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CIVIL AND STRUCTURAL ENGINEERING CONSULTANTS

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Job No: 2389E

25th July 2022

18, Linksway, Northwood, Middlesex, HA6 2XB
Proposed Re-Development of the above site with 1 new residential house

Surface Water Drainage

Impermeable Areas
Existing

The existing house and its garage and driveway, all drain to the public foul water sewer in Linksway.

A*p* = 0.120hectares (existing site)

Therefore existing 1 in 1 year site discharge approximates to:

Q = 2.78 x 55 x 0.120 = 18.35 litres per second (based on Tc = 5 mins, R = 55mm/hr)

Proposed (1 house development)

Ap_1 house (roofs)	= 0.052 ha
Ap_2 driveway	= 0.030 ha
Ap_3 patios	= 0.023 ha

Total A*p* = 0.105ha (post development)

It has been established that there are no ditches, or watercourses in the vicinity of the site and that the sub-soil is predominantly clay and not suitable for a soakaway system of drainage.

It is therefore proposed to discharge surface water run-off from the developed site to the public surface water sewer in Linksway, with a flow restriction below the existing 1 in 1 year rate. The flow will be restricted using a hydrobrake flow control, the flow restriction will be set to 9 litres per second which is a greater than 50% reduction from the existing 1 in 1 year flow.

There are significant tree root protection zones within the site which restrict the possibility of large storage attenuation tanks, which is further complicated by the topography of the site.

From the attached hydraulic modelling it can be seen that a system of over sized pipes and manholes, including a flow control manhole provides sufficient storage to accommodate a 1 in 30 year storm event, restricted to an outflow of 9 litres per second (less than 50% of the existing 1 in 1 year discharge from the site).

The existing situation is further improved by no longer discharging surface water to the public foul sewer and creating a new connection to the public surface water sewer, as required in the drainage hierarchy of the Building Regulations and the London Plan Policy SI 5.

Rainwater Harvesting

A rainwater harvesting tank has been proposed at the rear of the property under the patio, providing 1500 litres of water for irrigation. This tank will be filled during rainfall from patio.

Maintenance Management Plan

The maintenance requirements for each proposed SuDS component is given below, based on the CIRIA report C753 "The SuDS Manual".

The maintenance of the drainage system will be the responsibility of the property owner.

Drainage Pipes and Inspection Chambers

Maintenance Schedule	Required Action	Typical Frequency
Regular Maintenance	Remove sediment and debris from inspection chambers, channel drainage and hydro-brake flow control manhole.	Annually
	Cleaning of gutters and any filters on downpipes.	Annually
	Remove any root ingress	As required
Occasional Maintenance	CCTV Survey of drains to check for cracking, misalignment, blockage.	10 year interval

Design Settings

Rainfall Methodology	FSR	Maximum Time of Concentration (mins)	30.00
Return Period (years)	2	Maximum Rainfall (mm/hr)	50.0
Additional Flow (%)	0	Minimum Velocity (m/s)	1.00
FSR Region	England and Wales	Connection Type	Level Soffits
M5-60 (mm)	20.000	Minimum Backdrop Height (m)	0.200
Ratio-R	0.400	Preferred Cover Depth (m)	1.200
CV	0.750	Include Intermediate Ground	✓
Time of Entry (mins)	4.00	Enforce best practice design rules	✓

Nodes

Name	Area (ha)	T of E (mins)	Cover Level (m)	Diameter (mm)	Easting (m)	Northing (m)	Depth (m)
S6	0.013	4.00	66.225	600	508445.558	190856.892	1.796
S5	0.030	4.00	66.225	1200	508455.750	190842.698	2.314
S4	0.013	4.00	66.225	600	508428.799	190828.293	1.377
S3	0.011	4.00	66.225	1200	508430.704	190821.060	2.002
S2	0.030	4.00	66.225	1200	508459.464	190828.484	2.570
S1	0.008	4.00	65.350	1200	508467.154	190832.122	1.730
OUTFALL			64.900	1200	508478.040	190834.320	1.500

Links

Name	US Node	DS Node	Length (m)	ks (mm) / n	US IL (m)	DS IL (m)	Fall (m)	Slope (1:X)	Dia (mm)	T of C (mins)	Rain (mm/hr)
1.000	S4	S3	7.500	0.600	64.848	64.348	0.500	15.0	100	4.06	50.0
1.001	S3	S2	29.000	0.600	64.223	63.730	0.493	58.8	225	4.35	50.0
1.002	S2	S1	7.000	0.600	63.655	63.620	0.035	200.0	300	4.45	50.0
1.003	S1	OUTFALL	11.000	0.600	63.620	63.400	0.220	50.0	150	4.58	50.0
2.000	S6	S5	17.500	0.600	64.429	63.986	0.443	39.5	150	4.18	50.0
2.001	S5	S2	14.500	0.600	63.911	63.730	0.181	80.1	225	4.35	50.0

