within Mon Repos Conservation Park.

Refer to Appendix D for the beach access locations within the proposed layout plan.

4.1.3 Vegetation and Elevation

Site vegetation and elevation has a critical role in screening and shielding artificial light from reaching the beach and the sky. To preserve the current state and role of vegetation and elevation on site and to maximise screening for hatchling turtle orientation between 0° (horizon) and 30° (high):

- Greater than 90% of all vegetation surrounding the beachside camping precinct will be retained as a screen between the nesting beach and light sources;
- Shrubs and grasses to the east of the beachside camping precinct will be retained and maintained to shield the view of hatchlings on emergence and during ocean-finding;
- Revegetation of the beachfront camping precinct is already underway with additional Sheoaks currently being planted; and
- The existing topography of the site will be maintained.

In addition to this, the following vegetation will be added on site:

- Screen planting of medium sized trees is proposed in front of the toilet facility building to screen any potential light from the building use overnight;
- Canopy trees are proposed throughout the accommodation on site, and in front of the recreation buildings, pool, playground and open recreational spaces.

Refer to Appendix D for proposed site landscape plan.

4.1.4 Recreation precinct

The recreation precinct is the central focus of the site and is located in the centre and to the west of the sandy ridge (topographical peak) at a distance of approximately 110m from the highest astronomical tide (HAT) line. It consists of the toilet facility, pool lounge, camp kitchen, swimming pool and playground.

The recreation precinct will typically be used by guests during daylight hours and before 10pm. Building and lighting design has been focused on strategic placement of buildings and the elimination and mitigation of the artificial light on site.

In addition to those listed in Section 4.1, the following design elements have been considered to reduce light pollution onto Mon Repos beach:

- The recreational buildings and precinct have been situated and orientated to minimise exposure to the nesting habitat. The topography and vegetation on site along with the placement of the toilet facility, provides a light shield for the camp kitchen, pool, playground and to some extent the pool lounge. The building entrances all face towards the centre of TSHP, to create a central point of social interaction and limit the exposure of artificial light to the surrounding areas;
- The pool and playground will be closed from 10pm;
- Privacy screening will be erected around the drying area, with dual purpose as light shield for the playground and camp kitchen;
- Television screens will be located so that the screen is not visible from nesting habitat;
- The toilet facility has been designed with no openings or windows on the beach side of the building, and fitted with motion activated lighting at the entrances after 8pm for wayfinding and safety when using the facility at night; and
- The beach facing deck of the Pool Lounge and Camp Kitchen will have timber cladding from the deck floor to the railing. Opaque (block out) blinds on the Pool Lounge that will be lowered by Park Management at 8pm to manage any filtered light from inside the building from reaching the beach (refer Section 6.2.1 Code of conduct).

In addition to those listed in Section 4.1, the following light mitigation elements are proposed:

- Outdoor lights will operate at 50% dimmed capacity between 8pm and 10 pm and then are extinguished through to dawn. With exceptions as follows
 - The toilet building entrance lights will remain motion activated with an associated deactivation period of a maximum of five minutes;
 - Outdoor deck lighting on the north, south and beach facing decks of the Pool Lounge will be extinguished from 8pm – dawn;
- Indoor lights will operate at 50% dimmed capacity between 8 and 10pm, and will be motion activated after 10pm with an associated deactivation period of a maximum of five minutes;
- Luminaires on buildings will be located on the southwest side of the building; and
- No pool lighting will be installed (underwater or reflecting onto pool surface).

Refer to Appendix D for recreational precinct building plans.

4.1.5 Beachfront camping precinct

The beachfront camping precinct is located between 12 and 20m from property boundary, and is comprised of 31 sites, half of which are directly adjacent to the nesting habitat. The beachfront camping precinct remains largely unchanged from its current operation; however, individual sites have been expanded and the number of sites decreased to accommodate the sealed road.

Each site will contain a synthetic grass pad to prevent wear from overuse. The existing fence will be removed and a replacement fence will be installed to protect nesting habitat through delineation of the camping precinct extent and encourage the use of designated beach access pathways. Proposed fencing will be turtle friendly with either a post and rail or a post and rail with plastic filament strand. Service facilities (water and power) for the sites will not be fitted with lighting.

Apart from a sealed road and fencing, there are no permanent building structures proposed in this precinct. Intermittent flashing lights at the beach access pathway and at the road intersection are the only permanent lights proposed in this precinct.

The code of conduct (Section 6.4.1) for park guests is intended to manage the anthropogenic elements of the patrons using the beachfront precinct, in particular, the temporary lighting that will be brought into the site with caravan or camping equipment.

Refer Appendix D for proposed site plan.

4.1.6 Cabin and Glamping precinct

The cabin and glamping precincts are located in the central northern and central southern areas of the park along the sandy ridge which is the highest point on the site. The beachfront cabins, existing residence and glamping tents are located a minimum of 95m away from the HAT.

In addition to those listed in Section 4.1, the following design elements are proposed to reduce light pollution onto Mon Repos beach:

- No skylights or roof height windows on the beachside cabins and glamping tents to avoid contribution to sky glow;
- Television screens will be orientated so they are not visible from the nesting habitat; and

- An opaque nib wall or dense vegetation (less than 10% visible light transmittance) is proposed on the beach side of allocated carparks to block headlights from reaching the nesting habitat.

In addition to the measures listed in Section 4.1, the following light mitigation elements are proposed:

- Outdoor lights are extinguished from 8pm through to dawn.

Refer to Appendix D for building designs.

4.1.7 Bunkhouse precinct

The bunkhouse precinct is located a minimum of 130m away from the HAT line in the northwest corner of the site at an elevation of 5.5m AHD. The bunkhouse building consists of a two-storey dormitory style building with a central kitchen and dining area on the bottom floor. Building and lighting design has been focused on elimination, and mitigation of the artificial light on site.

In addition to those measures listed in Section 4.1, the following design elements are proposed in order to reduce light pollution onto Mon Repos beach:

- Some shielding is provided by the topography of the site along with the building structures and vegetation that are located between the precinct and the nesting habitat. The bunkhouse building is 3.8m higher than glamping tents 89, 90 and 91, which are located directly between the bunkhouse and the nesting habitat;
- The building has been designed and orientated to reduce artificial light impacts to the nesting habitat through the elimination of beach facing windows on the northern wing of the building. Windows visible from the beach have been removed on the top floor, and windows on the bottom floor have opaque (block out) blinds;
- Timber panelling will be fitted to shield the second-floor decking area on the northern wing of the building;
- No furniture will be placed outside the rooms on the second level of the building to reduce the likelihood of triggering of the motion activated lights after 8pm;
- All windows facing the beach have block-out curtains to reduce light spill at night;
- The open campfire will be shielded from the beach by glamping tents 89, 90 and 91 and vegetation on site;
- All vehicle parking bays face away from the beach, and guests will be instructed to park with vehicle headlights facing away from the beach; and
- Dormitory doors are fitted with a gas strut for self-closing.

In addition to the measures listed in Section 4.1, the following light mitigation elements are proposed:

- Outdoor lights for navigation to rooms and toilet facility will be motion activated from 8pm with an associated deactivation period of a maximum of five minutes;
- The indoor open kitchen and dining area will operate at 50% dimmed capacity between 8pm and 10pm and be motion activated after 10pm with a deactivation period of five minutes; and
- The internal lights of the toilet facility within the building will be motion activated after 10pm with an associated deactivation period of a maximum of five minutes.

Refer Appendix D for the layout and building design of the bunkhouse precinct.

4.1.8 Park Entrance

The park entrance precinct is located at the southwest corner of the site and comprises of the entrance roadway, manager and reception building and workshop building. Building and lighting design has been focused on elimination, and mitigation of the artificial light on site.

In addition to those measures listed in Section 4.1, the following design elements are proposed in order to reduce light pollution onto Mon Repos beach:

- Building has been designed to limit the number of windows facing the nesting habitat;
- Beach facing windows are shielded through architectural features; and
- All beach facing doors are automated or fitted with a gas strut for self-closing.

In addition to the measures listed in Section 4.1, the following light mitigation elements are proposed:

- Road mounted LED bead lighting installed into the road to allow drivers gradual acclimation to the 'dark park' environment within TSHP;
- Park signage not be illuminated; and
- Any flags across the site will be lowered by 8pm.

Refer to Appendix D for the layout and building designs.

4.2 Anthropogenic Impacts

The redevelopment of TSHP will result in an increase in the capacity to accommodate people on site from 330 to 416 persons (based on maximum capacity). The additional 86 persons on site represents a potential increase in anthropogenic impacts on site such as;

- Artificial light usage (tent lights, vehicle headlights, handheld torches, headlamps, increase in trigger of motion activated building light on site); and
- Unintentional nesting turtle disturbance.

We propose the continued commitment to education of park guests, along with the use of a park wide code of conduct and the formalisation of the existing agreements with DES for interpretation activities to manage the increase in capacity on site.

4.2.1 Code of conduct

We propose the development of a Code of Conduct (COC) as a tool for the TSHP to communicate the standards and expectations of behaviour for guests during their stay at the park.

The Turtle Code of Conduct will be a condition of entry for TSHP guests, and is enforceable by park management during turtle season. The code of conduct will include all management principles listed in this plan that apply to patron behaviour and will be displayed in prominent locations across the park. The code of conduct will also be translated into multiple languages to ensure that the behavioural standard is understood by international travellers visiting the site.

