HyndsFilter

(Stormwater Treatment)

Technical Guide SW 32

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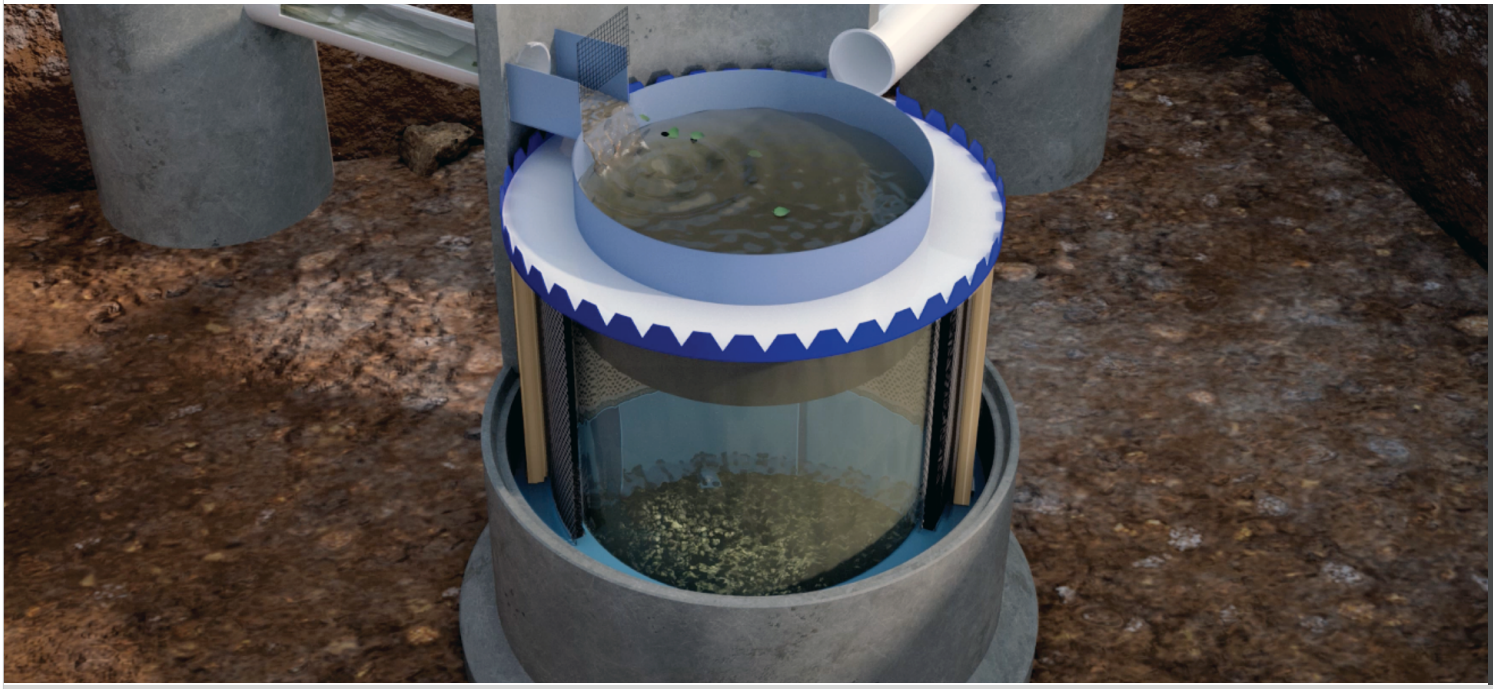

Applications

- Large commercial carparks
- Residential Subdivisions
- Industrial hardstands
- Municipal Roadways
- High contaminant generating sites
- Targeted fines removal

Product Attributes

- High treatment flows with very small footprint
- 89% reduction in Total Suspended Solids (TSS)
- 75% reduction in Total Phosphorous (TP)
- 50% reduction in Total Nitrogen (TN)
- Heavy Metals: 57% Copper and 64% Zinc removal

Approvals/Standards

- Auckland Council Approval for Private sites (PDEP)
- New Jersey Department of Environmental Protection, NJCAT Program
- ARC TP10 approval for removal of greater than 75 percent TSS
- SQIDEP (Stormwater Quality Improvement Device Evaluation Protocol)

HYNDS STORMWATER

The HyndsFilter is a multistage stormwater treatment device – featuring primary screening, media adsorption and membrane filtration.

