Design, Construction & Maintenance of WSUD

Shire of Melton

A healthy waterways initiative in partnership between Melbourne Water and the Shire of Melton

Victoria The Place To Be

Melbourne Water

Introduction

The following document has been prepared as an addendum to the Water Sensitive Urban Design (WSUD) guidelines for the northern and western growth area councils. This addendum outlines specific requirements for the Shire of Melton in:

- council approved WSUD treatment types and council requirements
- council specific WSUD construction requirements
- stormwater quality improvement modelling requirements using MUSIC
- Council specific approved maintenance regimes

There are currently a number of Melbourne Water Development Services Scheme in the Shire of Melton which are listed in Table A-1.

Table A-1 – Melbourne Water Development Services Schemes

Scheme Number	Development Services Scheme	Suburb
4140	Rockbank	Rockbank
8060	Brookfield Creek Strategy	Brookfield
8055	Arnolds Creek West Strategy	Melton West
8051	Minns Road Strategy	Melton West
8037	Eynesbury Estate Strategy	Eynesbury
8201	Toolern Creek	Melton South
8035	Rees Road Drain	Melton South

Shire of Melton necessitates that the treatment of stormwater meet the stormwater performance objectives defined in Section 2.3 of the Urban Stormwater Best Practice Environmental Management Guidelines (CSIRO – 1999).

The aforementioned documents outline the minimum performance targets set for stormwater treatment as being:

- 45% retention of Total Nitrogen annual load
- 45% retention of Total Phosphorus annual load
- 80% retention of Total Suspended Solids annual load
- 70% reduction of annual load for Litter

Shire of Melton is the responsible authority for assessing Water Sensitive Urban Designs, including MUSIC models, within the Shire of Melton. The exception to this is where a Development Service Scheme or other arrangement is in place whereby the assets are or become those of another responsible authority such as Melbourne Water.

MUSIC is a design program developed by the CRC for Catchment Hydrology's Urban Stormwater Quality Program.

MUSIC provides the ability to simulate the quality and quantity of stormwater runoff from catchments of varying sizes. It allows for the evaluation of performance of the proposed Water Sensitive Urban Design feature for both the designer and the responsible authority assessing the design.

Shire of Melton will only accept Water Sensitive Urban Designs that incorporate the use of MUSIC modelling and uses MUSIC version 3 or later. An electronic copy of the sqz file shall be submitted to Council to be assessed by a responsible officer.

This document endeavours to provide guidance on input parameters and modelling approaches for MUSIC that is recommended by Shire of Melton.

Climate data

Rainfall data

Greater accuracy of the stormwater treatment performance is dependant upon the duration of the representative years used, which infers that the longer the time period considered, the better it reflects real conditions. However, a complete set of rainfall records is not available. Therefore, as a compromise, only a portion of the climate data is considered. And the appropriateness of the representative years of rainfall data used is determined by how well it approximates the long-term climate for the area.

Various weather stations around the Melbourne area have historical records to assist in determining the most suitable year or sequence of years to be used.

The following representative rainfall stations and years, as identified by Melbourne Water, are to be used for MUSIC modelling in the Melton Shire:

- Melbourne Airport (86282) – reference years yet to be confirmed
- Little River (87033) – reference years yet to be confirmed

Refer to the Figure A-1 for the locations of the various rainfall bands across Melton.

Accordingly Shire of Melton has decided upon the following, as shown in Table A-2.

Table A-2 – Rainfall data applicable to the Shire of Melton

Weather Station	Long term Annual Rainfall (mm)	Reference years	BOM rainfall station number
Melbourne Airport	500 - 640	TBC	86282
Little River	436 - 500	TBC	87033