The Turtle Code of Conduct will include the following minimum standards which apply on site during turtle season:

1. After 8pm, the TSHP becomes a 'Dark Park'. Outdoor lights will be extinguished or motion activated and patrons will be asked to draw curtains shut;
2. Before 8pm, outdoor lights on tents and caravans are to be kept to the lowest number required, mounted/placed below 1 metre in height and shaded to the east to stop direct light from reaching the beach and contributing to sky glow;
3. When moving around the park, handheld torches will be held low to the ground and pointed at the ground ahead (not directed toward the beach, nesting/hatchling turtles, or dune area);

4. When driving around the park, comply with the speed limit of 8km/hour, use the lowest light of headlight that is practicable, and park vehicles in a way so that headlights do not illuminate the beach or nesting habitat; and
5. Turtle watching is encouraged and guests will ensure turtles are not disturbed by following the below instructions from the Queensland Marine Turtle Conservation Strategy.²²

Recommended behaviour for watching nesting turtles and hatchlings:

- Stay well clear (at least two metres) of turtles
- Turn off all lights until laying begins
- Keep still and quiet
- Remain behind turtles as they dig and lay their eggs – do not stand in front of or where they can see you
- Restrict flash photography to a minimum and only take flash photos once the eggs have been laid
- Remove/turn off lights and back away from the turtles if they appear to show signs of disturbance
- Watch where you step to avoid crushing eggs or hatchlings.
- Do not disturb or dig up nests
- Be aware that turtles have good eyesight and an excellent sense of smell

Source: Queensland Marine Turtle Conservation Strategy (2018)

In addition to the code of conduct, park management will ensure the following are standard park operations;

- Check-in and check-out should occur prior to 8pm for all beachfront camping sites;
- Outdoor opaque blinds are drawn prior to 8pm nightly at the Pool Lounge;
- Guests are provided with formal and informal guidance on management of light through TSHP education (signage, DES Cut the Glow campaign pamphlet, on site presentations by DES Rangers); and
- At time of booking, guests are notified of the beach closure (below high water) from 6pm – 6am.

4.2.2 Turtle Watching

Mon Repos is globally recognised for its tourism around nesting and hatchling turtles and TSHP provides a unique opportunity for tourists to stay on the beach. Turtle watching is encouraged by the Queensland Government, with a key message of ‘Watch her lay, but take care’.²²

Turtle Sands Holiday Park will continue to provide ancillary education opportunities for park guests after the redevelopment. These will be offered through;

- Continued partnership with DES to provide Ranger talks on marine turtles at peak holiday periods;
- Negotiated partnership with DES to adopt the ‘Cut the Glow’ program key messages and graphics for educational signage and light management advice throughout the park. Adoption of the ‘Cut the Glow’ program within TSHP ensures consistent messaging and brand recognition amongst the park guests and local visitors; and
- Formalising agreements for interpretation of nesting turtles on TSHP land (as discussed in further detail below)

The proposed redevelopment will potentially result in an additional 86 persons on site (based on current and future maximum capacity) during peak holiday periods. Under the existing agreements in place with DES, TSHP guests are able to join the guided tour groups underway within 300m of TSHP (on both Conservation Park and TSHP land). Albeit highly unlikely, it could result in a total of 476 people (comprised of TSHP guests and tourist group from the information centre) around a single nesting turtle or clutch emergence.

To circumvent possible increases in disturbance of nesting turtles, we propose the negotiation of a formal agreement or procedure for nesting turtle interpretation on TSHP land, which may resolve a pre-existing concern around public liability for both TSHP and DES.

There are numerous collaboration opportunities with the DES programs in place at Mon Repos, that would be explored for feasibility in lieu of the current arrangements:

- Negotiate for a discounted rate and/or priority access for holiday park patrons to attend the visitor centre and turtle experience at Mon Repos;
- Negotiate for additional DES staff or visitor centre volunteers to assist in interpretation on TSHP land during peak holiday periods;
- Negotiate for DES research volunteers to be available to conduct interpretation during peak holiday periods;
- Consider a university partnership under the existing DES programs to offer an interpretation internship position dedicated to TSHP guests; and
- Offer private guided tours on TSHP land (subject to approval of a permit under the *Nature Conservation Act 1992*). Note that this is not recommended due to site sensitivity and the limited number of turtles nesting on TSHP land.

4.3 Terrestrial predators

An annual baiting program for the European Red Fox (*Vulpes vulpes*) reduced the loss of marine turtle eggs from approximately 90% in the late 1970s – early 1980s to less than 5% since the late 1980s.⁹ DES conducts an annual baiting program for foxes within the Mon Repos Conservation Park to manage the impact of foxes.

Turtle Sands Holiday Park will work with the adjacent landowners to participate in coordinated approaches to terrestrial predators to ensure effective control of introduced species and reporting of sightings. Where refuse areas are at capacity, additional receptacles will be procured to manage overflow, reducing potential scavenging opportunities.

4.4 Chemical and terrestrial discharge

Chemical pollutants and sediment can enter the ocean through a number of processes (for example, run off or leakage) and can be highly toxic to marine turtles in all life cycle phases.

Refuse stations will be placed in various locations around TSHP to provide ease of access for rubbish disposal, reducing the potential for pollution to occur within the nesting habitat. Particular emphasis on receptacle placement and signage located close to beach access pathways to ensure guests dispose of their waste appropriately.

Similarly, chemical pollutants will be appropriately disposed of in accordance with their Material Safety Data Sheet. Sewage stations are proposed on site for emptying of cassettes from mobile toilets. Vehicle maintenance carried out by park guests on site will be prohibited and park vehicle maintenance will be restricted to the workshop on site.

Where extreme weather is predicted, the TSHP will remove or secure any potential hazards on site.

4.5 Fisheries Bycatch

Fisheries bycatch is the incidental catch and interactions with marine turtles in fishing gear and this threat can occur at any time during the oceanic life cycle phases of marine turtles.

Recreational fishing is likely to occur at Mon Repos by park guests. Information on minimisation of impacts to turtles, such as the correct disposal of equipment will be included in park education materials. Waste bins will be placed strategically along beach access pathways to encourage correct disposal of garbage.

4.6 Marine Debris

Marine debris is typically floating and beached non-degradable debris known to cause entanglement and ingestion in turtles at sea, and can create barriers to hatchling emergence onshore.^{23,24}

The park will provide waste bins throughout the park, specifically located along beach access pathways to encourage correct disposal of garbage away from the nesting habitat. Park staff will undertake regular sweeps of the nesting habitat in front of the beachside camping precinct to ensure there are no obstacles for nesting or emerging turtles (outside of proposed park infrastructure e.g. fencing).

4.7 Climate change and variability

Climate change is likely to impact marine turtles across their entire range and at all life stages.⁵ TSHP is vulnerable to sea level rise and extreme weather due to its location in the coastal environment and the flood levels on site. Due to its location, TSHP is particularly vulnerable where extreme weather causes the erosion of dunes and associated nesting habitat.

The impact of high sand temperatures on egg mortality is well understood. The proposal will be retaining greater than 90% of vegetation in the beachside precinct, and 100% of vegetation between the beachside camping precinct and the property boundary. This will ensure that the redevelopment will not impact sand temperatures through loss of shade.

Continued partnership between TSHP and the turtle programs at Mon Repos to support research on site will contribute to increased understanding and management of climate related issues.

4.8 Construction Phase

The following conditions are proposed for any construction occurring on site during turtle season:

- Construction operation to occur only between 7am and 5pm;
- Pile driving is prohibited;
- Erosion and sediment control fences and measures are implemented to protect the nesting habitat and streams with drainage to the ocean;
- Security lighting is prohibited; and
- Exclusion fencing erected on the eastern side of the beachside camping precinct to protect nesting habitat.

A construction environmental management plan will be prepared at detailed design stage.

5. Monitoring

5.1 Ecological Monitoring

Mon Repos is one of six index nesting beaches for the Loggerhead turtle across Queensland. The beach (as part of the Woongarra Coast index study site) has been monitored for nightly turtle nesting from October – March from 1968 through to 2018.³

The long-term data collected over 50 years by the Queensland Turtle Conservation Project provides a baseline from which impacts to nesting behaviour and outcomes of this project can be further understood. While no monitoring data will be collected by the TSHP, we propose to seek a partnership with the DES programs to benefit from the existing long-term and ongoing data collection, analysis and expertise.

Marine Turtle Nest Site Selection

The objective of reviewing nest site selection data would be to determine if there has been any change in the distribution of nesting along Mon Repos beach. This is studied annually by the QTCP and results will be reviewed at pre and post season meetings with DES representatives.

Marine Turtle Nest Success

The objective of reviewing nest success data would be to determine if there has been any additional failure of nests in sectors in close proximity to the TSHP due to anthropogenic impacts (human disturbance or artificial light disturbance). This is studied annually by the QTCP and results will be reviewed at pre and post season meetings with DES representatives.

Marine Turtle Adult and Hatchling Track Orientation

The objective of monitoring adult and hatchling track orientation (pre and post redevelopment) would be to determine impacts of artificial light on the orientation of turtles within close proximity of TSHP. This is studied annually by the QTCP, and results will be reviewed at pre and post season meetings with DES representatives.

5.2 Anthropogenic Impact Monitoring

The TSHP is the responsible party for ensuring patrons comply with the code of conduct. Where any breaches of behaviour are observed within the park, DES and TSHP patrons are to contact park management for further action. As per the current protocol for breaches of agreements, park management will assess the validity of any complaint through an investigation, resolve the issue and report outstanding issues to DES. Similarly, as per current agreements, where TSHP recognises an issue within the jurisdiction of DES, they will be advised by TSHP staff.

Park staff will undertake actions to ensure guests and buildings have moved to curfew mode of operation at 8pm each evening during turtle season. Any breaches of the curfew will be addressed at this time by TSHP. Major breaches or other important information are to be reported to DES, e.g. potentially damaging light management issues.

5.3 Reporting and incident response strategy

Reporting

A semi-annual review of monitoring outcomes, incidents, concerns and TSHP access by DES programs will be undertaken at the start and end of each turtle season. This semi-annual review will allow for considerations for any required changes to mitigation and management listed within this plan. Any changes are to be undertaken in a timely manner to reduce any unforeseen or emerging impacts.

Incident response strategy

All disorientated or disturbed nesting and hatchling turtles will be reported to DES immediately for investigation and resolution. Where an issue is identified by any party, all attempts will be made to mitigate the issue and to avoid future repetition.

6. Significant Impact Criteria

The *Environmental Protection and Biodiversity Conservation Act 1999* is Commonwealth Government Legislation that protects matters of national environmental significance. Any person or organisation intending to take an action that will have, or is likely to have, a significant impact on matters of national environmental significance is required to refer their proposed activity to the Minister of the Department of Environment for assessment.

Notwithstanding the considerable mitigation measures to reduce the duration and intensity of impact to the adjacent turtle rookery, we recommend referral to the Commonwealth Minister for Environment for an assessment of the proposal under the EPBC Act due to the considerable value of Mon Repos as a major rookery for an endangered species.

6.1 Significant Impact Criteria Discussion

The Commonwealth have published Significant Impact Guidelines that provide criteria under which an action can be assessed. In this section we assess and provide responses to the Significant Impact Criteria for the Loggerhead, Green and Flatback turtles.

