Local Flooding

Drainage Problems?

Stormwater Management?

We built the shopping center, the highway, the subdivision etc.


Shell

The rain comes down

This is the result

Damage to Downstream Properties

What is the Answer?

In 1984 Stormwater Management (SWM) Laws are Adopted

- Development may not cause any increase in the 10% chance (10 year) storm peak runoff rate
- Implemented through runoff storage (ponds)

Through 2006 SWM designs have been constantly monitored, modified and improved by MDE, the delegated Local Governments and private consultants.

2006 New Subdivision with SWM Correctly Designed and Implemented

The Results

Sometimes Even Today

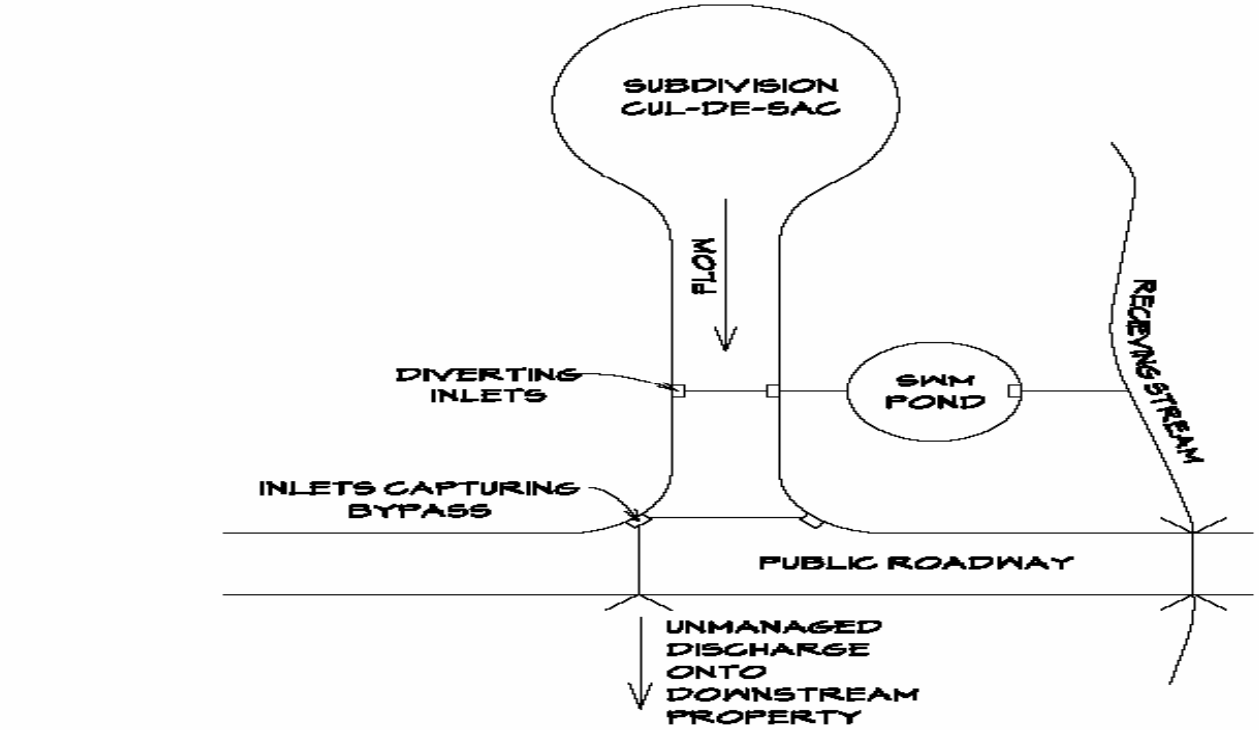
Why??

