Mott MacDonald
Hughes Trueman

Our Ref: 08P172

8th December 2010

Suters Architects
Suite 118 Lower Deck Jones Bay Wharf
26 – 32 Pirrana Road
Pyrmont, NSW, 2009

Attention: Mr Steven Donaghey

RE: WEST PYMBLE POOL – STORMWATER MANAGEMENT ASSESSMENT

1.0 INTRODUCTION

Hughes Trueman have undertaken hydrological / hydraulic calculations for the proposed upgrade works to West Pymble Pool, West Pymble, and submit the following report in support of the development application.

The purpose of the investigation is to:

- estimate the required Site Storage Requirement (SSR) and Permissible Site Discharge (PSD) rate for the proposed development in accordance with Ku-ring-gai Council's statutory requirements;
- recommend a suitably sized on-site detention (OSD) system to provide sufficient flow retardation and attenuation to restrict the post developed peak discharges to those of the pre developed scenario; and
- identify appropriate treatment measures to satisfy Ku-ring-gai Council's water quality statutory requirements.

2.0 SITE DESCRIPTION

The subject site is situated off Prince of Wales Drive, West Pymble in Sydney's north-west, approximately 13.4km from the Sydney CBD. The site is bound by Prince of Wales Dr. to the south with vegetated areas on all other sides, and grades steeply to the south-east. The proposed development works are to include a two-storey administration office/pool hall situated on the raised grassed landscape immediately north-west of the existing Olympic size swimming pool.

Detailed survey information of the existing development indicates that a council pipe system enters the West Pymble Pool site to the south-east of the proposed building works. This will be the proposed discharge point for stormwater flows developed within the site.

3.0 DESIGN GUIDELINES

The stormwater drainage for the West Pymble Pool development has been designed to comply with the following guidelines:

- *Australian Rainfall and Runoff* 2001;
- Ku-ring-gai Council's *Development Control Plan* (DCP 47 2005); and
- Managing Urban Stormwater: *Soils and Construction*, Volume 1, 4th Edition, March 2004.

4.0 STORMWATER QUANTITY

4.1 METHODOLOGY

In accordance with Council's policies, On-Site Detention (OSD) is required to restrict the peak post developed flows to pre-development levels for rainfall events up to and including the 100yr ARI. For the purposes of this report, the principles as outlined in Ku-ring-gai Council' Development Control Plan were used to calculate the allowable flows exiting the site under the proposed scenario. Detention requirements are then recommended from the results.

4.2 PROPOSED SYSTEM

The proposed stormwater drainage network for the West Pymble Pool site has the following parameters:

- The proposed pit and pipe network has been designed to connect to the authorities' drainage system (refer drawing 08P172-DAC120);
- The roof water from the proposed administration/pool hall building is to be collected via roof gutters and downpipes and discharged directly into the proposed rainwater re-use tank (re-use associated with irrigation of planting areas). When full, the rainwater tank will overflow into "ODS Tank 1" prior to discharge from the site;
- All paved and landscape areas are collected within grated pits and drains. 80% of the catchment drains to the proposed OSD systems, with 20% discharging directly to council's drainage network as bypass; and
- The OSD systems have been designed to control flows from the site to the discharge point via an internal orifice.

4.3 ON-SITE DETENTION (OSD) SYSTEMS

The proposed on-site detention (OSD) has been designed in accordance with Ku-ring-gai Council's DCP 47 and consists of two (2) below ground systems, the first located beneath the proposed administration/pool hall building (OSD 1) and the second within the landscaped area at the south-east corner of the site (OSD 2) as shown on drawing 08P172-DAC120.

The site falls within the Loftberg Quarry Creek catchment area with a site storage requirement (SSR) of 272m^3/ha and permitted site discharge (PSD) of 153L/s/ha.

The proposed below ground OSD systems have the following parameters (refer to Appendix A for OSD spreadsheet calculations):

OSD System	Orifice Diameter (mm)	Discharge (L/s)	OSD Storage (m^3)
OSD 1	108	39.01	70.0
OSD 2	121	38.98	70.0

These results indicate that the OSD system as listed above is consistent with Ku-ring-gai Council's statutory requirements.