An action is likely to have a significant impact on a critically endangered or endangered species if there is a genuine possibility that it will:

Lead to a long-term decrease in the size of a population

The proposal outlines multiple mitigating actions which eliminate, reduce and avoid the use of artificial light across the TSHP, however, to function as an operating holiday park for tourist use, artificial light is required. The proposed redevelopment presents an opportunity to permanently manage and control artificial light on site. The holiday park in its current form operates under lawful fettered use, being that the park was in existence prior to any town plan for the region, and therefore operates with no restrictions at all. The proposed development provides an opportunity to constrain the presently unconstrained rights of the proponent to use artificial light on site.

If left uncontrolled, the artificial light levels proposed within this project would alter the nest selection of adult nesting females and impact the ocean finding behaviours of both adult and hatchling turtles, resulting in a reduction of population size. However, through the considerable mitigating actions proposed, in particular the 8pm outdoor lighting curfew on site, there is a reduced impact on nesting and hatchling turtles. Limpus (1985) found that the majority of hatchlings cross the beach between 8pm and midnight. Similarly, it is reasonable to suggest that only a small number of adult turtles will nest between late afternoon and 8pm. The 8pm outdoor lighting curfew on site limits the temporal exposure of turtles to the impacts of artificial light from TSHP.

Despite the 8pm curfew, there remains some potential for disruption of the natural behaviours of turtles due to the artificial light originating from beachside campers and indoor building lights. Typically, these would be extinguished before midnight, resulting in a minimum of 50% of the evening with very low impact.

Where artificial light is shown to potentially impact the behaviour of turtles on site, TSHP commits to undertaking an adaptive management approach, using remediation works (such as planting screening vegetation or retrofitting of opaque fixtures or screens onto specific buildings) to reduce the impact of issues raised through the reporting strategies listed in this document.

Reduction of the area of occupancy of the species

Whilst the project proposes little physical change in the extent of use within the nesting habitat, there is potential that over time adult female turtles will respond negatively to the artificial light on site and avoid nesting on the dune in front of TSHP and surrounding nesting habitat. Implementation of the measures listed in this TMP will provide mitigation to reduce the likelihood of the impact. Outdoor lighting across the TSHP will be extinguished at 8pm, however, several will remain on at lower function until 10pm or will be motion activated and deactivated. Temporary lighting owned by guests (such as caravan or camping lights) will be managed after 8pm through the code of conduct and accompanying education program (signage and Ranger talks). There may be some residual impacts from the after-curfew lighting scenario, however, these are considered reasonable for the operation of a holiday park and are limited through the use of motion activation/deactivation.

Mon Repos beach is a minor rookery and the most southerly nesting population of Flatback turtles for eastern Australia. If the Flatback turtles responded negatively to the presence of additional limited and controlled artificial light and altered their nest site selection, there is some potential for a contraction of the overall range of the genetic stock. The 8pm outdoor lighting curfew limits the temporal exposure of both adult and hatchling marine turtles on site, with further reduction of lighting on site at 10pm and again once all guests are asleep, therefore, typically at least 50% of the evening all lights will be extinguished across the park (exclusive of intermittent light used for patron navigation). We consider that the park in its current lawful use has greater potential for adverse impacts through artificial light onsite, as light is currently not legally restricted or controlled on site.

Fragmentation of an existing population into two or more populations

As the major rookery for the Loggerhead turtle on the eastern Australian coastline, Mon Repos beach hosts a large component of the population (along with low density Flatback and Green turtle). The proposal is considered to be unlikely to fragment any of the species populations into two or more populations as the distribution of the genetic stocks occur over such large geographical areas. It does however have the potential to alter nest site selection of nesting females, away from the protected area of Mon Repos.

Observations of tagged remigrant turtles demonstrating within or inter-season changes of colony to beaches within or outside the Woongarra Coastline will likely be reported to DES through the QTRP, which conducts nesting census studies at major and minor rookeries for Loggerhead, Green and Flatback turtles through Queensland. Changes of colony may not be immediately evident; however, it is possible that that tag recoveries over decades may show that nesting has shifted to beaches outside of Mon Repos.

The 8pm outdoor light curfew on site is key to the management of this impact, Limpus (1971) found that the majority of clutches emerge between 8pm and midnight. The 8pm curfew also restricts the temporal impact of the majority of permanent artificial light on site to the hours between sunset and 8pm, which would typically be less than two hours in duration. The proposed development aims to restrict artificial light to as low as practical for safe operation of the holiday park.

If a significant change in nest site selection is detected, an adaptive management approach can be taken to mitigate site impacts. Further revegetation between the beachfront camping precinct and the nesting habitat to create light screening may reduce the intensity of the impact.

Adverse effect on habitat critical to the survival of a species

Mon Repos beach is identified as habitat critical to the survival of the species for both the swPac Loggerhead turtle and the eastern Australian Flatback turtle.⁵ The proposal will retain the current vegetation and site conditions to the east of the beachside camping precinct and

greater than 90% of vegetation across the entire beachside camping precinct. The beachside camping precinct remains largely unchanged from its current operation; however, it is reasonable to expect a greater occupancy of these sites through the entire season, similar to what the park operated at from the late 1970s to 2011. It is difficult to quantify the impact of artificial light originating from this precinct, as park patrons use their own caravan/camping lights, it is reasonable to consider this impact similar to the current use of the site. Notwithstanding this, there are cumulative impacts from the redevelopment on top of the existing issues originating in Bargara, as detailed in section 4.1 which may exacerbate the pre-existing concerns around turtles and navigation at Mon Repos.

The proposal will introduce controlled permanent artificial light on site, but the limitations on intensity and duration will reduce the adverse effect on the nesting habitat. The permanent artificial light is at higher levels than the current operation, but results in a much lower level than what could be introduced currently on an 'as of right' basis given the lawful fettered use status of the park. The 8pm outdoor light curfew and other tools as listed in this plan will significantly reduce the intensity and duration of the impact to the period of time between sunset and 8pm, with a lower impact to 10pm (recreational precinct), and then only intermittent light (associated with patron navigation) from 10pm to dawn.

Outside of the existing mitigation proposed in this plan, an adaptive management approach is most suitable to mitigate issues as they emerge over time. Due to the long-life cycles of marine turtles, impacts to the local population may not be apparent for decades after redevelopment takes place.

If over time significant changes in turtle orientation behaviour (adult or hatchling) are established, further mitigation of artificial light on site will be able to be undertaken in accordance with the conditions on the development approval. This is in contrast to the current status of the park where no such controls exist for adaptive management. This may include the establishment of lower and mid canopy level vegetation between the beachside camping precinct and nesting habitat to filter artificial light to reduce impact. Any further revegetation may be at the cost of view amenity values for the holiday park.

Disruption of population's breeding cycle

The proposed development may disrupt the breeding cycle of a population by way of the alteration of a nesting female's nest site selection, occasional disturbance of nesting turtles through either artificial light or unintentional anthropogenic impacts or disrupt the ocean finding behaviour of hatchling turtles.

Human disturbance to nesting turtles are mitigated to an extent by the presence of staff and/or volunteers from the turtle projects adjacent to TSHP. Interpretive rangers and volunteers provide education to park guests in relation to anthropogenic disturbance, which builds on the code of conduct, educational materials and advice provided by TSHP management.

The retention of the natural topography of the site and the vegetation between the beachside camping precinct and the beach may reduce the impact of artificial light on the ocean finding behaviour of hatchling turtles. Hatchling turtles are impacted by artificial light between 0 and 30° in height, the retention of vegetation in that range provides shielding and allows natural navigational cues to be followed. This does not however provide mitigation for the hatchlings once outside the shield of the dune vegetation, during the crawl to the ocean or once in the ocean. The removal of beach facing roof windows, skylights, street lighting, and outdoor light after 8pm across the site reduces the proposals contribution to sky glow, which avoids contribution of the cumulative light glow that originating in surrounding suburbs such as Bargara.

As discussed above, considerable mitigation and behavioural standards for guests are imposed to reduce artificial light pollution at TSHP. These limit the intensity and duration of exposure of impacts to turtles, including adult females undertaking nest site selection.

Where the level of disruption escalates beyond this assessment, we propose the resolution of the issues outlined in section 6.2.2 to formalise the interpretation around nesting turtles through agreements with DES, and further light mitigation (for example vegetation screening) on site as guided by the development conditions and DES.

Modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline

It is considered unlikely that the proposal will modify, destroy, remove, isolate or decrease the availability of habitat of the marine turtles nesting on site to the extent that the species is likely to decline. It is possible, however that the additional artificial light on site may modify or decrease the quality of the nesting habitat across the length of the TSHP site and potentially the nesting habitat adjacent.

There are very little changes proposed on site located within 100m of the HAT line. The footprint of the beachside camping precinct remains largely unchanged, all sites are setback not less than 20 metres from the vegetation edge of the dune.

Outdoor lighting on site is managed in the most part through the 8pm curfew. Indoor permanent lighting is managed through 15% visible light transmittance tinting on all glass visible from the nesting habitat along with opaque block out blinds, matte finishes on indoor and outdoor surfaces and the code of conduct & education signage and discussions to influence patron behaviour while on site.

It is anticipated that the semi-annual meetings with DES to review monitoring results will raise issues as they are identified and provide opportunity to mitigate further on site as discussed above.

Interfere with the recovery of the species

It is difficult to determine if the impact of the introduction of permanent controlled artificial light at TSHP will affect only individuals, or if there will be a greater impact at stock level that could interfere with the recovery of the Loggerhead turtle. The mitigation proposed within this TMP manages artificial light to the lowest level that is practical for the operation of a tourist park. The redevelopment presents an opportunity to constrain artificial light for TSHP, which in its current state of operation has no legal restriction on the amount or type of light that impacts the nesting habitat.

The 8pm outdoor light curfew limits the intensity and duration of the impact of permanent lighting on site. The code of conduct and accompanying educational signage and discussions provided by staff and DES rangers ensures that park guests are advised about the behavioural standards for the site, and the impacts that noncompliance can cause. TSHP commits to providing the code of conduct in multiple languages to ensure that international tourists comply with the behavioural standards for the site.

As technology advances and is integrated with monitoring data, the opportunity for updating luminaires within the park and further understanding of the impact on species will become apparent. For this reason, we suggest an adaptive management approach where semi-annual meetings with DES are an opportunity to consider implementation of new approaches to light management.

