

28 March 2019

Water by Design
Email: glen.b@hlw.org.au

Attn: Glenn Browning

Dear Glenn,

RE: MUSIC Modelling Guideline (v3) (November 2018), Stormwater Queensland Submission

Stormwater Queensland (SQ) would like to thank Water by Design for the opportunity to provide a submission on the *MUSIC Modelling Guideline, v3, Consultation Draft* (November 2018) hereafter referred to as 'the guideline/s'. SQ has advertised the guidelines via our 'Stormcast' eNews and requested feedback from our members on the guidelines. This submission has been prepared on behalf of SQ members and is based in part on the submissions we have received. It has been prepared by the SQ Advocacy and Engagement Sub-Committee and endorsed by the full committee.

General Comments

1. **Revision timing** – While SQ acknowledges the funding limitations which have contributed to the delay in revising the guideline, we would be encouraged if this document undergoes a more regular update. Unless funding is already secured for a new guideline in two years' time when MUSIC Version X is expected to be released, SQ does not share the same optimism of Water by Design (as expressed on the Water by Design website) that a new guideline would be forthcoming at that time. Such optimism also assumes that the new model will be delivered in two years which may not be the case. It would therefore be safer to assume that this version of the guideline will be applicable for at least two years and likely much longer. This comment has been provided in part as context to the subsequent comments below.
2. **Guideline scope** – Further to the above point, the importance and therefore the scope of this revision should not be underestimated. With limited actual changes to the guidelines (content-wise it feels more like a version 2.1 rather than version 3.0), combined with the aforementioned advice expressed on the Water by Design website, it seems this guideline is being treated as a 'band-aid solution' when something more substantial is both needed and justified. It is therefore considered appropriate to spend more time (as necessary) on getting this guideline right and addressing all of the issues raised in the submissions to make this guideline more relevant and more applicable for a longer period of time.
3. **Guideline publication format** – Also further to the above points, the amount of work involved in the release of a new guideline version is acknowledged to have been another factor in limiting more frequent revisions i.e. X.X versions. Water by Design is therefore encouraged to consider the multiple options afforded by current technology which would make updates more readily facilitated. Practice notes, while valuable in the past, have had their limitations as they do not officially form part of the guidelines and can be confusing to track.

4. **Helpful hints and advice** – It is noted that some of the helpful hints and advice provided in grey boxes in previous versions of the guideline have been omitted from the latest guideline (e.g. the one related to modelling roof areas on page 18). These were included due to high proportion of enquiries received about these issues from development assessment staff, consultants and developers at the time of publication of the first iteration of the guideline. These are still considered relevant issues and it is recommended that they be retained in the new guideline.
5. **QA/QC** – A high proportion of the comments provided herein are issues picked up by multiple submitters and largely represent a lack of new work and poor attention to detail. For the most part, these would likely have been picked up in a peer review which should have been undertaken prior to the release of this guideline to the industry for comment. To release what appears to be an unreviewed version for comment (with many required updates being altogether absent) results in very lengthy submissions and a high demand on the resources of submitters. This may be a factor which may frustrate submitters and limits the number of submissions received. It also erodes confidence in the advice provided by the Water by Design program.
6. **Complimentary models and nodes** – The guidelines should be supported by recommended climate templates (models) and source and treatment nodes for each climate region with notes in those nodes describing from where the values were sourced and their version. This would make for significantly more user-friendly advice, support the guideline in a practical way and minimise modelling errors.

Specific Comments

7. A very high number of grammatical errors have been picked up throughout the guideline. Review of the guideline by a professional editor is recommended prior to its release.
8. Specific reference is made to the State Planning Policy (DILGP, 2017). Given this is a document which is regularly reviewed, the relevance of the guideline will be diminished as soon as a new version of the SPP is published (likely later this year). A better approach would be to simply reference 'state planning policy', rather than referencing the actual publication. Using such a generic term would also allow for name changes to the policy should they occur again.
9. Section 3.1 Meteorological Data
 - a. Figure A1.1 shows local government boundaries which have long since changed since this figure was prepared in 2010. It is recommended that this figure is updated accordingly.
 - b. The regional climate data in Appendix A is limited to South East Queensland (SEQ) and the Whitsunday region although the guideline is used across the state. To not provide values for at least the major cities across the state is considered a major omission. It is recommended that data for major cities across Queensland be provided.

- c. The guideline states that '*This data has been compiled from existing local government MUSIC modelling guidelines and assessment of additional rainfall data.*' As the values are identical to the 2010 guidelines, there is no evidence that a revision has actually been undertaken. It is recommended that the data presented in this table is reviewed to ensure that it is still accurate/current. Known problems with some of this data exist.
- d. It is unclear why the data related to this section of the guideline has been moved into an appendix. This decreases the useability of the guideline whereby the reader is forced to flick between the main body of the guideline and the appendices when establishing a model. This occurs regardless of whether a printed or electronic version of the guideline is used. It is recommended that the data be retained in the main body of the guideline.

