

MUSIC Version History

What's New in this Version of MUSIC

There have been several functional and visual changes to MUSIC version 6.0. The largest is the introduction of MUSIC-*link*, which streamlines the process of assessing the compliance of water sensitive designs submitted by the development sector against guidelines from a specific assessing authority. Other significant changes are summarised below:

Version 6.3

- Runs at a 5 minute time step
- Fix for out of memory when running large projects
- Custom storage relationship fixed
- Command line should now work for all projects
- Improved validation messages
- Fixed Import/Export Errors for some MSF files
- Updated the GPT User interface

Version 6.2 (Build 1)

Landuse Zoning / Surface Type categories within the Urban Source Node – these will allow for a better “split catchment modelling approach”. The new categories have guided default EMC/DWC values (see: [Editing Source Node Properties](#)).

New [Results Manager](#) and charting tool that offers:

- Different chart types eg. Line, Exceedance and Cumulative.
- Different statistics and data filtering options.
- Direct graphing of flux files. This allows various analysis of hydrological matrixes, such as:
 - Time series results comparison of multiple scenarios (e.g. pre and post)
 - Time series soil moisture for the Bioretention Node
 - Inundation frequency analysis for the Wetland Node (and other storage nodes)
 - Calculation of the number of wet/dry/runoff days
 - Calculation of Stream Erosion Index
 - Calculation of Volumetric Runoff Coefficient.

Version 6.1 (Build 1)

- Evapotranspiration loss for Bioretention Node now taking into account seasonal variations.

Version 6.0 (Build 4)

- Fixed an issue with hardlock network licences that affected a number of users.

Version 6.0 (Build 3)

- Unit conversion error in daily and sub-daily flux files for source nodes has been fixed
- Installer now correctly installing .NET and HASP dongle drivers
- Some input dialog sizes have been adjusted to fit within small laptop screen
- Version ID is now correctly displayed in 'About Screen', Release Note', and 'MUSIC.exe'

Version 6.0 (Build 1)

- MUSIC-*link*
- The ability to import time-series flow files on source nodes;
- The ability to specify an initial volume for all storage nodes. Prior to this addition, the assumption was that the storage was full at the beginning of the model run;
- The ability to include a maximum draw down limit for all storage nodes with stormwater harvesting options;
- The ability to estimate the surface area for a sedimentation basin, and the inlet volume for wetland nodes;
- The ability to add multiple rainwater tanks (with the same properties) in a model;
- The inclusion of flow-based capture efficiency for the Gross Pollutant Trap and Generic node, allowing for improved handling of pollutants;
- Improvements in the re-use functionality for all treatment nodes with storage;

- Additional properties in the Vegetated Swale node, including Swale Capacity, providing a more clear indication of the results of changing parameters;
- The inclusion of a time-step timestamp in flux files, along with other file format changes to improve usage. Additionally, these files are now saved in the .csv format by default;
- Enhancements in command line functionality; and
- Several bug fixes, including zooming issues and font displays on some computers.

Version 5.1 (Build 16)

MUSIC Version 5.1 includes a number of significant new features and enhancements, which are summarised below. Users are referred to the specified chapter below for further information:

- Fix incorporated to ensure "Load" Y-axis label is always correctly updated when "Load" radio button is selected in Advanced Charting window; and
- Fix incorporated to ensure that correct project window is selected/highlighted when trying to re-open a currently open project.

Version 5.1 (Build 15)

- Fix incorporated to allow MUSIC v3 bioretention and infiltration nodes to run in MUSIC 5.1 including support for split flows;
- Fix to ensure correct default values are displayed for Source nodes in the node multi-edit dialog;
- Fix incorporated in Advanced Charting module to ensure only nodes with valid data are available for selection;
- Fix incorporated to allow alternate water quality to be imported via msf/csv import;
- Fix incorporated to address bug when exporting time series data with user-defined time-step is selected from node right click menu; and
- Additional checks incorporated to ensure there is sufficient disk space to save drainage flux files before model execution.

Version 5.1 (Build 14)

- Fix incorporated to address bug where a meteorologic template file is not successfully saved;
- Fix to address dialog sizing issues on some Windows7 machines; and
- Fix to prevent 'Initial Storage' value from being incorrectly modified when the 'Soil Storage Capacity' is changed in the node multi-edit dialog.

