WATER RECLAMATION
SOLID WASTE MANAGEMENT

COUNTY SANITATION DISTRICTS
OF LOS ANGELES COUNTY

1955 Workman Mill Road, Whittier, CA 90601-1400
Mailing Address: P.O. Box 4998, Whittier, CA 90607-4998
Telephone: (562) 699-7411, FAX: (562) 699-5422
www.lacsd.org

JAMES F. STAHL
Chief Engineer and General Manager

September 13, 2005
File No. 31R-109.10

Mr. Bruce Fujimoto, Chief
Storm Water Program
State Water Resources Control Board
P.O. Box 100
Sacramento, CA 95812-0100

National Pollutant Discharge Elimination System (NPDES)
Storm Water Program Meeting of Storm Water Panel of Experts

Dear Mr. Fujimoto:

The County Sanitation Districts of Los Angeles County (Sanitation Districts) appreciate the State Water Resources Control Board's (State Board) decision to convene a panel of highly qualified experts to consider the technical feasibility of implementing numeric effluent limitations for storm water permits. The Sanitation Districts concur with the State Board's desire to improve storm water discharge quality in the State of California. However, as described below, the Sanitation Districts do not believe that numeric discharge limits are appropriate for highly variable, unpredictable storm water events. Instead, we suggest that the State Board consider mechanisms for evaluating and applying industry-specific best management practices (BMPs). Provided below are the Sanitation Districts' responses to the two questions that the subject panel has been tasked with answering:

1. **Is it technically feasible to establish numeric effluent limitations or some other objective criteria, for inclusion in storm water permits?**

Storm water discharges occur sporadically, vary in composition, flow rate, and duration. In addition, the quality of storm water discharges also vary geographically and are dependent upon local variations in rainfall intensity, topography and natural background soil composition. Further, the quality of storm water discharges can vary throughout the duration of a storm and are also dependent upon the length of time between storms. Depending on site-specific considerations, water quality of storm water discharges may be more related to natural physical effects particular to the site rather than the industrial activities at the site. Existing methodologies for deriving numeric water quality based effluent limitations were designed primarily for process wastewater discharges. These types of discharges typically occur at predictable rates with predictable pollutant loadings under low flow conditions in receiving waters. The EPA, finding that the methodology currently available for deriving numeric effluent limits is significantly complicated by the variability of storm water, has determined that storm water pollutants are appropriately controlled by BMPs rather than numeric limits (Federal Register: December 8, 1999 (Volume 64, Number 235)). Based upon the variability in storm water discharges and site-specific factors that must be considered to establish numeric limits, the Sanitation Districts believe that that implementation of industry-specific BMPs is the only viable objective and enforceable criteria that can be included in storm water permits.

2. **How would such limitations or criteria be established, and what information and data would be required?**

As described above, the Sanitation Districts do not believe that numeric discharge standards can be established for storm water discharges. Moreover, any limitations or established permit criteria could not realistically be applied uniformly for all industrial activities. For example, the Puente Hills Landfill, operated by the Sanitation Districts, is located on 1,365 acres, of which approximately 625 acres are used for landfill purposes and the remaining area is comprised of steep natural slopes, wetlands, public trails and other open space areas. The areas of the property dedicated to landfilling purposes as well as all of the other areas within the property boundary are subject to natural erosion. Such erosion will generate naturally occurring suspended solids with entrained heavy metals. In contrast, small industrial facilities that are fully paved have no issues related to storm water contact with natural sediment. Consequently, the Sanitation Districts recommend that storm water permits refer to industry-specific categories to establish applicable BMPs. Such industry-specific categories should consider pollution potential, economic impacts, regulatory requirements or restrictions, environmental impacts and site setting (e.g., topographic relief and natural site conditions.)

As you are aware, the Draft NPDES Industrial General Permit, dated December 15, 2004, utilized EPA benchmarks as a measure of a discharger's compliance. To assess the infrastructure required by the Draft Permit to achieve EPA benchmarks, the Sanitation Districts retained a consultant. As described in the enclosed report, the Sanitation Districts would need to expend approximately $381 million in order to attempt to achieve EPA benchmarks. The report concluded that, despite spending $381 million, the Sanitation Districts would still not be able to consistently achieve EPA benchmarks. Further, many solid waste facilities, including those operated by the Sanitation Districts, do not have sufficient property on which to construct additional treatment facilities and may need to condemn private property and utilize areas previously set aside for native habitat. The potential impact of implementing arbitrary numeric discharge limits is illustrated by the 590-acre sediment basin that would be needed for the Puente Hills Landfill in an attempt to comply with EPA benchmarks.

