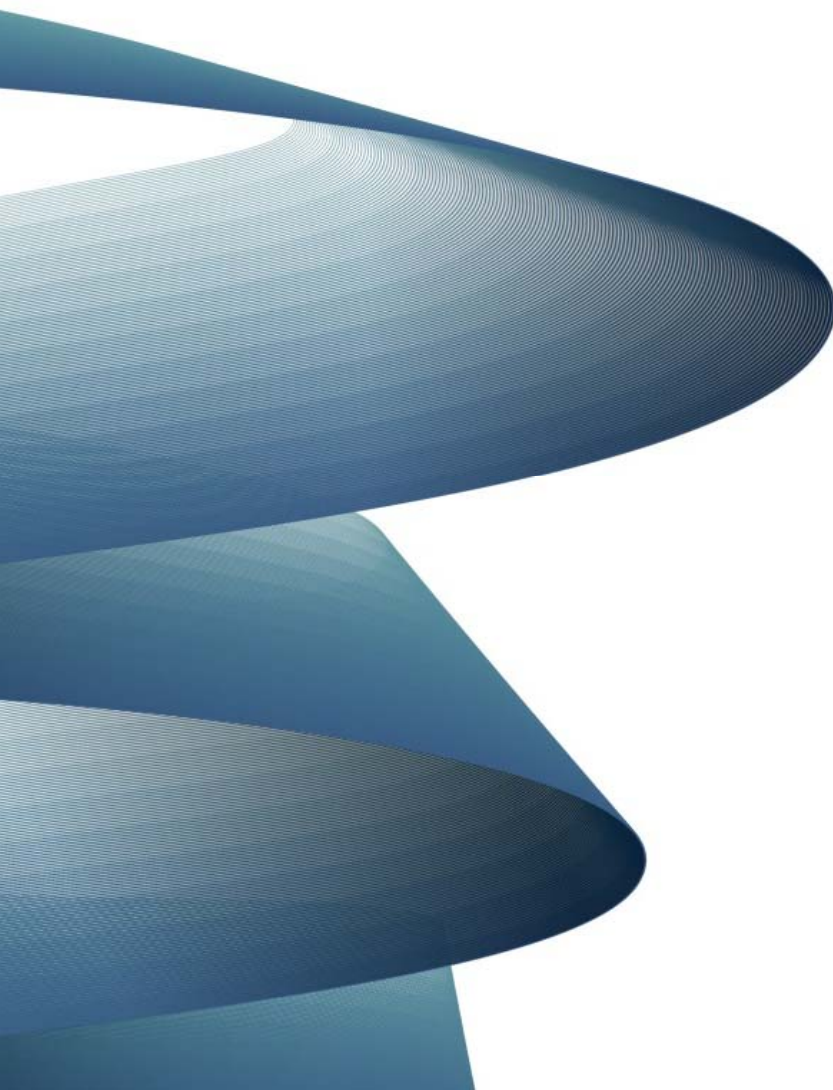


Guide to Modelling Hydro-Brake Optimum[®]
using Micro Drainage from XP Solutions



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1.0 Introduction

Hydro-Brake® Flow Controls have long been a feature within the Micro Drainage design suite (formerly known as WinDes®) from XP Solutions in order to give system designers the very best tools available.

Hydro International have developed a self-contained Hydro-Brake® Optimum design engine which has been seamlessly integrated into Micro Drainage 2014 by XP Solutions' programmers to allow engineers to design drainage networks around the Hydro-Brake Optimum®.



In conjunction with this Hydro International have also developed an online Hydro-Brake Optimum® Design Tool, which not only complements the integrated design engine built into Micro Drainage 2014, but also allows users of older XP Solutions packages to make full use of the Hydro-Brake Optimum® within their drainage designs.

Click the image below to launch the Hydro-Brake Optimum® Design Tool or visit:

www.hydrobrakeoptimum.com



Download the Hydro-Brake Optimum® Design Tool User Guide [here](#).

Hydro-Brake Optimum® Design Tool

The Hydro-Brake Optimum® Design Tool allows you to quickly and easily compare a number of different flow control options for your site to develop the most robust and sustainable drainage solution possible.

In just 3 simple steps you can obtain:

- Detailed dimensional drawings.
- Head / flow characteristic curves.
- Hydraulic modelling data for direct import or copy/paste into commercial hydraulic modelling software.