Name	Vel (m/s)	Cap (l/s)	Flow (l/s)	US Depth (m)	DS Depth (m)	Σ Area (ha)	Σ Add Inflow (l/s)
1.000	2.005	15.7	1.8	1.277	1.777	0.013	0.0
1.001	1.708	67.9	3.3	1.777	2.270	0.024	0.0
1.002	1.108	78.3	13.1	2.270	1.430	0.097	0.0
1.003	1.426	25.2	14.2	1.580	1.350	0.105	0.0
2.000	1.606	28.4	1.8	1.646	2.089	0.013	0.0
2.001	1.462	58.1	5.8	2.089	2.270	0.043	0.0

Simulation Settings

Rainfall Methodology	FSR	Analysis Speed	Normal
FSR Region	England and Wales	Skip Steady State	x
M5-60 (mm)	20.000	Drain Down Time (mins)	240
Ratio-R	0.400	Additional Storage (m³/ha)	20.0
Summer CV	0.750	Check Discharge Rate(s)	x
Winter CV	0.840	Check Discharge Volume	x

Storm Durations

15	30	60	120	180	240	360	480	600	720	960	1440

Return Period (years)	Climate Change (CC %)	Additional Area (A %)	Additional Flow (Q %)	Return Period (years)	Climate Change (CC %)	Additional Area (A %)	Additional Flow (Q %)
1	0	0	0	30	0	0	0
10	0	0	0				

Node S1 Online Hydro-Brake® Control

Flap Valve	x	Objective	(HE) Minimise upstream storage
Replaces Downstream Link	✓	Sump Available	✓
Invert Level (m)	63.620	Product Number	CTL-SHE-0131-9000-1500-9000
Design Depth (m)	1.500	Min Outlet Diameter (m)	0.150
Design Flow (l/s)	9.0	Min Node Diameter (mm)	1200

Rainfall

Event	Peak Intensity (mm/hr)	Average Intensity (mm/hr)	Event	Peak Intensity (mm/hr)	Average Intensity (mm/hr)
1 year 15 minute summer	109.521	30.991	10 year 360 minute summer	24.632	6.339
1 year 15 minute winter	76.857	30.991	10 year 360 minute winter	16.012	6.339
1 year 30 minute summer	71.439	20.215	10 year 480 minute summer	19.260	5.090
1 year 30 minute winter	50.133	20.215	10 year 480 minute winter	12.796	5.090
1 year 60 minute summer	48.435	12.800	10 year 600 minute summer	15.690	4.291
1 year 60 minute winter	32.179	12.800	10 year 600 minute winter	10.720	4.291
1 year 120 minute summer	30.053	7.942	10 year 720 minute summer	13.925	3.732
1 year 120 minute winter	19.966	7.942	10 year 720 minute winter	9.358	3.732
1 year 180 minute summer	23.233	5.979	10 year 960 minute summer	11.365	2.993
1 year 180 minute winter	15.102	5.979	10 year 960 minute winter	7.528	2.993
1 year 240 minute summer	18.475	4.882	10 year 1440 minute summer	8.174	2.191
1 year 240 minute winter	12.274	4.882	10 year 1440 minute winter	5.493	2.191
1 year 360 minute summer	14.169	3.646	30 year 15 minute summer	268.706	76.035
1 year 360 minute winter	9.210	3.646	30 year 15 minute winter	188.566	76.035
1 year 480 minute summer	11.185	2.956	30 year 30 minute summer	174.929	49.499
1 year 480 minute winter	7.431	2.956	30 year 30 minute winter	122.757	49.499
1 year 600 minute summer	9.182	2.511	30 year 60 minute summer	116.589	30.811
1 year 600 minute winter	6.274	2.511	30 year 60 minute winter	77.459	30.811
1 year 720 minute summer	8.203	2.199	30 year 120 minute summer	70.438	18.615
1 year 720 minute winter	5.513	2.199	30 year 120 minute winter	46.797	18.615
1 year 960 minute summer	6.768	1.782	30 year 180 minute summer	53.298	13.715
1 year 960 minute winter	4.483	1.782	30 year 180 minute winter	34.645	13.715
1 year 1440 minute summer	4.949	1.326	30 year 240 minute summer	41.604	10.995
1 year 1440 minute winter	3.326	1.326	30 year 240 minute winter	27.641	10.995
10 year 15 minute summer	211.819	59.937	30 year 360 minute summer	31.221	8.034
10 year 15 minute winter	148.645	59.937	30 year 360 minute winter	20.295	8.034
10 year 30 minute summer	136.831	38.718	30 year 480 minute summer	24.324	6.428
10 year 30 minute winter	96.022	38.718	30 year 480 minute winter	16.160	6.428
10 year 60 minute summer	90.826	24.003	30 year 600 minute summer	19.756	5.404
10 year 60 minute winter	60.342	24.003	30 year 600 minute winter	13.498	5.404
10 year 120 minute summer	54.899	14.508	30 year 720 minute summer	17.490	4.687
10 year 120 minute winter	36.474	14.508	30 year 720 minute winter	11.754	4.687
10 year 180 minute summer	41.666	10.722	30 year 960 minute summer	14.215	3.743
10 year 180 minute winter	27.084	10.722	30 year 960 minute winter	9.416	3.743
10 year 240 minute summer	32.645	8.627	30 year 1440 minute summer	10.161	2.723
10 year 240 minute winter	21.689	8.627	30 year 1440 minute winter	6.829	2.723

