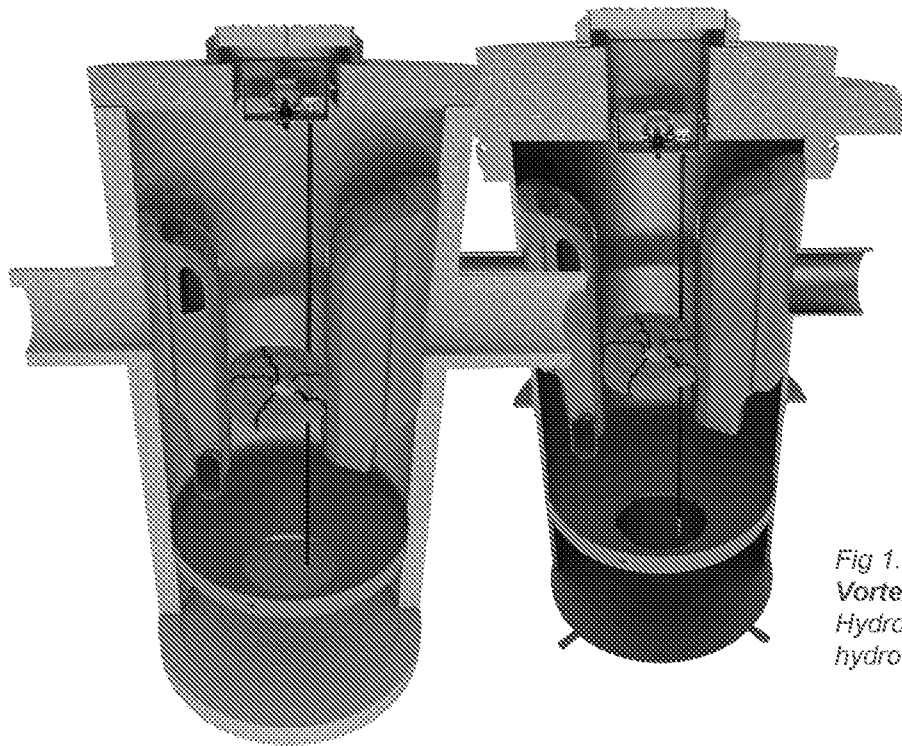


Downstream Defender® Select

Design Data



The Downstream Defender® Select is the new generation of advanced hydrodynamic separator for treatment of urban surface water runoff. Its customisable performance and extended range of chamber sizes allows engineers to tailor their drainage designs to meet specific pollutant removal standards. The Downstream Defender® Select also offers easier installation with much more flexibility of pipe sizes and connections and can accept up to three inlets.



Key Features

- » Selectable performance levels for pollutant targets and retention.
- » Extended range of chamber sizes.
- » Can accept up to three inlet pipes.
- » Can accept a range of pipe sizes.
- » No moving parts and no power requirement.
- » Available in concrete or plastic chambers.

Fig 1. Downstream Defender® Select. Advanced Vortex models in concrete and plastic shown with Hydro-Logic® Smart Monitoring and enhanced hydrocarbon (oil) retention options.

Targeted pollutant removal

The Downstream Defender® Select performance can be tailored to remove some or all of the following pollutants:

Sediment (Total Suspended Solids)



The Downstream Defender® Select is a highly effective sediment/TSS removal device. It can be sized in a number of ways to suit the application and level of protection required (see Table 2).

Gross Pollutants



100% removal of floatable debris, such as food wrappers, Styrofoam cups and drinks cartons.

Sediment Bound Hydrocarbons (including Polycyclic Aromatic Hydrocarbons - PAHs)



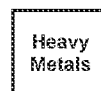
PAHs have low solubility in water and are readily adsorbed onto sediment particles. Effective removal of sediment particles will also ensure the removal of many PAHs.

Liquid Hydrocarbons (oils)



Effective spill containment device that meets the BS EN 858-1:2002 Class I and Class II effluent targets at low flow rates. Note these systems are not considered oil separators according to the BS EN 858-1 and must not be used in applications where full certification is required.

Sediment Bound Heavy Metals and Nutrients



As an efficient device for removal of fine sediment, the Downstream Defender® Select is also effective for the removal of sediment bound pollutants.

