Flexible Treatment Options

REVISITED

April 19, 2013

MIDS Work Group Meeting

p-gen3-15c

Presentation Outline

- Review existing Flexible Treatment Options (FTO) Decision Sequence and framework used to develop it
- Test options on D-soil site
- Review FTO and determine if group desires a change

Excerpt from Current FTO Decision Sequence

Goal

Applicant attempts to comply with New Development Performance Goal (1.1” volume reduction). Options considered and presented shall examine the merits of relocating project elements to address varying soil conditions and other constraints across the site.

Excerpt from Current FTO

Alternative #1

Applicant attempts to comply with the following conditions:

a) Achieve *at least 0.55" volume reduction goal*, and

b) Remove 75% of the annual TP load, and

c) Options considered and presented shall examine the merits of relocating project elements to address varying soil conditions and other constraints across the site

Excerpt from Current FTO

Alternative #2

Applicant attempts to comply with the following conditions:

a) Achieve *volume reduction to the maximum extent practicable* (as determined by the Local Authority), and

b) Remove 75% of the annual TP load, and

c) Options considered and presented shall examine the merits of relocating project elements to address varying soil conditions and other constraints across the site

Excerpt from Current FTO

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Applicant attempts to comply with the following conditions:

- Achieve at least 0.55" volume reduction goal, and
- Remove 75% of the annual TP load, and
- Options considered and presented shall examine the merits of relocating project elements to address varying soil conditions and other constraints across the site

Alternative #2

Applicant attempts to comply with the following conditions:

- Achieve volume reduction to the maximum extent practicable (as determined by the Local Authority), and
- Remove 75% of the annual TP load, and
- Options considered and presented shall examine the merits of relocating project elements to address varying soil conditions and other constraints across the site.

Framework

Big Question:

Only non-infiltration, volume control BMPs and BMPs that manage dissolved phosphorus can achieve similar treatment results on sites with restrictions.

Is requiring these BMPs prudent and feasible?

Yes

- Performance goal for sites with restrictions:
  "provide *equivalent* TP removal"

No

- How much treatment is enough?

How much treatment is enough?

Simple Approach #1:

What TP% reduction for a developed site is needed to match natural P load?

Treatment needed to match natural load

- To match *concentrations*, need 87% reduction from developed site–if the runoff volumes are the same
- Developed site will have more runoff volume than natural site
- Therefore, to match load, reduction would need to be greater than 87%

How much treatment is enough?

Simple Approach #2:

What is % TP reduction at sites with A, B, and C soils when a development conforms to the agreed-upon volume performance goal?

Estimated Annual Phosphorus Loads Using Calculator

10 Acre Site 50% Impervious		HSG			
		A	B	C	D
Developed without BMPs	TP (lbs)	10.5	10.9	11.1	

Estimated Annual Phosphorus Loads Using Calculator

10 Acre Site 50% Impervious		HSG			
		A	B	C	D
Developed without BMPs	TP (lbs)	10.5	10.9	11.1	
Developed with Bioretention Basin	TP (lbs)	0.8	1.2	1.5	

Estimated Annual Phosphorus Load Reduction Percentage Using Calculator

10 Acre Site 50% Impervious		HSG			
		A	B	C	D
Developed without BMPs	TP (lbs)	10.5	10.9	11.1	
Developed with Bioretention Basin	TP (lbs)	0.8	1.2	1.5	
% Reduction	TP	92%	89%	87%	

Estimated Annual Phosphorus Load Reduction Percentage Using Calculator

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Developed without BMPs	TP (lbs)	10.5	10.9	11.1	
Developed with Bioretention Basin	TP (lbs)	0.8	1.2	1.5	AVERAGE
% Reduction	TP	92%	89%	87%	89%

How much treatment is enough?

Simple Approach #3:
What about stream, shallow lake, and lake standards?

Stream, shallow lake, and lake standards

- In Twin Cities, the TP concentrations in these waters needs to be 100 (draft), 60, and 40 µg/L, respectively

- Assuming stormwater runoff has a TP concentration of 300 µg/L, need 67, 80, and 87% reductions, respectively

Summary of Simple Approaches

- Looking at needed TP reductions various *simple* ways:
  - Minimum: 67% reduction
  - Maximum: 92% reduction

- Is goal within this range prudent and feasible?

Testing on Example 50% & 80% Impervious D-Soil Sites

Testing on Example 50% Impervious D-Soil Site

Equivalent BMP Footprint Approach

Example D-Soil Site

10 acre site, 50% Imperviousness, Entire Site Tributary to BMP

Scenario	BMP(s)	Assumptions
1	Pond	NURP criteria

Example D-Soil Site

10 acre site, 50% Imperviousness, Entire Site Tributary to BMP

Scenario	BMP(s)	Assumptions
1	Pond	NURP criteria
2	Biofiltration Basin	Same footprint as pond

Example D-Soil Site

10 acre site, 50% Imperviousness, Entire Site Tributary to BMP

Scenario	BMP(s)	Assumptions
1	Pond	NURP criteria
2	Biofiltration Basin	Same footprint as pond
3A, 3B, 3C	Biofiltration Basin	Same footprint as bioretention basin sized to Performance Goal for A, B, & C soils; drain tile at bottom of basin

