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8 May 2017

NSW Department of Planning and Environment
GPO Box 39
Sydney NSW 2001

Attention: Robert Byrne

Dear Robert

RE: Review of Estuarine Processes Modelling Report: Proposed Mixed Use Subdivision, West Culburra, (report P1203365JR04V02)

Thank you for inviting BMT WBM to provide assistance with regard to the above. This letter provides detailed commentary on some technical aspects of that report, as a supplement to BMT WBM's broader review letter of 5th May 2017.

I will be happy to discuss outcomes with the Department if required.

Yours Faithfully
BMT WBM

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This letter is supplemental to BMT WBM's correspondence of 5th May 2017, and provides further technical detail as to the reviewer's assessment of the consultant's report: *Estuarine Processes Modelling Report: Proposed Mixed Use Subdivision, West Culburra, (report P1203365JR04V02).* The letter of 5th May omitted these details for clarity.

By way of background, BMT WBM has provided ongoing detailed review of the consultant's receiving water quality modelling work since late 2014. Over the intervening period, the following key modifications, amongst others, have been made to the consultant's modelling program and associated works, as a result of BMT WBM's review:

- Collection of hydrographic data to allow calibration of the model, specifically
  - Tidal water levels
  - Acoustic Doppler Current Profiler (flow) data
  - Salinity

- Critical interpretation of these data by the consultant, especially with regards to salinity measurements

- Use of these data to calibrate the hydrodynamic model components

- Reparameterisation of the downstream tidal salinity boundary condition

- Extension of the model domain to include estuarine waters to the tidal limits

- Re-examination of model roughnesses and grid sizes

- Re-examination of model dispersion coefficients

- Inclusion and correct implementation of flood gates within the system (as 1D elements with blockages), including their post-event release behaviour

- Correct inclusion of Culburra Road crest levels in the model

- Re-examination of catchment inflows and consideration of catchment storage

- Re-examination of the method in which catchment inflows are delivered to the receiving waters (to avoid numerical dilution)

- Implementation of spatially varying salinity initial conditions

- Execution of sensitivity tests around dispersion coefficients

- Proper definition of appropriate scenario suites for impact assessment purposes

- Proper presentation of impact assessment results as spatial maps, both absolute and differences

Whilst the above resulted in considerable improvements to the consultant's modelling program, there remain some further points of concern that have arisen as a result of reviewing the consultant's latest report. These follow.

- The consultant notes the presence of two wastewater treatment plants (WWTPs) in the catchment, but does not confirm whether or not discharges from these are in practise released to the estuary of interest. Given the potential impacts on water quality of such discharges, the consultant should explicitly state if this occurs in reality, and if so, how WWTP discharges were therefore included in the modelling.

- In some places, the consultant reports an increase in salinity and decrease in pollutant concentrations between existing and developed cases. These differences are reported to be up to 10% for salinity (e.g. section 5.4.c.2.i, although the particular statistic corresponding to these percentages is not stated in this section). Notwithstanding that this is an unusual outcome, it is self-evident that the only means by which a development might deliver this reduction in ambient pollutant concentrations is through complete and permanent removal of a portion of the stormwater volume and associated loads derived from the site, before it is delivered to the receiving waters. This is to say that the proposed development has a mechanism by which permanent and ongoing removal of a component of the stormwater generated on the site can occur. It is not clear to this reviewer as to what that mechanism might be, and how it might cope with an ongoing and indefinite accumulation of stormwater. Presumably the removed stormwater cannot be lost to groundwater because the groundwater store is not infinite, and also in all likelihood connects with the receiving waters in any case, thus delivering the stormwater and pollutant loads to the estuary. Perhaps this unusual model prediction might be related to the concerns held by the peer reviewer of the stormwater treatment train. In any event, the consultant should deal with this matter explicitly in its report and provide plausible mechanisms by which the loss of stormwater and pollutant loads can occur.

- The post processing methods, as presented in section 5.3, are of concern. That section notes that dry cells are reported within the model as having a concentration of 0 mg/L for each constituent. Whilst this may or may not be the case, it does not make inclusion of these zero values in the subsequent calculation of statistics acceptable. Indeed, if the consultant has included zeros (where zeros represent dry cells) in the calculation of any calibration or impacts assessment statistics then these calculations are in error, and potentially seriously so. This applies equally to the calculation of all statistics, and therefore has obvious consequences for the voracity of reported impact statistics throughout the consultant's report.

  It is standard industry practise to exclude numerical cells from analysis when dry, and to therefore remove their potential influence on the calculation of statistics and predicted impacts. In the particular software package used by the consultant, this is easily accomplished by utilising the wet/dry flag reported in the hydrodynamic files, and the coding of some simple routines in Matlab, python or the like.

  Clarification as to whether or not zeros were included in statistical analyses is required.