Downstream Defender® Select model options

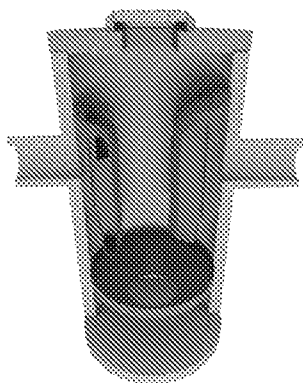
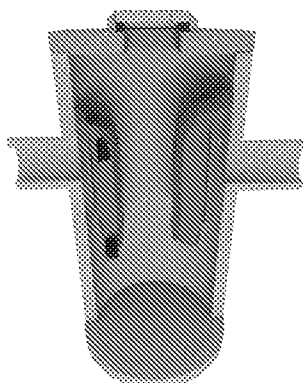
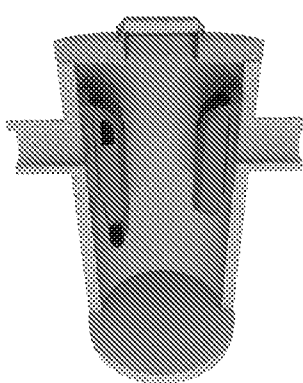
Downstream Defender® Select Model			
Advanced Vortex Our recommended model which provides sediments, litter and hydrocarbon (oil) removal with enhanced sediment retention up to four times the treatment flow rate. 	Vortex Plus Provides sediments, litter and hydrocarbon (oil) removal, with sediments retained at up to two times the treatment flow rate. 	Vortex A simpler model providing removal of sediments, with retention up to two times the treatment flow rate. 	
Coarse and fine	Coarse and fine	Coarse and fine	
Retained up to 4 x treatment flow rate	Retained up to 2 x treatment flow rate	Retained up to 2 x treatment flow rate	
✓	✓	✗	
✓	✓	✗	
Option for increased retention on request	Option for increased retention on request	✗	
✓	✓	✓	

Table 1 - Downstream Defender® Select pollutant removal performance

The Downstream Defender® Select may be sized for different target particle sizes and removal efficiencies – contact us for site specific design.

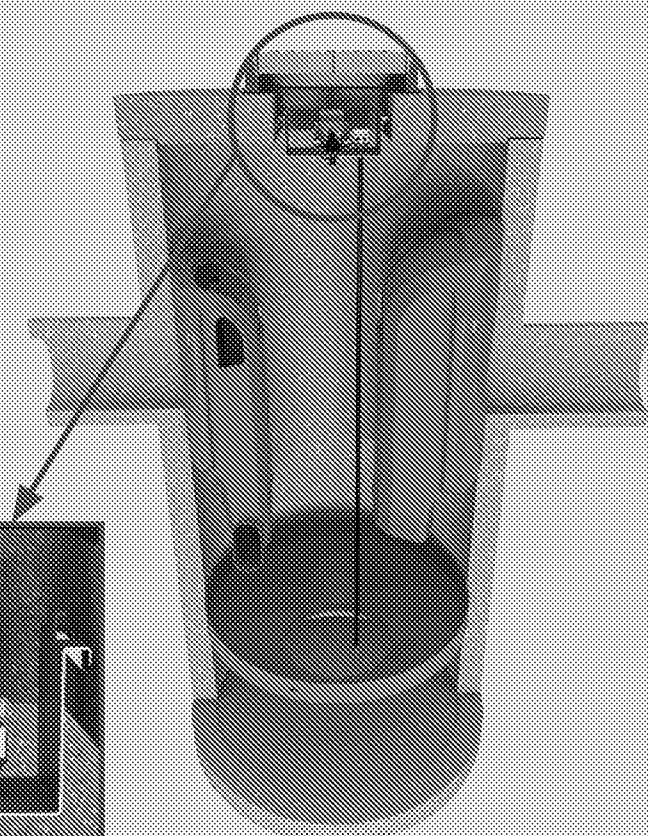
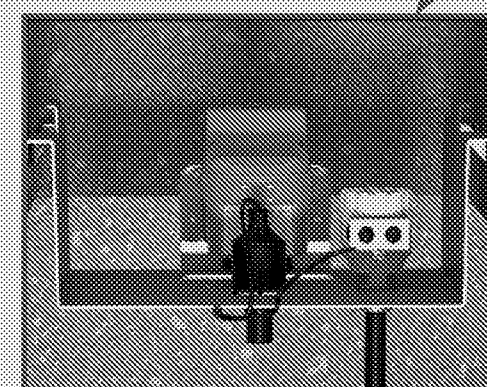
Enhancement Options

Make Maintenance Smart

To help with SuDS maintenance plans and to ensure that maintenance is cost-effective, add Hydro-Logic® Smart Monitoring to any model and get automated maintenance alerts.

