

MIDUSS[®] Version 2

Appendices

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Table of Contents

Appendix A – References	A-1
Appendix B – Installation Instructions	B-1
Appendix C – Malaysian Customization	C-1
Appendix D – New in MIDUSS Version 2	D-1

Notes:

Appendix A

References

- ASCE, Design and construction of urban stormwater management systems.. Manual of practice No. 77, Amer. Soc. Of Civil Engineers. 1992.
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Notes:

Appendix B

Installation Instructions

Introduction

MIDUSS Version 2 is available as two basic types of installation:

- Single license – which means the installation to one PC and intended for the use of engineers using that single PC.
- Network license – which means the installation of files to a server on a network with client PCs accessing the server over a TCP/IP Windows-based network.

This Appendix provide instruction on how to install MIDUSS for both these scenarios.

You can also find guidance on how to upgrade from:

- a Version 2 demonstration mode to a Single or Network Version 2 license
- a Single Version 2 License to a Network Version 2 license
- MIDUSS 98 to Version 2
- MIDUSS 4.72 for DOS to Version 2

Information is provided on the use of Serial Numbers that activate a Version 2 licenses.

MIDUSS Version 2 introduces Maintenance Serial Numbers. This Appendix discusses how they are used.

MIDUSS Version 2 demonstration mode lets you try MIDUSS for an unlimited time. There are feature and data limitations in demonstration mode and these are fully described in this Appendix

There is also information on MIDUSS Version 2 compatibility with older versions of MIDUSS as well as compatibility with updates to Version 2 as they are developed.

MIDUSS Upgrades

License costs

MIDUSS Version 2 may be available at a discount if upgrading from previous versions. Price information is available from authorized MIDUSS resellers or the ShopMIDUSS web site.

Version 2 Demonstration Mode to a Version 2 Single license

A Single license is the same as demo license in terms of files and installation procedures. All that is needed to upgrade from a demo to a Single version is the addition of a serial number on the opening screen.

Version 2 Demonstration Mode to a Version 2 Network license

A demo license **cannot** be updated to a Network version. The demo license must be completely uninstalled first.

Version 2 Single to Version 2 Network

A Single license **cannot** be updated to a Network version. The Single license must be completely uninstalled first.

Miduss 98 to Version 2

Miduss 98 **cannot** be upgraded to Version 2. However, Miduss 98 will co-exist on the same PC or server running Version 2.

MIDUSS 4.72 for DOS to Version 2

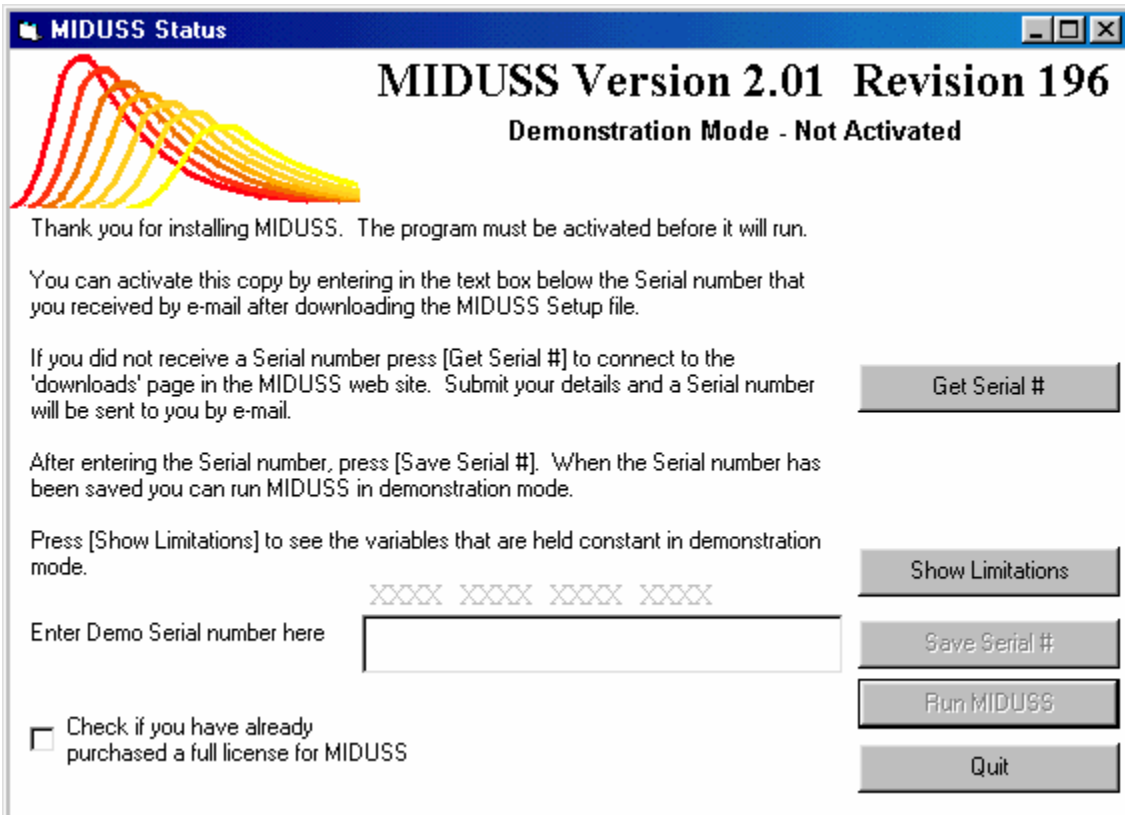
MIDUSS 4.72 for DOS files **cannot** be upgraded to Version 2. However, MIDUSS 4.72 for DOS and Miduss 98 will co-exist on the same PC or server running Version 2.

Version 2 serial numbers

MIDUSS Version 2 requires Serial Numbers to activate the use of the program.

Demonstration Mode

Version 2 Demonstration Mode requires a serial number to activate it in demo mode. This serial number is usually emailed to you after you have downloaded the files from the MIDUSS web site. The opening screen in MIDUSS has a [Get Serial Number] button which takes you to the appropriate page on the MIDUSS web site so that you can request and immediately receive a demo serial number by email.



The screenshot shows a window titled "MIDUSS Status" with a blue header bar. The main content area has a white background. On the left, there is a graphic of several overlapping, curved lines in red, orange, and yellow. To the right of the graphic, the text reads "MIDUSS Version 2.01 Revision 196" in a large, bold, black font, followed by "Demonstration Mode - Not Activated" in a smaller, bold, black font. Below this, there are several paragraphs of text: "Thank you for installing MIDUSS. The program must be activated before it will run.", "You can activate this copy by entering in the text box below the Serial number that you received by e-mail after downloading the MIDUSS Setup file.", "If you did not receive a Serial number press [Get Serial #] to connect to the 'downloads' page in the MIDUSS web site. Submit your details and a Serial number will be sent to you by e-mail.", "After entering the Serial number, press [Save Serial #]. When the Serial number has been saved you can run MIDUSS in demonstration mode.", "Press [Show Limitations] to see the variables that are held constant in demonstration mode." Below the text, there is a text input field with the placeholder text "Enter Demo Serial number here" and a small box containing "XXXX XXXX XXXX XXXX". To the right of the text input field, there are five buttons stacked vertically: "Get Serial #", "Show Limitations", "Save Serial #", "Run MIDUSS", and "Quit". At the bottom left, there is a checkbox labeled "Check if you have already purchased a full license for MIDUSS".

Figure B-1 – The initial Status form.

Single license

Version 2 Single licenses have a Serial Number starting with a 4-digit numerical sequence. Example: 1890.

The full serial number has 4 blocks of digits as displayed in the example below.

Enter MIDUSS Serial number

XXXX XXXX XXXX XXXX

1890 DE56 76EA 34AE

Save Serial #

Figure B-2 – Entering a typical Serial number.

The Serial Number is used to track and communicate with purchasers of the license. It is important to keep this number in a safe place and use it when contacting our company or a reseller for upgrade or technical support.

A Single license Serial Number will not activate a Network license.

Network license

Version 2 Network licenses have the same attributes as the Single license except they always start with the number '9'.

A Network license Serial Number will not activate a Single license.

Maintenance Serial Number

MIDUSS Version 2 provides an automatic 90 days of support and updates after purchase. This applies to both new licenses or upgrades from previous versions.

Figure B-3 shows the expiry date for maintenance if the new or upgrade MIDUSS Version 2 was installed on January 8, 2004. There is an automatic 90 days added after the installation date.

The Maintenance Serial Number is purchased from our company or authorized agent and is sent to you by email. A typical Maintenance Serial Number looks similar to the license serial number. Here is an example of a Maintenance Serial Number: 1023 24EA 76DD 67EE.

When you have purchased a full license of Version 2 each time you run MIDUSS there is an opportunity to enter a Maintenance Serial Number. Once entered the top portion of the opening screen tells you the period you are eligible to download updates from our web site.

When the maintenance period expires you will be unable to gain access to the download area and therefore cannot receive MIDUSS Version 2 updates.

To re-instate a maintenance period you must purchase a Maintenance Serial Number from our web site or from an authorized agent. The web location is www.shopmiduss.com. All Maintenance Serial Numbers provide 12 months of access to the update area of the MIDUSS web site. The Maintenance Serial Number will sent to you by e-mail.

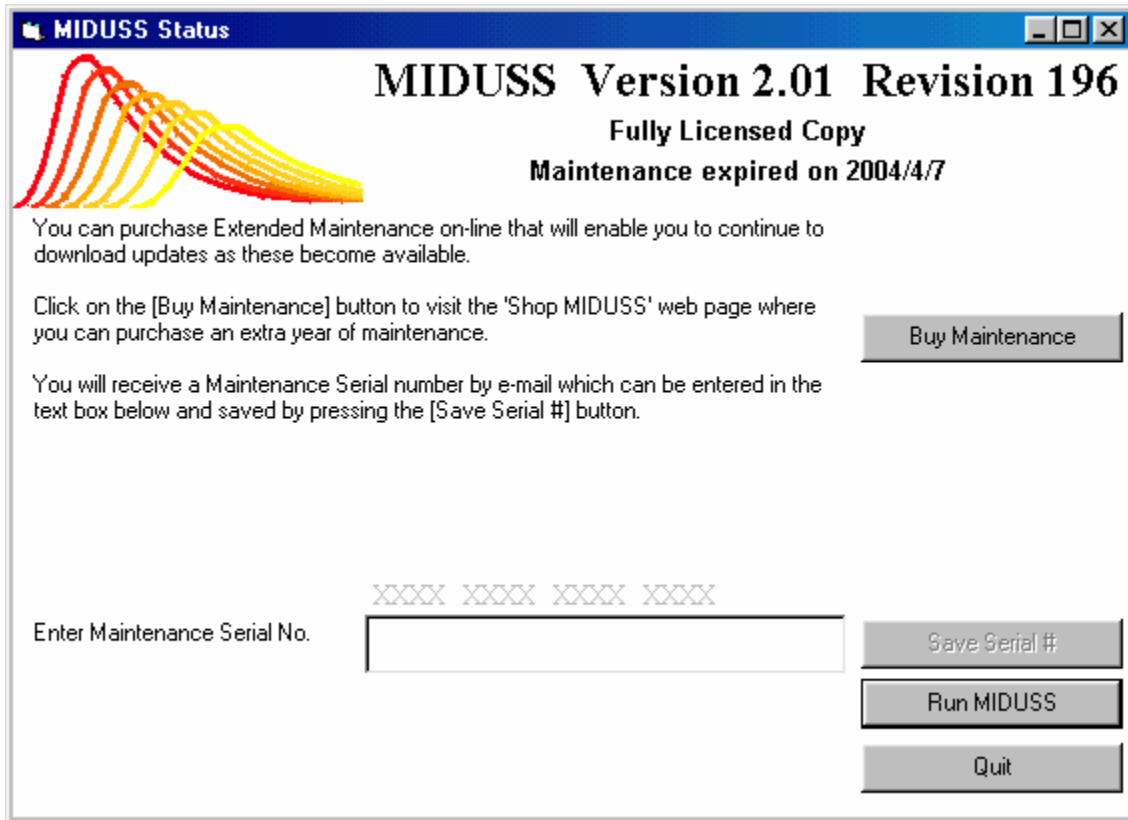


Figure B-3 – The Status form shows the Maintenance period.

When the email arrives you simply copy and paste the number into the appropriate field on the MIDUSS opening screen. Then press the [Save Serial Number] button. The maintenance period date will be updated.



Figure B-4 – Entering a maintenance serial number.

A Maintenance Serial Number provides updates for 12 months from its date of purchase. If you purchase a Maintenance Serial Number at the same time as you purchased Version 2 you will receive an additional 90 days (3 months) of maintenance for a total of 15 months.

If your copy of Version 2 showed that you have 2 months of maintenance still to go and you purchased a Maintenance Serial Number and installed it in MIDUSS then the maintenance period expiry date shown in MIDUSS would be 14 months. The opening screen of MIDUSS shows you the date when maintenance expires. The MIDUSS Help / About menu item also shows you the same date information.

The Version 2 demo

The MIDUSS Version 2 Demonstration Mode is identical to the program used in the purchased license. That is, the main executable file MIDUSS.exe is identical. How the MIDUSS program operates depends on the supporting files and the serial number used.

There is no demo offered for Version 2 Network license. The functionality provided in the Demonstration Mode and Single license should provide the prospective purchaser with enough opportunity to test MIDUSS for engineering purposes. Testing for purposes of network compatibility and performance can be arranged on a case-by-case basis. Please contact us for more information.

Version 2 Demonstration Mode requires a serial number to activate it in demo mode. The serial number is available free of charge from the MIDUSS web site. It will be sent to you by email immediately after you have requested it.

Once the Demonstration Mode is activated you will see a screen similar to the one below. Pressing the [Show Limitations] button will list the feature and data entry restrictions for the Demonstration Mode license.

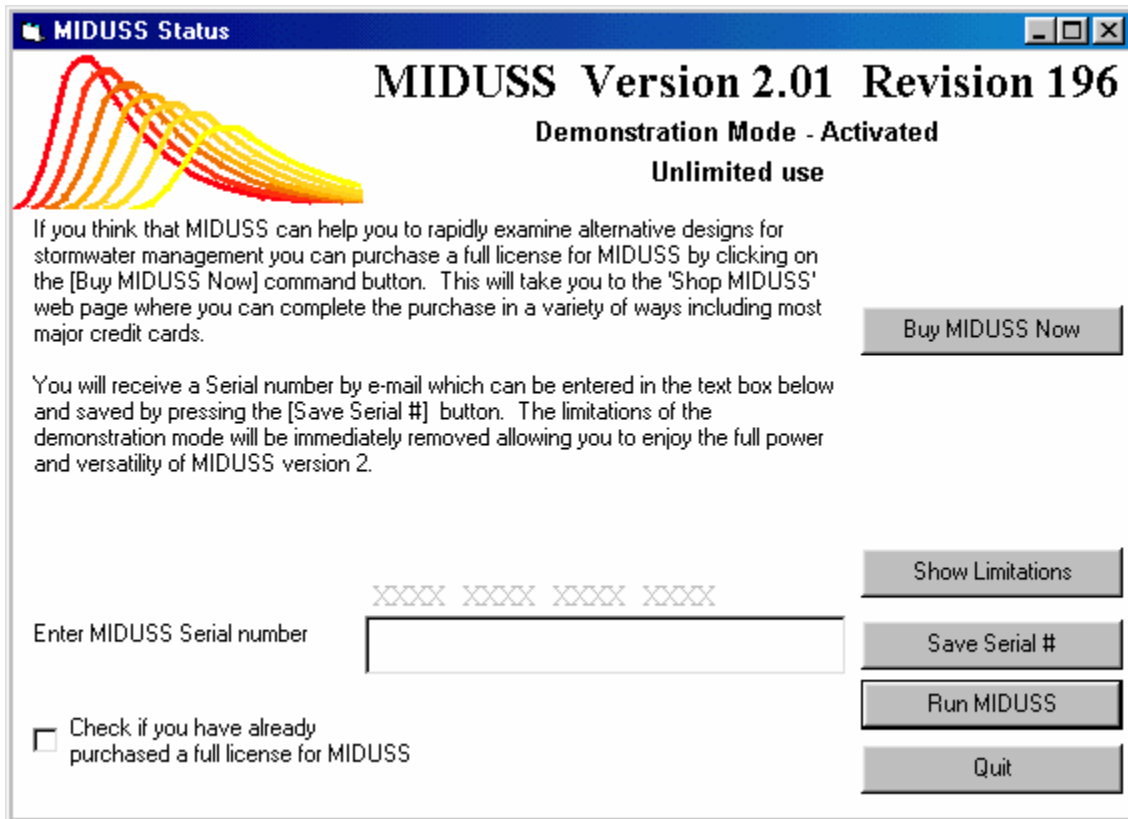


Figure B-5 – MIDUSS activated in Demo mode.

There is no time limit to the Demonstration Mode but there are feature and data entry limitations. These limitations are:

Time Parameters:	Fixed Time step = 10 minutes
Storm command:	Chicago & Historic storms available only. Remaining storms are not available. Fixed Chicago storm 'a' parameter = 1200 mm/h or 47 in/h
Catchment command.:	Fixed Overland flow length = 45 m or 150 ft. Fixed Overland slope = 2%. Fixed SCS CN = 75 Fixed Horton f0 = 75 mm/h or 3 inch Fixed Green Ampt water deficit = 0.4
Pipe design:	Fixed Manning 'n' = 0.013
Channel design:	Fixed Manning 'n' = 0.04 for both types of cross-section even if Variable Roughness option is selected.
Route command:	Fixed Route length = 120 m or 400 ft.
Pond design:	Fixed Number of stages = 11 (i.e. 10 increments).
Culvert design:	Fixed barrell length = 25 m or 75 ft. Fixed downstream invert = 100 m or ft. Weir elevation = 103 m or 110 ft. Constant inflow rate not allowed.
Trench design:	Fixed Hydraulic Conductivity = 50 mm/h or 2 inch/h.

The labels describing 'frozen' parameters are grayed out and followed by **.

Version 2 Compatibility

General

Version 2 Network will co-exist with older versions of MIDUSS on the same computer. These older versions are Miduss 98 and MIDUSS 4.72 for DOS.

Version 2 Single will **not** co-exist on the same computer with Version 2 **Network** installed either as server or client.

Version 2.0

Data files

Early Version 2 text output files are fully compatible with later updates to Version 2. That is, an early output file created in Version 2.00 Rev. 200 will work in Version 2.65 Rev 400 (for example).