5.0 WATER QUALITY

5.1 WATER QUALITY OBJECTIVE

In accordance with Ku-ring-gai Council's DCP 47, we note that the following targets have been set in relation to stormwater quality:

1. *Reduction in annual average suspended solids (TSS) export load of 80%*
2. *Reduction in annual average total phosphorus (TP) export load of 45%*
3. *Reduction in annual average total nitrogen (TN) export load of 45%*
4. *Reduction in annual average gross pollutant (GP) export load of 70%*

To demonstrate compliance with these objectives, treatment removal loads were analysed from developed untreated to development treated scenarios using MUSIC (Model for Urban Stormwater Improvement Conceptualisation) software. Generally, MUSIC modelling is undertaken for sites in excess of 5Ha, however for the purpose of this exercise modelling was undertaken to represent the affects that the proposed development may have on the water quality. Model development and results are discussed in the following sections.

5.2 WATER QUALITY MODELLING

A water quality modeling tool, MUSIC was utilised to simulate urban stormwater systems operating at a range of temporal and spatial scales. MUSIC models the total amounts of gross pollutants and nutrients produced within various types of catchments. It allows the user to simulate the removal rates expected when implementing removal filters to reduce the increased gross pollutant and nutrient levels created by the proposed development.

The following methodology and parameters were incorporated in the MUSIC modeling:

- The MUSIC model was created to assess the effectiveness of water quality treatment nodes which are to be constructed within areas adjacent to the proposed pool redevelopment.
- The MUSIC models default pluviograph data for Sydney Observatory 6 minute interval (10 years historical data) was utilised within the model.
- A MUSIC model was setup to represent the post developed site. From architectural plans the site was then categorised into the following categories;
    - Roof;
    - Pool/Hardstand areas; and
    - Landscaped areas.

  Refer to Appendix B for the MUSIC model.

Post Developed Region	Area (Ha)
Roof	0.228
Pool/Hardstand	0.243
Landscaped Areas	0.149
Total	**0.621**
Bypass	0.217

- Pollutant concentration parameters used within the models were incorporated from Table 3-9 and Table 3-10 in the *Draft NSW MUSIC modeling Guidelines*, prepared for the Sydney Metropolitan Catchment Management Authority. Values were generated for nodes in post developed scenarios.

  These are categorised in the following table.

Node	NSW MUSIC modelling guidelines
Roof	"Residential"
Pool/Hardstand	"Residential"
Landscaped Areas	"Residential"

- Stormwater that discharges directly from the roofed areas is generally 'clean' water and has been modeled to discharge directly to a rainwater tank for water re-use.
- A treatment train was designed to incorporate a series of treatment nodes including GPT (humeceptor), rainwater tank, enviropod pit inserts (refer Appendix C for product specification) and grassed swales. Results are provided below for the effectiveness of the proposed treatments.

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5.3 RESULTS

The following results were achieved within the model.

Pollutant	(kg/yr)		Removal Rate (%)	Target Removal Rate (%)
	Post – Development with no WSUD measures	Post – Development with WSUD measures		
Suspended Solids	1,190	76.9	93.6	80
Phosphorus	1.98	0.831	58	45
Nitrogen	15.2	8.33	45.2	45
Gross Pollutants	151	0	100	70

Results indicate that the treatment train as listed above will satisfy Council's statutory requirements in target removal rates.

