RYMAR®
WATERWORKS INNOVATIONS

Using Skimmers for Post-Construction Water Quality and Reduced Maintenance

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1992 Graduate – Clemson University
BS – Civil Engineering

1999 - Founded CCAD Engineering

2013 - Invented the Marlee Float skimmer

Licensed Professional Engineer in
SC, NC & GA

Presentation Objectives

- Understand the benefits of use of skimmers in permanent basins
- Recognize opportunities for retrofit of existing basins by adding skimmers to reduce maintenance
- Introduce the new post-construction filter for water quality

Audience Question

What is your current occupation/role?

- Engineer
- Inspector
- DOT/MS4
- Contractor

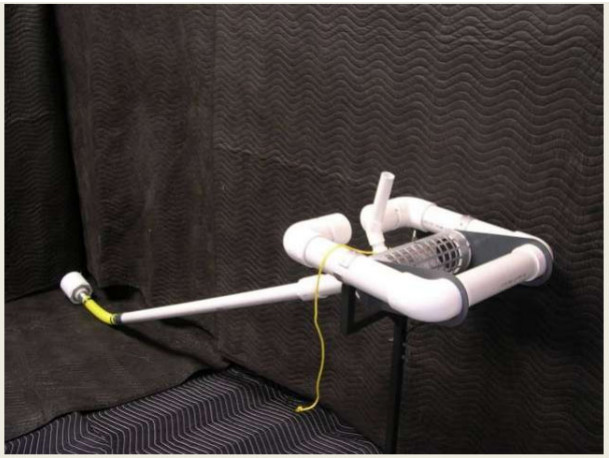
Skimmer Background Information

Skimmers have been around for many years and promoted for use in sediment basins during construction

Skimmers meet the requirement for surface withdrawal from sediment basins, which drains the basin from the top down, releasing the cleaner water from near the surface.

Skimmers have been shown to greatly increase the trapping efficiency of sediment basins - obtaining over 90% trapping during construction

Examples of skimmers



Faircloth Skimmer

ESC Skimmer

Marlee Float Skimmer

IAS Skimmer

Flow Rate – Not Skimmer Size

Skimmer Flow Rate, gal/min													
Water Depth, ft	Skimmer												
	Type 2: 2-inch + 1-in Orifice	Type 4: 1.5-inch	Type 4: 2.5-inch	Type 1: 1.5-inch	Type 3: 1.5-inch + 1-in Orifice	Type 2: 2-inch	Type 3: 1.5-inch	Type 1: 2-inch	Type 2: 3-inch + 2-in Orifice	Type 3: 3-inch + 2-in Orifice	Type 2: 3-inch	Type 1: 3-inch	Type 3: 3-inch
4.0	8.4	10.1	10.5	12.3	12.4	23.8	26.2	30.0	26.4	35.2	47.3	53.3	90.1
3.5									25.2	34.7	46.2	51.5	88.0
3.0									24.0	34.2	45.1	49.4	85.7
2.5									22.6	33.5	43.7	47.0	83.0
2.0									21.1	32.8	42.1	44.2	79.8
1.5									19.2	31.9	40.1	40.9	75.9
1.0									16.8	30.6	37.5	36.7	70.7
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Testing has shown that skimmers with the same size orifice can have significantly different flow rates.

One 3” skimmer has a flow rates nearly double the others.

All skimmers flow rate increases with depth

Critical to compare flow rates -
Can’t assume the same size is an equal

Why use Skimmers in Permanent Basins?

Basins are designed to capture pollutants by allowing time for settlement

Surface withdrawal from permanent detention or retention basins releases the cleaner water from near the surface and allows more time for pollutants to settle.

Does it make sense to do this during construction but not post construction?

Low-flow water quality orifices often need to be 3” or less in diameter and are very prone to clogging. A skimmer can provide similar flow rates and be much less prone to clogging, thereby reducing maintenance requirements

A Case Study of a Skimmer used to retrofit basin for permanent use and reduced maintenance

- Former Simpsonville Chevrolet Simpsonville, South Carolina

Former Simpsonville Chevrolet

- In 2013 the site received an NOV for failure to maintain the pond. The pond was severely overgrown and the outlet structure was not functioning properly.

- After the removal of the initial vegetation, it was determined that the pond had accumulated +/-6’ of mud and debris. There was a 2” outlet at the bottom of the basin that had been clogged for many years.