Example D-Soil Site

10 acre site, 50% Imperviousness, Entire Site Tributary to BMP

Scenario	BMP(s)	Assumptions
1	Pond	NURP criteria
2	Biofiltration Basin	Same footprint as pond
3A, 3B, 3C	Biofiltration Basin	Same footprint as bioretention basin sized to Performance Goal for A, B, & C soils; drain tile at bottom of basin
4A, 4B, 4C	Biofiltration Basin	Same footprint as bioretention basin sized to Performance Goal for A, B, & C soils; drain tile suspended 1 foot off bottom of basin

Example D-Soil Site

10 acre site, 50% Imperviousness, Entire Site Tributary to BMP

Scenario	BMP Footprint % of Site	TP% Removal
1	3	50

Example D-Soil Site

10 acre site, 50% Imperviousness, Entire Site Tributary to BMP

Scenario	BMP Footprint % of Site	TP% Removal
1	3	50
2	3	55

If we match filtration footprint = pond footprint
TP removal is higher

Example D-Soil Site

10 acre site, 50% Imperviousness, Entire Site Tributary to BMP

Scenario	BMP Footprint % of Site	TP% Removal
1	3	50
2	3	55
3A	3	
4A	3	

Size of Bioretention Basin on A Soils

Example D-Soil Site

10 acre site, 50% Imperviousness, Entire Site Tributary to BMP

Scenario	BMP Footprint % of Site	TP% Removal
1	3	50
2	3	55
3A	3	55
4A	3	57

Suspended Drain Tile Makes a Small Difference

Example D-Soil Site

10 acre site, 50% Imperviousness, Entire Site Tributary to BMP

Scenario			BMP Footprint % of Site			TP% Removal		
1			3			50		
2			3			55		
3A	3B		3	4		55		
4A	4B		3	4		57		

Size of Bioretention Basin on B Soils

Example D-Soil Site

10 acre site, 50% Imperviousness, Entire Site Tributary to BMP

Scenario			BMP Footprint % of Site			TP% Removal		
1			3			50		
2			3			55		
3A	3B		3	4		55	57	
4A	4B		3	4		57	59	

Suspended Drain Tile Makes a Small Difference

Example D-Soil Site

10 acre site, 50% Imperviousness, Entire Site Tributary to BMP

Scenario			BMP Footprint % of Site			TP% Removal		
1			3			50		
2			3			55		
3A	3B	3C	3	4	6	55	57	
4A	4B	4C	3	4	6	57	59	

Size of Bioretention Basin on C Soils

Example D-Soil Site

10 acre site, 50% Imperviousness, Entire Site Tributary to BMP

Scenario			BMP Footprint % of Site			TP% Removal		
1			3			50		
2			3			55		
3A	3B	3C	3	4	6	55	57	61
4A	4B	4C	3	4	6	57	59	65

Suspended Drain Tile Makes a Small Difference

Example D-Soil Site

10 acre site, 50% Imperviousness, Entire Site Tributary to BMP

BARR

Summary:

If developers held to same footprint as bioretention basin required for A, B, C soils without restrictions:

- **55-61%** TP reduction achieved with biofiltration basins with drain tile at bottom
- **57-65%** TP reduction achieved with biofiltration basins with suspended drain tile

Testing on Example 50% Impervious D-Soil Site

What footprint is needed to achieve 55%, 60%, 65%, 70%, and 75% TP removals?

Example D-Soil Site

10 acre site, 50% Imperviousness, Entire Site Tributary to BMP

Scenario	TP % Reduction Goal	BMP
5	55-75%	Biofiltration Basin without iron and drain tile at the bottom

