BCI MINERALS LTD

ADVISORY MEMO: MARDIE SALT PROJECT ERD: RESPONSE TO MARINE TURTLE RELATED SUBMISSIONS

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1 INTRODUCTION

1.1 Scope of Work

BCI Minerals have requested Pendoley Environmental (PENV) provide a response to submissions received from the Western Australia Environmental Protection Authority (EPA) on their Environmental Review Document submitted as part of their Mardie Salt Project.

2 RESPONSE TO ENVIRONMENTAL REVIEW DOCUMENT SUBMISSIONS

1. *Green turtles demonstrate high site fidelity to foraging grounds and localised loss of seagrass may result in localised impacts to turtles foraging in the area. However, the stock is highly dispersed and given the likely localised impacts on seagrass beds, the proposed activity is unlikely to adversely impact the stock.*

Agree.

> *Pilbara Coast Flatback genetic stocks are unknown, and a precautionary approach should be employed when considering impacts on this species.*

A recent publication by Fitzsimmons et al. (2020) provided an update to the knowledge gaps on flatback turtle genetic stocks in Western Australia. While we agree little is known about mainland coast flatback nesting, this is largely due to the limited amount of mainland nesting that has been documented during regional surveys (see Pendoley et al. 2016). The nesting that has been documented on this coastline is concentrated north of the Mardie Salt Project location at Cape Preston and south between Onslow and Exmouth Gulf.

The BCI field survey was timed to coincide with the peak nesting period for flatback and green turtles and covered a full inter-nesting period (14 days) when ~80 % of females nesting at that location can be expected to come ashore to nest. The three flatback turtle tracks recorded from the survey extent on the mainland represented a density of 0.012 tracks/km/night compared to 3.2 – 9.6 tracks/km/night for the offshore islands. This low density nesting activity corroborate previous survey findings in Pendoley et al. (2016) and suggests that the mainland coast in the vicinity of the Mardie Salt Project is a marginal rookery compared with the nesting on the offshore islands and on the mainland coast between Onslow and the Ashburton River.

> *A precautionary approach should also be employed when considering impacts on hawksbill turtles as A07-1 Marine Turtle Monitoring Report did not conduct monitoring of hawksbill turtles during peak nesting season. Please provide a discussion on proposed mitigation measures to be implemented for hawksbill turtles.*

The BCI field survey was designed to focus effort during the peak nesting period for flatback and green turtles. This design was based on the findings of Pendoley et al. (2016) and personal knowledge of the region and nesting habitat preferences of the three species (*pers. comm.* Kellie Pendoley, Paul Whittock, Catherine Bell) which indicated that this coastline was not likely to support substantial hawksbill nesting. Hawksbill turtle nesting is more seasonally diffuse than green and flatback nesting,

however a spring (October) peak in nesting is recognised in the Pilbara (Pendoley 2005). Low numbers of hawksbill tracks have been recorded at Cape Preston to the north (Pendoley et al, 2016).

The density of hawksbill tracks recorded from the survey extent on the mainland was 0.008 tracks/km/night compared to 0.14 - 0.57 tracks/km/night on the offshore islands. This result confirmed hawksbill nesting was occurring regionally during the December survey and the mainland habitat featured less activity compared to the offshore islands. In addition, the timing of the survey in December was planned to coincide with the hatching time of any hawksbill nests that might have been laid in October. None were observed hatching over the 14-day survey. It is important to note that the daily surveys were carried out soon after dawn to reduce the chance of adult and hatchling tracks being erased by the daily winds.

Hawksbill turtles see and respond to light in a similar way that green and flatback turtles use light as a cue. Consequently, any mitigation measures implemented to control the impact of light will apply to all species regardless of their spatial and temporal distribution across the region.