The combination of the media and membrane filters provides an extremely large contact surface area, allowing for high flow treatment at low headloss with exceptional universal stormwater pollutant removal.

The proven performance of the HyndsFilter and its high flow rate treatment approach enables water quality objectives to be met with a smaller footprint system than typical bioretention systems. The system is assembled within a trafficable, precast concrete structure for underground installations on constrained sites.

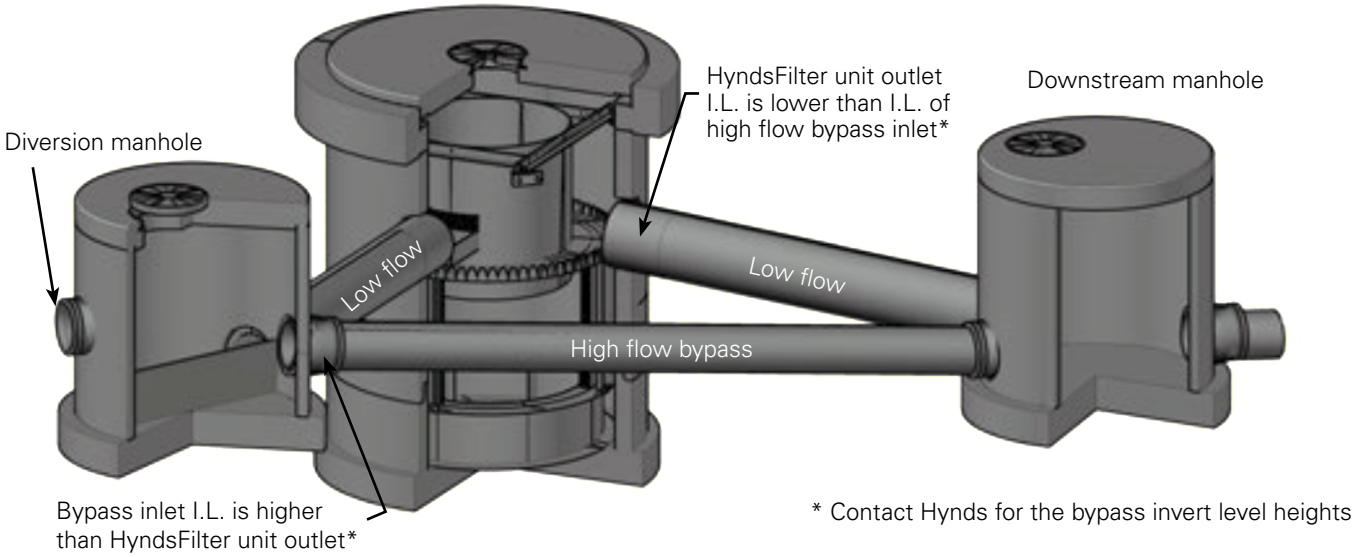

FIG. 1 HyndsFilter offline arrangement with diversion weir

HyndsFilter Design and Sizing

The HyndsFilter has no moving parts and requires no external power.

The device should be designed in an offline configuration – a standard offline configuration has an external bypass that uses an upstream diversion structure. The bypass pipe between these two structures will have an invert level set higher than the inlet pipe into the HyndsFilter. Alternatively, a weir can be fitted into the upstream diversion structure.

The invert level difference between the inlet pipe and the outlet pipe of the HyndsFilter is 150 mm.

The HyndsFilter is sized for a specified design flow rate to meet the water quality flow (WQF).

This WQF should be sized according to local council guidelines.

