

ENVIRONMENTAL BENEFITS

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Protect water quality
Comply with legislation

ARCHITECTS AND ENGINEERS

professional assurance

See page 4

EPS replaces a treatment train
Tested, certified and approved

DEVELOPMENT BENEFITS

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Low service and maintenance cost
Long-term sustainable WSUD

CONTRACTOR BENEFITS

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One unit to install
Delivered fully assembled

CONTACTS

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Information



Environmental Protection Systems for improving the sustainability of our rivers and oceans

Enviro is a passionate specialist in providing Environmental Protection Systems that are compliant with legislation; low cost to install, service and maintain.

The underlying benefits are in summary:

1. Compliance with regulation and legislation. Under a National Policy, all states legislate that it is an offence for any individual or organisation to pollute storm water regardless of whether the site is new or existing.
2. Ease of installation. All EPS units are fully assembled prior to delivery on site. EPS systems are in line with the drainage system, requiring only an enlarged trench for placement and connection to pipes.
3. One unit replaces a treatment train. Multiple chambers and zones within EPS systems separate large floatables from heavier sediments and oils. EPS systems are categorised to suit catchment types and the anticipated discharge load.
4. Fully tested and certified. The performance of EPS systems has been independently verified by Universities and NATA accredited laboratories. Results and methodology have been internationally peer reviewed and published. MUSIC nodes are also subject to independent development.

Enviro EPS systems are designed to suit the type and load transported by storm water from a catchment. This is the primary selection criterion to determine the series required. The model within each series is then sized to suit treated flow and structural duty.

The H Series is a certified oil/water separator in accordance with EN858-1 Class 1, as well as a broad-spectrum pollution control device. The test results showed near 100% retention of raw diesel oil. Only 4.1ppm was detected by NATA Certified Laboratory analysis. See Fig 1.

The E Series is a multi-chamber system suitable for high impact catchments, which includes commercial and industrial activities.

Fig 2 illustrates the unique separation chambers and zones. Independent testing confirmed 100% capture of gross pollutants and 86% retention of particles below 500 microns.

The G Series replaces the conventional GPT with a complete treatment train in one device, suitable for low impact catchments, typically residential developments.

Fig 3 illustrates the ease of installation in-line with drainage pipework and full access for inspection, service and maintenance.

Fig 1

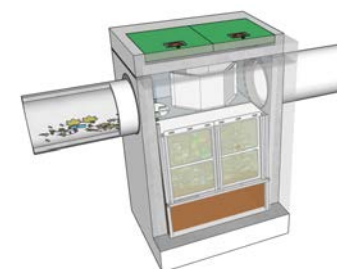


Fig 1 An H90 installed into water charged soil. Substantial savings were generated by minimal site works. The reinforced concrete chamber is installed directly into final position without additional base slabs and tie downs. Risers and cover slab are then added to match final site levels.

Fig 2



Fig 3



ENVIRO EPS Range - Features and Benefits

Enviro's passion extends to engaging all contributors and benefactors associated with preserving the quality of water.



Toxic chemicals pollute water columns and sediment beds.



Nutrients super-charge algal blooms and suck oxygen from the water.



Trash and litter clog rivers and oceans.

Enviro's Mission is to assist in reversing these trends and make planet Earth sustainable for future generations.

Enviro's passion extends to engaging all contributors and benefactors associated with preserving the quality of water on planet Earth.

ENVIRONMENTAL BENEFITS



The water on our planet has been recycled for 3.5 billion years. Of that water only 0.01% is available for human use.

Health of that water is declining mainly due to pollution discharged through our drainage systems as witnessed by reports such as:

2015: Will Steffan (ANU) and 18 scientists published a report on sustainability factors affecting the planet. Over-nutrication of freshwater had passed critical levels in many highly populated regions.

2018: The Global Oceanographic Data Center (GODAC), published a report that recorded plastic waste in the Mariana Trench, 11km deep in the ocean. In the North Pacific, plastic refuse was populated at up to 355 items per square kilometre at depths of 1 to 5km.

