Infiltration Background

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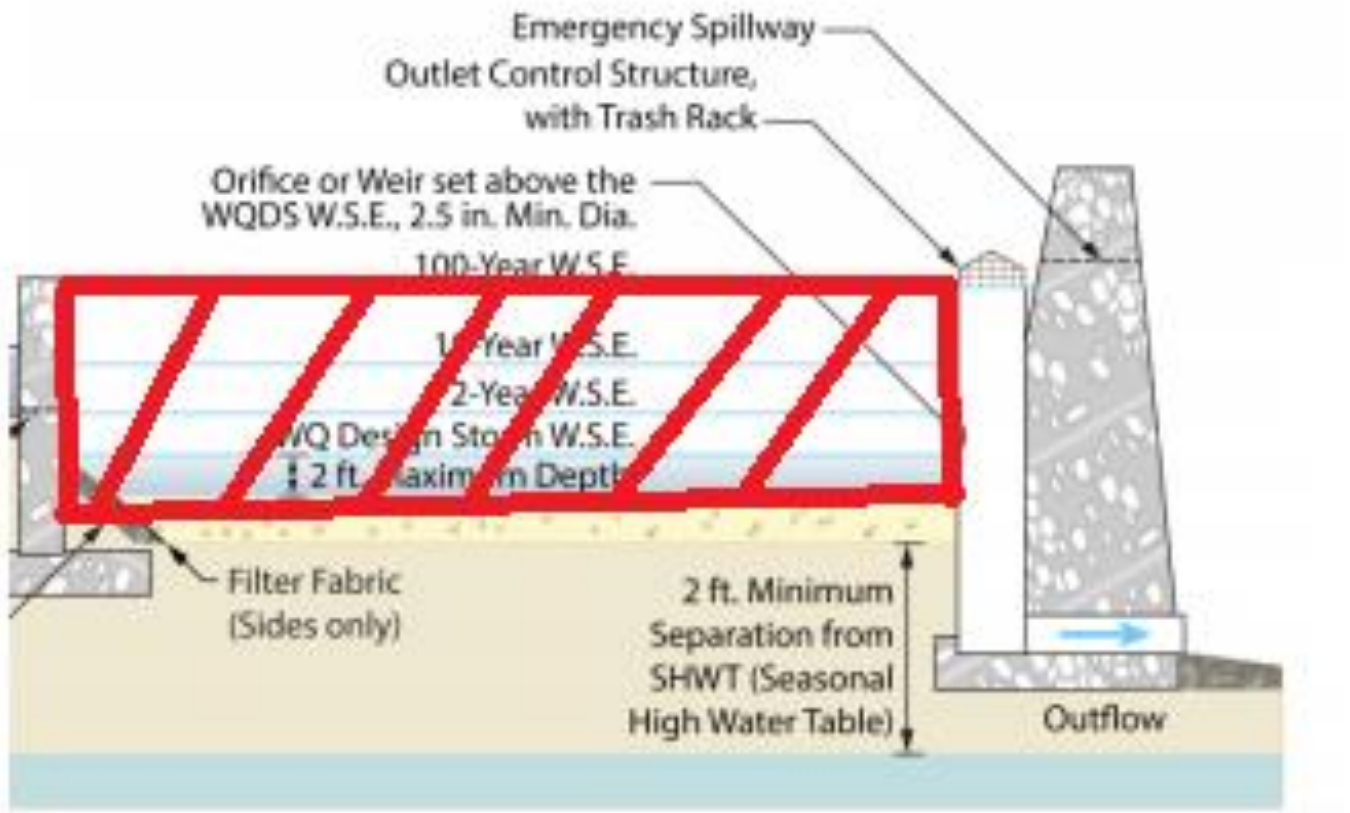
What does a basin do?

- Water Quality
  - Basins can provide anywhere from 40-90% TSS removal depending on type
- Groundwater Recharge
  - Basins with infiltration components can be used to maintain existing recharge
- Water Quantity
  - Basins store stormwater runoff and slowly release it to prevent increases in flowrates

How does a basin store runoff?