Version 5.1 (Build 13)

- New [Split Flow](#) feature allowing different outflow components to be routed via different flow pathways;
- MUSIC now uses binary files for the exchange of time series data during model execution. Testing shows significant reductions in simulation times;
- MUSIC can now operate via the [command line](#) allowing "batching" of simulations as well as the use of MUSIC with third party optimisation software (Beta);
- MUSIC now takes better care of the management of temporary files during and after model execution. As a result, the hard drive "footprint" of MUSIC should be greatly reduced;
- Improved memory management should result in fewer "out of memory" messages during execution of large models;
- The progress of the simulation is now indicated on the catchment diagram. Once a node or link is processed it will change from the default colour to green making it much easier to identify and diagnose problematic nodes;
- Graphical User Interface updates for display of tabulated outputs (e.g., treatment train effectiveness); and
- Minor update to outflow component names on the node water balance dialog to ensure consistency with new split flow feature.

Version 5.0 (Build 11)

- Modified Advanced Charting so default chart colours are more distinguishable. Charts can also now be given a custom title.
- Meteorologic Template Builder can now accept Bureau of Meteorology 6 minute rainfall files with *.dat extension.
- Included support for additional date/time formats in CSV rainfall reader. Also improved speed of CSV reader.

- Ctrl+S will now open Save As dialog for new projects and will automatically save over a previously saved project.
- Main window can now be 'docked' in Windows7.
- Fixed bug associated with bioretention node not running with restricted UAC security settings.
- Fixed bug associated with 'floating point error's in Treatment Train Effectiveness dialog when comparing pre and post development nodes.
- Fixed bug associated with printing of background images.
- Fixed bug that previously allowed a non-defined custom storage-outflow relationship to be defined.
- Minor Graphical User Interface updates (eg. progress bar).

Version 5.0 (Build 10)

- New Graphical User Interface.
- Bioretention treatment performance has been further updated in MUSIC based on the latest research from the Facility for Advancing Water Biofiltration (FAWB). Treatment performance now follows a continuous relationship instead of the lookup table relationships in MUSIC version 4 (refer [Appendix E](#) for further information).
- [Node multi select and edit](#) allows easy comparison and edit of multiple nodes of the same type.
- [Advanced Charting](#) allows comparison of outputs from multiple nodes and pollutants simultaneously on the one chart.
- A new [Outflow and Storage Interface](#) is included for selected nodes to allow outflow and storage characteristics to be completely customised.
- New [Detention Basin Node](#) is now available.
- Peak outflow is now reported on Mean Annual Loads and Treatment Train Effectiveness dialogs.
- New [Pre and Post-Development nodes](#) are incorporated to allow improved comparison of pre and post-development outputs.
- [MSF file changes](#) (MSF and CSV files can now be exported from MUSIC in addition to imported, the MSF file format has been simplified and is now more robust, Meteorological Template can now be specified in the MSF file, MUSIC projects can be opened directly by double clicking the MSF).
- Reporting of results at a custom time-step (there is no longer the restriction for the reporting time-step to be a direct multiple of the model time-step).
- [New time series formats](#) for rainfall data (including DTF, TTS, CSV, WISKI, Met Office (UK) and Met Eirran).
- [Life Cycle Costing \(LCC\) Regionalisation](#) (allows different LCC specifications for different countries/regions).
- [New background image format support](#) (eg. jpg, ecw, sid, tif), ability to incorporate multiple background images, ability to zoom to catchment diagram and image extents, zoom rectangle, and inclusion of real world coordinates.
- A bioretention outflow oscillation bug when certain combinations of filter depth and saturated hydraulic conductivity were selected can now be rectified by enabling a check box within the Preferences dialog (Settings » Preferences...).

Version 4.1 (Build 1)

As part of eWater's initiative to maintain the MUSIC software into the future and to continue to include improvements, both functionality and science based, we are releasing MUSIC 4.1. This version includes a number of bug fixes, and enhancements, that will allow users and software IT staff to manage the software in current standard operating environments.

- Ability to run in UAC in MS Vista, Win 7 using temporary directory for temporary files - minimising the need to have the software run in administrator mode.
- Updated Win 7 HASP drivers.
- Enhancements to the licence management system.
- Fix to MRT file where a column heading was incorrectly labelled.
- Splash Screen improvement - default display screen shown when user not connected to internet.
- [Sponsored Product Listings](#) (The sponsored product listings project was undertaken at the request of users and out of the need to continually improve the software and provide services to the MUSIC user community. It allows users to search a database of supplier products (mainly GPT's at this stage) and aid in choosing the most suitable product for their project. Over time the number of listings will grow and as a not-for-profit, eWater is using this paid for initiative to further develop, enhance and improve the software).

