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Report on the Test of a Source Control Oil Separation System

Assessment and Monitoring of the Oil Retention Performance of the Gullyceptor Treatment System

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This test was undertaken and carried out by the authors on the premises of SEL Environmental (SEL) on behalf of Permavoid Limited.

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Introduction and Rationale

Sustainable Drainage Systems (SUDS) are increasingly being used to reduce the adverse effects of development on run off from urban surfaces into streams and rivers. A fundamental principle of SUDS is source control, i.e. controlling the volume of run off and improving its quality as close as possible to the place where the rainfall hits the ground (Woods-Ballard *et al.* 2007).

As an integral part of SUDS solutions a diverse range of techniques are used to deal with the storm water whilst addressing the key idea of the SUDS philosophy which focus on water quantity, water quality and amenity. SUDS take a holistic approach to all these parameters and none of them should be neglected.

There are numerous treatment techniques available for the design of SUDS solutions. They range from softer solutions (landscaping) including ponds, swales and wetlands to harder devices (constructed/engineered systems) such as pervious pavements and interception devices.

Water quality aspects

Urbanisation and land development are commonly associated with significant negative impacts on the environment (increasing run-off water volumes and pollutant loads). Pollution arising from such often individually minor, point sources contributing to what has been identified as an increasingly significant problem, diffuse pollution, not least because recent improvements in control of identifiable point sources (such as water pollution from a site wastewater discharge outlet). Thus pollutants mobilised from surfaces are now becoming recognised as a major cause of decline in the quality of controlled waters (D'Arcy *et al.* 2000). The pollutants are specific to the land use and in areas where contamination from traffic is significant can include substances from atmospheric deposition, maintenance activities and depositions from exhausts and vehicle oil leaks. Since 1980 there has been an increase of 83% in number of cars on the road and this is still increasing per year. Currently there are 28 million cars on UK roads which account for 79% of the total road traffic (Napier *et al.* 2008). Depending on the land-use

Figure 1 Typical pollution incident (Earl Street Coventry 2003)

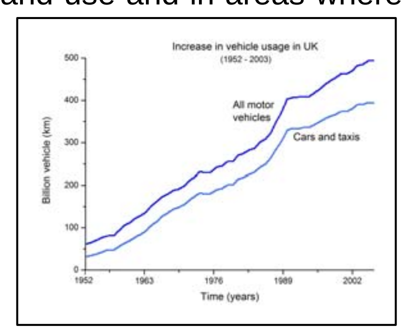

Figure 2 Increase in vehicle usage in UK (National Statistics 2006)

typical surface pollutants available for mobilisation by precipitation are found such as:

- sediments, oils, grits,
- heavy metals, fertilisers, pesticides,
- animal wastes, salts,
- pathogens and
- litter.

Those deposited pollutants are flushed away during rain events, collected from impermeable surfaces and will be concentrated within the drainage systems and are often discharged to aquatic ecosystems with little or no treatment.
Among those harmful substances listed above hydrocarbons are one of the major pollutant groups affecting the environment.

Hydrocarbon pollution

Hydrocarbons are both one of today's prime energy sources and key components consumed by modern society in the role of lubricants and solvents thus contributing to losses to the environment. Resulting from this and the usage of hydrocarbons in general is the occurrence of frequent accidental spills, despite all technological advances to prevent them from taking place. These spills are often from transportation, storage and distribution or the unnoticed release. As an example petroleum hydrocarbon contamination of aquifers presents a serious threat to ground water resources. Incidents with mineral oil products such as crude oils, engine oils, petrol, and diesel result in severe and complex contaminations with their multiple compounds (Bockelmann *et al.* 2003; Chaplin *et al.* 2002; Heidrich *et al.* 2004; Meckenstock *et al.* 2004).

The diffuse discharge of oil and hydrocarbons to urban receiving waters constitutes a major pollution source being responsible for up to 17% of all reported water pollution incidents in the UK (Ellis *et al.* 2006). In order to quantify the pollution problem in a more comprehensively way Brian D'Arcy has produced a review looking in depth into the hydrocarbon pollutions problems in the UK (D'Arcy 2008). The review concludes that the extent of the pollution problem is equivalent to 17 full road tankers of oil per year being lost to the urban surface water drainage system of an area as limited as the region of West Yorkshire in England (0.8% of UK area; Wikipedia 2008; Non UK readers are directed to towards the appendix for an illustration of its relative size).

This report describes the effectiveness of a new hydrocarbon interception device which provides an additional option to SUDS solutions when paved areas are to be drained.

Systems for dealing with hydrocarbons spillages

Oil interceptors

These are basically large tanks or chambers incorporating a means of drawing water from the base of the tank leaving oil floating at the top. More modern designs often also incorporate proprietary inserts to aid the separation of oil from water. The guidelines regulating the 'Use and Design of Oil Separators in Surface Water Drainage Systems' (PPG 3 2000) requires either Class 1 or 2 separator performance under standard test condition will limit the effluent oil concentration to 5 mg/l or 100 mg/l, respectively. (Ellis, J. B. *et al.* 2006)
However PPG3 acknowledges also that these limits may well not be complied with when installed in the field because of various effects:

- This can be due to very high flows. Normal oil separators allow oil to become entrained in a high velocity water stream before separation.
- Due to dissolved or emulsified oils originating from vehicle washing caused by degreasers or surfactants.

Source control systems

As alternatives to end of pipe treatment systems there are other approaches available which have collectively become known as source control systems. These can best be considered as overlapping with and to a great extent forming a subset of sustainable drainage systems (SUDS). The best example of such systems include such devices as pervious pavements (PPS) but the range of devices available has grown markedly in recent years (Woods-Ballard, B. *et al.* 2007).