Step 1: Enter Design Inputs



Step 2: Review Design Online



Step 3: Receive Detailed Design Outputs Direct to your Email Inbox



2.0 Hydro-Brake® Flow Control Hydraulic Characteristics

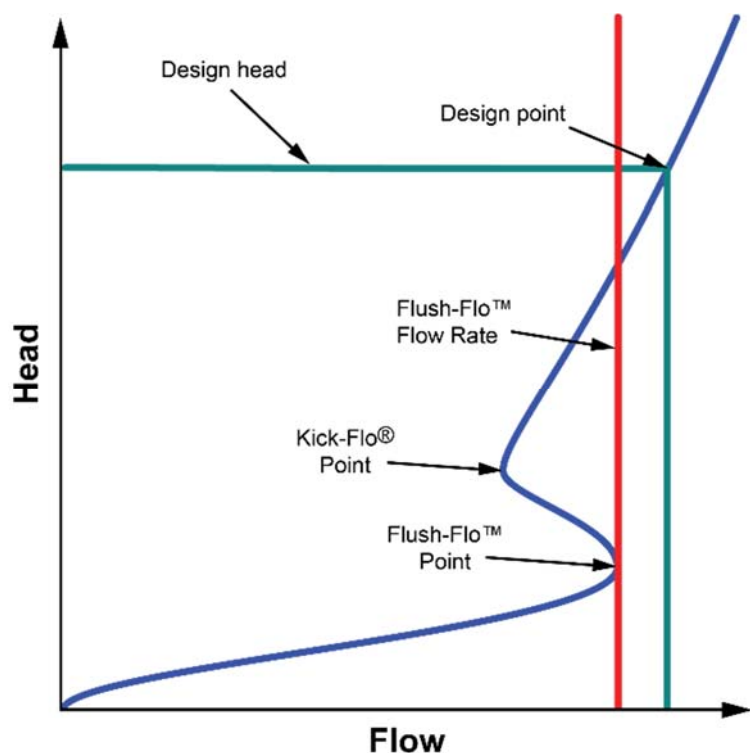


Figure 1 - Hydro-Brake® Flow Control Hydraulic Characteristics

Where a drainage system design has been completed around the use of a particular vortex flow control, the same flow control, or a flow control that has been confirmed to provide equivalent hydraulic performance over the full range of heads, must be used in the final installation.

Calculations within the program are based on a consideration of the full hydraulic characteristic of the flow control, not just the design / duty point. It is essential that the full unit reference / type, diameter (where given), objective (where stated) and control points (where stated) are included on any specification.

The hydraulic behaviour of any Hydro-Brake® Flow Control is described by its hydraulic characteristic curve, which relates the head acting upon the unit to the discharge flow.

The hydraulic characteristic curve contains three distinct control points, each corresponding to different governing flow control behavior:

1) Flush Flo™ – the point at which the vortex begins to initiate and have a throttling effect. A red line on the characteristic curve highlights the flow rate at the Flush-Flo™ point (see Figure 1). This point on the Hydro-Brake® curve is usually much nearer to the maximum design flow (Design Point) than other vortex flow controls leading to more water passing through the unit during the earlier stages of a storm, thus reducing the amount of water that needs to be stored upstream.

2) Kick Flo® - the point at which the vortex has initiated and at which the curve begins to return back to follow the orifice curve.

3) Design/Duty Point – The desired head / flow condition, at which point the vortex is fully initiated.

3.1 Supported Hydro-Brake® Ranges & Models

Micro Drainage 2014 supports 2 ranges of Hydro-Brake® Flow Controls:

Hydro-Brake Optimum® Flow Control

The Hydro-Brake Optimum® Flow Control for Surface Water applications is fully supported in Micro Drainage 2014.





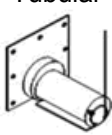
Range	Type	Style/Typical Shape	Application	Design/Installation Notes
Hydro-Brake Optimum® - Sump Type Units	n/a	Sump-type 	Surface/storm water only	BBA and WRc Approved. Design objective can be specified. Available with optional adjustable inlet. Sump-type units require the provision of a sump to accommodate the flow control. Sump-type units are unsuitable for use in foul/combined systems.

Table 1 - Supported Hydro-Brake Optimum® Range

Hydro-Brake® Flow Control

13 different Hydro-Brake® Flow Control model types are also supported as outlined in the table below. These models have been largely superseded by the Hydro-Brake Optimum®, but are retained within the Micro Drainage software to allow users to model existing networks.

Range	Type	Style/Typical Shape	Application	Design/Installation Notes
Hydro-Brake® Flow control – Conical Type Units	Md1, Md2, Md3 (obsolete), Md4, Md14	Conical 	Foul/combined and surface/storm water	With the exception of the Md3 and Md14, conical units require benching into the intake (the Md3 and Md14 have a piped intake). They generally require larger manholes than equivalent sump-type units.
Hydro-Brake® Flow control – Sump Type Units	Md5, Md6, Md7, Md12, Md13*	Sump-type 	Surface/storm water only	Sump-type units require the provision of a sump to accommodate the flow control. Sump-type units are unsuitable for use in foul/combined systems.
Hydro-Brake® Flow control for specialist applications	Md8, Md9, Md11	Vertical discharge 	Foul/combined and surface/storm water	Vertical discharge units require a chamber design to accommodate the vertically directed outlet. They do not have S-shaped head/discharge curves and are for special applications only - refer to your local Hydro-Brake® Flow Control distributor for advice.
	Md10	Tubular 	Foul/combined and surface/storm water	Tubular units require benching into the intake. They do not have S-shaped head/discharge curves and are for special applications only – refer to your local Hydro-Brake® Flow Control distributor for advice.