10. Section 3.2 Modelling Period and Time-Step

- a. Using the six minute timestep and 10-year modelling periods suggested in the guideline is not appropriate in every scenario e.g. where longer periods are more appropriate such as in water balance modelling. It is recommended that this be recognised in the guideline.

11. Section 3.3 Catchment Properties

- a. The following sentence does not make sense: '*Include all areas of the development in the model, including polluting any surfaces that will not receive treatment.*' As noted above, it is recommended that a professional editor review the guideline prior to final publication.

12. Section 3.3.2 Defining Land Uses and Surface Types

- a. It is noted that the new version of the guideline no longer recommends splitting source nodes for development applications. For most typical urban development applications, splitting source nodes provides for more representative modelling and therefore more accurate results regardless of whether or not rainwater tanks are adopted. Without a similar recommendation in the guidelines, many consultants will revert to lumped modelling resulting in less accurate sizing of treatment systems. It is recommended that the guideline retains some form advice which states that for typical development applications where a development layout is available, the splitting approach should be adopted.
- b. The guideline suggests that, '*When rainwater tanks are proposed to form part the stormwater treatment strategy, source nodes must be 'split' into roof, ground and roads.*' The word 'must' is not appropriate given rainwater tanks are not mandatory and can often not be enforced even when forming part of development approvals. Excluding tanks from the model would also provide for more conservative results. It is therefore recommended that the word be replaced with 'can'.
- c. Table 3-4 and 3-7 – The data presented in these tables has not changed since the first the iteration of the guideline but development trends have changed to increasingly dense development with greater impervious areas. It is recommended that the values be reviewed against real-world development applications plans and/or aerial imagery.
 - i. Noting that some impervious areas may not drain to treatment devices or infiltrate through permeable surfaces before reaching the receiving environment, there is merit in discussing modelling of 'effective impervious areas' (with specific use of this term and referencing of supporting research papers) in the guideline.

- d. Table 3-8 and 3-9 – The data presented in these tables relies on data collected over a decade ago. More current data has been published recently including:
 - i. Orr, D.N., Turner, R.D.R., Thomson, B., Ferguson, B., Newham, M., Wallace, R., Huggins, R., Severino, Z. (2017), *South East Queensland water quality statistics for event flow and base flow conditions*, Department of Science, Information Technology and Innovation.
 - ii. Lucke, T., Drapper, D. and Hornbuckle, A. (2018), *Urban stormwater characterisation and nitrogen composition from lot-scale catchments - New management implications*. Science of the Total Environment, Issue 619-620:65-71.

It is recommended that this data be reviewed and if appropriate, used to revise the recommended pollutant export parameters.

13. Section 4.2.2 Residential Tank Demands

- a. Table 4.3 There is nothing in the guideline to suggest that the values in this table are still relevant or even that they have been reviewed. It is recommended that the values be reviewed against more current data and revised as appropriate.
- b. An annual irrigation application value is provided for SEQ only. Given the guideline is clearly intended to be used in other regions (i.e. rainfall data for the Whitsundays region is provided in Appendix A), irrigation rates should also be provided for major cities across Queensland at a minimum.

14. Section 4.2.5 Lumped Versus Individual Tanks

- a. There is an error in the worked example calculation which has been copied from previous versions of the guideline. This suggests that the calculations have not been re-checked. It is recommended that all calculations in the guideline be re-checked.
- b. There are two errors in the text box related to the correct units of measurement which have been copied from the previous versions of the guideline but which are not correct in the current version of MUSIC. It is recommended that the guideline be thoroughly checked for such errors and the errors be corrected.

15. Section 4.3 Constructed Wetlands

- a. The justification for changing the K and C* values provided in the Design Flow report are not considered sufficiently robust to justify amendment of the existing values i.e. too many questions about the science and assumptions in the report as well as some potentially flawed conclusions/recommendations remain. In the absence of sound scientific decision-making the precautionary principle prevails and in this case, that principle would indicate that no change should be made to the values. This is of particular relevance given what's at stake i.e. the health of our receiving waterways. Consequently, SQ does not support changing the values until there is a strong case for change based on sound science.
- b. Further to the above point, it may be tempting to simply defer the decision about this issue to local governments. We do not consider that local governments have the adequate resources to commission a review of such reports/data and it would be a poor use of resources for each local government to have to undertake their own reviews. SQ does not therefore recommend this option.

16. Section 4.5 Bioretention Systems

- a. The recommended values for hydraulic conductivity, nitrogen and orthophosphate content potentially limit innovation in filter media composition. It is important to encourage this type of innovation given that current filter media specifications are resulting in failed assets across Queensland. It is recommended that the guidelines recognise and account for such innovation providing the necessary flexibility. This also applies to the sections on bioretention swales and self-watering street trees.