When considering the oil retaining potential of such devices (which is only part of the aim of the devices) an advantage of these systems is that unlike conventional oil interceptors they trap the oils at source before changes in the nature of the pollutant, caused by the conveyance system, make the separation more difficult. In the case of pervious pavements they allow water to infiltrate into hard surfaces and the underlying construction is designed to clean the water, store it and either infiltrate it to the ground or slowly release it to a drainage outlet. Correctly designed pervious pavements have been shown to remove the majority of pollutants present in stormwater runoff caused by small scale incidents (Pratt et al, 2002). This is achieved by filtration and also by biodegradation of hydrocarbons that are adsorbed to materials within the construction. However although it has been demonstrated to deal with typical low volume pollution (Pratt et al 2002) such as that from slow leakage of oil from a car over time it can be difficult to deal with large scale spillages of pollutants originating from accidental vehicular accidents, lorry parks or industrial areas (Puehmeier T. *et al.* 2004) including relatively small scale, but frequent incidents such as car oil sump failures.

This introduces another aspect of the SUDS philosophy which is the treatment train approach. This builds in redundancy into the system whereby, for example, a sub-surface detention tank, necessary for attenuation of discharge, can also provide a back up water treatment performance in the event of an upstream component becoming overwhelmed either by a catastrophic spillage or a system malfunction. The use of numerous and dispersed upstream devices in small sub-catchments also means that in the event of a minor escape from one sub-system the dilution with clean water from unaffected devices provides an overall system with the required performance. The guidance provided for SUDS design increasingly stresses the need for this treatment train approach.

The Gullyceptor - Oil interception system

As mentioned above oil interception devices have been widely used for dealing with hydrocarbon pollutants emanating from numerous sources (see "Hydrocarbon pollution" above). However the Gullyceptor takes a significantly different approach to the problem by providing hydrocarbon treatment within the SUDS systems serving localised hardstandings thus treating the water close to the source.

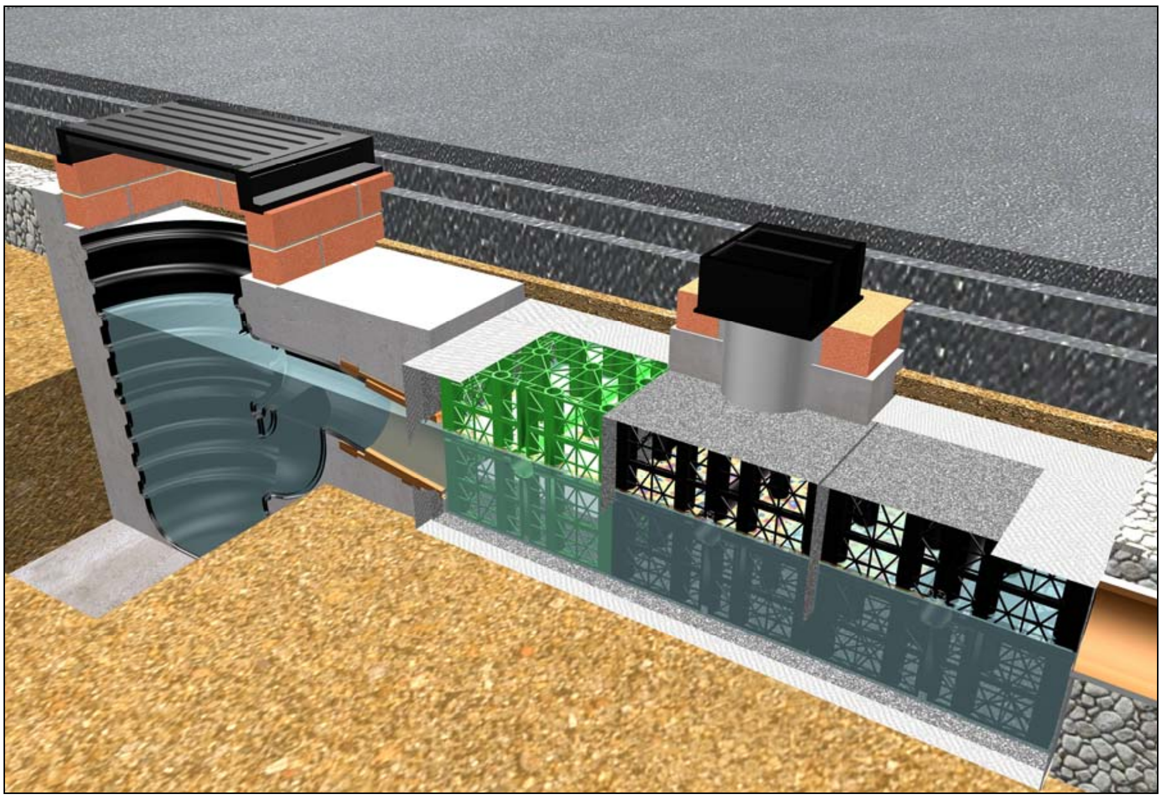

Figure 3 Gullyceptor System – Installation Example

Thus Gullyceptor units are designed to serve smaller sub-catchments as part of a source control treatment train. This allows easy integration of conventional hardstandings with gullypot drainage and, where appropriate, within an overall site specific SUDS design.

This task would prove very difficult to achieve with a conventional downstream interceptor. Moreover, as indicated above, the contemporary SUDS design guidance is moving away from such end of line, large tank oil interceptor designs as these do not meet the recognised SUDS criteria.

The Gullyceptor system is typically designed to receive drainage from a catchment area of 75m^2 with a flow not exceeding 3 l/s.

Working principle of Gullyceptor (MKII)

The Gullyceptor system illustrated below (see Figure 4) depicts a typical installation situation. The stormwater originating from the impervious surfacing (mostly tarmac or block paving) enters the Gullyceptor via the road gully (see, Figure 4, 1) that is attached directly to the system.