ENVIRO EPS Range - Features and Benefits

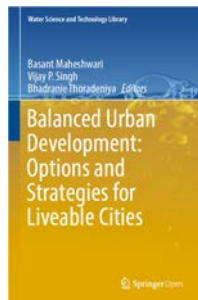
In addition to performance, Enviro is committed to:

- Safety in design. No personnel access required to enter the device for service and maintenance.
- Initial cost savings via an integrated treatment train in one unit. Replaces up to 5 measures as shown in ARQ Fig 1.3
- Service intervals of 1 year as per ARQ 3.7
- Service by conventional evacuation truck.
- Maintenance simplified with removable, wash down and replacement screens.

Performance as tested:

- Gross Pollutant retention 100%
- Suspended Solids 85%
- Total Nitrogen 45%

Professional responsibility is underpinned by Enviro assurance of compliance with Environmental Legislation. Performance has been validated, peer reviewed and internationally published.



Internationally
published

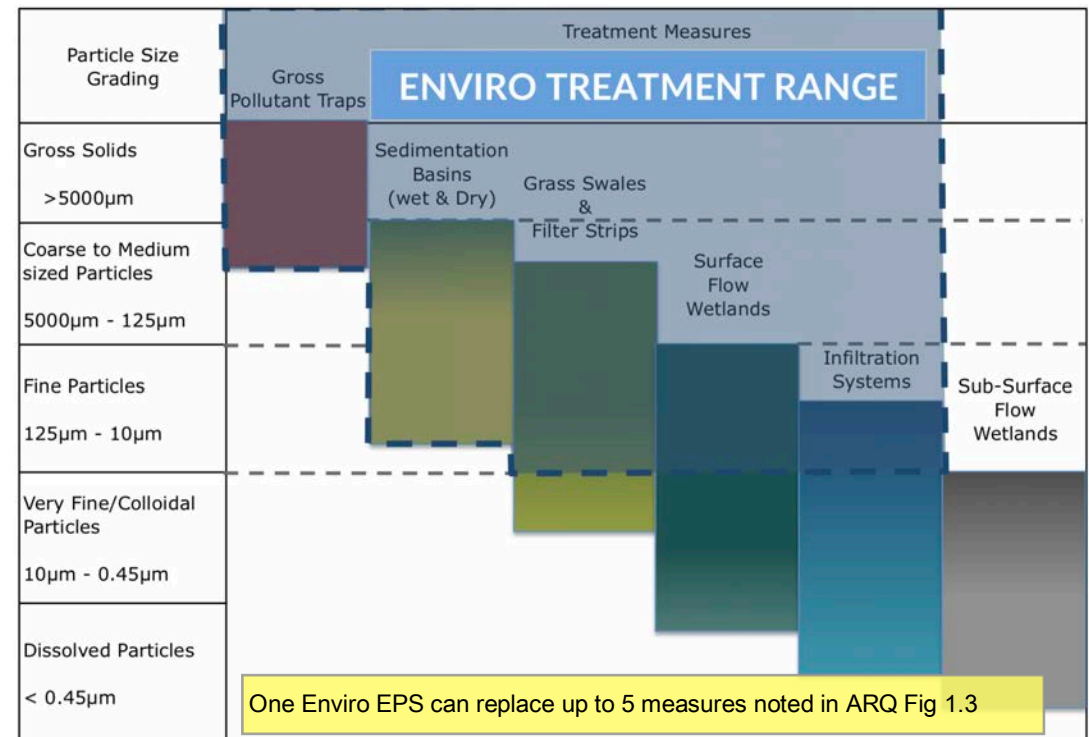
Tested and/or peer reviewed by:



Enviro EPS series have been tested and third-party verified. A full technical manual is available on request.

Environmental Legislation prohibits the discharge of pollutants into storm water.

Enviro EPS series are intended to provide the designer with a single unit to replace a treatment train, reducing installation and service costs.



DEVELOPMENT BENEFITS

ENVIRO EPS Range - Features and Benefits

Enviro supports the principals of WSUD.