* Only available in certain sizes

Table 2 - Micro Drainage Supported Hydro-Brake® Flow Control Model Types

3.2 Hydro-Brake® Flow Control Selection Guidance – Surface Water Applications

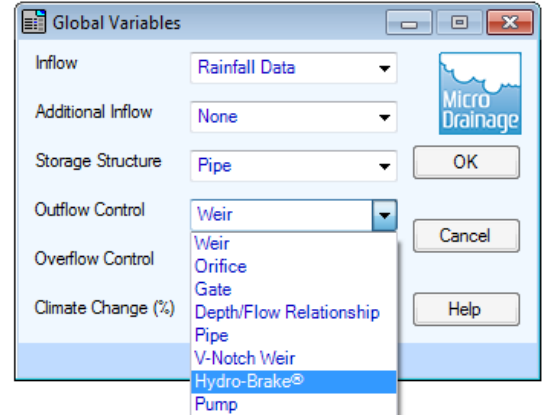
Selection of the most appropriate Hydro-Brake® Flow Control for a particular application depends on a number of considerations, including the hydraulic characteristic of the device, device clearances and overall physical dimensions. The program provides outputs for hydraulic characteristic and outlet size.

3.2.1 Select Hydro-Brake® Flow Control and Range

Select Hydro-Brake® from either the *Global Variables* dialogue box (Source Control, Storage Design modules) or the *Online Controls* dialogue box (Simulation, Network modules).

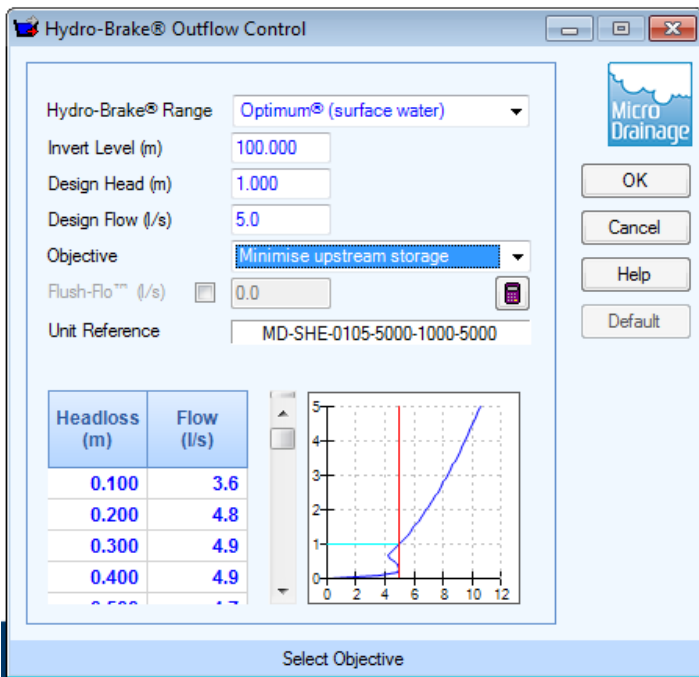
The programme will then display the *Hydro-Brake® Details*, *Hydro-Brake® Outflow Control* or *Hydro-Brake® Overflow Control* dialogue box. By default, the programme will select the Hydro-Brake Optimum® range for surface water only applications.

The *Range* input box allows you to select between the Hydro-Brake Optimum® and the Hydro-Brake® Flow Control, which has been retained for analysis of existing systems / designs.



3.2.2 Hydro-Brake Optimum® Design Window

Enter the Invert Level, Design Flow and Design Head.



A unique feature of the Hydro-Brake Optimum® is the ability to manipulate the flush flow, the point at which the vortex forms within the device, to allow a fully customised hydraulic response to best suit the site requirements.

The Hydro-Brake Optimum® can be configured to prioritise different hydraulic objectives by tailoring the head / discharge characteristic curve.

The *Objective* drop down list can be used to select the desired hydraulic objective. The desired flow rate at the Flush-Flo™ point can also be manually set by checking the *Flush-Flo™* check box (optional).

