Royal ENVIRONMENTAL SYSTEMS, Inc.
A Division of Royal Enterprises America

ecoStorm plus
U.S. Pat. No. 7,632,403

# ecoStorm® plus frequently asked questions

## What is the expected life of the ecoStorm® plus filter?

ecoStorm® plus units have been successfully in operation for more than five years. Normal service life depends on pollutant loadings, pollutant types and maintenance intervals performed on the system.

## How often does the filter need to be maintained?

Maintenance depends on the pollutant loadings at each site. For sites with heavy sediment loading, the filter should be checked after any storm event exceeding 1" per hour of rainfall intensity, or any rain event in excess of 2". For sites with light sediment loading, the filter should be checked after any storm event exceeding 2" per hour of rainfall intensity, or any rain event in excess of 3". Once a combined total of 6" of rain has fallen on any site, regardless of the sediment loading, the system should be checked and maintained. A visual check of the system will indicate whether maintenance is necessary, determined by observation of fine particles accumulated on top of the filter. To check the sump for solids loading, drop a leveling rod through the bypass/clean-out pipe. When the sediment has reached approximately 12", maintenance should be performed.

## What is the head loss of the filter?

A typical design incorporates approximately 10" of head loss for the filter. This 10" of head ensures the passing of the maximum treatment flow rate of 0.8 cfs through a properly maintained filter.

## What is the typical flow rate that the filter can handle?

The maximum flow rate for a 60" ecoStorm plus is approximately 360 gpm or 0.8 cfs. Sites with higher flow rate requirements can be designed using multiple units, upstream detention, or incorporating an offline design that treats the first portion of a storm event, then bypasses at a specific flow rate. The design combinations are virtually endless based on the engineer's treatment goals and the specific site layout.

## How much pollution reduction is the ecoStorm plus filter capable of achieving?

- Total Suspended Solids (TSS)
  >80% removal
- Total nutrients (particulate and soluble)
  >60% phosphorus reduction

Total heavy metals (particulate and soluble – Pb, Zn, Cd, Cr, Cu and Ni)

>90% zinc (Zn) reduction
>95% lead (Pb) reduction
>60% copper (Cu) reduction

*For additional information, please see Removal Efficiency Sheet – Summary Data.*

## How does the system remove hydrocarbons (free or dissolved oils)?

While the ecoStorm plus is not an oil-water separator, it incorporates a submerged inlet, forcing free oils to be maintained in the upstream structure. *For additional information, see Removal of Free Oils in an ecoStorm Plus.*

## Will suspended solids ever be found in the chamber above the filter or settled on top of the filter media?

Yes. The filter removes >80% of TSS. Some portion of the TSS not removed may settle on top of the filter.

## How does the filter remove contaminants?

Throughout the system, contaminant removal occurs by sedimentation, filtration, adsorption, and chemical transformation.

Water enters the ecoStorm plus structure below the filter through the inlet pipe, which is attached to a 90º bend in the interior, and is forced into a centrifugal swirl pattern above the cyclonic separator and below the porous concrete filter. Due to the unique inlet design, hydrodynamic separation occurs in a controlled space, where gravity forces settleable and suspended solid pollutants through the center opening of the hydrodynamic separator. This sedimentation falls through the opening into the quiet water below the hydrodynamic separator, where previously deposited sediment remains undisturbed in the sediment catchment sump.

Head pressure drives the influent waters up through the porous filter. During treatment, unsettled smaller particles remain in the centrifugal swirl pattern under the filter, where they slowly attach to the underside or find their way into the filter's pores and become trapped. Dissolved particles come in contact with the internal surface area of the filter and adsorb to the filter. A chemical transformation occurs and the particles form an insoluble compound and precipitate out of the filter. As the storm event subsides, much of the particulate gravitates out of the filter and into the sediment catchment sump.

Sedimentation and filtration: Sediments are removed from stormwater in two steps based on particle size and weight. Cyclonic separation occurs as the water is introduced to the structure. Here settleable and larger suspended particles drop out due to gravity. They are then stored in the sediment catchment sump apart from mainline flow of the ecoStorm plus. Smaller particles remain in the cyclonic separation chamber or are captured in the porous filter as water passes through vertically. After the storm event ends and upward vertical flow subsides, through gravitation many of the filtered particles precipitate out of the filter. They are subsequently collected in the sediment catchment sump of the ecoStorm plus.

Adsorption: Certain dissolved solids have an affinity for the filter and accumulate on the filter's surfaces. This is a physical process that is caused by the surface energy of the dissolved solid and the filter.

Chemical transformation: Dissolved solids with ionic characteristics (metals) are converted to an insoluble form (particles) by the reaction between the dissolved (soluble) compounds and the alkalinity (increased buffering ability) associated with the filter. These particles are removed by filtration and subsequent gravitational settling when flow through the filter stops.
*For additional information, please see Treatment Process Characteristics.*