

# MUSIC INPUT PARAMETERS



*Revised March 2004*

## INTRODUCTION

Model for Urban Stormwater Improvement Conceptualisation (MUSIC) was developed by the CRC for Catchment Hydrology's Urban Stormwater Quality Program. MUSIC is a conceptual design tool that estimates both stormwater pollutant generation and the performance of stormwater treatment measures. It supports decision-making and enables users to evaluate conceptual designs and to demonstrate the performance of particular designs.

Generally Melbourne Water requires treatment of stormwater so that annual pollutant loads achieve targets set out in the Best Practice Environmental Management Guidelines (BPEMG), these are:

- 45% reduction in Total Nitrogen from typical urban loads
- 45% reduction in Total Phosphorus from typical urban loads
- 80 % reduction in Total Suspended Solids from typical urban loads
- 70% reduction in Litter from typical urban loads
- Maintain discharges for the 1.5 year ARI event at pre-development levels

There are however many cases where individual treatment measures will have different targets, for instance if the receiving aquatic ecosystem is identified as being of very high value, then Melbourne Water may require a higher treatment level.

The design intent for any treatment system must be clearly documented and discussed with Melbourne Water early in the conceptual design stage. Melbourne Water uses MUSIC to assess the impacts of proposed development against performance targets. If alternative methods or models are used, the developer must demonstrate to Melbourne Water's satisfaction that performance targets can be achieved.

This document provides guidance on input parameters and modelling approaches for MUSIC that are recommended by Melbourne Water.

## PURPOSE OF THIS DOCUMENT

This document is aimed at supporting those submitting MUSIC models to Melbourne Water. The objectives are to:

- Ensure a consistent; scientifically based approach is applied to MUSIC models.
- Provide guidance on methods specific to the Melbourne region without inhibiting innovative modelling approaches.
- Reduce the time taken by Melbourne Water in assessing models.

**This document is not intended to provide general advice in using MUSIC and should be read in conjunction with the MUSIC users manual.**

## 1. RAINFALL DATA & EVAPOTRANSPIRATION

Use of metrological data within MUSIC is a balance between accurate representation and computing time. Testing has shown that the use of an appropriately selected year of rainfall data can approximate the long-term metrological record. Ten rainfall stations across Melbourne have been selected to reflect the rainfall gradient shown in Figure 1 below. The Representative years were selected as the best match in terms of mean annual rainfall and 90<sup>th</sup> percentile of rainfall when each year was compared with long term records. Melbourne Water recommends that results obtained by the "reference year" method be compared with long term rainfall records as a final check.

The rainfall distribution map can be used to determine the appropriate weather station. Rainfall data is available from the Bureau of Meteorology. [www.bom.gov.au](http://www.bom.gov.au).