A text output file created in a later release (example) Version 2.65 Rev. 400 will work in earlier releases, Version 2.00 Rev 200 for example, with the warning that any new field data in the newer output file will not have a suitable location or use in the older release and so that newer-type data will be ignored.

Version 2 introduces the Save Session feature which is a snapshot of all interactions with MIDUSS. Sessions are saved in a binary file (with the .bin extension). As with the text output files discussed above, older Session files are compatible with updated releases of MIDUSS Version 2. However, a Session created with a recent Version 2 will be compatible with older Version 2 releases to the extent that new features (on the new Session file) cannot be properly assigned in the older release and will be ignored.

Program Upgrades – Single to Network

A Single license cannot be updated to a Network version. The Single license must be completely uninstalled first.

Program Upgrades – Demonstration Mode to Network

A Demonstration Mode license cannot be updated to a Network version. The Demonstration license must be completely uninstalled first.

Program Upgrades – Demo to Single

A Single license is the same as Demonstration Mode license in terms of files and installation procedures. All that is needed to upgrade from a Demonstration Mode to a Single version is the addition of a Serial Number on the opening screen.

Miduss 98

Miduss 98 data files (the output files) can be used in Version 2 Network and Single. Once the older files have been processed by Version 2 the new output files cannot be used in Miduss 98.

In general, MIDUSS Version 2 data files will not work with Miduss 98.

MIDUSS Version 2 data files will not work with MIDUSS 4.72 for DOS.

MIDUSS 4.72 for DOS

MIDUSS 4.72 for DOS data files will not work with Miduss 98 or Version 2 licenses.

Installing MIDUSS Single license

MIDUSS Single license

MIDUSS Version 2 Single license is delivered in two ways:

1. CD media with a menu system and installation prompt
2. Internet download of a single file.

The CD media system includes all files such as:

- installation file Setup.exe
- MIDUSS version 2 program
- help system
- support files (e.g. storms, design parameters)
- system DLLs and OCXs
- user manuals in PDF format
- autorun to launch the CD
- MIDUSSV2menu program
- video tutorials

The internet download includes a partial file set:

- installation file Setup.exe
- MIDUSS version 2 program
- help system
- support files (e.g. storms, design parameters)
- system DLLs and OCXs
- user manuals in PDF format

The video tutorials are not included in the internet download because they are large multimedia files that would make the download session too long and problematic.

Nevertheless, users who have a fast internet connection can download the tutorial files one-at-a-time from our web site www.miduss.com/MIDUSS_support_tutorials_sum.htm.

The tutorials are available as *.EXE and *.ZIP files to avoid problems with some internet firewalls. ZIP files must be 'unzipped' before they can be played. Once downloaded they should be expanded into the \ **Program Files** \ **MIDUSS** \ **Tutorials** folder which has already been setup with the installation of the MIDUSS program files. The tutorial files all have a name starting with 'Tut'. When you are running MIDUSS and use **Help / Video Tutorials /** you will see a list of available video tutorial that MIDUSS has detected as been stored in the ... \ **Program Files** \ **MIDUSS** \ **Tutorials** folder. All files starting with Tut will be listed in the MIDUSS Video Tutorials help menu. This means that using TechSmith's Camtasia program you could produce your own video tutorials that are relevant to your organization or location and these can be made directly available to the your user within MIDUSS - as long as your media files begin with the letters 'Tut

Notes before installing:

MIDUSS Version 2 Single license or Demo will **NOT** co-exist with MIDUSS Version 2 Network.

MIDUSS Version 2 Single or Demo **will** co-exist earlier versions of MIDUSS (98 or Ver 4.72 for DOS).

CD Media installation

- Insert the CD media into the CD drive.
- The files on the CD include an **autorun** file which should start the **MIDUSSV2Menu** program. If not, navigate to the CD and run **MIDUSSV2Menu** by double clicking on it.
- The top command button is labelled **Setup** and this is used to perform the installation of MIDUSS Version 2. Simply select this button to start the automatic installation process.
- Follow the on-screen prompts to install Version 2. It is recommended you install to ...**Program Files \ MIDUSS**.
- At the end of the installation you will find MIDUSS in Start / Programs / MIDUSS.

Internet Download

- The internet download is a single large file of over 20 MB and is named **Setup.exe**.
- Once downloaded, store this file in a convenient location on your PC.
- Navigate to the location and run the file **Setup.exe**.
- MIDUSS Version 2 installation will start.
- Follow the on-screen prompts to install Version 2. It is recommended you install to **C:\Program Files\MIDUSS**.
- At the end of the installation you will find MIDUSS in Start / Programs / MIDUSS.

Installing MIDUSS on a Network

MIDUSS Network version

MIDUSS Version 2 Network is delivered on CD media.

On the CD media there are important files to identify and learn about:

- ServerSetup.exe – sets up MIDUSS Server on a server.
- ClientSetup.exe – sets up MIDUSSnet on the client PC.
- MIDUSS.exe - the main executable that runs MIDUSS. Stored on the server only.
- MIDUSSnet.exe – the program the Client User runs on their PC.

Note:

- MIDUSS Version 2 Network will co-exist on the server with an old version of MIDUSS 98 or MIDUSS ver 4.72 for DOS.
- MIDUSS Version 2 Network will **NOT** co-exist on the server with a MIDUSS Version 2 Single user license. If you are upgrading from a Single user version to a Network version, please completely uninstall all previous Version 2 installations and then reboot the server. Otherwise there will be conflicting Registry settings that will make both the new Network install and previous Single licenses inoperable.
- MIDUSS Version 2 Network does not have a demo version. It is assumed that the engineering functionality can be appreciated by reviewing the Demonstration Mode or Single license products.

General Overview

MIDUSS Network allows an unlimited number of client PCs to access the MIDUSS files installed on a server. The MIDUSS Network license is to be used on a “per office location” basis. Wide Area Networks (WAN) require the purchase of a MIDUSS Enterprise license.

- MIDUSS Network runs on servers running Windows NT4, 2000, XP, and Server2003
- MIDUSS Network consists of a Server setup, then once completed, a Client setup on each PC.
- All Client working files (i.e. files that a user creates or modifies) are stored on the Client PC or on another folder where the Client User has write permission. In addition, MIDUSS read-only data files such as Help or storm data files will be stored in the Client PC in the folder ...\\MIDUSSNet\\.

- Only the Administrator of the MIDUSS Server installation can update the MIDUSS.exe executable. Client Users can learn if an update is available, and in some circumstances, can download the update files.
- The Administrator runs the program ServerSetup.exe to install the MIDUSS Server files. The Administrator also enters the License & Maintenance serial numbers.
- Once this is completed, Client Users run a file named ClientSetup.exe from the Server location. This sets up the local MIDUSS support files on their PC. On the Client User PC the engineer will be running a program named MIDUSSnet.exe.
- MIDUSSnet.exe prompts the User to navigate to where the MIDUSS.exe file is located on the network. This is done only once. The User runs MIDUSS by clicking the RunMIDUSS button.
- The MIDUSSnet.exe uses a local file NetSetupHelp.txt to assist the user in browsing to the Server application folder. This help file can be edited by the System Administrator to reflect site specific information.

Hardware required

Server:

- Pentium III-500
- 256MB memory
- 600 MB hard disk space
- CD ROM
- 1024x768 resolution video

Client:

- Pentium II-400
- 64 MB memory
- 200 MB free hard disk space
- 1024x768 resolution video
- sound card (for tutorials)
- network card

Software required

Server:

- Windows NT4 SP6, 2000 SP1, XP, Server2003 installed
- Windows Networking
- Domain or Workgroup
- Administrator permissions
- Internet access

Client:

- Windows 98, 98SE, Me, NT4 SP6, 2000 SP1, XP
- Windows Networking
- Domain or Workgroup
- User permissions
- Internet access

MIDUSS server setup

Focus on a file named: ServerSetup.exe

To install MIDUSS Network you will need to have Administrator permissions.

The MIDUSS Network software comes on CD media only. It is not available as a download from our website. However, the main program executable named MIDUSS.exe (about 4 MB in size) is regularly updated and can be downloaded from our web site at www.miduss.com as long as Maintenance access is valid.

The ServerSetup.exe contains all the files necessary to setup the server portion of MIDUSS.

ServerSetup.exe also includes the MIDUSS client software that a user runs to install the client components on their PC.

ServerSetup.exe does not include the video tutorials because this would make the file too large and unwieldy (about 450 MB). However, the tutorials are included on the CD in a folder \Tutorials\.

1. Insert the MIDUSS Network CD in your server's CD reader. Let's assume this is D: drive (your's may be different).
2. Navigate to the root of D:\ using the Windows file explorer.
3. Find the program named ServerSetup.exe. It is a large file of over 40MB.
4. Run this program and follow the usual Windows installer dialog.
5. We recommend you install MIDUSS Network server to C:\Program Files\MIDUSS
6. The files will be copied to the install folder.
7. Depending on your version of Windows you may be asked to reboot your server.
8. Next, you need to manually copy the MIDUSS tutorial files to your server.
9. Navigate to the C:\Program Files\MIDUSS folder and makes sure there is a folder named \Tutorials already present. It should be there.
10. Return to the MIDUSS CD media and navigate to the D:\Tutorials folder.
11. Copy all the files from the media in folder D:\Tutorials to your server in C:\Program Files\MIDUSS\Tutorials.
12. The file installation and copying of MIDUSS Network setup is now complete.
13. Start MIDUSS by running it from Start\Programs\MIDUSS.
14. The first screen you will see is the MIDUSS License screen. It will request that you enter a MIDUSS serial number in order for the program to be enabled. Do not enter a serial number for a single user version. The server serial numbers are different.

15. Enter the serial number found on your License Certificate or on the MIDUSS CD media case.
16. Press the [Save Serial #] button.
17. MIDUSS server has been setup successfully.
18. You are provided with an initial 90 days of free maintenance downloads. The MIDUSS.exe (the main executable) is constantly being updated. During the 90 day period you can download the updates from our web site at: <http://www.miduss.com/d-man>. You will be asked to enter your user name and password to gain entry to the latest downloads. Your user name is the name of the person who registered the program on our web site joined into a single string of not more than 15 upper and lower case characters without any space. Your password is the first eight characters of your Serial number but without the space. After 90 days your access will stop.
19. When the Serial Number has been saved successfully you will see that a Maintenance Serial Number box is now displayed. This is where you enter your Maintenance Serial Number which provides an additional 12 months of access to the latest MIDUSS updates.
20. You receive a Maintenance Serial Number when you purchase MIDUSS extended maintenance. Maintenance Serial Numbers can be purchased from our ShopMIDUSS web site at: <http://www.shopmiduss.com>. Once your credit card details have been approved you will receive an email that contains your unique Maintenance Serial Number.
21. Assuming you have purchased MIDUSS maintenance and have received a Maintenance Serial Number, simply enter it in the Maintenance Serial Number box and press the [Save Serial #] button.
22. MIDUSS will recognize the number and add one year to the number of days of maintenance you may already have in place. The Status screen will be updated to show the expiry date of your MIDUSS maintenance. Note: You automatically receive 90 days (3 months) free updates when you purchase and install MIDUSS. If you add a Maintenance Serial Number you will ADD to the existing 90 days (3 months) for a total of 15 months. The calculated expiry date at the top of the License Screen reflects this extended period.

MIDUSS client setup

Focus on a file named: ClientSetup.exe

This file is contained inside the ServerSetup.exe program which installs the server portion of MIDUSS Network.

ClientSetup.exe is located in the same folder on the server where MIDUSS Network was installed.

1. Navigate to the server location where MIDUSS Network was installed. Your Administrator will provide you with detailed information about the whereabouts of this computer. Your Administrator will also have provided you with Network access permissions.
2. Find a file named ClientSetup.exe and run it by double clicking. You do not need to download this file to your PC, but you can if you wish.
3. The installation will start and you will be prompted to name a location on your local PC. Normally this is C:\Program Files\MIDUSSNet. We recommend you use this location.
4. Follow the prompts to complete the installation.
5. Depending on the version of your Windows operating system, you may be asked to reboot your PC. Later versions, such as XP, do not require a reboot.
6. On the Start / Programs menu of the client PC you will find MIDUSSNet. The program you will run from there is MIDUSSnet.exe which has been setup by the MIDUSS client installation.
7. Run MIDUSSnet.exe
8. You will see a path location box which is empty the first time it is used. You need to tell MIDUSSnet where the main program file named MIDUSS.exe is located. It should be in the same location on the server where you ran the ClientSetup.exe file.
9. A label on the MIDUSSnet form provides assistance in browsing to the Server location. This information can be customized by the System Administrator. Navigate to the MIDUSS.exe file on the Server by clicking the Setup button.
10. The path in the box will be completed. Click [Open] on the File Open dialog box. The path will be saved on the Client machine. You will only have to do this path setup once, unless your Administrator changes the location at some point in the future.
11. Run MIDUSS by clicking the Run MIDUSS button.

Appendix C

Malaysian Customization

Malaysian Features in MIDUSS

This Appendix 'C' describes the customization features which have been added to MIDUSS to facilitate use of the program in accordance with the recommendations and guidelines in the Stormwater Design Manual introduced by the Department of Irrigation and Drainage (DID) in January 1, 2001.

Some of these features – such as the Design Rainfall - are applicable only to drainage engineers working in West (Peninsular) Malaysia. Other features have been developed primarily for the Malaysian scene but may be made available as MIDUSS design tools for general use.

Currently, the features described here are enabled only if the user has loaded a special package of files in the same folder or directory as the MIDUSS files. When the MIDUSS program is launched a check is made for the presence of these files and, if found to be present, the Disclaimer form contains a statement confirming that the Malaysian Customization has been enabled. The relevant section of the Disclaimer form is shown in Figure 1 below.

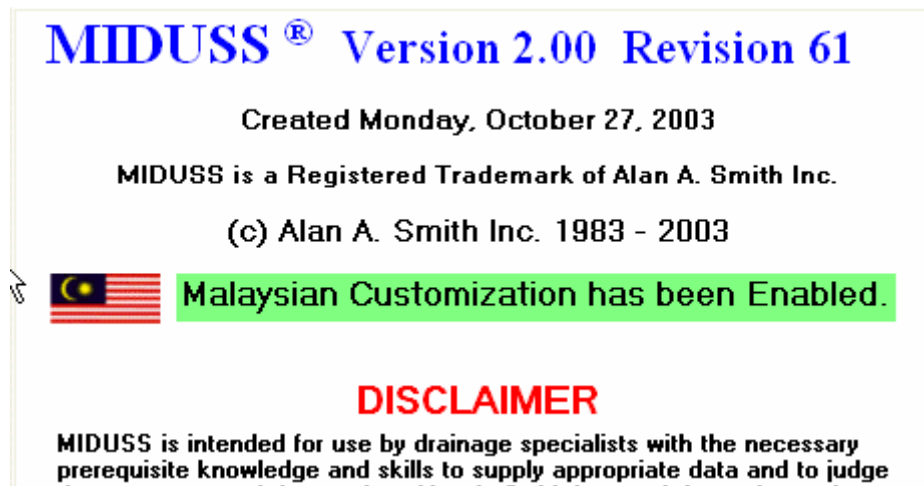


Figure 1 - MIDUSS checks for the presence of special Malaysian files.

The special pack of Malaysian files is distributed by DRE Consulting Sdn. Bhd.

The topics covered in this Help File are listed below.

- Design Rainfall
- Time of Concentration
- A Method for Rational Design

Design Rainfall

A design storm is a synthetic (i.e. artificial) rainfall event that is designed to have statistical properties that are consistent with observations of a large number of historical rainfall events. It is characterized by a number of parameters the most important of which are listed below.

- Average Return Interval (ARI) – a measure of the probability or frequency of occurrence.
- Storm duration
- Total depth of rainfall
- The distribution of rainfall intensity throughout the duration

The rainfall hyetograph which describes the design storm is a sequence of uniform rainfall intensities over a short interval of time Δt over a duration which is an integer multiple of Δt . It follows that a design storm cannot be defined until the time parameters have been defined. The tool for definition of a design rainfall using the guidelines of the DID Stormwater Design Manual is an additional Storms item called Storms (Malaysia) in the general Hydrology menu. Figure 2 below shows the Hydrology menu before and after the time parameters have been defined.



Figure 2 - The Hydrology menu after use of the Hydrology/Time Parameters command

The command Hydrology/Storms (Malaysia) is enabled once the time step and maximum storm duration have been defined. This is necessary because the Storms (Malaysia) command uses the Hydrology/Storms command to compute and display the storm hyetograph once the other parameter values have been selected. A step-by-step description of the command is given in the following topics.

- The Storms (Malaysia) Window
- Specify the Return Period (ARI)
- Define the storm duration
- Select the Geographical Location
- Compute the Total Rainfall Depth
- Copy the Depth and Duration to the Storm
- Displaying the Rainfall Event
- Special steps for Short Duration storms

The Storms (Malaysia) Command

Clicking on the Hydrology/Storms (Malaysia) menu causes the form in Figure 3 to be displayed.

IDF (Malaysia)

$$\ln(I_r) = A + B \ln(T_d) + C (\ln(T_d))^2 + D (\ln(T_d))^3$$

First select the Return Period or ARI in years with the Spin Button. If required, specify whether the Region is Western or Eastern.

Press F1 for more Help

Return period: 2 years
Duration: 30 minutes
Region: West East

A = 5.3255 B = .1806 C = -.1322 D = .0047

Compute Storm

Show Map

Storm
Depth: 45.840 mm
Intensity: 110.022 mm/hr

Copy

Close

Kuala Lumpur 2-yr 5.3255

Figure 3 - The Storms (Malaysia) Window

The Storms (Malaysia) window contains the following items of data for proper definition of the design storm. The order in which some of these items are entered can be important and several methods are provided to assist you in doing this easily. These are:

- Some of the command buttons are disabled (grayed out) until prerequisite data has been entered.
- A yellow text box displays a prompt to help you decide on the next step.
- The appropriate topic in this Help file can be displayed by pressing the 'F1' key at any stage.

In summary the various data required are as follows.

1. The Return Period (ARI) must be selected from a predetermined list of values taken from the DID manual. The initial default is 2 years.
2. The location of interest must be described as being in the West or East coast of the Peninsula. Initially the West coast button is selected.
3. The duration entered should be a multiple of the time-step defined in the Hydrology/Time Parameters command. An initial value of 30 minutes is used.
4. Four coefficients for the definition of the IDF curve must be selected from a pre-set list of 36 locations. The four coefficients A, B, C and D are shown in the equation at the top of the form.

This polynomial is taken from equation (13.2) in the DID manual. The initial or default values of these coefficients is for the 2-year event at Kuala Lumpur.