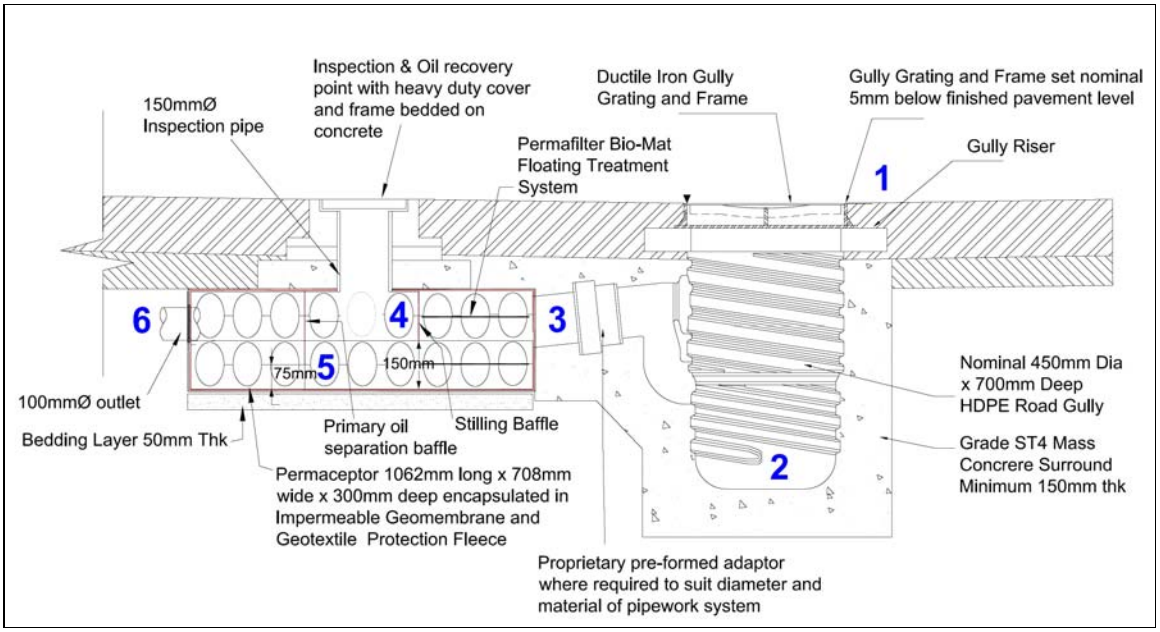

Figure 4 Typical section through Gullyceptor Installation

The gully (see Figure 4, 2) provides several functions; primarily it serves to receive the storm water from the hardstandings. During this first stage the inflow is slowed down and the velocity is taken by the gully structure. Furthermore silts and larger particulates are also separated out in this step. As the Gully incorporates a primitive baffle arrangement a fraction of the hydrocarbons is either retained or will only be allowed to be slowly transferred further. The Gullyceptor is thus a treatment system operating by gravity separation of the hydrocarbons on the basis that the oil will float on the water because of its lesser density.

The raised inlet (see Figure 4, 3) and outlet (see Figure 4, 6) of the Gullyceptor unit are formed on both sides a weir arrangement creating a permanent pool of water. As effluent enters the Gullyceptor treatment chamber the hydrocarbons are stilled by the first stilling baffle (see Figure 4, 4) and partially retained. They are finally retained by the subsequent “primary” baffle (see Figure 4, 5). As highlighted above the oils are separated gravimetrically whereas the clean water is discharged below the second baffle and is flows out over the weir (see Figure 4, 6).

Trial

A laboratory trial of the Gullyceptor was undertaken on the premises of SEL Environmental, Bury, UK (see Figure 5, for schematic of experimental arrangement).

The procedure of the test reported here for the oil retention performance was undertaken using methods developed from the European Standard 858:2002 (BSI 2002) with modifications to more correctly reflect the challenges that need to be met by the source control system.

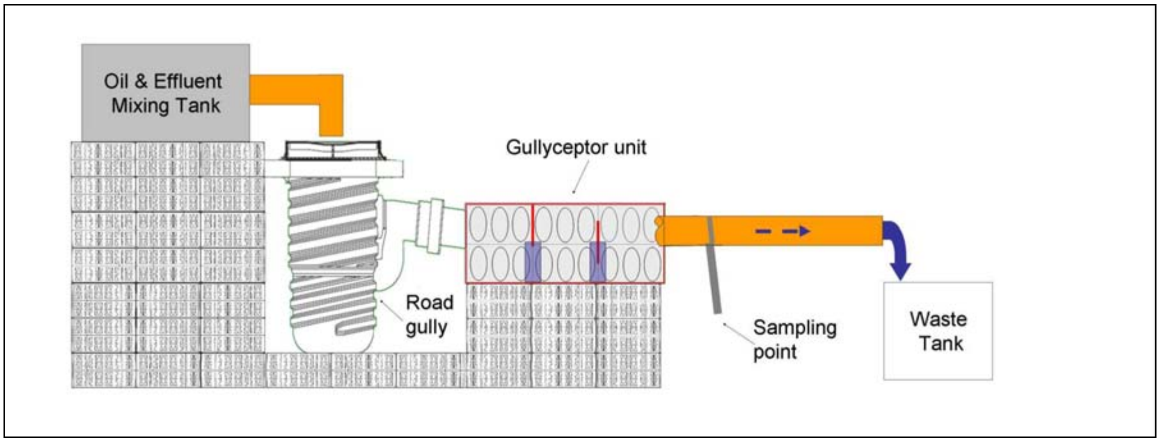

Figure 5 Gullyceptor Test Arrangement

The test protocol was designed to simulate worse credible pollution and rainfall events. Table 2 shows clearly that chemical testing of samples taken from the water issuing from the trial system show that the risk of pollution is minimal, even when considering catastrophic pollution events.