Inflow volume = average inflow rate X storm duration



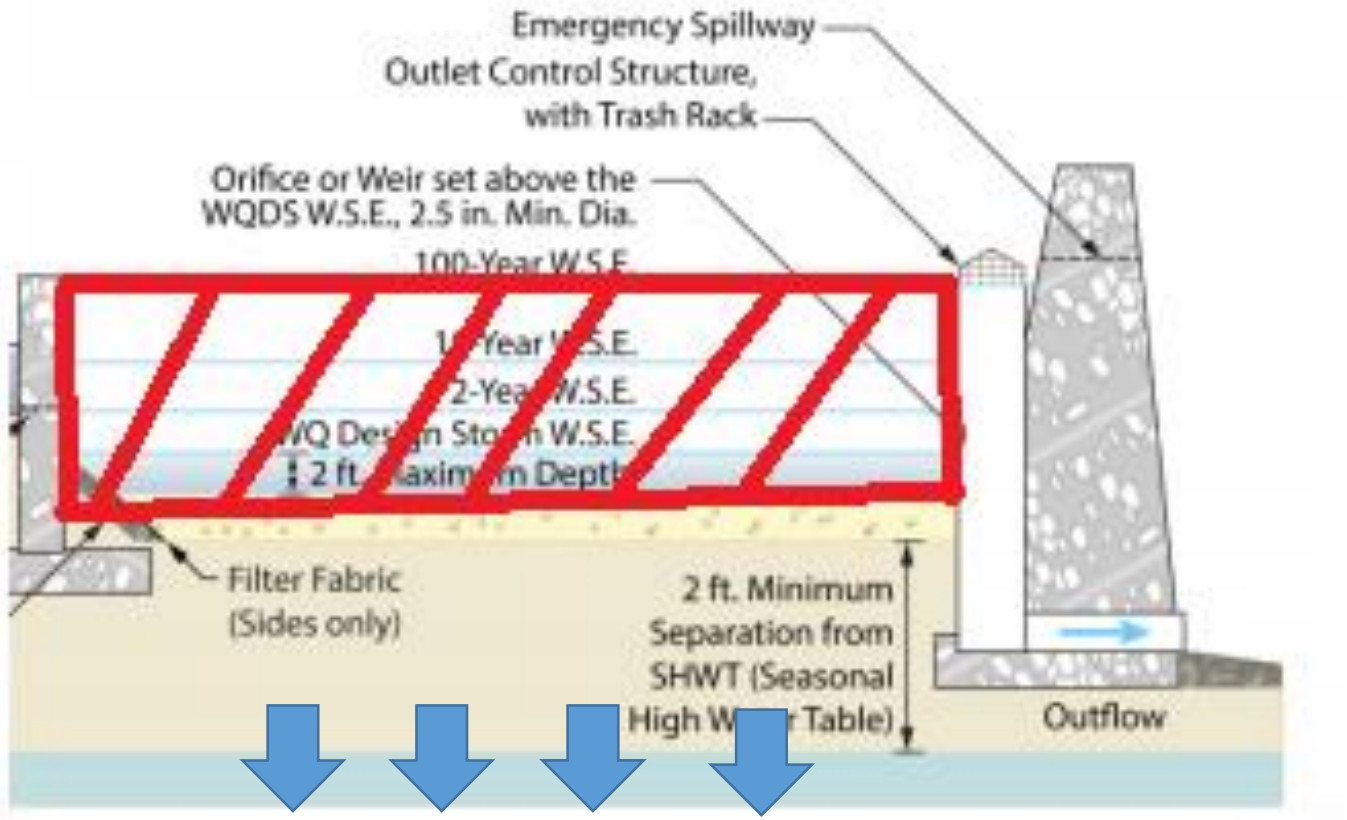
Outflow volume = average outflow rate X outflow duration

Basin storage volume = inflow volume – average outflow rate x storm duration

Infiltration

- NJ Stormwater BMP Manual does not allow infiltration during 2-, 10-, and 100-year storm routings
- Infiltration is allowed for smaller storm events, such as the Water Quality Design Storm (1.25” of rain)
  - When infiltration is used, the designer must assume ½ of the slowest field tested rate
- Similar standards present in previous version of the Stormwater BMP Manual (1986 manual)
- This issue was discussed at BMP Manual Committee Meetings (early 2000s), these meetings acted as BMP Manual stakeholder process

How does infiltration change that?