Stormwater Management
vs
Stormwater Drain Design Standards

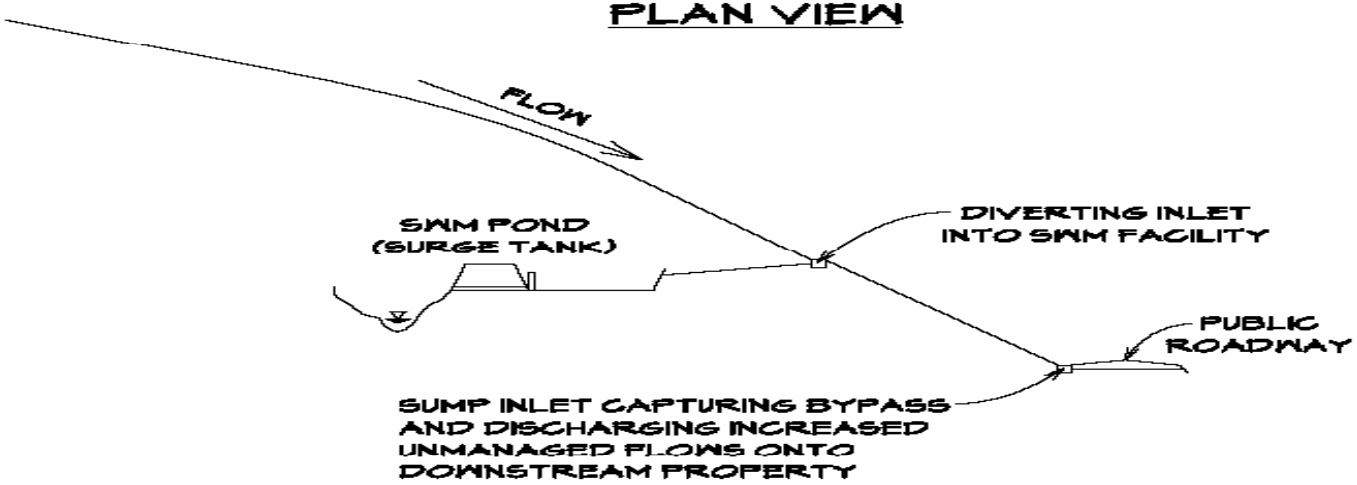
(Why Do Downstream Properties

Continue to be Flooded?)

