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# KENNEDY ENVIRONMENTAL LIMITED

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8 July 2018

Christchurch City Council  
PO Box 73015  
Christchurch  
New Zealand

Attn: Kevin McDonnell

Dear Kevin

Kennedy Environmental Limited (KEL) were commissioned by Christchurch City Council to undertake a review of the Contaminant Load Model that has been used to support the CCC application to Canterbury Regional Council (Ecan) for a Comprehensive Stormwater Network Discharge Consent (CSNDC). The model and its supporting document (Golder (2018) were prepared by Golder Associates (NZ) Limited (Golder). This work followed on following on from earlier work undertaken by Golder for the Avon River catchment in 2014 (post-earthquake) and prior. The review was undertaken with discussions with Eric Van Nieuwkerk of Golder.

The model review did not examine and test the CLM model spreadsheet linkages. Golder undertook a thorough check of all spreadsheet linkages and formula and undertook model edits where required.

## **Contaminant Load Model**

The Contaminant Load Model (CLM) was first developed in 2006 by Auckland Regional Council and updated in 2010 (ARC 2011a, Timperley et al. 2011). CCC have undertaken a range of contaminant load modelling to-date using the CLM (e.g., Golder 2014, PDP 2017) and modelling in Addington catchment by the University of Canterbury using an in-house model 'Medusa' (Charters 2016, Cochrane & Charters 2017). To provide a single Christchurch city-wide C-CLM Golder were commissioned to assess the current and future annual stormwater contaminant load (for total suspended solids, copper and zinc) within the four river catchments in Christchurch (Styx River, Avon River, Heathcote River and Halswell River).

## C-CLM Inputs

The model utilises a simple series of calculations to determine the load of a contaminant discharged from a catchment (based on the integrated load from a series of sub-catchments that are likely to have different land-uses and stormwater treatment systems). Although the C-CLM is a simple additive model, its 'accuracy' is principally dependent upon the catchment input information, contaminant source and the yield (treatment reduction) information. Some input values are fixed in the model but others allow user input (yield and treatment efficiency). There are limitations to the model which are described in ARC (2011a,b). It notes, the model is of limited use for stormwater management purposes other than estimating 'relative' contaminant loads for large urban areas.

The C-CLM model purpose is primarily to provide information of the effects of future development and its potential influence on contaminant loads and contaminant loads can be mitigated and that this can be used as a performance measure in the CSNDC consent conditions.

## Review of Model and Golder (2018) Report

The model is primarily based on CCC GIS catchment information and as such is dependent upon the quality of that information. The review of the model identified some inconsistencies in the input values used, in particular the contaminant yields and treatment efficiency information. It was recommended at this point in time, the C-CLM use in most cases the input values provided for the Auckland CLM. This matter has now been addressed to my satisfaction. The C-CLM is set up to utilise any input data that better represents contaminant source types and yields when suitable data becomes available.

The C-CLM produces contaminant load reductions from an untreated stormwater scenario. It must be recognised that:

- The reduction estimates are based on contaminant yields and treatment efficiencies that are general estimates based on best available data.
- Both the yield estimates and the treatment reductions have large confidence limits around the reduction estimates produced from scenarios developed. The predictions therefor must be regarded as informed reductions not absolute predictions.

As the CLM is a relative tool the input data currently used in the C-CLM will still provide useful outputs on relative contaminant loads and implications of treatment options at the catchment/sub-catchment scale. Key data that can be improved at any time in the future includes information areas such as:

- Roof type definition in Christchurch.
- Roof type allocation to primary land use.
- Non-roof and road impervious surface area definition (grasslands and unpaved areas) for the catchments.

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- Treatment efficiency for specific treatment types.

At any point in the future if it is agreed that new data better reflects Christchurch stormwater/environment conditions, the C-CLM can be updated and scenarios run again.

The Golder (2018) report provides a good summary of the inputs to the C-CLM model and the workings of the model. It provides a summary of model outputs for a series of future growth and mitigation scenarios that will assist in further planning for contaminant load reduction in catchment receiving environments. Overall, the C-CLM is a suitable tool for providing estimates of the relative reduction of stormwater contaminant loads over time as a result of treatment facilities and devices bring proposed and implemented by CCC. As such, bearing in mind the limitations of the model noted above and in ARC (2011), it is therefore suitable for use as a performance indicator in the CSNDC.

### Closing statement

Thank you for this opportunity to assist CCC with the contaminant load project. If you have any queries regarding any of the information set out above please contact the writer.

Sincerely,



Paul Kennedy

Principal: Kennedy Environmental Limited

### References

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CCC 2007. Water quality assessment. South-West Christchurch Integrated Catchment Management Plan Technical Series. Report No 5, Prepared by Golder Kingett Mitchell, July 2007.

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