The trial system, constructed for this trial, comprised a full size Gullyceptor unit (1062 mm x 708 mm x 300 mm) which was installed in the laboratory simulating the conditions as installed in the field (as shown in Figure 3). The system tested did not include Permafilter Biomat inserts as incorporated into the latest MKII model (this is discussed later in this report).

The system under test was receiving the stormwater/oil mixture from a separate mixing chamber (725 mm x 360 mm x 450 mm) discharging directly into the standard road gully of the Gullyceptor unit. The experimental set up is shown above schematically in Figure 5.

The brief outline about the test conditions and aspects described here and in the EN 858:2002 are shown below in Table 1.

Test procedure

Prior to the test the system was primed with water during several test runs without hydrocarbons added to ensure the proper installation of all pipe work, the determination of the system volume and durations for the full water displacement through the system.

During the experiment the system was operated with a constant flow rate of 3.0 l/s, fed from a proprietary pump system. The flow was set and monitored using a flow meter (Danfoss MAG 3000, Denham Bucks), which was installed in the feeder pipe work (see Figure 6). The entire oil retention performance test was conducted over a period of 20 minutes.

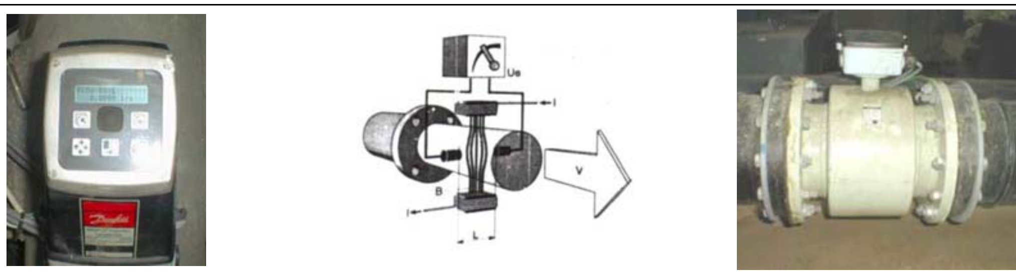

Figure 6 Flow Meter

The test oil used was Castrol GTX Magnatec 5W-30 (Castrol UK Ltd 2004) in accordance with EN 858:2002 and was added at a rate of 5ml/l (4265mg/l).

The stormwater was then transferred to the separation unit passing the two baffles (see Figure 4, "5, 6") and then discharging the water over a weir to the outlet. The laboratory model was also provided with transparent Perspex windows (shown in Figure 5 next to the baffles) allowing inspection of the system whilst in operation. The samples were taken directly from the effluent pipe through a proprietary sampling point (constructed to the specification of EN 858:2000). The samples were taken into amber glass bottles (STL Ltd, Coventry) at one minute intervals during the last five minutes of the test. The sampling was started at exactly 15 minutes after the experiment started (minutes 16 to 20).

The samples were transported to the laboratory on the following day and tested for "oil & grease" (STL 2002). The samples were maintained at a temperature below 4ºC during transport to the laboratory.

	Gullyceptor	Test method for conventional oil interceptors (EN 858-1:2002)	Implications
Flow of water	Continuous supply to Gullyceptor.	Continuous supply to Interceptor with very high velocities.	None – both tests uses continuous supply. However the flows into conventional interceptors can be very high (up to 130 l/s); whereas The Gullyceptor is not designed to deal with such large flows and therefore is tested at moderate flow appropriate to its designed function.
Oil	Test uses engine lubricating oil with density of 853kg/m^3.	Test uses fuel oil to ISO 8217, Class ISO-F-DMA with density of between 835kg/m^3 and 865kg/m^3	The Gullyceptor test use oil well within the specification for diesel and slightly denser for lubricating oil (ISO 8217) and therefore deliver comparable results.
Nominal Size	Not applicable. This value would be below NS1.	Typical Nominal size (NS) values are between 1 and 500.	This parameter is approx. equivalent to the maximum effluent pertaining to a specific catchment area (i.e. NS1 $\approx$556m^2). The Gullyceptor is always installed following an individual risk and sizing exercise and therefore the nominal size (NS) classification is not applicable.

Table 1 Systematic differences between oil separations systems

Results and Discussion

The experiments as outlined above were completed with no unexpected outcomes or incidents. During the experiment the road gully demonstrated that it effectively formed the first phase of the treatment process. The gully acts as a pre-treatment device within the Gullyceptor system. The effluent collected into the system was slowed down and the forces and velocity of the water were taken by the gully. Furthermore the gully provided a simple and primitive weir and baffle arrangement, which at this early stage is already retaining some proportion of the hydrocarbons. The gully cannot retain those indefinitely but releases them forward very slowly towards the separation section of the Gullyceptor. The gully also retains silts (not applied and tested during this trial). The effluent enters from the gully into the separation section, where two baffles are present in series comprising firstly a stilling baffle and secondly the main baffle that provides most of the oil retention. During the experiment the oil was observed, though the Perspex inspection windows, arriving and being retained at both baffles (see Figure 4). At the first stilling baffle it could be seen that the inflowing hydrocarbon containing effluent was slowed down and stilled whilst the second baffle had retained the oil, which built up to a significant layer.

This more than onerous test regime for the Gullyceptor system has demonstrated clearly the effectiveness of the system. It can either be used in areas with a lower risk in isolation or as part of a treatment train in high risk areas.

The test highlights that the Gullyceptor can effectively deal with hydrocarbon contaminants conveyed by storm water runoff (peak flow rain events) resulting in a mean oil concentration in the effluent of 12 ppm (trapping efficiency ~99%, see Equation 1) whilst receiving an input oil concentration of 4236ppm at a flow of 3 l/s.

$$\text{Trapping efficiency (\%)} = \left(1 - \frac{\text{Outflow concentration}}{\text{Input ceoncetration}}\right) \cdot 100$$

Equation 1

Time from start of test	Concentration of Oil in Effluent at constant water flow rate (3 l/s) through Gullyceptor
[min]	[ppm]
16	20.1
17	10.1
18	4.4
19	19.5
20	7.0
Input concentration	4265

Table 2 Effluent concentrations

Above in Table 2 are shown the individual effluent measurements undertaken by Severn Trent Laboratories (STL, Coventry) and also plotted in Figure 10 shown in the appendix.