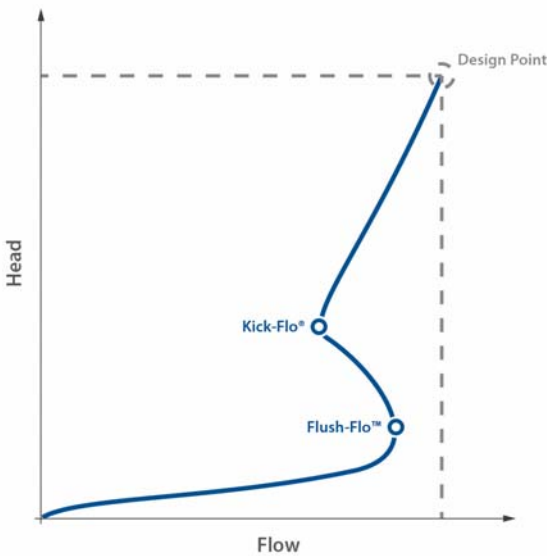
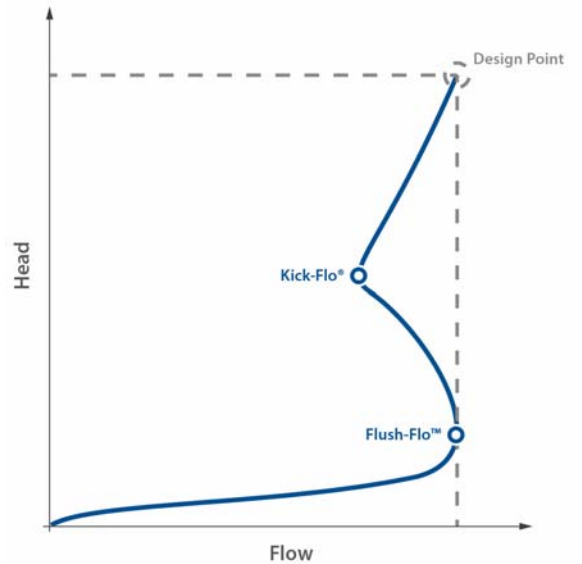
The *Hydro-Brake Optimum® Calculator* can be accessed using the *calculator* button and will show units to satisfy each of the hydraulic objectives.

Once all inputs have been entered the system will calculate the appropriate Hydro-Brake Optimum® and display the *Unit Reference*.

A headloss / flow table is generated alongside the hydraulic characteristic chart (blue line). The vertical red line on the chart shows the flow rate at which the vortex is fully formed (the Flush-Flo™). The cyan lines show the Design Head and Design Flow.

Minimise upstream storage (default)

This is the default option and will generally result in the smallest volume of upstream storage by aligning the flush flow point with the design point as far as practicable whilst also maximizing the head at the kick flow point. This will pass the greatest possible volume of water downstream during the earlier stages of a storm event thus consistently minimising upstream storage requirements. An example hydraulic curve to satisfy this objective is shown right.



Minimise blockage risk

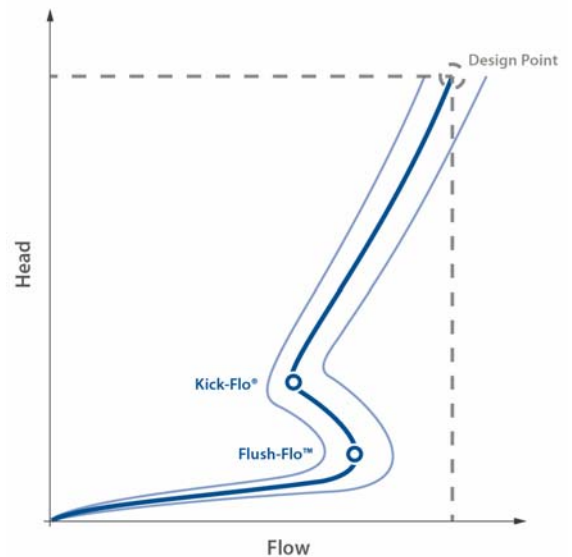
Selecting this option will maximise the clearances through the Hydro-Brake Optimum® unit to minimise the risk of any debris carried in the flow from becoming lodged in the unit. Whilst a unit designed to meet the *Minimise upstream storage* objective may have a larger outlet diameter, the *Minimise blockage risk* unit will maintain greater open cross sectional areas throughout the internal cavity of the unit.