Result in invasive species that are harmful to a critically endangered or endangered species becoming established in the endangered or critically endangered species' habitat, or

It is unlikely that the proposal will result in invasive species becoming established in the marine turtle nesting habitat. There are existing terrestrial predators through the site and adjacent conservation parks, TSHP is committed to working with the adjacent landowners to participate in coordinated approaches to terrestrial predators to ensure effective control of introduced species and also to the management of refuse stations to ensure there are no opportunities for scavenging on site.

Introduce disease that may cause the species to decline

The project redevelopment presents no change of use for the property, making it unlikely that the proposal in its operational phase will introduce disease that may cause marine turtle species decline. Notwithstanding this, the construction phase presents a minor risk of introduced disease or contaminants through the importation of soil and vegetation into the site that could impact nest success. It is proposed that the construction exclusion zone to the east of the beachside camping precinct will mitigate this risk along with good hygiene practices implemented during the landscaping phase of development.

6.2 Significant Impact Criteria Risk Assessment Summary

The risk assessment approach taken within this plan has been adapted from the Queensland Curtis LNG Long Term Turtle Management Plan, which was modified from the Great Barrier Reef Marine Park Authority Environmental Assessment and Management (EAM) Risk Management Framework.^{25,26} In this section we assess the risk before (inherent risk) and after (residual risk) mitigation measures are applied to the project. The criteria used to determine likelihood and consequence are described in Table 4 below.

Table 4: Risk Assessment Matrix

Likelihood (probability of occurring)	Consequence Rating				
	Insignificant – Little to no impact on the overall ecosystem. Very small levels of impact on turtles and their habitats. Only occasional injury to or mortality of turtles.	Minor – Impacts are present, but not to the extent that the overall condition of turtle populations or their habitats are impaired in the long term. Low levels of mortality of turtles and their habitats. Recovery would generally be measured in years for habitats.	Moderate – Turtle populations and their habitats are significantly affected, either through elevated mortality of turtles or a minor disruption to a population over a widespread geographic area. Recovery at habitat level would take at least a decade, with recovery of turtle populations taking several decades.	Major – Significant impact on sea turtle populations and their habitats, with high level of turtle mortality. Recovery of habitats would take a few decades with turtle populations taking several decades.	Catastrophic – Turtle habitats irretrievably compromised. Mass mortality of sea turtles and local extinction of species. Recovery over several decades for habitat values and centuries for turtle populations.
	1	2	3	4	5
Almost Certain (95 – 100%)	5 Medium 5	High 10	High 15	Extreme 20	Extreme 25
Likely (71 – 95%)	4 Medium 4	Medium 8	High 12	High 16	Extreme 20
Possible (31 – 70%)	3 Low 3	Medium 6	Medium 9	High 12	High 15
Unlikely (5 – 30%)	2 Low 2	Low 4	Medium 6	Medium 8	High 10
Rare (0 – 5%)	1 Low 1	Low 2	Low 3	Medium 4	Medium 5

Inherent risks, or risks to the turtle populations prior to consideration of mitigation strategies, were assessed as Low, Medium or High based on the likelihood of occurrence and the consequences and recovery periods. Once the likelihood of occurrence is reduced as a result of mitigation strategies applied, a residual risk assessment of Low, Medium or High remains. The assessment is summarised in Table 5.

For the purpose of understanding the existing and potential uncontrolled impacts of TSHP, the risk assessment of current and past operations of the park are also represented in Table 5.

Table 5: Summary of risk assessment for impacts to marine turtles arising from current and future operations of Turtle Sands Holiday Park

Significant Impact Criteria	Potential Impact	Potential Consequence	Likelihood	Consequence	Existing and Inherent Risk	Mitigation	Likelihood	Residual Risk
<i>Lead to a long-term decrease in the size of a population</i>	Alter adult female nest site selection	Reduced nesting attempts and nesting success	Likely	Moderate	High 12	Use of a site wide 8pm curfew (with exceptions as noted within this document) based on research suggesting the majority of clutches emerge between 8pm and midnight (Limpus 1971).	Possible	Medium 9
<i>Reduction of the area of occupancy of the species</i>	Disruption of ocean finding behaviour of adult and hatchling turtles	Nesting attempts occur outside of the protected zone of Mon Repos, leading to reduced success	Likely	Moderate	High 12	Use of Amber LED lighting (as described within this plan) regulated by centrally controlled smart lighting and motion activated sensors with maximum deactivation periods.	Possible	Medium 9
<i>Fragmentation of an existing population into two or more populations</i>		Loss of energetic resources leading to reduced fecundity	Likely	Moderate	High 12	Use of light reflecting signage, round mounted cats' eyes, designated pedestrian zones and other traffic calming devices to eliminate street lighting.	Possible	Medium 9
<i>Adverse effect on habitat critical to the survival of a species</i>		Increased mortality of hatchlings from dehydration, fatigue and predation.	Almost certain	Moderate	High 15	Use of low reflectance dark surfaces on and within buildings, glass tinting and opaque blinds.	Possible	Medium 9
<i>Disruption of population's breeding cycle</i>		Almost certain	Moderate	High 15	Use of low reflectance dark surfaces on and within buildings, glass tinting and opaque blinds.	Possible	Medium 9	
<i>Modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline</i>		Likely	Moderate	High 12	Placement, orientation and design of buildings on site to limit and control light spill towards the nesting habitat and above. Retention of all dune vegetation. Implementation of landscape plan.	Possible	Medium 9	
<i>Interfere with the recovery of the species</i>		Likely	Moderate	High 12	Maintenance of existing topography on site	Possible	Medium 9	

Significant Impact Criteria	Potential Impact	Potential Consequence	Likelihood	Consequence	Existing and Inherent Risk	Mitigation	Likelihood	Residual Risk
<i>Result in invasive species that are harmful to a critically endangered or endangered species becoming established in the endangered or critically endangered species' habitat</i>	Increased predator presence due to scavenging opportunities	Increased predation and reduced nest success.	Possible	Minor	Medium 6	Participate in coordinated approaches to terrestrial predators Management of refuse stations to ensure no opportunity for scavengers	Unlikely	Low 4
<i>Introduce disease that may cause the species to decline, or</i>	Introduction of contaminants to soil and sand	Decreased nest success	Possible	Minor	Medium 6	Construction exclusion zone around nesting habitat Hygiene practices during landscaping and construction	Unlikely	Low 4

It is difficult to quantify the potential likelihood of occurrence further than the 'Possible' category (31 – 70%) for several of the significant impact criteria. The large scale (49% of matrix) of the occurrence also allows for the compounding effect of impacts from outside of the proposed development (e.g. marine debris ingestion).

In summary, the assessment finds that the mitigation strategies applied to the development result in a reduction in risk to marine turtle populations from the existing and inherent risk scenarios. Adoption of the mitigation measures will

- Reduce the risk of a long-term reduction in the size of the turtle population.
- Reduce the risk of a contraction of the area of occupancy of the species.
- Reduce the risk of fragmenting the existing population into two or more populations.
- Reduce the risk of adverse effects on habitats critical to survival of a species.
- Reduce the risk of disrupting a turtle population's breeding cycle.
- Reduce the risk of modification, destruction, removal, isolation or decrease in the availability or quality of habitat to the extent that the species is likely to decline.
- Reduce the risk of interference with the recovery of the species.
- Reduce the risk of invasive species that are harmful to a critically endangered or endangered species becoming established in the endangered or critically endangered species habitat.
- Reduce the risk of introducing diseases that may cause the species to decline.

7. Recommendations

Based on the above assessment and plan, we make the following recommendations, aimed at mitigating site impacts to marine turtles:

- A referral to the Commonwealth Minister for Environment should be lodged to assess for impacts to listed species under the EPBC Act. Should the assessment be found to be acceptable, comply with the approved conditions as listed in this management plan;
- Undertake an adaptive management approach to artificial light impacts to marine turtles on site by ensuring the park uses the most appropriate and up to date lighting technology as recommended by the Queensland state government turtle programs and the pending Commonwealth guideline for management of artificial light for marine turtles;
- Seek a partnership with the DES Queensland Turtle Research Project to conduct adult and hatchling track orientation studies that could be analysed to test for significant behaviour changes to marine turtle orientation on site;
- Ensure this Turtle Management Plan is followed in full by suitably qualified contractors who have reviewed the conditions listed within this document and included additional management actions if needed;
- It is strongly recommended that the proponent engage a lighting designer/engineer to conduct a detailed design and site-specific lighting risk assessment to further determine appropriate lighting on site within the limits proposed in this plan;
- Ensure that the reporting strategy is implemented and adhered to in full, including the semi-annual meeting with DES; and
- Continue the long-term commitment to turtle research and conservation efforts on Mon Repos Beach by allowing researchers access to holiday park land for the purposes of turtle research and public education.

8. Limitations of this study

This management plan has been developed to investigate marine turtle impacts and management for Turtle Sands Holiday Park, Mon Repos Road, Mon Repos: described as Lot 2 on RP82146.

This Turtle Management Plan was developed to accompany an application for Material Change of Use to the Bundaberg Regional Council and referral to the Commonwealth Minister for Environment in relation to the redevelopment of TSHP. The plan aims to provide strategies to mitigate threats to threatened species of marine turtle nesting on the adjacent Mon Repos beach.

This report has been prepared for the specific purpose of TSHP, and is solely for the use of TSHP.

This report is only to be used in full, and may not be used to support objectives other than those set out herein, except where written approval, with comments, are provided by Blandeen Pty. Ltd.

Blandeen Pty. Ltd accepts no responsibility for the accuracy of information supplied to them by second and third parties.

Blandeen Pty. Ltd. accepts no responsibility for the lighting conditions compliance with the AS/NZS 1158 Series or AS/NZS 1482.

9. Closure

The redevelopment of the Turtle Sands Holiday Park presents a unique opportunity for both the proponents and the wider Woongarra coastline. The design, implementation and operation of the park will be undertaken in a manner that ensures a much more controlled outcome for marine turtles than what currently exists pre-redevelopment.

The redevelopment achieves six of the seven actions listed within the Single Species Action Plan for the Loggerhead Turtle, in particular provides an opportunity to trial road mounted LED lighting in place of traditional street lights. In addition to this, the management of lighting in the TSHP builds on the existing Harmony Road, Mon Repos residential development of the mid to late 1980's to showcase tourism and residential developments that are functional and safe without increasing impact to critical habitat for threatened marine turtles.

