Chapter 12 - Emerging Technologies

This Chapter addresses emerging (new) technologies that have not been evaluated in sufficient detail to be acceptable for general usage in new development or redevelopment situations.

12.1 Background

It has become clear that the treatment BMPs described in Ecology's 1992 Stormwater Manual, in some situations, are either not applicable or do not provide reliable and cost-effective removal of pollutants. For these reasons a need to develop new stormwater treatment technologies has emerged in this State as well as nationwide.

Emerging technologies are new technologies that have not been evaluated using approved protocols, but for which preliminary data indicate that they may provide a desirable level of stormwater pollutant removal. Some emerging technologies have already been installed in Washington as parts of treatment trains or as stand-alone systems for specific applications. In some cases, emerging technologies are necessary to remove metals, hydrocarbons, and nutrients. Emerging technologies can also be used for retrofits and where land availability is unavailable for larger natural systems.

12.2 Ecology Role in Evaluating Emerging Technologies

Ecology ~~recognizes the need to~~ currently participates in a process to evaluate emerging technologies for permanent and construction site stormwater runoff applications and to convey judgments made by local jurisdictions and others on their acceptance. Based on recommendations from Ecology's Volume V Stormwater Technical Advisory Committee (TAC), Ecology ~~plans to~~ has ~~implement the~~implemented the following process:

- Operating~~To develop~~ a web site for publishing information on emerging technologies for permanent and construction site stormwater applications and protocols (TAPE and CTAPE) used in their evaluation,
- Participating~~To organize and convene a~~ in meetings of Technical Review Committee (TRC) and Chemical Technical Review Committee (CTRC) which will be asked to evaluate emerging technologies,
- Based on performance and other pertinent data from vendors and manufacturers and recommendations by the review committees Ecology~~To use Best Professional Judgment (BPJ) in the interim, with~~

~~input from its TRC, in~~ assess~~ing~~es levels of developments of emerging technologies and posts relevant decisions and supporting documentation at its stormwater web site. ~~.~~

12.3 Local Government Evaluation of Emerging Technologies

Local governments should consider the following as they make decisions concerning the use of new stormwater technologies in their jurisdictions:

Remember the goal:

The goal of any stormwater management program or BMP is to treat and release stormwater in a manner that does not harm beneficial uses. Compliance with water quality standards is one measure of determining whether beneficial uses will be harmed.

Exercise reasonable caution:

It is important to be cautious with the use of emerging, unproven, technologies for new development and for retrofits. Before selecting a new technology for a limited application, the local government should review evaluation information based on ~~an~~ acceptable protocols such as Ecology's TAPE and CTAPE.

An emerging technology *must not be used* for new development sites unless there are data indicating that its performance is expected to be reasonably equivalent to the performance goals listed in Chapter 3 for the treatment type applicable to the site: ~~a~~ Basic ~~Treatment~~, Enhanced, Phosphorus, or Oil Treatment. It may also receive approval as part of a treatment train to help achieve the applicable performance goal.~~or as part of a treatment train.~~ Local governments can refer to Ecology's web site to obtain the latest performance verification of an emerging technology.

Local governments are encouraged to:

- Conduct a monitoring program, using an acceptable protocol, of those emerging technologies that have not been verified for limited or full-scale statewide use at Ecology's web site.
- Look for achieving acceptable performance objectives as specified in Chapter 3.

To achieve the goals of the Clean Water Act and the Endangered Species Act, local governments may find it necessary to retrofit stormwater pollutant control systems for many~~,~~ existing stormwater discharges. In retrofit situations the use of any BMPs that make substantial progress toward these goals is a step forward and is

encouraged by Ecology. To the extent practical, the performance of these BMPs should be evaluated, using approved protocols.