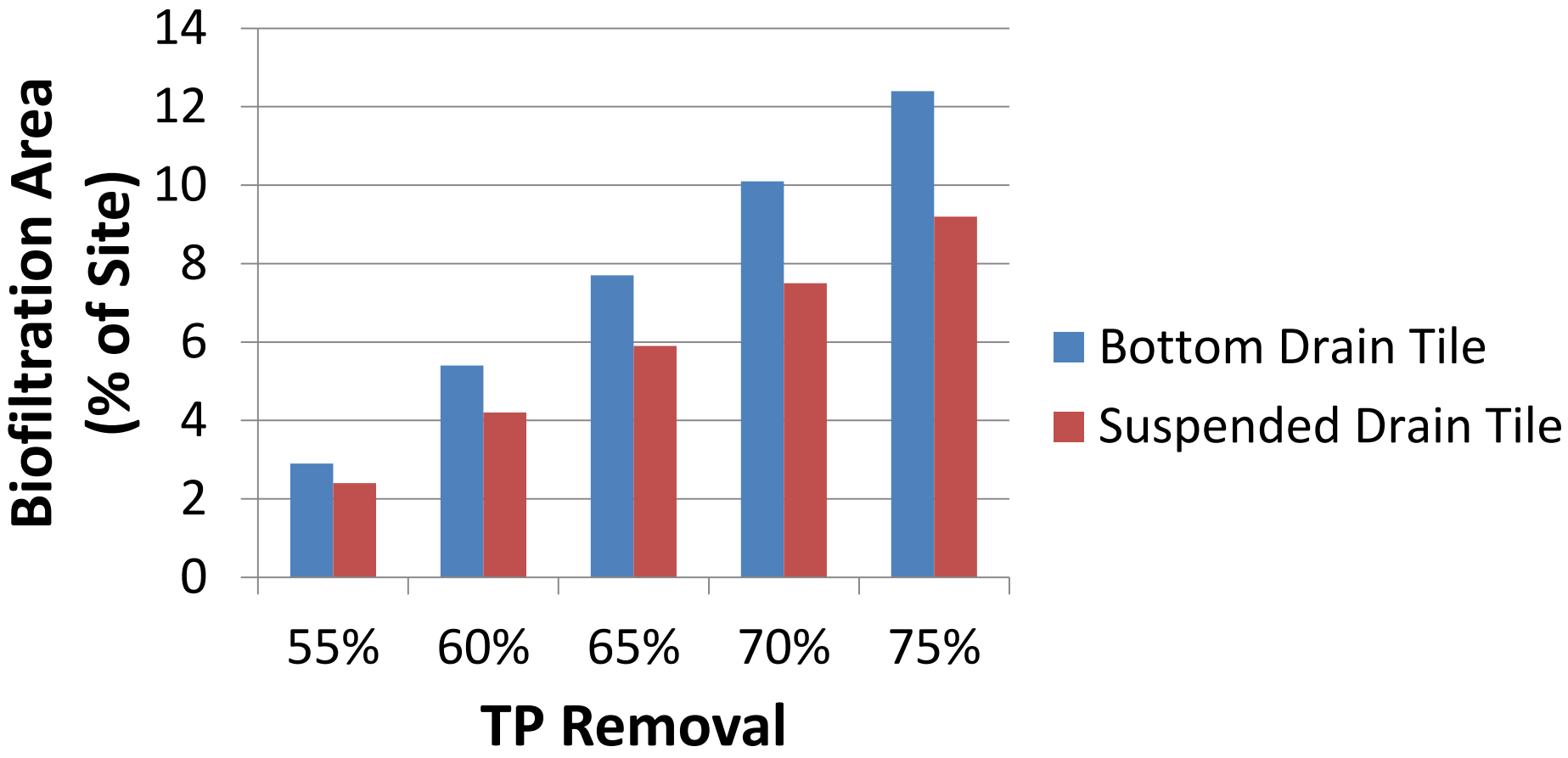
Example D-Soil Site

10 acre site, 50% Imperviousness, Entire Site Tributary to BMP

Scenario	TP % Reduction Goal	BMP
5	55-75%	Biofiltration Basin without iron and drain tile at the bottom
6	55-75%	Biofiltration Basin without iron and drain tile suspended 1 foot above the bottom

Example D-Soil Site

10 acre site, 50% Imperviousness, Entire Site Tributary to BMP



D-Soil Site & 0.3-Acre Pond

(Dead Storage Volume = Runoff from 2.5" Event)

Annual TP Reduction
50%

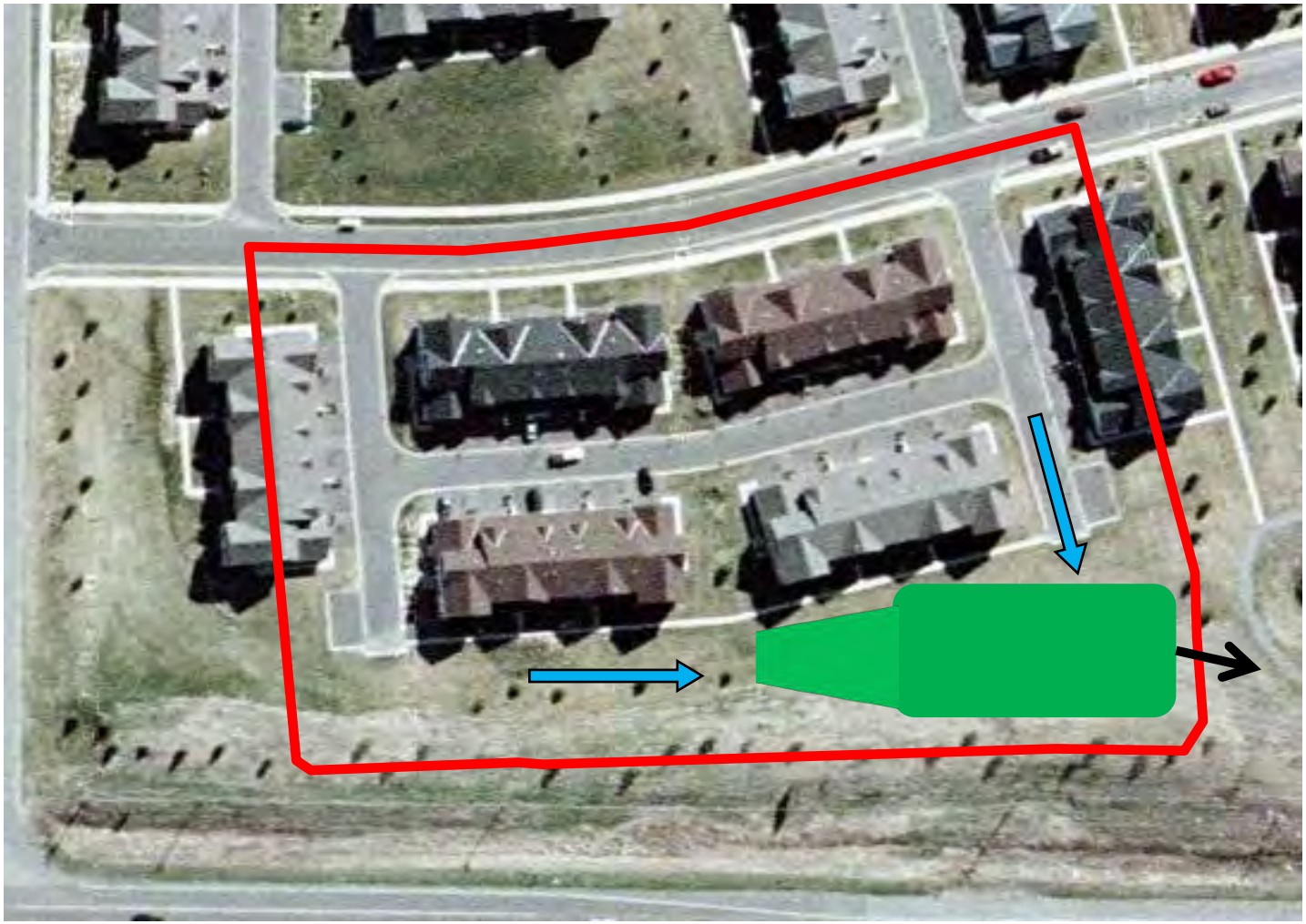
D-Soil Site & 0.3 acre Biofiltration Basin