Results for 1 year Critical Storm Duration. Lowest mass balance: 99.29%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute winter	S6	10	64.456	0.027	1.9	0.0114	0.0000	OK
15 minute winter	S5	10	63.961	0.050	6.4	0.0697	0.0000	OK
15 minute winter	S4	10	64.872	0.024	1.9	0.0114	0.0000	OK
15 minute winter	S3	10	64.258	0.035	3.5	0.0429	0.0000	OK
15 minute winter	S2	13	63.938	0.283	14.4	0.3866	0.0000	OK
15 minute winter	S1	13	63.938	0.318	10.5	0.3885	0.0000	SURCHARGED
15 minute summer	OUTFALL	1	63.400	0.000	8.7	0.0000	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute winter	S6	2.000	S5	1.9	0.907	0.067	0.0366	
15 minute winter	S5	2.001	S2	6.4	0.827	0.110	0.3143	
15 minute winter	S4	1.000	S3	1.9	1.326	0.121	0.0107	
15 minute winter	S3	1.001	S2	3.5	0.721	0.051	0.5998	
15 minute winter	S2	1.002	S1	9.3	0.371	0.119	0.4878	
15 minute winter	S1	Hydro-Brake®	OUTFALL	8.8				6.8

Results for 10 year Critical Storm Duration. Lowest mass balance: 99.29%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute winter	S6	15	64.572	0.143	3.7	0.0613	0.0000	OK
15 minute winter	S5	14	64.574	0.663	15.3	0.9218	0.0000	SURCHARGED
15 minute winter	S4	10	64.883	0.035	3.7	0.0163	0.0000	OK
15 minute winter	S3	15	64.589	0.366	14.5	0.4545	0.0000	SURCHARGED
15 minute winter	S2	14	64.572	0.917	22.6	1.2511	0.0000	SURCHARGED
15 minute winter	S1	14	64.571	0.951	12.8	1.1637	0.0000	SURCHARGED
15 minute summer	OUTFALL	1	63.400	0.000	9.0	0.0000	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute winter	S6	2.000	S5	3.7	1.023	0.130	0.3057	
15 minute winter	S5	2.001	S2	11.3	0.838	0.194	0.5767	
15 minute winter	S4	1.000	S3	3.7	1.589	0.235	0.0355	
15 minute winter	S3	1.001	S2	-8.5	0.704	-0.125	1.1534	
15 minute winter	S2	1.002	S1	10.5	0.400	0.134	0.4929	
15 minute winter	S1	Hydro-Brake®	OUTFALL	9.0				13.3

