Hydro Biofilter™

Design Data

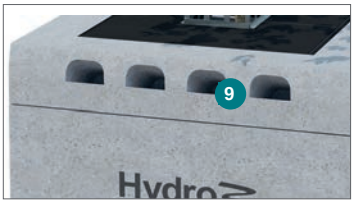
LM20066-DYSE-XX-ZZ-RP-C-0002
SuDS Verification Report P02
Appendix A - Specialist supplier information and product data review

The Hydro Biofilter™ is an innovative bioretention and biofiltration system that harnesses the natural treatment action of vegetation and the filtration power of specially engineered soils.

Hydro Biofilter™ engineers in nature's way to enhance any urban environment even where space is at a premium or where a retrofit surface water treatment solution is required. Suitable for residential or commercial settings, car parks and highways.

1) Robust chamber suitable for installation alongside highways.
2) Cover slab incorporating half-battered kerb and integrated kerb inlet slots (9).
3) Engineered filter media.
4) Enhanced mulch.
5) Tree or shrub.
6) Underdrain system.
7) Protective tree grate.
8) Pipe clean-out port (where required).
9) Half-battered kerb profile, complete with high capacity inlet slots for UK applications.
10) Tree guard

Note: Energy dissipater stones (omitted from drawing for clarity).





Components

From the surface Hydro Biofilter™ looks like a tree box, with a suitable shrub or small tree protruding through a decorative grating in a concrete slab at pavement level. Underneath, the pre-cast concrete chamber contains a layer of enhanced mulch, on top of a unique soil filter medium to deliver high levels of surface water treatment.

Similar in application and concept to a traditional bioretention system, the Hydro Biofilter™ has been optimised for high volume flow whilst retaining high pollutant removal efficiencies.

Figure 1 - The Hydro Biofilter™ Bioretention System

Repeatable, reliable performance

Surface water is channelled into the unit through a kerbside inlet, through an inlet pipe or directly from the surface and is filtered through the mulch and engineered soil-based media to provide effective removal and remediation of a number of pollutants including:

Very fine particles

Constructed to be functionally similar to an enhanced dry swale, comparable removal rates of 70-96% of total suspended solids can be achieved.

Gross pollutants

The integrated kerb inlet slots prevent larger litter from entering the system and are shaped to inhibit any smaller debris from becoming lodged within the inlet channels.

Liquid and sediment bound hydrocarbons

A substrate for natural bacteria is provided within the mulch layer for degradation of hydrocarbons. Removal efficiencies of 70-90% can be expected.

Sediment bound heavy metals

Heavy Metals

Plants assimilate metals and other contaminants into their bio-mass. Removal efficiencies are in the order of 50-98%.

Sediment bound nutrients

Nutrients

Nutrients including Nitrogen and Phosphorus are taken up by the plant and used for growth and other biological processes. Removal rates of 40-90% can be achieved.

Dissolved pollutants

Chemical and biological interactions within the soil ecosystem also work to isolate and remove dissolved pollutants.

As several processes are at work, there is an element of redundancy in the pollutant removal, which improves the overall reliability of the system.

The Simple Index Approach (SIA)

The Simple Index Approach outlined in CIRIA C753 The SuDS Manual is a water quality design method for sites with a low to medium risk pollution hazard level. Sites with a high risk pollution hazard level should consider a more precautionary approach.

The approach assigns pollution hazard indices to the given land use for three pollutant groups, total suspended solids (TSS), metals and hydrocarbons. SuDS components are then selected until their combined pollution mitigation index score is greater than the pollution hazard index for each pollutant group.

Hydro Biofilter™ SuDS Mitigation Indices [a]		
Total Suspended Solids (TSS)	**Metals**	**Hydrocarbons**
0.9	0.92	0.8

Notes:
(a) All mitigation indices supplied by Hydro International Ltd are independently verified and calculated using the methods laid out in the British Water How To Guide: Applying the CIRIA SuDS Manual Simple Index Approach to Proprietary / Manufactured Stormwater Treatment Devices.

Table 1 - SuDS mitigation indices for Hydro Biofilter™

Sizing

Section 4.3.2 of CIRIA C609 states that "*To remove the major proportion of pollution it is necessary to capture and treat the runoff from frequent small scale events and a proportion of the runoff (first flush) from larger and rarer events.... The depths of rainfall will be country specific and should be determined using UK rainfall data for the specific site location.*"

Designed as an inlet system, the Hydro Biofilter™ inlet structure has the capacity to accept flows associated with these frequent smaller events and first flush via a kerbside inlet, through an inlet pipe or channel or directly from the surface. A clearance is maintained beneath the cover slab to allow for some surface ponding.

The Hydro Biofilter™ unit will typically be designed to treat in excess of 90% of the average annual rainfall runoff volume. The remaining 10% of runoff can be diverted to appropriate temporary storage areas via an internal or external bypass arrangement.

