Infrastructure Department

LIVINGSTONE SHIRE
DRAINAGE INFRASTRUCTURE NETWORK

COMPUTER MODELLING
MUSIC
Model Guidelines

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Abbreviations

LSC	Livingstone Shire Council
PET	Potential Evapo-Transpiration
USTM	Universal Stormwater Treatment Model
SEQ	Southeast Queensland
WSUD	Water Sensitive Urban Design
SPP	State Planning Policy

1.0 OBJECTIVES

The objectives of these guidelines are for Livingstone Shire Council (LSC) to:

- Provide advice on using MUSIC in building models for works within Livingstone Shire Region; and
- Provide directions on parameters for consistency between various models.

1.1 Environmental Targets for Livingstone Shire

LSC follows the Queensland State Planning Policy (SPP) 2017 stormwater design objectives as seen on the image below.

Table B: Post construction phase—stormwater management design objectives

Application

(a) Applies to western Queensland and Cape York/ Far North Queensland, for population centres greater than 25,000 persons, and
(b) For all other climatic regions with population centres greater than 3000 persons.

Climatic region (Refer SPP Interactive Mapping System)	Design objectives: Minimum reductions in mean annual load from unmitigated development (%)				Application
	Total suspended solids (TSS)	Total phosphorus (TP)	Total nitrogen (TN)	Gross pollutants >5 mm	
South East Queensland	80	60	45	90	Development for urban purposes within population centres greater than 3000 persons.
Central Queensland (south)	85	60	45	90	As above.
Central Queensland (north)	75	60	40 *	90	As above. * Mackay Regional Council has adopted a 35% reduction for TN.
Dry Tropics	80	60 *	40	90	As above. * Townsville City Council has adopted a 65% reduction for TP.
Wet Tropics	80	60	40	90	As above.
Cape York/FNQ	80	60	40	90	Development for urban purposes within population centres greater than 25,000 persons.
Western Queensland	85	60	45	90	As above.
All	N/A	N/A	N/A	N/A	Excludes development that is less than 25% impervious. In lieu of modelling, the default bio-retention treatment area to comply with load reduction targets for all Queensland regions is 1.5% of the contributing catchment area.
	Waterway stability management • Limit the peak 1-year ARI event discharge within the receiving waterway to the pre-development peak 1-year ARI event discharge.				Catchments contributing to un-lined receiving waterway. Local government may not require compliance if the waterway is degraded. For peak flow for the 1-year ARI event, use co-located storages to attenuate site discharge rate of stormwater.

1.2 Livingstone Shire Council Stormwater Management Objectives

- Water quality - maintain or improve the quality of surface and groundwater in the development areas in comparison with the conditions of preliminary development.
- Water quantity - maintain the overall water cycle balance in the development areas in comparison with the conditions of preliminary development.
- Water conservation - for maximum reuse of stormwater.
- Ecosystem health - to preserve natural drainage systems and protect the health of ecosystems.
- Economic viability - introduction of stormwater management systems that are economically viable in the long term
- Protection of property - to protect the built environment from floods and swamping.
- Social values - to ensure the recognition and maintenance of social, aesthetic and cultural values in the management of storm water.
- Development - ensure the delivery of best practice stormwater management through planning and development.

2.0 LIMITATIONS

The following limitations and conditions apply in using these guidelines:

- Objectives of these guidelines include neither providing guidance in learning skills in the software, nor interpretation of model behaviour and in the results and making conclusions;
- It is assumed that users of these guidelines will be competent in using the MUSIC software package; and
- These guidelines should be read in conjunction with the **"Getting Started with MUSIC"**, which outlines all the definitions, assumptions and methodologies provided within the MUSIC software package. A copy of the manual can be downloaded from this link: https://wiki.ewater.org.au/display/MD6/Getting+Started+with+MUSIC

Livingstone Shire Council uses MUSIC for the following purposes *only*:

- Simulating different treatment train designs to achieve the minimum reductions in mean annual load from unmitigated development;
- Provide parameters to be used when using MUSIC to assess compliance with LSC's stormwater management objectives; and
- To ensure consistency in the application and approval process for stormwater management in developments in the Livingstone Shire region.

