AQUIS RESORT AT THE GREAT BARRIER REEF PTY LTD

ENVIRONMENTAL IMPACT STATEMENT

VOLUME 2

CHAPTER 20

HEALTH AND SAFETY

20. HEALTH AND SAFETY

20.1 CROCODILES

20.1.1 Existing Situation

The estuarine (saltwater) crocodile (*Crocodylus porosus*) inhabits estuaries and rivers, as well as off-shore islands throughout the northern parts of Western Australia, the Northern Territory and Queensland and is known to inhabit tidal areas within Trinity Inlet and the local area. Research has shown that crocodiles are more abundant in the remote habitat regions and least abundant in the waterways along the populated east coast of Queensland.

Crocodiles have been recorded inhabiting water features in golf courses in the Cairns area including the nearby Half Moon Bay course at Yorkeys Knob.

There have been at least nine crocodile sightings between Yorkeys Knob and Holloways Beach since 2010. A *Cairns Post* article (7 September 2013) noted that two 3 m crocodiles were removed from Thomatis Creek with the space of a week and subsequent stories report more removals. One and possibly two crocodiles were recorded in one of the five aquaculture ponds in the site and tracks were observed in the Richters Creek area (this was prior to the September *Cairns Post* article).

A variety of habitats suitable for crocodiles such as freshwater rivers and lakes, mangroves and brackish water are available in the area surrounding the proposed development site. Crocodiles are known to disperse from areas in search of resources such as food or habitat and the individual(s) seen within the development envelope are likely to utilise different areas depending on seasonal resource availability. Given current population size and distribution in Queensland, there are many suitable niche habitats available. Adult crocodiles do not appear highly territorial, with a number of individuals exhibiting overlapping home ranges.

Crocodiles use the water, sun and shade to maintain their preferred body temperature and are often observed basking on the banks of watercourses to warm up before returning to the water to cool down. They require sloping banks to enter and exit the water.

The species is semi-aquatic with the ability to cross land to reach alternative water bodies. Nesting often takes place near the tidal limit of waterways and in freshwater inland waterholes.

While it is a listed species (Vulnerable – *NCA*) *Crocodylus porosus* is also a known predator. The species has been involved in a number of human fatalities in northern Australia since the 1980s

Crocodiles responsible for attacking people are mostly large males, and those responsible for fatalities are very large. The main reasons for crocodiles attacking humans are thought to be:

- territory defence
- nest defence
- hunting behaviour
- mistaken identity (e.g. attacks on people with dogs by small crocodiles)
- self-defence.

Under the EHP's *Nature Conservation (Estuarine Crocodile) Conservation Plan 2007 and Management Program 2007–2017* which came into effect on 1 March 2008, animals sighted in habitats close to urban uses and human activity are often trapped and removed by Queensland's National Parks and Wildlife Service.

Implementation of the new crocodile management policy started with the development of Crocodile Management Plans (CMPs) for the key areas that experience a higher level of potential crocodile / human interaction than other population centres. Under the new policy, Cairns was selected as a local government area that has had a CMP developed by EHP in conjunction with CRC (Department of Environment and Heritage Protection 2013b).

This plan continues to protect the estuarine crocodile as a vulnerable species while addressing a range of management issues. Public safety is critical and is addressed in this plan through a system of managing 'crocodiles of concern' and the enforcement of responsible behaviour in areas where crocodiles are likely to be encountered. The Cairns CMP sets out a risk-based approach to crocodile management consisting of three different zones:

- Zone 1: The objective is to prevent crocodiles from entering the zone and remove all crocodiles that enter into it.
- Zone 2: The objective is to remove all crocodiles 2 m or greater in length or any crocodile displaying aggressive behaviour once a sighting is confirmed.
- Zone 3: The objective is to remove crocodiles of concern.

Zone 2 includes beaches and extends for the length of the beach and 150 m off-shore from the highest astronomical tide (HAT) line, as well as inland water sites. The zone extends for the specific area of water used for recreational activities.

The response to a confirmed sighting of a crocodile 2 m or greater, or any crocodile displaying aggressive behaviour is to target the crocodile for removal.