Results review in the light of peak storm events

The trial reported and discussed above shows the system performance based on the capability of an individual Gullyceptor and the test conditions clearly address a worst case scenario allowing for very high flows in the system that would only be present in exceptional storm events and as discussed above; in practice the Gullyceptor would be incorporated into a SUDS designed as one component within a treatment train (i.e. see Figure 7). The following tables give indicative catchments and return period storm events that might be considered in for the Gullyceptor in a typical SUDS arrangement. The data is based on the Wallingford Procedure with rainfall data for Manchester, England.

Storm event return period [yr]	Design catchment area per unit [m^2]	Flow velocity [l/s]	Rainfall Intensity [mm/h]
100	68	3.0	158
30	86	3.0	125
5	125	3.0	86

Table 3 Storm event return periods for Manchester UK with System flows of 3.0 l/s

Storm event return period [yr]	Design catchment area per unit [m^2]	Flow velocity [l/s]	Rainfall Intensity [mm/h
185	30	1.5	180
100	34	1.5	159
30	43	1.5	125
5	61	1.5	88

Table 4 Storm event return periods for Manchester UK with System flows of 1.5 l/s

Currently the system has only been tested under constant flow of 3.0 l/s (see Table 3). The data in that table shows the different scenarios the system can be worked within or designed towards. However it is believed and also backed up by other interceptor test data (Pratt 2000) that the flow is one of the key factors affecting the treatment efficiency. Therefore the authors conclude that where the Gullyceptor is used in designs with much lower flow (i.e. 1.5 l/s) the treatment efficiency would be much improved against the average recorded effluent level of 12ppm.

Hydrocarbon treatment train based on model site layout

This example here is intended to show the Gullyceptor system functioning as one part of a treatment train. In Figure 10 a typical site layout is shown detailing the design of a SUDS scheme dealing with runoff from hardstandings (i.e. commercial retail car park, industrial yard) with a footprint ranging typically from 500 to 10000 square meters.

The various hydrocarbon treatment stages are identified in the layout as "*TS-X*" (i.e. TS-1) and the illustrated values are in the context of worst case scenarios, such as that the system is modelled at peak flows coincident with catastrophic spillages of oil.

System process and Treatment stages

The stormwater runoff from the hardstandings is received by both the Permachannel system (TS-1, oil retaining drainage channel) and the Gullyceptor units (TS-1, see Figure 3). Both systems convey the storm water towards the attenuation tank (TS-3). In the first treatment stage (TS-1), whilst receiving the potentially polluted storm water, the cleansing process has commenced (source control) and removes the majority of the pollutants.

The Permachannel system reduces the hydrocarbon pollution loadings to below 5 ppm (Newman *et al.* 2003) in the effluent whereas the Gullyceptor provides a mean discharge of 12 ppm. Prior to the stormwater entering the attenuation tank the effluent from both TS-1 stages passes through Permafilter Biomat units. This step further improves the water quality.

The Permafilter Biomat units carry a special floating filter insert. This insert is capable of staying afloat with the water conveyed through the system whilst skimming and retaining hydrocarbons from the water. The Biomat system can deal with 56g/m^2 and biodegrade the oils as the pollutants remain in the aerated zone where they are exposed to indigenous species of bacteria. The Biomat system has also been rigorously researched by Coventry University (Puehmeier T. *et al.* 2005). Finally the effluent is discharged from the attenuation tank through additional Permafilter Biomat elements (TS-4) before discharging to a final (polishing) treatment component comprising a swale, Permaceptor, gravel filter or similar (see option for TS-5).

Collectively, the cleansing steps of this treatment train approach can ensure that very low pollution concentrations and potentially total pollution removal even in extreme conditions can be achieved; thus allowing secure discharge of the run-off to controlled water. By contrast, most commercial oil interceptors are designed to deal with high flows up to 130 l/s and the treatment efficiency worsens with increasing velocities and can be as high as (at just 25 l/s effluent can be 736ppm; (Pratt, C. J. 2000).