The installation of a multi-treatment Enviro EPS as part of an urban development will enhance the amenity, reduce development costs and potentially eliminate long term high maintenance.



Students from Sydney University inspected wetlands at Rockdale, a southern suburb of Sydney. The basic upstream GPT was ineffective in removing sediment, and nutrient reduction, creating long term remediation requirements and collapse of water health. The Enviro EPS installed at the entrance to the wetland is a long-term sustainable solution.

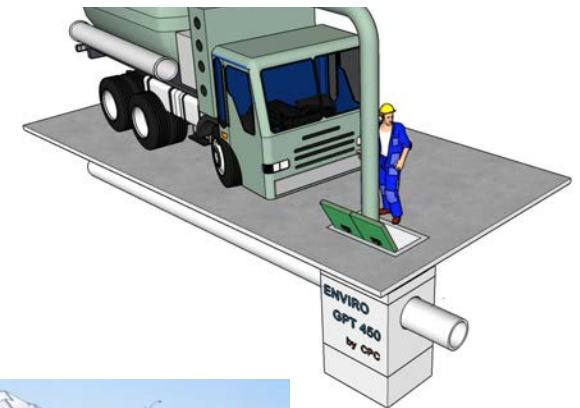


The Enviro advantages extend to practical matters as well, such as cost to service and maintain.

The integrated treatment train can also eliminate wetland remediation.

Design service intervals are 12 months.

Service by evacuation truck is typically completed in less than one hour.



Enviro EPS eliminates the need for sediment ponds and bio-filtration basins, which need remediation at a greater cost than the initial installation.

ENVIRO EPS Range - Features and Benefits

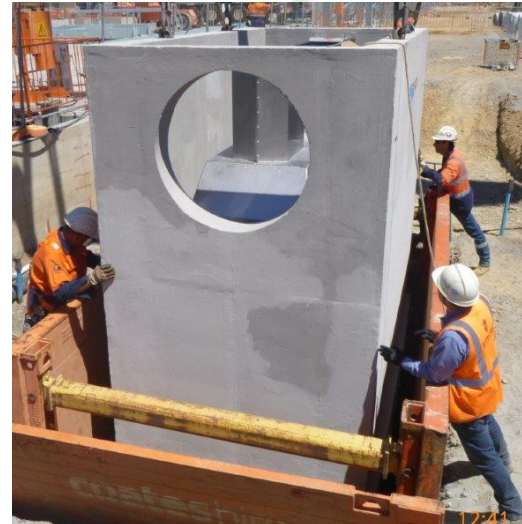
CONTRACTOR BENEFITS

Small or large, all Enviro EPS units arrive on site complete and ready for installation within hours and minimum excavation costs.

12.19pm lift off



3 hours later installed and backfilled



3.22pm backfilled



Installation of Enviro H Series oil/water separators in South Australia.



The next day,
pipework installed

ENVIRO EPS Range - Performance and Testing

Enviro, in conjunction with CPC (Civilmart) has constructed a full-time testing facility.

This facility is believed to be unique in the environmental sector. The aim is to mimic rainfall events and catchment load discharge, and subject Enviro EPS systems to constant testing and avoid the uncertainty of site testing as the only form of “proof of performance”.

Life cycle projections and performance testing in a controlled environment is a well-established practice across many industries. For example, paint companies do not watch paint for 25 years before producing their claims. Products are subjected to severe, exaggerated controlled tests over a shorter time frame. Enviro has adopted a similar approach and developed a series of stress tests.