5. If the storm duration is less than 30 minutes some additional calculation is required which requires you to enter the 2-year, 24-hour rainfall depth for the selected location (see section 13.2.7 of the DID manual). To assist you, a map of isohyets can be displayed or hidden by means of the [Show Map] command button. Note that this calculation is sensitive to the West or East designation.

Specify the Return Period (ARI)

The first step is to specify the Average Return Interval (ARI) in years. Typically this will be a relatively frequent storm event such as a 2-year or 5-year storm for the design of the minor drainage system – i.e the storm sewer pipes in the ground. Alternatively, a more extreme event such as a 100-year storm may be required to test the reaction of the designed system to an extreme event.

The DID manual requires that the ARI be selected from a set of pre-defined return intervals 2, 5, 10, 20, 50 or 100 years.

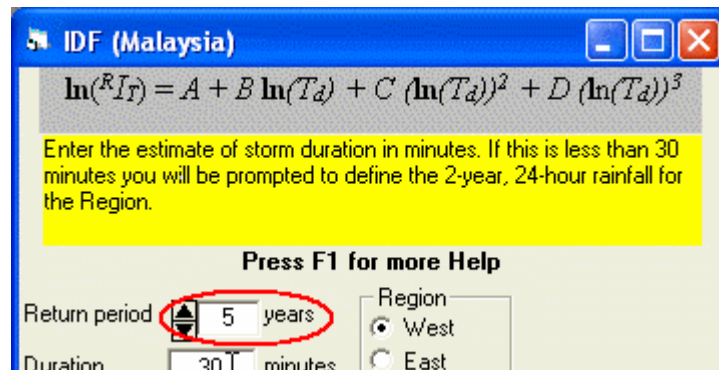


Figure 4 - The Return Interval is Specified by Clicking the Up/Down Arrows

An ARI of 5-years is shown selected in Figure 4. It is appropriate at this point also to specify if the location of interest is located on the East or West side of the peninsula. In the figure, the West side is selected.

The yellow prompt window suggests that the next step is to define the duration T_d of the storm.

Define the Storm Duration

Figure 5 below shows a value of 60 minutes has been entered. The prompt defines the next step as displaying the drop-down list of locations in order to obtain the appropriate coefficient values for the desired location and the specified return interval.

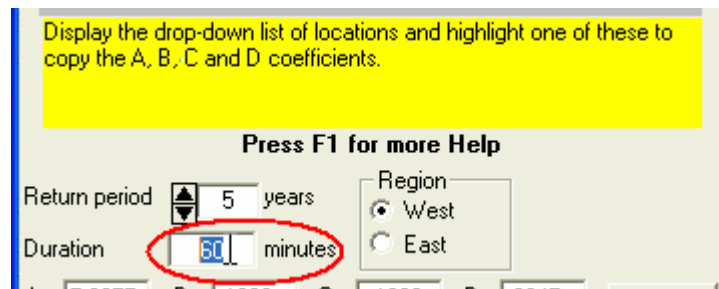


Figure 5 - The Storm Duration should be a Multiple of the Time Step

For the example illustrated, the duration of 60 minutes is sufficient to obtain the total depth of the storm. However, if the selected duration is less than 30 minutes further information must be provided. This is described in a later topic Special steps for Short Duration Storms.

Select the Geographical Location

When the Return Interval is specified, the drop-down list at the bottom of the window is changed to show the IDF coefficients for the specified ARI. For example, having selected an ARI of 5 years, the window of the drop-down list in Figure 6 shows “5-year IDF coefficients”.

Now by clicking on the down-arrow at the right hand end of the window, a scrolling list is displayed of all the geographic locations for which IDF-coefficients are defined. Only the A-coefficient can be seen but when a particular location is first highlighted and then clicked, the four coefficients are displayed in the text boxes for A, B, C and D. Figure 6 shows the list when the record for Bagan Serai in the state of Perak is highlighted but before it is clicked. Perak is, of course, on the West side of the peninsula. Select the West option button in the ‘Region’ frame.

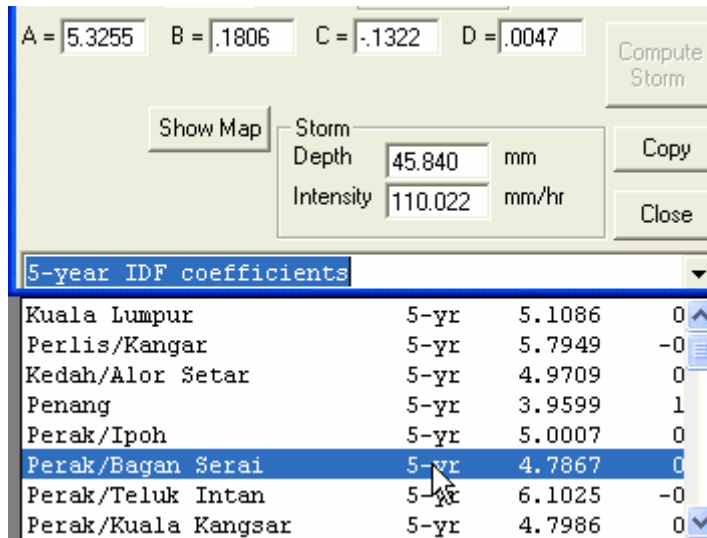


Figure 6 - Selecting the Location from the Drop-down List

After the highlighted record is clicked several changes occur.

- The drop down list is closed and the window shows the ARI and the four coefficient values
- The values are copied into the boxes for A, B, C and D.
- The command button [Compute Storm] is enabled

The relevant portion of the window is shown in Figure 7.

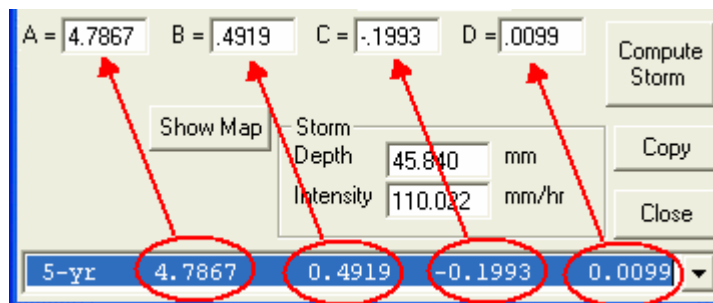


Figure 7 - The IDF Window after Clicking the Highlighted Location

The IDF coefficients for the 36 geographical locations are taken from Table 13.A1 of the DID manual. For some locations only a sub-set of the 6 ARI values are available. As more rainfall records become available the data may change or be augmented. These changes can be included by careful editing of the relevant files in the Malaysian pack distributed by DRE Consulting Sdn. Bhd.

Compute the Total Rainfall Depth

Although it is not shown in Figure 7, the yellow prompt box advises you to press the [Compute Storm] command button. The display is then as shown in Figure 8 below.

Click on the [Copy] button to open the Storm window. Select the suggested file (e.g. WMy5yr.mrd) and press [Display] in the Storm window to see the rainfall distribution.

Press F1 for more Help

Return period years Region West East

Duration minutes

A = B = C = D =

Show Map Storm Depth mm Intensity mm/hr

Perak/Bagan Serai 5-yr 4.7867

Figure 8 - The Total Rainfall Depth is Obtained by Pressing [Compute Storm]

The next step is to convert the computed storm depth to a rainfall hyetograph with the correct distribution of intensities over the specified duration. The yellow prompt advises you to do this by pressing the [Copy] command button.

All of the data values entered are used as the new default data values. This means that if the Storms (Malaysia) is used a second time the values entered will be preserved.

Copy the Depth and Duration to the Storm Command

After the total rainfall depth has been computed, pressing the [Copy] command button causes a number of things to happen. These are illustrated in Figure 9 below.

- The Storm command is invoked and the Storm window is displayed with the 'Mass Curve' tab active.
- The total storm depth and duration are copied from the Storms (Malaysia) window to the appropriate text boxes in the Storm window.
- In the Storms (Malaysia) window you are advised to use a particular Mass Rainfall Distribution file (e.g. WMy060min.mrd) to define the 'shape' of the storm or the distribution of intensity.

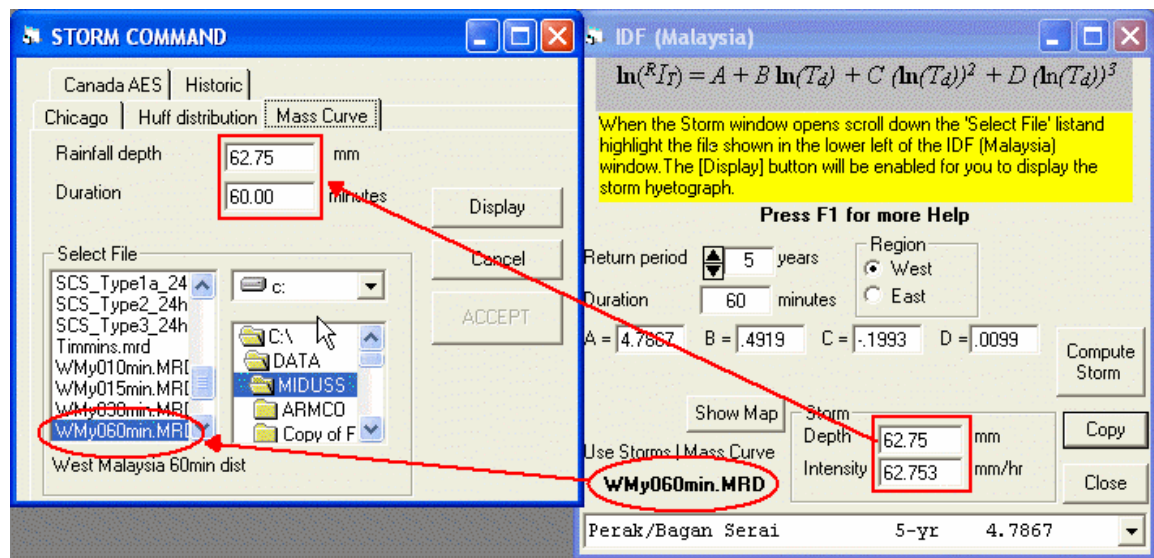


Figure 9 - Clicking [Copy] opens the Storm Window

The recommended MRD file is selected and highlighted automatically in the list of *.MRD files in the Storm window. As shown in Figure 9, when a distribution file is highlighted, the [Display] command button on the Storm window is enabled.

The Mass Rainfall Distribution files are constructed from the information contained in Tables 13.B1 and 13.B2 of the DID manual which relate to West Coast and East Coast locations respectively. It should be noted that the MRD files for the East coast can be used for Sabah and Sarawak until more information is available.

Displaying the Rainfall Event

When the [Display] command button on the Storm window is clicked three things happen.

1. A graphical display of the rainfall hyetograph is opened in the upper-right corner of the screen.
2. A tabular display of the hyetograph intensities is opened in the lower left corner of the screen.
3. The [Accept] button in the Storm window is enabled.

The upper portion of the screen is illustrated in Figure 10 below.

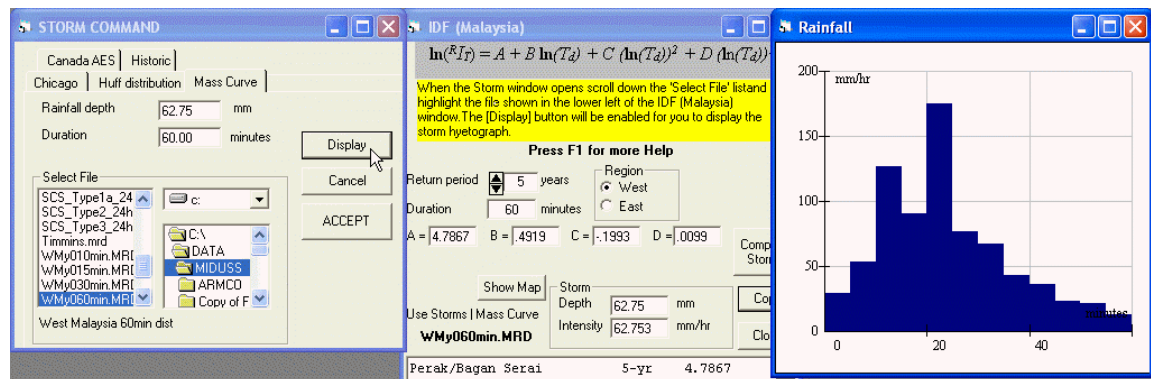


Figure 10 - Clicking the [Display] Command Adds a Graphical Plot of the Storm

The two additional windows are the standard display of results for the Storm command and more information on these windows can be found in the MIDUSS Help file.

If the design storm appears to be satisfactory you should press the [Accept] command button on the Storm window. All four of the open windows are closed. Note that the Output file will contain information on the total depth, duration and the MRD file used so that in Automatic mode the rainfall hyetograph can be reproduced. If the MRD file used is one of the Malaysian distributions, an additional record is written to the output file containing the ARI of the storm and the string describing the location and the four IDF coefficients A, B, C and D selected from the drop down list.

If this file is used to run MIDUSS in Automatic mode the information contained in the extra record is used to set the defaults in the Storms (Malaysia) window should it be re-used.

To document the design storm you may want to use the Tools/Add Comment command to record other data or information used to obtain the total rainfall depth.

Special steps for Short Duration storms

The IDF coefficients developed for the different locations in Malaysia are intended for storms with a duration of not less than 30 minutes. Section 13.2.7 of the DID manual describes a method of extrapolating the IDF curves to allow for a storm duration between 5 and 30 minutes. The method requires the user to specify the 2-year, 24-hour rainfall for the location and also depends on whether the location is East or West.

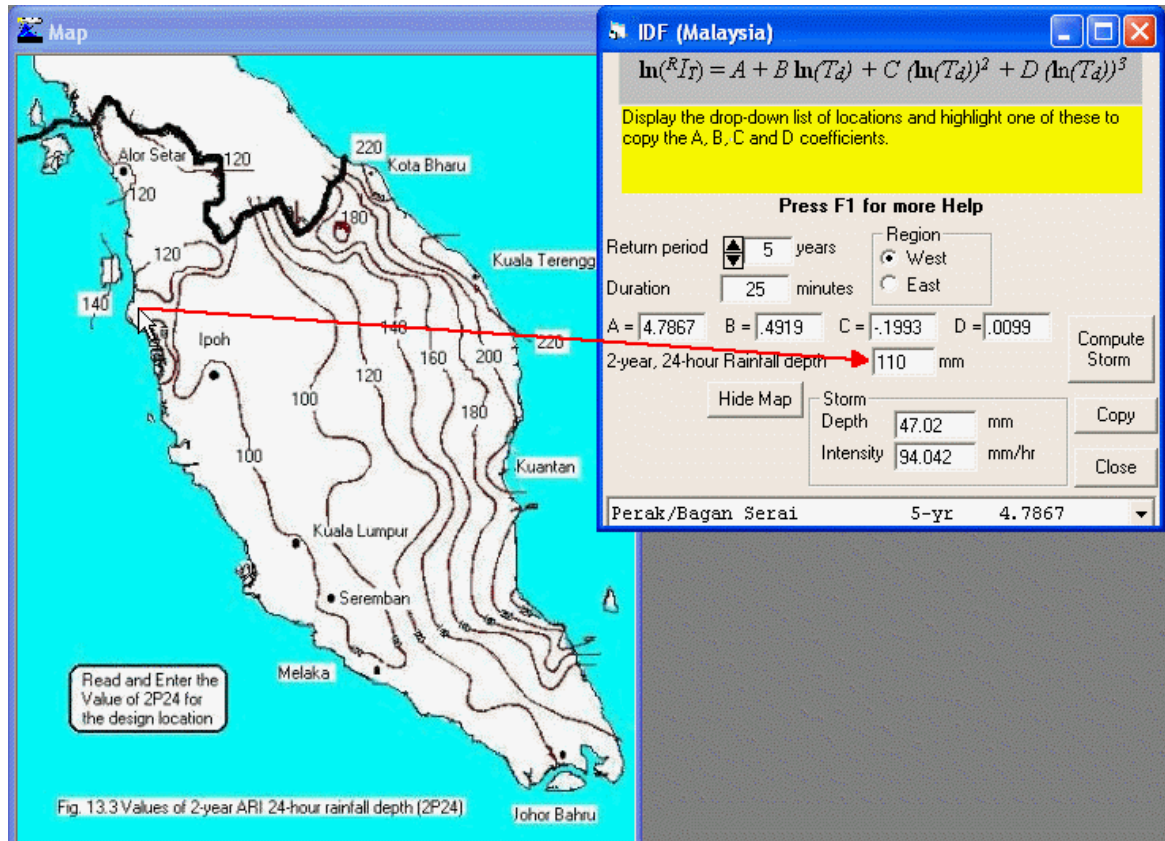


Figure 11 - Extra data is required for a Duration less than 30 minutes

Figure 11 shows the Storms (Malaysia) window when a duration of only 25 minutes has been entered. The yellow prompt box advises you that the 2-year, 24-hour rainfall depth must be supplied and a text box is opened for this purpose.

For your convenience, a map of isohyets can be displayed by clicking on the command button [Show Map]. The command button label changes to [Hide Map] when the map is displayed. A small-scale illustration of the map is displayed on the left. Once the 2-year, 24-hour depth has been entered the command button [Compute Storm] is enabled and the procedure reverts to that described in the topic Compute the Total Rainfall Depth.

The Time of Concentration Tool

Time of Concentration

Overland Flow

Friend's eq.

Kinematic Wave eq.

$$t_c = k \left(\frac{Ln}{\sqrt{S}} \right)^{0.6} i^{-0.4}$$

Overland sheet flow length: 55 metre

Slope of surface: 1.000 %

Manning's 'n' of surface: 0.250

Effective rainfall intensity: 100 mm/hr

Overland time of concentration: 21.3 minutes

Kerb Gutter Flow Time

Kerb Gutter flow length: 0.0 metre

Longitudinal Gutter slope: 1.000 %

Kerb Gutter flow time: 0.0 minutes

Conduit Travel Time

Pipe Length: 0.00 metre

Pipe Gradient: 1.000 %

Pipe Manning 'n': 0.013

Pipe Channel

Pipe Diameter: 0.500 metre

Pipe Travel Time: 0.0 minutes

Total Time of Concentration: 21.25 minutes

Figure 12 The Time of Concentration Tool

With few exceptions, peak runoff will occur when the entire catchment area is contributing to the outflow. Thus the storm duration should be long enough for the runoff from the most remote area – in terms of time of travel – to reach the outflow point. This is commonly referred to as the Time of Concentration T_c

The estimate of time of concentration is discussed thoroughly in Chapter 14, Section 14.4 in the DID manual. T_c is usually equal to the overland flow time and the time of travel in pipes, gutters, channels and other elements of the drainage network. A more detailed list of components is shown in Table 14.1 of the DID manual.