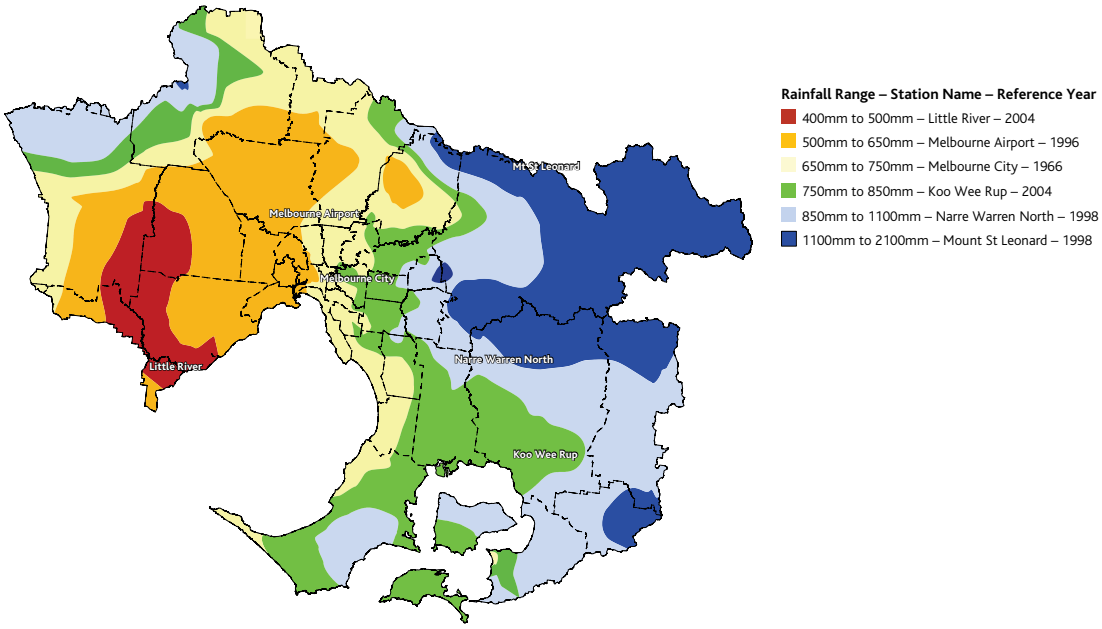
The following show the reasons for the choice:

- Neither the Bureau of Meteorology nor the Shire of Melton has climate data for the area. The closest weather station is at Melbourne Airport.
- Melbourne Airport rainfall data closely approximates the long-term annual rainfall for the Shire of Melton, as shown in Figure A-1.
- The representative years have a complete set of daily rainfall records. There are no gaps where a reading was not taken or assumed.
- It matches the representative years and location chosen by Melbourne Water.

Any submission that deviates from the abovementioned reference years and location shall have attached with it a published scientific report supporting their proposal.

Rainfall distribution across Melbourne

Figure A-1 – Mean Annual Rainfall Distribution (Greater Melbourne)

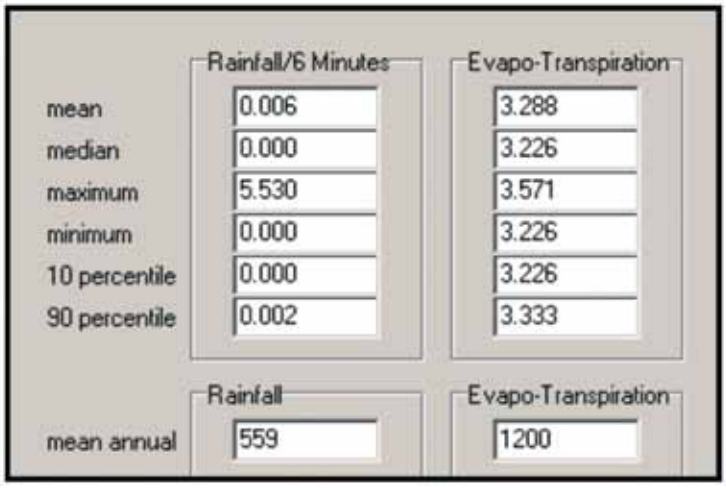


Source: Melbourne Water MUSIC Guidelines (2010)

Monthly evapotranspiration

The Melbourne Airport evapotranspiration figures are supplied within the MUSIC software, as shown below in Figure A-2.

Figure A-2 – Evapotranspiration input figures



Timestep

The selection of an appropriate timestep for modelling is a compromise between accuracy and run time requirements. A smaller timestep will require longer computing time.

An appropriate timestep will depend upon the Source Node, overall catchment size and the size of the Treatment Nodes within the catchment.

Therefore the timestep must be equal or less than:

- the time of concentration of the smallest sub-catchment within the model
- the shortest expected detention time of the proposed treatment measures.

If either of the above are less than six minutes, a timestep of six minutes shall be used.

Hydrological routing

Hydrological routing takes into account the variations in flow within a moving water body and can produce a more accurate time of concentration and thus a more realistic model. If used by the applicant shall supply Council with supporting documents.

To simplify the complexities associated with hydrological routing, the applicant may choose to neglect it in their MUSIC model. The consequence of this action, in general, results in an underestimation of the performance of the treatment systems.