We gratefully acknowledge the IDA for the use of their Sample Lighting Management Plan, Lorna Gibb and Dr Julie O'Connor for their review of the management plan and stakeholders for their input and feedback.²⁷

Should further information be required please contact



Kate Hofmeister
BAppSci (Environmental Science)

10. References

1. Department of Environment. (2013). *Matters of National Environmental Significance: Significant impact guidelines 1.1*. Canberra: Commonwealth of Australia.
2. Limpus, C. J., McLaren, M., McLaren, G., & Knuckey, B. (2006). *Queensland Turtle Conservation Project: Curtis Island and Woongarra Coast Flatback Turtle Studies, 2005 - 2006*. Conservation and Technical Data Report.
3. Limpus, C. J., Parmenter, C. J., & Chaloupka, M. (2013). *Monitoring of Coastal Sea Turtles: Gap Analysis 1. Loggerhead Turtles, *Caretta caretta*, in the Port Curtis and Port Alma Region*. Report produced for the Ecosystem and Monitoring Program Advisory Panel as part of the Gladstone Ports Corporation's Ecosystem Research and Monitoring Program.
4. Integrated Site Design. (2018). *Business Development Strategy and Masterplan: Turtle Sands Holiday Park*. Ballina: Integrated Site Design.
5. Commonwealth of Australia. (2017). *Recovery Plan for Marine Turtles in Australia*. Canberra : Commonwealth of Australia.
6. Hamann M, L. C. (2006). *Assessment of the Conservation Status of the Leatherback Turtle in the Indian Ocean and South-East Asia*. Bangkok: IOSEA Marine Turtle MoU Secretariat.
7. Limpus, C. J., Parmenter, C. J., & Chaloupka, M. (2013). *Monitoring of Coastal Sea Turtles: Gap Analysis 6. Leatherback Turtles, *Dermochelys coreacea*, in the Port Curtis and Port Alma Region*. Report produced for the Ecosystem Research and Monitoring Program Advisory Panel as part of Gladstone Ports Corporation's Ecosystem Research and Monitoring Program.
8. Limus, C., & Limpus, D. (2003a). *The loggerhead turtle, *Caretta caretta*, in the equatorial and southwest Pacific Ocean: a species in decline*. In "Biology and Conservation of Loggerhead Turtles.". (A. W. Eds. Bolton, Ed.) Washington D. C.: Smithsonian Institution Press.
9. Limpus, C. J. (2009). *A Biological Review of Australian Marine Turtles*. Brisbane.
10. Convention on the Conservation of Migratory Species of Wild Animals (CMS). (2014). *Single Species Action Plan for the Loggerhead Turtle (*Caretta caretta*) in the South Pacific Ocean*. Quito : United Nations Environment Program.
11. Limpus, C., McLaren, M., McLaren, G., Gatley, C., Limpus, D., O'Leary, K., & Turner, T. (2016). *Marine Turtle Nesting Populations: Curtis Island and Woongarra Coast Flatback Turtles, 2015 - 2016 breeding season*. Brisbane: Department of Environment and Heritage Protection, Queensland Government. Report produced for the Ecosystem Reserach and Monitoring Program Advisory Panel as part of Gladstone Ports Corporation's Ecoystem Research and Monitoring Program.
12. Limpus, C. J., Parmenter, C. J., & Chaloupka, M. (2013). *Monitoring of Coastal Sea Turtles: Gap Analysis 5. Flatback turtles, *Natator depressus*, in the Port Curtis and Port Alma Region*. . Report produced for the Ecosystem Research and Monitoring Program Advisory Panel as part of the Gladstone Ports Corporation's Ecosystem Research and Monitoring Program.
13. Chaloupka, M., & Limpus, C. (2001). Trends in the abundance of sea turtles resident in southern Great Barrier Reef waters. *Biological Conservation* 102, 235-249.
14. Limpus, C., Parmenter, C., & Chaloupka, M. (2013). *Monitoring of Coastal Sea Turtles: Gap Analysis 2. Green turtles, *Chelonia mydas*, in the Port Curtis and Port Alma Region*. Report produced for the Ecosystem Research and Monitoring Program Advisory Panel as part of Gladstone Ports Corporation's Ecosystem Research and Monitoring Program.
15. Salmon, M. (2003). Artificial night lighting and sea turtles. *Biologist*, 50: 163-168.
16. Limpus CJ, Kamrowski RL and Riskas KA (2015) Darkness is the best lighting management option at turtle nesting beaches. In *Proceedings of the Second Australian and Second Western Australian Marine Turtle Symposia, Perth 25-27*

- August 2014, Whiting SD and Tucker A, Eds. Science Division, Department of Parks and Wildlife, Perth, Western Australia. pp 56.
17. Robertson, K. A., Booth, D. T., & Limpus, C. J. (2016). An assessment of 'turtle-friendly' lights on the sea-finding behavior of loggerhead turtle hatchlings (*Caretta caretta*). *Wildlife Research*, 43:27-37.
 18. Kamrowski, R., Limpus, C., Moloney, J., & Hamman, M. (2012). Coastal light pollution and marine turtles: assessing the magnitude of the problem. *Endangered Species Research*, 19, 85-98.
 19. Limpus, C. J. (1985). *A study of the Loggerhead turtle, Caretta caretta, in eastern Australia*. PhD thesis, Zoology Department, University of Queensland.
 20. Institution for Lighting Professionals. (2011). *Guidance Notes for the Reduction of Obtrusive Light (GN01)*. Institution of Lighting Professionals.
 21. Citelum. (2016). *Sunshine Coast Council Urban Lighting Master Plan. Version 2 revision 3 ed*. Caloundra: Sunshine Coast Council.
 22. Conservation & Biodiversity Operations Branch. (2018). *Marine Turtle Conservation Strategy*. Queensland, Brisbane: Department of Environment and Science, Queensland Government.
 23. Balzas, G. H. (1985). Impact of ocean debris on marine turtles: Entanglement and ingestion. . *Proceedings of the Workshop on the Fate and impact of Marine Debris* (pp. 387 - 429). Honolulu, Hawaii: U.S. Department of Commerce, National Oceanic and Atmospheric Administration Technical Memorandum.
 24. Whiting, S.D., Macrae, I., Thorn, R., Murray, W., & Whiting, A.U. (2014) Sea turtles of the Cocos (Keeling) Islands, Indian Ocean. *Raffles Bulletin of Zoology Supplement*, No. 30: 168 – 183
 25. Queensland Curtis LNG (2015). Long-Term Turtle Management Plan. Curtis Island, Gladstone, Rev 4.
 26. GBRMPA (2009). Environmental Assessment and Management (EAM) Risk Management Framework 7 pp.
http://www.gbrmpa.gov.au/__data/assets/pdf_file/0008/4949/gbrmpa_EAMRiskManagementFramework.pdf
 27. International Dark-sky Association (2017) Sample Lighting Management Plan. *International Dark-sky Association*


APPENDIX A

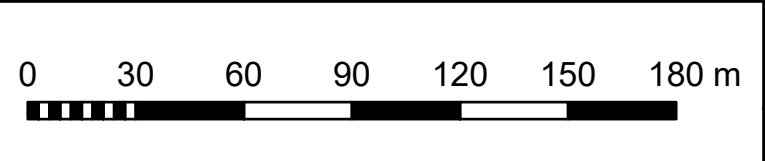


CORAL SEA

MON REPOS BEACH

KEY

 Boundary of subject site



AT: **LOT 2 ON RP82146:
MON REPOS ROAD, MON REPOS**

TITLE: **SITE LOCALITY AND AERIAL**

CLIENT: **TURTLE SANDS HOLIDAY PARK**

PREPARED BY: **JESSICA BOLIN FOR BLANDEEN PTY LTD**

SHEET: **1 of 1** DATE: **14-11-2018**

APPENDIX B



Figure 2. Baker, B. View from beach to proposed amenities building and pool lounge. 2018.



Figure 3. Baker, B. View from beach to existing cabins. 2018.



Figure 4. Baker, B. View from proposed glamping site to beach (North east direction). 2018.



Figure 5. Baker, B. View from proposed glamping site to beach (North). 2018.



Figure 6. Baker, B. View from existing cabin to beach (north east). 2018.



Figure 7. Baker, B. View from existing cabin to beach (north). 2018.



Figure 8. Searle, B. View of proposed beachside camping precinct (north north-west). 2018