Inflow volume = average inflow rate X storm duration

Outflow volume = average outflow rate X outflow duration

Infiltration volume = infiltration rate x infiltration duration

Basin storage volume = inflow volume – (average outflow rate + infiltration rate) x storm duration

Comparisons of Infiltration Rates - Impact on Basin Size

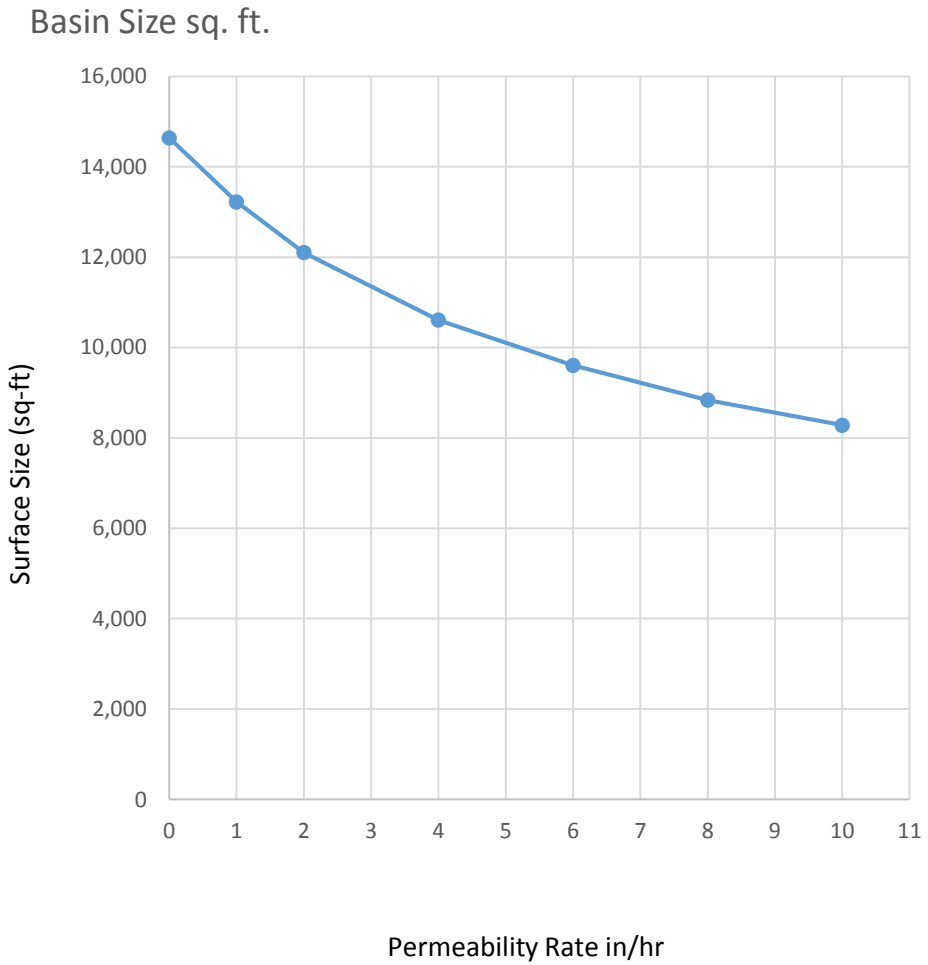
Drainage Area

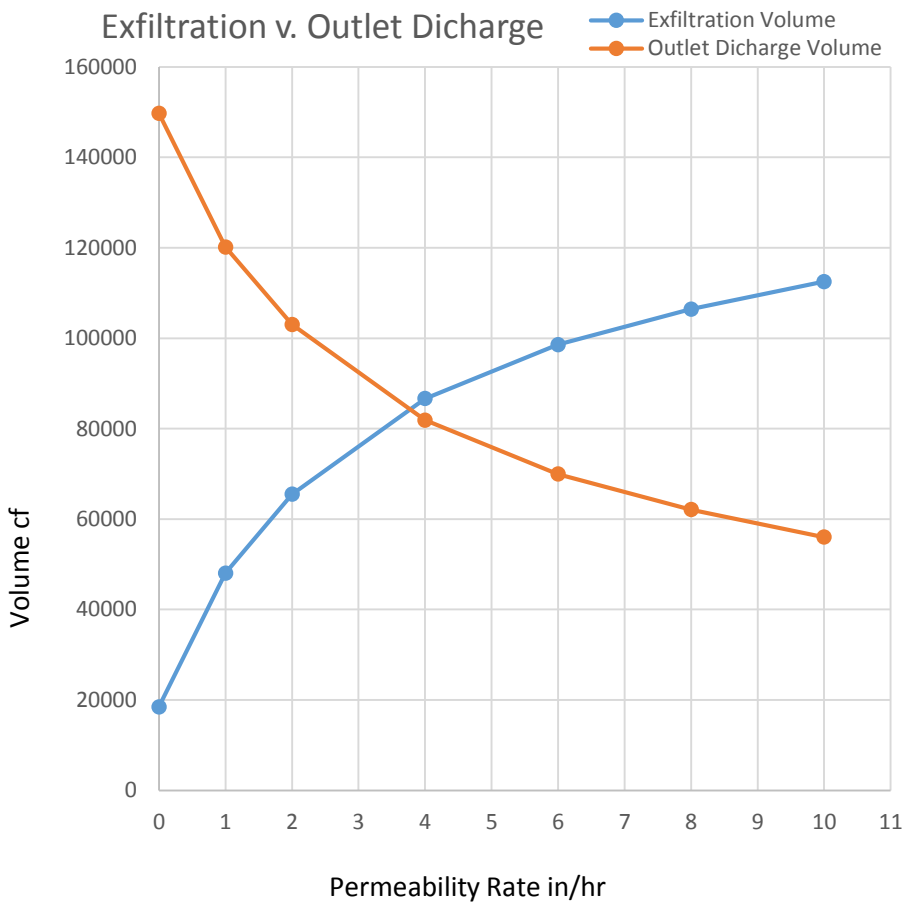
- Drainage 5.3 acres
- Rainfall 9 in/24 hours (~100yr)
- Existing runoff 16.2 cfs (CN 65)
- Target reduction 20%
  - Post-construction runoff must be less than 13.2 cfs
- Proposed Impervious 5.3 acres
  - Peak 40.56 cfs
  - Inflow 168,527 cf

Detention Basin infiltrating Water Quality Storm but Without Infiltration of Large Storm

- Basin
  - 14,641 sq-ft (121’ x 121’)
  - 4 x 3’ top-overflow box @6’
  - 2’ weir @4’
  - 0.5’ weir @1.22’ (water quality)
- Result
  - Outflow peak 12.93 cfs
  - Water level 5.10’
  - Volume via primary outlet 149,736 cf

Infiltration Rate	BMP Area	100-year depth	peak outflow rate	outflow volume	Outflow rate if inf. fails
0 in/hr	14,641 sf	5.10'	12.93 cfs	149,736 cf	n/a
1 in/hr	13,225 sf	5.09'	12.84 cfs	120,146 cf	14.77 cfs
2 in/hr	12,100 sf	5.09'	12.85 cfs	103,084 cf	16.29 cfs