Subdivision and Roadway Layout



PLAN VIEW



PROFILE VIEW

FIGURE 2: SCHEMATIC
NTS

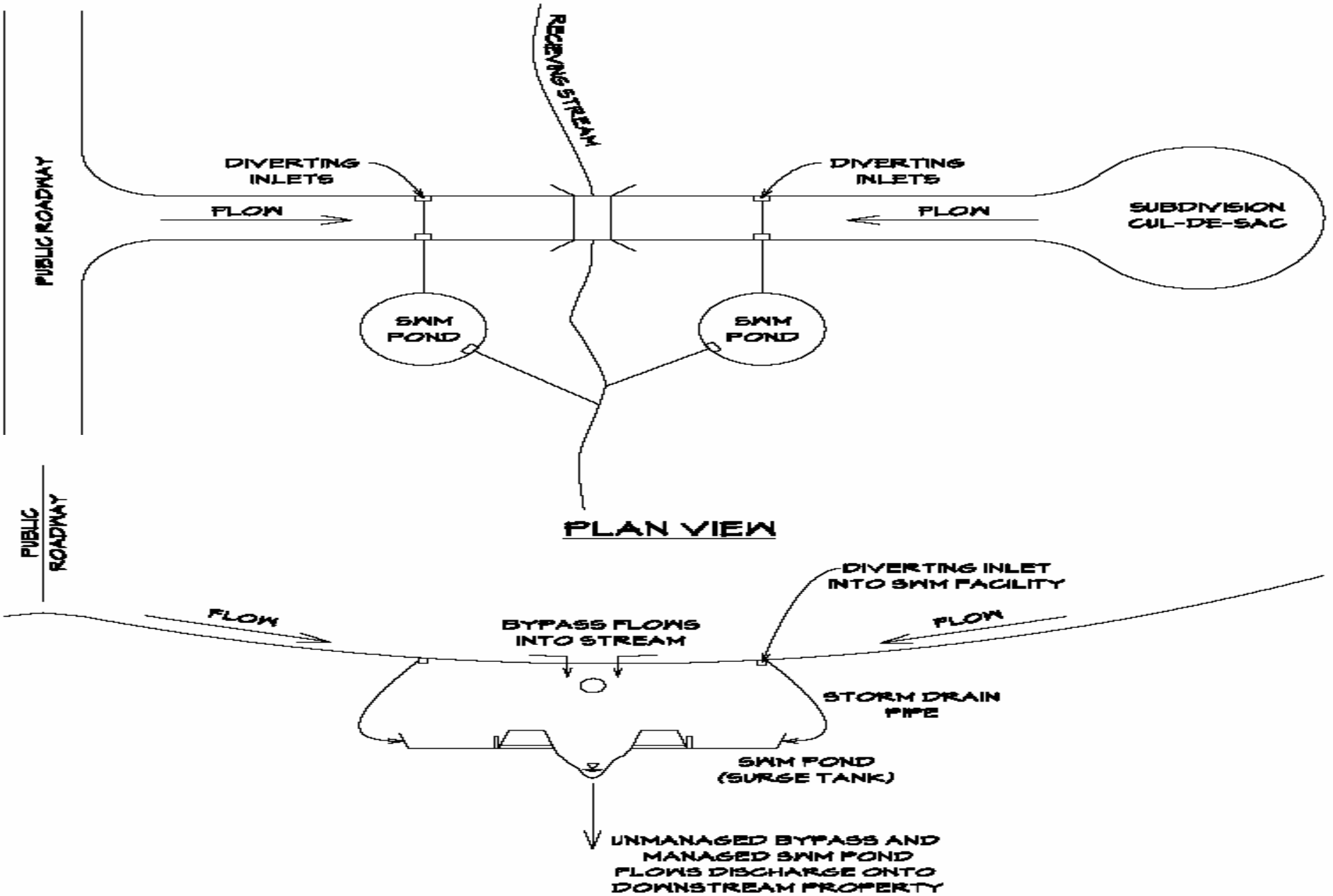


FIGURE 3: SCHEMATIC
NTS

The Problem

To achieve SWM, adequate property designed stormwater conveyance systems are critical.

If the storm drain system is unable to completely capture the stormwater management design flow, the peak flows will not be managed no matter how the stormwater management ponds are designed and constructed.

Quote of the Day

“Engineers have always designed storm drains this way. If you tell anyone about this you’ll never work in Consulting Engineering again”…2005

Standard SWM Designs

SCS Method TR-55 (hand),

TR-20 (computer)

Standard professional practices in the United States is to determine the highest runoff rates from a development site prior to development and match or reduce these peaks after development.

All jurisdictions in Maryland, and most nationwide, establish recurrence interval storms that must be managed, typically 50%and/or 10% and/or 1% annual exceedence probabilities.

These are commonly referred to as 2,10, and 100-year storms. Likewise, the methodology used to determine these peaks is established by regulation.

All jurisdictions in Maryland and throughout most of the nation mandate the use of the Natural Resource Conservation Service (SCS), TR-55 "Urban Hydrology for Small Watersheds".

“The curve number (TR-55) method owes its popularity among hydrology practitioners to its simplicity, predictability and stability, and to its support by a major United States federal agency.

Standard Storm Drain Designs

Rational Method

Maryland’s criteria, which are typical of many State Highway Administrations, require that “All storm drain systems shall be designed using the Rational Method”.

Carroll County's Design Manual for Roads and Storm Drains, states that "Criteria for the design of storm drain systems in Carroll County shall be, that of the Maryland Department of Transportation, State Highway Administration."

And that:

- 2-year Inlet Design shall be used
- Inlets on grade shall be spaced to pick up at least 85% of the total gutter flow.

Notice the Problem

SWM is designed for 100% of the peak of the 100 year storm

Storm drain inlets are designed for 85% of the peak of the of the 2 year storm

If water can not go into the inlets how can it reach the pond?

TABLE 1
Rational vs. TR-55 Methodology for "B" Hydrologic Soil Groups

Standard Lot Sizes, 6% Grade, tc = 5 min., I_2 = 5.38 in/hr., I_{10} = 7.0 in/hr.