The Sanitation Districts strongly believe that a cost-benefit analysis should be performed for any proposed surface water discharge numeric limit and that an evaluation of whether or not proposed limits are attainable given natural background loadings. As illustrated above, significant detrimental impacts would likely result from the promulgation of unachievable numeric limits that do not recognize various industry and site-specific factors. Accordingly, the Sanitation Districts support the use of reasonable and appropriate industry-specific BMPs as a measure of storm water permit compliance.

We appreciate the opportunity to provide these comments and look forward to working with you to achieve our mutual goal of improving storm water quality. If you should have any questions regarding this transmittal, please do not hesitate to contact me at the above listed telephone number, extension 2412.

Very truly yours,

James F. Stahl

David L. Rothbart
Supervising Engineer
Technical Services Department

DLR:sdp
Enclosure

GEOSYNTEC CONSULTANTS

2100 Main Street, Suite 150
Huntington Beach, California 92648 • USA
Tel. (714) 969-0800 • Fax (714) 969-0820

2 February 2005

David Rothbart, P.E.
County Sanitation Districts of Los Angeles County
Supervising Engineer
1955 Workman Mill Road
Whittier, California 90601

Subject: Preliminary Evaluation
Infrastructure Estimate for Surface Water Discharge Treatment
Draft NPDES General Permit Conditions (15 December 2004)
County Sanitation Districts of Los Angeles County (CSDLAC) Landfill Facilities

Dear Mr. Rothbart:

The California Environmental Protection Agency, State Water Resources Control Board (SWRCB) is reissuing the National Pollutant Discharge Elimination System (NPDES) General Permit for Discharges of Storm Water Associated with Industrial Activities (Industrial General Permit). The existing Industrial General Permit (Order No. 97-03-DWQ) was adopted on 17 April 1997. A draft Industrial General Permit was circulated on 15 December 2004 for comment. GeoSyntec Consultants (GeoSyntec) was retained by the CSDLAC to perform a preliminary evaluation of the infrastructure that may be required to achieve the total suspended solids (TSS) benchmark limit proposed in the draft Industrial General Permit, specifically with respect to the potential upgrades that may be required at the CSDLAC landfill facilities. This letter is divided into the following sections:

- Facility Information and Design Considerations;
- Cost Evaluation and Conclusions; and
- Closing.

A summary of cost information is provided at the end of this letter as Attachment 1. A description of certain treatment technologies that could potentially remove TSS from storm water is included as Attachment 2. These technologies are generally not applied to the discharge from landfill facilities, due to its characteristics, as described later in this letter.

FACILITY INFORMATION AND DESIGN CONSIDERATIONS

The CSDLAC currently operates three active landfill facilities, three inactive landfill facilities in Los Angeles County. For this evaluation, GeoSyntec considered the upgrades that may be required for landfill facilities, both active and inactive. These facilities include:

- Active
  - Calabasas
  - Puente Hills
  - Scholl Canyon
- Inactive
  - Mission Canyons 1-3
  - Palos Verdes
  - Spadra

On average, the Los Angeles metropolitan area receives approximately 16 to 18 in. of rainfall annually. Pursuant to the requirements of the California Code of Regulations (CCR) Title 27, landfill facilities must be designed to accommodate the 100-year, 24-hour design storm. Depending on the exact location within the Los Angeles metropolitan area, the intensity of the design storm varies. Using CSDLAC figures, the resulting run-off flow from each of the landfill facilities that must be accommodated is provided below:

FACILITY	FLOW (cfs)	LANDFILL DRAINAGE AREA (acres)
Calabasas	1070	380
Puente Hills	1620	590
Scholl Canyon	540	310
Mission Canyon	2200	420
Palos Verdes	1250	370
Spadra	1150	320

cfs – cubic feet per second for a 100-year, 24-hour design storm

According to CCR Title 27 requirements, landfill facilities are not allowed to pond surface water over waste, and must direct storm water as efficiency as possible from the waste footprint. In addition, CCR Title 27 requires these facilities to cover waste on a daily basis, and ultimately close inactive sections of each waste area with cover systems. Generally, these daily, interim and final cover systems consist of soil-based engineered systems having prescribed water permeabilities (i.e., permeabilities selected to reduce water infiltration into the in-place waste). To achieve these design permeabilities, soils consisting of a large percentage of finer particle sizes (i.e., silts and clays) are generally used in the cover systems. Based on data provided by the CSDLAC, the suspended solids within the storm water discharge at the Palos Verdes Landfill contained the approximate particle size distribution provided in the table below. This particle size distribution is considered representative of suspended solids within storm water from each facility.