3.0 MODELLING STEPS

The council's use of the MUSIC software can be broken down into four major steps as listed in the figure below. This section of the report will guide the user on how to use MUSIC in accordance to Council's design parameters and standards.

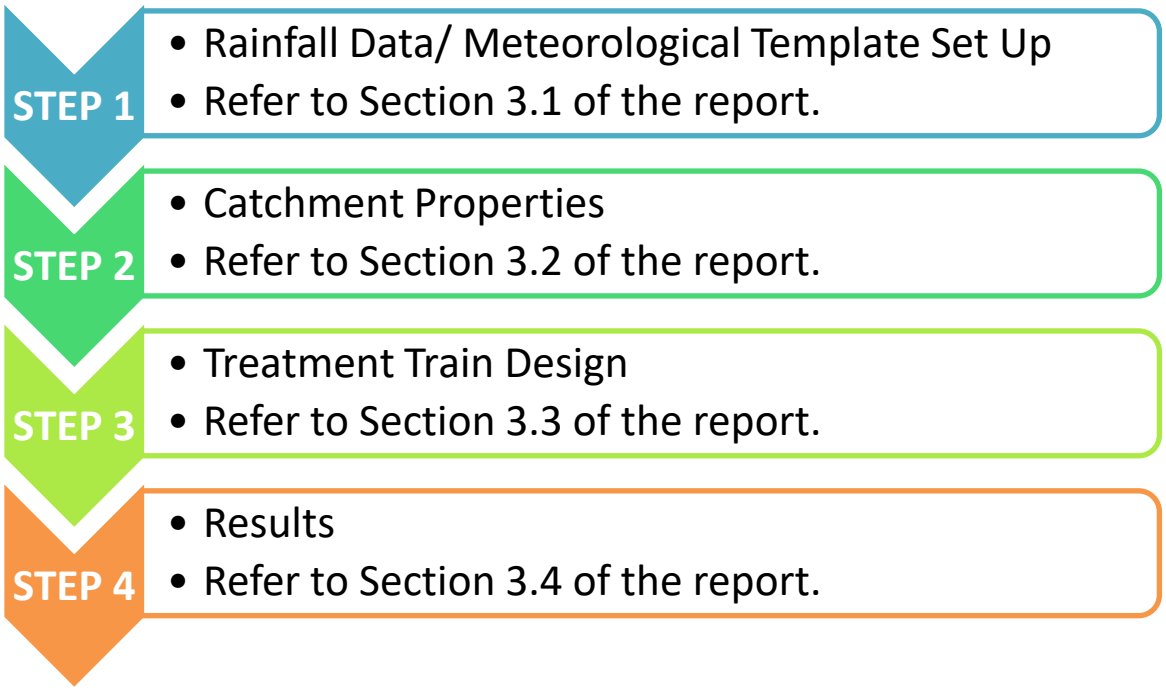

Figure 1: Four Major Steps in MUSIC Modelling

3.1 STEP 1: RAINFALL DATA/ METEOROLOGICAL TEMPLATE SET UP

Livingstone Shire Council uses Gladstone's 6 minute rainfall data and monthly Potential Evapo transpiration (PET) data as a default Rainfall Data/ Meteorological template set up. This template is to be run with a 6 minute Template Time Step.

The time frame to be used in Gladstone's 6 minute rainfall data is from 1/01/1980 up to 31/12/1989 as seen in the image below.