Hydro-Logic® Smart Monitoring can also reduce risk and save costs by reducing the need for inspection visits for units installed alongside roads or rail tracks.

The ATEX/IECEx rated logger and sensors capture real-time data for flow levels and/or sediment build-up. Level monitoring will enable the detection of blockages relating to the unit, and sediment level monitoring can be set to a trigger point and self-report to the client's maintenance team when maintenance is due.



*Fig 2. Downstream Defender® Select
Hydro-Logic® Smart Maintenance.
Available for all models.*

Improve hydrocarbon retention

The option of storing hydrocarbons (oils) as solids can be added, providing increased retention, even at flow rates where the unit is bypassing.

This option is available for the Advanced Vortex and Vortex Plus models only.

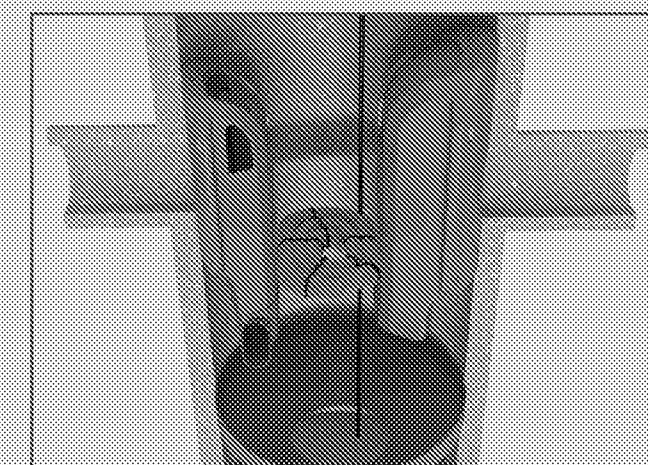


Fig 3. Enhanced hydrocarbon (oil) retention option for the Downstream Defender® Select. Available for the Advanced Vortex and Vortex Plus models only.

Pollutant retention

It is important to ensure that pollutants in a rainfall event are retained throughout subsequent events. The Downstream Defender® Select offers engineers the option of specifying the retention performance of sediments. The Vortex and Vortex Plus models provide sediment retention up to twice the treatment flow rate, and the Advanced Vortex, with its benching skirt creating a calm sediment storage zone, provides sediment retention up to four times the treatment flow rate.

An option for enhancing the retention of hydrocarbons (oils) by storing them as a solid is available, ensuring no wash out during extremely high flows. This option is only available for the Advanced Vortex and Vortex Plus models

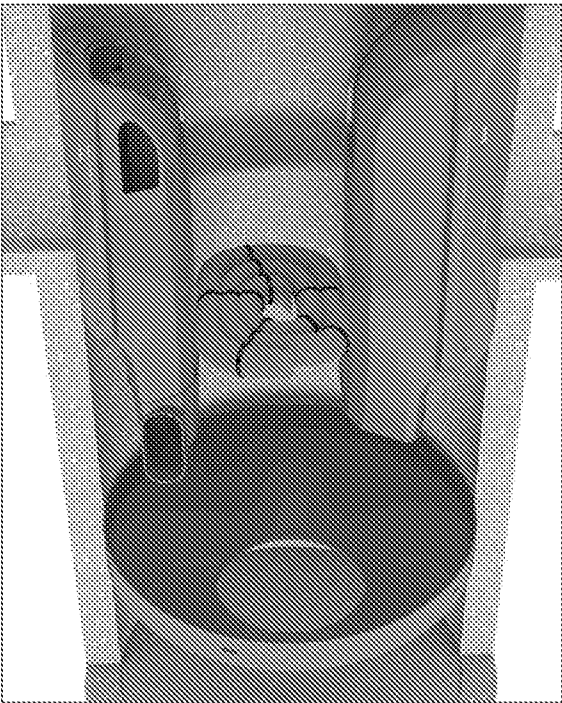


Fig 4. Downstream Defender® Select with enhanced sediment retention and enhanced hydrocarbon (oil) retention options.