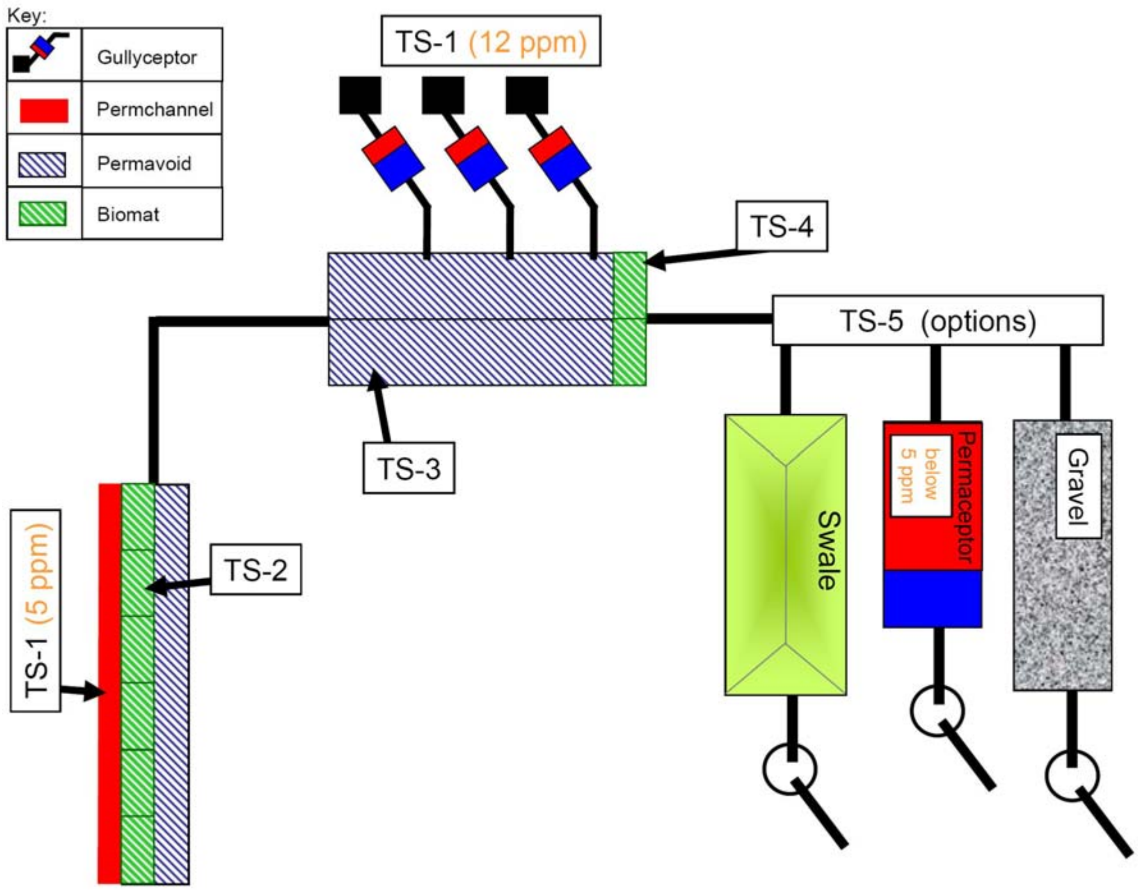

Figure 7 Gullyceptor as part of a SUDS treatment train

Conclusions

A laboratory trial has been undertaken on the Gullyceptor system. The system uses a combination of polypropylene geo-cellular units incorporating baffle and weir plates below pavement surfaces. Oils and street dust can be treated within the system (Hydrocarbon treatment is only reported here) and It can be shown that the Gullyceptor system can achieve outstanding treatment performance results. The Gullyceptor has a retention efficiency of ~99%, passing a mean oil effluent concentration of only 12 ppm. It clearly demonstrates that the Gullyceptor system is operating very effectively and outperforms (8 times better) the stated requirements of a class 2 limits as defined in PPS3 and EN 858:2000.

A summary of the results are shown below in Table 5 during a very adverse scenario allowing for very high flows in the system that would only be present during exceptional storm events.

Flow rate	Oil concentration in Outflow (ppm)			Trapping Efficiency, [%]
	Mean concentration, [ppm]	Standard Deviation, [ppm]	No. of Samples	
3 l/s	12	7	5	99.72

Table 5 Gullyceptor Test Results Summary

Furthermore the Gullyceptor unit (MKII) has now evolved further by inclusion of Permafilter Biomat units that further contribute to the oil removal. The Permafilter Biomats have been developed as a polishing system to absorb and biodegrade traces of free product oil which may escape from any upstream oil separation device (Puehmeier T. *et al.* 2005). These Biomats now aid the effectiveness of the Gullyceptor by acting as an additional stilling element and also a long term prevention to re-entrainment of oil after its density has increased because of post entrapment changes and accumulation of biological material. Normally oils would begin to flocculate by these biological and other processes and be flushed out of the system in cases where maintenance is neglected or not undertake appropriately.

Appropriately designed into a SUDS arrangement, The Gullyceptor allows the connection of large areas of impervious pavements to (SUDS) drainage systems in situations where end of line storage tanks would struggle to perform effectively, especially during larger storm events. It should be noted that regulatory guidance already advises toward dealing with the pollution problems at source rather than at the end of a site-wide drainage system. The increasing imperative under the Water Framework Directive (European Commission 2000) to address urban diffuse pollution may well mean that a major shift of regulatory focus will be required to move away from consents for end-of-pipe treatment (Ellis, J. B. *et al.* 2006).

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Appendix

- West Yorkshire Map
- STL Method Statement
- Plot of Gullyceptor Results - Oil & Grease
- Safety Data Sheet: Castrol GTX Magmatec 5W-30 A1

West Yorkshire, UK

Figure 8 West Yorkshire UK, (Reproduced from Ordnance Survey map data by permission of the Ordnance Survey © Crown copyright 2001.)

Method Statement: Oil & Grease Analysis

SEVERN TRENT ENVIRONMENTAL LEADERSHIP STL Leaders in Environmental Testing

ANALYTICAL METHOD STATEMENT

Determinand:
Non-volatile matter (NVM)

Matrix:
Waste waters, leachates, effluents and industrial waste

Principle of Method:
A group of substances are extracted from an acidified aqueous phase into a solvent phase (40°C to 60°C petroleum spirit). The extracted substances will primarily include fats, waxes, oils and grease, although other organic substances will also be co-extracted. Few inorganic compounds are extracted into the solvent layer. The sum total of the extracted substances are calculated by separating the solvent layer from the aqueous layer, followed by evaporation of the solvent and weighing of the residue. The residue after removal of the solvent is referred to as non-volatile matter.

Interferences:
As the analysis does not measure a specific chemical, but rather a range of substances deemed soluble in petroleum spirit, all substances extracted are valid to the test.

Performance of Method:

Range of Application:	4 mg/l upwards based on a 250 ml sample volume
Limit of Detection:	Estimated* at 4 mg/l
Normal Reporting Level:	4 mg/l

*Based upon a balance capable of weighing to 0.1mg, a 250ml sample portion giving a 0.1mg difference between the initial and final weight, will be calculated to contain 0.4mg/l of extractable substance.
The limit of detection has consequently been set at 4mg/l (ten times the theoretical limit).
Limit of detection = 4mg/l (estimated).