Annual TP Reduction
55% Bottom Drain Tile
60% Suspended Drain Tile

D-Soil Site & 0.55-Acre Biofiltration Basin

Annual TP Reduction
60% Bottom Drain Tile
65% Suspended Drain Tile

D-Soil Site & 0.77-Acre Biofiltration Basin



Annual TP Reduction
65% Bottom Drain Tile
70% Suspended Drain Tile

D-Soil Site & 1-Acre Biofiltration Basin

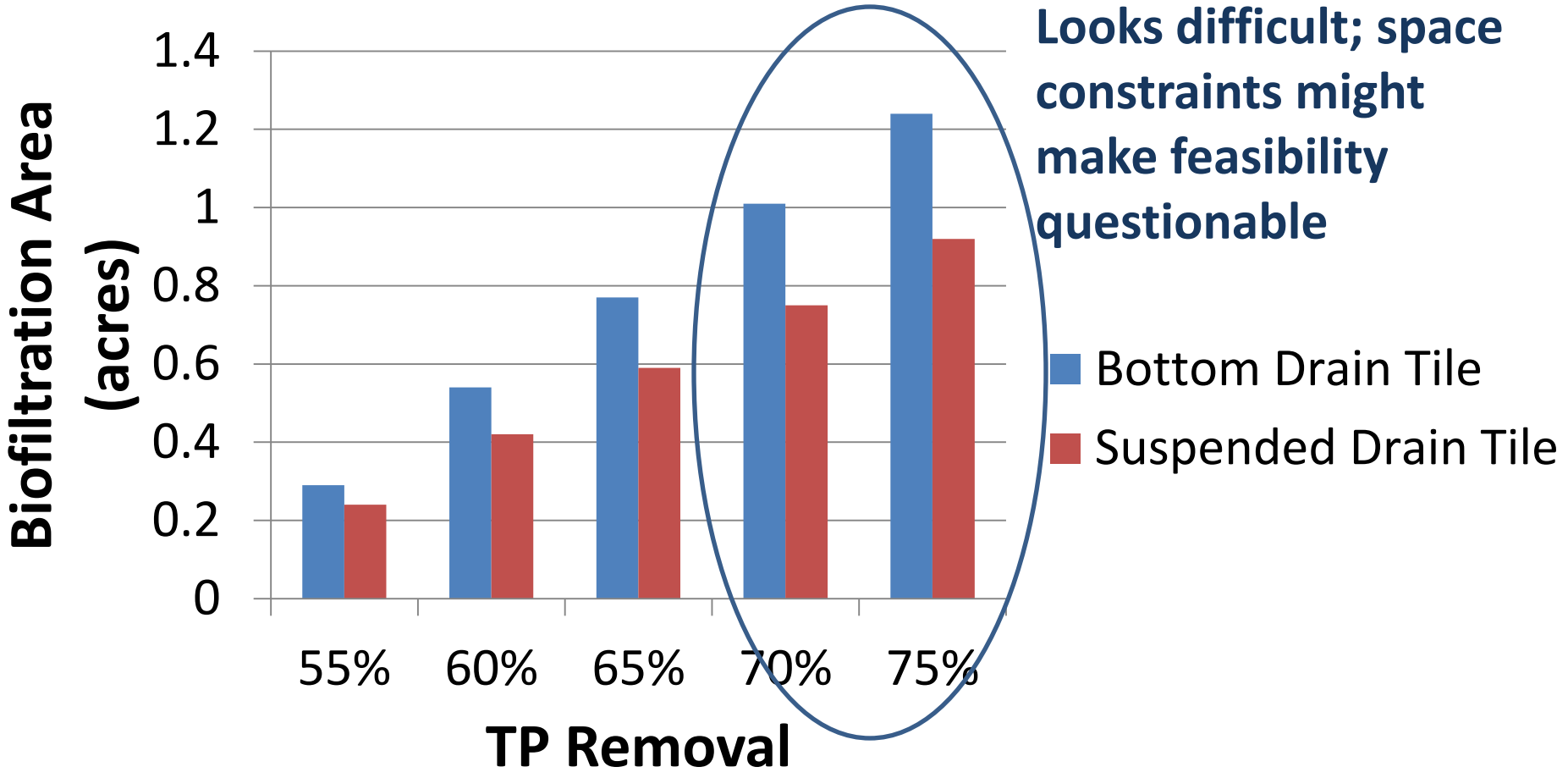
Annual TP Reduction
70% Bottom Drain Tile
75% Suspended Drain Tile

D-Soil Site & 1.25-Acre Biofiltration Basin

Annual TP Reduction
75% Bottom Drain Tile

Example D-Soil Site

10 acre site, 50% Imperviousness, Entire Site Tributary to BMP



Summary for 50% Impervious Site

- Achieving 55% TP reduction is realistic
- Achieving greater than 70% TP reduction is feasible (without iron) but is it prudent?