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.

Model	Downstream Defender® Select Mitigation Indices ^{(a)(b)}		
	Total Suspended Solids (TSS)	Metals	Hydrocarbons (Oils)
Vortex	0.3	0.2	0.2
Vortex Plus	0.5	0.4	0.5
Advanced Vortex	0.5	0.4	0.5

- 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. Performance declarations are available on request or on the British Water website.
 - (b) Mitigation Indices quoted for the Downstream Defender® Select are valid when the unit is designed according to the Treatment Flow Rate (see Table 3).

Table 2 - SuDS Mitigation Indices for Downstream Defender® Select

Sizing a Downstream Defender® Select

The Downstream Defender® can be sized for different treatment goals and objectives. For design purposes, the selected model's Treatment Flow Rate should be greater than or equal to the site's Water Quality Flow Rate.

The hydraulic capacity of the selected model should be considered with respect to the peak discharge flow rate from the site.

If there is no treatment objective, just betterment, do not use a treatment flow rate and only compare the hydraulic capacity to the peak discharge flow rate.

Model diameter (m)	Treatment flow rate ^{(a)(b)} (l/s)	Hydraulic capacity ^(c) with recommended pipe size (l/s)	Hydraulic capacity ^(d) with maximum pipe size (l/s)	Maximum catchment area m ²	Maximum headloss at treatment flow rate (mm)
1.0	21	46	70	2800	160
1.2	30	84	107	4000	170
1.5	48	144	170	6400	220
1.8	69	217	278	9200	230
2.1	94	271	355	12500	240
2.4	123	422	529	16400	250
3.0	192	652	787	25600	260

- Notes:
- (a) The Treatment Flow Rate is based on an annualised removal efficiency of >50% of all particles up to 1000 microns with a mass-median particle size (D50) of 63 microns and a specific gravity of 2.65. The testing was conducted in line with the British Water Code of Practice.
 - (b) Alternative sizing based on different sediment grades available on request.
 - (c) Maximum flow rate that can pass through the chamber with a maximum headloss of 500mm. Figures shown are when using the recommended pipe size in Table 5.
 - (d) Maximum flow rate that can pass through the chamber with a maximum headloss of 500mm. Figures shown are when using the maximum pipe size in Table 5.

Table 3 - Downstream Defender® Select design information.

Model diameter (m)	Oil Storage Capacity (l)		Minimum sediment storage capacity (c) (m³)
	Minimum liquid hydrocarbon (oil) storage capacity up to Treatment Flow Rate (a)	Solid state storage capacity with enhanced retention option (b)	
1.0	256	43-70	0.31
1.2	442	43-70	0.45
1.5	849	85-140	0.71
1.8	1458	85-140	1.02
2.1	2550	128-210	1.39
2.4	3586	170-280	1.81
3.0	6811	231-350	2.83

Notes:

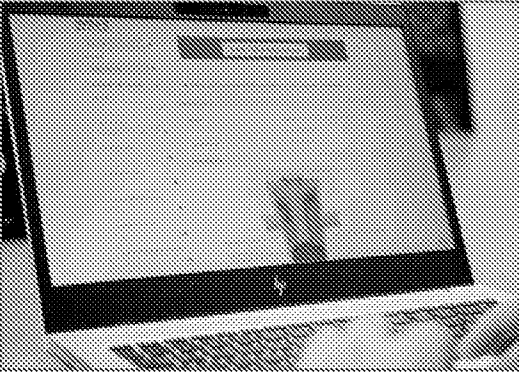
(a) Liquid oil storage capacity is valid up to the Treatment Flow Rate. Oil capture and retention is only available for the Advanced Vortex and Vortex Plus models only.

(b) Permanent oil storage capacity when using the enhanced oil retention option (available for the Advanced Vortex and Vortex Plus models only).

(c) Additional sediment storage capacity for all Downstream Defender® Select models (Advanced Vortex, Vortex Plus and Vortex) can be provided to extend maintenance intervals if required.