NEIL: If BCI is going to commit to any turtle monitoring this is something that could be done, at least one October survey similar to the December one we did to just confirm this is not a weird but undiscovered hawksbill rookery

2. *It should also be noted that mangroves represent an important habitat for juvenile green turtles in other regions and it is likely that they forage on, and reside in, mangroves at the proposal site. Loss of mangroves will represent a loss of habitat for green turtles that have not been considered in the ERD. Please provide a discussion on the likely impacts to green turtles through the loss of mangrove habitat.*

The area of mangrove habitat that will be impacted by the pump station disturbance footprint is small relative to the remaining habitat both within the creek where the pump station is located, and in the broader coastal region. The mangroves in the disturbance footprint are relatively sparse and extend along a total ~80 m of shoreline. The loss of this habitat is unlikely to have any detectable impact on juvenile green turtles sheltering or foraging since good quality mangrove habitat is available elsewhere in the creek. Green adult turtles are known to forage on mangroves (Pendoley & Fitzpatrick XXXX) by grazing on low hanging leaves and fruit on a high tide, however it is likely the adult turtles will use the better quality mangrove stands elsewhere in the creek and along the coastline.

3. *The Department understands that dredging operations (as proposed in the ERD) will be restricted to daylight hours, night-time operations of the salt mine (and shipping) likely require artificial light at night. The A07-1 Marine Turtle Monitoring Report notes the existence of pristine darkness in the proposed site. It is possible that even a small addition of artificial light (i.e. navigational lighting, jetty operations, salt mine operations) to a greenfield dark area could impact hatchling behaviour, attracting hatchlings to newly installed light sources. The ERD refers to the 1.5km dark zone recommended in the 2010 EPA Guidelines. However, the Department considers this recommendation is only relevant to lights on land where vegetation and topography are likely to mitigate the impacts of light. In the proposed development, hatchlings are likely to be exposed to light across the water where there is evidence artificial light can affect hatchlings up to 17km away (see Kamrowski et al. 2014, Wildlife Research 41: 421-434 and Hodge et al. 2007, Queensland turtle conservation project: Hummock Hill Island*

Nesting Turtle Study). The Department considers the 1.5 km buffer is insufficient, and the measurement of success for light management should be unaltered hatchling behaviour (given baseline demonstrates hatchlings have a high rate of success finding the ocean) rather than distance to a light source.

It is reasonable to conclude that the risk of hatchlings being exposed to light on the mainland beaches is very low. This conclusion is based on the extremely low density of nesting by flatback and hawksbill turtles along this stretch of mainland coast, together with the poor quality of the nesting habitat and high sand temperature that would likely reduce the hatch success of any clutches that might be laid.

There is a potential risk that light from the Mardie Salt Project in a currently pristine dark area will be visible to hatchlings on the offshore islands located between 8 – 12 km away i.e. Angle, Middle, Long, Round, Sholl, and Mardi Islands. These islands have direct line of sight to the development across the ocean and are situated within 20 km of the project site (i.e. the distance identified within the more recently released *National Light Pollution Guidelines for Wildlife* at which light could potentially impact marine turtle hatchlings; Commonwealth of Australia 2020).

The baseline data has confirmed that hatchlings on the offshore islands are currently orienting seaward successfully despite the visibility of light from Cape Preston situated 30 km away. BCI has committed to managing the lighting for the Mardie Salt Project and this is expected to mitigate any potential impacts on hatchlings during sea finding on the offshore islands.

NEIL: However, the only way to confirm the accuracy of this prediction and the success of the light management is to monitor hatchling orientation on the offshore islands during construction and for the first 3 years of operations.

4. *Artificial light may also cause hatchlings to swim in circles near light sources adjacent to or over the water. Hatchlings captured in light pools are likely to be exposed to increased predation. As noted above, the ERD only provides principles of light management rather than specific mitigation and does not address the likelihood of light attracting hatchlings in water. This should be considered as part of the light management plan, which should include appropriate turtle monitoring to ensure artificial light is not impacting hatchlings in-water dispersal. Furthermore, jetty structures like the one proposed can concentrate hatchling predators increasing the rate of predation of passing hatchlings. Please provide a discussion addressing this risk.*

The EPA is correct in recognising that light from the jetty could attract and trap hatchlings, increasing the risk of predation (Thums et al. 2016; Wilson et al. 2019). However, the likelihood and consequences of this occurring for the Mardie Salt Project is considered low. As discussed above, the limited nesting activity and low incubation success rates reported on this stretch of mainland coast means that the number of hatchlings emerging at this location is low when compared to the annual productivity of the respective genetic stocks. Any hatchlings emerging from the mainland beaches that may become disorientated in the water will represent a negligible proportion of the local and regional population.