17. Section 4.5.6 Vegetation Properties

The guideline is unclear with respect to what vegetation species provide 'ineffective nutrient removal'. Consider for example the following points:

- i. The term 'functional attributes' is not at all defined. If the guideline is going to use such a term it is necessary to define it and provide some guidance on how to demonstrate to assessment authorities which plant species meet the definition.
- ii. Recent research suggests that many plant species previously thought unsuitable for bioretention systems actually perform as well, if not better, than many traditional bioretention plant species, especially in climates which exhibit frequent/prolonged drying (as occurs in many parts of Queensland). This includes both native and lawn grasses. An example of one such paper (others exist) includes:

Payne, EG, Pham, T, Cook, PLM, Fletcher, TD, Hatt, BE & Deletic, A 2013a, '*Biofilter design for effective nitrogen removal from stormwater – influence of plant species, inflow hydrology and use of a saturated zone*', Novatech, Lyon, France.

It is recommended that current research be reviewed and advice be provided in the guideline which reflects current research.

18. Section 4.8 Proprietary and Custom Products

- a. Many engineering/scientific journals lack sufficient scrutiny (e.g. of monitoring methods and results) to add significant value to performance claims of proprietary products. The criteria for suitably demonstrating the performance of proprietary treatment systems could be strengthened by adopting the pathway used by Brisbane City Council (BCC) i.e. requiring that data be independently peer review by an academic. While this in itself is not a perfect solution, it appears to be resulting in good outcomes for BCC.

19. Section 4.9 Sediment Basins

- a. When using MUSIC to model proprietary filter type products which incorporate the use of detention tanks, a detention or sediment basin node is to be used. However, the 'k' values associated with this system should have no additional treatment (i.e. k value set to 1 or zero). Selection of parameter values (default or otherwise) should not be used to claim additional stormwater treatment when none materially exists. Some advice in the guideline to this effect is recommended.

20. Section 4.12 Self-Watering Street Trees

- a. Table 4-9
 - i. The source of the recommended hydraulic conductivity (50-100 mm/hr) is not explained or referenced in any way. Given this value is something new to the industry it requires some form of explanation and a reference. Ideally it should be supported by adequate justification (i.e. sound science and/or good examples of multiple practical experiences). Please also see comment 16a. above.
 - ii. High flow bypass: a value of '100 m³/s (unless secondary routing defined)' is set as the default. This is inconsistent with the text given in section 4.12.1 (regarding high flow bypass). It is also anticipated that this assumed value would not be representative (as the system will bypass even for small flow-rates) significantly over-estimating the treatment performance of these systems. SQ recommends a value given consistent with the likely actual high flow bypass of the system, or simply refer to Section 4.12.1.
- b. Comparing the guidelines to the *Passive Irrigation Fact Sheet*, which are both Water by Design documents, there are several inconsistencies. These include, but are not limited to, the issues identified in the following table.

	MUSIC Guidelines V3	Passive Irrigation Fact Sheet
Treatment	Can only be used to treat nutrients	Can be included for all pollutants to meet SPP (implied with the worked example)
Inlet	Generally implies that there is an inlet pipe	Recommends kerb cut-out, however image on page 4 shows a piped inlet/outlet arrangement
Underdrain	Typically there is no underdrainage	Underdrainage is shown
High flow bypass	This will be different depending on whether a kerb cut-out or an inlet pipe is used. More detail about how this should be calculated should be included.	

It is acknowledged that for scenarios where stormwater is piped to the filter media, limited gross pollutant treatment would result. However, the recommendation in the guidelines that street trees can only be used to treat nutrients, is not considered appropriate for all scenarios such as kerb cut outs where all pollutants would flow to the surface of filter media. It is recommended that the guidelines should enable flexibility in what pollutants are treated in response to the design proposed.

Overall, the Passive Irrigation Fact Sheet provides a lot more detail and is much simpler to understand than the information in the MUSIC guidelines. It is recommended that the two documents provide a consistent approach. It is also recommended that a worked example is included in the guidelines to provide greater clarity to users.

21. 4.13 Generic Nodes

- a. Refer to comment 18 above.

22. Section 5 Life Cycle Cost Assessment

- a. The real discount rate and inflation rate provided are extremely dated and should be updated.
- b. There would be value in providing typical unit cost rates for typical treatment devices.

23. Appendix A – Regional Climatic & Rainfall Run-Off Parameters

- a. See previous comments on related matters above.

24. Appendix C – Reporting Tables

- a. These tables are useful but their usability is severely limited by including them in PDF format only. The original intent of these tables was to provide a MS Word version of them online to allow their download and use directly in stormwater management plans. It is recommended that this be facilitated and the industry be actively encouraged to copy and use them in reporting.

25. Other comments

- a. MUSIC is commonly used for undertaking spells analyses for wetlands, lakes, other water bodies. A new section which explains how to undertake such analyses, and which provides reference values would be extremely useful for both assessment authorities and consultants.

Should you have any questions, please contact SQ President Peter Worth (e: peterw@oceanprotect.com.au, m: 0409 754 172) or myself.

Kind regards



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