There are 2 models to be made available as follows:

- HF1800: 20-30L/s TFR
- HF2550*: 36-55L/s TFR**

**** Internal Diameter of the Concrete Chamber***

***** TFR –Treatment Flow Rate (Maximum)***

To be developed (2025):

- HF3000: 66-100L/s TFR
- HF4000: 106-160L/s TFR

Peak bypass to be sized to accommodate peak online network flows

TABLE 1 HyndsFilter Variants - Auckland PDEP

Product Code	Manhole Ø (m)	Max WQF (l/s)	Max carpark/roadway area based on PDEP treatment flow rate
HF1800KIT	Ø1.8	20	7,502
HF2550KIT	Ø2.55	36	13,754
HF3000KIT	Ø3.0	66	25,008
HF4000KIT	Ø4.0	106	40,014

TABLE 2 **HyndsFilter Variants**

Product Type	**Manhole Ø** (m)	**Max WQF** (l/s)	**Max carpark/roadway area based on10mm/hr rainfall intensity** (m2)	**Max carpark area based on 5mm/hr rainfall intensity** (m2)
HF1800KIT	Ø1.8	30	11,367	22,734
HF2550KIT	Ø2.55	55	20,840	41,680
HF3000KIT	Ø3.0	100	37,892	75,784
HF4000KIT	Ø4.0	160	60,627	121,254

Device components

The HyndsFilter is comprised of several structural and functional components:

- A cylindrical precast concrete structure for HD60 loadings
- A rigid high-strength stainless-steel plinth sits in the lower section of the concrete chamber creating a 500 mm deep sump for the deposition/accumulation of sediments and debris.
- The multistage filter arrangement is seated on top of the plinth, which comprises three basic elements:
  - An inner stainless-steel perforated screen
  - A stainless-steel basket containing a layer of granulated activated carbon
  - A 50 mm wide pleated cartridge filter
- A rigid high-strength stainless-steel insert sits on top of the filters, which performs all of the hydraulic control for the system.
- A heavy duty lid and surround. The lid is seated on surround so as to be removable for maintenance (discussed later).

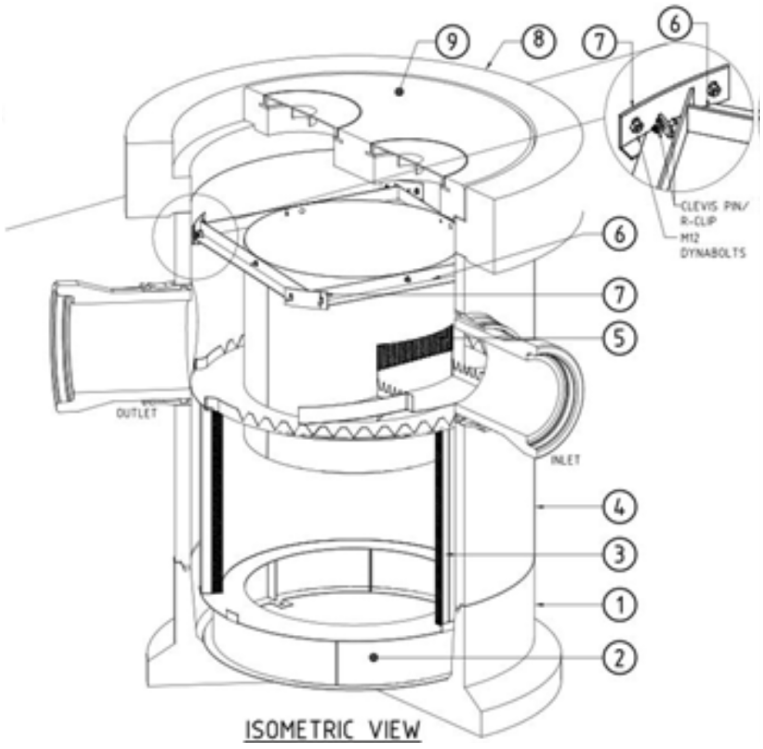

FIG. 2 Isometric internal view

1. Precast concrete base unit
2. Stainless-steel plinth fitted to base kit
3. Inner and outer filters
4. Precast concrete riser – inlet and outlet fitted at factory.
5. Stainless-steel insert that sits inside the precast concrete riser - on top of the inner and outer filters
6. Stainless-steel insert support bracket
7. Support frame mounting brackets *(pre-fitted to the riser in the factory)*
8. Precast concrete surround
9. Precast concrete lid

Device Operation

Operation of the HyndsFilter is as follows:

Water enters the HyndsFilter via an inlet pipe through the concrete chamber and into the centre of the stainless-steel insert and into the centre of the chamber.

Sediments and other heavy materials fall into the 500 mm deep sump of the device.