Particle Size (mm)	Approximate Distribution (%)(1)	Settling Velocity (ft/sec)(2)	Basin Surface Area Requirement (sq ft / cfs discharge)(2)
Coarse Sand (0.5)	0	0.19	6.3
Medium Sand (0.2)	0	0.067	17.9
Fine Sand (0.1)	2	0.023	52.2
Coarse Silt (0.05)	10	0.062	193.6
Medium Silt (0.02)	30	0.00096	1,250
Fine Silt (0.01)	28	0.00024	5,000
Clay (0.005)	30	0.00006	20,000

(1) CSCLAC, 2005
(2) Goldman, et. al. 1986

The draft numeric effluent discharge limitations for industrial dischargers, including landfill facilities, are derived from EPA benchmark values. Specifically, this evaluation focused on achieving compliance with the 100 milligram/Litre (mg/L) total suspended solids (TSS) benchmark proposed in the draft Industrial General Permit. Using the flow rate from the design storm, particle size distribution from the run-off water, and surface area requirements to meet the TSS benchmark value, the following table shows the acreage that would be needed to implement extended detention basins, the primary infrastructure component that could be implemented at the landfill facilities:

FACILITY	RANGE OF BASIN SURFACE AREA (acres)	
	Large(1)	Likely(2)
Calabasas	490	190
Puente Hills	740	290
Scholl Canyon	250	100
Mission Canyon	1000	390
Palos Verdes	570	220
Spadra	530	210

(1)Large extended detention basin assumes the run-off consists of 100% clay particle size.
(2)Likely extended detention basin assumes the run-off consists of CSDLAC particle size distribution.

COST EVALUATION and CONCLUSIONS

Given the design considerations identified above, GeoSyntec evaluated preliminary budget costs for implementation of infrastructure upgrades. These costs are highlighted on the tables in Attachment 1. Based on the preliminary evaluation of the cost of these upgrades, CSDLAC would need approximately $381 million in 2006 to retrofit their landfill facilities. Due to the limited space available for extended detention basins, condemnation and purchase of adjacent private property was included in the cost estimate, however this cost did not include such peripheral costs as legal fees associated with the condemnation action. Costs associated with the preparation of an Environmental Impact Report for such a project was not included in our cost estimate. In addition, it should be noted that certain public right-of-ways would probably prohibit the installation of several extended detention basins described herein.

Conventional storm water controls employed at landfills are focused on attenuating peak runoff discharge volumes, as prescribed by State of California Code of Regulations (CCR) Title 27. These conventional controls include engineered channels, drop structures and retention basins. In an attempt to achieve the numeric effluent discharge criteria proposed by the State Water Resources Control Board (SWRCB), enhancements to the conventional controls would be needed (e.g., increasing sizing of basins to extend water retention time), as well as additional technologies not routinely employed at landfill sites.

The primary upgrades would be focused on retrofitting, and in many cases, removal and re-construction of extended detention basins designed to settle out the suspended solids in an attempt to achieve the EPA benchmark value of 100 mg/L. However, additional storm water treatment technologies that are not standard for landfill applications would be required at various locations throughout the facility, including the extended detention basin discharge. A summary of these non-standard treatment technologies are listed in Attachment 2 to this letter. It is important to note, however, that these technologies were not designed for use at sites where fine soil particles (generally less than 0.1 mm) make up the largest percentage of TSS in the discharge. The current array of storm water treatment technologies is designed to handle debris and larger particle sizes (sands, gravel, and debris). Therefore, even with these upgrades, the benchmark value could not be achieved for all storm events.

CLOSING

This preliminary evaluation is for CSDLAC initial feasibility review. The scope of the evaluation was limited, and therefore, should be used in the manner intended. The evaluation did not consider site-specific design details, such as geotechnical siting specifications, or groundwater constraints, which would substantially increase the costs presented herein. Should the draft Industrial General Permit requirements be promulgated, GeoSyntec recommends performing a more detailed, site-specific evaluation of hydrology and treatment technology feasibility study.

Sincerely,

Eric Smalstig, P.E.
Senior Engineer

HW0900-15/LSW05-01

Attachment 1: Cost Summary
Attachment 2: Storm Water Treatment Technologies

ATTACHMENT 1

Cost Summary - Preliminary Budget Estimate
County Sanitation Districts of Los Angeles County
Los Angeles County, California

SITES	CONSTRUCTION COST[1,2]	YEARLY O&M COSTS[1,2]	2006 BUDGET ESTIMATE
Calabasas Landfill (active)	$55,378,200	$981,600	$56,000,000
Mission Canyon (inactive)	$25,367,800	$532,680	$26,000,000
Palos Verdes Landfill (inactive)	$76,346,800	$919,080	$77,000,000
Puente Hills Landfill (active)	$111,952,600	$1,475,520	$113,000,000
Scholl Canyon (active)	$38,473,400	$816,960	$39,000,000
Spadra Landfill (inactive)	$69,454,800	$801,480	$70,000,000
Grand Total	**$376,973,600**	**$5,527,320**	**$381,000,000**

NOTES

(1) Costs expressed in 2005 dollars.