**Table 1. Weather station, long term annual rainfall, reference year and source**

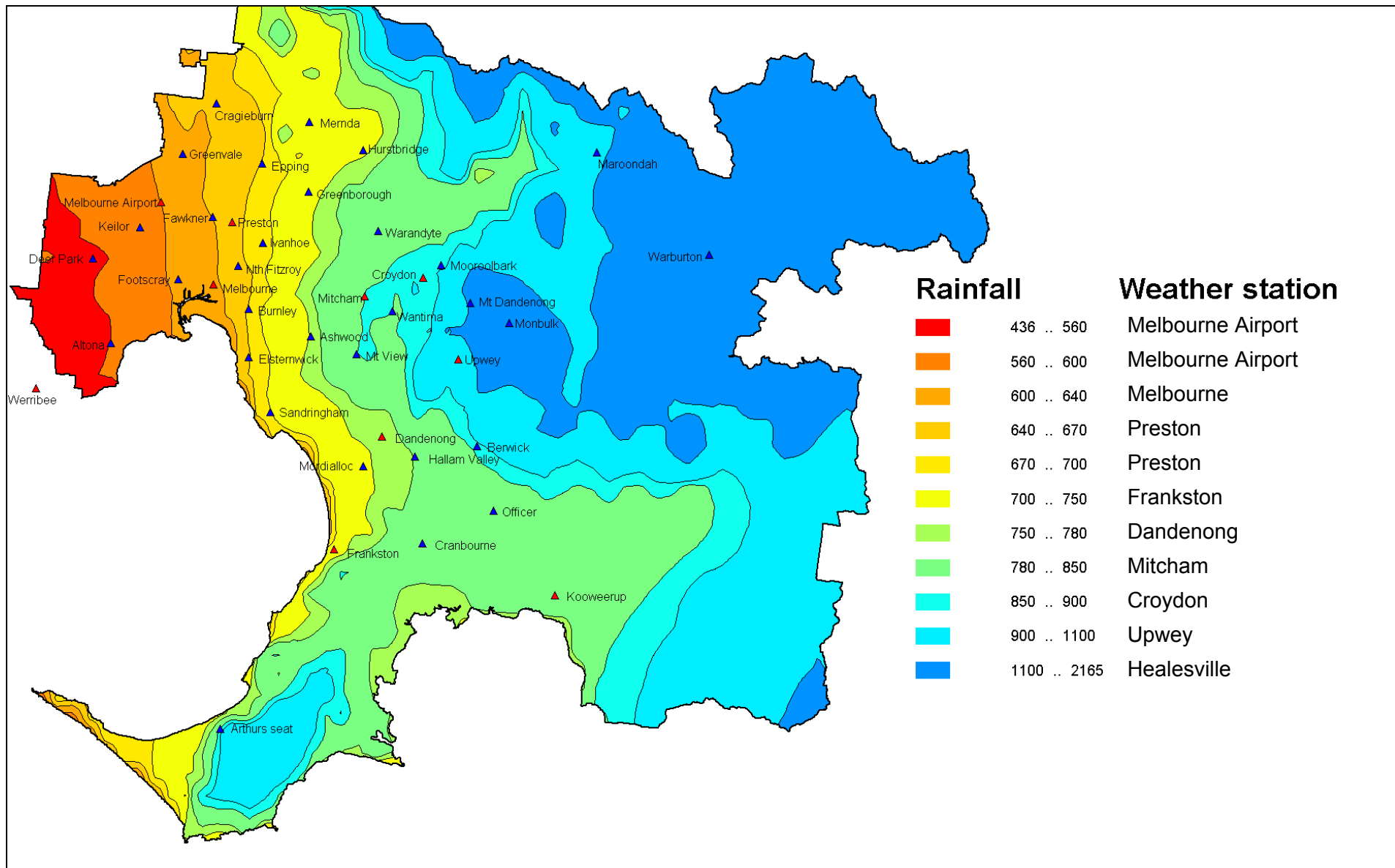
<b>Weather Station</b>	<b>Long term Annual Rainfall (mm)</b>	<b>Reference year(s)</b>	<b>BOM rainfall station number.</b>
Melbourne Airport	553	1989-1990	Data supplied with MUSIC
Melbourne	562	1959	Data supplied with MUSIC
Preston	669	1965-1966	86096
Frankston	739	1988	86245
Dandenong	683	1987	86224
Mitcham	690	1976	86074
Croydon	897	1990	Data supplied with MUSIC
Upwey	970	1989	86251
Mt St Leonard/Healesville	1313	1968	86142

**Table 2. Monthly Evapotranspiration**

	<b>Jan</b>	<b>Feb</b>	<b>Mar</b>	<b>Apr</b>	<b>May</b>	<b>Jun</b>	<b>July</b>	<b>Aug</b>	<b>Sept</b>	<b>Oct</b>	<b>Nov</b>	<b>Dec</b>
<b>Preston</b>	157	127	110	65	40	40	35	45	65	110	135	140
<b>Frankston</b>	140	115	110	65	40	40	35	45	65	100	130	127
<b>Dandenong</b>	150	120	110	65	40	40	35	45	65	105	130	135
<b>Mitcham</b>	150	120	110	65	40	40	35	45	65	105	130	135
<b>Upwey</b>	150	120	110	65	40	40	35	45	65	105	130	135
<b>Mt St Leonard/Healesville</b>	150	120	110	65	40	40	35	45	65	105	130	135

Please note, the Melbourne Airport, Melbourne and Croydon evapotranspiration figures are supplied with the MUSIC software.

