



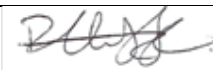
BELL MUNRO CONSULTING LTD.

**Proposed Development at
Old Market Street, Blackley**

**Drainage Calculations
November 2023**

Rev A 30/11/23

To include MH/pipeline/flow control/storage schedules

	Initials	Signature	Date
Prepared by:	R.C		11/23
Checked by:	S.J.B		11/23
Approved by:	S.J.B		11/23

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Philosophy

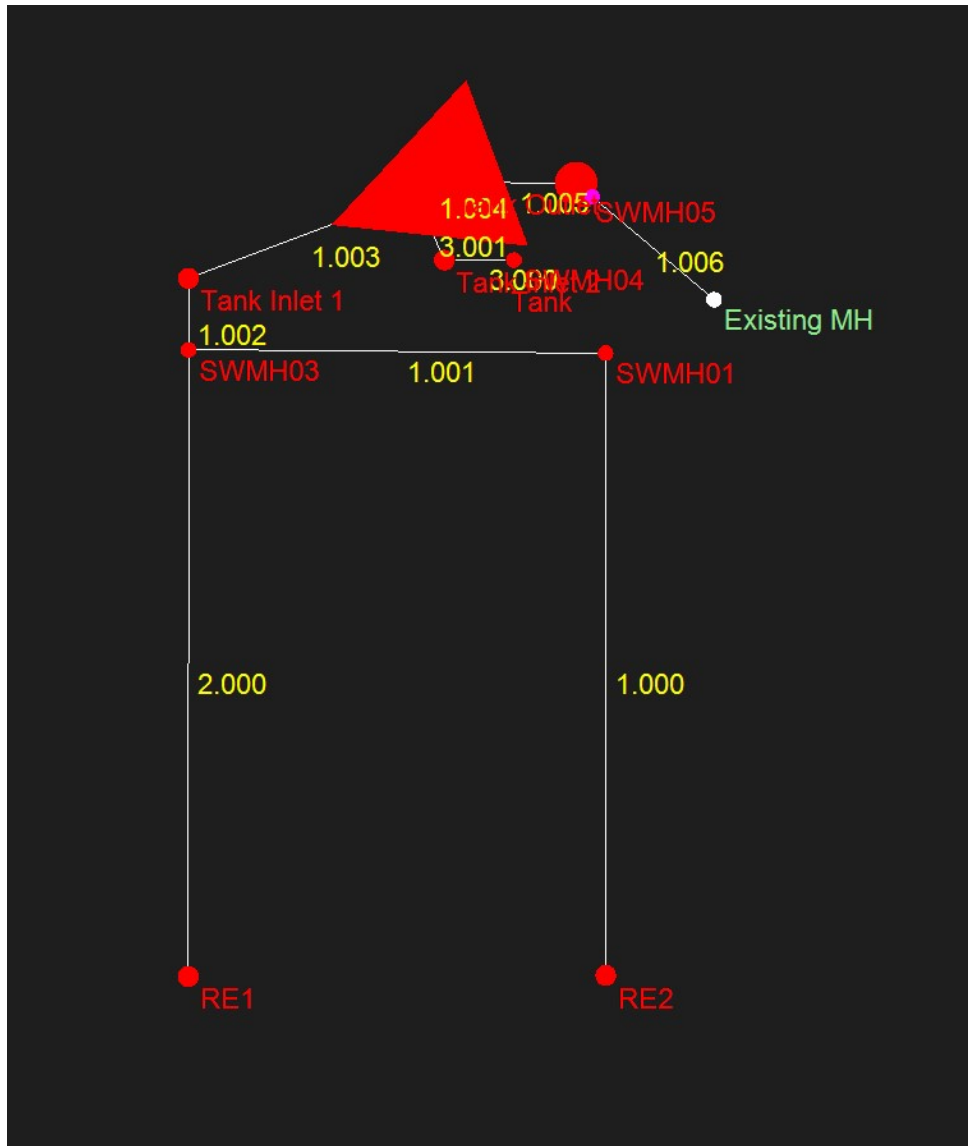
An analysis of the site following the SuDS hierarchy has concluded that the only viable option for discharging the surface water from the development is via a connection to a combined sewer.

An assessment has been made of the existing runoff from the site for a worst case event with a 1 year return period. The maximum discharge rate was found to be 9.2l/s as shown by the Microdrainage calculation attached.

To offer a 50% betterment on the existing rate, a maximum discharge rate of 4.6l/s has been proposed for all storms up to the 1 in 100 year event plus a 40% climate change allowance. During these events, the proposed drainage system has been designed to allow no flooding on the site.