Hatchlings leaving the nesting beaches on the offshore islands i.e. Angle, Middle, Long, Round, Sholl and Mardi Islands, could potentially be attracted to light from the onshore facilities and jetty.

Following emergence, hatchlings crawl to the ocean and swim offshore under the influence of tides and currents, into deeper, less predator rich, waters (Pilcher et al. 2000; Wyneken & Salmon 1992). Upon entering the ocean, hatchlings use wave cues to guide them offshore (Lohmann et al. 1990; Lohmann et al. 1995; Okuyama et al. 2009; Wyneken et al. 1990) up to a distance of at least 3 km (Salmon & Lohmann 1989). Ocean currents which exceed speeds of approximately 0.3 $m.s^{-1}$ (0.6 knots) will influence the bearing of hatchlings (Thums et al. 2016), carrying them offshore. While larger than all other hatchlings, flatback turtles typically swim at similar speeds (0.4 to 0.5 $m.s^{-1}$) to green turtles (0.5 $m.s^{-1}$) (Thums et al. 2016; Wilson et al. 2018) both of which are greater than the smaller hawksbill turtle (0.21 m/s^{-1}) (Chung *et al.,* 2009).. In the absence of wave cues however, swimming hatchlings have been shown to orient towards light cues (Harewood & Horrocks 2008) and in some cases, wave cues were overridden by light cues (Thums et al., 2013, 2016; Wilson et al., 2018).

Hatchlings departing from nesting beaches on the offshore islands will typically be carried on prevailing tides and currents into deeper offshore waters and not inshore to the mainland where the jetty is located. Tide flow in the vicinity of the project site is locally complex and strongly influenced by the presence of islands and local bathymetry. These waters flow both east-west and northeast-southwest at 1 – 1.5 knots (AUS742 navigation chart; 0.5 – 0.8 $m.s^{-1}$), in the waters between the Mardie Salt Project site and the coastal island chain. Strong flow rates are expected in the channels between the islands.

While considered unlikely, should hatchlings be carried 10 – 12 km inshore to the vicinity of the jetty light source, hatchlings would have to swim against low velocity currents to stay within the light spill and would be carried away from the area on flooding or ebbing tides or wind driven currents. It is not considered credible that hatchlings would be able to correct against current displacement over the 10 – 12 km distance from their nesting beach to reach the source of artificial light at the jetty, particularly when current speeds may exceed hatchling swimming speeds (i.e. >0.4 $m.s^{-1}$).

NEIL: If you wanted to commit to something you could say you would carry out opportunistic observations from the jetty during night operations using BCI staff to see if hatchlings were aggregating. Or install some camera surveillance equipment ….that could be processed and analysed remotely.

5. *Section 8.6.2 #9n of the Draft ERD -The Department notes that mitigation of lighting impacts is proposed to be undertaken in accordance with the National Light Pollution Guidelines for Wildlife Including Marine Turtles, Seabirds and Migratory Shorebirds through monitoring of turtle hatchlings orientations and the artificial light. Even though it is a good proposed mitigation measure the timeframe for monitoring will need to be extended beyond 12 months. The Department notes the proponents surveys provide evidence that there is high quantity and quality of sea turtle nesting habitat directly offshore on Shell Island, Round Island, Long Island, Middle Island, and Angle Island and the noticeable light sources from the Sine Iron Facility 30 km away (as shown in Figures 7-10 in Appendix A07 -1). Light pollution from the proposed project site has the potential to impact on these island's nesting beaches, which are within 7-10 km from the proposed project site. Therefore, the Department considers that additional monitoring is required.*

NEIL: I agree. I would suggest the following:

1. Monitor hatchling orientation on the islands during the summer season when the project reaches steady state operations, i.e. when the salt storage area is at normal capacity (this is when the most light is reflected from salt piles) operation, based on the results of this initial survey decide if ongoing surveys are required; 14 days of field work at peak hatching in Jan/Feb.
2. Monitor light at the same time as 1.
3. Do a single 14-day survey in October in the next year or so to prove that hawksbills are not using the mainland in any meaningful numbers – this is lower priority than 1 and 2 and only do this if the EPA pushes back on our explanation about low risk to hawksbills. We don't think this is absolutely necessary though. They may want to see light and hatchlings monitored during construction, given it is only one year we don't see this as a priority.