(2) Total construction and yearly O&M costs includes a 20% contingency.

ASSUMPTIONS

1. No protracted permitting issues.
2. No contaminated soil in work zone.
3. Excess soil will be disposed of or reused on-site.
4. Costs strictly consider on-site acreage; run-on from off-site assumed to be diverted.
5. Land purchase costs assume $100,000/acre rural, $200,000/acre urban; does not include home purchase/demo.

Master - Unit Costs
County Sanitation Districts of Los Angeles County
Los Angeles County, California

ITEM	UNIT	UNIT CAPITAL COST	UNIT YEARLY O&M COST	REFERENCE	NOTES
Sedimentation/Detention Basins					
Extended Detention Basin	AC	$10,000	$300	Sunshine Canyon Construction Cost; Manufacturer	Unit value equals acres of watershed area to be treated. Assumed BMP to maintain a 100 year storm.
Extended Detention Basin (retrofit-low)	AC	$25,000	$300	Barrett, 1999, Manufacturer BMP Evaluation Table	Unit value equals acres of watershed area to be treated. Assumed BMP to maintain a 100 year storm.
Extended Detention Basin (retrofit-high)	AC	$37,500	$300	Assumes Barrett, 1999 cost + 50% for particle size anticipated from landfills	
Wet Pond (lined)	AC	$7,000	$400	Manufacturer BMP Cost Data Spreadsheet	Unit value equals acres of watershed area to be treated. Flow-thru BMP at this design storm
Wet Pond (unlined)	AC	$4,500	$300	Manufacturer BMP Cost Data Spreadsheet	Unit value equals acres of watershed area to be treated. Flow-thru BMP at this design storm.
Underground Basins					
StormChamber™	AC	$17,000	$250	Manufacturer BMP Evaluation Table	Unit value equals acres of watershed area to be treated. Assumed BMP to maintain a 100 year storm.
Corrugated Steel	AC	$37,000	$250	Manufacturer BMP Evaluation Table	Unit value equals acres of watershed area to be treated. Assumed BMP to maintain a 100 year storm.
HDPE	AC	$62,000	$250	Manufacturer BMP Evaluation Table	Unit value equals acres of watershed area to be treated. Assumed BMP to maintain a 100 year storm.
NTS					
Wetland (lined)	AC	$15,000	$1,000	Manufacturer BMP Cost Data Spreadsheet	Unit value equals acres of watershed area to be treated. Assumed BMP to maintain a 100 year storm.
Wetland (unlined)	AC	$7,000	$800	Manufacturer BMP Cost Data Spreadsheet	Unit value equals acres of watershed area to be treated. Flow-thru BMP at this design storm
Drainage Improvements					
Vegetative Drainage Swales	AC	$10,000	$100	Barrett, 1999	Unit value equals acres of watershed area to be treated. Flow-thru BMP at this design storm.
Concrete Drainage Structures	LF	$275	$15	Bena Construction Costs	Typical trapezoidal channel
Hydrodynamic Separators					
BaySaver®	AC	$8,000	$500	Manufacturer BMP Evaluation Table	Unit value equals acres of watershed area to be treated. Flow-thru BMP for 100 year storm.
CDS®	AC	$12,000	$500	Manufacturer BMP Evaluation Table	Unit value equals acres of watershed area to be treated. Flow-thru BMP for 100 year storm
Stormsceptor®	AC	$10,000	$500	Manufacturer BMP Evaluation Table	Unit value equals acres of watershed area to be treated. Flow-thru BMP for 100 year storm
Vortechs®	AC	$12,000	$500	Manufacturer BMP Evaluation Table	Unit value equals acres of watershed area to be treated. Flow-thru BMP for 100 year storm
Filters					
DrainPac™	AC	$4,000	$500	Manufacturer BMP Evaluation Table	Unit value equals acres of watershed area to be treated. Flow-thru BMP for 100 year storm.
AbTech Ultra-Urban Filter ®	AC	$3,000	$500	Manufacturer BMP Evaluation Table	Unit value equals acres of watershed area to be treated. Flow-thru BMP for 100 year storm.
HydroCartridge	AC	$3,000	$500	Manufacturer BMP Evaluation Table	Unit value equals acres of watershed area to be treated. Flow-thru BMP for 100 year storm
Stormfilter™	AC	$20,000	$1,000	Manufacturer BMP Evaluation Table	Unit value equals acres of watershed area to be treated. Flow-thru BMP for 100 year storm
MCTT	AC	$27,000	$1,000	Manufacturer BMP Evaluation Table	Unit value equals acres of watershed area to be treated. Flow-thru BMP for 100 year storm
Clarifiers					
CSI	AC	$16,000	$1,000	Manufacturer BMP Evaluation Table	Unit value equals acres of watershed area to be treated. Flow-thru BMP for 100 year storm
PSI	AC	$15,000	$1,000	Manufacturer BMP Evaluation Table	Unit value equals acres of watershed area to be treated. Flow-thru BMP for 100 year storm
Erosion Control					
Erosion Control Mats	AC	$10,000	$1,000	Means 02300-550-0100	Assume 10% of site area will need mats. Assume 1% of site area will need mats replaced per year (maintenance).
Hydroseeding	AC	$2,000	$200	Bena Construction Costs, Means 02920-510-5400	Assume 10% of site will require initial hydroseeding. Assume 1% of site area will need rehydroseeding per year (maintenance).
Sandbags/Silt fences	LF	$2	$0.20	Saddleback Sandbags (800-286-sand)	Assume 200 LF per acre. 10% will need to be replace per year (maintenance)
Stormwater Monitoring					
Monitoring (technician)	EA	$0	$65,000	Estimate	Yearly salary and benefits
Testing	EA	$0	$1,600	Calscience Env. Labs (714-894-7512)	Constituents analyzed are the same as Crystal Cove
Reporting	EA	$0	$5,000	Estimate	One report per year
Miscellaneous Items					
Property Purchase					
Permitting	EA	$25,000		Estimate	Does not include CEQA/EIR Costs
Subtotal					
Design/Engineering Costs		10%	-		
CM/CQA Costs		10%	-		
Contingency		20%	20%		
TOTAL					