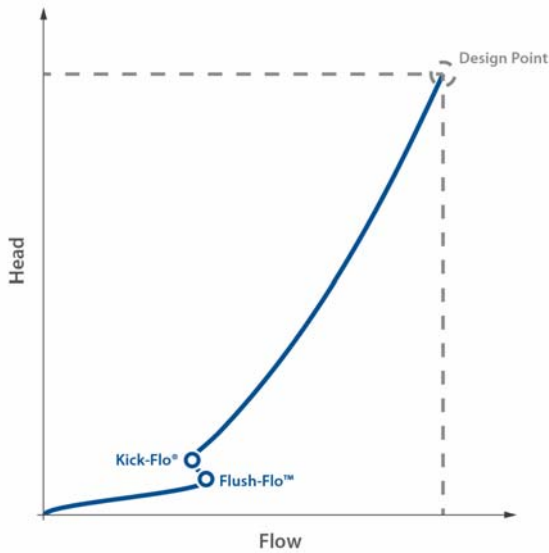
An example hydraulic response curve to satisfy this hydraulic objective is shown left.

Future proof

The addition of an adjustable inlet gate to the Hydro-Brake Optimum® allows the design flow to be adjusted by up to 20% post-installation. The example curve to satisfy this hydraulic objective (right) demonstrates the range of adjustability that can be achieved.

Note: Modelling of the range of adjustment is not currently supported in the software. Please contact Hydro International for further information.





Linear Discharge Profile

This option will generate a discharge profile as close to linear as possible, providing similar hydraulic behaviour to an orifice plate, but with much greater clearances reducing the risk of blockage.

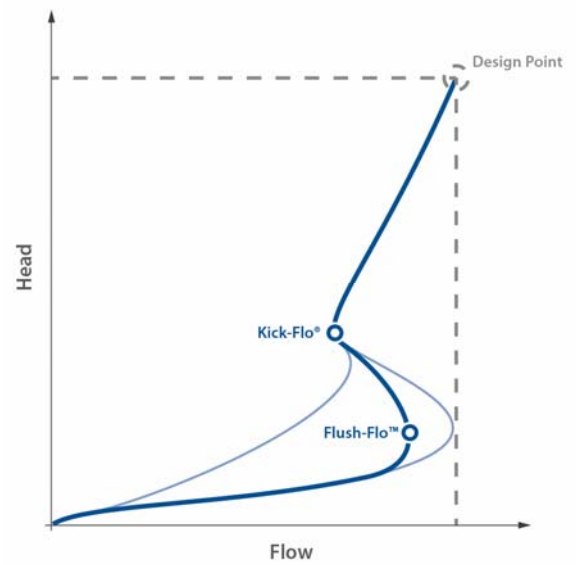
An example hydraulic characteristic to satisfy this objective is shown left.

User specified Flush-Flo™ Flow Rate

The flow rate at which the vortex begins to form (or Flush-Flo™ point) can be specified by checking the *Flush-Flo™* check box.

The Flush-Flo™ may be less than, equal to or greater than the Design Flow depending on the application and can be used to customise the hydraulic response when the standard objective options listed above are not suitable.

The diagram right shows how adjusting the flow rate at the Flush-Flo™ point affects the hydraulic characteristic curve.



3.2.3 Hydro-Brake® Flow Control Design Window

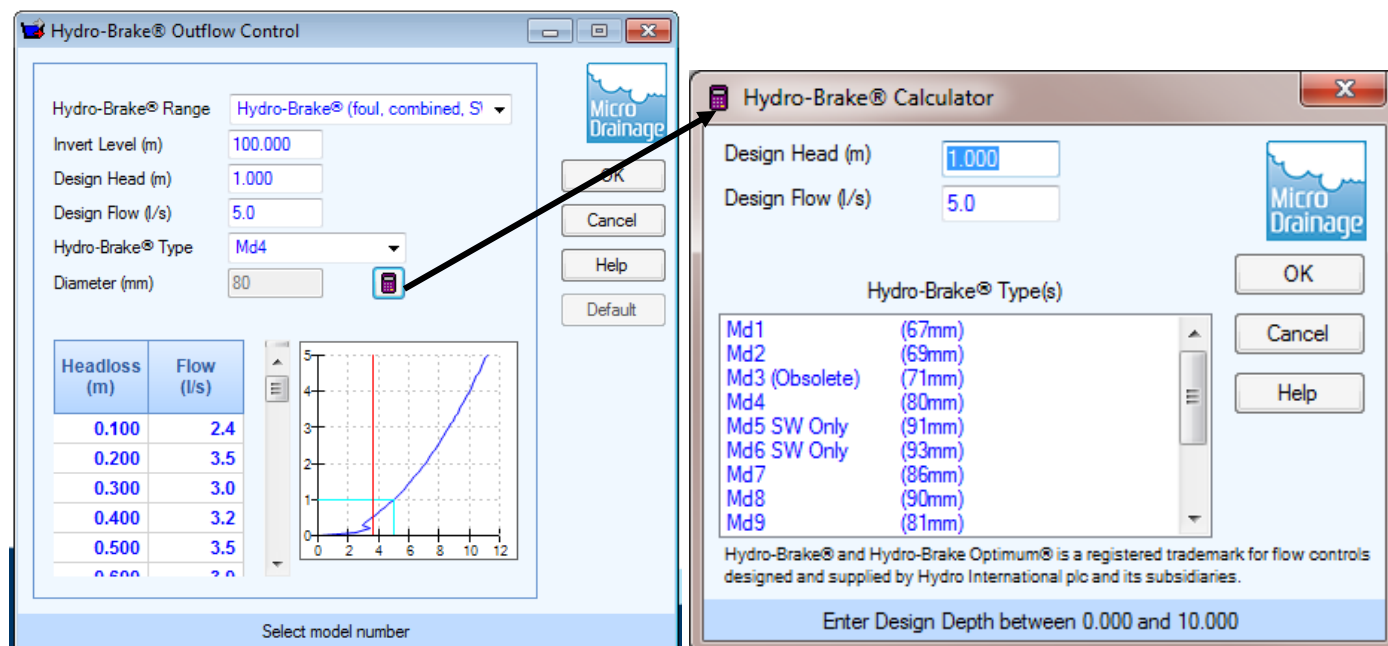
For new designs, the Hydro-Brake Optimum® should be used (see Section 3.2.1).