Most of the equations for estimating overland flow time and travel time are empirical and a wide range of methods are described in the literature. The MIDUSS tool offers a choice between the Friend eq. which is advocated in the DID manual and the Kinematic eq. that is used in MIDUSS.

The tool can be used to estimate travel time for three components in the drainage network. Each is described briefly in the topics listed below.

- Overland or 'sheet' flow
- Flow in gutters
- Flow in pipes and channels

Overland or 'sheet' flow

You will find that the Friend and Kinematic equations give significantly different answers for the same values of Overland flow length L , Manning roughness n and slope S . If you decide to use the Friend eq. you should try to satisfy yourself that the answers seem appropriate for the high rainfall intensities experienced in Malaysia. It is possible that the equation was based on data obtained during less extreme events than are common in Malaysia.

The Kinematic equation gives shorter times and also shows the effect of response being dependant on the magnitude of the inflow (i.e. rainfall intensity).

Both equations use Manning's n as a measure of surface roughness. Typical values for different types of surface are listed in the Table below.

For the Kinematic eq. you will need to provide an estimate of the effective rainfall intensity. This should be an average value (over time) and will frequently be significantly less than the average rainfall intensity obtained from the Hydrology/Storms (Malaysia) command.

Suggested values of Manning Roughness for Overland Flow

(adapted from the DID manual)

Surface	Suggested Manning 'n'		
	Minimum	Average	Maximum
Paved surfaces	0.010	0.011	0.013
Sand, no vegetation	0.010	0.010	0.060
Clay-loam, no vegetation	0.012	0.020	0.033
Gravel	0.012	0.020	0.030
Short grass	0.10	0.15	0.20
Light turf		0.20	
Lawns	0.20	0.25	0.30
Dense turf		0.35	
Pasture	0.30	0.35	0.40
Dense shrubbery, forest litter		0.40	

Flow in gutters

The time of travel in gutters and along road-side kerbs is likely to be very short compared to the total time of concentration due to the fact that lengths are likely to be less than the distance between catch basins and the gradients are of the order of 0.5% to 1% or steeper.

The equation is taken from the DID manual and uses only the length and slope. You can use the Channel option to obtain an estimate for different roughness values to allow for accumulated debris. If the cross-fall of the road profile is (say) 1V:25H you can approximate the two gutters as a symmetrical triangle with side-slopes of 1V:25H.

Flow in pipes and channels

Travel time in pipes and channels is given by dividing length by velocity in which velocity is given by the Manning equation.

The Time of Concentration has two Option buttons for you to choose between Pipes and Channels. The data entry for pipes is displayed by default and is shown in Figure 13 . Clicking the Channel Option button causes the lower part of the window to change as shown in Figure 14 below.

Time of Concentration

Overland Flow

Friend's eq.
 Kinematic Wave eq.

$$t_c = k \left(\frac{Ln}{\sqrt{S}} \right)^{0.6} i^{-0.4}$$

Overland sheet flow length: 55 metre
Slope of surface: 1.000 %
Manning's 'n' of surface: 0.250
Effective rainfall intensity: 100 mm/hr
Overland time of concentration: 21.3 minutes

Kerb Gutter Flow Time

Kerb Gutter flow length: 0.0 metre
Longitudinal Gutter slope: 1.000 %
Kerb Gutter flow time: 0.0 minutes

Conduit Travel Time

Pipe Length: 0.00 metre
Pipe Gradient: 1.000 %
Pipe Manning 'n': 0.013
 Pipe Channel
Pipe Diameter: 0.500 metre
Pipe Travel Time: 0.0 minutes

Total Time of Concentration: 21.25 minutes

Figure 13 – The Time of Concentration form configured for Pipes as Conduits

Conduit Travel Time

Channel Length: 100 metre

Channel Gradient: 0.5 %

Channel Manning 'n': 0.025

Pipe Channel

Channel Depth: 0.500 metre

Channel base width: 0.00 metre

Channel Side slope: 3.000 H:1 V

Channel Travel Time: 1.54 minutes

Total Time of Concentration: 1.54 minutes

Figure 14 -The Conduit Travel Time frame Configured for Channels

Both pipes and channels require entry of Length, Gradient and roughness as Manning's n coefficient. Below the Option buttons, pipes require only diameter whereas channels are assumed to have a symmetrical, trapezoidal cross-section that is defined by depth, base-width and side-slope.

In estimating velocity, both pipes and channels are assumed to be flowing full. If pipes are flowing part full you may allow some adjustment but recall that average pipe velocity is the same for $y/D = 0.5$ and 1.0 .

In use, the travel time is re-computed for each change in the entered data. To allow for zero values the following minimum values are assumed.

	Pipes	Channels
Depth or diameter	0.2 m (0.66 ft)	0.2 m (0.66 ft)
Gradient	0.01 %	0.01 %
Manning 'n'	0.009	0.01
Area	n/a	0.02 x Depth

Typical values for Manning's n in Pipes and Channels are shown in the following tables.

Typical values of Manning's 'n' for pipes

Description	"n"
Metal pipe - spun concrete lining	0.007
Wrought iron	0.008
Smooth pre-cast well jointed concrete	0.009
Uncoated cast iron; well-aligned glazed vitrified clay	0.01
Spun concrete	0.011
Monolithic concrete; rough pre-cast concrete; butt-jointed drain tile; slimed sewers	0.013
Pre-cast pipes with mortar squeeze at joints; well pointed brickwork	0.015
Old brickwork; foul sewers with grease, lime encrusted or sludge	0.019

Typical values of Manning's 'n' for channels

Description	"n"
Concrete lined, screeded and smoothed	0.014
Gunit concrete, not smoothed with sandy deposits	0.018
Irrigation canal in hard-packed smooth sand	0.020
Canal excavated in silty clay	0.024
Channel with cobble stone bottom	0.028
Natural channel with fairly regular cross-section	0.035
Natural channel, irregular section, grass slopes	0.040
Dredged channel, irregular side slopes, grass and weeds	0.050
Irregular channel with dense growth, little foliage	0.080
Irregular channel with dense growth, with much foliage and vegetation	0.110

A Method for Rational Design

Chapter 14 of the DID Stormwater Design Manual describes two main methods of flow estimation:

The **Rational Method** (Section 14.5) is based on the following assumptions.

- The rainfall is uniformly distributed in time and space
- The runoff is maximized when the entire catchment area is contributing
- Since average intensity decreases as storm duration increases, maximum runoff usually occurs when the storm duration is equal to the time of concentration of the catchment area.

Major disadvantages of the Rational Method are that only peak flow is predicted (not a runoff hydrograph), the rectangular storm hyetograph is unrealistic and the runoff coefficient is a poor predictor of rainfall losses.

The **Hydrograph Method** (Section 14.5) uses a more realistic design storm, can employ different methods to estimate rainfall losses and yields a runoff hydrograph from which both peak flow and volume are obtained and which can be routed through conduits and storage facilities.

One disadvantage of the hydrograph method is that the duration of the design rainfall should be approximately equal to the time of concentration of the entire drainage area. Therefore, for a specified ARI, the method may underestimate the peak flow at upstream locations where the time of concentration is short.

This Section describes a method of runoff estimation that is a compromise between the Rational Method and the Hydrograph method. MIDUSS uses hydrograph methods all of which start by defining a design storm of specified intensity and duration. Initially the storm can have a short duration (with high intensity) to design the drainage elements in the upstream reaches. Then, as the design proceeds in a downstream direction, the time of concentration increases and the storm can be redefined with longer duration and reduced intensity. However, once the storm has been lengthened, the flow estimation must be re-started from the furthest upstream point using the same design decisions for the upstream conduits as were made for the initial, shorter storm.

The situation is illustrated schematically in Figure 15 below.

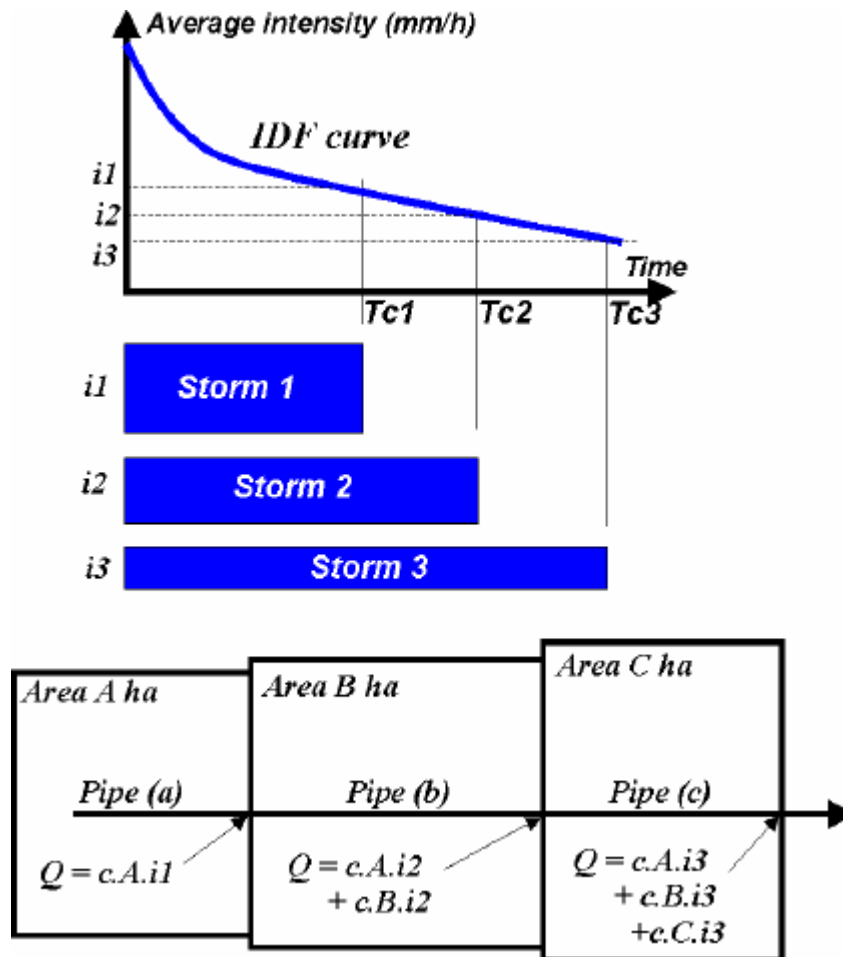


Figure 15 Schematic of Design Using Multiple Storms

The times T_{c1} , T_{c2} and T_{c3} represent the times of concentration at the outflow points from areas **A**, **B** and **C** respectively. To design Pipe (a) a storm with duration T_{c1} is used which has an average intensity i_1 . Pipe (a) must therefore be designed for a runoff resulting from intensity i_1 over area **A**.

To continue downstream a storm with duration T_{c2} must be used. From the IDF curve it is clear that the average intensity i_2 is less than i_1 . Pipe (b) must therefore be designed for a flow resulting from intensity i_2 on the total area (**A+B**). Carrying the design further downstream, the last conduit Pipe (c) must be able to convey a flow rate produced by intensity i_3 acting on the total area (**A+B+C**).

The Repeat from Start command allows this type of repetitive design to be carried out without laborious re-entry of the rainfall-runoff and design decisions. The following topics describe the method in more detail.

- The Repeat from Start Command
- A Warning Message Summarizes the Steps
- Saving a Copy of the Output File
- The Qpeaks.txt file is Deleted Before being Updated
- Preparing to Run in Automatic Mode

The Repeat from Start Command

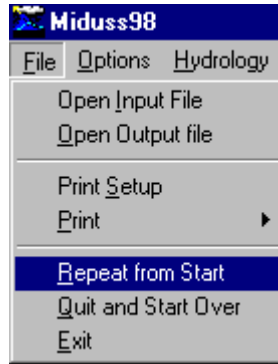


Figure 16 The Repeat from Start command is in the File menu

As shown in Figure 16 above, the Repeat from Start command is available in the File menu as long as the Malaysian Customization features have been enabled. Normally, this command will be invoked after one or more upstream catchment areas have been analyzed and the resulting runoff has been routed down the drainage network to a point where the Time of Concentration is now greater than the duration of the current design storm.

This initial stage will allow design or sizing of drainage elements that must convey the runoff resulting from short, intense storms.

The Repeat from Start command will allow you to redefine a storm with a longer duration with a reduced average intensity. However, once a new storm is defined, you cannot simply continue from this point in the drainage network as it would result in runoff hydrographs being combined which have been generated from different storm events.

Instead, once the storm is changed, the rainfall-runoff modelling must be repeated from the furthest upstream point. The runoff will be slightly reduced but no change should be made to the design decision (e.g. pipe diameters) made in the initial stage.

The Repeat from Start command carries out all of the necessary steps automatically with the exception of defining the parameters of the modified storm.

A Warning Message Summarizes the Steps

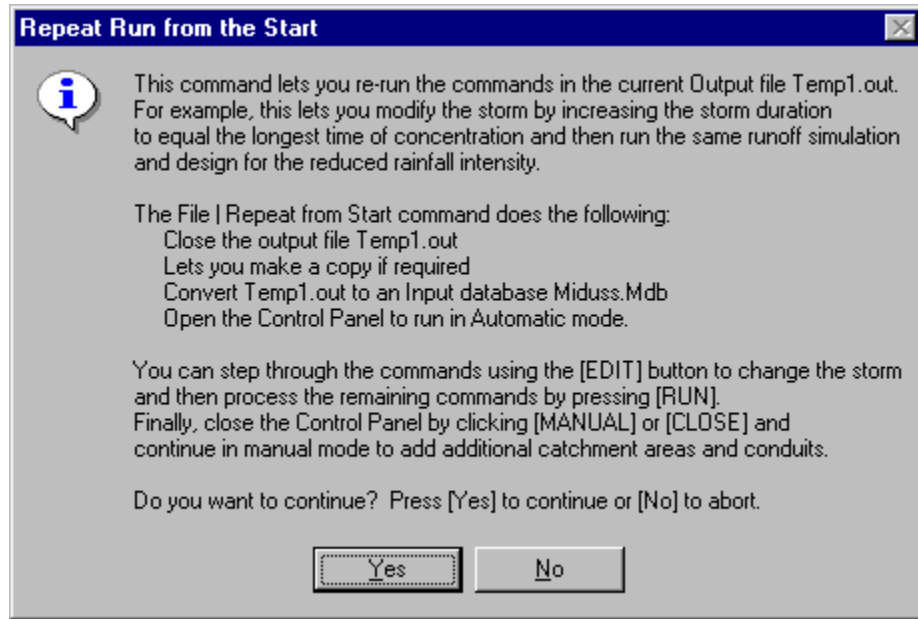


Figure 17 A Warning Message Summarizes the Steps

The warning message summarizes the various steps that will be carried out and gives you the opportunity to either continue or abort the process. The steps to be carried out are summarized below.

1. The current output file must be closed but you can save a copy of the file with a different filename extension for reference.
2. After closing the current output file, it is re-opened as an input file and an Input Database Miduss.Mdb is created. No action is required by you but you will see briefly the progress window as the database is generated.
3. The file containing the table of peak flows (Qpeaks.txt) must be closed because these flow values will be regenerated for the modified storm. A message is displayed for information only.
4. A message is displayed advising you that MIDUSS will now run in Automatic mode and suggesting that you use the [EDIT] button to advance to the Storm command and after modifying the storm you can press the [RUN] button to process the remainder of the input database. This message is also for information only.
5. The Control Panel is opened with the new database loaded ready for a run in Automatic mode.

If you press the [Yes] button the above process will start. You can abandon the process by clicking on the [No] button.

Saving a Copy of the Output File

Before closing the Output file you will see the warning shown in Figure 18 below. If you press [No] the current Output file will be overwritten with the results for the new storm. If you want to keep a record of the design decisions for the first storm (e.g. to recall how full a pipe design was flowing) you should click [Yes] to keep a copy of the Output file with a slightly different name.

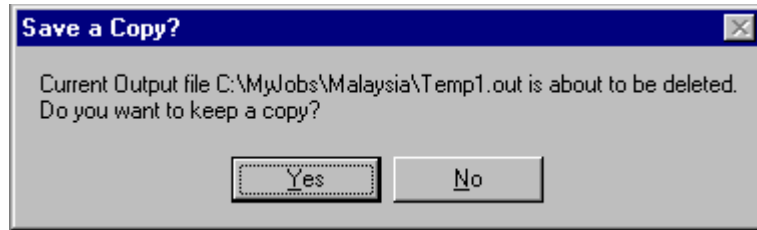


Figure 18 You can Save a Copy of the Output File

For record purposes, the filename for the copy should be unchanged but the extension can be modified. MIDUSS suggests a simple change by adding a letter 'A', 'B', etc. to the existing extension. The suggested name change is displayed as shown in Figure 19 below.

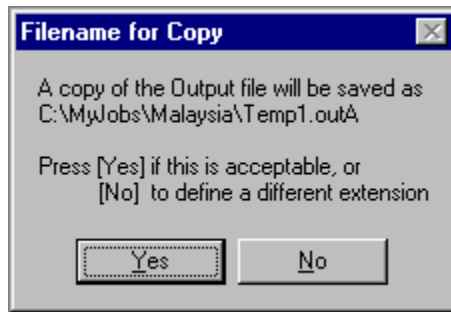


Figure 19 MIDUSS Suggests a Modified Extension for the Copy File

Should you prefer to use some other naming procedure you should click [No] in the above message. The data entry window shown in Figure 20 is opened and you can enter an extension of your choice. Any reasonable filename extension can be entered.

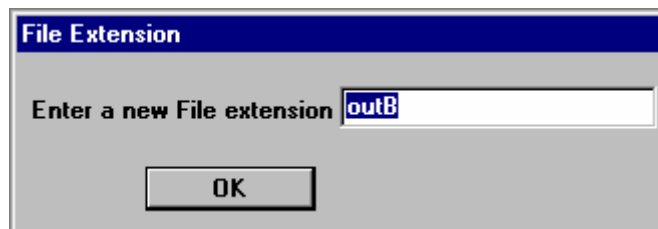


Figure 20 You Can Change the File Extension for the Copy File

The Qpeaks.txt File is Deleted Before being Updated

As shown in Figure 21 below, the file Qpeaks.txt is deleted. It will be re-generated when running in Automatic mode with the modified storm. All of the information in the file is contained in the copy of the Output file. Should you wish to keep a copy of the Qpeaks.txt file you can use the Show / Qpeaks file command and from Notepad save the file by another name.