ATTACHMENT 2

ATTACHMENT 2
PRELIMINARY EVALUATION
INFRASTRUCTURE ESTIMATE FOR STORM WATER DISCHARGE TREATMENT
DRAFT NPDES GENERAL PERMIT CONDITIONS (15 DECEMBER 2004)
COUNTY SANITATION DISTRICTS OF LOS ANGELES COUNTY (CSDLAC) LANDFILL FACILITIES

(January 2005)

INTRODUCTION

Conventional storm water controls employed at landfills are focused on attenuating peak runoff discharge volumes, as prescribed by State of California Code of Regulations (CCR) Title 27. These conventional controls include engineered channels, drop structures and retention basins. In an attempt to achieve the numeric effluent discharge criteria proposed by the State Water Resources Control Board (SWRCB), enhancements to the conventional controls would be needed (e.g., increasing sizing of basins to extend water retention time), as well as additional technologies not routinely employed at landfill sites. Presented in this attachment is summary information on a variety of storm water treatment technologies that may be suitable for enhancing runoff quality from areas with higher potential for storm water impacts at the space-constrained Sanitation Districts facilities. For the sake of this brief evaluation, solids removal (quantified by total suspended solids, TSS, content) is the focus of the treatment technologies. This is for information purposes only. This list is not all-inclusive. **It is important to note, however, that these technologies were not designed for application to facilities or sites where fine soil particles (generally less than 0.1 mm) make up the largest percentage of TSS in the discharge.**

Several treatment technologies were evaluated as to their suitability for application at the CSDLAC landfill facilities. These treatment technologies fall into four general categories:

1. Solids Separators,
2. Catchbasin Inserts,
3. Filters, and
4. Under-Ground Detention Systems.

For each technology category listed above, a general description of treatment mechanisms, operational processes, target constituents, and design constraints is provided. Immediately following the general information for each category, are more detailed descriptions of specific treatment devices, which include schematics and vendor information.

1. SOLIDS SEPARATORS

Separators are in-line structures that reduce runoff velocities and allow particulate matter to fall out of suspension and settle in a collection chamber. Typically, separators have an outlet designed to discharge from below the water surface, which allows floatable trash, oils, and grease to be collected in the structure as well. Some types of separators induce flow conditions (centrifugal) that encourage sedimentation and/or prevent clogging of screens installed in the flow path. The structural components of separators include a controlled inlet device, a detention vault, a sediment storage area, a baffle or water seal, a floatable material collection area, and an outlet structure. The largest component of the device is the detention vault, which is usually constructed from sections of large diameter reinforced concrete pipe which are stacked vertically and have cast-in-place openings to accept the various proprietary inlets, outlets, screens, and other treatment and flow control structures. These systems require extensive underground work that is usually costly. Solids separators evaluated include:

- BaySaver®
- CDS®
- Stormsceptor®
- Vortechs®

BaySaver® Separation Unit

The BaySaver® is a patented separation system that removes and retains sediments and floating contaminants (oil, debris) after they have been washed into the storm drain. The twin-vault system is constructed from two standard precast concrete manholes and the BaySaver separation unit. Under low to moderate flow conditions, the separator unit diverts all flow to an off line detention and storage vault where sedimentation can occur and floating materials are trapped. Under higher flow conditions, the sedimentation vault is bypassed which prevents collected materials from be resuspended. Accumulated contaminants are retained by the system until they are removed, typically with a vacuum truck, during routine maintenance.