Microdrainage calculations for the proposed drainage system are attached.





Screenshot of Microdrainage Model

Pipe Numbers and Manhole References are also shown on drawing J7996/D01

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Date 30/11/2023 File J7996 D01 REV C.MDX	Designed by RichardCliffe Checked by SimonBerry	
XP Solutions		Network 2020.1

STORM SEWER DESIGN by the Modified Rational Method

Design Criteria for Surface Network 1

Pipe Sizes STANDARD Manhole Sizes STANDARD

FSR Rainfall Model - England and Wales

Return Period (years)	100	PIMP (%)	100
M5-60 (mm)	18.700	Add Flow / Climate Change (%)	0
Ratio R	0.308	Minimum Backdrop Height (m)	0.200
Maximum Rainfall (mm/hr)	50	Maximum Backdrop Height (m)	1.500
Maximum Time of Concentration (mins)	30	Min Design Depth for Optimisation (m)	1.200
Foul Sewage (l/s/ha)	0.000	Min Vel for Auto Design only (m/s)	1.00
Volumetric Runoff Coeff.	0.750	Min Slope for Optimisation (1:X)	500

Designed with Level Soffits

Time Area Diagram for Surface Network 1

Time (mins)	Area (ha)	Time (mins)	Area (ha)
0-4	0.043	4-8	0.020

Total Area Contributing (ha) = 0.064

Total Pipe Volume (m³) = 0.865

Network Design Table for Surface Network 1

« - Indicates pipe capacity < flow

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
1.000	17.581	0.176	100.0	0.011	5.00	0.0	0.600	o	100	Pipe/Conduit	
1.001	11.784	0.140	84.2	0.029	0.00	0.0	0.600	o	150	Pipe/Conduit	
2.000	17.701	0.177	100.0	0.011	5.00	0.0	0.600	o	100	Pipe/Conduit	

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	I.Area (ha)	Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
1.000	50.00	5.38	57.296	0.011	0.0	0.0	0.0	0.77	6.0	1.5
1.001	50.00	5.56	57.120	0.040	0.0	0.0	0.0	1.10	19.4	5.5
2.000	50.00	5.38	56.687	0.011	0.0	0.0	0.0	0.77	6.0	1.4

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Manhole Schedules for Surface Network 1

MH Name	MH CL (m)	MH Depth (m)	MH Connection	MH Diam., L*W (mm)	PN	Pipe Out Invert Level (m)	Diameter (mm)	PN	Pipes In Invert Level (m)	Diameter (mm)	Back (mm)
RE2	57.800	0.504	Open Manhole	600	1.000	57.296	100				
SWMH01	57.820	0.700	Open Manhole	450	1.001	57.120	150	1.000	57.120	100	
RE1	57.800	1.113	Open Manhole	600	2.000	56.687	100				
SWMH03	58.200	1.690	Open Manhole	450	1.002	56.510	150	1.001	56.980	150	
								2.000	56.510	100	
Tank Inlet 1	58.080	1.595	Open Manhole	600	1.003	56.485	150	1.002	56.485	150	
SWMH04	58.080	1.570	Open Manhole	450	3.000	56.510	100				
Tank Inlet 2	58.080	1.590	Open Manhole	600	3.001	56.490	150	3.000	56.490	100	
Tank	58.080	1.600	Open Manhole	600	1.004	56.480	150	1.003	56.480	150	
								3.001	56.480	150	
Tank Outlet	58.080	1.601	Open Manhole	600	1.005	56.479	150	1.004	56.479	150	
SWMH05	58.360	1.893	Open Manhole	1200	1.006	56.467	150	1.005	56.467	150	
Existing MH	57.950	1.500	Open Manhole	450		OUTFALL		1.006	56.450	150	

MH Name	Manhole Easting (m)	Manhole Northing (m)	Intersection Easting (m)	Intersection Northing (m)	Manhole Access	Layout (North)
RE2	-366.956	419.625	-366.956	419.625	Required	
SWMH01	-366.961	437.206	-366.961	437.206	Required	
RE1	-378.755	419.593	-378.755	419.593	Required	
SWMH03	-378.744	437.295	-378.744	437.295	Required	
Tank Inlet 1	-378.744	439.317	-378.744	439.317	Required	
SWMH04	-369.550	439.831	-369.550	439.831	Required	
Tank Inlet 2	-371.514	439.831	-371.514	439.831	Required	
Tank	-372.365	441.699	-372.365	441.699	Required	

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Manhole Schedules for Surface Network 1