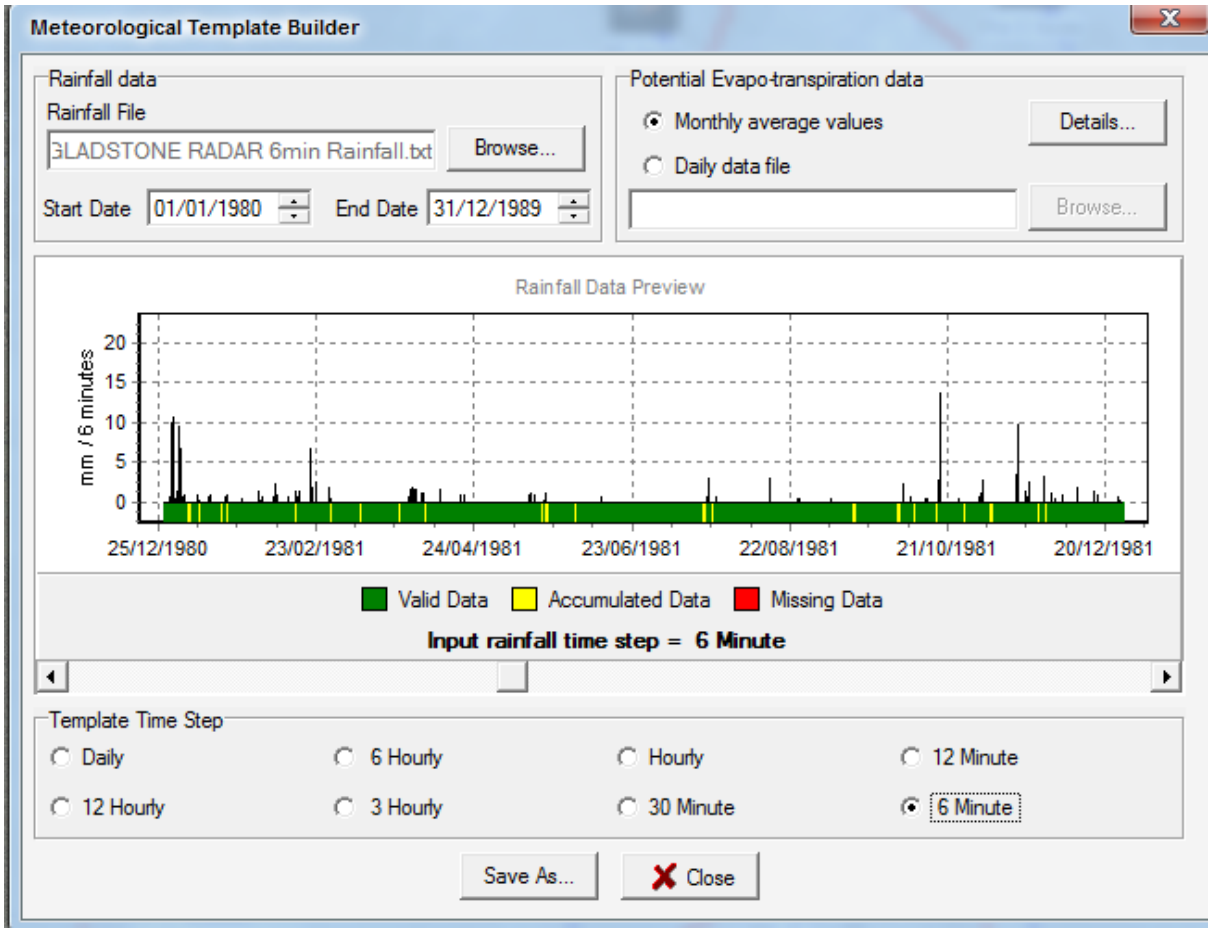

Figure 2: Required Rainfall data used by LSC

The monthly PET for Gladstone area that LSC uses should look like the image below.

