Wet Vault MP-50

Description

A wet vault is a vault with a permanent water pool, generally 3 to 5 feet deep. The vault may also have a constricted outlet that causes a temporary rise of the water level (i.e., extended detention) during each storm. This live volume generally drains within 12 to 48 hours after the end of each storm.

California Experience

There are currently several hundred stormwater treatment facilities in California that use manufactured wet vaults currently in operation in California.

Advantages

- Internal baffling and other design features such as bypasses may increase performance over traditional wet vaults and/or reduce the likelihood of resuspension and loss of sediments or floatables during high flows.
- Head loss is modest.

Limitations

- Concern about mosquito breeding in standing water
- The area served is limited by the capacity of the largest models.
- As the products come in standard sizes, the facilities will be oversized in many cases relative to the design treatment storm, increasing the cost.
- Do not remove dissolved pollutants.
- A loss of dissolved pollutants may occur as accumulated organic matter (e.g., leaves) decomposes in the units.

Design and Sizing Guidelines

Water quality volume or flow rate (depending on the particular product) is determined by local governments or sized so that 85% of the annual runoff volume is treated. There are three general configurations of wet vaults currently available, differing with the particular manufacturer.

Vault System A: This system consists of two standard precast manholes, the size varying to achieve the desired capacity. Stormwater enters the first (primary) manhole where coarse solids are removed. The stormwater flows from the first to the second (storage) manhole, carrying floatables where they are captured and retained. Further sedimentation occurs in this second manhole. The off-line serves as a storage reservoir for

Design Considerations

- Hydraulic Capacity
- Sediment Accumulation

Targeted Constituents

- ☑ Sediment
- ☑ Nutrients
- ☑ Trash
- ☑ Metals
- Bacteria
- ☑ Oil and Grease
- ☑ Organics

Removal Effectiveness

See New Development and Redevelopment Handbook-Section 5.

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floatables as stormwater flows though at flow rates less than the design flow. A patented device controls the flow into the storage manhole. All flows above the stated treatment flow rate bypass through the device. The bypass prevents resuspension or loss of sediment and floatables that have accumulated in the second manhole. It is important to recognize that has storage of accumulated sediment occurs directly in the operating area of the manholes; treatment efficiency will decline over time given the reduction in treatment volume

The manufacturer currently provides 4 models, with treatment capacities (flow rate above which bypass occurs) from 2.4 to 21.8 cfs. The hydraulic capacities range from 10 to 100 cfs. As such, all stormwater achieves at least partial treatment through essentially all but the most extreme storm flows since some settling occurs in the first manhole. The manufacturer provides information on the total system (water) volume, sediment capacity, and floatable capacities. The size of the storage manhole can be varied with each of the four models to increase storage capacity as desired, following recommendations of the manufacturer. The footprint of this system ranges from about 200 to 350 ft2, with heights of about 11.5 to 13.5 feet (excluding minimum soil cover and access port extenders), depending on the model. Head loss ranges from 5 to 12 inches, depending on the model. Sediment and floatable capacities range up to 201 cf and 150 gallons, respectively. The recommended point of maintenance is when about 25% of the wet pool volume is supplanted by sediment. The affect of the accumulation of sediment on performance is not given

Vault System B: This wet vault has outward appearance of a standard, rectangular wet vault, but with its own unique design for internal baffles. Included is an entrance baffle, presumably to reduce the energy of the flow entering the unit. Baffles are also affixed to the floor, purportedly to reduce resuspension of settled sediments improve performance. A floating sorbent pad may be placed near the outlet to remove free oil floating on the surface. The vault includes both a permanent wet pool, 3 feet in depth, and live storage volume that is filled during each storm. The live storage volume is accomplished by restricting the outlet. The system is modular: that is, it consists of standard units that are added to increase the length, thereby providing the desired volume. Presumably for very large sites there is a practical total length. Further capacity could be accomplished by having two or more vaults in parallel. The capacity of the system is therefore essentially unlimited, Being modular may allow the design engineer to more closely match facility size to the design event.