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WAS026-MS

Figure 9 STL Method Statement

Results of Oil & Grease Measurements

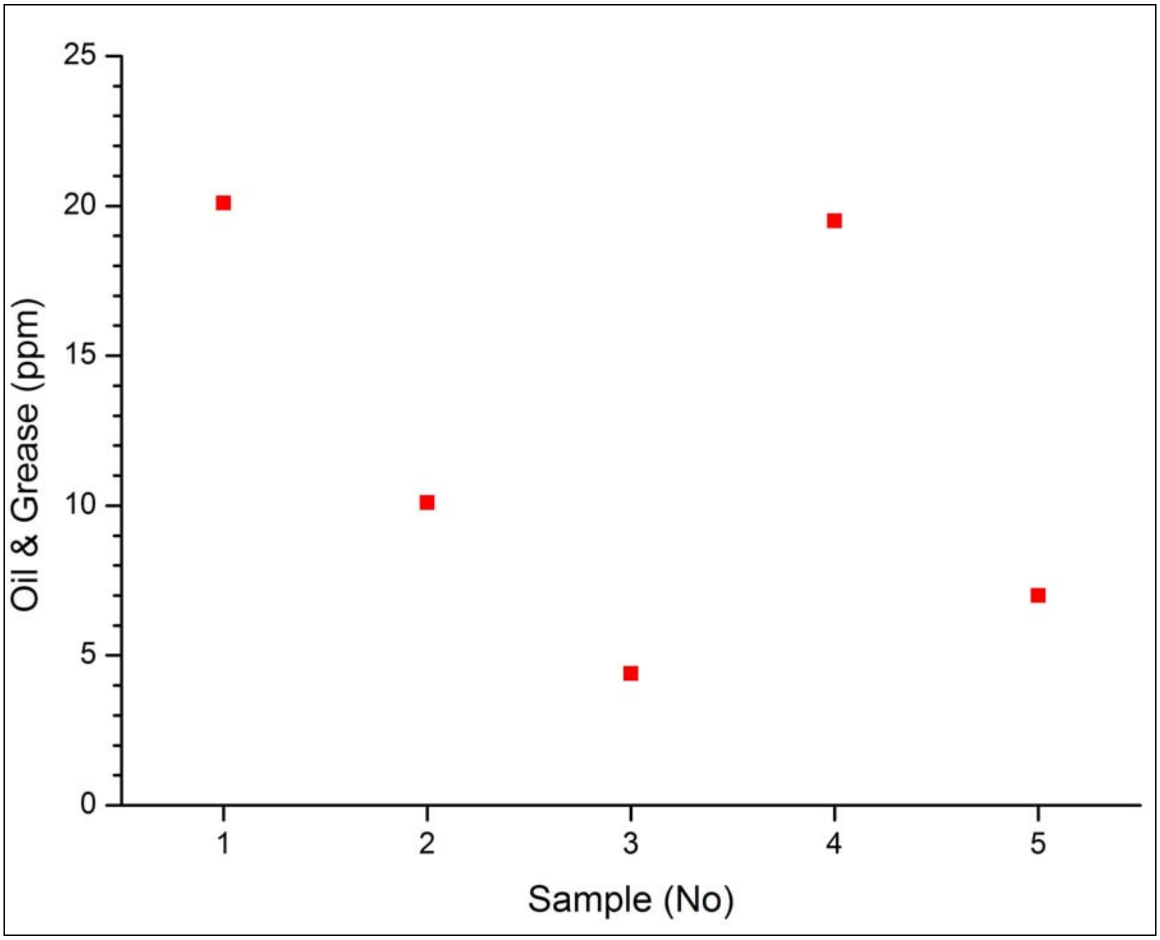

Figure 10 Gullyceptor Results - Oil & Grease

Material Safety Data Sheet for Castrol Magnatec Lubricating Oil

SAFETY DATA SHEET

1 . Identification of the substance/preparation and of the company/undertaking

Product name	**Castrol GTX Magnatec 5W-30 A1**
SDS #	453736
Product use	Automotive engine crankcase lubricant. For specific application advice see appropriate Technical Data Sheet or consult our company representative.
Supplier	Castrol (UK) Ltd Wakefield House Pipers Way Swindon Wiltshire SN3 1RE
EMERGENCY TELEPHONE NUMBER	+44 (0) 1793 512712

2 . Composition/information on ingredients

Highly refined base stock Proprietary performance additives.

Chemical name	CAS no.	%	EINECS / ELINCS.	Classification
alkyl phenol	not available	1 - 5	406-040-9	R53

See section 16 for the full text of the R Phrases declared above

Occupational Exposure Limit(s), if available, are listed in Section 8

3 . Hazards identification

This preparation is not classified as dangerous according to Directive 1999/45/EC as amended and adapted.

Physical/chemical hazards	Not classified as dangerous.
Human health hazards	Not classified as dangerous.
Environmental hazards	Unlikely to be harmful to aquatic organisms.
Effects and symptoms	
Eyes	No significant health hazards identified.
Skin	No significant health hazards identified. USED ENGINE OILS Used engine oil may contain hazardous components which have the potential to cause skin cancer. See Toxicological Information, section 11 of this Safety Data Sheet.
Inhalation	No significant health hazards identified.
Ingestion	No significant health hazards identified.

4 . First aid measures

Eye Contact	In case of contact, immediately flush eyes with a copious amount of water for at least 15 minutes. Get medical attention if irritation occurs.
Skin contact	In case of contact, immediately flush skin with plenty of water. Remove contaminated clothing and shoes. Wash clothing before reuse. Clean shoes thoroughly before reuse. Get medical attention if irritation develops.
Inhalation	If inhaled, remove to fresh air. Get medical attention if symptoms appear.
Ingestion	Do NOT induce vomiting unless directed to do so by medical personnel. Never give anything by mouth to an unconscious person. If large quantities of this material are swallowed, call a physician immediately.
Notes to physician	Treatment should in general be symptomatic and directed to relieving any effects.