APPENDIX C

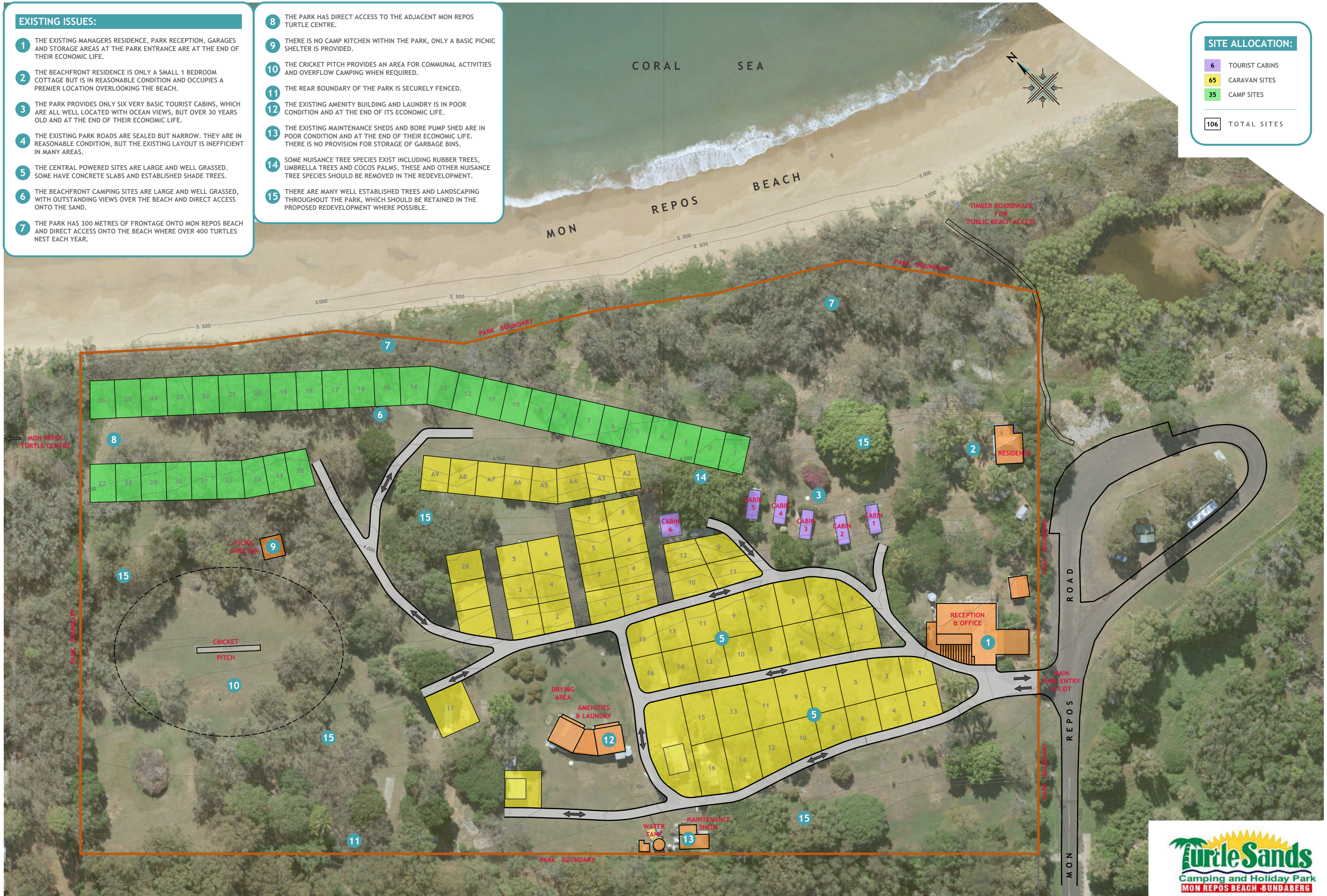
EXISTING ISSUES:

- 1 THE EXISTING MANAGERS RESIDENCE, PARK RECEPTION, GARAGES AND STORAGE AREAS AT THE PARK ENTRANCE ARE AT THE END OF THEIR ECONOMIC LIFE.
- 2 THE BEACHFRONT RESIDENCE IS ONLY A SMALL 1 BEDROOM COTTAGE BUT IS IN REASONABLE CONDITION AND OCCUPIES A PREMIER LOCATION OVERLOOKING THE BEACH.
- 3 THE PARK PROVIDES ONLY SIX VERY BASIC TOURIST CABINS, WHICH ARE ALL WELL LOCATED WITH OCEAN VIEWS, BUT OVER 30 YEARS OLD AND AT THE END OF THEIR ECONOMIC LIFE.
- 4 THE EXISTING PARK ROADS ARE SEALED BUT NARROW. THEY ARE IN REASONABLE CONDITION, BUT THE EXISTING LAYOUT IS INEFFICIENT IN MANY AREAS.
- 5 THE CENTRAL POWERED SITES ARE LARGE AND WELL GRASSED. SOME HAVE CONCRETE SLABS AND ESTABLISHED SHADE TREES.
- 6 THE BEACHFRONT CAMPING SITES ARE LARGE AND WELL GRASSED, WITH OUTSTANDING VIEWS OVER THE BEACH AND DIRECT ACCESS ONTO THE SAND.
- 7 THE PARK HAS 300 METRES OF FRONTAGE ONTO MON REPOS BEACH AND DIRECT ACCESS ONTO THE BEACH WHERE OVER 400 TURTLES NEST EACH YEAR.

- 8 THE PARK HAS DIRECT ACCESS TO THE ADJACENT MON REPOS TURTLE CENTRE.
- 9 THERE IS NO CAMP KITCHEN WITHIN THE PARK, ONLY A BASIC PICNIC SHELTER IS PROVIDED.
- 10 THE CRICKET PITCH PROVIDES AN AREA FOR COMMUNAL ACTIVITIES AND OVERFLOW CAMPING WHEN REQUIRED.
- 11 THE REAR BOUNDARY OF THE PARK IS SECURELY FENCED.
- 12 THE EXISTING AMENITY BUILDING AND LAUNDRY IS IN POOR CONDITION AND AT THE END OF ITS ECONOMIC LIFE.
- 13 THE EXISTING MAINTENANCE SHEDS AND BORE PUMP SHED ARE IN POOR CONDITION AND AT THE END OF THEIR ECONOMIC LIFE. THERE IS NO PROVISION FOR STORAGE OF GARBAGE BINS.
- 14 SOME NUISANCE TREE SPECIES EXIST INCLUDING RUBBER TREES, UMBRELLA TREES AND COCOS PALMS. THESE AND OTHER NUISANCE TREE SPECIES SHOULD BE REMOVED IN THE REDEVELOPMENT.
- 15 THERE ARE MANY WELL ESTABLISHED TREES AND LANDSCAPING THROUGHOUT THE PARK, WHICH SHOULD BE RETAINED IN THE PROPOSED REDEVELOPMENT WHERE POSSIBLE.



SITE ALLOCATION:

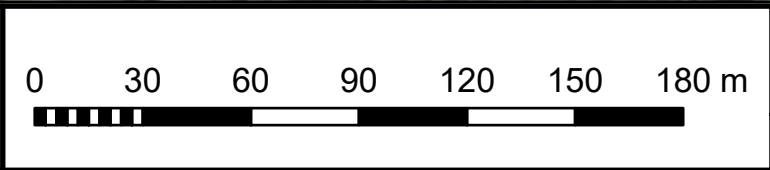
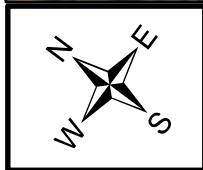
- 6 TOURIST CABINS
 - 65 CARAVAN SITES
 - 35 CAMP SITES
- 106 TOTAL SITES





KEY

-  Boundary of subject site
-  Marine turtle nesting habitat



AT: **LOT 2 ON RP82146:
MON REPOS ROAD, MON REPOS**

TITLE: **MARINE TURTLE NESTING HABITAT**

CLIENT: **TURTLE SANDS HOLIDAY PARK**

PREPARED BY: **JESSICA BOLIN FOR BLANDEEN PTY LTD**

SHEET: **1 of 1** DATE: **13-11-2018**

APPENDIX D

PROPOSED IMPROVEMENTS:

- 1 CONSTRUCT A NEW PARK ENTRY ROAD AND CHECK-IN BAY.
- 2 INSTALL A NEW PARK OFFICE AND MANAGERS RESIDENCE BUILDING ON THE WESTERN SIDE OF THE ENTRY ROAD WITH VISITOR PARKING AT THE FRONT.
- 3 CONSTRUCT A NEW PARK MAINTENANCE BUILDING AND COMPOUND TO SUPPORT ALL MAINTENANCE ACTIVITIES, WASTE MANAGEMENT AND MATERIALS STORAGE.
- 4 PROVIDE AN EFFICIENT INTERNAL ROAD NETWORK TO ALL NEW PRECINCTS, MAKING BEST USE OF THE AVAILABLE SITE AREA TO OPTIMISE SITE NUMBERS. ALL NEW ROADS ARE 6 METRES WIDE AND TWO-WAY.
- 5 UPGRADE THE EXISTING BEACHFRONT COTTAGE TO PROVIDE AN ICONIC BEACHFRONT BUNGALOW FOR TOURIST USE.
- 6 INSTALL 11 NEW 3-BEDROOM TOURIST CABINS ALONG THE RIDGE OVERLOOKING THE BEACH.
- 7 ESTABLISH A TROPICAL GARDEN STUDIO PRECINCT WITH 20 NEW 1-BEDROOM STUDIOS IN 5 BLOCKS NEAR THE ENTRY. INSTALL A COMMUNAL BBQ AND LOUNGE AREA WITH DENSE TROPICAL LANDSCAPING TO CREATE A LUSH ATMOSPHERE.
- 8 INSTALL 5 NEW 3-BEDROOM CABINS OVERLOOKING THE POOL PRECINCT.
- 9 ESTABLISH A NEW RESORT STYLE POOL AS THE MAJOR FOCUS FOR THE PARK.

- 10 INSTALL A NEW CHILDRENS PLAYGROUND WITH SEATING AND SHADE.
- 11 INSTALL A NEW CAMP KITCHEN BUILDING OVERLOOKING THE POOL AND PLAYGROUND.
- 12 INSTALL A NEW MAIN AMENITY BUILDING TO SERVICE ALL SITES.
- 13 INSTALL A POOL LOUNGE BUILDING OVERLOOKING BOTH THE POOL AND BEACH.
- 14 ESTABLISH A NEW SERVICED (WATER, SEWER AND POWER) SITE PRECINCT WITH LARGE FLAT SITES WHICH ARE EASILY ACCESSED. INSTALL SYNTHETIC GRASS ON HIGH USE SITES.
- 15 INSTALL 9 GLAMPING TENTS ON SITES BENEATH EXISTING TREE COVER.
- 16 DEVELOP A BUNKHOUSE PRECINCT WITH DIRECT ACCESS TO THE ADJACENT TURTLE CENTRE. PROVIDE ACCOMMODATION FOR 48 PEOPLE, IN A TWO-STORY BUILDING WITH 12 ROOMS AND SEPARATE SHOWER, TOILET, KITCHEN AND DINING FACILITIES.
- 17 RECONFIGURE THE BEACHFRONT SITES TO PROVIDE 31 SERVICED (WATER, SEWER AND POWER) SITES.
- 18 RETAIN EXISTING ESTABLISHED VEGETATION THROUGHOUT THE PARK WHERE POSSIBLE AND PROVIDE ADDITIONAL LANDSCAPING AND TREE PLANTING WHERE OPPORTUNITIES ALLOW.