Testing on Example 80% Impervious D-Soil Site

Equivalent BMP Footprint Approach

Example D-Soil Site

10 acre site, 80% Imperviousness, Entire Site Tributary to BMP

Scenario	BMP	Assumptions
7A, 7B, 7C	Biofiltration Basin	Same footprint as bioretention basin sized to Performance Goal for A, B, & C soils; drain tile at bottom of basin

Example D-Soil Site

10 acre site, 80% Imperviousness, Entire Site Tributary to BMP

Scenario	BMP	Assumptions
7A, 7B, 7C	Biofiltration Basin	Same footprint as bioretention basin sized to Performance Goal for A, B, & C soils; drain tile at bottom of basin
8A, 8B, 8C	Biofiltration Basin	Same footprint as bioretention basin sized to Performance Goal for A, B, & C soils; drain tile suspended 1 foot off bottom of basin

Example D-Soil Site

10 acre site, 80% Imperviousness, Entire Site Tributary to BMP

Scenario			BMP Footprint % of Site			TP% Removal		
7A	7B	7C	5	6	9			
8A	8B	8C	5	6	9			

Size of Bioretention Basin on A, B, & C Soils

Example D-Soil Site

10 acre site, 80% Imperviousness, Entire Site Tributary to BMP

Scenario			BMP Footprint % of Site			TP% Removal		
7A	7B	7C	5	6	9	56	57	61
8A	8B	8C	5	6	9	58	60	66

Suspended Drain Tile makes a Difference

Example D-Soil Site

10 acre site, 80% Imperviousness, Entire Site Tributary to BMP

BARR

Summary:

If developers held to same footprint as bioretention basin required for A, B, C soils without restrictions:

- **56-61%** TP reduction achieved with biofiltration basins with drain tile at bottom
- **58-66%** TP reduction achieved with biofiltration basins with suspended drain tile

Testing on Example 80% Impervious D-Soil Site

What footprint is needed to achieve 55%, 60%, 65%, 70%, and 75% TP removals?

Example D-Soil Site

10 acre site, 80% Imperviousness, Entire Site Tributary to BMP

Scenario	TP % Reduction Goal	BMP
9	55-75	Biofiltration basin without iron and drain tile at the bottom