BaySaver units are sized according to the expected flow rate. The manufacturer provides sizing tables and recommends the treatment capacity be sufficient to accommodate the two-year, one-hour storm at moderate flow rate. Based on this criterion, the maximum impervious area that a single unit can treat is limited to less than 6 acres. BaySaver literature publishes TSS removal efficiencies of about 80% and effluent quality levels as low 5 mg/l for discharge streams that do not have a significant percentage of fines.

Manufacturer

Bay Saver Incorporated

1010 Deer Hollow Drive

Mount Airy, MD 21771

CDS® Separation Unit

Continuous deflective separation is a screening and sedimentation system designed by CDS® Technologies, which removes trash, debris, coarse and medium sediments, and some fine sediments from runoff using a method similar to vortex separators commonly used in wastewater treatment. The CDS separates solids by diverting the incoming flow and associated pollutants away from the main flow stream of the pipe into a pollutant separation and containment chamber. This chamber contains a cylindrical screen, which traps crude solids on the inside and allows liquids to bypass and be discharged. Solids within the separation chamber are kept in continuous motion using a hydraulic design which ensures that the force exerted on an object by the circular flow action is significantly higher than that caused by the pressure differential across the separation screen. This prevents clogging and makes the screen self-cleaning to a certain degree. The pollutant separation and containment chamber is generally precast from reinforced concrete or fiberglass, screens are stainless steel. Very large units can be cast-in-place.

Maintenance of the units involves removal of the screenings, which can be accomplished by using a vacuum truck or by removing the entire screen and cleaning it manually.

Manufacturer

US Head Office - West

16360 South Monterey Road, Suite 250

Morgan Hill, CA 95037

Phone: 888 535 7559

Fax: 408 782 0721

Stormceptor® Separation Unit

The Stormceptor® is a water quality separator designed to remove oil and sediment from storm water. The unit consists of a separation chamber constructed from precast reinforced concrete pipe with a patented fiberglass insert to bypass high flows and prevent resuspension of accumulated solids. Under normal operating conditions storm water flows into the upper chamber and is diverted by a u-shaped weir, into the separation holding chamber. Right angle outlets direct flow around the circular walls of the chamber. Fine and coarse sediments settle to the floor of the chamber, while the petroleum products rise and become trapped beneath the fiberglass insert. During high flow events, peak storm water flows pass over the diverting weir and continue downstream without treatment.

There are two access ports that allow for removal of accumulated solids and oils and grease. Maintenance is typically performed using a vacuum truck.

Manufacturer

Houston (Corporate Office)

16701 Greenspoint Park Drive, Ste. 350

Houston, TX 77060

Phone: 800- 909-7763

Fax: 816- 802-3871

Vortechs® Separation Unit

The Vortechs® separator is a three-chamber system that removes sediments and separates oil and grease from storm water. The first chamber removes large particulates by sedimentation. A tangential inlet creates a vortex in the grit chamber, which directs settleable solids towards the center, reducing resuspension and dissipating potentially disruptive flows. A center barrier traps oil and grease and other floatables. The second chamber controls flow out of the grit chamber and prevents settled solids from entering the outlet chamber.

The Vortechs System provides an access port in each of the three chambers for cleaning or repair. A vacuum truck is generally used to remove collected sediments and oil and grease.

Manufacturer

Vortechnics, Inc.

41 Evergreen Drive

Portland, ME 04103

tel. 207-878-3662

e-mail vortechnics@vortechnics.com

2. CATCHBASIN INSERTS

Catchbasin inserts are screens or filters that can be installed in existing or new stormdrains to capture a portion of the pollutants in the storm water runoff. The level of treatment these systems afford is dependent on the nature of the pollutants in the runoff and the type and size of filter media installed in the device. The devices are relatively inexpensive, simple to install, and easy to maintain which has made them an attractive option for storm water quality enhancement for many municipalities, commercial developments, and industrial sites. Another key advantage is that the devices can usually be installed without altering the structure or interrupting the function of an existing stormdrain system. What is important to consider when selecting the type of catchbasin insert to use at a site are the pollutants that will be trapped by the media, the character of the media itself. In order for landfill sites to achieve proposed numeric effluent discharge standards, these filter inserts would have to be sized with a sufficiently small aperture size, and would be prone to clogging.