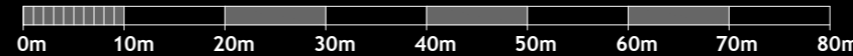
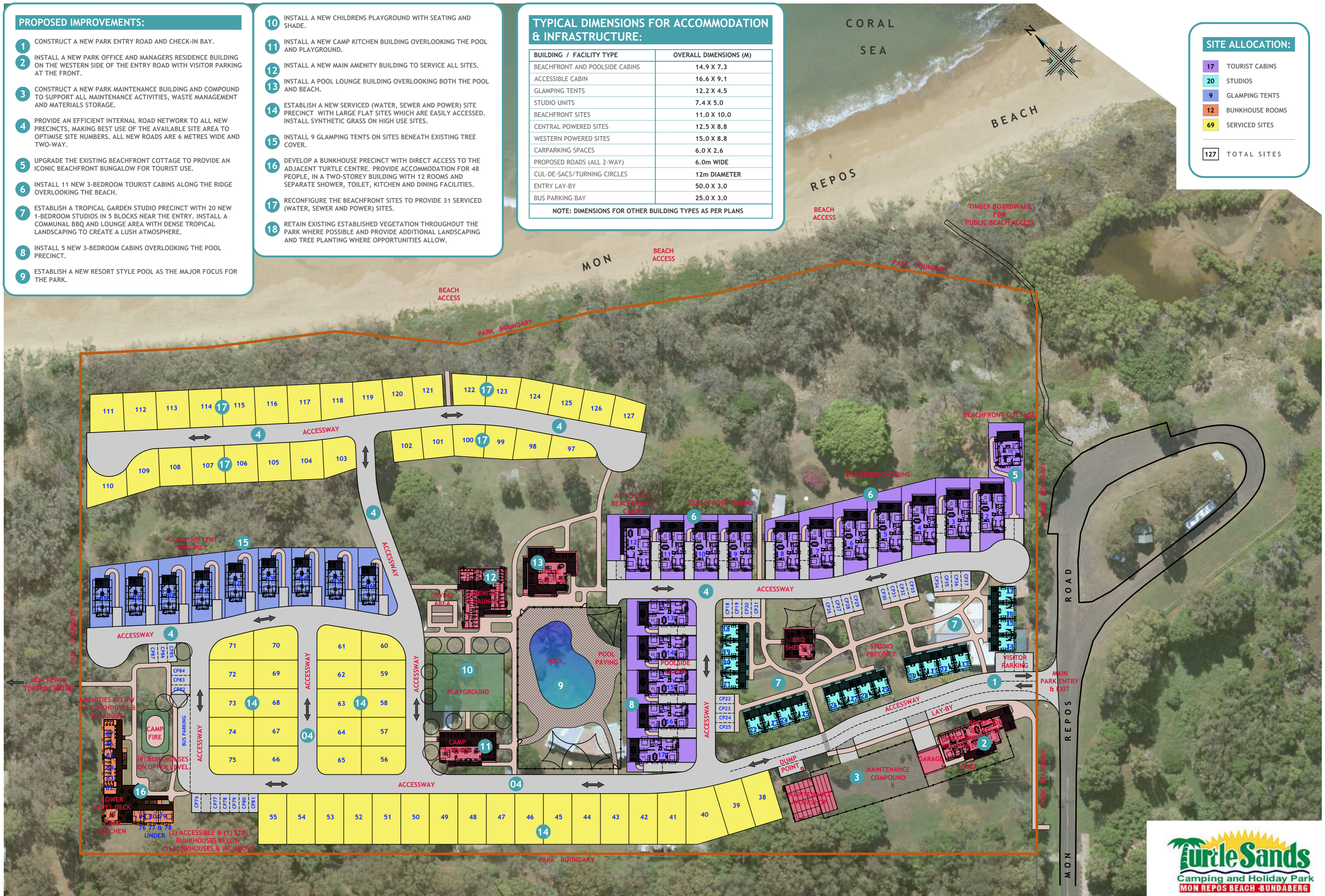
TYPICAL DIMENSIONS FOR ACCOMMODATION & INFRASTRUCTURE:

BUILDING / FACILITY TYPE	OVERALL DIMENSIONS (M)
BEACHFRONT AND POOLSIDE CABINS	14.9 X 7.3
ACCESSIBLE CABIN	16.6 X 9.1
GLAMPING TENTS	12.2 X 4.5
STUDIO UNITS	7.4 X 5.0
BEACHFRONT SITES	11.0 X 10.0
CENTRAL POWERED SITES	12.5 X 8.8
WESTERN POWERED SITES	15.0 X 8.8
CARPARKING SPACES	6.0 X 2.6
PROPOSED ROADS (ALL 2-WAY)	6.0m WIDE
CUL-DE-SACS/TURNING CIRCLES	12m DIAMETER
ENTRY LAY-BY	50.0 X 3.0
BUS PARKING BAY	25.0 X 3.0

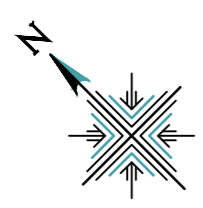
NOTE: DIMENSIONS FOR OTHER BUILDING TYPES AS PER PLANS

SITE ALLOCATION:

- 17 TOURIST CABINS
 - 20 STUDIOS
 - 9 GLAMPING TENTS
 - 12 BUNKHOUSE ROOMS
 - 69 SERVICED SITES
- 127 TOTAL SITES

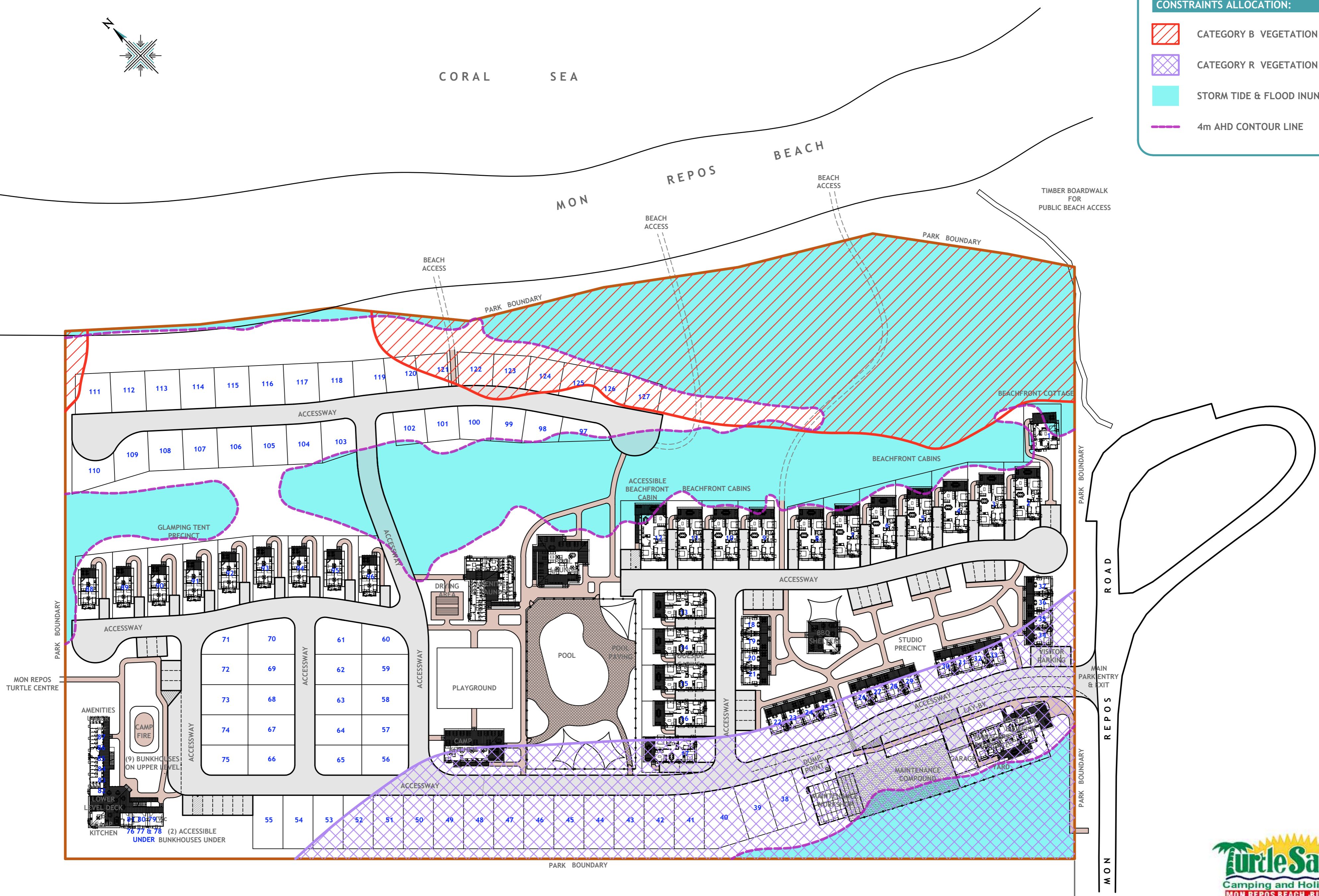


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 3 / 181 - 183 River St, Ballina, NSW, 2478
 e : tsd@i-site.com.au
 t : 0437 458 490



CONSTRAINTS ALLOCATION:

- CATEGORY B VEGETATION
- CATEGORY R VEGETATION
- STORM TIDE & FLOOD INUNDATION
- 4m AHD CONTOUR LINE



CANOPY TREE PLANTING (THROUGHOUT THE REDEVELOPMENT AREA) :

- | | |
|--|--|
| ACMENA HEMILAMPRA
BACKHOUSIA CITRIODORA
BANKSIA INTEGRIFOLIA
CUPANIOPSIS ANACARDIODES
ELAEOCARPUS OBOVATUS
HARPULLIA PENDULA
MELALEUCA LEUCADENDRA
MELALEUCA QUINQUENRERIA
SYZYGIVM LUEHMANNII
WATERHOUSEA FLORIBUNDA | SATIN ASH
LEMON SCENTED MYRTLE
COASTAL BANKSIA
TUCKEROO
HARD QUANDONG
TULIPWOOD
WEEPING PAPERBARK
SWAMP PAPERBARK
RIBERRY
WEEPING LILLY PILLY |
|--|--|



SCREEN PLANTING (ALONG ROAD FRONTAGE AND PARK BOUNDARIES) :