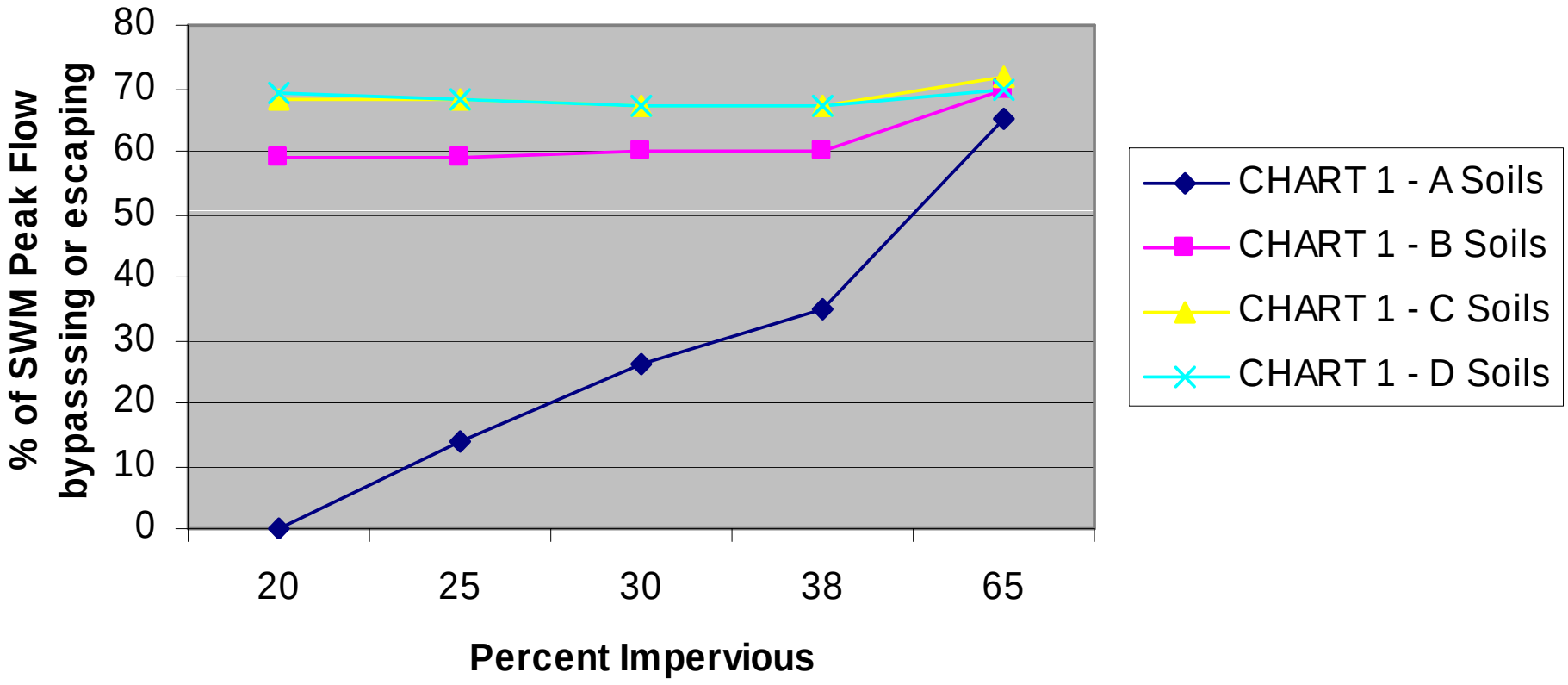
1/8 Ac. Lots	1/4	1/3	1/2	1
C = .35	.33	.30	.28	.26

Q Rational - 1 Acre DA

1/8 Ac. Lots	1/4	1/3	1/2	1
Q_2 (cfs) 1.88	1.78	1.61	1.51	1.40
Q_{10} (cfs) 2.45	2.31	2.10	1.96	1.82

Lot Size (ac)	85% Q_2 Rational (cfs)	Q_{10} SCS (cfs)	Diff (cfs)	% of SWM Peak Flow Bypassing/ escaping
1/8	1.60	5.32	3.72	70
1/4	1.51	3.82	2.31	60
1/3	1.37	3.40	2.03	60
1/2	1.28	3.13	1.85	59
1	1.19	2.87	1.68	59

10 Year SCS vs 2 Year Rational



The Result

Designing SWM using MDE & Local criteria and Storm Drains using SHA & Local Department of Public Works (DPW) criteria at least 60% of the peak flow will bypass the pond when development occurs in B,C, & D soils.

Does This Really Happen?