- Due to the size of the pond, the steep banks and the volume of muck to be removed, initial estimates for cleanout of the basin were $60,000 - $75,000.

Former Simpsonville Chevrolet

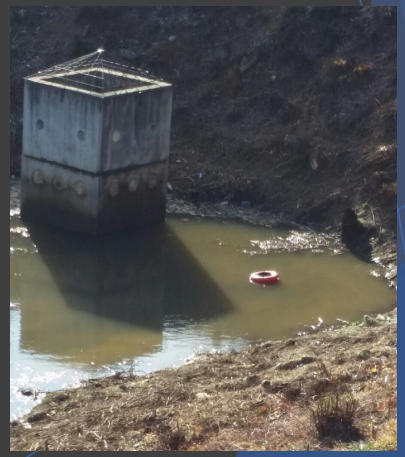
- The basin was redesigned to allow the muck and debris to remain and modify the outlet structure to still meet regulatory requirements.
- Greenville County required that the 2” low flow discharge rate be maintained as part of the design modification.
- Not having to remove the sediment buildup resulted in a savings of over $50,000.

Former Simpsonville Chevrolet

- A skimmer with a 5” orifice was installed as a pilot project to provide similar flows to the previous 2” low flow orifice.
- The other orifices in the outlet structure were modified to control the larger storm events.

Former Simpsonville Chevrolet

- The basin was monitored monthly for the first 12 months of the skimmer being in place to insure it was working properly.



Former Simpsonville Chevrolet

- In August 2014 the area had a major rain event that dumped nearly 5” of rain in less than 8 hours. This occurred the afternoon after the pond had been cut but before the debris could be removed. Despite the large amount of debris in the basin, the skimmer did not clog and drained the basin.

Former Simpsonville Chevrol

- The skimmer was replaced with a protype with filter fabric for field testing

Former Simpsonville Chevrolet

- The prototype was replaced in March 2021 with latest model that uses two stage filter

Former Simpsonville Chevrolet

- The prototype is regularly monitored and has been in the pond for over 24 months

- Area flowing to pond is highly developed with few other stormwater management facilities, therefore, large volume of sediment, trash and debris enters this pond

Former Simpsonville Chevrolet

- Time lapse camera was installed to monitor flow.

Former Simpsonville Chevrolet

- Verify during a large rain event pond fills

Former Simpsonville Chevrolet

- Pond drains within 48 hours

Former Simpsonville Chevrol

- Vegetation started to grow in inner non-woven filter.

Former Simpsonville Chevrolet

March 2022

- The vegetation tended to die off over the winter and had minimal effect on the skimmer or filter.

Former Simpsonville Chevrolet

July 2022

- The vegetation returned
- Future research could include use of specific vegetation for targeted pollutant removal, such as phosphorous or nitrogen
- Vegetation did not seem to affect flow

Skimmers in Permanent Basins

- **Additional filtration can be added around the skimmer to further reduce pollutant discharge**
- **Testing recently completed to confirm TSS removal efficiency greater than 90% based on post-construction sediment loads**
- **Filter can also remove hydrocarbons and other pollutants**

Audience Question

Have you ever considered using a Skimmer permanently?

If not, now that you are aware of the benefits would you?

Skimmers can be modeled in most hydrology programs (Hydraflow, HydroCAD, etc.) as part of the Permanent Outlet Structure by using a User Defined Input to develop the flow rate curve

Flaws with using Extended Detention for Water Quality

- Basins are designed to capture pollutants by holding runoff for an extended time, allowing for settlement
- Basins that rely on settling time provide very little treatment for smaller storm events due to limited ponding/holding time
- Volume based design results in larger pond sizes or larger underground storage volumes

Benefits to Filtration vs Settlement

Ponds provide a large containment volume to reduce maintenance frequency and treat larger drainage areas

There is excellent potential to retrofit older basins that did not include water quality benefits in the design

Filters in ponds are relatively easy to access and maintain, especially when compared to systems that use underground vaults and require confined space entry.

Benefits to Filtration vs Settlement

The peak rate of discharge can be increased based on filter capacity, which can result in significantly smaller pond volume

The filter treats 100% of runoff from storms at or below the water quality design event and up to the next orifice in the outlet.