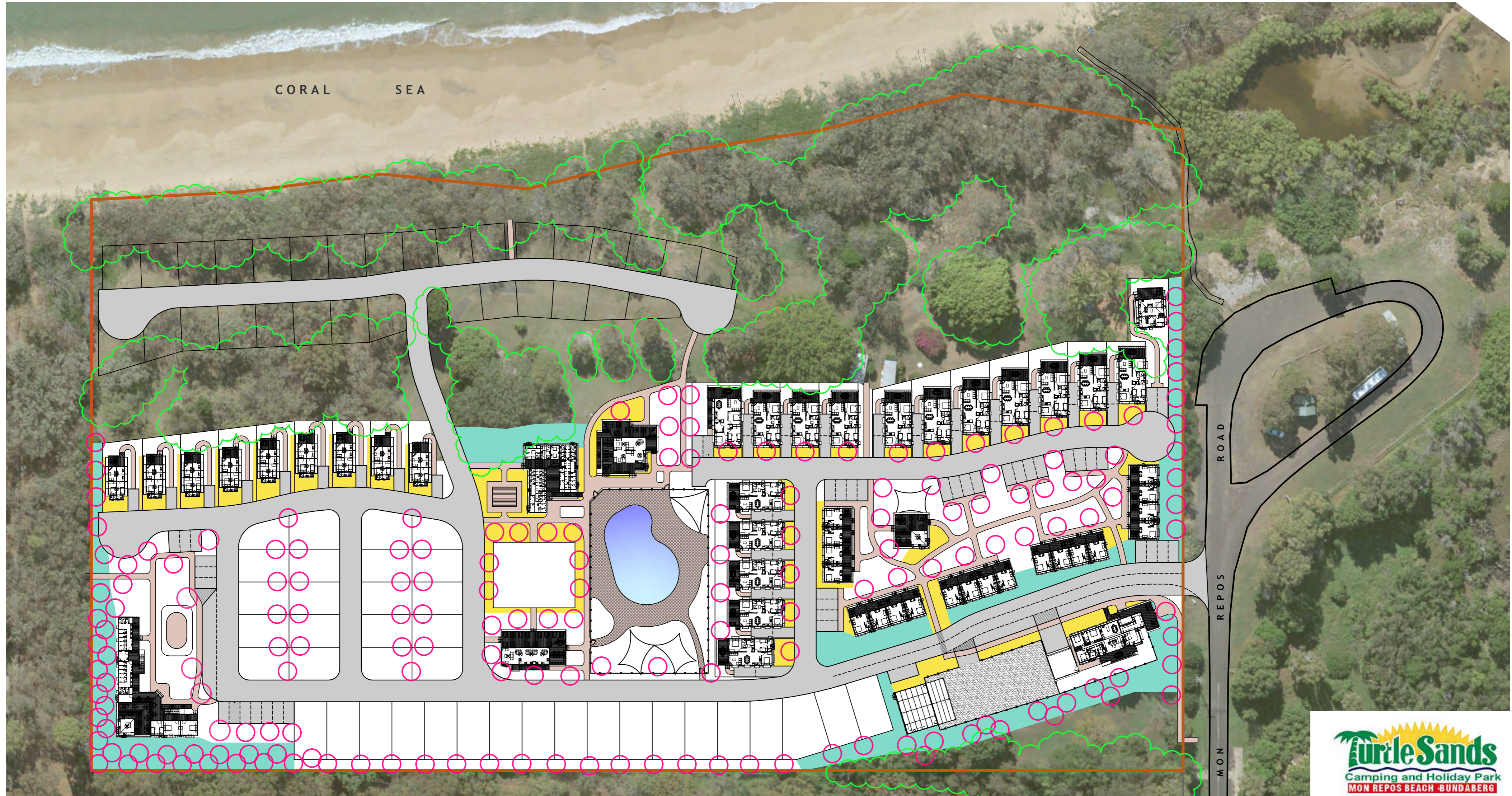
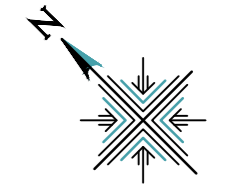
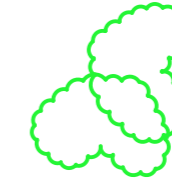
- | | |
|--|--|
| ACMENA SMITHII
ACRONYCHIA IMPERFORATA
ALECTRYON CORIACEUS
BUCKINGHAMIA CELSISIMA
CALLITRIS COLUMELLARIS
CASUARINA GLAUCA
CRYPTOCARYI TRIPLINERVIS
EUGENIA REINWARDTIANA
GLOCHIDION SUMARTANUM
SYZYGIVM AUSTRALE
XANTHOSTEMON CHRYSANTHUS | LILLY PILLY
FRASER ISLAND APPLE
BEACH BIRDS EYE
IVORY CURL
COASTAL CYPRESS
SWAMP OAK
THREE VEINED LAUREL
BEACH CHERRY
UMBRELLA CHEESE TREE
BRUSH CHERRY
GOLDEN PENDA |
|--|--|

ORNAMENTAL PLANTING (AROUND BUILDINGS & COMMON AREAS) :

- | | |
|---|--|
| AUSTROMYRTUS DULCIS
CRINUM PEDUNCULATUM
DIANELLA CAERULEA
LOMANDRA HYSTRIX
PANDANUS TECTORIUS
WESTRINGIA FRUTICOSA
XANTHORRHOEA JOHNSONII | MIDYIM
RIVER LILY
BLUE FLAX LILY
MAT RUSH
SCREW PINE
COASTAL ROSEMARY
GRASS TREE |
|---|--|

EXISTING VEGETATION (TO BE RETAINED WHERE SHOWN) :

NOTE: EXISTING TREES WITHIN THE DEVELOPMENT AREA TO BE RETAINED WHERE POSSIBLE.



PROPOSED IMPROVEMENTS:

- 1 CONSTRUCT A NEW PARK ENTRY ROAD AND CHECK-IN BAY.
- 2 INSTALL A NEW PARK OFFICE AND MANAGERS RESIDENCE BUILDING ON THE WESTERN SIDE OF THE ENTRY ROAD WITH VISITOR PARKING AT THE FRONT.
- 3 CONSTRUCT A NEW PARK MAINTENANCE BUILDING AND COMPOUND TO SUPPORT ALL MAINTENANCE ACTIVITIES, WASTE MANAGEMENT AND MATERIALS STORAGE.
- 4 PROVIDE AN EFFICIENT INTERNAL ROAD NETWORK TO ALL NEW PRECINCTS, MAKING BEST USE OF THE AVAILABLE SITE AREA TO OPTIMISE SITE NUMBERS. ALL NEW ROADS ARE 6 METRES WIDE AND TWO-WAY.
- 5 UPGRADE THE EXISTING BEACHFRONT COTTAGE TO PROVIDE AN ICONIC BEACHFRONT BUNGALOW FOR TOURIST USE.
- 6 INSTALL 11 NEW 3-BEDROOM TOURIST CABINS ALONG THE RIDGE OVERLOOKING THE BEACH.
- 7 ESTABLISH A TROPICAL GARDEN STUDIO PRECINCT WITH 20 NEW 1-BEDROOM STUDIOS IN 5 BLOCKS NEAR THE ENTRY. INSTALL A COMMUNAL BBQ AND LOUNGE AREA WITH DENSE TROPICAL LANDSCAPING TO CREATE A LUSH ATMOSPHERE.
- 8 INSTALL 5 NEW 3-BEDROOM CABINS OVERLOOKING THE POOL PRECINCT.
- 9 ESTABLISH A NEW RESORT STYLE POOL AS THE MAJOR FOCUS FOR THE PARK.

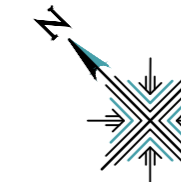
- 10 INSTALL A NEW CHILDRENS PLAYGROUND WITH SEATING AND SHADE.
- 11 INSTALL A NEW CAMP KITCHEN BUILDING OVERLOOKING THE POOL AND PLAYGROUND.
- 12 INSTALL A NEW MAIN AMENITY BUILDING TO SERVICE ALL SITES.
- 13 INSTALL A POOL LOUNGE BUILDING OVERLOOKING BOTH THE POOL AND BEACH.
- 14 ESTABLISH A NEW SERVICED (WATER, SEWER AND POWER) SITE PRECINCT WITH LARGE FLAT SITES WHICH ARE EASILY ACCESSED. INSTALL SYNTHETIC GRASS ON HIGH USE SITES.
- 15 INSTALL 9 GLAMPING TENTS ON SITES BENEATH EXISTING TREE COVER.
- 16 DEVELOP A BUNKHOUSE PRECINCT WITH DIRECT ACCESS TO THE ADJACENT TURTLE CENTRE. PROVIDE ACCOMMODATION FOR 48 PEOPLE, IN A TWO-STORY BUILDING WITH 12 ROOMS AND SEPARATE SHOWER, TOILET, KITCHEN AND DINING FACILITIES.
- 17 RECONFIGURE THE BEACHFRONT SITES TO PROVIDE 31 SERVICED (WATER, SEWER AND POWER) SITES.
- 18 RETAIN EXISTING ESTABLISHED VEGETATION THROUGHOUT THE PARK WHERE POSSIBLE AND PROVIDE ADDITIONAL LANDSCAPING AND TREE PLANTING WHERE OPPORTUNITIES ALLOW.

TYPICAL DIMENSIONS FOR ACCOMMODATION & INFRASTRUCTURE:

BUILDING / FACILITY TYPE	OVERALL DIMENSIONS (M)
BEACHFRONT AND POOLSIDE CABINS	14.9 X 7.3
ACCESSIBLE CABIN	16.6 X 9.1
GLAMPING TENTS	12.2 X 4.5
STUDIO UNITS	7.4 X 5.0
BEACHFRONT SITES	11.0 X 10.0
CENTRAL POWERED SITES	12.5 X 8.8
WESTERN POWERED SITES	15.0 X 8.8
CARPARKING SPACES	6.0 X 2.6
PROPOSED ROADS (ALL 2-WAY)	6.0m WIDE
CUL-DE-SACS/TURNING CIRCLES	12m DIAMETER
ENTRY LAY-BY	50.0 X 3.0
BUS PARKING BAY	25.0 X 3.0

NOTE: DIMENSIONS FOR OTHER BUILDING TYPES AS PER PLANS

CORAL SEA



BEACH

SITE ALLOCATION:

- 17 TOURIST CABINS
 - 20 STUDIOS
 - 9 GLAMPING TENTS
 - 12 BUNKHOUSE ROOMS
 - 69 SERVICED SITES
- 127 TOTAL SITES