Water passes through the filter arrangement from inside to out under the hydraulic head created by a 150 mm difference between the inlet invert level and outlet invert level

Water first passes through the screen, then the granular activated carbon layer, and finally through the pleated cartridge. The filters are designed to only operate at 34% of their capability, therefore having a redundancy of 64% to cater for blocking over time.

Due to this redundancy, the HyndsFilter would pass flows in exceedance of the maximum Treatment Flow Rate (TFR) if the inflows are not controlled. Excess flows through the device would not be treated as there would not be adequate contact time with the activated carbon. As such, the inlet flow control is set by the inlet pipe size/type and grade to ensure flows do not exceed TFR (Refer to Table 2 below).

Once through the pleated cartridge, the water then rises up between the outside of the cartridge and the concrete chamber, and through a series of v-notches in a rim weir on the outer edge of the stainless-steel insert.

The water passes through these v-notches and onto the return channel toward the outlet pipe. The v-notches are important to ensure that the flow on the return channel remains laminar to minimise losses through the system and into the downstream drainage network.

The outlet pipe can be located on a 270° arc (minimum 45° from the inlet) as per Fig. 4 below.

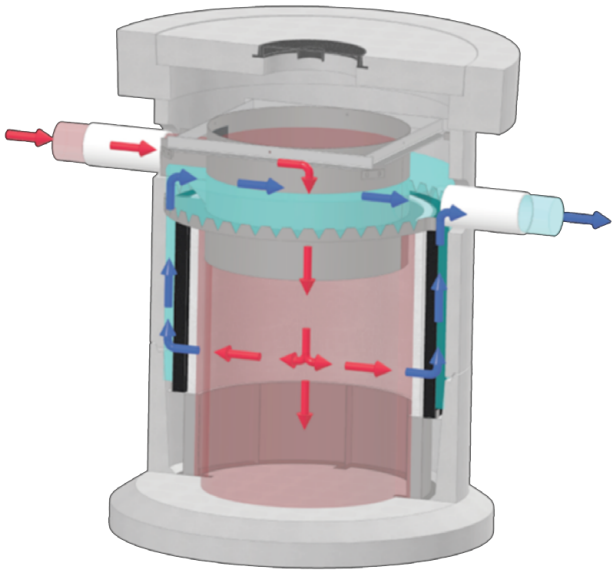

FIG. 3 Internal device Operation

TABLE 3 **HyndsFilter Flow Controls**

HyndsFIlter Model	**Inlet Pipe Ø and material**	**Inlet Grade** (Fixed)	**Oulet Pipe Ø and material**	**Outlet grade** (Fixed)
HF1800KIT	225mm PVC	0.4%	225mm PVC	1.0%
HF2550KIT	225mm PVC	1.0%	225mm PVC	1.5%
HF3000KIT	300mm RRJCP	1.1%	300mm RRJCP	1.5%
HF4000KIT	375mm RRJCP	0.8%	375mm RRJCP	1.25%

TABLE 4 **HyndsFilter Flow Controls - Auckland PDEP**

Product Code	**Inlet Pipe Ø and material**	**Inlet Grade** (Fixed)	**Oulet Pipe Ø and material**	**Outlet grade** (Fixed)
HF1800KIT	175mm PVC	0.6%	175mm PVC	1.0%
HF2550KIT	225mm PVC	0.5%	225mm PVC	1.0%
HF3000KIT	300mm RRJCP	0.5%	300mm RRJCP	1.0%
HF4000KIT	375mm RRJCP	0.4%	375mm RRJCP	1.0%

TABLE 5 **Hynds Filter Dimensions**

Hynds Product Code	Manhole ID (mm)	Inlet DTI (mm)	Outlet DTI (mm)	Base OD (mm)	Overall Depth (mm)	Mass Total (T)
HF1800KIT	1800	924	1074	2280	3004	9.6
HF2550KIT	2550	1125	1275	3150	3230	21.015
HF3000KIT	3000	1080	1244	3608	3200	26.606
HF4000KIT	4000	1292	1483	4500	3450	TBC