MH Name	Manhole Easting (m)	Manhole Northing (m)	Intersection Easting (m)	Intersection Northing (m)	Manhole Access	Layout (North)
Tank Outlet	-371.514	442.017	-371.514	442.017	Required	
SWMH05	-367.793	442.010	-367.793	442.010	Required	
Existing MH	-363.896	438.711			No Entry	

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PIPELINE SCHEDULES for Surface Network 1

Upstream Manhole

PN	Hyd Sect	Diam (mm)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
1.000	o	100	RE2	57.800	57.296	0.404	Open Manhole	600
1.001	o	150	SWMH01	57.820	57.120	0.550	Open Manhole	450
2.000	o	100	RE1	57.800	56.687	1.013	Open Manhole	600
1.002	o	150	SWMH03	58.200	56.510	1.540	Open Manhole	450
1.003	o	150	Tank Inlet 1	58.080	56.485	1.445	Open Manhole	600
3.000	o	100	SWMH04	58.080	56.510	1.470	Open Manhole	450
3.001	o	150	Tank Inlet 2	58.080	56.490	1.440	Open Manhole	600
1.004	o	150	Tank	58.080	56.480	1.450	Open Manhole	600
1.005	o	150	Tank Outlet	58.080	56.479	1.451	Open Manhole	600
1.006	o	150	SWMH05	58.360	56.467	1.743	Open Manhole	1200

Downstream Manhole

PN	Length (m)	Slope (1:X)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
1.000	17.581	100.0	SWMH01	57.820	57.120	0.600	Open Manhole	450
1.001	11.784	84.2	SWMH03	58.200	56.980	1.070	Open Manhole	450
2.000	17.701	100.0	SWMH03	58.200	56.510	1.590	Open Manhole	450
1.002	2.022	80.0	Tank Inlet 1	58.080	56.485	1.445	Open Manhole	600
1.003	6.809	1441.8	Tank	58.080	56.480	1.450	Open Manhole	600
3.000	1.964	100.0	Tank Inlet 2	58.080	56.490	1.490	Open Manhole	600
3.001	2.053	197.4	Tank	58.080	56.480	1.450	Open Manhole	600
1.004	0.909	1515.1	Tank Outlet	58.080	56.479	1.451	Open Manhole	600
1.005	3.721	300.1	SWMH05	58.360	56.467	1.743	Open Manhole	1200
1.006	5.106	300.3	Existing MH	57.950	56.450	1.350	Open Manhole	450

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Area Summary for Surface Network 1

Pipe Number	PIMP Type	PIMP Name	PIMP (%)	Gross Area (ha)	Imp. Area (ha)	Pipe Total (ha)
1.000	User	-	100	0.011	0.011	0.011
1.001	User	-	100	0.010	0.010	0.010
	User	-	100	0.010	0.010	0.019
	User	-	100	0.010	0.010	0.029
2.000	User	-	100	0.011	0.011	0.011
1.002	-	-	100	0.000	0.000	0.000
1.003	-	-	100	0.000	0.000	0.000
3.000	User	-	100	0.013	0.013	0.013
3.001	-	-	100	0.000	0.000	0.000
1.004	-	-	100	0.000	0.000	0.000
1.005	-	-	100	0.000	0.000	0.000
1.006	-	-	100	0.000	0.000	0.000
				Total	Total	Total
				0.064	0.064	0.064

Simulation Criteria for Surface Network 1

Volumetric Runoff Coeff	0.750	Additional Flow - % of Total Flow	0.000
Areal Reduction Factor	1.000	MADD Factor * 10m³/ha Storage	0.000
Hot Start (mins)	0	Inlet Coefficient	0.800
Hot Start Level (mm)	0	Flow per Person per Day (l/per/day)	0.000
Manhole Headloss Coeff (Global)	0.500	Run Time (mins)	60
Foul Sewage per hectare (l/s)	0.000	Output Interval (mins)	1

Number of Input Hydrographs	0	Number of Storage Structures	1
Number of Online Controls	1	Number of Time/Area Diagrams	0
Number of Offline Controls	0	Number of Real Time Controls	0

Synthetic Rainfall Details

Rainfall Model	FSR	Profile Type	Summer
Return Period (years)	100	Cv (Summer)	0.750
Region	England and Wales	Cv (Winter)	0.840
M5-60 (mm)	18.700	Storm Duration (mins)	30
Ratio R	0.308		

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Online Controls for Surface Network 1