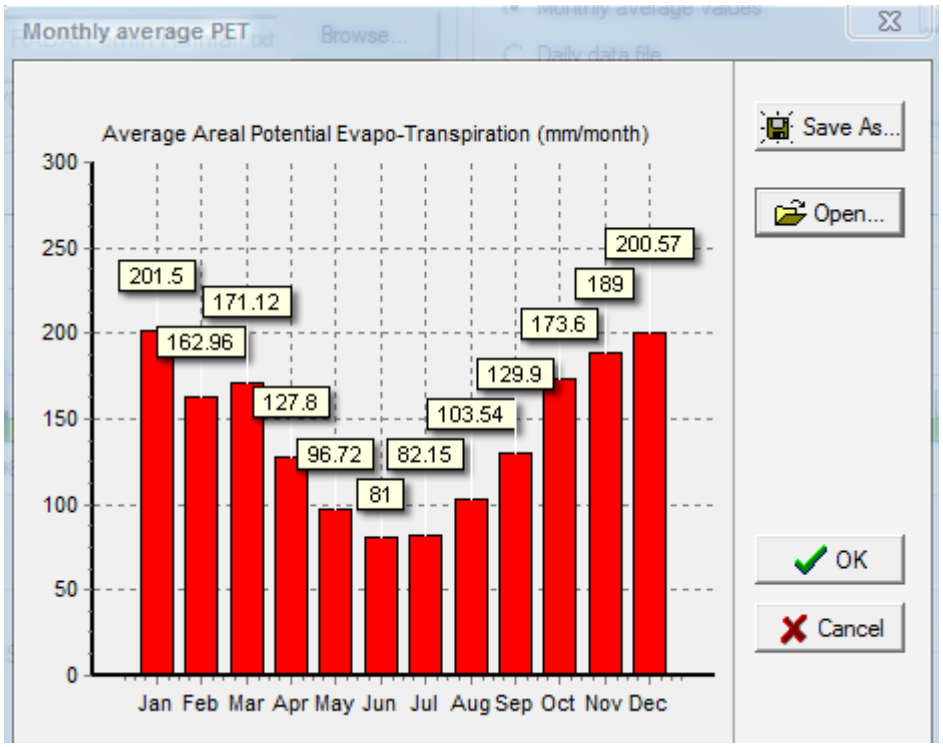

Figure 3: Required PET data used by LSC

3.2 STEP 2: CATCHMENT PROPERTIES

Once the meteorological data has been input into the model, the user must then define the source nodes to reflect the details of the contributing catchments.

This involves: *ƒ*

- Creating the type of land-use and source nodes; *ƒ*
- Defining the catchments; *ƒ*
- Splitting the catchments into land types (roof, road, ground level) where required;
- Inserting rainfall runoff parameters; and *ƒ*
- Inserting pollutant export parameters.

LSC is not a part, sponsor, nor a partner of the MUSIC software, hence our exclusion in the MUSIC-link list provided in the software, therefore all our parameters are always set to default.

3.3 STEP 3: TREATMENT TRAIN DESIGN

Following the creation of the catchment properties, a treatment train is to be developed based on site constraints and opportunities. The user is able to define the physical configuration of treatment systems as well as parameters relating to the removal of pollutants e.g. k, c* for the universal stormwater treatment model (USTM) (refer Section 5 of the MUSIC User's Manual). The default parameters in MUSIC for the first order decay k C* model used to define the treatment efficiency of each treatment device should be used unless local relevant treatment performance monitoring can be used as reasonable justification for modification of the default parameters.

Council recommends using the parameters shown in Table 1.

Table 1: Recommended k & C* values

k	**Sedimentation Basin**	**Swale**	**Wetland**	**Pond/ Infiltration System**	**Rainwater Tank**	**Bio retention**
TSS	8000	8000	1500	400	400	8000
TP	6000	6000	1000	300	300	6000
TN	500	500	150	40	40	500
C*	**Sedimentation Basin**	**Swale**	**Wetland**	**Pond/ Infiltration System**	**Rainwater Tank**	**Bio retention**
TSS	20	20	6	12	12	20
TP	0.13	0.13	0.06	0.09	0.13	0.13
TN	1.4	1.4	1.0	1.0	1.4	1.4

Source: eWater Music Training Notes 01/07/2015, Brisbane

Below is a list of treatment measures found in MUSIC that can be used in a wide array of combinations to achieve the recommended reduction rate stated by the Water Sensitive Urban Design (WSUD):

- Rainwater tanks *ƒ*
- Wetlands *ƒ*
- Bio-retention *ƒ*
- Swales *ƒ*
- Bio-retention Swales *ƒ*
- Gross Pollutant Traps *ƒ*
- Sedimentation Basins *ƒ*
- Ponds *ƒ*
- Infiltration

The image below shows on what treatment measures are to be used based on the design's Hydraulic Loading and Particle Size grading.