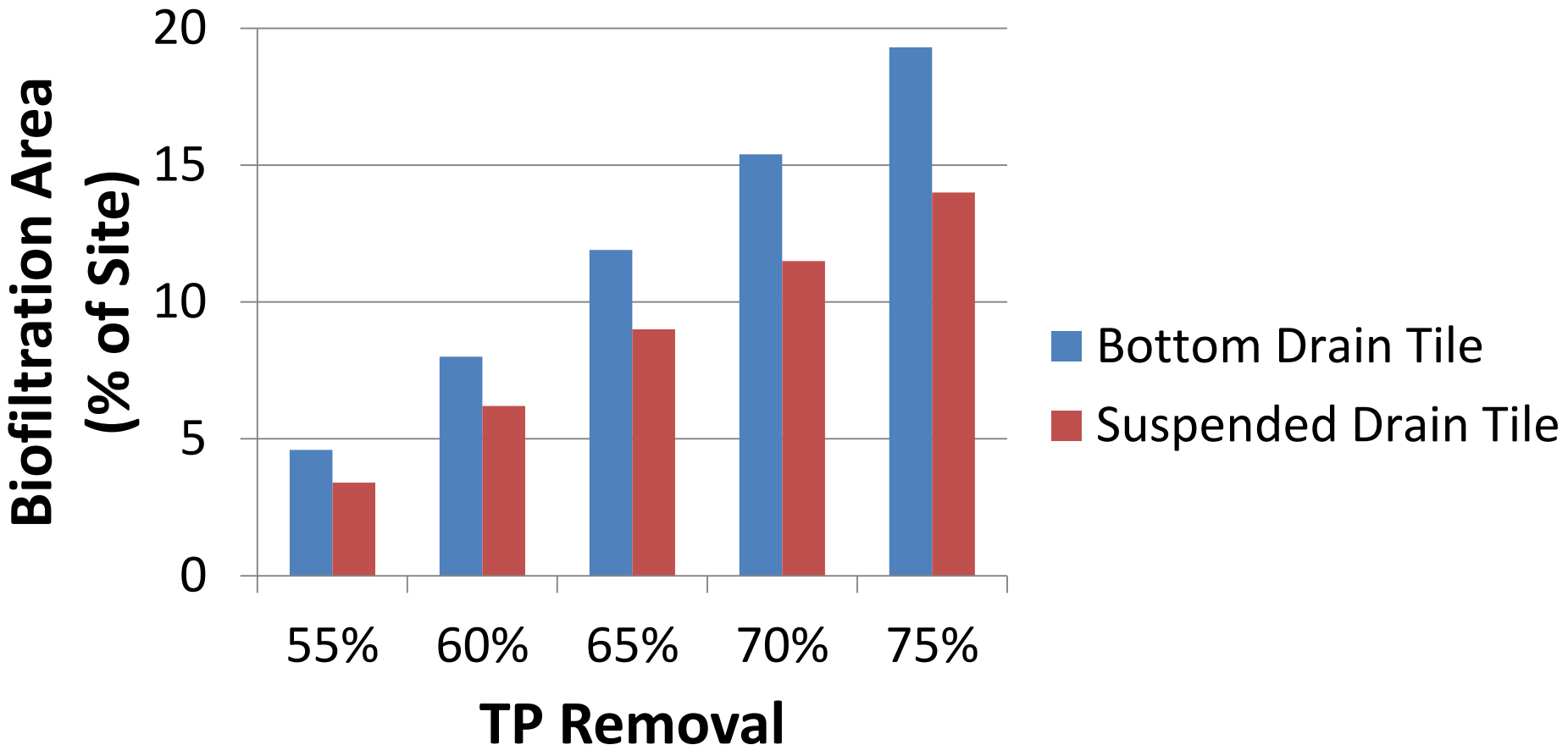
Example D-Soil Site

10 acre site, 80% Imperviousness, Entire Site Tributary to BMP

Scenario	TP % Reduction Goal	BMP
9	55-75	Biofiltration basin without iron and drain tile at the bottom
10	55-75	Biofiltration basin without iron and drain tile suspended 1 foot above the bottom