Yours faithfully

D. Reilly

MOTT MACDONALD HUGHES TRUEMAN
DEAN REILLY
Civil Engineer

REVIEWED BY
CHRIS AVIS
Associate Director

APPENDIX A: OSD CALCULATIONS

Appendix 3
On-Site Detention Calculation Sheet

Address WEST PYMBLE POOL

Catchment Detail					
1.	Catchment Name NORTHERN CATCHMENT (OSD 1)				
2.		Catchment Discharge Rate	0.0153	l/sec/m^2	**A**
3.		Catchment Storage Rate	0.0272	m^3/m^2	**B**
Site Details					
4.	Site Area 4250 m^2 ^	60% of site area	2,550	m^2	**C**
5.	Area(s) not draining to the detention system 366 m^2				
6.		Total impervious area (roofs, driveways, paving, etc.)	3884	m^2	**D**
7.		Impervious area bypassing detention system	0	m^2	**E**
Permitted Site Discharge					
8.		**C** [2550 m^2] x **A** [0.0153 l/sec/m^2] =	39.015	l/sec	**Flow 1**
9.		Adjustment for any uncontrolled impervious flow **E / D** =	0	(<0.25)	**F**
10.		**Flow 1** [39.015 l/sec] x **F** [0] =	0	l/sec	**Flow 2**
11.		**Flow 1** [39.015] – **Flow 2** [0] =	39.015	**l/sec**	**PSD**
Site Storage Requirement					
12.		**C** [2550 m^2] x **B** [0.0272 m^3/m^2] =	69.36	**m^3**	**SSR1**
13.		If the storage is in a landscaped basin, **SSR1** x 1.2 =	N/A	**m^3**	**SSR2**
Outlet Control					
14.		Height difference between top water surface level and the centre of the orifice	2.5	m	**G**
15.		Orifice Diameter $21.8 \times \sqrt{\frac{PSD}{\sqrt{G}}}$	108.29	**mm**	**OD**

PSD = Permitted Site Discharge
SSR1 = Site Storage Requirement (except for landscaped basins)
SSR2 = Site Storage Requirement (landscaped basins) **(Note: Use only SSR1 or SSR2)**
OD = Orifice Diameter

Signature..... **Name**.....

Qualifications..... **Date** .....

Appendix 3
On-Site Detention Calculation Sheet

Address WEST PYMBLE POOL

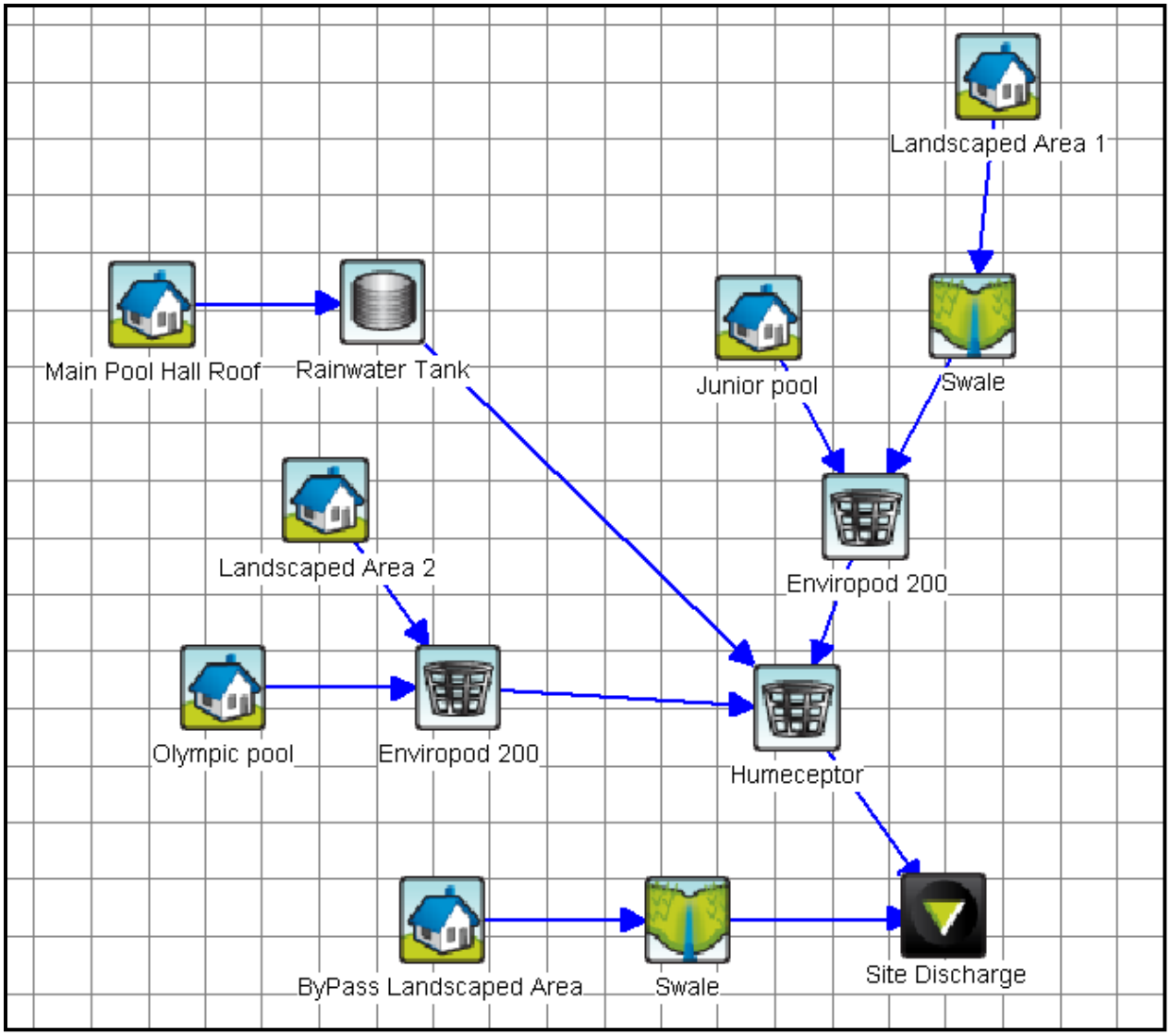
Catchment Detail				
1.	Catchment Name SOUTHERN CATCHMENT (OSD 2)			
2.	Catchment Discharge Rate	0.0153	l/sec/m^2	**A**
3.	Catchment Storage Rate	0.0272	m^3/m^2	**B**
Site Details				
4.	Site Area 4,247 m^2 ^ 60% of site area	2,548	m^2	**C**
5.	Area(s) not draining to the detention system 1,600 m^2			
6.	Total impervious area (roofs, driveways, paving, etc.)	1815	m^2	**D**
7.	Impervious area bypassing detention system	0	m^2	**E**
Permitted Site Discharge				
8.	**C** [2548 m^2] x **A** [0.0153 l/sec/m^2] =	38.98	l/sec	**Flow 1**
9.	Adjustment for any uncontrolled impervious flow **E / D** =	0	(<0.25)	**F**
10.	**Flow 1** [38.98 l/sec] x **F** [0] =	0	l/sec	**Flow 2**
11.	**Flow 1** [38.98] – **Flow 2** [0] =	38.98	**l/sec**	**PSD**
Site Storage Requirement				
12.	**C** [2548 m^2] x **B** [0.0272 m^3/m^2] =	69.3	**m^3**	**SSR1**
13.	If the storage is in a landscaped basin, **SSR1** x 1.2 =	N/A	**m^3**	**SSR2**
Outlet Control				
14.	Height difference between top water surface level and the centre of the orifice	1.6	m	**G**
15.	Orifice Diameter $21.8 \times \sqrt{\frac{PSD}{\sqrt{G}}}$	121.02	**mm**	**OD**

