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Dear John,

WEST CULBURRA MIXED USE SUBDIVISION (SSD 3846) – STORMWATER QUALITY PEER REVIEW

Cardno understands that the West Culburra Concept Proposal SSD 3846 (The Proposal) was submitted to the Department of Planning and Environment (DPE) and a recommendation made by DPE in June 2018 to refuse the development. The refusal, in part, was due to *'unacceptable risk to water quality in the Crookhaven River Estuary and Lake Wollumboola'*. The matter is now with the Independent Planning Commission (IPC) for determination.

Given DPE's reasons for recommending refusal, Sealark Pty Ltd has requested Cardno undertake a peer review of the 'landside' stormwater quality strategy and modelling undertaken by Martens and Associates Pty Ltd (for clarity, review of the estuarine processes modelling was not within the scope of this review). This letter documents the findings of Cardno's review.

1.1 Available Data

The key documents and models provided to inform this review included:

- Water Cycle Management Report (WCMR) - Mixed Use Subdivision; West Culburra, NSW, P1203365JR01V07 (Martens, November, 2016).
- Estuary Management Study (EMS) - Mixed Use Subdivision; West Culburra, NSW, P1203365JR02V04 (Martens, November, 2016).
- Water Quality Monitoring Plan (WQMP) - Mixed Use Subdivision; West Culburra, NSW, P1203365JR03V04 (Martens, November, 2016).
- Explanatory Note - West Culburra Concept Plan (SSD 3846); Water Quality Issue Land Side Stormwater Report (Martens, 31 January 2017).
- Water Cycle Management Report Addendum; Mixed Use Subdivision, West Culburra (SSD 3846) (Martens, June, 2017)
- Stormwater Quality Assessment – Stage 1; Culburra West Mixed Use Development, Culburra (Martens, November 2017)
- Review of Water Cycle Management Report Addendum (BMT WBM, 20 July 2017)
- Assessment of West Culburra Concept Plan (Alluvium, 19 July 2017)
- State Significant Development Assessment: West Culburra Concept Proposal SSD 3846' (DPE, June 2018)
- Independent Planning Commission Water Quality Briefing – Culburra West Mixed Use Development (SSD3846) (Martens, 30 July 2018)
- MUSIC Models (Martens):
 - P1203365MUS01V16 (pre development)
 - P1203365MUS02V43 (post development V43)

- P1203365MUS02V44 (post development V44)
- P1203365MUS02V45 (post development V45)

1.2 Previous Peer Reviews

From review of the reports referenced above, it is noted that the stormwater quality strategy for the proposed development has been developed over a number of years and in consultation with DPE's independent stormwater quality experts, BMT WBM and Alluvium. Also, DPE's recommendation for refusal of the development references the advice contained in reports by Alluvium (19 July 2017) and BMT WBM (20 July 2017).

Key issues that BMT WBM / Alluvium raise in their July 2017 reports include:

- there is insufficient detail of the proposed development to undertake an assessment of proposed development modifications
- final MUSIC models have not been provided for review
- there is potentially "double counting" of pollutant removal in the treatment train

In relation to stormwater quality objectives there is agreement that a Neutral or Beneficial Effect (NorBE) target is appropriate.

1.3 Assessment

In regards to the level of detail of the proposed development, the information provided to inform this review is considered appropriate and typical for this stage in the planning and design process. Further, the proposed stormwater treatment devices are commonly implemented in a range of urban development scenarios and there is no reason to believe that they couldn't be successfully implemented in the proposed West Culburra development.

It is considered of most importance to review whether the modelling of the proposed treatment measures is appropriate and this has therefore been the focus of this review. We agree with the previous reviewers concerns that "double counting" is a potential issue, in particular where the proposed Enviro Pod Storm Filter (EPSF) proprietary devices are placed downstream of bioretention systems. This scenario hasn't explicitly been tested in field trials. As part of this assessment we have therefore reviewed the MUSIC models and, in particular, focused on the potential for "double counting" of pollutant removal where treatment devices are placed in series.

The bioretention systems are the first device in the treatment train and there is no reason to believe that MUSIC wouldn't model these correctly when using parameters that are generally in accordance with local modelling guidelines (eg; NSW MUSIC Modelling Guidelines). However, there is potential for MUSIC to overestimate the performance of the EPSF devices when placed downstream of the bioretention systems.

To satisfy ourselves that "double counting" is not an issue in this instance, we have reviewed the supporting literature for these devices. The key peer reviewed journal paper provided by the manufacturer (Stormwater360) to support the performance of the EPSF is:

Nutrients and Solids Removal by an Engineered Treatment Train, M Wicks et al., Water Vol 38 No 6, September 2011

The study which is documented in this paper has a number of limitations in terms of the number of samples collected, type of development (road only) and location (Queensland). These limitations are commonly found when assessing the performance of proprietary stormwater treatment devices, where collecting large amounts of data is typically cost prohibitive and a degree of uncertainty is therefore generally accepted. There is also currently no standard testing protocol for these devices in Australia (although a protocol has been under development for a number of years now).

To allow for uncertainty in the field testing and also in the modelling, Martens has been able to demonstrate that there is a significant buffer in relation to the modelled pollutant removal performance relative to the targets.

For Total Suspended Solids (TSS), this has been demonstrated by increasing the minimum modelled TSS effluent concentration for the EPSF to 8 mg/L (in line with the minimum reported effluent concentration in the field trial) and 16mg/L (to allow for additional uncertainty). In both scenarios it was found that the NorBE target was still achieved.

For Total Nitrogen (TN) and Total Phosphorus (TP) it is harder to justify an appropriate concentration due to complications associated with the presence of both dissolved and particulate fractions as well as different species.

For TN, it was assumed that the particulate fraction would largely be removed by the bioretention devices and hence it would only be the dissolved fraction entering the EPSF. Therefore, rather than modelling 44% TN removal, which would be justified without a bioretention system upstream, in this scenario we recommend that TN removal be reduced to 20%. This still being less than the total dissolved TN removal of 25% found in the field study.

The model results showed that TN overall was able to meet the NorBE target. However, at one discharge location (catchment 'O2') a small increase (4%) was noted.

For TP, which has a total reported mean removal efficiency of 47% from the field study, we recommend this also be reduced to 20% to allow for the likely reduced efficiency. Similarly to TN, the model results showed that TP overall was able to meet the NorBE target. However, at the same discharge location as for TN (catchment 'O2') a small increase (14%) was noted.

It is expected that as part of future design development, NorBE could still be achieved for catchment 'O2' by making minor adjustments to the stormwater system which could include one or more of:

- Minor redistribution of catchment flows
- Reviewing the sizing of other treatment measures in the catchment (ie. bioretention and rainwater tanks)
- Substituting the EPSF with an alternative proprietary device or using an alternative filter media in the EPSF.

1.4 Conclusion

The stormwater quality management strategy for the proposed development has been developed using best management practice techniques. While there were some valid concerns raised by DPE's peer reviewers regarding modelled pollutant removal performance, from our own review of the latest MUSIC models prepared by Martens and making a reasonable allowance for uncertainty in the modelling and performance of the proposed treatment devices, we are satisfied that the NorBE water quality target is able to be met.

Yours sincerely,



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