12.4 Acceptable Evaluation Protocols (TAPE and CTAPE) ~~(APWA Task Committee, 1999)~~

To properly evaluate new technologies, performance data must be obtained using the Ecology approved Technology Assessment Protocol-Ecology (TAPE) and the chemical TAPE (CTAPE) or other ~~an~~ accepted protocols. ~~Such a protocol has been drafted by the Washington State Chapter of the APWA.~~ Ecology ~~plans to~~ published these protocols ~~the final version of the APWA Protocol~~ at its web site for use by local governments, suppliers of new technologies, and consultants. They ~~current version~~ can be downloaded ~~from the APWA web site~~ at ~~http://www.mrsc.org/stormwater.~~ http://www.ecy.wa.gov/programs/wq/stormwater/newtech/ Other acceptable protocols may also be added to Ecology's web site. Such protocols may be developed by local, state, or federal agencies.

12.5 Assessing Levels of Development of Emerging Technologies

Ecology has received many~~several~~ submittals from vendors to approve their new technologies for statewide applications. ~~However, none of the submittals included performance information using the APWA, or equivalent protocol. Moreover, it is evident that some technologies have been under development for many years and have been improved considerably during that time.~~ Technologies have been proposed for permanent and construction site applications that include cartridge filtration, vortex enhanced sedimentation, manufactured storm drain structures, electrocoagulation, chemical flocculants and upgrades of catchbasin insert technologies. Because the submittals demonstrated various stages of development Ecology decided to classify technologies depending on the adequacy of the verification testing.

To assess and classify levels of developments, Ecology is ~~proposing to~~ use~~e~~ing the classification criteria given below. These criteria are ~~will be~~ included in the TAPE and CTAPE posted ~~on~~ at Ecology's ~~the planned~~ web site. Emerging technologies shall be used only within the application criteria and performance limits listed at Ecology's web site. ~~Best Professional judgment may be used in the interim until the APWA-TRC process is operational.~~

- *Pilot Level (PLD)* - Pilot studies could typically be conducted at roadway, commercial and residential sites, or specific land uses for which the system is marketed. Runoff at each site should be tested at full flow (design flow) conditions using the TAPE or CTAPE

~~reasonable evaluation criteria~~ before deciding on a limited or general statewide use of the technology. The pilot studies should be conducted during dry and wet seasons.

- *General Statewide Use (GULD)*. - To obtain general statewide acceptance the performance criteria as specified in Chapter 3 must be verified ~~met~~ using the TAPE or CTAPE~~APWA protocol~~, or other acceptable protocol. Final application, design and O&M criteria, and costs must be determined. Approvals may include application as part of a treatment train and/or as a stand-alone BMP.

- *Conditional Use Designation (CUD)*- A CUD may be granted by Ecology under the following circumstances:

- *An emerging technology is in widespread use in the Pacific Norhtwest and/or on a national basis, and the* manufacturer *has performance data that does not meet approved protocols, or,*

- An emerging technology is in limited use has limited data and is deemed to be functionally equivalent to another emerging technology for which the TRC or CTRC has recommended a Conditional or General Use Designation, and, it is likely that after completing additional laboratory and/or field testing meeting TAPE/CTAPE criteria, the technology will be awarded a GULD.

- Technologies that are granted a CUD may continue to be sold subject to CUD conditions for a specified time period during which the field and laboratory testing necessary to obtain a General Use Designation must be completed.

12.6 Examples of Emerging Technologies for Stormwater Treatment and Control

Note: ***The descriptions and other supplier information provided in this section should not be construed as approvals by Ecology of any of the technologies.*** ***Download information on technologies that are under review and development levels with supporting data at***
http://www.ecy.wa.gov/programs/wq/stormwater/newtech/

12.6.2 Amended Sand Filters

Description

The addition of media to improve the pollutant removal capabilities of basic sand filters.