PSD = Permitted Site Discharge
SSR1 = Site Storage Requirement (except for landscaped basins)
SSR2 = Site Storage Requirement (landscaped basins) **(Note: Use only SSR1 or SSR2)**
OD = Orifice Diameter

Signature..... **Name**.....

Qualifications..... **Date** .....

APPENDIX B: MUSIC MODEL



Music Model Layout

APPENDIX C: PRODUCT SPECIFICATIONS

EnviroPod
(Pit Inserts)

Technical Design Manual

EnviroPod Contents

Design and Operation

The EnviroPod® is a proven catchpit insert designed to be easily retrofitted into new and existing stormwater catchpits, requiring no construction or land take. It removes a significant portion of sediment, trash, debris and other pollutants from water entering the stormwater system, and can be installed in either curb inlet, standard pre-cast catchpits or manhole catchpits. Using low-cost passive screening and optional oil-adsorbent media, the EnviroPod® can be customised to meet site-specific requirements with interchangeable polyester mesh screens ranging from 100 to1600 micron pore size. 200micron filter mesh screening bags are supplied as standard (unless specified otherwise). This filter mesh has a moderate/high removal rate and a moderate maintenance requirement.

The EnviroPod is also effective as a pre-treatment device for use in a treatment train with hydrodynamic separators, filtration, ponds, swales and wetlands. In many cases, it's often the most practical solution for retrofits.