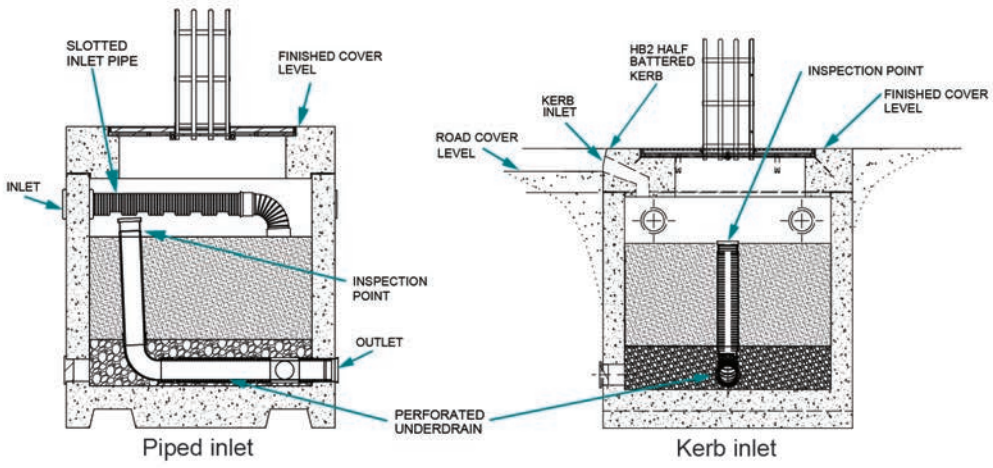
For initial sizing, it can be assumed that the filter surface area to drained area ratio will be between 0.2-0.3% for the UK.

Hydro Biofilter™ Sizes			Drained Area (m^2)		Outlet Flow Rate
Width (m)	**Length (m)**	**Filter Surface Area (m^2)**	**Minimum**	**Maximum**	
1.2	1.2	1.44	480	720	1.0 l/s
1.2	1.8	2.16	720	1080	1.5 l/s
1.2	2.4	2.88	960	1440	2.0 l/s

Table 2 - Hydro Biofilter™ design information.

Configuration options

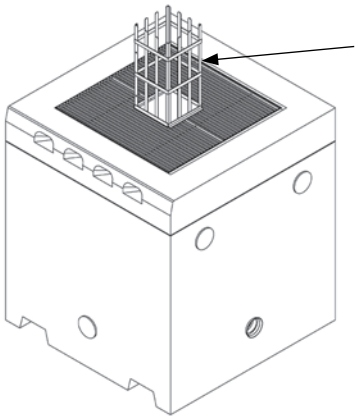
The piped or kerb inlet configurations are our most popular, but grille inlet only or a combined kerb and piped inlet configuration are also available.



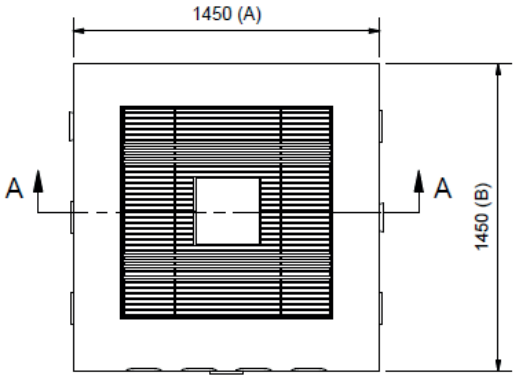
Chamber dimensions and weights

The dimensions in Table 3 are given as a guide.

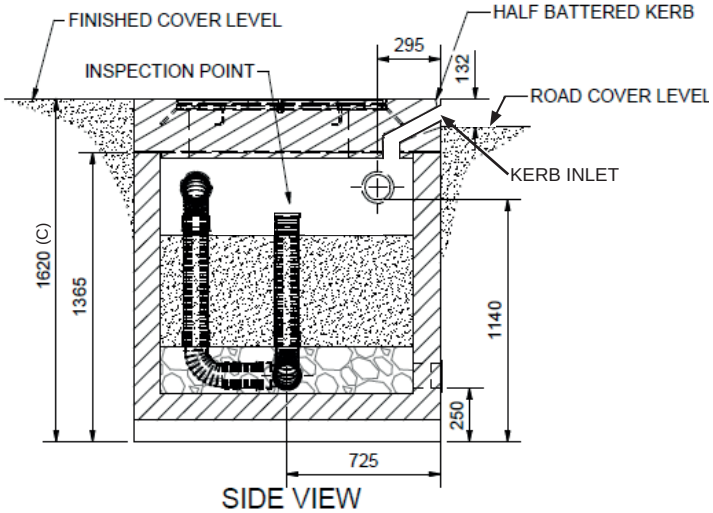
An indicative chamber drawing of the 1.2 m x 1.2 m Hydro Biofilter™ unit, as delivered to site, is shown below. Detailed installation drawings of each chamber size are available from Hydro International.