Table 4 - Downstream Defender® Select capacities.

Design your own Downstream Defender® Select with our Online Design Tool



Register free and design your own Downstream Defender® Select and try out different performance objectives.

Project designs can be saved and submitted for a free review by our expert technical team if required. General arrangement drawings and quotes can also be requested from the tool for any saved design.

Pipe sizes

Downstream Defender® Select can accept a range of inlet / outlet pipe sizes, removing the need for complicated pipe connections or couplers. The inlet pipe size must always be equal to or smaller than the outlet pipe size.

Additional pipe sizes may be accommodated, please contact us for assistance.

Chamber size	1.0 m	1.2 m	1.5 m	1.8 m	2.1 m	2.4 m	3.0 m
Pipe sizes	150	150	300	375	375	500	600
	225 ^{a)}	225	375 ^{a)}	400	400	600 ^{a)}	675 ^{b)}
	300	300 ^{a)}	400	450 ^{a)}	450	675 ^{b)}	750 ^{a)}
		375	450	500	500 ^{a)}	750	900
				600	600		
					675 ^{b)}		

Notes:

a) The recommended pipe size for optimum performance.

b) 675 mm is only available for concrete chambers.

Table 5 - Downstream Defender® Select pipe sizes.

Setting out

The Downstream Defender® Select can accommodate a change in pipe direction to suit site specific requirements and accept up to three inlet pipes.

Pipe angles can be adjusted to suit. Minimum angle between inlets and outlet is 90°.

For ease of installation the Downstream Defender® Select can now accept a range of pipe sizes.

Head loss across the chamber is kept to a minimum (see Table 3). The inlet and outlet pipes should be sized in accordance with Table 5.

Inlet and outlet pipe connections are at the same invert level.

Additional manhole sections can be provided to extend the chamber to meet site cover and invert levels or provide additional pollutant storage where required.