Independently trialled and tested by city councils throughout Australia and New Zealand and with installation of over 7,000 units including North America, the EnviroPod® Filter is the premiere pit insert.

DESIGN AND OPERATION

The EnviroPod® consists of a screening bag supported by a fillterbox and structural cage. Modular plastic deflector panels attach to the filterbox and guide the flow of water to the screening bag. The screening bag captures pollutants and allows the water to pass through to the outlet pipe. Optional absorbent material inside the screening bag captures oil and grease. Openings in the filterbox allow water to bypass the screening bag during high flow conditions to prevent surface flooding.

CONFIGURATIONS

The EnviroPod® is designed to simply insert into the gully pit below the grate and is mounted on aluminium rails anchored to the (gully) pit walls. The one configuration fits sump type grates, road gullies, kerb entry units etc. Plastic deflector panels seal against the pit walls and direct flow into the filterbox and through the mesh screens. There are mainly two standard sizes to fit most pre-cast (FRC & plastic included) regular and curb entry gullypits with varying plan dimensions between 400 x 400 up to 1200 x 1200. Custom designs are able to be fabricated for non-standard pits.

MAINTENANCE

Maintenance of the EnviroPod is easy and straight forward. Simply lift the screening bag from the frame and dump out the captured pollutants. Alternatively, the bag can be vacuumed for even faster maintenance. If necessary, replace the oil absorbent media bags.

CAPABILITIES

- Captures sediment, trash, debris and other pollutants before they enter the storm drain system
- Fits curb inlet and flat-grate gully pits
- Easy access — maintenance-friendly design
- Fits a range of gully pit sizes — ideal for retrofits
- Adjustable panels allows fine-tuning during installation for a perfect fit

CONFIGURATIONS

TABLE 1.

	EPod - A	EPod - C
Gully Pit Width, Min – Max (mm)	500 - 1200	400 - 650
Gully Pit Length, Min – Max (mm)	730 - 1200	450 – 750
Mesh Size[1] (µm)	200, 1600 & 5000	200, 1600 & 5000
Debris Capacity (L)	135	60
Treated Flow Rate (L/s)	10-100	10-100
Bypass Flow Rate[2] (L/s)	200+	130+