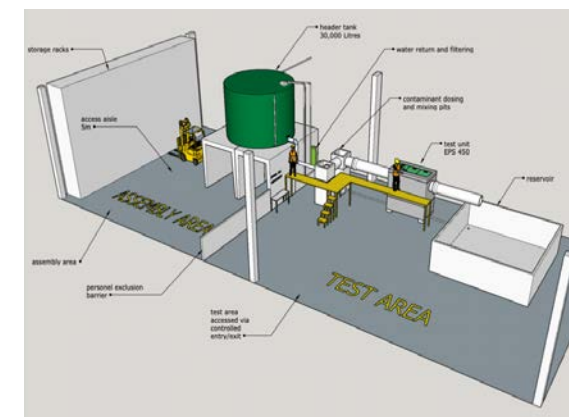
Site monitoring remains part of Enviro’s validation process. This entails installing a proprietary monitoring system that builds a long-term performance history and avoids the deficiencies of in-situ testing.

There are no standards or protocols for field evaluation which can be used as a basis for claims. The overarching requirement to not pollute storm water is legislated, while reduction targets are set by State and Local Governments. There are no reliable methods for site evaluation. For example, “grab samples” may only account for 0.01% of flow volume; samples cannot include gross pollutants and pipe flow is not homogeneous, further reducing sampling accuracy as depth varies; comparative “in” versus “out” samples cannot be taken from the same body of water, and so on.

Pollutant Group	Tested Reduction	Claimed Reduction	Tested and Confirmed
Gross Pollutants	100%	90%	Manly Hydraulics Laboratory collected samples in accordance with definitions in the ARQ and Allison et al 1997. Regardless of treated flow the one-way in-line design captured 100% gross pollutants with no re-suspension during by-pass flows.
Sediments (TSS)	81% to 86%	80%	Sediments were recovered from discharge of a sediment pond at Blacktown International Sports Grounds. 90% were less than 500 microns and 35% were smaller than 53 microns. This PSD was regarded as severe stress testing. Multiple test runs accumulated with concentration and flow variants replicating over 2 years of rainfall events. No blind was observed.
TP	80%	65%	Sydney University testing, field monitoring and laboratory analysis established that majority of TP was bonded to fine particles and that up to 92% of the TP could be retained by early capture of fine particles.
TN	80%	45%	Sydney University Civil and Agricultural Faculties and students monitored and tested the adsorption of Nitrates and Ammonium the most prevalent N species in urban debris and found that over 90% could be reduced, if the bonded particles were removed from the flow in less than one (1) hour after wetting.
Hydrocarbons H series	99.95%	99.95%	Testing by UniSA and ALS NATA Laboratory in accordance with EN 858-1 demonstrated compliance as a Class 1 oil/water separator. In summary, after dosing with raw diesel oil for 20 minutes only 4.1ppm of total hydrocarbons were detected in the discharge samples.



Full scale testing at Manly Hydraulics Laboratory (left) and an illustration of the testing facility (below) located at North Edinburgh, SA within the CPC, Civilmart factory complex.



ENVIRO EPS Selection Guide

The Enviro EPS range is divided into three series. For simplicity, these are named G, E, and H series.

Selection of the recommended and appropriately sized series is shown in Steps 1 to 4 respectively.

A MUSIC Node is available on request.

The selection steps are provided as a guide for designers. Pipe size is determined by well-established design computations however, treated flow is not separately defined and it remains a responsibility of the designer to make that determination.

All Enviro EPS devices are fitted with a pre-set horizontal flow splitter at 30% of the flow depth. This determination was made after reviewing available third-party data on pollutant mobilisation and the relationship to rainfall intensity. The BOM AR and R87 data across Australia was analysed and compared to pipe design flows. The analysis showed that a 1 year 5 min IFD on average was 34% of a 100-year storm event. Discounting flow depth via the Manning's Equation created the 30% pipe depth treated flow design base. Further design and selection advice are available from Enviro Technical Support.

For further assistance, contact
Enviro Technical Support
Email: info@enviroaustralis.com.au

Step 1: Select Enviro Series

Select the EPS series that best suits the catchment characteristics and load discharged.

Note: receiving water sensitivity is also a determining factor. Sensitive receiving water is often defined by legislation and may be subject to special conditions.