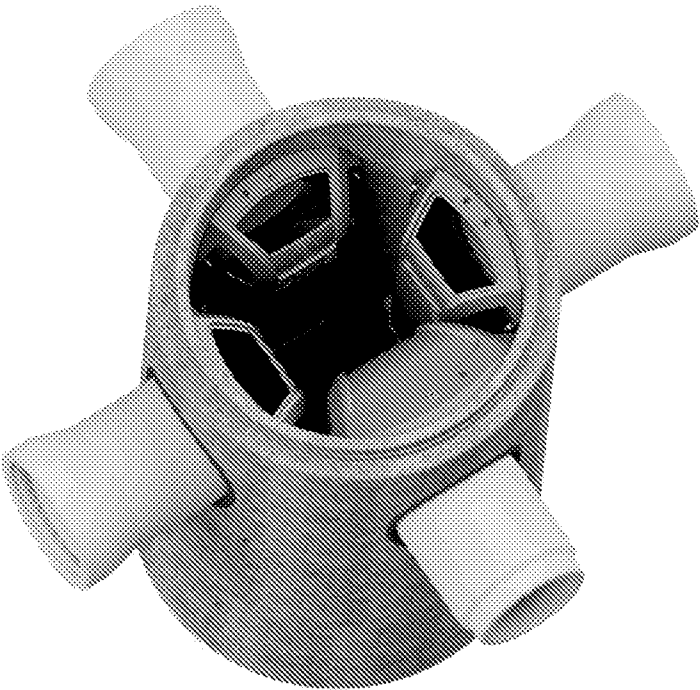


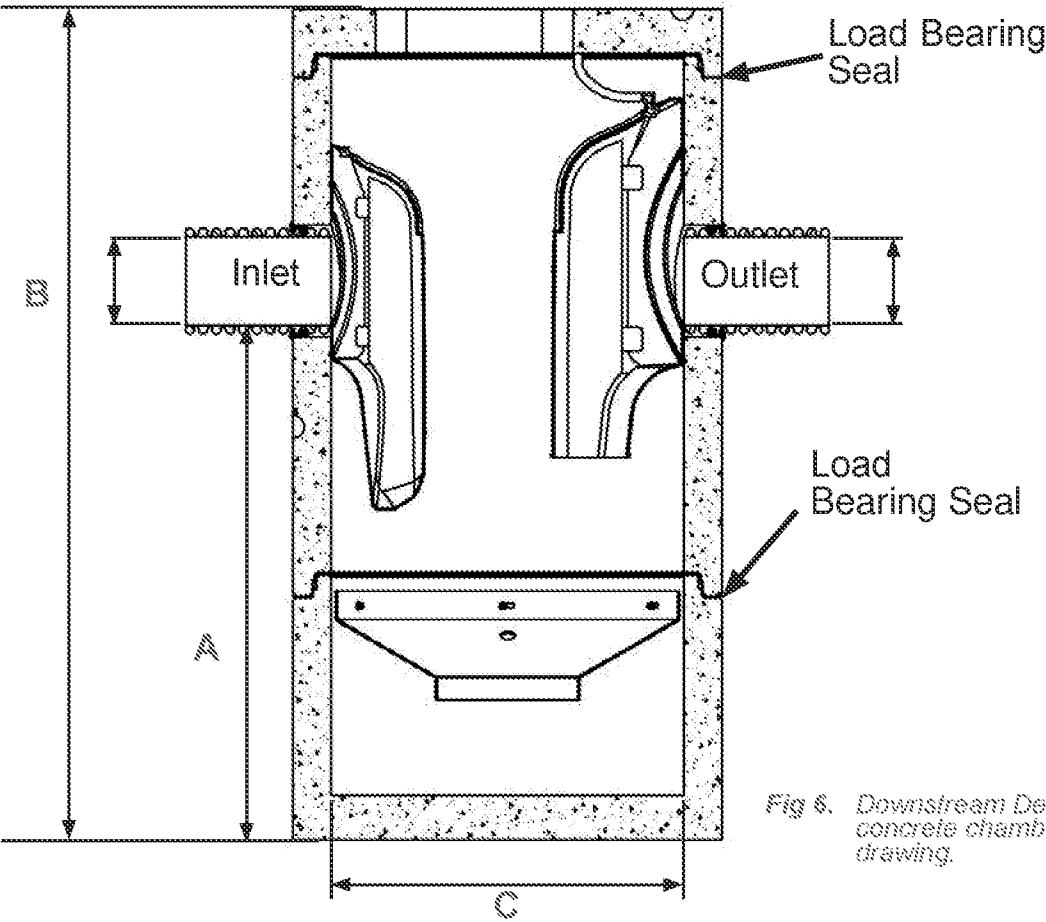
Fig 5. Downstream Defender® Select Advanced Vortex with three inlet pipes

Dimensions and weights for concrete chambers

Material	Chamber Diameter - Internal (mm) (C)	Chamber Diameter External (mm) (includes base slab and any extrusions)	Recommended Inlet and Outlet Internal Diameter (mm) (1)	Minimum Depth to Invert (mm) (A) (2)	Total Chamber Height Including cover (mm) (B) (3)	Maximum Component Lift Weight (kg) (4)
Concrete	1050	1420	225	1550	2390	2770
Concrete	1200	1460	300	1757	2831	2320
Concrete	1500	1760	375	2050	3276	3530
Concrete	1800	2160	450	2550	4090	5250
Concrete	2100	2650	500	2682	4364	6670
Concrete	2400	2950	600	3146	5375	8600
Concrete	3000	3480	750	3384	5174	14080

- Notes:
- (1) Recommended inlet and outlet internal diameter. For alternative pipe sizes to allow for easier connections, please see Table 5.
 - (2) Minimum depth to invert shown. Depth to invert can be increased if required.
 - (3) Minimum chamber depth shown. Additional sediment storage capacity or increased depth to invert can be provided if required. Total chamber height for concrete units **includes** the cover.
 - (4) Maximum component weight is based on a single inlet and includes internal components.