5. Fire-fighting measures

Extinguishing Media

Suitable	In case of fire, use water fog, foam, dry chemical or carbon dioxide extinguisher or spray.
Not Suitable	Do not use water jet.
Hazardous decomposition products	These products are carbon oxides (CO, CO_2), sulphur oxides (SO_2, SO_3, etc.) and oxides of phosphorus
Unusual fire/explosion Hazards	This material is not explosive as defined by established regulatory criteria.
Special Fire-Fighting Procedures	None identified.
Protection of fire-fighters	Fire-fighters should wear self-contained positive pressure breathing apparatus (SCBA) and full turnout gear.

6. Accidental release measures

Personal Precautions	Immediately contact emergency personnel. Keep unnecessary personnel away. Use suitable protective equipment (Section 8). Follow all fire fighting procedures (Section 5).
Environmental precautions and clean-up methods	If emergency personnel are unavailable, contain spilled material. For small spills add absorbent (soil may be used in the absence of other suitable materials) scoop up material and place in a sealed, liquid-proof container for disposal. For large spills dike spilled material or otherwise contain material to ensure runoff does not reach a waterway. Place spilled material in an appropriate container for disposal. Minimize contact of spilled material with soils to prevent runoff to surface waterways. See Section 13 for Waste Disposal Information.
Personal protection in case of a large spill	Splash goggles. Full suit. Boots. Gloves.

7. Handling and storage

Handling	Wash thoroughly after handling. Avoid strong oxidizers.
Storage	Keep container tightly closed. Keep container in a cool, well-ventilated area.

8. Exposure controls/personal protection

Occupational exposure limits	This product does not have any assigned OELs.
Control Measures	Provide exhaust ventilation or other engineering controls to keep the airborne concentrations of vapours below their respective occupational exposure limits. Ensure that eyewash stations and safety showers are close to the workstation location.
Hygiene measures	Wash hands after handling compounds and before eating, smoking, using lavatory, and at the end of day.

Personal protective equipment

Respiratory system	None required; however, use of adequate ventilation is good industrial practice.
Skin and body	None required; however, use of protective clothing is good industrial practice.
Hands	None required; however, use of gloves is good industrial practice.
Eyes	Safety glasses with side shields.

9. Physical and chemical properties

Flash point	200 °C (Closed cup) Pensky-Martens.
Colour	Amber.
Odour	Hydrocarbon. (Slight..)
Physical state	Liquid.
Density	853 kg/m^3 (0.853 g/cm^3) at 15°C
Solubility	Insoluble in water.
Viscosity	Kinematic: 56 mm^2/s (56 cSt) at 40°C Kinematic: 9.8 mm^2/s (9.8 cSt) at 100°C

10 . Stability and reactivity

Incompatibility with various substances	Reactive with oxidising agents.
Hazardous polymerization	Will not occur.

11 . Toxicological information

Acute toxicity

Unlikely to cause more than transient stinging or redness if accidental eye contact occurs.

Unlikely to cause harm to the skin on brief or occasional contact but prolonged or repeated exposure may lead to dermatitis.

USED ENGINE OILS
Combustion products resulting from the operation of internal combustion engines contaminate engine oils during use. Used engine oil may contain hazardous components which have the potential to cause skin cancer. Frequent or prolonged contact with all types and makes of used engine oil must therefore be avoided and a high standard of personal hygiene maintained.

Unlikely to cause harm if accidentally swallowed in small doses, though larger quantities may cause nausea and diarrhoea.

At normal ambient temperatures this product will be unlikely to present an inhalation hazard because of its low volatility. May be harmful by inhalation if exposure to vapour, mists or fumes resulting from thermal decomposition products occurs.

Chronic toxicity

Carcinogenic effects: No component of this product at levels greater than 0.1% is identified as a carcinogen by ACGIH, the International Agency for Research on Cancer (IARC) or the European Commission (EC).

12 . Ecological information

Persistence/degradability	Inherently biodegradable.
Mobility	Spillages may penetrate the soil causing ground water contamination.
Bioaccumulative potential	This product is not expected to bioaccumulate through food chains in the environment.
Environmental hazards	Unlikely to be harmful to aquatic organisms.
Other ecological information	Spills may form a film on water surfaces causing physical damage to organisms. Oxygen transfer could also be impaired.

13 . Disposal considerations

Disposal Consideration / Waste information	Where possible, arrange for product to be recycled. Dispose of via an authorised person/ licensed waste disposal contractor in accordance with local regulations.

14 . Transport information

Not classified as hazardous for transport (ADR, RID, UN , IMO, IATA/ICAO).

15 . Regulatory information

Label Requirements

Risk Phrases	This product is not classified according to the EU regulations.
EU Regulations	Classification and labelling have been performed according to EU directives1999/45/EC and 67/548/EEC as amended and adapted.

Other regulations

Inventories

AUSTRALIAN INVENTORY (AICS): In compliance.

CANADA INVENTORY (DSL): In compliance.

CHINA INVENTORY (IECS): Not determined.

EC INVENTORY (EINECS/ELINCS): In compliance.

JAPAN INVENTORY (ENCS): In compliance.

KOREA INVENTORY (ECL): In compliance.

PHILIPPINE INVENTORY (PICCS): In compliance.

US INVENTORY (TSCA): In compliance.

Additional warning phrases	Safety data sheet available for professional user on request.

16 . Other information

Full text of R phrases referred to in sections 2 and 3	R53- May cause long-term adverse effects in the aquatic environment.
History	
Date of issue	16/06/2004.
Date of previous issue	09/06/2004.
Prepared by	Product Stewardship Group

Notice to reader

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