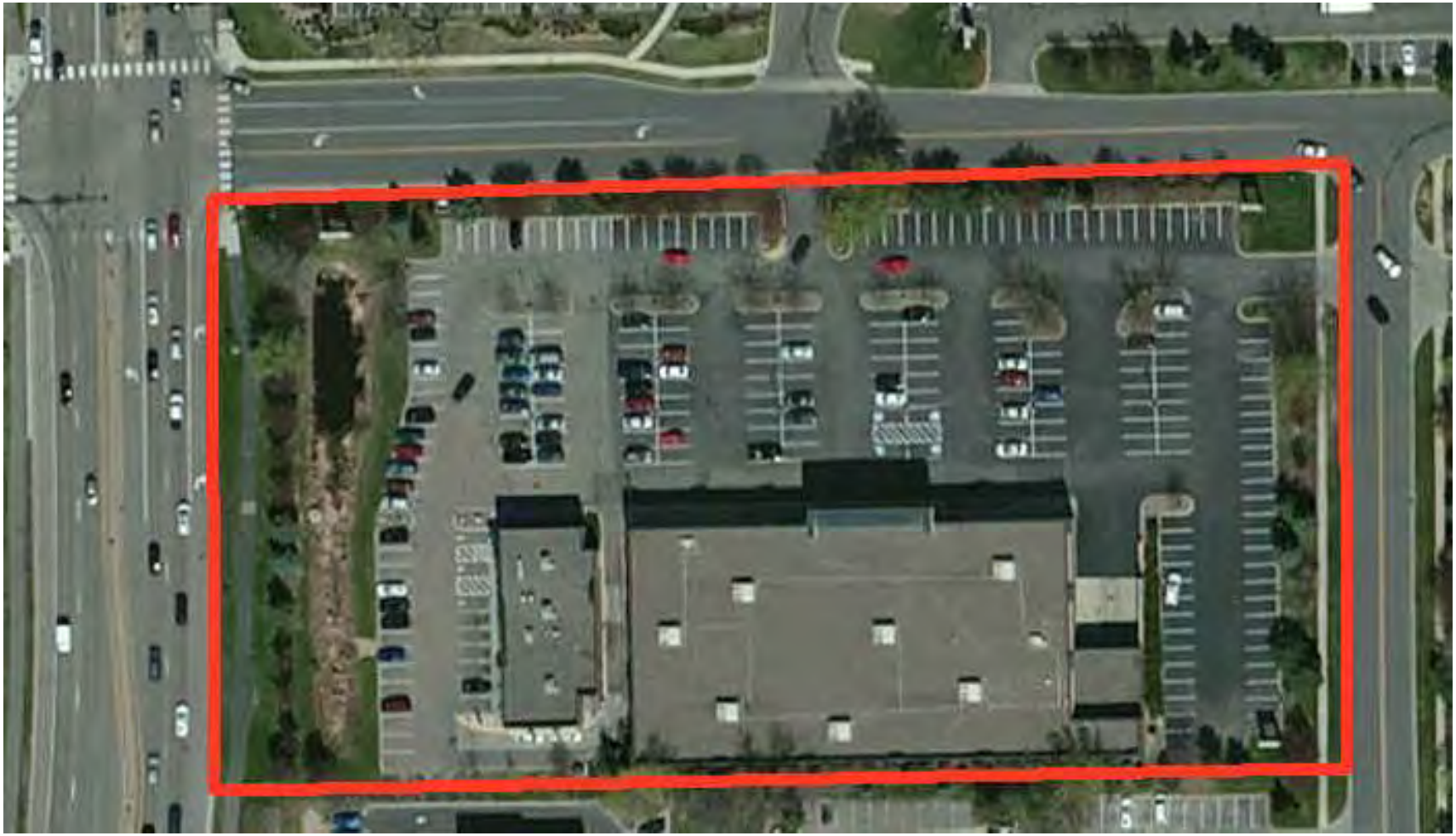
Example D-Soil Site

10 acre site, 80% Imperviousness, Entire Site Tributary to BMP



Example D-Soil Site

80% Imperviousness



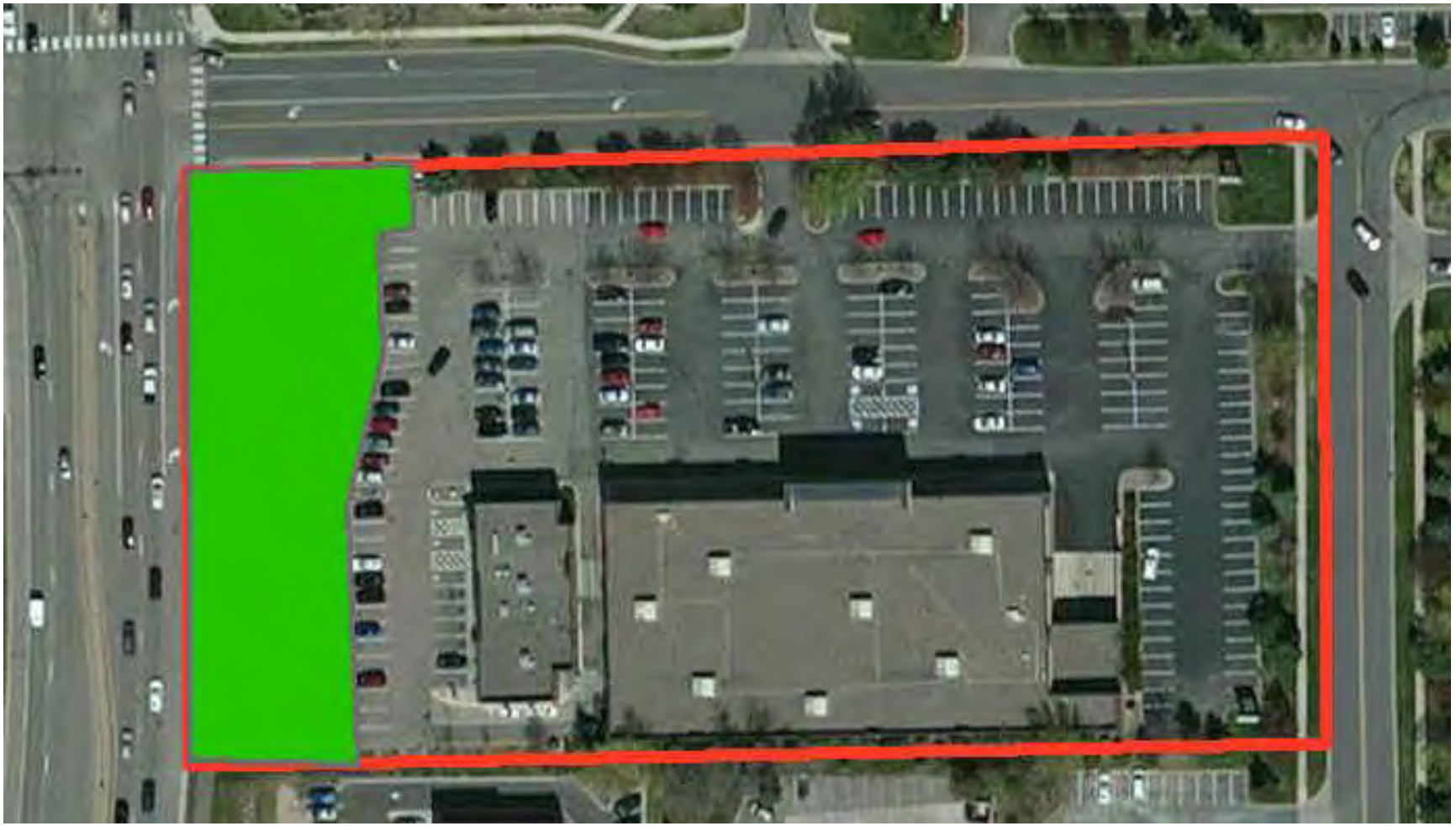
Example D-Soil Site, 80% Imperviousness, Entire Site Tributary to

Biofiltration Basin w/ Suspended Drain Tile using 3.4% of Site = 55% TP Reduction