Table 6 - Downstream Defender® Select dimensions and weights for concrete chambers

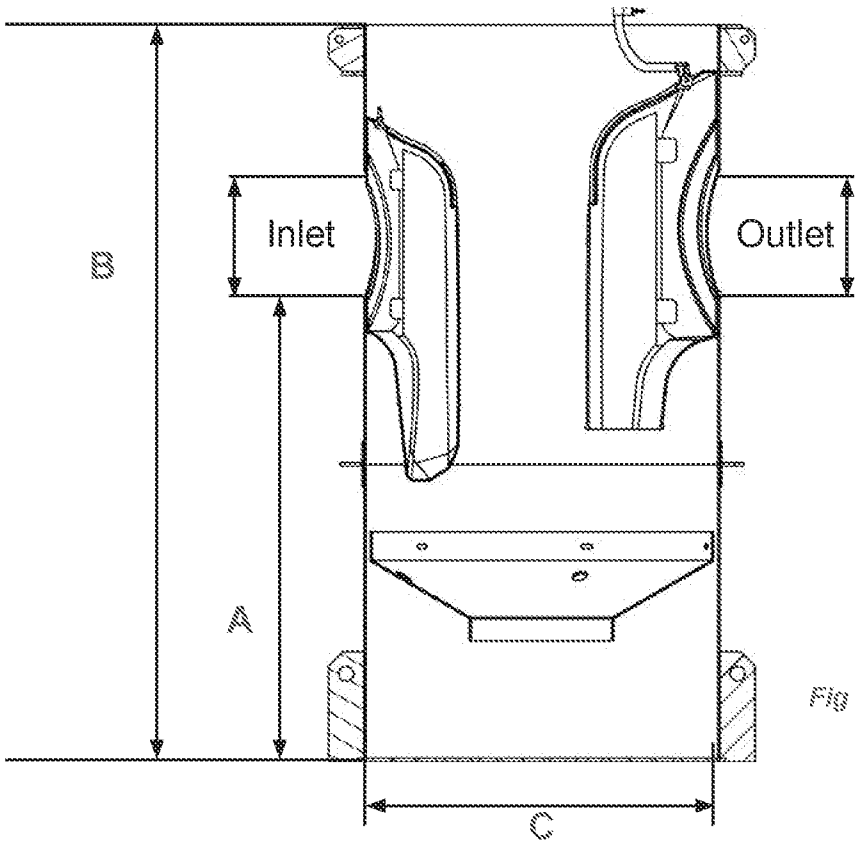


Dimensions and weights for plastic chambers

Material	Chamber Diameter - Internal (mm) (C)	Chamber Diameter External (mm) (includes base slab and any extrusions) (B)	Recommended Inlet and Outlet Internal Diameter (mm) (1)	Minimum Depth to Invert (mm) (A) (2)	Total Chamber Height Excluding Cover (mm) (B) (3)	Maximum Component Lift Weight (kg) (4)
HDPE Single Wall	1030	1282	225	1412	2012	125
HDPE Single Wall	1200	1452	300	1612	2512	170
HDPE Single Wall	1500	1752	375	1976	3012	240
HDPE Single Wall	1800	2316	450	2220	3520	410
HDPE Single Wall	2100	2626	500	2570	3920	750
HDPE Single Wall	2400	2926	600	2820	4420	950
HDPE Single Wall	3000	3520	750	3145	4770	1200

- Notes:
- (1) Recommended inlet and outlet internal diameter. For alternative pipe sizes to allow for easier connections, please see Table 5.
 - (2) Minimum depth to invert shown. Depth to invert can be increased if required.
 - (3) Minimum chamber depth shown. Additional sediment storage capacity or increased depth to invert can be provided if required. Total chamber height for plastic units **excludes** the cover.
 - (4) Maximum component weight is based on a single inlet and includes internal components.
 - (5) Maximum external diameter includes lifting lugs and base slab.

Table 7 - Downstream Defender® Select dimensions and weights for plastic chambers