Version 4.0 (Build 8)

- Fixed a bug related to calculation of the reuse reliability and percentage load reductions for time series of greater than 1 year.
- [Automatically setup a new project via MUSIC setup file.](#)

Version 4.0 (Build 7)

- The [Bioretention Node](#) has been completely re-written, offering more accurate modelling of flow as well as water quality treatment. The treatment algorithms in the bioretention filter media are based on the latest research from the Facility for Advancing Water Biofiltration (FAWB). The new node includes sophisticated predictions of water flow and treatment, taking into account factors such as evapotranspiration and its effect on soil moisture, as well as the design of the system (e.g. filter media type and composition, choice of vegetation, etc).
- A new [Media Filtration Node](#) has been written, which allows systems such as sand filters and granular filter media systems to be easily modelled. The treatment algorithms can be user-edited, to allow device-specific data to be entered.
- The [Infiltration Node](#) has been modified to allow infiltration through the sides of the system (in MUSIC v3 infiltration was only modelled through the base). This provides a much more realistic prediction of infiltration in the system.
- An improved Graphical User Interface has been implemented to allow improved visualisation of the various source and treatment node types and toolbar access to frequently used menu items.
- All graphing and statistics can now be undertaken at a user-specified time-step. For example, the model can be run at 6 minute time-steps, but then the daily results analysed or plotted.
- A new "[Node Water Balance](#)" feature tells the user exactly how much water flowed into and out of a node, through all its various outlet components (including exfiltration and evapotranspiration). It also tells the user how much stormwater was demanded, and the amount of that demand which was satisfied. This makes analysing the performance of stormwater harvesting strategies much easier than in previous versions of MUSIC.
- A new user-friendly graphical "CSTR assistant" helps the user to determine the appropriate number of CSTRS (continuously stirred tank reactors) which should be used to represent the system they're modelling, based on the shape of the system.
- Stormwater reuse demand can now be turned off automatically whenever rainfall exceeds evapotranspiration and a user-specified reuse time series can be imported, making MUSIC much more flexible and powerful for analysing stormwater harvesting strategies.
- A user-specified storage-discharge relationship can now be applied to most treatment nodes to simulate alternative outlet configurations.
- The life cycle cost algorithms have been modified to allow maintenance in the last year, as well as to allow elevated maintenance costs over the first few years of a treatment device during the establishment phase of a system. A "notes" facility has also been incorporated to the life cycle cost specification window to allow the user to record assumptions made when developing the life cycle cost estimates for a particular treatment node.
- The required volume of a GPT unit (for life cycle cost estimation purposes) is now calculated automatically by MUSIC based on the volume of trapped pollutants.
- Default serial correlation coefficients are automatically assigned to source nodes based on the adopted model time-step. This provides for much more realistic generation of pollutants between subsequent model time-steps.
- A number of minor bug fixes.

Version 3.0

- A Lifecycle Costing Module, which allows the lifecycle costs of a treatment node, or an entire stormwater treatment train, to be analysed. The module's features, and basis, are fully described in [Life Cycle Costing of Treatment Measures](#) and [Costing Information](#).
- The MUSIC development team have reviewed recent calibration studies, to provide new default k and C* values for MUSIC's Universal Stormwater Treatment Model. Users are referred to [Appendix G: Selecting Appropriate k and C* Values](#) for further information.
- New treatment nodes ([Infiltration System](#) and [Rainwater Tank](#)).
- Modifications to the bioretention node to allow user-specification of the height of the collection pipe (in order to simulate flow-losses below the perforated collection pipe, where appropriate or desired) ([Bioretention System](#)).
- Increased precision on the specification of re-use demands.
- New "Imported Data Node" which allows an observed time series (of flow and pollutants) to be imported, for simulating situations such as point-source, or for calibrating the model to observed data ([Imported Data Node](#)).
- Improved capability to export simulation results from nodes, allowing the user to specify the time-step at which the export is done ([Exporting MUSIC Output Data Files](#)).
- Revised calculation of meteorological statistics to include zero-rainfall time-steps.

Version 2.1

Version 2.1 introduced two bug fixes:

- Bioretention error update: Error in bioretention system algorithms for TP and TN treatment within filter media corrected, and new data incorporated in the fixed algorithms ([Appendix D: Modelling Filtration Media System Performance](#)).
- Occasional convergence error in USTM.exe, which caused mass imbalance in particular circumstances fixed.

Version 2.0

A number of enhancements and new features have been incorporated into MUSIC Version 2, and these are summarised below. Users are referred to the specified chapter for more details on each identified enhancement, where appropriate.

