ACTIVITY: Alternative Storage Measures

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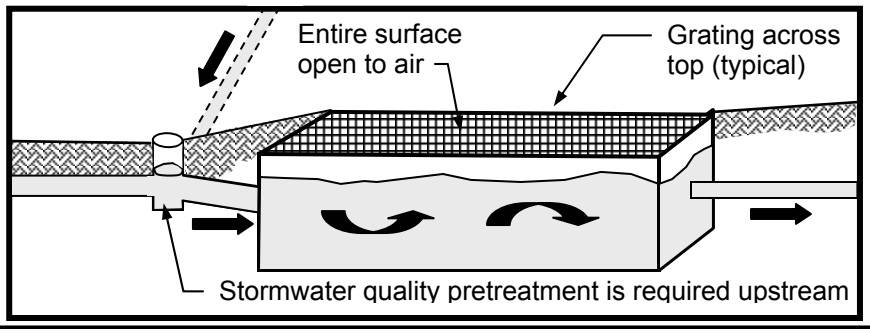

Targeted Constituents				
● Significant Benefit	◗ Partial Benefit	○ Low or Unknown Benefit		
◗ Sediment	○ Heavy Metals	◗ Floatable Materials	○ Oxygen Demanding Substances	
○ Nutrients	○ Toxic Materials	○ Oil & Grease	○ Bacteria & Viruses	○ Construction Wastes
Implementation Requirements				
● High	◗ Medium	○ Low		
● Capital Costs	● O & M Costs	● Maintenance	● Training	

Description

Alternative storage includes water quantity control measures such as underground detention, rooftop, or parking lot storage. These measures use structural means to provide necessary volumes for attenuating stormwater peak flows. An underground detention structure is a large underground tank that acts as a detention structure. Rooftop storage is water ponded on top of a building, to control runoff quantity from the impervious roof of a building. Parking lot storage is water detained on a parking lot along a curb. The discharge offsite can be controlled by a curb cut.

Selection Criteria

These measures are sometimes desired in areas where the cost of land is high enough to justify the additional construction, maintenance and operating costs, or where the risk to property damage is minimal. Potential applications could include very large development projects (such as regional shopping malls), for which the cost of providing alternative storage measure structures would not be prohibitive.

Design and Sizing Considerations

If designed and constructed in accordance with good engineering practices by reliable and proven contractors of local reputation, such facilities could be beneficial. The following minimum requirements must be followed in the potential design and construction of an underground detention facility:

- The entire area of the underground detention structure must be open to the air surface directly above, either with no cover or by installing continuous grates across the top. This allows for inspection and maintenance access of the entire facility with sunlight to provide the primary means of illumination. The facility will consider public safety and access (locks, fences, curbs) and is often designed to withstand truck loading such as HS-15 or HS-20.
- The underground detention structure must be constructed of durable materials with a typical 100-year lifetime. Detention storage volume shall not include the porous space within a stone or gravel bed (commonly done in many states for a series of pipes or pipe arches under parking lots).
- The underground detention structure shall be designed to have positive drainage into the receiving channel, assuming that there is a 10-year flood in the receiving

channel. This ensures that the designed volume is used for onsite detention rather than containing offsite floodwaters.

- The underground detention structure shall not receive surface runoff directly from parking lots through the top opening. Surface runoff shall be directed to a BMP that improves stormwater quality, such as an oil/water separator or grass filter strips. The underground structure will usually have a curb or other barrier around the top to prevent this.
- Design measures must be taken to trap and store sediments in locations where cleanout and maintenance can be easily performed. This generally requires that some type of water quality inlet or other stormwater treatment BMP must be installed upstream from the underground detention facility.
- Good design practices also require that structural measures shall be in place to prevent blockages. Floatable waste materials shall be collected by trash racks for periodic removal. The underground detention structure shall have a positive means of being dewatered for inspection and maintenance purposes.
- There are two primary designs for parking lot storage. One way is to pond areas along sections of curbs. Discharge is controlled by a downstream control measure such as a curb cut. The other design employs depressed areas of pavement at drop inlet locations. Discharge in both cases should be routed to a pond to remove first flush and other contaminants.
- The storage area in parking lot storage should have a minimum slope of 0.5% toward the outlet, to ensure complete drainage.
- Parking lot storage should not be located in the area of the fire lane.
- Rooftop storage can be used as a detention measure, provided the roof structure has been designed to support the additional weight of ponded water, and is sufficiently waterproofed.
- Rooftop storage measures must meet local and state codes.
- The minimum pitch on a roof subject to ponding is 0.25 inches per foot.
- The rooftop drainage system should have alternate mechanisms for draining the ponding area in case the primary outlet is clogged.

The above requirements do not allow for the use of large-diameter pipes in a gravel layer or envelope. Arch culverts filled with stone and gravel, or even masonry block structures, were frequently used to provide stormwater detention/infiltration underneath parking lots. Underground detention structures were promoted a few decades ago as a common means of detention in many areas of the country, particularly under parking lots. Most states and cities now discourage underground detention.

Construction/ Inspection Considerations

Regardless of the alternative storage measure chosen, it is essential that the BMP is constructed properly. Designed grades, materials, and compaction should be followed for these measures to function properly.

Maintenance

A detailed maintenance and inspection plan must be submitted and approved (including inspection schedules and guidelines). Evidence of responsibility and

financial budgeting must be presented, in addition to the usual bonds and agreements necessary for all detention structures.

Cost Considerations

Varies, depending on application.

Limitations

Underground detention structures are very strongly discouraged for several reasons:

- The cost of building underground structures is usually prohibitive when compared to dry detention basins, and this may cause some developers and contractors to illegally reduce detention volume or alter construction details in an effort to contain costs.
- It is very difficult to inspect underground structures, particularly if entering the structure qualifies as confined space entry (which is controlled by OSHA safety regulations). Cleanout and maintenance costs will need to be provided for and budgeted indefinitely.
- Areas with clay soils have low overall stormwater infiltration and high groundwater tables). Many parts of Tennessee have many karst and sinkhole formations, for which underground detention structures could potentially cause additional stormwater flow volumes without an adequate means of inspection.
- Underground structures may not receive enough air and proper ventilation to avoid anaerobic conditions and dangerous flow conditions.
- Stormwater runoff quality is not substantially improved or enhanced by underground detention. Underground structures do not allow grass or other vegetation to absorb nutrients, minerals or pollutants from stormwater runoff. Underground structures do not take advantage of natural stormwater infiltration into the ground surface.
- Parking lot storage should not be used when curb-high water levels are not acceptable.

References

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