3 REFERENCES

CHUNG, F.C., PILCHER, N.J., SALMON, M., & WYNEKEN, J. (2009) Offshore migratory activity of hawksbill turtle (*Eretmochelys imbricata*) hatchlings, ii. Swimming gaits, swimming speed, and morphological comparisons. *Chelonian Conservation and Biology*, 8: 35-42

COMMONWEALTH OF AUSTRALIA (2020) National Light Pollution Guidelines for Wildlife Including Marine Turtles, Seabirds and Migratory Shorebirds. January 2020.

HAREWOOD, A. & HORROCKS, J. (2008) Impacts of coastal development on hawksbill hatchling survival and swimming success during the initial offshore migration. *Biological Conservation*, 141(2), 394-401.

LOHMANN, K.J., SALMON, M. & WYNEKEN, J. (1990) Functional autonomy of land and sea orientation systems in sea turtle hatchlings. *Biological Bulletin*, 179(2), 214-218.

LOHMANN, K.J., SWARTZ, A.W. & LOHMANN, C.M. (1995) Perception of ocean wave direction by sea turtles. *Journal of Experimental Biology*, 198, 1079-1085.

OKUYAMA, J., ABE, O., NISHIZAWA, H., KOBAYASHI, M., YOSEDA, K. & ARAI, N. (2009) Ontogeny of the dispersal migration of green turtle (Chelonia mydas) hatchlings. *Journal of Experimental Marine Biology and Ecology*, 379(1-2), 43-50.

PENDOLEY, K. (2005) Sea turtles and the environmental management of industrial activities in north west Western Australia. (Doctor of Philosophy), Murdoch University, Perth, Australia, Perth, Australia.

PENDOLEY, K. and FITZPATRICK, J., 1999. Browsing of mangroves by green turtles in Western Australia. *Marine Turtle Newsletter*, *84*(10).

PILCHER, N.J., ENDERBY, S., STRINGELL, T. & BATEMAN, L. (2000) Nearshore turtle hatchling distribution and predation. In N. Pilcher & G. Ismail (Eds.), Sea turtles of the Indo-Pacific: research management and conservation. Proceedings of the Second ASEAN Symposium and Workshop on Sea Turtle Biology and Conservation. (pp. 151-166) London: ASEAN Academic Press.

SALMON, M. & LOHMANN, K.J. (1989) Orientation cues used by hatchling loggerhead sea turtles (*Caretta* L.) during their offshore migration. *Ethology*, 83, 215-228.

THUMS, M., WHITING, S.D., REISSER, J., PENDOLEY, K.L., PATTIARATCHI, C.B., PROIETTI, M., HETZEL, Y., FISHER, R. & MEEKAN, M.G. (2016) Artificial light on water attracts turtle hatchlings during their near shore transit. *Royal Society Open Science*, 3(5), p.160142.

WILSON, P., THUMS, M., PATTIARATCHI, C., WHITING, S., PENDOLEY, K., FERREIRA, L.C. & MEEKAN, M. (2019) High predation of marine turtle hatchlings near a coastal jetty. *Biological Conservation*, 236, 571-579.

WYNEKEN, J. & SALMON, M. (1992) Frenzy and post frenzy swimming activity in loggerhead, green, and leatherback hatchling sea turtles. *Copeia*, 1992(2), 478-484.

WYNEKEN, J., SALMON, M. & LOHMANN, C.M. (1990) Orientation by hatchling loggerhead sea turtles *Caretta caretta* L. in a wave tank. *Journal of Experimental Marine Biology and Ecology*, 139, 43-50.