For analysis of existing systems or review of old designs, Hydro-Brake® Flow Control design details have been retained.

Enter the Invert Level, Design Flow and Design Head.

The Hydro-Brake® Calculator can be used to directly compare the diameter (shown in brackets) of different Hydro-Brake® Types.

Note: The Md13 Hydro-Brake® Type is only available in certain sizes between 75 mm and 158 mm diameter and will only appear in the list when it is available. The diameter will not be displayed.



3.2.4 Hydro-Brake® Specification and Additional Details

Hydro-Brake Optimum® Outflow Control

Unit Reference	MD-SHE-0105-5000-1000-5000
Design Head (m)	1.000
Design Flow (l/s)	5.0
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Diameter (mm)	105
Invert Level (m)	100.000
Minimum Outlet Pipe Diameter (mm)	150
Suggested Manhole Diameter (mm)	1200

Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.000	5.0
Flush-Flo™	0.295	4.9
Kick-Flo®	0.636	4.0
Mean Flow over Head Range	-	4.3

The hydrological calculations have been based on the Head/Discharge relationship for the Hydro-Brake Optimum® as specified. Should another type of control device other than a Hydro-Brake Optimum® be utilised then these storage routing calculations will be invalidated

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	3.6	1.200	5.4	3.000	8.3	7.000	12.4
0.200	4.8	1.400	5.8	3.500	8.9	7.500	12.8
0.300	4.9	1.600	6.2	4.000	9.5	8.000	13.2
0.400	4.9	1.800	6.5	4.500	10.1	8.500	13.6
0.500	4.7	2.000	6.9	5.000	10.6	9.000	14.0
0.600	4.3	2.200	7.2	5.500	11.1	9.500	14.4
0.800	4.5	2.400	7.5	6.000	11.5		
1.000	5.0	2.600	7.8	6.500	12.0		

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The *Model Details* print option will detail the Hydro-Brake® Flow Control specification including:

- Design Head.
- Design Flow.
- Hydro-Brake® type (Hydro-Brake® Flow Control) or Unit Reference (Hydro-Brake Optimum®).
- Diameter.

The Hydro-Brake Optimum® specification will also include:

- Flush-Flo™ (head and flow).
- Kick-Flo® (head and flow).
- Mean flow over head range.
- Objective

Additional information is provided on:

- The minimum outlet pipe diameter to which the unit can be fitted.
- The suggested minimum flow control manhole diameter (this suggestion is based on the flow control size only and does not consider inlet / outlet pipe sizes and positions).
- Depth / Flow data.

3.2.5 Dimensioned Drawings

The [Hydro-Brake Optimum® Design Tool](#) can also be used to view and obtain detailed dimensioned drawings of Hydro-Brake Optimum® units. Contact us for detailed drawings for all other Hydro-Brake® Flow Controls.