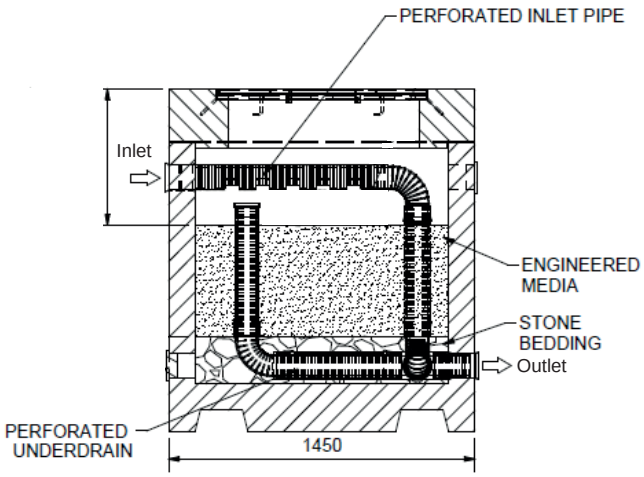
ISOMETRIC VIEW



PLAN VIEW



SIDE VIEW



SECTION A - A

Dimensions and Weights				
Hydro Biofilter™ Unit Size (internal dimensions) (mm)	**A (mm)**	**B (mm)**	**C (mm)**	**Total Chamber Weight (kg),** including all contents, fixtures and fixings.
1200 x 1200	1450	1450	1620	6300
1200 x 1800	2050	1450	1620	8700
1200 x 2400	2650	1450	1620	11200
Note: Chamber wall thickness is 125 mm.				

Table 3 - Hydro Biofilter™ dimensions and weights.

Maintenance

As a living system, the complex physical, chemical and biological processes at work within the Hydro Biofilter™ system act to recharge the filter media between storm events and so maintain the pollutant removal capabilities of the system.

The amount and type of maintenance required may vary from site to site depending on location, pollutant loading, storm conditions and local environmental strategy. However, the need for maintenance will generally be at a level consistent with the routine periodic maintenance of any landscaped area. This will maintain the appearance of the treatment area and its ability to infiltrate surface water and will include litter removal, pruning of plant, weeding and mulch replacement.

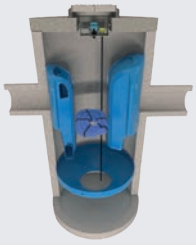
Expert Design Service

Hydro's professional engineers are able to utilise XP Solutions' Pluvius software, which contains over 700 years of UK rainfall data from the Met Office DELUGE® Database, to determine the local rainfall characteristics on a site-by-site basis. We can also provide estimated maintenance intervals, whole life cost estimates and predicted pollutant removal performance.

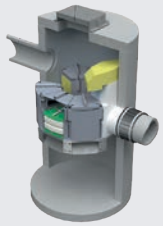
Call the Stormwater Hotline on: 01275 337937 or email stormwater@hydro-int.com

Our full range of stormwater treatment solutions

We have a range of stormwater treatment devices to treat stormwater flows of varying quality. All our solutions can work alongside, enable or enhance natural SuDS, helping to meet or improve on biodiversity and amenity targets.



Downstream Defender® Select



Up-Flo™ Filter



Hydro Biofilter™

Product		Description	Targeted pollutants						
			Sediments		Litter, debris	Liquid hydrocarbons	Sediment bound hydrocarbons, nutrients and heavy metals	Dissolved metals	Nutrients
Downstream Defender® Select	**Vortex**	Vortex separator	Coarse & fine	Retained up to 2 x treatment flow rate	✗	✗	✓	✗	✗
	Vortex Plus	Vortex plus separator	Coarse & fine	Retained up to 2 x treatment flow rate	✓	✓ Option for increased retention on request	✓	✗	✗
	Advanced Vortex	Advanced hydrodynamic vortex separator	Coarse & fine	Retained up to 4 x treatment flow rate	✓	✓ Option for increased retention on request	✓	✗	✗
Up-Flo™ Filter	**Sand**	Fluidised bed up flow filtration system with **Sand media**	Very fine sediment		✓	✓	✓	✗	✓
	CPZ	Fluidised bed up flow filtration system with **CPZ media**	Very fine sediment		✓	✓	✓	✓	✓
Hydro Biofilter™		Biofiltration system	Very fine and dissolved sediments		✓	✓	✓	✓	✓

To find out more about our range of stormwater treatment solutions visit hydro-int.com.

Downstream Defender® Select Up-Flo™ Filter Hydro-Biofilter™

Patent: www.hydro-int.com/patents

Tel: +44 (0)1275 337937 stormwater@hydro-int.com

Hydro International
Unit 2, Rivermead Court, Kenn Business Park,
Windmill Road, Kenn, Clevedon, BS21 6FT

hydro-int.com