Additionally, within the designated Proactive Removal Area within this zone, this approach is extended to remove crocodiles irrespective of the animal's size and behaviour to the greatest extent possible. Areas mapped as Zone 2 Proactive Removal areas include all Cairns northern beaches waterways (all waterways flowing into coastline from the northern bank of Trinity Inlet to Ellis Beach, as well as Lake Placid and Chinamans Creek), including the Aquis Resort site

Richters Creek is a Proactive Removal Area within Zone 2 and all confirmed sightings of crocodiles would result in the removal of these individuals.

20.1.2 Impacts

It is expected that the project will be neutral in terms of impacts on crocodiles. All areas of natural habitat will remain and there is expected to be little human activity in such areas.

The strengthening of ecological buffers will mean that some land adjacent to Richters Creek to the south of the site will be restored. However this restoration will occur some distance away from the bank of the creek and is not likely increase the use of this area by crocodiles.

The areas of anthropogenic disturbance associated with the development are some distance from Richters Creek.

The lake (and any other water body created by the development, such as water hazards for the golf course) has the potential to be used by crocodiles. The lake has the potential to be populated by crocodiles if it provides suitable habitat niches.

New habitat created by the proposed lake will support fish communities that may in turn provide food for crocodiles. The proposed development site is unlikely to provide nesting habitat.

The issue of concern therefore is the risk to human safety of crocodiles, especially on the golf course and in and around the lake.

It is likely that saltwater crocodiles will always be a potential risk, being virtually impossible to exclude from entering the lake via its outer edge or the two lake overflow channels. They may enter the development from any surrounding area, although entry is most likely from Richters Creek where existing habitat is most favourable and there is an existing population. They are more likely to appear if the lake represents a food source, and there is cover (water or vegetation) between the lake and the entry point(s). Food sources are more easily controlled, but movement cover is ineffective during hours of darkness when the species is active. Once inside the lake, specific animals can be trapped and re-located.

Development of the Concept design focused on making the Aquis Resort as unattractive as possible to crocodiles. In particular:

- Crocodiles require sloping banks to enter and exit the water. Therefore the outer lake margin should be steep-sided to reduce the attractiveness of the lake to crocodiles.
- Where possible, the golf course should be designed to reduce or eliminate water features that may be used by crocodiles.
- If possible, lake design should discourage the growth of target food species.

The outer edge of the lake will involve a vertical wall from its bed at -2.5 m AHD to the design ground level at about 2.0 m AHD. The proposed top water level will be 1.5 m AHD, meaning that a crocodile will need to scale a 0.5 m vertical wall. It is considered unlikely that a crocodile would find this task easy but it cannot be ruled out. Fences are undesirable due to the risk of trapping debris during flooding.

The inner edge of the lake (adjacent to the Resort Complex basement is proposed to involve a vertical wall from its bed at -2.5 m AHD to the design ground floor level of the Resort Complex Precinct at 7.5 m AHD. The proposed top water level will be 1.5 m AHD resulting in a crocodile needing to scale a 6 m vertical wall. It is considered that this is impossible. No ramps or other structures will provide the potential for crocodile access to the Resort Complex Precinct podium to ensure that guests and staff of the Aquis Resort will be safe from crocodiles. Access roads and bridges will be designed to ensure that crocodile access is prevented. Notwithstanding this, it is unlikely that heavily traffic areas will be attractive to crocodiles.

The golf course design will not include water artificial water bodies which could provide habitat

The development is likely to have a neutral effect on the crocodile population in the surrounding area. Richters Creek would be the most populated habitat for crocodiles within the study area and this will not be directly impacted by the proposed development.

The statutory plan provides guidance in relation to a site-specific management plan for the species. Development of such a plan would require input and consultation from specialists and stakeholders.

The long term management of the species at the site would require consideration based on potential changes in the nature and extent of aquatic habitats across the development and the likely resulting pattern of usage by crocodiles.

20.1.3 Mitigation and Management

Crocodile attacks within the development would be most likely to occur on people swimming in the lake, standing near its edge, or leaning out of small boats or over pontoons. Where these activities are limited, risk will be reduced. It is therefore critical that resort guests and staff be educated about crocodile risk and that unsafe practices such as those listed above are actively discouraged. In addition, in order to minimise the human / crocodile interaction at locations of risk mitigation measures

should also include physical separation of visitors from crocodile habitat in high risk areas good food hygiene procedures should be upheld at all times to ensure that crocodiles are not attracted.