Source node selection

Source Nodes for modelling the Shire of Melton catchments are defined by their usage, as shown below:

- The ***Forested Source Node*** shall be used for natural bushland areas, woodlands, open forest and closed forest.
- The ***Urban Source Node*** shall be used for residential subdivisions, commercial areas, areas servicing local needs such as schools and parklands, and light to general industrial precincts. Extractive and Heavy Industry Areas cannot be modelled using this Source Node. In these cases, supporting documents shall be provided to Council and shall be assessed by the responsible officer.
- The ***Agricultural Source Node*** shall be used for areas of large scale cropping or grazing that contains exposed soils.

Establishing source node rainfall runoff parameters

Impervious area

Ideally, models should be calibrated against local flow data. However, in most cases, there is no available information. That aside, as a guide, the following table, Table A-3, shows the fraction impervious for different land uses. It should be noted that these figures are total fraction impervious whereas MUSIC requires the effective fraction impervious. Therefore, the use of these values may result in an overestimation of flows in some cases.

Table A-3 – Fraction Impervious values for various land types

Zone	Brief Description/Examples	Normal Range	Typical Value
Residential Zones:			
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 minimum	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
Industrial Zones:			
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
Business Zones:			
Business 1 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
Rural Zones:			
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
Public Land Zones:			
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.	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 & 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

Pervious area

The pervious area is the percentage of area where infiltration occurs. Water that is stored in the pervious storage can be lost to evapotranspiration at any time, and to groundwater when the volume in store exceeds the field capacity.

Soil characteristics

Table A-4 shows the soil characteristic within the Shire of Melton. Applicants shall use these values in their MUSIC models. Any deviation from these default values must be accompanied by a published scientific report in support of the variation.

Table A-4 – Soil Characteristics with the Shire of Melton

Parameter	Forest	Agricultural	Urban: Residential, Commercial & Industrial *
Rainfall Threshold (mm)	1	1	1
Soil Capacity (mm)	30	30	30
Initial Storage (%)	30	30	30
Field Capacity	20	20	20
Infiltration Capacity Coefficient a	200	200	200
Infiltration Capacity Coefficient b	1	1	1
Initial depth (mm)	10	10	10
Daily Recharge Rate (%)	25	25	25
Daily Baseflow Rate (%)	5	5	0
Daily Deep Seepage Rate (%)	5	5	5

* For Extractive and Heavy Industry, refer to Section 5.0 – dot point 2.

Definitions:

- Soil Storage Capacity is the maximum storage depth of the pervious area store.
- Initial Storage represents the level of storage in the pervious area store at the start of the run.
- Field Capacity is the soil capacity above which water in the soil stores can drain by gravity to the groundwater store.
- The Daily Recharge Rate represents the amount of water that drains daily to groundwater from the soil store.
- The Daily Baseflow Rate represents the amount of water that leaves the groundwater daily as baseflow.
- The Daily Deep Seepage Rate represents the amount of water that leaves the groundwater daily as seepage.

Pollution concentration data

The default values for Total Nitrogen, Total Phosphorus and Total Suspended Solids are to be used unless additional data is available. New data must be sourced from a published scientific report and submitted to Council to be assessed by the responsible officer.

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.

Stormwater treatment nodes

Council approved WSUD treatment types and requirements

Table A-5 outlines the types of WSUD treatments Council accepts and what requirements are imposed for certain types of treatments.

Table A-5 – Summary of Council approved treatment types

Treatment Type	Approved for Use	Not Approved for Use
Bioretention swales	☑ Open space reserves within residential 1 zone	☒ Nature Strips and centre medians
Bioretention basins and rain gardens	☑	
Vegetated swales/grass swales/buffer strips	☑ Open space reserves within residential 1 zone	☒ Nature Strips and centre medians
Sand filters	☑	
Sedimentation basins	☑ Dry basin or as part of a wetland system	☒ Wet basin where catchment is < 60 ha
Constructed wetlands	☑ Where catchment is > 60 hectares	
Ponds and shallow lake systems	☑ Where catchment is > 60 hectares	
Gross pollutant traps	☑	
Rainwater tanks	☑ Development within existing urban subdivision	☒ Pre-developed subdivisions

Assessment criteria

Shire of Melton provides the following table (see Table A-6) to show what criteria will be used to assess the WSUD designs.