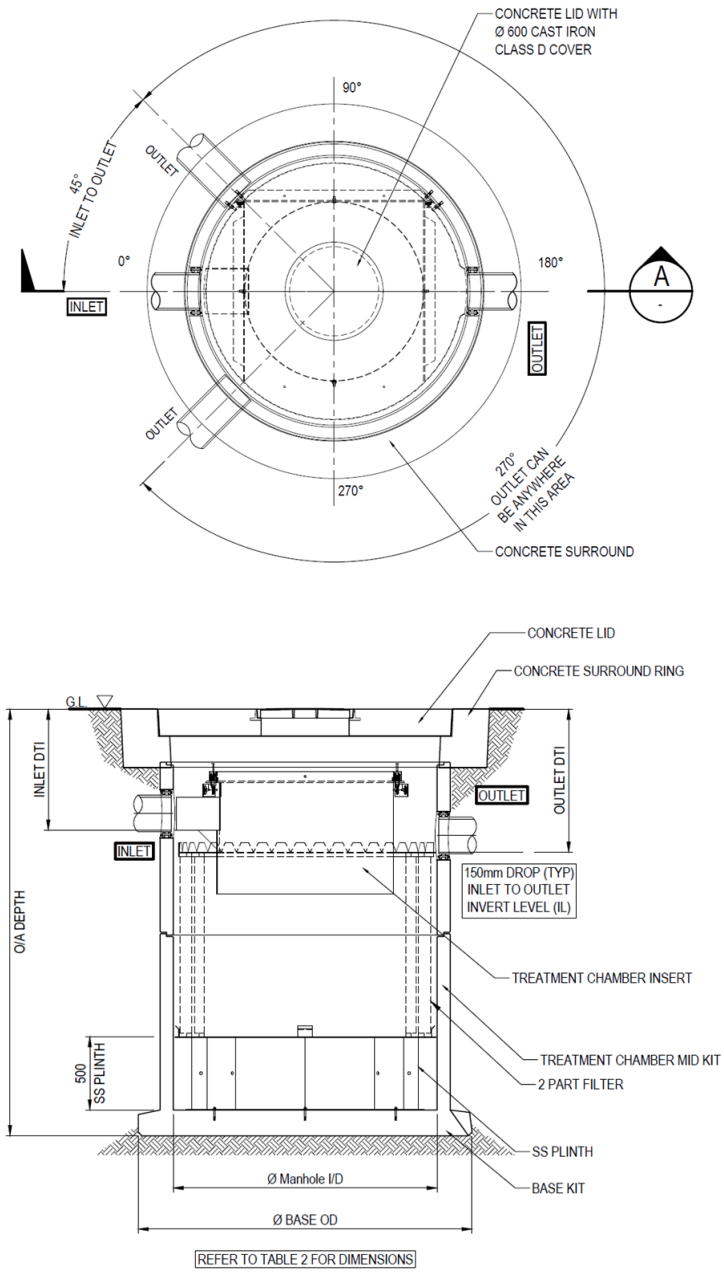

FIG. 4 Site Arrangement

Inspection and maintenance

The maintenance routine is scheduled on a 2-step basis, with each step repeated every second year:

1st Year – Initial Cleanout:

Equipment: Vacuum truck, Hiab/lifting equipment

- Arrive onsite with a vacuum truck, traffic management and all other permissions to be in place by contractor.
- Remove lid. Vacuum out the contents of the sump. Rinse the exterior and interior of the stainless-steel insert with clean water, into the sump.
- Backwash the filters by releasing 2,000L of clean water (at 5-10 L/s) on the external side of the filters, allowing the water to pass from outside the filters to inside the sump.
- If the water level on the outside of the filters rises to the level of the return channel, this triggers a filter exchange requirement (usually only required on the 2nd Year interval – please refer to Filter Maintenance below).
- If, however, the water freely backwashes through the filters and doesn't reach the return channel level, then the filters can remain until the next inspection.
- Vacuum out any sludges and water retained in the sump, replace lid.
- Remove contents for disposal at an approved facility.

2nd Year – Filter Maintenance:

Equipment: Vacuum truck, Hiab/lifting equipment

All steps as above. Including:

- Remove the stainless-steel insert after it has been rinsed;
- Rinse and remove the used GAC (granulated activated carbon) and pleated cartridge filters;
- Thoroughly rinse the inside of the concrete chamber and then vacuum out the residual material.
- Empty the GAC filter, clean and re-fill with new GAC; the pleated cartridge filter is backwashed and allowed to dry.
- Re-insert the SS insert, and replace the lid:

TABLE 6 Granulated Activated Carbon Refill Volumes:

HF Model	GAC Volume (m3)	KG (@500kg/m3)
HF1200	0.153	76.5
HF1800	0.370	185
HF2550	0.672	336
HF3000	1.220	610
HF4000	1.930	965

On Year 3, the process then repeats from the Initial Cleanout, and so on.