Results for 30 year Critical Storm Duration. Lowest mass balance: 99.29%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
30 minute winter	S6	24	65.030	0.601	4.6	0.2571	0.0000	SURCHARGED
30 minute winter	S5	24	65.030	1.119	11.8	1.5551	0.0000	SURCHARGED
30 minute winter	S4	25	65.028	0.180	3.6	0.0851	0.0000	SURCHARGED
30 minute winter	S3	24	65.028	0.805	13.5	0.9992	0.0000	SURCHARGED
30 minute winter	S2	24	65.029	1.374	23.2	1.8743	0.0000	SURCHARGED
30 minute winter	S1	24	65.029	1.409	14.0	1.7227	0.0000	SURCHARGED
15 minute summer	OUTFALL	1	63.400	0.000	9.0	0.0000	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
30 minute winter	S6	2.000	S5	3.6	0.988	0.126	0.3081	
30 minute winter	S5	2.001	S2	9.2	0.787	0.158	0.5767	
30 minute winter	S4	1.000	S3	3.6	1.576	0.228	0.0587	
30 minute winter	S3	1.001	S2	-6.9	0.705	-0.101	1.1534	
30 minute winter	S2	1.002	S1	11.9	0.401	0.152	0.4929	
30 minute winter	S1	Hydro-Brake®	OUTFALL	9.0				21.9

Technical Specification

Control Point	Head (m)	Flow (l/s)
Primary Design	1.500	9.000
Flush-Flo™	0.440	8.994
Kick-Flo®	0.927	7.182
Mean Flow		7.853

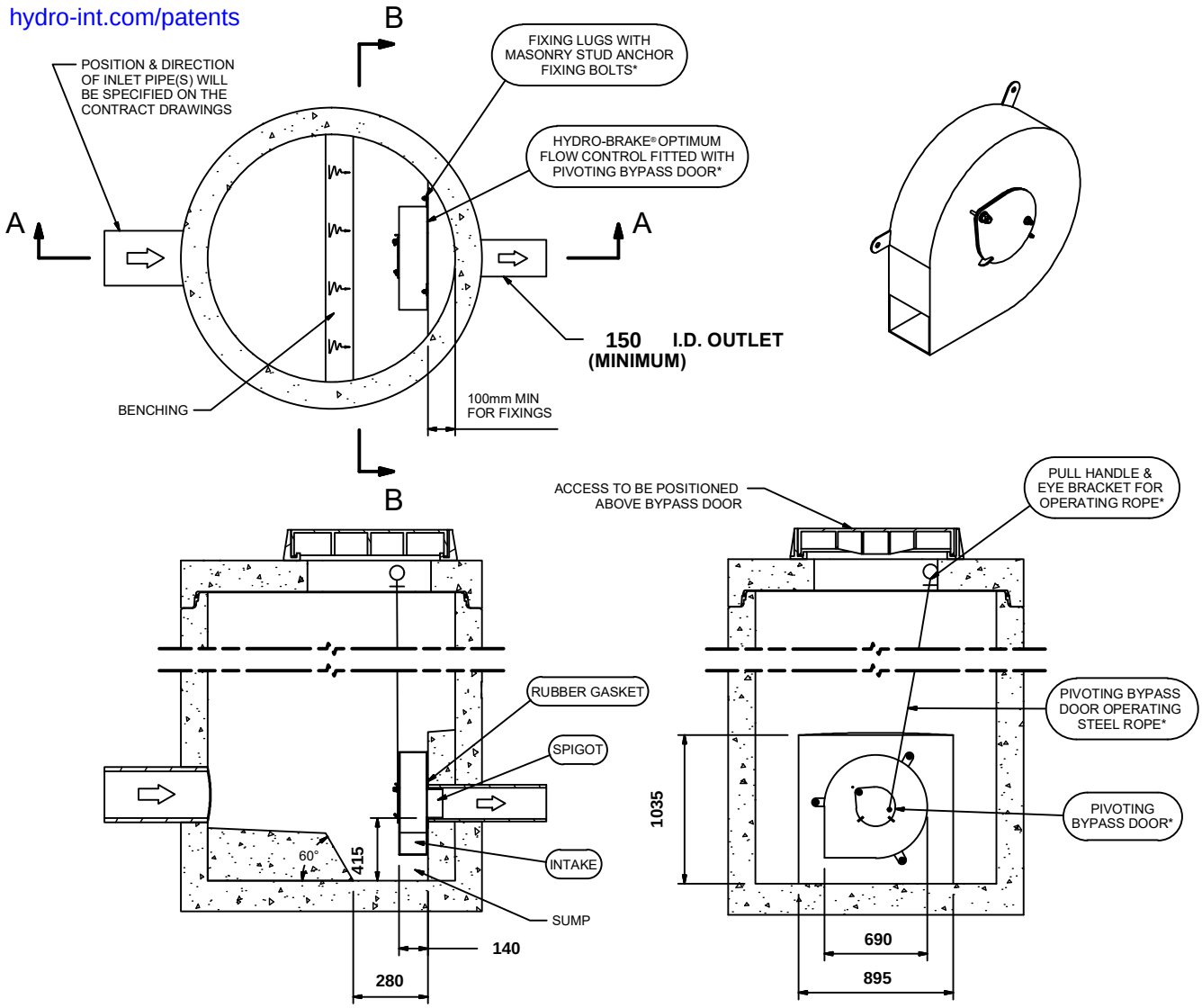
Hydro-Brake® Optimum Flow Control including:

- 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: 224 kg

BBA APPROVAL INSPECTION TESTING CERTIFICATION CERTIFICATE 08/4596

WRC Approved PT/329/0412

hydro-int.com/patents



SECTION A-A

SECTION B-B

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-0131-9000-1500-9000 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	26/07/2022 10:15
SITE	18 LINKSAY
DESIGNER	Philip Barton
REF	2389E

SHE-0131-9000-1500-9000
Hydro-Brake® Optimum

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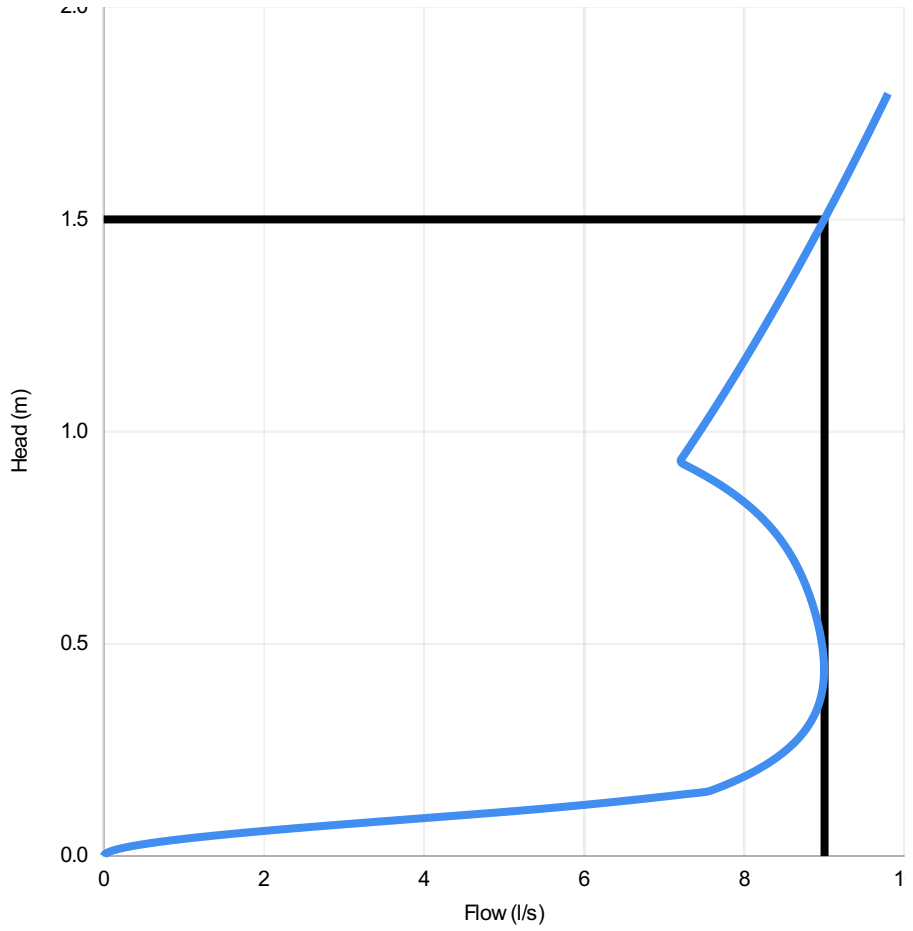

Head (m)	Flow (l/s)
0.000	0.000
0.052	1.563
0.103	4.960
0.155	7.593
0.207	8.192
0.259	8.575
0.310	8.808
0.362	8.936
0.414	8.988
0.466	8.989
0.517	8.952
0.569	8.888
0.621	8.800
0.672	8.684
0.724	8.530
0.776	8.322
0.828	8.039
0.879	7.658
0.931	7.202
0.983	7.380
1.034	7.559
1.086	7.733
1.138	7.903
1.190	8.069
1.241	8.231
1.293	8.390
1.345	8.546
1.397	8.699
1.448	8.849
1.500	8.996

DESIGN ADVICE

The head/flow characteristics of this SHE-0131-9000-1500-9000 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	26/07/2022 10:15
Site	18 LINKSAY
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Hydro-Brake Optimum®