4 in/hr	10,609 sf	5.09'	12.85 cfs	81,888 cf	18.43 cfs
6 in/hr	9,604 sf	5.09'	12.90 cfs	69,947 cf	19.99 cfs
8 in/hr	8,836 sf	5.10'	12.95 cfs	62,089 cf	21.10 cfs
10 in/hr	8,281 sf	5.09'	12.86 cfs	56,003 cf	21.96 cfs


Basin Size sq. ft.
Surface Size (sq-ft)
16,000
14,000
12,000
10,000
8,000
6,000
4,000
2,000
0
0 1 2 3 4 5 6 7 8 9 10 11
Permeability Rate in/hr


Exfiltration v. Outlet Dicharge
Exfiltration Volume
Outlet Dicharge Volume
Volume cf
160000
140000
120000
100000
80000
60000
40000
20000
0
0 1 2 3 4 5 6 7 8 9 10 11
Permeability Rate in/hr

If infiltration fails (10”/hr scenario)

Existing Site Peak Runoff Rate

- 16.2 cfs

Overflow Rate from Basin

- 21.96 cfs

In this example, the peak flowrate leaving the basin will be about 40% greater the peak flowrate leaving the existing site, if infiltration entirely fails.

Smaller basin = Increased downstream flooding risk

Factors affecting infiltration

A

- Groundwater mounding
- Maximum volume that can be infiltrated
- Infiltration rates change with seasons
- Infiltration rates may vary depending on chemical makeup of runoff
- Factors work together
- Acceptable level of risk

B

- Poor designs receiving approval
- Poor construction techniques
- Inadequate soil testing
- System not built as designed
- System not maintained