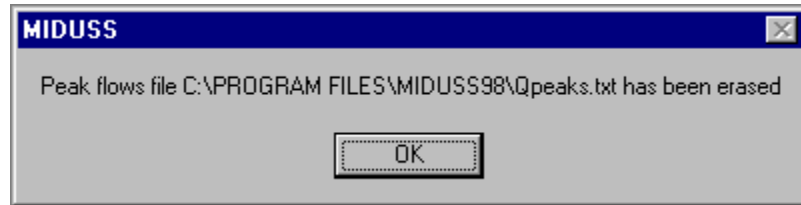


Figure 21 A Warning that the Qpeaks File will be Deleted

Preparing to Run in Automatic Mode

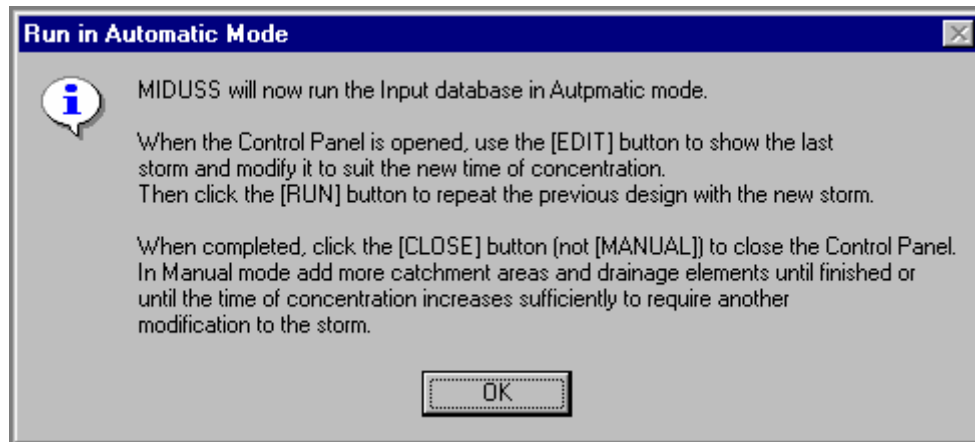


Figure 22 Some Advice is Offered Before Running in Automatic Mode

Before loading the Miduss.Mdb to run in Automatic mode, MIDUSS displays the message shown above in Figure 22.

Typically, the first two commands in the Input database are the Time Parameters command and the Storm command. Since you are using the Repeat from Start command to repeat the run with a modified design storm, it is necessary to advance to the Storm command by clicking the [EDIT] button. When the Storm window is displayed you can then obtain the parameters for a design storm with a longer duration.

If you use the Malaysian Storm tool you must enter the same Return Interval or ARI and use the IDF coefficients for the same location. Only the duration should be changed – typically by increasing it by 5 minutes. Pressing the [Compute Storm] button and then the [Copy] button will update these values in the Storm window.

You must also select the appropriate Mass Rainfall Distribution (MRD) file and click [Display] button to update the distribution. If the duration has been increased from (say) 35 to 40 minutes the MRD file will be the same as previously. However, the graph of the storm hyetograph will change slightly since the distribution pattern or storm shape is being imposed on a different duration.

After the new storm has been accepted, you can process the rest of the Input database automatically by clicking the [RUN] button. When finished, the Control Panel will be as shown below in Figure 23. It is good practice to close the Control Panel by clicking the [CLOSE] button.

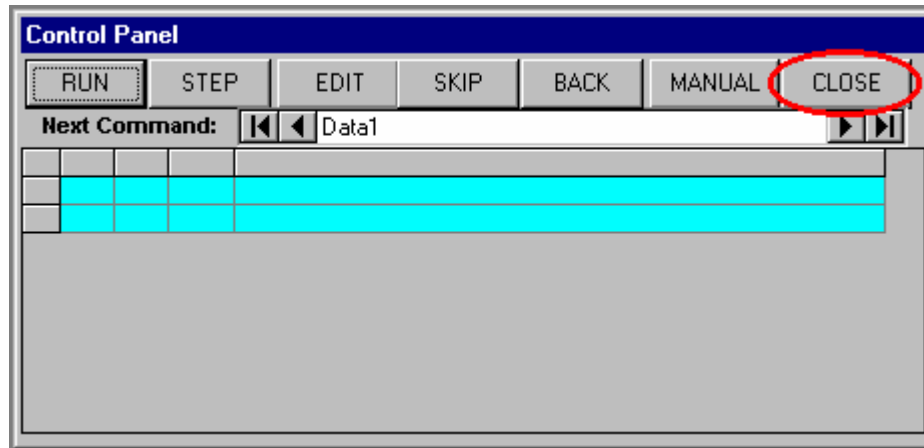


Figure 23 Close the Control Panel by clicking the [CLOSE] Button

You can now continue in Manual mode to add additional catchment areas and other elements of the drainage network until the time of concentration is once again increased sufficiently to require another increase in the storm duration.

One caution is necessary. If you are designing two very long branches of a drainage network which meet at a junction it is important (and logical) that the longest storm duration on each branch should be the same. It is desirable therefore to start with the branch that has the shortest time of concentration to the junction node.

Appendix D

New in MIDUSS Version 2

Introduction

This appendix contains descriptions of new features in Version 2 and commands which have been modified or augmented in some significant way. This section lists the commands in the Main Menu. Menu items shown as **bold double underlined** are new features and those **bolded underlined** indicate commands which have been augmented or modified..

File

Open Input File	
Open Output File	
<u>Save Session</u>	Save an image of all data and files for the current session
<u>Load Session</u>	Re-load data and files for a previous session
<u>Save file</u>	Commands to save rainfall and hydrograph files.
<u>Load file</u>	Commands to read in rainfall and hydrograph files. These two commands are an alternative to using the File Input-Output command in the Hydrograph menu.
Print Setup	
Print	
<u>Repeat from Start</u>	Repeat the session from the start. Typically this is used to allow the storm to be changed to correspond to the increase in the time of concentration.
Exit	

Edit

<u>Cut</u>	Delete highlighted data and place on the Clipboard
<u>Copy</u>	Copy highlighted data and place on the Clipboard
<u>Paste</u>	Copy data from the Clipboard to a text box or grid
<u>Options</u>	A new option lets you turn on or off an automatic check for a new update file. In addition, two options are provided that relate to the new Layout feature.

Hydrology

Time Parameters	
Storm	
<u>Catchment</u>	A Catchment description can be added.
<u>IUH Hydrograph</u>	A new option IUH Hydrograph lets you generate a Runoff hydrograph based on a pre-defined Instantaneous Unit Hydrograph
Lag and Route	
Baseflow	
<u>Runoff Area Totals</u>	Keep a running totals of catchment areas defined

Hydrograph

Undo	
Start New Tributary	
Edit Inflow	
Add Runoff	
Next Link	
Combine	
Confluence	
Copy Inflow to Outflow	
Refresh Junction Files	
<u>Move Outflow to Test hydrograph</u>	Fill the Test hydrograph with the current Outflow
<u>Edit Test hydrograph</u>	Edit the Test hydrograph

Design

Pipe	Relative depth (y/D) is reported
<u>Channel</u>	Variable roughness added; cross-section data can be saved in a file and subsequently reloaded.
<u>Culvert</u>	Design culverts of various shape and control conditions. Inflow can be either a user-defined constant flow or an inflow hydrograph. In the latter case the hydrograph can be routed through the upstream storage created by the culvert embankment and the design can be modified to suit the attenuated peak outflow rate.
<u>Cascade</u>	Design an underground storage facility comprising two elements in series. The cross-section can be rectangular, circular, elliptical or pipe arch
Route	
<u>Pond</u>	Extra Outflow Controls for an outlet pipe and a horizontal orifice have been added. A tool to compute the equivalent aspect ratio for irregular shapes is available
Diversion	
<u>Trench</u>	Outflow controls now include an outflow pipe.

Show

Output File	
<u>Layout</u>	Draws a layout of the current drainage network that can be modified by the user.
Design Log	
Flow Peaks	
Restore Peak Flows table	
Tabulate	
<u>Quick Graph</u>	Multiple hydrographs can be superimposed on a single plot
Graph Styles	
Graph	

Automatic

Create Miduss.Mdb Database
Edit Miduss.Mdb Database
Run Miduss.Mdb Database
Enable Control Panel buttons

Tools

Add Comment	
Calculator	
Notepad	
WordPad	
<u>IDF Curve Fit</u>	Compute Chicago Storm parameters from rainfall data
<u>Time of Concentration</u>	Find time of concentration
<u>Roughness Height</u>	Convert Manning 'n' to roughness height and <i>vice versa</i>

Window

Cascade
Tile
Arrange Icons
Status Bar

Help

Contents

Reference
Tutorial
New in v2
Using Help
Tutorials

Comprehensive help for all of MIDUSS
Tutorial Help file
This document

Tutorial files have been revised and re-formatted as self playing *.EXE files. New lessons have been added to describe new features in version 2

About
Edit About
Check for Update

Edit the information filed in the About window
Connects to our web site to determine if an update is available.

Get Update

Opens your internet browser to the MIDUSS download site.

General

Some command windows can be resized while maintaining the scale of the data displayed within the window. This may assist users with limited screen resolution.

Compatibility with MIDUSS 98

Version 2 of MIDUSS can co-exist with MIDUSS 98 on the same hard disk. Version 2 uses Serial numbers to enable different modes. These are entered in the initial Status form, as shown in Figure D-1 below.

The Crypkey copy protection system is no longer used but may still be implemented in some special customized versions of MIDUSS.

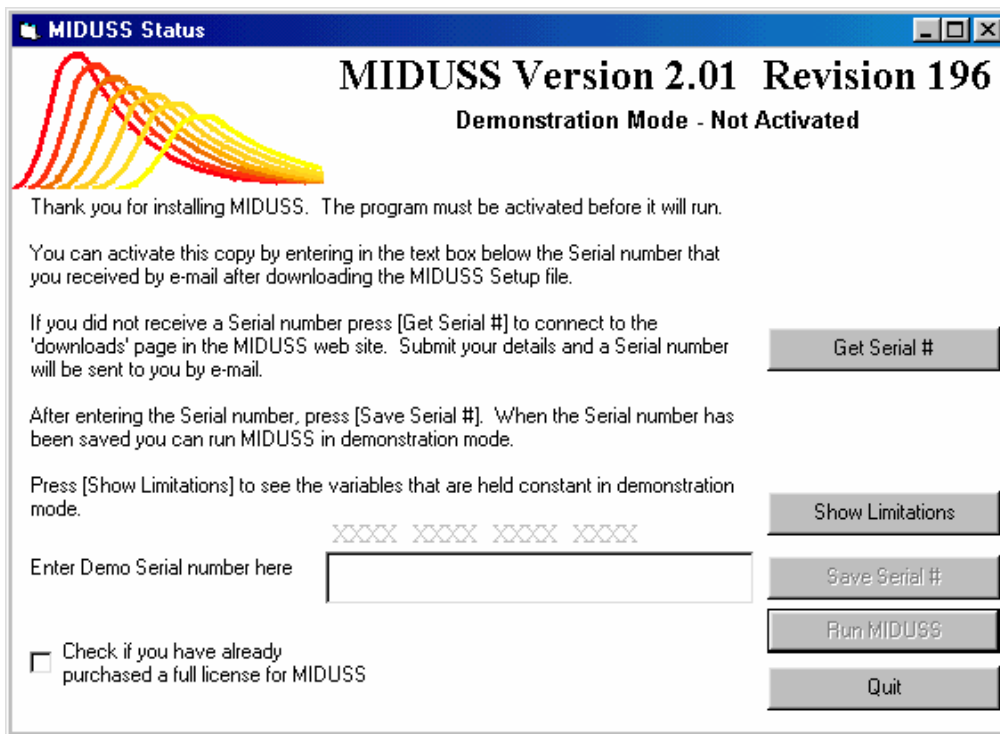


Figure D-1 – MIDUSS installed and waiting for a serial number to activate.

File and Edit

File Commands in version 2

Several new commands have been added to the File Menu as shown in the figure below. These are briefly as follows.

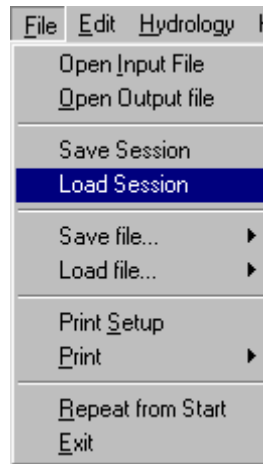


Figure D-2 – The File menu

Save Session: Saves the current state of all variables and arrays of data in a binary file. This is given the same name as the currently defined Output file but with the extension *.BIN. The command is initially disabled but is enabled once any significant data is entered. Save Session must be used just before Exiting from MIDUSS.

Load Session: Restores the value of all variables and data arrays from a specified binary file. Any data entered manually before this point will be overwritten. For this reason Load Session is usually used at the start of a design session immediately after selecting the units.

Save file: Saves a file containing a storm or effective rainfall hyetograph or any of a number of flow hydrographs.

Load file: Reads a file and loads a data array defining a rainfall hyetograph or flow hydrograph.

Repeat from Start:: This new command is intended to let you change the storm at some point in a design session and then repeat the entire design with this new storm up to the point

Repeat from Start command makes use of the Automatic mode and carries out the following steps.

1. Offers you a chance to keep a copy of the Output file
2. Closes the Output file and re-opens it in for reading.
3. Defines a new Output file.
4. Creates an Input database file Miduss.Mdb from the old output.

5. Opens the Control Panel to run in Automatic mode and prompts you to use the [EDIT] button to alter the storm and then the [RUN] button to process the rest of the input database.
6. Lets you continue the design in Manual mode.

Edit Commands

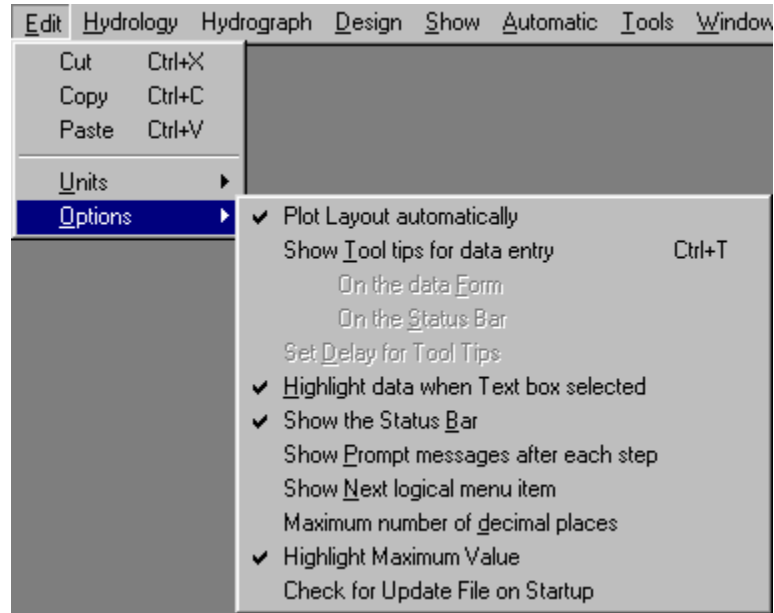


Figure D-3 The Options menu

The Edit Menu has been re-designed to replace what was previously called the Options menu. It now shows the standard Windows options to Cut, Copy or Paste a selection to or from the Clipboard object.

The Options available are similar to those in version 1 with an additional option to check for an available update file automatically each time MIDUSS is started.

The Cut, Copy and Paste commands let you use the Clipboard to transfer data between MIDUSS and any other Windows application that supports the use of the Clipboard in this way. Programs such as Microsoft Excel can be used to prepare data for use in MIDUSS by copying data from the spreadsheet to a data grid. Where possible, MIDUSS will adjust the incoming data to match the format of the MIDUSS data input grid.

The Edit commands Cut, Copy and Paste can be called using the normal Windows shortcut keystrokes, i.e.

- | | | |
|------------|------------|---|
| Edit Cut | Ctrl + 'X' | Copy selected text to Clipboard and delete source |
| Edit Copy | Ctrl + 'C' | Copy selected text to Clipboard; source unchanged |
| Edit Paste | Ctrl + 'V' | Copy Clipboard text to destination cell. |

If the Clipboard contains multiple cells the Paste operation checks to ensure that there is enough space available at the destination and then copies the text to the right and below the target cell.

In certain Design commands (e.g. Pond, Trench) the Main Menu is not visible when the Design window has the focus (i.e. has a highlighted title bar). The specialist menu in these commands has been modified to show the three Edit options for local use. The shortcut commands can also be used when the Main Menu is not visible.

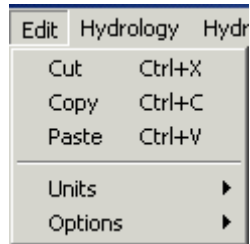


Figure D-4 – The Modified Pond Menu

Hydrology Commands

Changes have been made as follows:

- | | |
|--------------------|--|
| Catchment Command | A description of the catchment can be added in addition to ID number. An option box under the Catchment Tab lets you include a test hydrograph in the graphical display. This can be used for calibration or comparison. |
| IUH Hydrograph | A runoff hydrograph can be created using a pre-defined Instantaneous Unit Hydrograph with a user defined peak discharge, time to peak or duration. |
| Runoff Area Totals | An option in the Files menu causes the total area and impervious area to be accumulated either for the total design session or for a particular tributary area |
| Test Hydrograph | Several commands that display a computed hydrograph have a check box added which causes the current Test hydrograph to be added to the graphical display. A compatible observed hydrograph can be defined at any point during the session by importing a file or by editing the Test hydrograph. |

The Catchment Command

The screenshot shows a software dialog box titled "CATCHMENT COMMAND". It has a "Catchment" tab selected, with a sub-tab "Pervious Impervious". The "Description" field contains "type a description...". The "ID number" is 101, "% Impervious" is 30.00, "Total Area" is 10 hectares, "Flow length" is 45 metres, and "Overland Slope" is 2%. The "Show Test hyd" checkbox is unchecked. Under "Routing method", "Triangular SCS" is selected. Under "Pervious and impervious flow length", "Equal length" is selected. Buttons for "Display", "Cancel", "Show details", and "ACCEPT" are on the right.