Technical Specification

Control Point	Head (m)	Flow (l/s)
Primary Design	1.500	5.452
Flush-Flo™	0.446	5.447
Kick-Flo®	0.914	4.334
Mean Flow		4.784

Hydro-Brake Optimum® Flow Control including:

- 2mm (2008 - 2006) stainless steel
- Integral stainless steel jacking system
- Allow allowing clear line of sight through to outlet (no stainless steel operating rope)
- Steel housing frame for maximum component resistance
- Stainless steel fittings
- Neoprene gasket to seal outlet
- Variable flow rate valve via adjustable steel

BBA
WRc
APPROVED
PFD00412

IMPORTANT: ALL SET OF HYDRO-INTERNATIONAL SUPPLY THE DEVICE WILL BE HANDLED TO SITE CONDITIONS FOR SITE SPECIFIC TALE AND MINIMUM CHAMBER SIZE REFER TO HYDRO INTERNATIONAL. ALL CALL AND INSTALLATION WORK BY OTHERS. THESE SUPPLIES HYDRO-BRAKE® FLOW CONTROL & HYDRO-BRAKE OPTIMUM® FLOW CONTROL ARE REGISTERED TRADEMARKS FOR FLOW CONTROL'S DESIGNED AND MANUFACTURED EXCLUSIVELY BY HYDRO-INTERNATIONAL.

THIS DESIGN LAYOUT IS FOR ILLUSTRATIVE PURPOSES ONLY. NOT TO SCALE.

DESIGN ADVICE: The headflow characteristics of this SHE-0103-8500-1500-8500 Hydro-Brake Optimum® Flow Control are unique. Dynamic hydraulic modelling evaluates the full headflow characteristic curve. The use of any other flow control will invalidate any design based on this data and could constitute a flood risk.

DATE	24/10/2013 10:45:59	SHE-0103-5500-1500-5500
SITE		
DESIGNER	Neil McCarthy	Hydro-Brake Optimum®
REF	© 2013 Hydro-International, Shearwater House, Shearwater Hill, Shearwater Road, Crawley, West Sussex, BN11 2RT, UK. Tel: 01243 820201. Fax: 01243 820202. Web: www.hydro-int.com. Email: sales@hydro-int.com	

nmccarthy@hydro-int.com V1.0.0.0

3.3 Hydro-Brake® Flow Control Selection Guidance – Foul / Combined Water; Fluvial; Sumpless and Constrained Applications

The Hydro-Brake Optimum® range for foul / combined water, fluvial and sumpless applications will be integrated into a future release of Micro Drainage.


Range	Type	Style/Typical Shape	Application	Design/Installation Notes
Hydro-Brake Optimum® - Conical Type Units	n/a		Foul/combined and surface/storm water	BBA and WRc Approved. Design objective can be specified. Available with optional adjustable inlet. Conical units require benching into the intake.

Table 3 - Hydro-Brake Optimum® Conical Range for foul / combined; fluvial or sumpless applications

The design flowchart (Figure 2) should be used to determine which Hydro-Brake® Flow Control to use for any given application.