Table A-6 – Summary of Council criteria to assess WSUD designs

Treatment Type	Assessment Criteria
Treatment nodes – general	Access must be provided to all treatment nodes for maintenance purposes Are the high & low-flow bypass used appropriate? Does the treatment seem roughly appropriately sized (typically 1-3% of catchment for many types)? Deep seepage set appropriately, given local infiltration data?
Wetlands & Ponds	Inlet pond around 10% of total surface area (wetland)? Is the inlet pond designed to treat up to 95% of all suspended sediments down to a particle size of at least 125ìm? Extended detention depth within 0.4-0.7m? Is the permanent pool volume 20-50% of surface area (i.e. represents 20-50cm depth)? Notional detention time of 48-72 hours? k.C* and NCSTR values default, or justified by published data? Overflow weir appropriate for design storms?
Bioretention systems	Extended detention depth <0.4 (streetscape) or <1.0 (biofilter basin)? Filter area <70% of total surface area (unless otherwise justified)? Filter depth 0.5-1.0m (never <0.3m)? Hydraulic conductivity 100-300mm/hr (and explained)? Filter media particle diameter approximately 0.45mm? Overflow weir width appropriate to design flows and realistic? k,C* and NCSTR values default, or justified by published data?
Swale	Slope within 2-5% range (check dams if <4%), possibly under-drain if <2%? Dimensions realistic and suitable for constraints? Dimensions suitable for delivering design storm (e.g 5 year)? Seepage loss appropriate and justified? k,C* and NCSTR values default, or justified by published data? Vegetation height explained and justified?
Infiltration system	Infiltration rate justified by local testing? k,C* and NCSTR values default, or justified by published data? Dimensions appropriate to constraints? Pre-treatment in place to prevent clogging? Overflow weir appropriate for design storms?

Treatment Type	Assessment Criteria
GPT	Performance data supported by published and peer-reviewed data? Claims made about nutrient removal (if so, these need to be justified): generally, nutrient removal should NOT be predicted for GPTs Appropriate use of high-flow bypass?
Rainwater tank	Dimensions appropriate and realistic? k,C* and NCSTR values default, or justified by published data? Demand data appropriate and justified?

Maintenance regimes

Table A-7 is indicative of the acceptable WSUD infrastructure maintenance Shire of Melton is prepared to manage. Other regimes will be assessed on application.

Table A-7 – Summary of Council approved maintenance regimes

Asset	Maintenance
Wetland surrounds	Removal of litter once a month or as requested. Removal of fallen tree debris prior to mowing. Mowing in accordance with Council's cycle and intervention levels.
Pipelines, grills, concrete structures, rock weirs	Removal of litter and debris, blockages not to exceed 50% of inlet. Flush pipes of sediment prior to levels reaching 30% of pipe capacity.
Swale	Removal of litter as requested. Sediment to be cleaned out when accumulation causes flooding of surrounding area.
Bioretention basin and rain garden	Removal of all litter and debris once a month. Monitor every six months and after large storm events. Sediment to be cleaned out when accumulation is within 50mm of overflow pit level.
Gross pollutant traps	Monitor every 8 months and after large storm events. Clean every 8 months or as required.
Access tracks	Monitor at monthly maintenance inspection. Repair if required.
Pedestrian paths – concrete paths and walking trails	Trimming of edges once a month. Monitor at monthly maintenance inspection. Clean and repair if required in accordance with Council standards.
Boardwalks and poles	Monitor at monthly maintenance inspection. Clean and repair if required. A level 1 safety assessment must be carried out annually.
Plants	Yearly tree pruning. Weeding every 6 months. Plant and mulch replacement once a year maximum. Litter and weed removal once a month or as requested.
Lighting	Cleaning, painting and globe replacement as required.
Bench seats	Monitor at monthly maintenance inspection. Clean and repair if required.
Information signs and displays	Monitor at monthly maintenance inspection. Clean and repair as reported.
Irrigation systems	Annual inspection. Carry out repairs and replace if damaged.
Pump and pump house for irrigation	Operate and maintain as per manufacturer's specifications.

References

MUSIC User Guide, MUSIC Development Team, eWater, Australia 2009

MUSIC Guidelines – Recommended input parameters and modelling approaches for MUSIC users, Melbourne Water, Revised January 2011

Gold Coast City Council MUSIC Modelling Guidelines 2006, Gold Coast City Council, 2006

WSUD Engineering Procedures: Stormwater, Melbourne Water, CSIRO Publishing 2005

Concept and Functional Design of WSUD Vegetated Treatment Measures, Clearwater 2007

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