'99 1 3

THE RESULTS

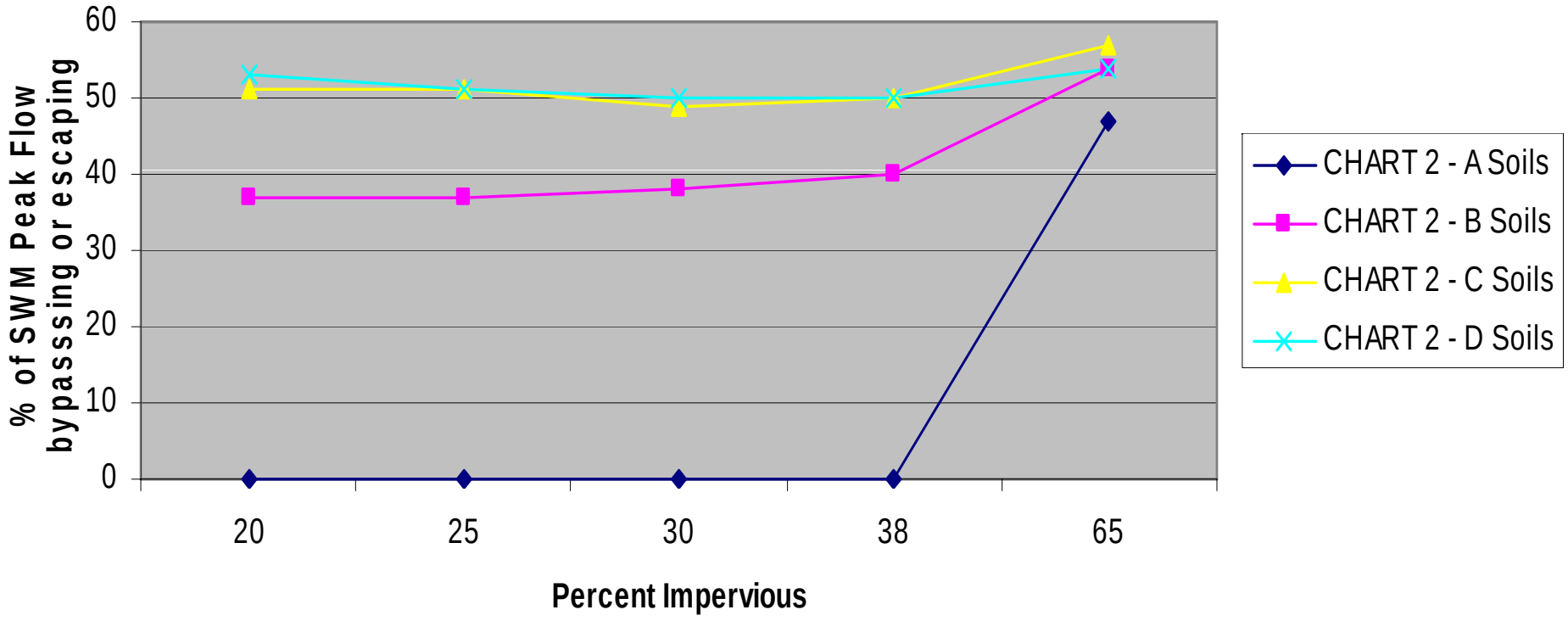
Stormwater Management Pond Only ¼ Full

(SWM not a problem)

Downstream Property Flooded

What if we require storm drains to capture 100% of the 10 year rational method discharge?

10 Year SCS vs 10 Year Rational



The Result

Now only 38% of the peak flow will bypass on developed “B” soils with 50% bypassing on developed C & D soils.

Conclusion 1

The main purposes of SWM laws are to protect public health and safety and down stream properties from flooding

Conclusion 2

The P.E. or P.L.S. certifying the plans is responsible to achieve specified levels of SWM regardless of SHA or DPW storm drain criteria

Question for Professional Engineers and Professional Land Surveyors

- How much liability is created if you sign the plans and the downstream property is damaged because runoff cannot get to the SWM facility?
- You certified that it met the legal requirements when it could not!

Recommendations

SHA and DPW criteria should be revised to require 150% capture of the Rational Method 10 year storm runoff capturing all bypass flows from upstream inlets at all drainage area divides.

Recommendation 3

A copy of the revised Carroll County DPW storm drain design criteria has been distributed for your use.