Figure D-5 – The Catchment Command

Two new features have been added to the Catchment tab in the Catchment window. They are:

- Description** This text entry box can contain a verbal description of the catchment area or merely an alpha-numeric identifier. A unique integer identifier ID number is still required. Both items appear in the output file. Each entry of an ID number is checked against a list of previously defined numbers to avoid duplication.
- Show Test hyd** When this check box is selected (i.e. checked) the graphical display generated when the [Display] button is clicked includes the user-defined Test hydrograph as well as the hydrographs for total Runoff and the runoff components from the pervious and impervious fractions. This can be of value in calibrating runoff parameters to match an observed runoff hydrograph

The IUH Command

This new command lets you generate a runoff hydrograph with a desired peak flow and with either a specified time to peak or duration. The command is shown in Figure D-6 below.

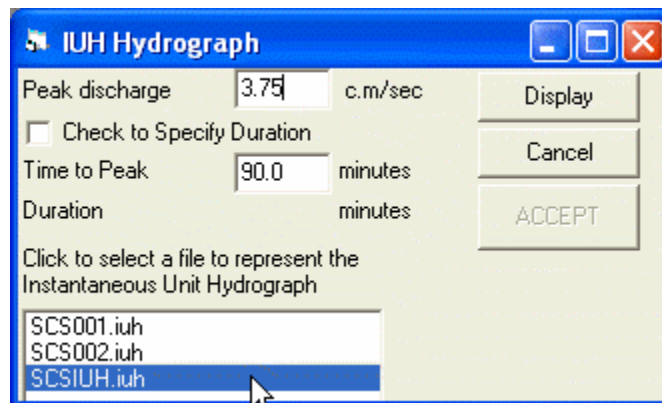


Figure D-6 – Defining a Runoff Hydrograph using a pre-defined IUH

When using a pre-defined IUH curve it is probably more usual to define the desired peak discharge and the time to peak. The hydrograph duration is then dependent on the skew-ness of the IUH curve. If the computed duration is greater than the maximum hydrograph length defined with the Times parameters, the length of the IUH hydrograph is truncated and a warning message is displayed.

However, if the box labeled “Check to Specify Duration” is checked, the form is modified to let you specify the duration and the time to peak is then calculated as some fraction of the duration defined by the shape of the IUH function.

A file defining an IUH function must be selected for the [Display] command to be enabled. Pressing [Display] then computes a runoff hydrograph and displays it both graphically and in tabular form.

Different IUH files can be prepared by the user by copying or editing one of the sample files provided with MIDUSS.

Runoff Area Totals

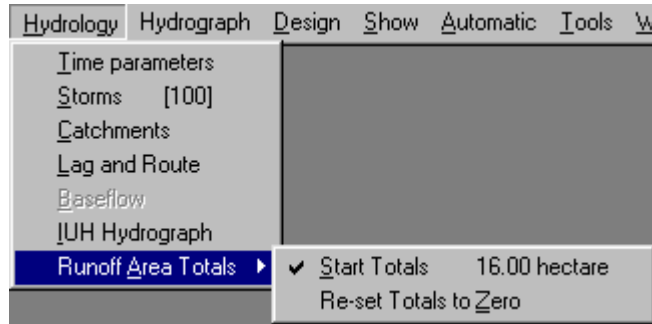


Figure D-7 – The Runoff Area Totals command

A new option in the Hydrology menu causes MIDUSS to keep a running total of the Catchment areas defined and also the total of impervious surface. The default condition when MIDUSS starts is to accumulate totals but this can be toggled off if desired. When totals are being calculated the Start Totals command is shown with a check mark. The current total area is also displayed against this menu item.

If separate totals are required for different branches in the same drainage network, the totals can be reset to zero by selecting (clicking) the Reset Totals to Zero command.

When you use the Files/Exit command a small summary message is displayed. More detail is shown in the output file.

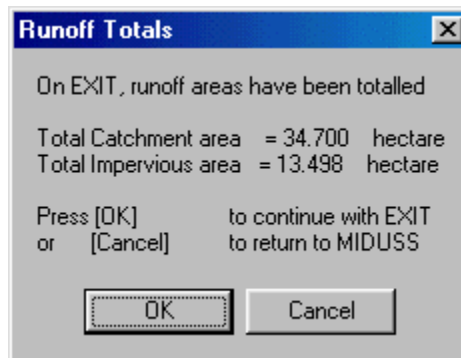


Figure D-8 – Area totals are displayed on Exit

Hydrograph Commands

The two new commands in the Hydrograph Menu are both concerned with manipulating the Test hydrograph. Several commands in MIDUSv2 have a checkbox which causes a user-defined Test hydrograph to be displayed graphically with the other hydrographs computed by the command. This allows some calibration of the MIDUSS model to improve the agreement between a hydrograph observed in the field and the hydrograph computed by MIDUSS.

Move Outflow to Test hydrograph

Moves a hydrograph that has been imported into the Outflow hydrograph array to the Test Hydrograph array.

Edit Test Hydrograph

Displays the current contents of the Test hydrograph in both tabular and graphical mode and allows the user to edit the individual cell-values. In addition, cells can be Inserted or Deleted with automatic adjustment of the hydrograph length, maximum flow value and total volume.

A useful method to import an observed hydrograph is to open the Test Hydrograph window with the Hydrograph/Edit Test Hydrograph command and then run (for example) Microsoft Excel.

Enter the observed values in appropriate units in the Excel spreadsheet using 10 columns. Then use the Edit/Copy and Edit/Paste commands to copy the block of cells from the spreadsheet to MIDUSS.

Design Commands

Several important changes have been made:

- | | |
|------------------------|--|
| Cascade Design | A new feature lets you design a storage device (typically below ground) that comprises multiple cells in series. Several cross-sectional shapes can be used but this initial version is limited to only two cells. |
| Channel Command | Complex cross-section data can now be saved and imported as required. In addition, the roughness (Manning 'n') of each segment of the cross-section can be varied. |
| Culvert Command | Culverts can be designed using a variety of barrel shapes for a constant flow or for an inflow hydrograph. In the latter case, the inflow can be routed through any upstream storage caused by surcharging of the culvert. |
| Pipe Command | When the form is opened a feasible design is displayed. The results now include the relative depth (y/D) |
| Pond Command | The outflow control options have been increased and a tool is provided to assist in representing ponds of irregular shape. Super-pipes of different cross-sectional shape. |
| Trench Command | The outflow controls now include pipe discharge in addition to the orifice and weir options. |

Cascade Command

On-site storage for commercial development frequently requires some underground storage facility to handle runoff from frequent storm events in order to reduce the frequency with which parking lot storage may be an inconvenience.

The Cascade command lets you route the current inflow hydrograph through a short cascade of storage cells formed from a variety of cross-sectional shapes such as pipes, rectangular boxes, horizontal and vertical elliptical pipes and pipe arch sections.

CASCADE Design

Peak inflow 2.162 c.m/sec Number of elements 2
 Inflow volume 3242.5 c.m System Volume 3481.3 c.m

Pipe Arch 4.370 2.870 1.035 0.815 2.265 4.895

Element	1	2
Length	125	100.00
Width	8	4.370
Height	2.5	2.870
Invert Elev.	10.00	9.50
Orifice Diam.	0.375	0.300
Coeff Cc	0.630	0.630
Type	Box	CSPA

Setup Current Data Route Cancel Accept

	Q(0)	H(1)	Q(1)	H(2)	Q(2)
Maximum	2.162	1.868	0.363	1.458	0.238
5.	0.000	0.000	0.000	0.000	0.000
10.	0.000	0.000	0.000	0.000	0.000
15.	0.000	0.000	0.000	0.000	0.000
20.	0.000	0.000	0.000	0.000	0.000

Cascade Design is currently limited to a maximum of 2 elements

Figure D-10 – Data entry for the Cascade command

The current version of the command is limited to only two elements. The data entry section is self-explanatory to some extent. The form displays a number of columns equal to the number of elements. The bottom row shows a drop-down list from which the type of cross-section can be selected.

If any of the three special pipe sections are used (e.g. elliptical or pipe arch) a second drop-down list on line 3 of the form is activated to let you browse through a set of commercially available sizes. These are shown in metric or imperial sizes depending on the choice of units.

Apart from the overall dimensions of each element, you must define the invert level and an orifice diameter and coefficient of contraction of the outflow control from each cell. The orifice invert is assumed to be the same as the invert of the upstream element.

Each iteration of the analysis requires two steps – first click on [Setup Current Data] to enable the [Route] command and then click [Route] to carry out the analysis.

The second row of the grid shows the peak values of the Inflow, outflow from each cell and maximum depth in each element. If a cell is surcharged, the data box containing the Height is highlighted to warn you that more storage or a larger orifice is required.

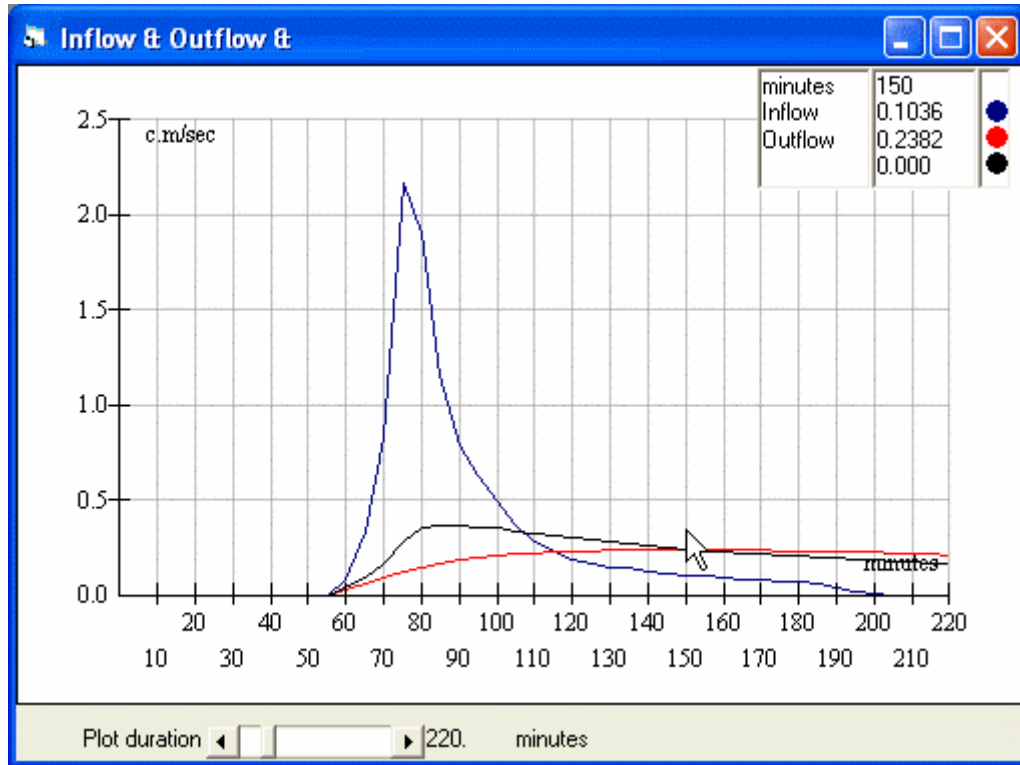


Figure D-11 – The results are displayed as a graph of multiple hydrographs

In addition to the graphical display a table of the final outflow hydrograph is shown.

Channel Command

Two changes have been made to the Channel design command. Both of these apply to the use of a complex cross-section

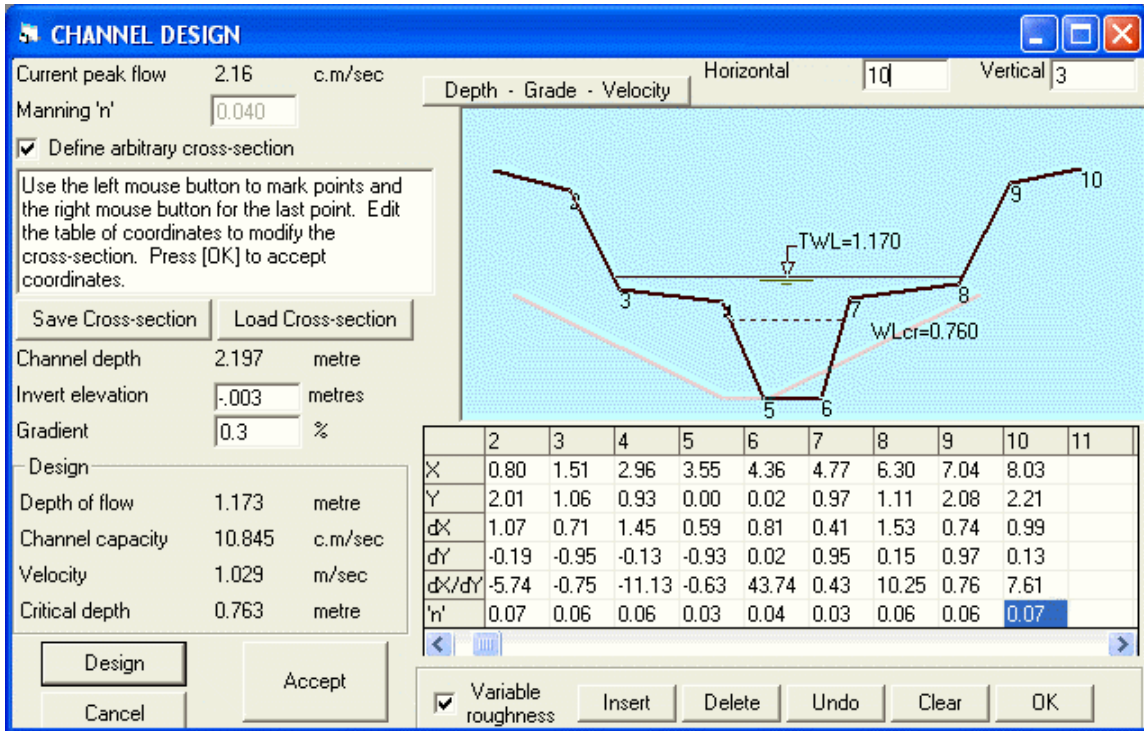


Figure D-12 – Channel cross-section can have variable roughness and can be saved or imported.

Cross-Section Files

Once a complex cross-section has been defined by clicking on the [OK] button it is possible to save the data in a file which is stored by default in the current Output directory. You may navigate to another folder if desired. The default file extension is *.XSEC.

Subsequently the file can be imported into the Channel command and can be edited in the usual way by modifying the data displayed in the grid.

Variable Roughness

When a check box labeled 'Variable Roughness' is selected an extra row in the data table is displayed. Initially this is filled with the default value of Manning 'n'. You can edit the values in the usual way to describe high values of roughness due to flood plane vegetation or other roughness elements. The variable roughness feature is disabled in Demonstration mode.

Culvert Design

The Culvert command can be used with a constant (i.e. steady) discharge or with an inflow hydrograph. A typical example is shown below.

The screenshot shows the 'CULVERT Design' dialog box with the following fields and values:

- Peak Inflow: 1.153 c.m/sec
- Length: 25.00 metre
- Manning 'n': 0.015
- Upstream invert: 100.250 metre
- Downstream invert: 100.000 metre
- Weir elevation: 103.000 metre
- Weir Breadth: 20.00 metre
- Weir Grade Left: 25.0 Hor:1 Vert
- Weir Grade Right: 25.0 Hor:1 Vert
- Number of Barrels: 1
- Diameter: 1.000 metre
- Shape: Pipe (selected)
- Tail Water elevation: 100.500 metre
- Inlet Coeff. Cc: 0.500
- Energy loss Ke: 0.900
- Channel Geometry: 0.50 Wingwall (10-25deg).square top edge
- Results:

Inlet control	101.189	metre
Outlet control	100.000	metre
Peak Outflow	1.153	c.m/sec
Weir flow	0.000	c.m/sec
Total outflow	TotFlow	cub.m/sec
Normal Depth	0.532	metre
Critical Depth	0.617	metre
Conjugate depth	0.713	metre
- Channel Data:

Basewidth	2
Depth	1
Topwidth	4
Left Bank	10
Right Bank	10
Grade %	1
Length	300

Buttons: Design, Dt = 75 s, Route, Cancel, Accept. Checkboxes: Show Channel Geometry (checked), H-Q-V table (unchecked).

Figure D-13a – The main Culvert Design form.

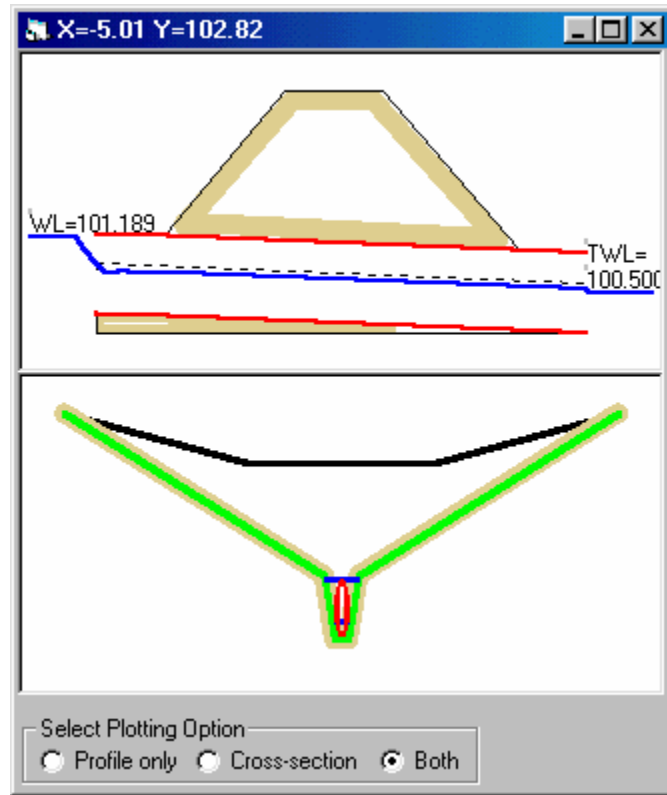


Figure D-13b – Designing a culvert for a constant, user-defined discharge

A variety of barrel cross-sections can be selected including pipes, rectangular box sections, horizontal or vertical elliptical sections of pipe arch sections. Multiple barrels can be defined but all barrels will have the same attributes.

If the inflow is described by a hydrograph completion of the design for the peak flow causes the [Route] command button to be enabled. The available storage upstream of the embankment through which the culvert passes is defined by the slope of the flood plains on either side of the channel and the slope and geometry of the channel leading to the culvert. A table is constructed with the stage, discharge and volume storage upstream of the culvert assuming that the upstream water surface is approximately horizontal. This allows the inflow hydrograph to be routed through the ponded reach with the result that the peak flow through the culvert is less than the peak of the inflow hydrograph. The design can then be updated for the reduced flow or left unchanged.

The results are displayed both graphically and in tabular form as in other flood routing commands.