Recent Performance Results

In a thorough study (Varner, Phyllis, City of Bellevue, 1999) of the performance of sand filters amended with processed steel fiber (95% sand and 5% processed steel fiber by volume), and crushed calcitic limestone (90% sand and 10% crushed calcitic limestone by volume), the City of Bellevue reported significant reductions in total phosphorus and dissolved zinc in runoff from the Lakemont residential area. Because the Lakemont filter study was a detailed, well-documented, and reviewed analysis of a full scale operation, Ecology considers this technology as sufficiently advanced in development to allow its use as an option under the Enhanced Treatment Menu and the Phosphorus Treatment Menu. Sand filters amended with one of these media should be sized using the design criteria for a basic sand filter. Ecology prefers that these amendments be tested at another location to confirm the performances achieved by the Lakemont study and to further refine the design criteria.

Bellevue experienced some reduction in infiltration in the sand filter amended with processed steel fiber due to formation of a cemented layer of ferric oxide. Filters amended with processed steel fiber may require more frequent rototilling and removal of top ~~layers to~~layers to prevent formation of a cemented layer.

12.6.3 Catch Basin Inserts (CBI)

Introduction

CBIs have been under development for many years in the Puget Sound Basin. They function similarly to media filtration except that they are typically limited by the size of the catchbasin. They also are likely to be maintenance intensive.

Description

Catch basin inserts typically consist of the following components:

- A structure (screened box, brackets, etc.) which contains a pollutant removal medium
- A means of suspending the structure in a catch basin
- A filter medium such as sand, carbon, fabric, etc.
- A primary inlet and outlet for the stormwater
- A secondary outlet for bypassing flows that exceed the design flow rate

Applications and Limitations

By treating runoff close to its source, the volume of flow is minimized and more effective pollutant removal is therefore possible. Depending on the insert medium, removals of TSS, organics (including oils), and metals can be achieved. The main drawbacks are the limited retention capacities and maintenance requirements on the order of once per month in the wet

12.6.4 Manufactured Storm Drain Structures

Most of these types of systems marketed thusfar are cylindrical in shape and are designed to fit into or adjacent to existing storm drainage systems or catch basins. The removal mechanisms include vortex-enhanced sedimentation, circular screening, and engineered designs of internal components, for large particle TSS and large oil droplets.

1. Vortex-enhanced Sedimentation

Description:

Vortex-enhanced Sedimentation consists of a cylindrical vessel with tangential inlet flow which spirals down the perimeter, thus causing the heavier particles to settle. It uses a vortex-enhanced settling mechanism (swirl-concentration) to capture settleable solids, floatables, and oil and grease. This system includes a wall to separate TSS from oil. ~~See Figure 12.2.~~ An assessment of a vortex technology with designation levels is provided at Ecology's web site at http://www.ecy.wa.gov/programs/wq/stormwater/newtech/

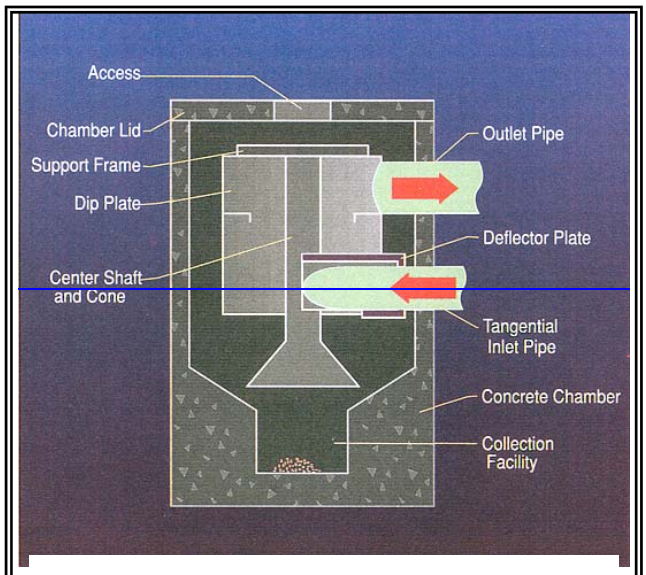

Figure 12.2 - Vortex-enhanced settling mechanism.

~~(Courtesy of HIL, Inc.)~~

~~***Applications, Limitations, Design, Construction, and Maintenance Criteria*** (See Ecology web site when available).~~