The filtration media can be customized to target specific pollutants of concern.

Benefits to Using Skimmers with Filtration

The skimmer can be sized to control the peak rate for lower storm events

Skimmer increases filter efficiency by withdrawing from the surface, where water is cleaner

Skimmer is easy to access or pull to side of pond for maintenance and changing filters.

Challenges to Using Skimmers with Filtration

Filters are prone to clog over time and will require maintenance and periodic cleaning or changing

Skimmer must be durable and last more than a few years to be suitable for permanent use. PVC may not be suitable

There are no established standards for basis of design and permitting based upon combination of pond and filtration

Testing Protocol

There are currently two widely recognized testing protocols – Washington TAPE program and NJCAT Certification

NJCAT has established testing procedures for Filtration Manufactured Treatment Devices (MTDs)

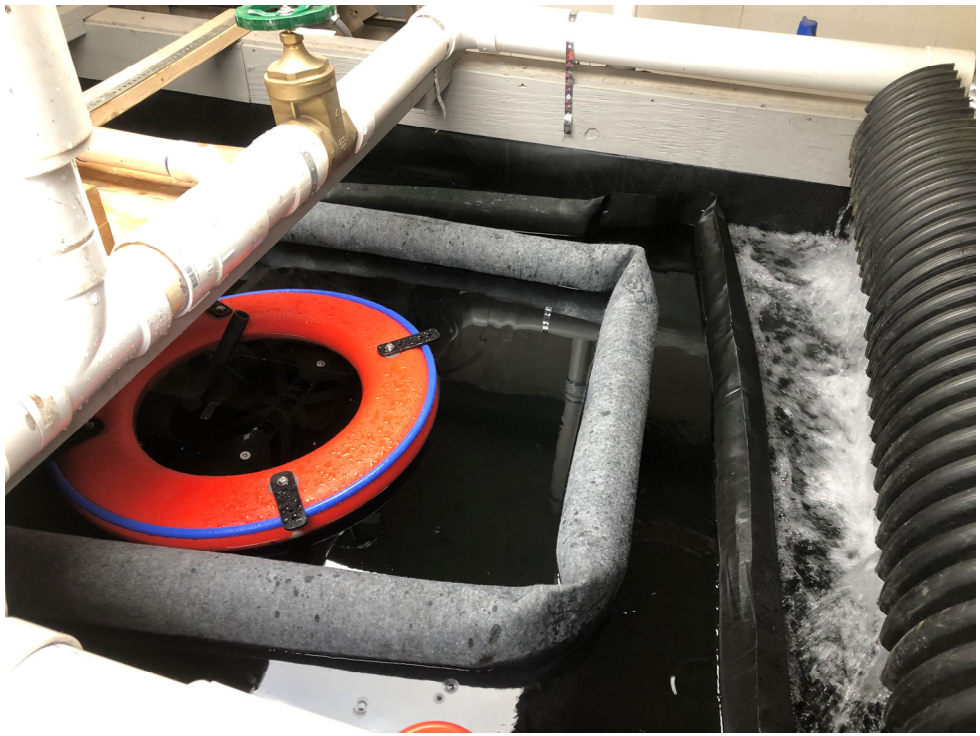
ASTM Standards have recently been established and other ASTM Standards are in process

Field Testing Results

Results

- **Field testing of two stage filtration model shows discharge water has less turbidity and minimal sediment.**
- **Third Party Testing to confirm TSS removal performed by TRI Environmental to confirm TSS removal efficacy**

Third Party Testing



- TRI Environmental tested two versions of the skimmer with filter in accordance with ASTM C1746
- ASTM C1746 is a standard test method for sediment removal efficiency.
- Tank was setup to minimize effect of the “pond” by introducing sediment laden water within 2’ of the filter.

Testing Results

Achieved Greater than

<u>90% TSS Removal Efficiency</u>

Future R&D will be conducted to test filter media to remove metals, hydrocarbons and other pollutants.

3rd party Field Testing is also being planned

Summary

Skimmers are less prone to clogging than orifices located at the bottom of the pond and often require less maintenance to keep the pond functioning properly.

Skimmers can be a very effective way to retrofit existing basins to reduce maintenance and provide enhanced water quality

Testing has confirmed TSS Removal Efficiency of over 90% for the Rymar Skimmer Filter.

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Questions?

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