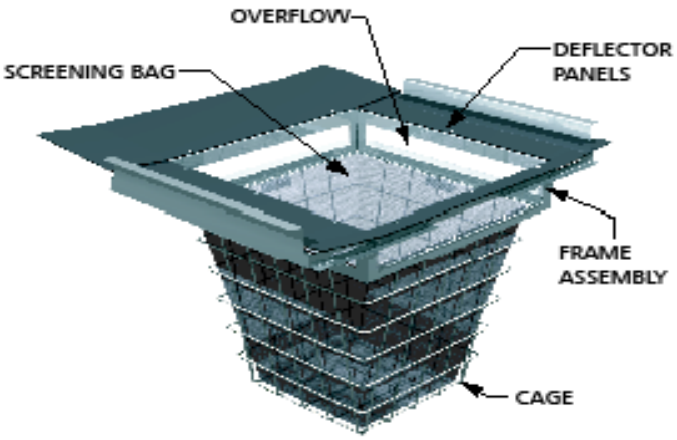


Figure 1. Standard Enviropod Filter

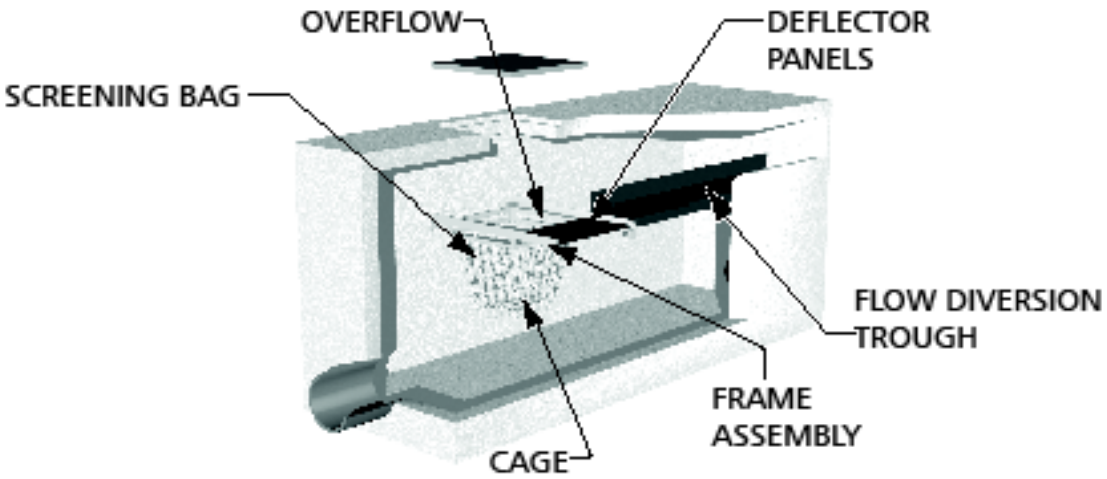


Figure 2. Gully Pit Enviropod Filter configuration.

Parameter Performance: Gross Pollutants & Coarse Sediment

Testing at the University of South Australia Urban Water Resources Centre found that the Enviropod unit retained all litter up to an approach flow of 100L/sec. On this basis and the design of the Enviropod Filter bag material which has a sieve aperture of 200 micron we can say with confidence that the Enviropod pre-treatment will retain 100% of Gross Pollutants and coarse sediment – defined by the Victoria Stormwater Committee as particles ranging from 500 to 5000 micron.

For full copies of the testing data please contact Stormwater360.

Parameter Performance: Suspended Solids

The Enviropod Filter is a gully pit insert designed to be easily retrofitted into new and existing stormwater gully pits, requiring no construction and no land take. Located at the source of stormwater contaminates the Enviropod Filter has interchangeable filters ranging from 100 micron to 4000 micron pore size. For Suspended Solids reduction application we recommend using a monofilament 200micron pore size filter bag (Enviropod 200).

The Enviropod filter relies on removing contaminants from stormwater by the mechanism of direct screening, guaranteeing debris and particles larger the pore size will be removed. Testing done in Auckland using an Enviropod 200micron filter shows a removal of up 97% Suspended Solids for particles 100 to 500micron in size (Butler, Ockleston, Foster, no date, pg 6).