Experience with catchbasin inserts has shown that proper maintenance of the devices is critical to their function and that without a responsible party to frequently inspect, clean, and/or replace the media they can do more harm than good by impeding flood flows or releasing accumulated material. In general, these systems provide moderate to low levels of treatment. The following vendors manufacture or distribute some of the more widely used catchbasins inserts:

- DrainPac™
- Ultra-Urban Filter®
- Hydrocartridge

DrainPac™ Catch Basin Insert

The DrainPac™ is a flexible storm drain catchment and filtration liner designed to be installed in an existing catchbasin. The filtration liner is a non-woven polypropylene filtration cloth supported by a grating made of high-density polyethylene. The grating is fastened to a stormdrain inlet with steel mounting brackets anchored to the catchbasin wall. The insert does not raise the drain grate or interfere with traffic flow and the liner support grating is suspended below the drain grating.

The DrainPac has been shown to reduce levels of medium to coarse suspended sediments, heavy metals, and petroleum hydrocarbons found in typical storm water run-off. The inserts have been installed at commercial parking lots, auto service stations, car wash facilities, mass transportation facilities, and shopping centers.

Manufacturer

PACTEC Incorporated

12365 Haynes St.

Clinton, LA 70722

Phone1-800-272-2832

Fax: 225-683-8711

AbTech Ultra-Urban Filter® Catch Basin Insert

The Ultra-Urban Filter® is designed to capture oil, grease, trash, and sediment from storm water runoff before it enters the storm drain system. The structural support components of the filter are constructed from steel and high strength corrugated plastic. The filtration media is a patented composite called "Smart Sponge" which absorbs hydrocarbons and transforms them into a stable solid, preventing re-release to the environment.

The Ultra-Urban Filter can be installed in existing catchbasins without disrupting service. The device is designed to bypass runoff in excess of treatment capacity and will not restrict high flows or reduce the capacity of the drainage system; however, at high flows no treatment will be performed.

Manufacturer

AbTech Incorporated

4110 N. Scottsdale Road Suite 235

Scottsdale, AZ 85251

Phone: 800-545-8999

Hydrocartridge Catch Basin Insert

The Hydrocartridge catchbasin insert is a fiberplastic product that can be installed in existing or new catch basins. It comes in a range of sizes to fit in most catch basins. Storm water flows into the Hydrocartridge basket where solids, such as sediment, debris, silt, and heavy metals, are filtered out. The storm water then passes through an absorbent material lining the basket to remove hydrocarbons.

Periodically, solids collected within the basket should be removed either by hand or using a vacuum truck.

Manufacturer

Advanced Aquatic Products

1107 Key Plaza, # 201

Key West, Florida 33040

Phone: 305-292-3070

3. FILTERS

High levels of storm water treatment can be obtained by installing filters in the stormdrain system that contain media which specifically target pollutants in the runoff. Metals and nutrients in their suspended and dissolved fractions can be effectively removed by media filters and suspended solids can be reduced by filtration. Zeolite, perlite, leaf compost, peat, and filter fabric are the most commonly used media in proprietary filter systems. Sand filtration is also used for storm water treatment. Even though removal rates can be high for runoff that goes through a filter, flow in excess of filter capacity is usually bypassed and discharged without treatment which can reduce overall system efficiency. Filters are also prone to clogging when suspended solids concentrations are high. Filters are best suited for highly impervious sites where above ground space is limited, effluent quality requirements are stringent, and the constituents in the runoff are well characterized and consistent. Filters evaluated as part of this investigation include:

- StormFilter™
- Multi-Chambered Treatment Train (MCTT)

StormFilter™

The StormFilter™ is a storm water filtration system that works by passing storm water through media-filled cartridges. The cartridges are usually installed in a precast concrete vault that is set below grade to allow for gravity flow through the system. A collection manifold is cast into the floor of the vault to which the rechargeable cartridges are attached. Flow enters the vault though an inlet, passes through a screen to remove trash and large debris, and then fills the vault to the top of the cartridges. When the water level reaches the top of the cartridges, a float opens a valve that allows flow through the filter. The system is installed in-line and has a built in overflow to bypass flows in excess of filter capacity. The filter cartridges can be filled with a variety of filter media including; pearlite, zeolite, or a patented leaf compost media manufactured to target specific pollutants in the waste stream.

Maintenance involves periodic inspections, cleanout of the vault, and changing the filter media when it becomes clogged. There is some head loss through the system and typically 2.3 ft. of head differential is required between the inlet and the outlet of the StormFilter™.

Manufacturer

Storm water Management, Inc.