Example D-Soil Site, 80% Imperviousness, Entire Site Tributary to

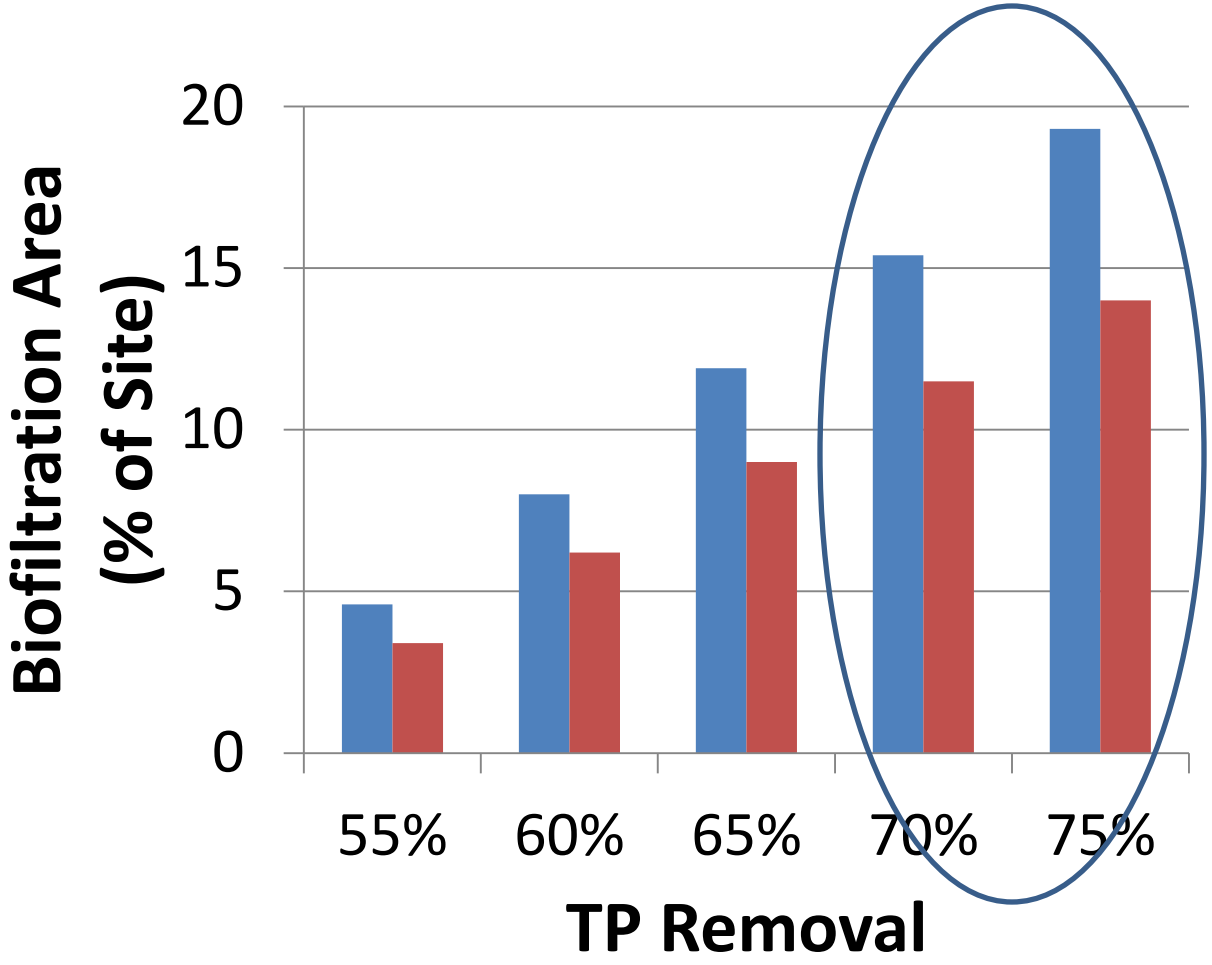
Biofiltration Basin w/ Suspended Drain Tile using 6.2% of Site = 60% TP Reduction

16% of the Site—using it all for a biofiltration basin with drain tile at the bottom = 70% TP reduction



Example D-Soil Site

10 acre site, 80% Imperviousness, Entire Site Tributary to BMP



Summary for 80% Impervious Site

- Achieving 55% TP reduction with biofiltration basin with suspended drain tile is feasible
- Achieving greater than 70% TP reduction is not feasible with biofiltration basin with drain tile at the bottom

Overall Summary

- Looking at needed TP reductions various *simple* ways: 67-92% is needed
- If developers held to same footprint as bioretention basin required for A, B, C soils without restrictions, 55-66% TP reduction is achieved on 50% and 80% impervious sites
- Achieving greater than 70% TP reduction on 50% impervious sites is difficult with biofiltration basins
- Achieving greater than 65% TP reduction on 80% impervious sites is difficult with biofiltration basins

Back to FTO

Excerpt of Current FTO

Goal: Applicant attempts to comply with New Development Performance Goal (1.1" volume reduction). Options considered and presented shall examine the merits of relocating project elements to address varying soil conditions and other constraints across the site.

Alternative #1: Applicant attempts to comply with the following conditions:

- Achieve at least 0.55" volume reduction goal, and
- Remove 75% of the annual TP load, and
- Options considered and presented shall examine the merits of relocating project elements to address varying soil conditions and other constraints across the site.

Alternative #2: Applicant attempts to comply with the following conditions:

- Achieve volume reduction to the maximum extent practicable (as determined by the Local Authority), and
- Remove 75% of the annual TP load, and
- Options considered and presented shall examine the merits of relocating project elements to address varying soil conditions and other constraints across the site.

Possible Options

- Keep FTO as is
- Lower 75% TP reduction requirement
- Other options

Framing Flexible Treatment Options: Antidegradation
Definition of "Prudent" Alternatives*

"Prudent" (in context of antidegradation alternatives analysis):

- Selected with care and sound judgment
- Does not have unusual or extraordinary economic, social, or environmental costs

* Based on MPCA's Draft Antidegradation Rule (5/25/11)

Framing Flexible Treatment Options: Antidegradation
Definition of "Feasible" Alternatives*

"Feasible" (in context of antidegradation alternatives analysis):

- Capable of being done with existing technology;
- In accordance with acceptable engineering standards;
- Consistent with reasonable public health, safety, and welfare requirements;
- Legally possible; and
- Has supportive governance that can be successfully put into practice to accomplish the task.

* Based on MPCA's Draft Antidegradation Rule (5/25/11)