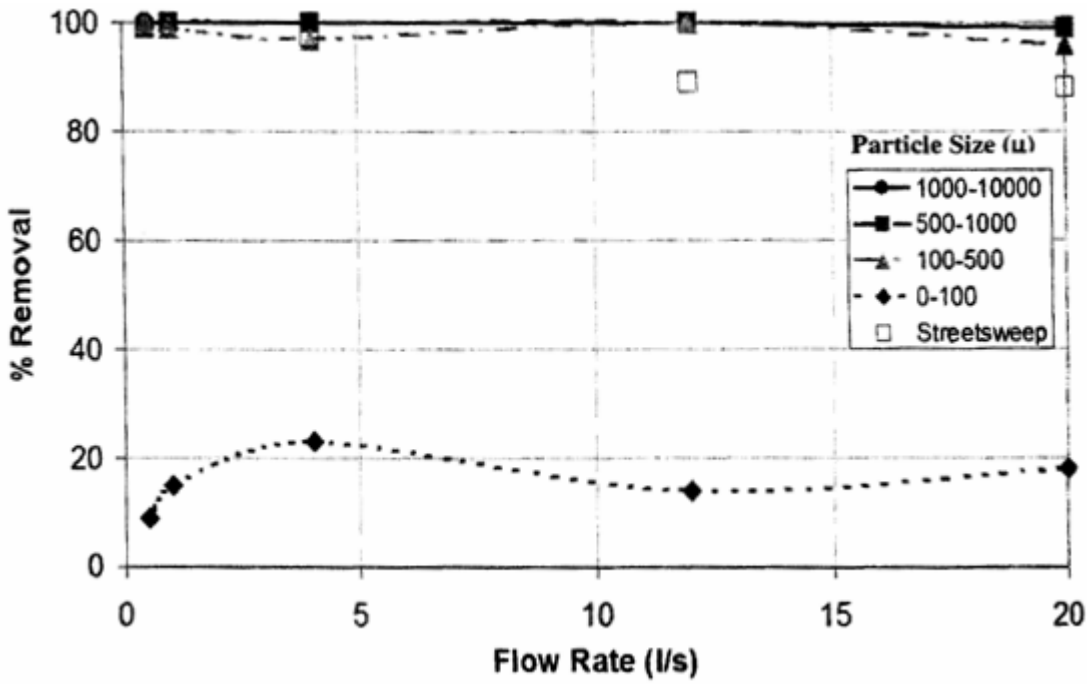


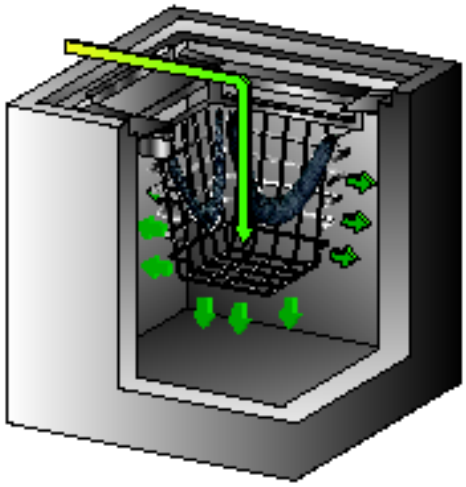
Figure 3. Percentage Removal for various particle sizes.

For full copies of the testing data please contact Stormwater360.

Parameter Performance: Oil and Grease

The EnviroPod uses a perlite based adsorbent material (optional) specially treated to enhance its natural ability to capture and retain oil and grease. The adsorbent material is contained in pouches that are designed to ensure maximum contact with stormwater as it enters the gully pit. Laboratory testing demonstrated that the oil adsorbent material can capture and retain three times its weight in oil.

Each EnviroPod is configured with oil adsorbent pouches around one side of the frame, at the top of the screening bag. During low flows, the water entering the catch basin contacts the oil adsorbent pouches before passing through the screening bag. During high flows, when the EnviroPod begins to bypass, the pouches skim floating oil and grease from the surface of the water retained in the screening bag.



The pouches are clipped to the screening bag for easy removal during maintenance. As the pouches capture oil, the adsorbent material darkens. When the pouches are nearly black they have almost reached their oil adsorbent capacity and should be replaced.

Inspection and Maintenance

EnviroPod installations vary due the vast number of gully pit configurations. These guidelines should apply to most cases as written. For the remaining cases, follow the general actions of these guidelines, varying them as necessary.

The maintenance crew is responsible for disposing of debris in accordance with all applicable regulations and is responsible for following all applicable regulations, including confined space entry requirements.

Contact the maintenance department at Stormwater360 for more information or to order EnviroPod bags and oil absorbent pouches.

VACUUM TRUCK MAINTENANCE

1. Establish a safe working area per typical catch basin service activity.
2. Remove grate.
3. Vacuum accumulated debris from the upper portion of the catch basin.
4. Remove and inspect the oil absorbent pouches clipped to the inside of the EnviroPod bag. Replace with new pouches in step 8 if the pouches are dark with oil.
5. Vacuum contents from bag. Once most of the material is removed, remove the bag from the EnviroPod with two manhole cover hooks through the loops at the top of the bag.
6. Clean sediment and oils from sides of bag by shaking and/or brushing, taking care not to damage the bag.
7. Inspect the bag, replace if damaged.
8. Re-install oil absorbent pouches. Place bag in EnviroPod.
9. Replace grate.

HAND MAINTENANCE

1. Establish a safe working area per typical catch basin service activity.
2. Remove manhole cover.
3. Remove any material that is in the trough through the curb inlet or manhole.
4. Remove the bag from the EnviroPod with two manhole cover hooks through the loops at the top of the bag. Excess debris should be scooped out first if the bag is near full.
5. Remove and inspect the oil absorbent pouches clipped to the inside of the bag. Replace with new pouches in step 9 if the pouches are dark with oil.
6. Pour contents of bag into disposal container.
7. Clean sediment and oils from sides of bag by shaking and/or brushing, taking care not to damage the bag.
8. Inspect bag, replace if damaged.
9. Re-install oil absorbent pouches in bag.
10. Place bag in EnviroPod. CRITICAL – There is a steel ring inside the bag. Make sure the loose ends are joined together in the connector tube.
11. Replace manhole cover.