The project Environmental Management Plan includes a *Crocodile Management Strategy*. This will be developed during detailed design. Key elements are expected to be as follows:

- Crocodile management plan to be developed to reduce risk of interaction with visitors.
- Design initiatives that could reduce the attractiveness of the development to crocodiles:
  - make the sides of the lake as steep as possible to restrict access to the water (and once in the water, to the adjacent land)
  - avoid water hazards in the golf course and natural water features in general.
- Installation and maintenance of appropriate signage to maximise visitor awareness in higher risk areas.
- Physical separation of the board walk / viewing platforms from crocodile habitat, either by elevation or fencing of the walking track and platforms.
- Feeding of crocodiles from the board walk / viewing platforms would be strictly prohibited. Hygiene procedures would be required to ensure that crocodiles are not attracted towards the boardwalk.
- Interpretative displays on the board walk to increase visitor knowledge on crocodiles where encounters are more likely (e.g. mangrove areas).
- Warning signs adjacent to creeks and water bodies (e.g. Yorkeys Creek, Richters Creek) within and adjacent to the development, warning of the potential presence of crocodiles.
- Design of lake edges to provide minimal crocodile entry / exit points. Steeper sided or vertical banks would be preferred.
- Minimising the creation of breeding habitat on any vegetated portions of the artificial lake area – such areas e.g. islands, may offer ideal undisturbed breeding habitat for crocodiles.
- Minimising the attraction of the lake surface – generating a level of random, anthropogenic disturbance that reduces the likelihood of usage, either through automated (aquatic drone) devices, or by incorporating a water taxi/gondola system may create a level of disturbance appropriate to dissuade crocodiles from using the lake. However it should be noted that it is illegal to drive a boat within 10 m of an estuarine crocodile.
- Using shallow sand-bunkers with sub-surface drainage on the golf course, in preference to water hazards.

20.1.4 Residual Impacts

Although crocodiles cannot be definitively excluded from the Aquis Resort, with appropriate design and management the risk can be managed. Crocodiles are a fact of life in the Cairns area and in Northern Australia and active management plans are in place for dealing with problem crocodiles.

The main residual impact is that resort guests and staff may be unaware of appropriate crocodile safety behaviour and therefore engage in unsafe practices. Education is essential.

20.2 MOSQUITOS AND MIDGES

20.2.1 Existing Situation

a) Mosquitos

Mosquitoes have been identified as being a major and significant threat to both human health and lifestyle throughout the world (CRC 2014a). More than 220 mosquito species can be found in Queensland and a substantial number of these have been implicated as vectors of some human

diseases. A variety of species of mosquito occur in association with salt, brackish or fresh waters and they are particularly prevalent in natural low-lying areas and watercourses. The Staff undertaking the Aquis Resort ecological surveys reported large populations of mosquitoes during the wet season surveys, particularly in the Yorkeys Creek area.

The Cairns climate provides ideal breeding conditions for mosquitos year-round, and their lifecycle can be completed in 7-10 days. Mosquitos can breed in both fresh and salt water. Females lay eggs on the surface of the water or the water's edge, and the eggs hatch when water levels rise (with the incidence of tidal inundation or heavy rainfall). Mosquito larvae spend the early part of their development living under the surface of still water and breathe air through the surface, emerging from the water soon after as an adult.

A substantial number of the 220 plus mosquito species found in Queensland have been implicated as vectors of some human diseases. Some of these diseases include:

- Ross River Virus
- Barmah Forest Virus
- Dengue Fever
- Malaria.

Of these, Ross River virus is the most prevalent disease, comprising 90% of total notification of mosquito-borne diseases (Queensland Health 2002). None of these diseases are endemic to the Cairns area, although they can be easily introduced by infected visitors from countries where the diseases occur.

b) Biting Midges

Commonly known as 'sand flies', biting midges are small flies renowned for their nuisance biting associated with shady, humid habitats in coastal lagoons, estuaries, mangrove swamps, and tidal flats. Biting midge are continually active in the Cairns region, but can be more active in the summer months when the temperature and humidity is higher. Staff undertaking the Aquis Resort ecological surveys reported large populations of biting midges during the wet season surveys, particularly in the Yorkeys Creek area.