If the culvert is surcharged either by a high flow rate or by a high tail-water depth it may happen that the flow is split into two components – through the culvert and over the weir formed by the embankment. In this case the weir flow is reported separately and the depth over the crest of the embankment is shown.

Pipe Command

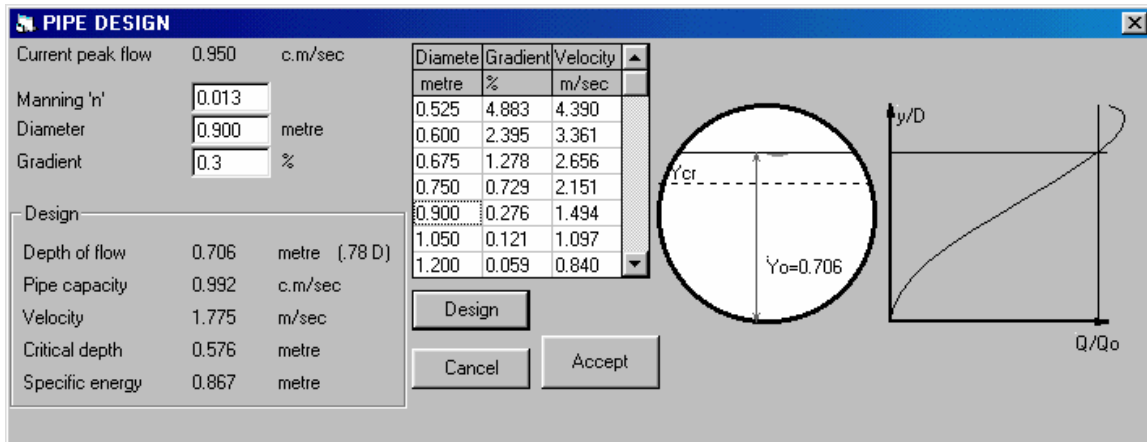


Figure D-14 – An Improved Pipe Design

In version 1 the values of Diameter and Gradient were previously empty. For user convenience these values are filled when the Pipe Design is displayed with the smallest diameter that will carry the inflow with a slope of 1.0% or less. (In the example shown, the initial design was for a 750 mm diameter at 0.8%)

Following the part-full analysis, the relative depth (Y_0/D) is displayed to the right of the Depth of Flow.

Pond Command

A number of improvements have been made to the Pond design procedure.

1. When the Pond window opens the Target outflow is arbitrarily set at one half of the peak inflow. Before the design proceeds you are prompted to either accept this value or enter a preferred Target outflow.
2. When using the 'Rectangular Pond' geometry option a Tool is made available to estimate the aspect ratio (Length/Width) of the equivalent rectangular area in terms of the measured surface area and perimeter. Figure D-15 below shows this feature in use.

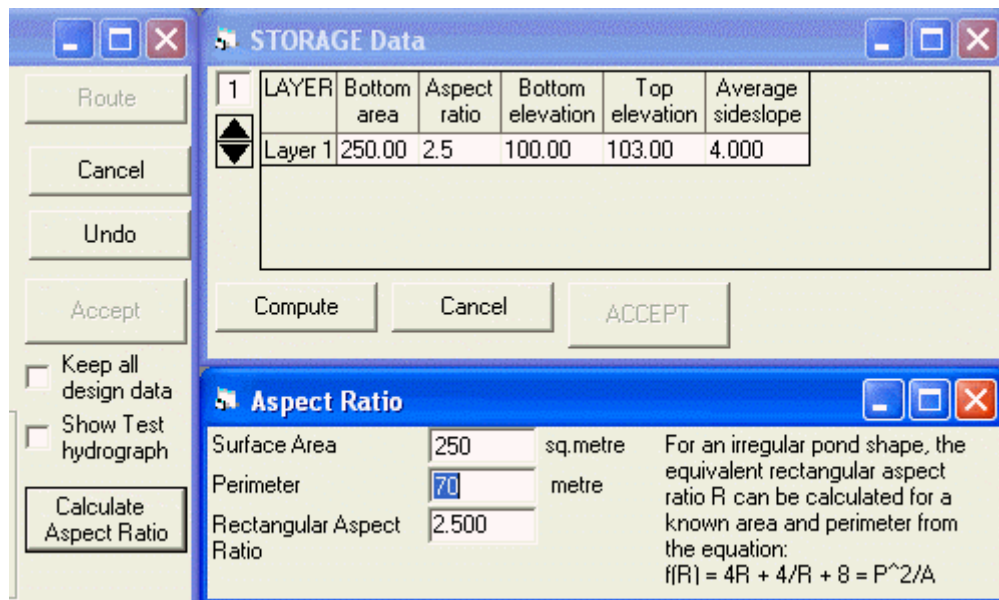


Figure D-15 – A Tool to Estimate Aspect Ratio

Outflow Control options now include two additional choices as shown in the menu fragment shown in Figure D-16 below.

A Horizontal Orifice is one in which the discharge flows vertically downward through a horizontal plate.

A Pipe control is simply an outflow pipe that is long enough that the normal depth of uniform flow occurs at the upstream end just after the initial acceleration. The head H in the pond is assumed to be equal to the specific energy at the upstream end of the pipe, i.e.

$$H = Y_0 + \frac{V^2}{2g}$$



Figure D-16 – Outflow Control Options

To improve on the accuracy with which the Stage – Discharge curve is computed, steps have been taken to discourage the user from specifying a weir crest elevation that falls between two values of the set of stage elevations. Figure D-17 below shows a warning message that is displayed if this occurs. In this example the stage values were ...108.0, 109.5, 121.0, 122.5...that could have resulted in a maximum water level greater than the weir crest producing zero flow over the weir.

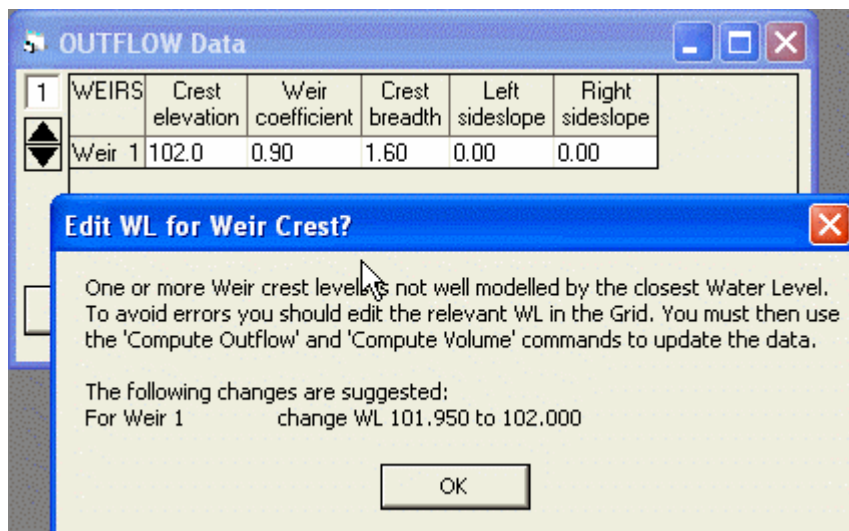


Figure D-17 – Warning that a Weir may not be Accurately modelled.

Trench Command

As shown on the right, the Outflow Control options for an Exfiltration Trench now include a pipe. This is similar to the new option described in the Pond command.

This is particularly important if the Trench design is of the Etobicoke (Toronto) type in which bypass of the trench occurs through a minor system storm drain passing through the clear stone fill of the trench.

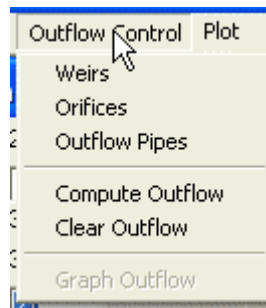


Figure D-18 – Trench Outflow Control Options

Show Commands

The Show Menu contains one new feature and one modified option.

Show / Layout Command This new feature causes a drainage network to be constructed on a Layout form. The creation of the various objects and links is done automatically by MIDUSS as the design proceeds. However, at any stage, you can drag objects to a different location and all the connected links are dragged with it.

Show / QuickGraph Command The QuickGraph item in the Show menu can now be used to superimpose several hydrographs on a single plot.

Show Layout

This new feature is intended to provide a visual display of the elements added to the drainage network. The procedure is carried out automatically in MIDUSS and Catchments, Pipes, Channels and other stormwater control devices are drawn on the Layout as they are designed.

On the Layout form you can select and drag one or more objects to more closely represent the topology of the drainage network that you are designing. To assist in this customization of the Layout you can initially select whether the origin (i.e. where $X = 0$, $Y = 0$) implies plotting on a specific quadrant – NE, SE, NW or SW. For example, if the default South-East quadrant is selected the origin will be at the top-left corner of the drawing area.

The first time you design an element that will be drawn on the Layout you will be prompted to select a quadrant. The form is shown in Figure D-19.

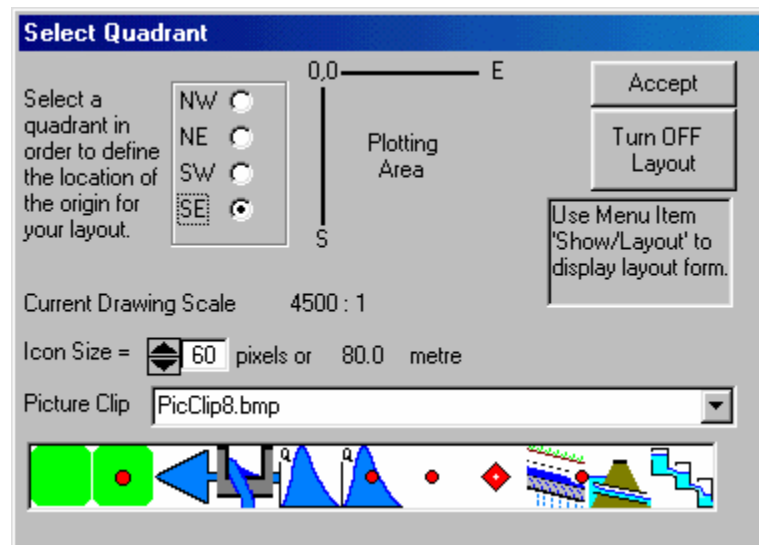


Figure D-19 – Selecting a Quadrant for the Layout

In addition to the objects shown in Figure D-19 the Layout will contain three types of link to represent a Pipe, a Channel or a Dummy link that serves to indicate connectivity between objects.

The Layout form can be displayed by using the Show / Layout menu command. Along the top edge of the form are a number of controls to allow some customization of the layout. These are shown in Figure D-20 below.

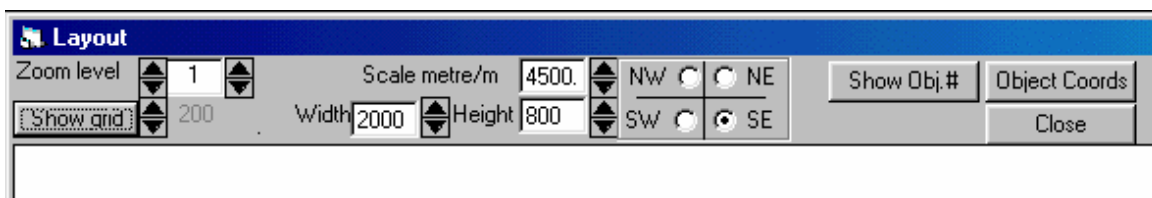


Figure D-20 – Customization Controls for the Layout Form

From left to right these perform the following tasks.

Zoom Level	The left and right spin buttons increase or decrease the zoom level by increments of 0.4 and 0.05 respectively.
Grid	A grid can be displayed over the layout. Each click reduces the size of the grid to the following values in feet or metres: 2000, 1000, 500, 200, 100 and 50. Pressing [Grid] when the spacing is 50 turns the grid off.
Scale units/25mm	The scale is modified by clicking the spin button to the right of the current value. Each click increase or decreases the scale by 100 length units. The smallest value is 100.
Total width	This reports the total width and height of the drawing area. Viewing of the total area is achieved by means of the vertical and horizontal scroll bars on the Layout form. Using the spin button increases or decreases the displayed number through a range of fixed values defined as follows Total width/height = 100 x100 to 1000 x 500 to 5000 x 1000 ...
Quadrant	Although a starting quadrant is selected as shown in Figure D-10 it may be necessary to change this after drawing has commenced. The four Option buttons let you change the quadrant. This will produce a vertical and/or horizontal mirror image of the current layout to be produced. This operation should be used with caution as complex networks may suffer some distortion when modified in this way.
Show Node #	Displays the sequential numbers assigned to each object on the layout. Used only by the layout drawing code inside MIDUSS.
Object Coords	This command causes a grid to be displayed or hidden. The grid displays a number of rows equal to the number of objects that have been drawn. Each row shows 15 attributes describing the object coordinates, type of icon used, the Windows 'handle' and several other quantities. This information is generally only of interest for diagnosing problems and is not likely to be of practical value to users.
Close	This command button hides the Layout form and also the Data grid if it is currently displayed.

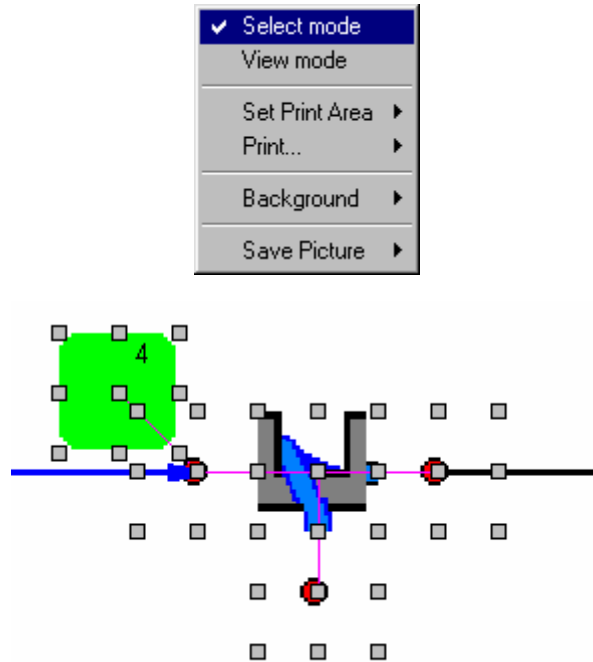


Figure D-21 – Using the Drop-Down Menu on the Layout display

Figure D-21 shows a typical display produced by ‘right-clicking’ (assuming a right-handed user) on the Layout form. The drop-down menu shows a number of options. The example shows that the ‘Select’ mode has been used. This causes the downstream node to be surrounded by ‘sizing handles’ and has also allowed this node to be dragged down below (i.e. south) of the catchment. An important feature of the drag operation is that links connected to the node are also ‘dragged’ along with the node.

In ‘View’ mode the grid is not displayed. However, when selected, the View mode causes an information box to be displayed when the mouse pointer is over an object. Figure D- 22 shows an example.

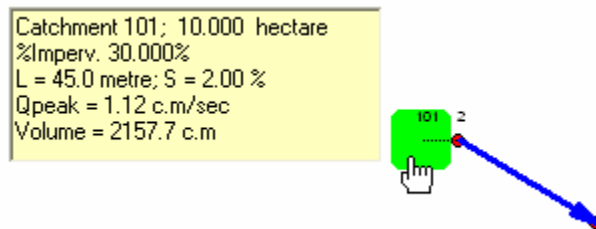


Figure D-22 – The View mode permits Object Attributes to be displayed

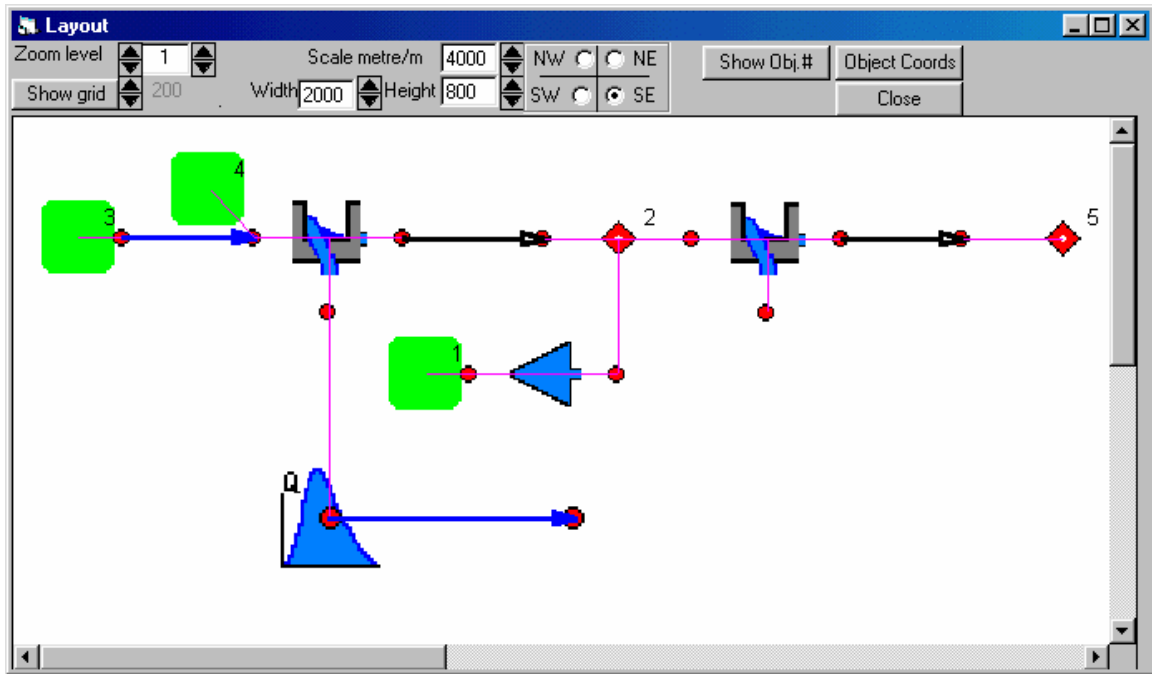


Figure D-23 – Layout of a Simple Drainage Network

Show QuickGraph

Previously this command allowed you to display only one available hydrograph at a time. It is now possible to use the command several times in succession to superimpose two or more hydrographs on the same graphical display.