Vault System C: This system is like System A, but differs in two primary respects. The Stormceptor module consists of only one circular structure. Hence, standard precast manholes can be used for the smaller models but larger models are non-standard sizes. Like System A, System C has an internal bypass, involving a unique design. The purpose of the bypass is to prevent resuspension of previously suspended material. All stormwater up to the bypass rate is diverted downward into the center well where removal occurs. Flows in excess of the treatment capacity are diverted directly across the top of the device to the outlet. According to the manufacturer there is also some storage capacity for floatables immediately beneath the bypass structure.

Twelve models are available. The treatment capacity of each is not indicated for the Stormceptor as it is a function of the removal efficiency specified by the designer. The manufacturer provides a methodology for the calculation of efficiency as a function of flow rate (see Design Guidelines). Hydraulic capacities range up to approximately 63 cfs. The head requirement is a function of the model and desired hydraulic flow rate, ranging up to 21 inches.

Diameters range from 4 to 12 feet, and minimum heights up to about 13 feet plus the diameter of the incoming pipe. Sediment and floatable capacities range up to 1,470 cf and 3,055 gallons, respectively. The recommended point of maintenance is when about 15% of the wet pool volume is supplanted by sediment. The affect of the accumulation of sediment on performance is not given but can be estimated using the manufacturer's sizing methodology.

Construction/Inspection Considerations

Refer to guidelines provided by the manufacturer.

Performance

A manufactured wet vault can be expected to perform similarly to large catch basins in that its wet volume (dead storage) is similar to that determined by methodology provided in TC-20 for wet ponds. Hence, the engineer should compare the volume of the model s/he intends to select to what the volume of a constructed wet vault would be for the site. Conceivably, manufactured vaults may give better performance than standard catch basins, given the inclusion of design elements that are intended to minimize resuspension. Given this benefit, it could be argued that manufactured wet vaults can be smaller than traditional catch basins, to achieve similar performance. However, there are no data indicating the incremental benefit of the particular design elements of each manufactured product.

Siting Criteria

There are no unique siting criteria. The size of the drainage area that can be served by a manufactured wet vault is directly related to the capacities of the largest models.

Additional Design Guidelines

Refer to guidelines of the manufacturers.

Maintenance

Maintenance consists of the removal of accumulated material with an eductor truck. It may be necessary to remove and dispose the floatables separately due to the presence of petroleum product. Annual maintenance is typical.

It is important to recognize that as storage of accumulated sediment occurs directly in the operating area of the wet vault, treatment efficiency will decline over time given the reduction in treatment volume. Whether this is significant depends on the design capacity. If the total volume of the wet pool is similar to that determined by the method on TC-20, the effect on performance is minor.

Maintenance Requirements

- Each manufacturer provides storage capacities with respect to sediments and floatables, with recommendations on the frequency of cleaning as a function of the percentage of the volume in the unit that has been filled by these materials.

- The recommended frequency of cleaning differs with the manufacturer, ranging from one to two years. It is prudent to inspect the unit twice during the first wet season of operation, setting the cleaning frequency accordingly.

Cost

Manufacturers provide costs for the units including delivery. Installation costs are generally on the order of 50 to 100 % of the manufacturer's cost.

Cost Considerations

- The different geometries of the several manufactured separators suggest that when comparing the costs of these systems to each other, that local conditions (e.g., groundwater levels) may affect the relative cost-effectiveness.
- Subsurface facilities are more expensive to construct than surface facilities of similar size. However, the added cost of construction is in many developments offset by the value of continued use of the land.
- Some of the manufactured vaults may be less expensive to maintain than public domain vaults as the former may be cleaned without the need for confined space entry.
- Subsurface facilities do not require landscaping, reducing maintenance costs accordingly.

References and Sources of Additional Information

Manufacturers literature.