# Rainfall distribution across Melbourne



## **2. TIMESTEP**

The timestep must be equal to or less than:

- i. the Time of Concentration of the smallest Sub-Catchment, and
- ii. the shortest detention time (under design flows) of the treatment measures being modelled.

Where either of these would be less than 6 minutes, the model should be run using a 6 minute interval.

## **3. HYDROLOGIC ROUTING**

Hydrologic routing should be used where appropriate to reflect the Time of Concentration of the Catchment as calculated using a recognised procedure.

The applicant may choose not to apply routing to reduce the complexity of the model. Generally this will result in the performance of treatment systems being underestimated.

## **4. SOILS**

The pervious area properties in MUSIC have been substantially altered in MUSIC version 2. Any deviation from the defaults should be described in the report provided with the model. Supporting evidence should also be provided.

## **5. LOSSES FROM THE SYSTEM**

On some soil types it is reasonable to assume that there are losses to groundwater from a swale drain or infiltration trench. If losses are to be built into a model then developers must engage a suitably qualified geotechnical engineer to determine the likely infiltration rate from a swale or bioremediation trench to surrounding soils.

## **6. POLLUTION CONCENTRATION DATA**

The default values for N, P & TSS are to be used, unless additional data are available. Any new data must be published and be able to demonstrate that there is a significance difference between the new data and the default data. Changes to default pollutant concentrations must be confirmed by Melbourne Water in writing.

The CRC for Catchment Hydrology are currently undertaking a monitoring program aimed at determining event mean concentrations specific to Melbourne. This document will be updated when the information becomes available (anticipated mid 2005).

## **7. FRACTION IMPERVIOUS**

Ideally models should be calibrated against local flow data however in most cases information is not available to achieve this. The following table indicates the fraction impervious for different land uses to be used as a guide. It should be noted that these figure are total fraction impervious whereas MUSIC requires the effective fraction impervious. Use of these figures may result in overestimation of more frequent flows in some cases.

Any significant deviation from these figures must be supported by relevant information (i.e. long term flow data that enables calibration of the model)

Zone	Brief Description / Examples	Normal Range	Typical Value
<b><u>Residential Zones :</u></b>			
Residential 1 & 2 Zone	Normal range of densities.	0.40 - 0.50	0.45
	Medium density	0.50 - 0.70	0.60
	High density	0.70 - 0.90	0.80
Low Density Residential Zone	0.4 ha min.	0.10 - 0.30	0.20
Mixed Use Zone	Mix of residential, commercial, industrial & hospitals.	0.40 - 0.60	0.50
Township Zone	Small townships with no specific zoning structures.	0.50 - 0.70	0.60
<b><u>Industrial Zones :</u></b>			
Industrial 1 Zone	Main zone to be applied in most industrial areas.	0.70 - 0.95	0.90
Industrial 2 Zone	Large industrial areas away from residential areas.	0.70 - 0.95	0.90
Industrial 3 Zone	Buffer between Zone 1 and Zone 3.	0.70 - 0.95	0.90
	- for garden supplies/nurseries.	0.30 - 0.60	0.50
	- for quarries.	0.10 - 0.30	0.20
<b><u>Business Zones :</u></b>			
Business Zone	Main zone to be applied in most commercial areas.	0.70 - 0.95	0.90
Business 2 Zone	Offices and associated commercial uses.	0.70 - 0.95	0.90
Business 3 Zone	Offices, manufacturing industries & associated uses.	0.70 - 0.95	0.90
Business 4 Zone	Mix of bulky goods retailing & manufacturing industries	0.70 - 0.95	0.90
Business 5 Zone	Mix of offices & multi-dwelling units.	0.70 - 0.95	0.80
<b><u>Rural Zones :</u></b>			
Rural Zone	Main zone to be applied in most rural areas.	0.05 - 0.20	0.10
Environmental Rural Zone	Rural areas with specific environmental considerations	0.05 - 0.20	0.10
Rural Living Zone	Predominantly residential use in rural environment.	0.10 - 0.30	0.20
<b><u>Public Land Zones :</u></b>			
Public Use Zone	Use of land for public purposes		
- Service and Utility	- power lines, pipe tracks and retarding basins.	0.00 - 0.10	0.05
	- reservoirs	0.40 - 0.60	0.50
- Education and Health	- schools and universities. hospitals.	0.60 - 0.80	0.70
- Transport	- railways and tramways.	0.60 - 0.80	0.70
- Cemetery/Crematorium	- cemeteries and crematoriums.	0.50 - 0.70	0.60
- Local Government	- libraries, sports complexes and offices/depots.	0.50 - 0.90	0.70
- Other Public Use	- museums.	0.50 - 0.80	0.60
Public Park and Recreation Zone	Main zone for public open space, inc golf courses.	0.00 - 0.20	0.10
Public Conservation and Resource Zone	Protection of natural environment or resources.	0.00 - 0.05	0.00
Road Zone – Category 1	Major roads and freeways.	0.60 - 0.90	0.70
Road Zone – Category 2	Secondary and local roads.	0.50 - 0.80	0.60