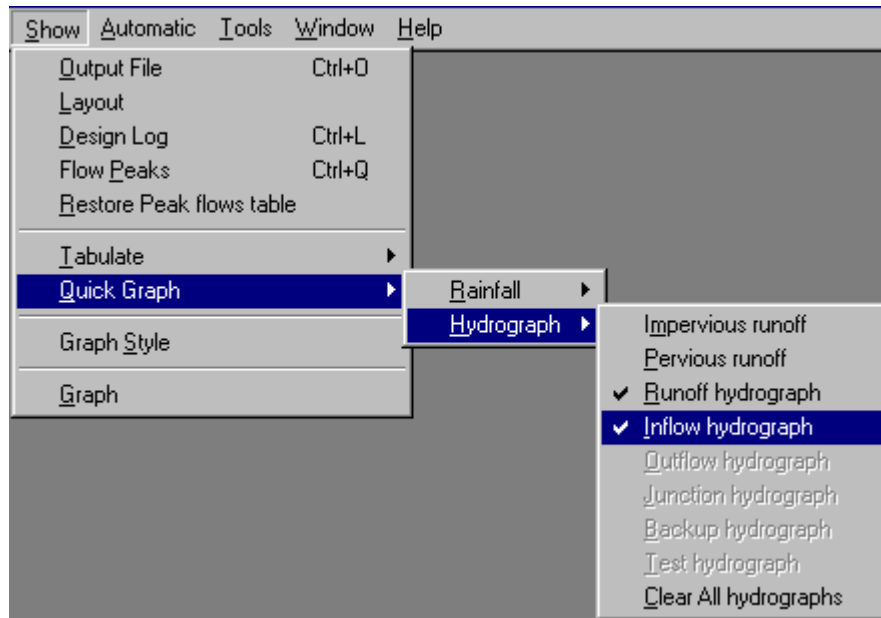


Figure D-25 – Show/QuickGraph can display multiple Hydrographs

As shown in the Figure D-25 above, the active hydrographs are indicated by a checkmark on the menu list. Hydrographs that are currently available are shown in regular type whereas hydrograph arrays that have not yet been filled are 'grayed' out.

All of the checkmarks can be cleared by using the Clear All Hydrographs menu option or by closing the graph window.

Tools Commands

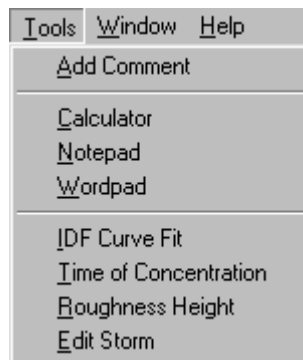


Figure D-26 – The new Tools Menu

Five new Tools have been added to the Tools menu. In summary these are:-

IDF Curve Fit

This is a Windows version of the DOS program that lets you estimate the parameter values for a Chicago hyetograph from observed records of either depth or intensity within a range of time intervals and for a specified return interval.

Time of Concentration

Computes time of concentration by two different formulae.

Roughness Height

Lets you convert between Manning's 'n' value and roughness height in mm or feet for fully developed rough turbulent flow.

Edit Storm

This tool lets you define or edit the file describing the dimensionless mass rainfall distribution.

Each of these is described in more detail in the topics that follow.

The IDF Curve Fit Tool

The IDF Curve Fit tool manipulates data describing an Intensity-Duration-Frequency for a particular geographical locality and can be used in two modes:

1. To compute the 'a', 'b' and 'c' parameters of a Chicago hyetograph that most closely approximates a set of observed data.
2. To compute the IDF curve for user-supplied values of the three coefficients and compare this with observed data.

The mode is selected by checking the 'Optimize' check box on the form or clearing it to simply compute the curve for specified values of 'a', 'b' and 'c'.

Figure D-27 below shows data that has been entered for the first mode of operation.

Time (hr)	Depth (min)	Intensity (mm)	Intensity (mm/hr)	Computed Depth	Computed Intensity
5	12	144.00		12.24	146.87
10	16	96.00		16.00	95.98
15	19	76.00		18.02	72.06
30	21	42.00		21.09	42.18
1.00	60	23.5	23.50	23.78	23.78
2.00	120	25	12.50	26.27	13.13
3.00	180	27.5	9.17	27.69	9.23
4.00	240	29	7.25	28.70	7.17
6.00	360	31	5.17	30.13	5.02
12.00	720			32.67	2.72
18.00	1080			34.22	1.90
24.00	1440			35.35	1.47

Figure D-27 – Entering data for an IDF curve

In the grid on the left for Time, Depth and Intensity a column of time intervals is displayed as shown. These values can be customized if desired.

For any time interval the rainfall can be defined either as a total depth of rainfall or as an average intensity over the time interval. Entering either value automatically displays the other. The number of data pairs is automatically displayed in the top of the form and not every time interval need be entered.

When the [Optimize] button is clicked several things are displayed:

The optimal values of the three parameters

The computed values of Depth and Intensity for each time interval. These are shown in the right hand grid.

A 'log-log' graph of both observed and computed values is displayed. A typical result is shown in Figure D-28 below.

Data for different return periods (e.g. 5, 10 & 50 years) can be processed and the IDF graphs are accumulated on a single graph.

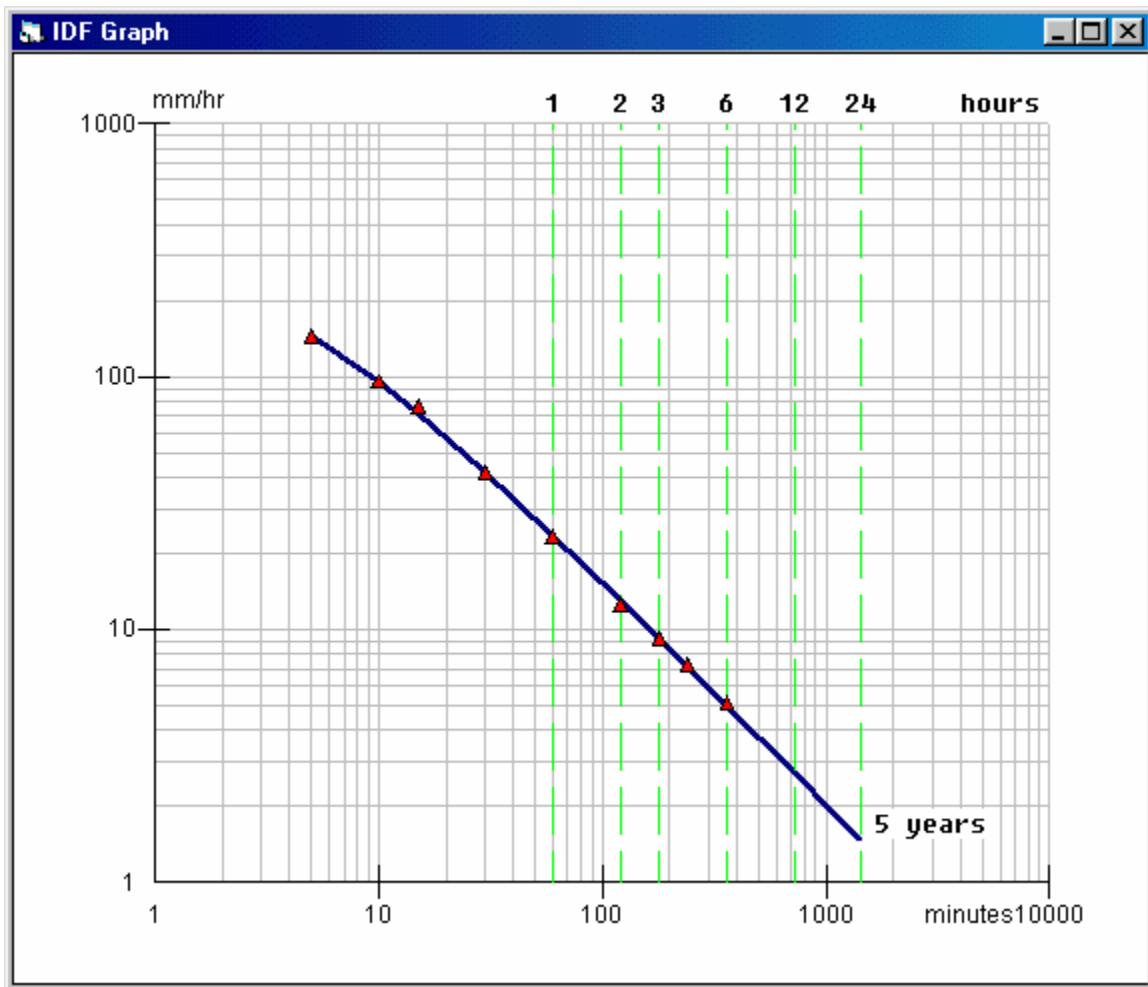


Figure D-28 – Graphical comparison of observed and optimized values of intensity for a single return period of 5 years.

By clearing the 'Optimize best fit' box the top command button is re-labeled [Calculate]. You can then enter values of 'a', 'b' and 'c' that differ from the optimized values previously calculated.

Clicking [Calculate] causes the computed values of depth and intensity to be revised and the blue curve on the graph is re-plotted.

Typically the error reported between observed and computed values of rainfall will be increased.

This lets you experiment with parameter values for practical use.

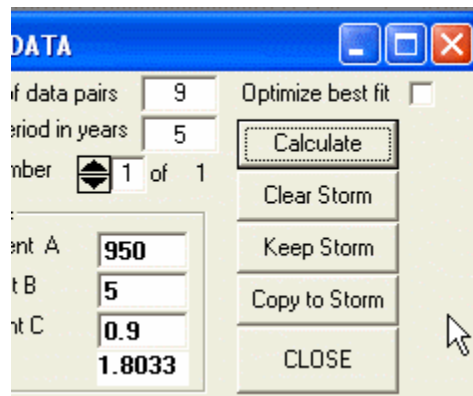


Figure D-29 – Using the IDF tool in 'Calculate' mode

The other command buttons shown in Figure D-27 can be used to use the computed results for the Storm command or to save the storm details as a file.

The Time of Concentration tool

The time of concentration is calculated as the sum of up to three components of travel time. These are:

1. Flood wave travel time of overland flow
2. Travel time in relatively small collector channels or gutters
3. Travel time in a storm conduit such as a circular pipe or a channel of general trapezoidal cross-section.

For the overland flow you can select one of two equations. Friend's eq. is:

$$t_c = k \left(\frac{nL^{0.333}}{S^{0.2}} \right)$$

where $k = 107$ (metric) or 72.042 (imperial)

Each of the three components requires entry of data to describe the length, gradient and roughness of the conduit or surface. In addition, overland flow may also depend on the intensity of the effective rainfall.

On entry of a finite length the time is computed for each component and the total is displayed as the Time of Concentration.

Both metric and U.S. Customary (Imperial) units can be used depending on the units selected in running MIDUSS

Time of Concentration

Overland Flow

Friend's eq.
 Kinematic Wave eq.

$$t_c = k \left(\frac{Ln}{\sqrt{S}} \right)^{0.6} i^{0.4}$$

Overland sheet flow length: 75 metre
 Slope of surface: 1.000 %
 Manning's 'n' of surface: 0.250
 Effective rainfall intensity: 100.000 mm/hr
 Overland time of concentration: 25.6 minutes

Kerb Gutter Flow Time

Kerb Gutter flow length: 120 metre
 Longitudinal Gutter slope: 1.000 %
 Kerb Gutter flow time: 3.0 minutes

Conduit Travel Time

Pipe Length: 300.00 metre
 Pipe Gradient: 1.000 %
 Pipe Manning 'n': 0.013
 Pipe Channel
 Pipe Diameter: 0.500 metre
 Pipe Travel Time: 2.6 minutes

Total Time of Concentration: **31.20** minutes

Figure D-30 – Time of Concentration tool

Equivalent Roughness Height

MIDUSS design routines use the Manning 'n' to describe surface roughness. Users who prefer to define roughness in terms of the equivalent roughness height can use the Roughness Height tool to convert from roughness height to Manning 'n'. Once calculated, the computed value can be imported into the current or next design command by clicking the [Use for Design] button.

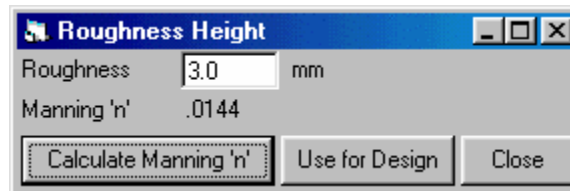


Figure D-31 – Converting roughness height to Manning 'n'

The conversion uses the following equation where g = gravitational acceleration and k = roughness height.

$$n = \frac{k^{1/6}}{8.41\sqrt{g}}$$

The equation is valid for fully developed, rough turbulent flow.

The Edit Storm Tool

One of the options in the Storm command is to use a pre-defined curve known as a Mass Rainfall Distribution curve. These files are given the extension *.MRD and define the fraction of rainfall depth $R(t)/R_{tot}$ as a function of ratio of elapsed time over total storm duration. Typical examples are for the various Huff storm quartiles and the SCS hyetographs.

The Edit Storm tool lets you modify an existing MRD file or construct a new one.

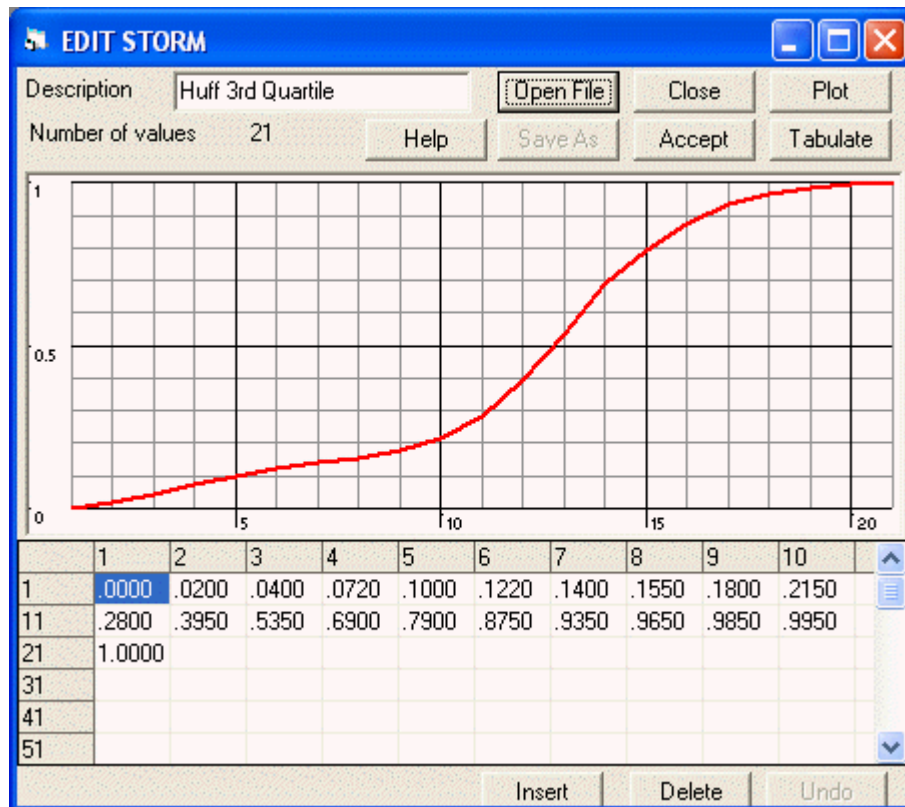


Figure D-32 – Editing the Mass Rainfall Distribution curve for a storm.

Figure D-32 shows the storm-editing window. In this example the 3rd quartile Huff storm has been imported by using the [Open File] command button. Alternatively, if no file is imported, the initial distribution is a straight line. The array of values must start with zero and end with 1.0 and the intermediate values must increase monotonically. The steepness of an incremental line segment defines the intensity of the resultant storm so clearly a negative slope would imply a negative rainfall intensity.

The values can be edited in two ways – by graphical manipulation or numerically.

Graphical Edits: Position the mouse pointer on one of the vertical grid lines and either above or below the red line. Each mouse click causes the numerical value in the table to increase or decrease by 0.01. By holding down the Shift key while clicking the mouse key increases the numerical change to 0.1.

Numerical Edits: Click on any cell in the grid with the exception of the 0.0 and 1.0 values and type in the desired value.

Any change in either the graphical or tabular display is reflected in the other.

The command buttons at the top of the form have the following functions.

- [Open File] Load an existing MRD file.
- [Accept] Accept the editing that you have done so far. This enables the [Save As] button
- [Save As] Lets you save the new MRD data as a file. The first two records in the file will contain a brief description and the total number of values including the 0 and 1 values. If you have modified an existing MRD file the description will be shown in the 'Description' label. You will be prompted to either accept the current description or change it.
- [Plot] Causes the current MRD data to be displayed as a hyetograph of rainfall intensities. This shows only the 'shape' of the storm and not actual intensities.
- [Tabulate] Displays a table of Mass Rain Intensity values for a total rainfall depth of 1 unit. The number of intensity values is one less than the number of points in the MRD distribution.
- [Insert] Insert an additional element in front of the currently highlighted cell in the grid. The new point is given a value that is the mean of the values before and after it and the 'Number of values' is increased by one. If the first zero value is currently highlighted no action is taken. The graphical display is updated to show the change.
- [Delete] Removes the currently selected cell in the grid and reduces the number of values by one. The graph is updated.
- [Undo] Reverses the last use of either the [Insert] or [Delete] command button.

Notes:

Steps:

1. Photocopy this form.
2. Enter details.
3. Fax to our offices.

Error Report

Printed Manuals or Help Files	Installation and Setup	Running MIDUSS
<input type="checkbox"/> Reference Manual <input type="checkbox"/> Tutorial Manual <input type="checkbox"/> Reference Help <input type="checkbox"/> Tutorial Help <input type="checkbox"/> Audio / Visual Tutorials <input type="checkbox"/> Other (e.g. comment or suggestion)	<input type="checkbox"/> CD media files missing, not working <input type="checkbox"/> Setup program errors <input type="checkbox"/> License number problems <input type="checkbox"/> Network use or permissions <input type="checkbox"/> Other (e.g. comment or suggestion)	<input type="checkbox"/> Critical error - Urgent, program crashes. <input type="checkbox"/> Serious – Error, but program needs attention. <input type="checkbox"/> Cosmetic – Visual error. <input type="checkbox"/> Other (e.g. comment or suggestion)
Name of Topic:	Your version of MIDUSS (e.g. 2.00Rev200):	Version of MIDUSS (e.g. 2.00Rev200):
Page number or file date:		
Description of error or problem:		
Would you like to be contacted about this report? <input type="checkbox"/> No <input type="checkbox"/> Yes.....by <input type="checkbox"/> E-mail <input type="checkbox"/> Phone		
Name:		Organization:
E-mail address:		Phone number:

Thank you for completing this report.

Please fax to: **Alan A. Smith Inc. +1 (905) 628-1364**