Step 2: Select size, based on pipe diameter

Pipes and/or channels are sized to meet storm water conditions and protect assets from damage. It therefore follows that a Storm Water Quality Improvement Device (SQID) must form part of that drainage system. Since storm water flow is the transporter of pollutants, the Enviro EPS chosen needs to match both the hydraulic performance of the water flow as well as the physical constraints of pipe size.

Also note that flood mitigation, in the form of OSD's, should be placed after the EPS, otherwise the OSD becomes the primary treatment location and forms a treatment train requiring maintenance.

Step 3: Check Treated Flow for Compliance

Enviro EPS systems are designed to treat at least a 1 year 5 min IFD.

Treated flow is a fundamental design consideration to determining the compliance of a pollution control system.

Additionally, check treated flow for time lag

The catchment time lag is influenced by many factors, such as overland flow gradients, surface roughness etc. In this step, compare the pre-set treated flow (F_T) to the required design treated flow (F_D), where F_D is defined as that flow which will mobilise the majority of pollutants from the entire catchment to the Enviro System. The value for F_D is typically calculated by the drainage design software.

If $F_T \geq F_D$ (Fig 1), then the pre-set treated flow should be adequate. If however, $F_T < F_D$ (Fig 2), then the next model size with adequate treated flow should be chosen.

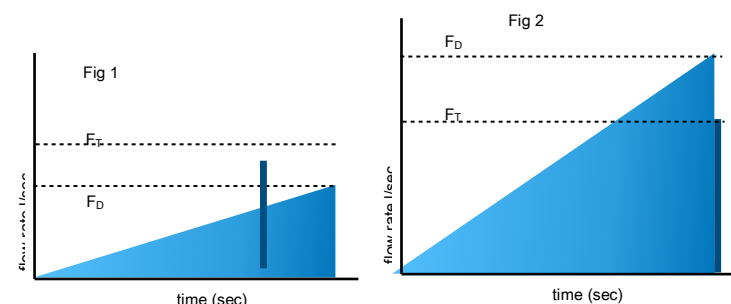
Step 4: Check Flow Velocity

If $F_D > 4\text{m/sec}$, consider increasing model size to minimise turbulence and reduce impedance during high flow by-pass.

SENSITIVITY FACTORS	ASSESS FACTOR SENSITIVITY		
	Low	High	High
RECEIVING WATER SENSITIVITY	✓	✓	✓
POLLUTANT TOXICITY	✓	✓	✓
ANTICIPATED POLLUTANT LOAD	✓	✓	✓
FUTURE CHANGES & IMPACTS	✓	✓	✓
HYDROCARBON HANDLING AND/OR SPILLAGE			✓
SELECT THE SERIES:	G	E	H

ENVIRO MODELS	PIPE SIZE Nominal Internal Diameter (mm)									
	150	225	300	375	450	525	600	675	750	900
G, E & H30	✓	✓	✓	✓						
G, E & H45			✓	✓	✓					
G, E & H60					✓	✓	✓			
G, E & H75							✓	✓	✓	
G, E & H90									✓	✓

ENVIRO MODELS	PRE-SET TREATED FLOW (l/sec) V's GRADIENT (%)				
	0.5	1.0	2	3	4
G, E & H30	16	22	32	39	45
G, E & H45	47	66	93	114	132
G, E & H60	101	142	201	246	284
G, E & H75	182	258	364	446	515
G, E & H90	296	419	593	726	838



ENVIRO Treated Flow Explained

Fundamentally, treated flow occurs when there is sufficient energy in the water flow to transport the materials surrounded by that water. EPA legislation prevents pollution of storm water. State and Local Government policy set reduction targets by area and often to specific water ways.

The ARQ section 2.4.2 notes that 70% to 90% of contaminants are transported by a 1-year ARI. Therefore, to remove 90% of the load, at least a 1-year ARI should be treated.

If water falls on a porous (pervious) surface, then water is unlikely to surround the materials. The result would be wet stationary materials. This condition remains for as long as the rate of infiltration exceeds the rate of rainfall. Once the rate of rainfall exceeds infiltration then run-off begins.