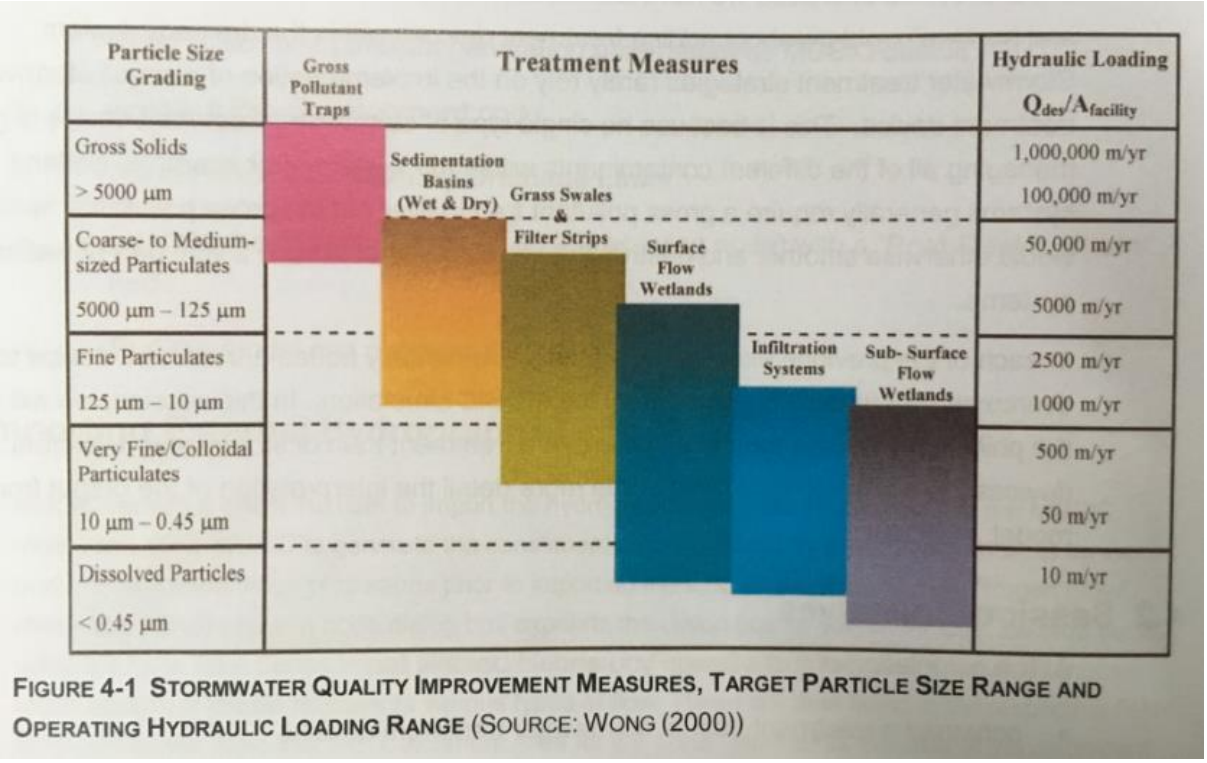

FIGURE 4-1 STORMWATER QUALITY IMPROVEMENT MEASURES, TARGET PARTICLE SIZE RANGE AND OPERATING HYDRAULIC LOADING RANGE (SOURCE: WONG (2000))

Figure 4: Treatment Measures Guide

Source: eWater guide 2013

4.0 REFERENCES

Healthy Waterways. (2006, June). Water Sensitive Urban Design. Queensland.

eWater. (2015, July). MUSIC by eWater Training Course Notes.

eWater. (2018, March). MUSIC Version 6 Documentation and Help.

Queensland Government (2017). State Planning Policy