Hydro-Brake® Optimum Manhole: SWMH05, DS/PN: 1.006, Volume (m³): 2.2

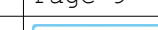
Unit Reference	MD-SHE-0101-4600-1000-4600
Design Head (m)	1.000
Design Flow (l/s)	4.6
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	101
Invert Level (m)	56.467
Minimum Outlet Pipe Diameter (mm)	150
Suggested Manhole Diameter (mm)	1200

Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.000	4.6
Flush-Flo™	0.293	4.6
Kick-Flo®	0.633	3.7
Mean Flow over Head Range	-	4.0

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	3.4	1.200	5.0	3.000	7.7	7.000	11.5
0.200	4.5	1.400	5.4	3.500	8.3	7.500	11.9
0.300	4.6	1.600	5.7	4.000	8.8	8.000	12.2
0.400	4.5	1.800	6.0	4.500	9.3	8.500	12.6
0.500	4.4	2.000	6.3	5.000	9.8	9.000	12.9
0.600	4.0	2.200	6.6	5.500	10.2	9.500	13.3
0.800	4.1	2.400	6.9	6.000	10.7		
1.000	4.6	2.600	7.2	6.500	11.1		

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XP Solutions Network 2020.1																				
Storage Structures for Surface Network 1 Cellular Storage Manhole: Tank, DS/PN: 1.004 Invert Level (m) 56.480 Safety Factor 2.0 Infiltration Coefficient Base (m/hr) 0.00000 Porosity 0.95 Infiltration Coefficient Side (m/hr) 0.00000 <table><thead><tr><th>Depth (m)</th><th>Area (m²)</th><th>Inf. Area (m²)</th><th>Depth (m)</th><th>Area (m²)</th><th>Inf. Area (m²)</th></tr></thead><tbody><tr><td>0.000</td><td>32.0</td><td>32.0</td><td>0.500</td><td>0.0</td><td>41.6</td></tr><tr><td>0.400</td><td>32.0</td><td>41.6</td><td></td><td></td><td></td></tr></tbody></table>			Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)	0.000	32.0	32.0	0.500	0.0	41.6	0.400	32.0	41.6			
Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)															
0.000	32.0	32.0	0.500	0.0	41.6															
0.400	32.0	41.6																		
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Summary of Critical Results by Maximum Level (Rank 1) for Surface Network 1

Simulation Criteria

Number of Input Hydrographs	0	Number of Storage Structures	1
Number of Online Controls	1	Number of Time/Area Diagrams	0
Number of Offline Controls	0	Number of Real Time Controls	0

Rainfall Model	FSR	Ratio R	0.305
Region	England and Wales	Cv (Summer)	0.750
M5-60 (mm)	18.800	Cv (Winter)	0.840

Profile(s)	Summer and Winter
Duration(s) (mins)	15, 30, 60, 120, 180, 240, 360, 480, 600, 720, 960, 1440
Return Period(s) (years)	100
Climate Change (%)	40

PN	US/MH Name	Water	Surcharged	Flooded			Half Drain	Pipe	Status
		Level (m)	Depth (m)	Volume (m³)	Flow / Cap.	Overflow (l/s)	Time (mins)	Flow (l/s)	
1.000	RE2	57.506	0.110	0.000	0.57			3.3	SURCHARGED
1.001	SWMH01	57.498	0.228	0.000	0.70			12.3	SURCHARGED
2.000	RE1	57.496	0.709	0.000	0.52			3.0	SURCHARGED