The starting point for run-off will vary depending on surface porosity (permeability), roughness and gradient. The driving factor is to determine run-off energy. Energy is available in the following forms. Firstly, the explosive energy of rain drops striking the surface mobilises materials. In particular, smaller sized materials such as sediment. The next available energy is wind, creating a horizontal force. The greater prevailing form of energy is gravitational energy, creating a force to cause water to flow, relative to gradient.

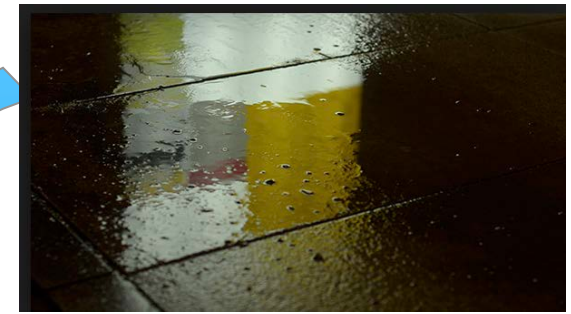
The final component of treated flow is duration (time) required for the flow to transport the material of source to point of separation and retention. Images 1, 2 and 3 show flow stages.

The treated flow determination is generally expressed as rainfall, either as intensity and/or depth. Therefore, to determine the treated flow, both factors need to be considered.

There is no fixed standard by which treated flow is determined. The range of variables are diverse, complex and unique to a catchment at the time of a rainfall event.

Engineers need to be mindful that they are ultimately responsible for compliance with Environmental Protection Legislation, which has provision for prosecution. Though suppliers of Storm water Quality Improvement Devices (SQID's) are responsible for performance claims, engineers (design specifiers) are responsible for catchment related factors, and in particular treated flow.

Further information on treated flow and determination factors is available in *Balanced Urban Development: Options and Strategies for Liveable Cities* Chapter 6, by Leo Crasti, Technical Director



1. the surface wets and a water layer develops



2. rainfall intensifies, raindrops explode, materials are gathered



3. flows increase and develop transport energy

How much rainfall is required to transport pollutants and wash-out the catchment? It varies and is subject to many factors

ENVIRO In-Line Configuration

All Enviro EPS systems are installed in-line with the pipe or drainage channel. Off-line diversion may be used in special circumstances and is subject to custom design in consultation with the Certifying Engineer.

There are fundamentally two reasons. Firstly in-line installations ensure treated flow is directed into the EPS, therefore compliance with legislation occurs. Secondly, installation costs are minimised by eliminating additional civil works and reducing the number of items to install to achieve the same outcome.

The hydraulic characteristics of skew weirs used to divert water are well known to exhibit hydraulic jump and subsequent draw-through.

Explained simply, as water velocity increases, so does the tendency for water level to build up, particularly as velocity approaches 1m/sec (Fig 1). As levels rise, the flow velocity in a drain also continues to increase, eventually cresting and topping over the weir (Fig 2).

Hydraulic resistance within the off-line device will also influence the critical flow at which hydraulic jump occurs.

An Enviro experiment showed that a critical point occurred at approximately 70% of the weir height, particularly when flow velocities exceeded one metre/sec. After this point was reached, all the flow effectively by-passed over the weir.

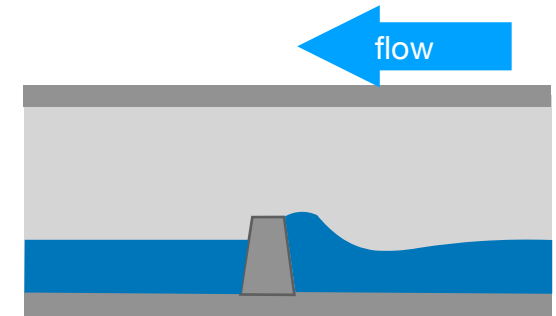


Fig 1: illustrates the tendency of the water level on the weir upstream side to build up. note the water level on the downstream side also rises reducing the

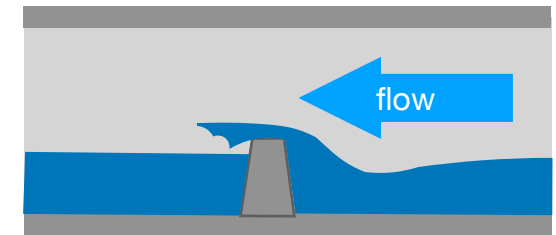


Fig 2: illustrates the break through point, when the water crests and tops over the weir. The hydraulic resistance or 'k' factor of the off-line device also plays a role in causing the weir overflow.