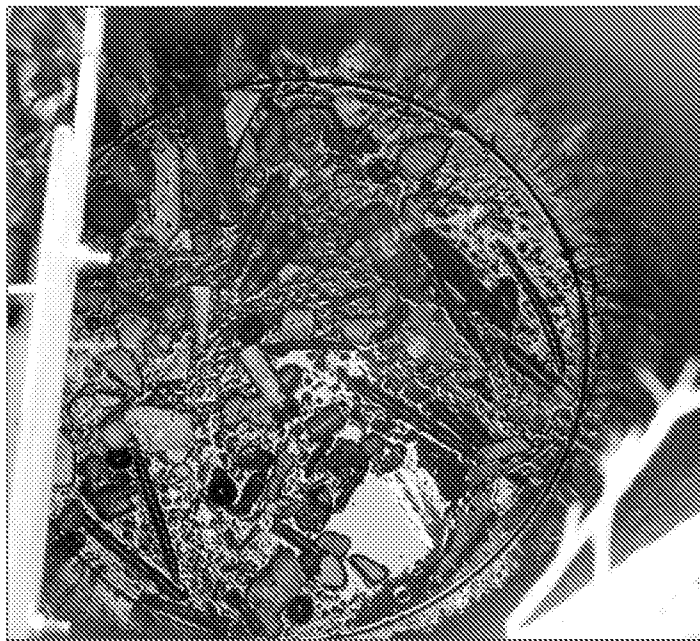


Maintenance for a Downstream Defender® Select

Periodic removal of captured pollutants is essential to the continuous, long-term functioning of your Downstream Defender® Select. The device will capture and retain sediment and oil until the sediment and oil storage volumes are full to capacity. When sediment and oil storage capacities are reached, the Downstream Defender® Select will no longer be able to store removed sediment and oil. Maximum pollutant storage capacities are provided in Table 4.

If a Hydro-Logic® Smart Maintenance system is installed in the Downstream Defender® Select, when captured sediment volumes reach a predetermined level, the system will send an automated alert to request maintenance.

Maintenance events may include hydrocarbons (oils), floatables and sediment removal. These can be removed safely from the surface, no entry into the Downstream Defender® Select is required. The Hydro-Logic® Smart Maintenance system will need to be removed to allow access for the Jet Vac truck / Vacuum Tanker. This is easily done by carefully lifting the bracket holding the Hydro-Logic® Flexi Logger 300Ex and sensors out of the unit and putting them to one side prior to inserting the Vacuum Tanker hose into the unit. The internal components of the Downstream Defender® Select do not need to be removed as the jet / vacuum hose can access the full depth of the unit through the centre of the chamber.



Determining a maintenance schedule

The frequency of clean-out is determined in the field after installation. During the first year of operation, the unit should be inspected every six months or sooner to determine the rate of sediment and floatables accumulation. A simple probe such as a Sludge Judge® can be used to determine the level of accumulated solids stored in the sump.

To enable the provision of maintenance plans for planning applications, a typical maintenance schedule for a Downstream Defender® Select would be:

Activity	Frequency
Inspection	- Regularly during first year of installation. - Every 6 months after the first year of installation
Hydrocarbons (oils) and floatables removal	- Once per year, or as needed with sediment removal. - Following a spill in the drainage area.
Sediment removal	- As and when alerted by the Hydro-Logic® Smart Maintenance system, or - At intervals as determined by the first year's inspections - Following a spill in the drainage area.
Note: For most clean-outs it is not necessary to remove the entire volume of liquid in the vessel. Only removing the first few inches of oils/floatables and the sediment storage volume is required.	

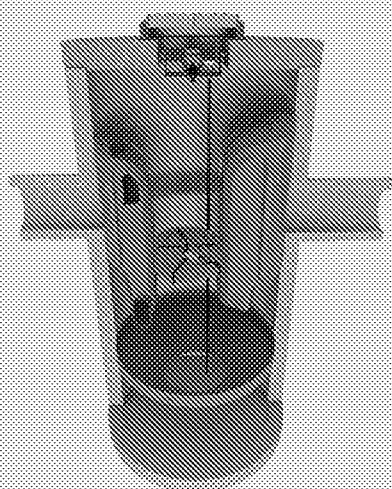
Table 8 - Typical maintenance schedule for a Downstream Defender® Select

We can provide full inspection and maintenance services for the Downstream Defender® Select, as well as for any other Sustainable Drainage Systems (SuDS) on your site - providing peace of mind and saving you time and money.

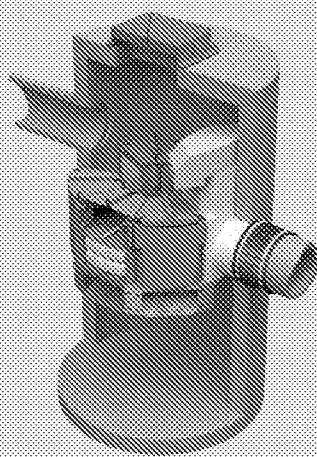
For more information, please call 01275 878371 or email sudservices@hydro-int.com

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™](#)