10 Year - Filter Renewal:

After 10 years it is assumed that the pleated cartridge filter may need to be replaced.

Note:

This annual maintenance schedule is as specified for the treatment areas noted for Auckland Council PDEP Approval (Table 1).
This is based on expected TSS build-up within Auckland catchments.
The larger catchments allowed outside of Auckland by the higher functional treatment flow rate (Table 2) may increase maintenance frequency depending on TSS build-up/ wash-off rates.
Increased inspection intervals are recommended to determine a site-specific maintenance regime.

FIG. 5 HyndsFiler Components to be delivered

System Installation

The HyndsFilter can be installed by a civil contractor in much the same way as a manhole or other stormwater drainage structures. It is supplied to site in separate, easily identifiable components, and an installation guide will also be provided. If required, a Hynds representative can also be present.

- The flanged base-kit (with SS plinth fitted inside) is lowered into place on the pre-prepared bedding, which is specified by the design engineers based on local geotechnical information.
- The manhole sealant/epoxy is applied to the base, and the mid-kit riser is then placed on the base.
- The pleated cartridge panels are placed into the treatment chamber to rest on the plinth. The granular activated carbon (GAC) filter is lowered into the shaft and rests inside the pleated cartridge filter. There should be an even gap of approximately 40 mm between the two filters all the way around, and the top of the two filters should be level.
- The stainless-steel insert is then lowered into position to sit directly on top of the filters. The insert has a 25 mm lower rim, which fits around the outer edge of the pleated cartridge filter. If the insert isn't located correctly on top of the filters, the insert will not sit level. It is important to check the levels (in multiple directions) at the top of the insert to ensure that the insert is correctly positioned. The weight of the insert will apply enough pressure on the filter seals to adequately seal the system.
- When the insert is correctly positioned, the four brackets on the wall of the chamber can be tightened into their correct positions. Connection steps are further detailed in the expanded installation manual.

If excessive fine sediment/clay is present in runoff during construction, or if the site is expected to be unsealed for a prolonged period of time; it is advised to avoid directing runoff through the HyndsFilter – the offline diversion to the unit should be closed off until the site is stabilized. Alternatively, it is also possible to refrain from installing the filters until the unit has been fully cleaned, post-construction and the site stabilized.

Lifting and Handling

All applicable Hynds Pipes manufactured concrete products feature certified concrete lifting anchor systems, designed and tested to guarantee safe and secure handling.

Hynds Pipe Systems has designed and manufactured HyndsFilter with a minimum dynamic factor of 1.2. The dynamic factor requires that all the following conditions are observed when lifting, moving or placing the units:

1. Lifting with mobile plant *(such as an excavator or similar)* where equipment is specifically exempt from the requirements of the PECPR Regulations 1999, subject to the conditions outlined in the New Zealand Gazette, No. 104, September 2015 and
2. Lifting, travelling and placing over rough or uneven ground where anchor failure is not anticipated to cause harm or injury, by adopting procedures such as:
   a. Transporting the element as close as practical to ground level (300mm recommended)
   b. Establishing and maintaining exclusion zones
   c. Transporting only precast concrete elements that are unlikely to topple if they were to hit the ground
   d. Inspecting lifting anchors both after transportation and before final lifting into place
3. All Hynds concrete lifting anchor systems are engineered in accordance with Haeussler specifications, ensuring full compatibility with Reid, Deha, CLS, and Ancon lifting clutches, as well as recess formers, across corresponding load ranges.

Refer to "Safe work with precast concrete – Handling, transportation and erection of precast concrete elements" published by Worksafe New Zealand (October 2018).

Shock loads resulting from travelling with suspended HyndsFilter units over rough terrain and uneven ground may exceed design, dynamic and safety factors of the lifting systems. It is essential that care is taken during lifting and transporting as additional stresses could result in anchor failure.

Please consult the Hynds Precast Safe Lifting Guide for safe handling technique.