Midges most commonly breed on gently sloping intertidal substrate (mud, silt or sand) with regular wetting and drying cycles (CRC 2014b). The midge life cycle takes 3-10 weeks, depending on the species and environmental conditions (e.g. temperature). Midges of the genus *Culicoides,* typically lay their eggs in well-aerated wet areas, in the upper half of either fresh or saline intertidal zones. Breeding is commonly dependent on monthly tidal inundation; so adult emergence and the incidence of biting activity are synchronous with phases of the moon.

Like mosquitos, they most commonly bite around dusk and dawn, and are relatively inactive in windy conditions. Biting midge activity also increases shortly after high tides, and spring tides. Infestations are usually the result of a number of species rather than an individual species. The pest range for biting midges is species dependent, but rarely more than 1.5 km.

Female midges may attack humans in large numbers, biting on any areas of exposed skin, and often on the face, scalp and hands. Some species will blood feed on a wide range of animal hosts. Although biting midges are not known to transmit any diseases, some people have severe reactions to their bites, which may result in blistering and weeping. These reactions may last for several days to weeks. Medical attention may be required for severe cases.

c) CRC Management

The main activities of CRC's Vector Control Unit are:

- proactive chemical spraying in known breeding areas for nuisance mosquito control
- response to complaints of vector breeding
- cooperation with Queensland Health in anti-Dengue Fever procedures
- proactive on-site monitoring procedures to determine breeding sites and vector species
- development of biological control measures, such as specific fish breeds, to lessen the reliance on chemical means of control of nuisance mosquito larvae
- maintenance of a Mosquito Chemical Allergy Register.

CRC's Health Services unit is currently developing a Vector Control Policy which, when implemented, will provide an integrated technology-based program based on the latest principles of vector control. The Vector Control Policy will employ a wide variety of control measures described above, including chemical control for adults and larvae and biological control using specific fish breeds. Initial studies have shown that these fish significantly decrease the incidence of mosquito larvae and have contributed to a decrease in the use of chemicals in these areas. Further breeding of different species is underway to widen the potential areas into which fish may be released to combat mosquito larvae.

The Queensland Government provides guidelines to minimise mosquito and biting midge problems in new development areas (Queensland Health 2002). These guidelines contain avoidance measures for consideration in land-use planning and mitigation approaches to be adopted where development may expose significant numbers of people to insect vectors and pests.

20.2.2 Impacts

New developments located in close proximity to wetlands, particularly in the coastal zone, bring humans in closer contact with biting insects in their natural habitats, and may create new mosquito and biting midge breeding habitat. The Aquis Resort site adjoins Yorkeys, Richters, Thomatis and Half Moon Creeks, which are mangrove-lined and provide breeding habitat for both mosquitoes and biting midge.

The development of the project has the potential to increase existing freshwater breeding habitat for mosquito and biting midge larvae. Potential breeding habitat may be created in infrastructure such as. stormwater / irrigation drains and grassy swales; well mulched and watered garden beds; dams and stormwater retention basins; and in newly created intertidal areas of the resort lake.

Construction-phase and post commissioning –phase mosquito and biting midge management plans will be formulated by the study team prior to the commencement of construction, and will be compatible with the suite of measures currently implemented by CRC's Health Services Unit and the Queensland Health's *Guidelines to Minimise Mosquito and Biting Midge Problems in New Development Areas* (Queensland Health 2002). The measures will be based on avoiding mosquito and midge breeding on the Aquis Resort site, and minimising the potential for biting insects from adjacent wetland areas to access the Aquis Resort site.

20.2.3 Mitigation and Management

Although Council's Vector Control Plan activities are not strictly relevant to the Aquis Resort, liaison will be undertaken with the CRC Health Services unit during detailed design to formulate an appropriate detailed design and management response.

Monitoring of mosquitos and biting midge larvae will be conducted after construction to ensure mitigation measures are adequate (Queensland Health 2002). Monthly surveys for mosquitos and biting midge larvae, including detailed identification to species, will be undertaken to ensure Aquis guests are at minimal risk.

20.2.4 Residual Impacts

The design decisions to adopt a saline lake and limit flat or gently sloping edges will reduce the main risk of mosquitos and midges and standard management of construction via the EMP (Construction) can be expected to limit problems during construction.

Regardless of any design and management controls that the Aquis Resort can implement, mosquitos and midges already inhabit the site at times and cannot be excluded from the development. Some people are especially susceptible to bites from these insects and an active educational program is essential, appropriate first aid facilities and trained staff will also be required.