## 8. STOCHASTIC VERSUS MEAN GENERATED DATA

Stochastically generated data is always to be used, except where there is a requirement to examine behaviour for a particular storm event or set of operating conditions.

## 9. SOURCE NODES

Any Agricultural & Forest nodes must be submitted as independent subcatchments, parkland within an urban development will usually be modelled as an urban node. The uncertainties associated with the defaults used for agricultural nodes are significantly higher than those for urban nodes. In most cases the use of urban nodes, with low fraction impervious, will be preferable to the use of agricultural nodes.

## 10. INSTREAM WORKS

Any works within receiving waters (such as pool and riffle systems) shall not be included into any treatment train models.

## 11. GPT's

Default curves are to be used as per page 111 of the MUSIC users manual or in other reliable studies.

## **12. WETLANDS**

To access design guidelines for constructed wetland systems please refer to the Melbourne Water publication '*Constructed Wetland Systems – Design Guidelines for Developers*'. This document is available as a PDF download from Melbourne Water's web page.

## **13. LAKES**

MUSIC is not a suitable model for in-lake processes. Guidance on this topic can be found in the Melbourne Water publication "*Constructed Shallow Lake Systems for Developers*". This document is available as a PDF download from Melbourne Water's web page.

## **14. REUSE**

A reuse master plan must be provided which is to be signed off by all relevant authorities (Local Government, Melbourne Water). Calculations should be provided to support reuse volumes.

For reuse to be accepted as part of a MUSIC model there needs to be a formalised agreement between local government, Melbourne Water and the developer which contains the necessary approvals for the reuse plan to proceed.

## **15. K, C\*, C\*\***

Melbourne Water must approve any changes to these parameters in writing. Any data used to modify these parameters must be published data, and be appropriate for the circumstances being modelled.

If bioretention systems are used without initial sediment treatment (for instance in the case of roof runoff) the K and C\* values for TSS should be changed to perform at the same level as a sediment pond.

## **16. SWALES**

Suggested vegetation heights

Grass swale (mowed) height range: 10 – 100mm

Vegetation (not mowed): 100 – 400mm

In the case where unmown vegetation is being used, the proponent should identify what type of vegetation is proposed, and how it will be managed within the landscape and maintenance requirements of the development.

## **SUBMISSION REQUIREMENTS**

Models should be submitted with a report that outlines the assumption used, catchment details and a description of the approach taken. The following items should be included:

### **SUMMARY**

- Summary of treatment performance in terms of:
  1. Mean annual load reduction for TSS, TP and TN
  2. % reduction of each treatment device
  3. % reduction of total Treatment system
- Description of the function and intent of the treatment system.
- Description of how fraction impervious was calculated (what figures were used for different zonings).
- Description of and documentation for any departure from the Melbourne Water “MUSIC Inputs” document.

### **MODEL**

- Sqn or Sqz model of catchment with treatment measures.
- Sqn or Sqz model of catchment without treatment measures.
- Description of rainfall/ET data used (should be one of MW’s reference years)
- If available an electronic copy of the catchment and subcatchment used in MapInfo or other approved format. If an electronic copy is not available a hard copy is acceptable.