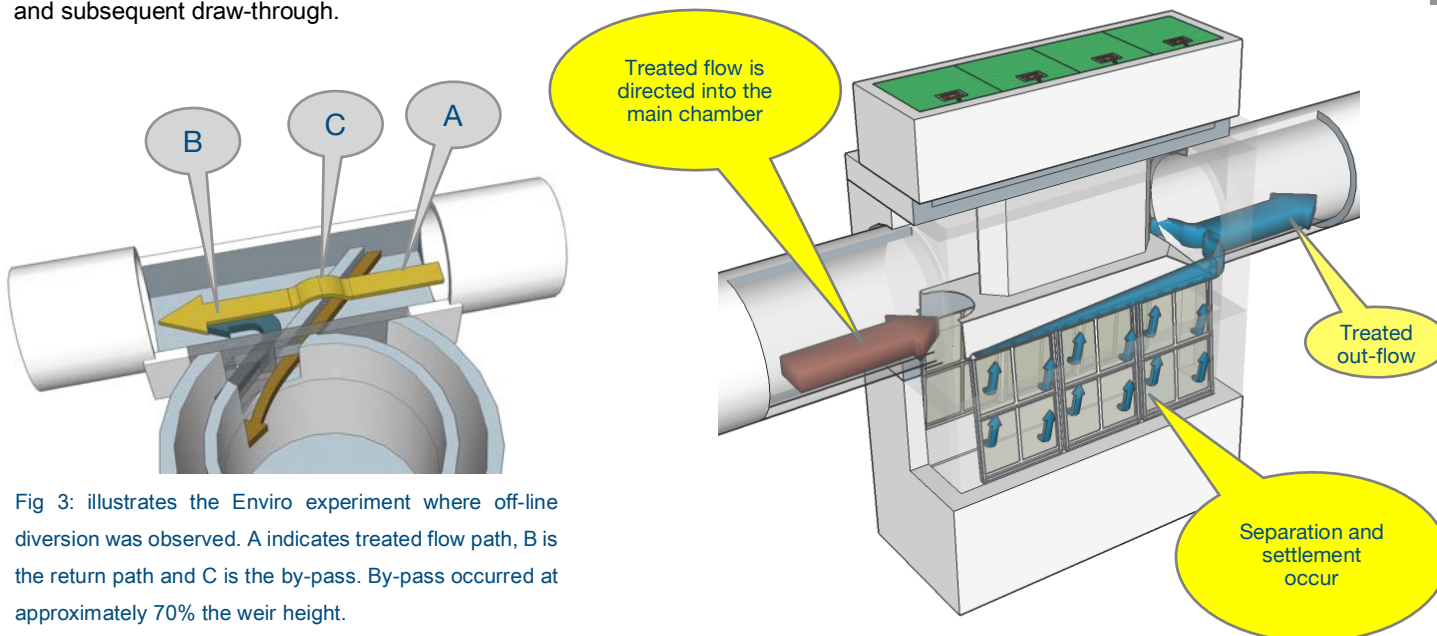


Fig 3: illustrates the Enviro experiment where off-line diversion was observed. A indicates treated flow path, B is the return path and C is the by-pass. By-pass occurred at approximately 70% the weir height.

Fig 4: illustrates the Enviro EPS (G series) showing the in-line configuration which is common to all the EPS Series. The one-way entry is positive and continues to direct treated flow into the process chamber regardless of flow rate and velocity. As tested, no re-suspension and by-pass is possible once materials have been captured.

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