Technical Specification

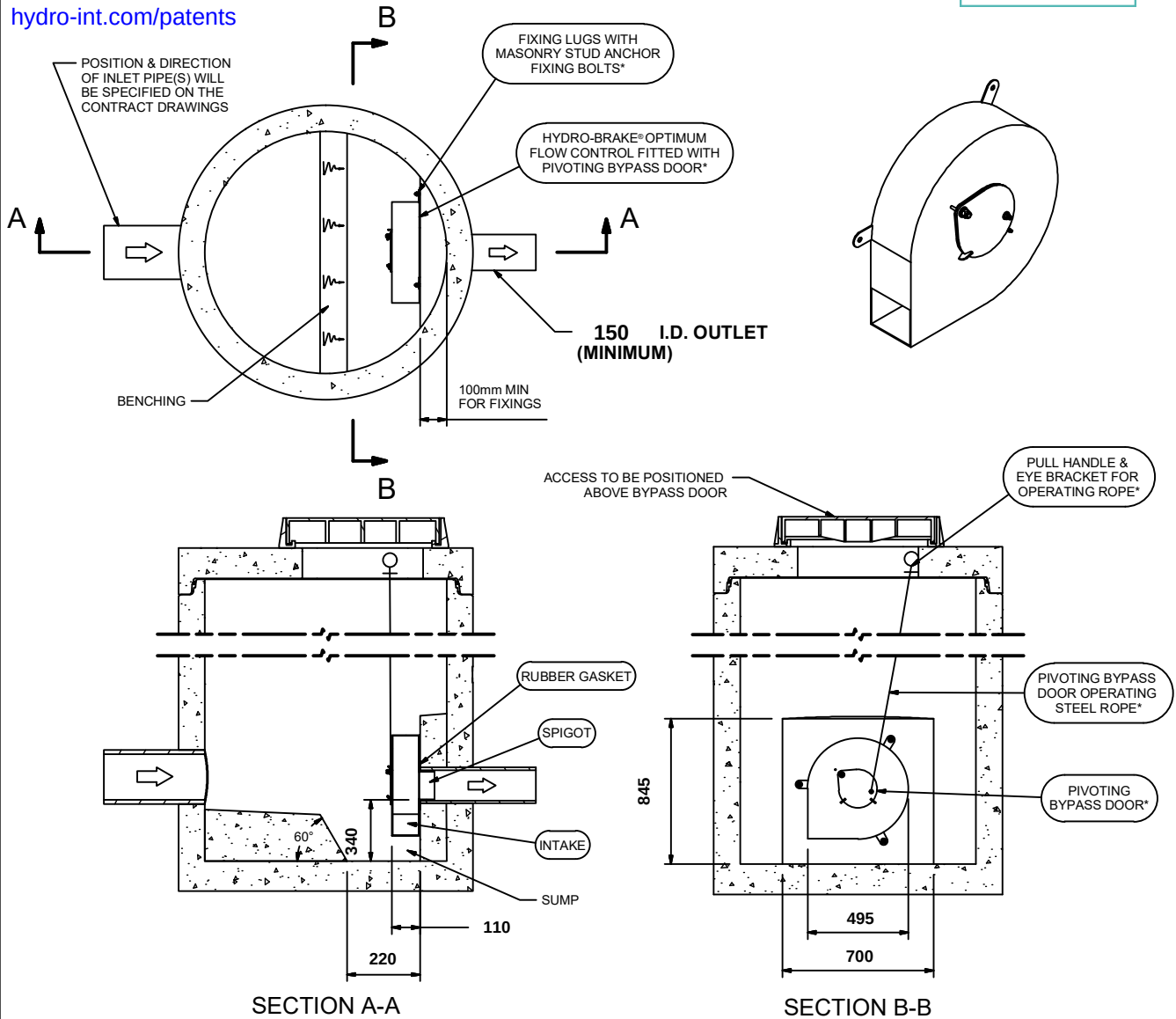
Control Point	Head (m)	Flow (l/s)
Primary Design	1.000	4.600
Flush-Flo™	0.293	4.595
Kick-Flo®	0.633	3.726
Mean Flow		3.999

Hydro-Brake® Optimum Flow Control including:

- 3 mm grade 304L stainless steel
- Integral stainless steel pivoting by-pass door allowing clear line of sight through to outlet, c/w stainless steel operating rope
- Beed blasted finish to maximise corrosion resistance
- Stainless steel fixings
- Rubber gasket to seal outlet
- Indicative Weight: 10 kg



hydro-int.com/patents



IMPORTANT:

○ LIMIT OF HYDRO INTERNATIONAL SUPPLY

THE DEVICE WILL BE HANDED TO SUIT SITE CONDITIONS
FOR SITE SPECIFIC DETAILS AND MINIMUM CHAMBER SIZE REFER TO HYDRO INTERNATIONAL
ALL CIVIL AND INSTALLATION WORK BY OTHERS

* WHERE SUPPLIED

HYDRO-BRAKE® FLOW CONTROL & HYDRO-BRAKE® OPTIMUM FLOW CONTROL ARE REGISTERED TRADEMARKS FOR FLOW CONTROLS DESIGNED AND MANUFACTURED EXCLUSIVELY BY HYDRO INTERNATIONAL

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

**DESIGN
ADVICE**



The head/flow characteristics of this SHE-0101-4600-1000-4600 Hydro-Brake® Optimum Flow Control are unique. Dynamic hydraulic modelling evaluates the full head/flow characteristic curve.
The use of any other flow control will invalidate any design based on this data and could constitute a flood risk.

Hydro
International®

DATE 17/07/2023 08:24

SITE

DESIGNER Richard Cliffe

REF

SHE-0101-4600-1000-4600

Hydro-Brake® Optimum