23035 NE Columbia Blvd.

Portland, OR 97211

Phone: 800-548-4667

Multi-Chambered Treatment Train (MCTT)

The MCTT is a non-proprietary storm water treatment device that combines several treatment processes to address a broad range of contaminants in runoff. These processes include coarse screening, aeration, primary sedimentation, enhanced sedimentation, floatation and absorption, and multi-media filtration. Target constituents for this device include suspended sediments, metals, nutrients, and hydrocarbons. The main structure of the MCTT can be fabricated from a precast concrete vault or cast in place. The internal components are constructed from PVC pipe, packing balls, geotextiles, and other readily available materials. One key advantage to an engineered system over a proprietary system is the increased flexibility of the design to address site-specific conditions and concerns. Several different absorbents and filtration media could be experimented to optimize treatment efficiency and minimize costs.

Maintenance of the device includes inspection and periodic removal of accumulated sediments and oil and grease. Filter media may need replacement if head loss becomes unacceptable or breakthrough of contaminants is observed. As with other filtration devices, a certain amount of headloss will be incurred by the filter media. This loss could be limited to about three feet by sizing the filter bed appropriately.

4. UNDER-GROUND DETENTION VAULT SYSTEMS

At sites where land is expensive or space is limited, underground extended detention may be a feasible alternative for storm water treatment. Similar to aboveground detention, underground detention systems reduce velocities in storm water allowing for sedimentation of suspended particulates. Underground detention systems are generally constructed from arrays of large diameter corrugated steel or plastic pipe which are laid on a bedding of gravel then covered so the surface can be used for other purposes. Occasionally, large tanks or subsurface beds made from pervious material such as gravel are also used for this purpose. Underground detention systems can achieve a level of treatment that is comparable to aboveground storm water detention systems of similar size and with similar detention time for pollutants that do not photodegrade, although expected treatment level would be potentially lower with reduced biological activity (no sunlight). Construction costs for these systems are very high and, since the entire facility is belowground, maintenance can be difficult and expensive. Evaluated were three types of underground detention system 1) corrugated steel pipe, 2) high density polyethylene (HDPE) pipe, and 3) an HDPE vault system. Vendors contacted were:

- Pacific Corrugated Pipe Company
- Advanced Drainage Systems (ADS)
- Cultec, Inc.

Pacific Corrugated Pipe Company Underground Detention Vault System

Pacific Corrugated Pipe Company manufactures corrugated metal pipe for a number of applications, including storm water detention or retention. Pipes are installed underground, sometimes above a gravel bed layer, and used to store runoff. If soil and environmental conditions warrant, the pipes can be coated to provide additional protection from corrosion and expand the service life of the system. Storm water runoff is collected from the site and transported through the normal storm water collection system and piped to the underground storage chambers. The stored water can then be slowly released from the corrugated metal pipe storage units through an outlet control structure equipped with an orifice, flap gate or other flow control device to restrict outflows to the desired rate of discharge.

The system can be as simple as a single length of pipe with closed ends, an inlet and an outlet, an air vent, and a means of accessing the chamber via a manhole. It may also be an expansive system using multiple barrels and a manifold collection pipe with multiple access openings and crossovers. The storage capacity can be increased with the addition of more pipes or with pipes of larger diameter.

Manufacturer

Pacific Corrugated Pipe Company

P.O. Box 2450

Newport Beach, California 92658-8972

Phone: 800-338-5858,Fax: 949-650-0781

Website: http://www.pac-corr-pipe.com

Advanced Drainage Systems (ADS) Underground Detention Vault System

ADS pipes are used for a variety of applications. The pipes are made of high density polyethylene (HDPE), a tough but flexible plastic which is able to withstand large loads (32,000 lbs/axle traffic live loadbearing capability) and is corrosion resistant. Pipes are available with a corrugated or smooth wall up in sizes up to 48" in diameter. These plastic pipes can be used in as a detention storage system with inlet and outlet control structures, or as a retention system with perforations throughout the pipe. The pipes would be installed underground in series to accommodate the specified storage volume. Perforated pipes are also available which can be laid on top of a gravel bed to allow for infiltration of runoff rather than surface discharge.

Manufacturer

Advanced Drainage Systems

300 Riverside Drive

Columbus, OH 43211

Phone: 800-733-7473

Website: www.ads-pipe.com

Cultec Storm water Chamber

Cultec Storm water Chambers are plastic underground retention vaults designed to store water and release it for infiltration or direct the flows to the stormdrain system. The chambers are made of lightweight HDPE, and are fully opened on the bottom, with perforated sides and top. Units are available from 8.5 to 32.5" high, storing 55 to 425 gallons of storm water per unit, respectively. Inspection ports can be designed for every chamber. Installation of these chambers will help reduce peak flows by storing and slowly releasing water to the stormdrain system, as well as induce settling of solids for improved effluent water quality. Clogging of the infiltration media below the chamber is problematic.

Manufacturer

Cultec, Inc.

P.O. Box 280 Brookfield, CT 06804

Phone: (800) 4-CULTEC

Fax: (203) 775-1462

Website: http://www.cultec.com/