- MUSIC's rainfall-runoff algorithm has been significantly enhanced. Firstly, there is now only one pervious store per source node, making calibration easier, and avoiding potential instabilities where two pervious stores were specified. Secondly, the rainfall-runoff algorithm now includes the option to 'lose' water from the groundwater store, which is NOT returned to baseflow. This can be used to simulate any situation where infiltrated water does not return to baseflow within the catchment of interest, as in many small catchments, and where a catchment's defined outlet is a pipe ([Toolbar and Menu Items](#) & [Editing Source Node Properties, Rainfall Runoff Modelling](#)).
- There is now the provision to specify a 'warm-up period' for MUSIC's rainfall runoff model. When selected, this option will 'pre-run' the rainfall-runoff model for the first 12 months of the simulation period, in order to equilibrate the initial storage states (pervious area and groundwater) in the model. The warm-up option will only operate when the total period of simulation is greater than 12 months ([Running and Saving Simulations, Rainfall Runoff Modelling](#)).
- Specification of statistical characteristics (dry weather concentration and storm event mean concentration) has been simplified (the option to specify + or - 1 Std. Dev from the mean has been removed) ([Editing Source Node Properties](#)).
- Generic Treatment Node (GTN) graphical equation editor improved to allow equation coordinates to be entered directly (via right-clicking on the point of interest on the equation curve) - this makes exact specification of values easier than by dragging the graph ([Gross Pollutant Traps](#), [Generic Treatment Devices](#)).
- MUSIC prompts you to Save your file before running a simulation, to prevent losing the model setup as a result of an abnormal program termination ([Running and Saving Simulations](#)).
- MUSIC now saves files (.sqz) without simulation results by default (but keeping the attached meteorological template), saving disk space, and time in opening files. Users can still specify to save simulation results (.sqr) if required ([Running and Saving Simulations](#)). This has largely removed the need to use the Export function to create a (.sqn) file with only the model setup (but no meteorological template attached).
- The MUSIC Toolbar has been simplified, with Source, Treatment and Other Nodes now included on their own drop-down menus from the main toolbar. This allows the MUSIC window to be reduced to a smaller size, without losing access to toolbar items ([Toolbar and Menu Items](#)).
- Specification of acceptable parameter ranges has been relaxed (to allow users to experiment with unusual scenarios, if desired), although MUSIC will still warn users of the potential risk of using these 'out of range' values.
- The import wizard for meteorology agencies (BOM) climate files has been improved to include a graphical illustration of the data being imported, to allow the user to identify periods for which there are reliable data. A colour-coding system is used to identify periods of missing or estimated data ([Meteorological Data](#)).
- The Statistics options for viewing simulation results have been extensively revised. MUSIC allows users to view the Mean Annual Load from a node, and also the % change in load through the node (primarily used for treatment nodes). The new "Treatment Train Effectiveness" option can be used to compare the load at a given node (e.g. receiving node), with the sum of all source nodes contributing to it. This removes the need to individually add up the values from all source nodes (required in MUSIC Version 1). All statistics results dialogue boxes can be copied, and then pasted into other applications, such as Microsoft Excel ([Type of Output - Statistics](#)).
- Both Statistics and Cumulative Frequency Graphs now have the option to be created for a subset of flow conditions (Flow-based Sub-sample). For example, they can be calculated for only baseflows (by setting an upper flow threshold), or for only stormflows (by setting a lower flow threshold) ([Type of Output - Statistics](#), [Type of Output - Cumulative Frequency Graphs](#)).
- MUSIC v2 includes a "Generic Source Node", which allows users to specify their own rainfall-runoff and water-quality parameters. This might be used, for example, to specify roof area runoff. Any of the other source nodes (urban, agricultural, forested) could achieve the same result, but users reported their icons (which portrayed their default land use) as a potential for mis-communication ([Toolbar and Menu Items](#)).
- Specification of water re-use from treatment nodes with a permanent pool is now more flexible, allowing any combination of constant (uniform) and seasonal (scaled by PET) demand, to simulate, for example, a combination of use for toilet-flushing, and garden watering. MUSIC also now allows an annual pattern to be specified by the user, using an adjustable "bar-chart" of monthly demand ([Water Reuse from Treatment Nodes](#)).

Bug Fixes

- "Running Models" status bar modified to address occasional incompatibility with Windows XP.
- Mis-alignment of column headings in Statistics display fixed.
- Instability in calculation of concentrations during time-steps of 'near-zero' flow in some treatment measures rectified.
- Occasional instances of MUSIC incorrectly stating "This does not appear to be a valid catchment file" fixed.
- Persistence of MUSIC temp files after file closure fixed.
- Peculiarities (under certain circumstances) of Generic Treatment Node graphical editor rectified.