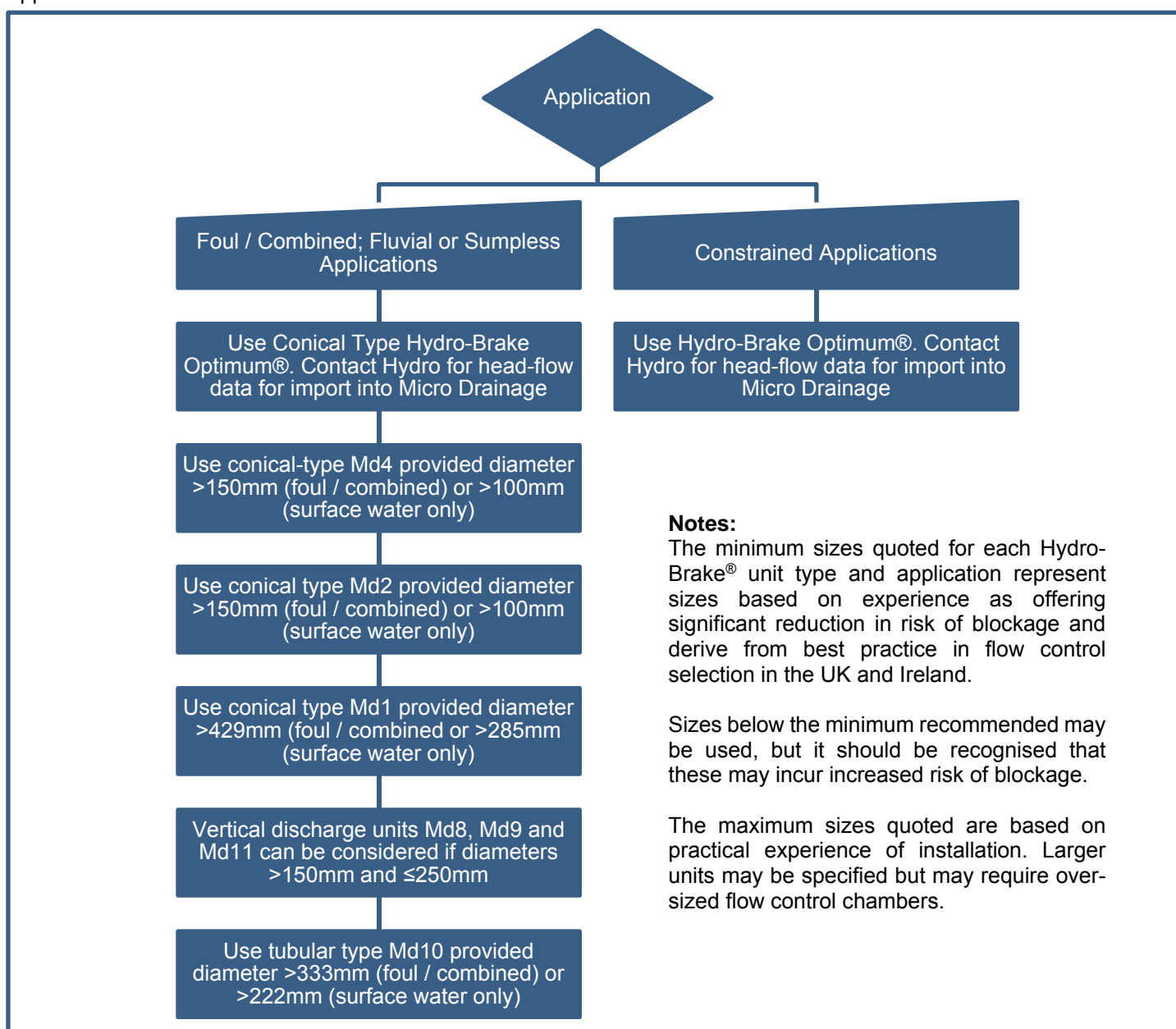


Figure 2 - Micro Drainage 2014 Design Flowchart

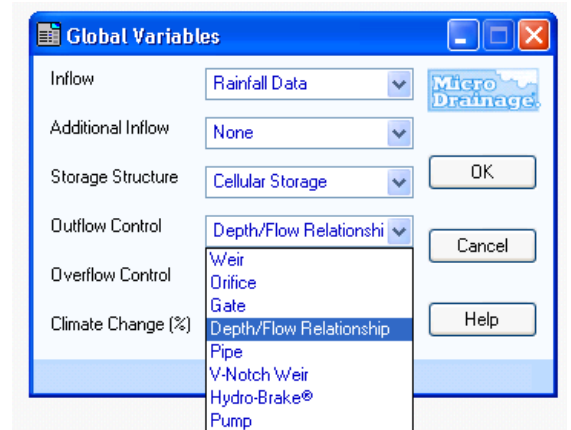
3.3.1 Importing Hydro-Brake Optimum® Hydraulic Data

Contact us for Hydro-Brake Optimum® hydraulic data for units for foul / combined water; fluvial; sumpless or constrained applications. We will provide a *Micro Drainage Compatible* data file in comma separated value (.csv) format that can be opened in Microsoft Excel or similar.

This data can be imported into Micro Drainage 2014 using the following steps:

Step 1: Global Variables / Online Controls

Choose 'Depth/Flow Relationship' from the drop down list.



Step 2: Copy Hydro-Brake Optimum® depth / flow data

The *Depth/Flow Relationship Outflow Control* dialogue window in WinDes® is sized to accept 51 values of depth and flow. The depth / flow data as provided by Hydro International will also contain 51 values at equal depth increments to suit the design criteria for the site. An allowance is added above the maximum design water depth to allow for surcharge of the network and design storm exceedance.

Open the Hydro-Brake Optimum® depth / flow data in Microsoft Excel (or similar), select and copy the *Depth* and *Outflow* data and paste this data directly into the WinDes® *Depth/Flow Relationship Outflow Control* dialogue box.

Depth (m)	Outflow (l/s)
0.02	0.235
0.041	0.869
0.061	1.773
0.082	2.776
0.102	3.633
0.122	4.327
0.143	4.537
0.163	4.664
0.184	4.759
0.204	4.83
0.224	4.88
0.245	4.913

Expert Design Service

Hydro's professional engineers are on hand to provide free support to aid with correct design and application of Hydro products within each drainage design.

Our dedicated design support team is available to advise on all aspects of Hydro-Brake Optimum® design, including use of the Hydro-Brake Optimum® Design Tool and modelling of the Hydro-Brake Optimum® in commercial modelling software. We can also provide you with a detailed quotation for any units designed using the Hydro-Brake Optimum® Design Tool.

Hydro-Brake Optimum® Hotline: 01275 337937

Email: enquiries@hydro-int.com

The Hydro-Brake Optimum® has been assessed to the very highest level by the BBA and WRc. These assessments include:

- Hydraulic design and performance.
- Structural design and performance.
- Material and manufacturing quality.
- Practicability and ease of installation.



Stormwater Solutions

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