

# Street Cleaning and Catch Basins as Floatables BMPs?

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# USEPA Nine Minimum Controls

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1. Proper O&M for sewers and CSO outfalls
2. Maximize use of collection system for storage
3. Update pretreatment requirements to minimize CSO impacts
4. Maximize flow to POTW
5. Eliminate dry weather overflows
6. Control solids and floatables in CSOs  
(catch basins, booms, nets, screens, skimmer boats)
7. Pollution prevention to reduce contaminants in CSOs  
(street cleaning, public education, waste collection practices, recycling, product bans)
8. Public notification
9. Monitoring to characterize CSO impacts

# The Advantages of Street Cleaning and Catch Basins As Floatables BMPs

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- Provide a Means of Source Control
- Simple/Low-Tech
- Maintenance Programs, Personnel and Equipment are Already in Place
- Can be Implemented Quickly
- Resources Can be Scaled Up/Down or Redirected

## *The Message:*

*Maximize the use of existing equipment and practices before building, operating and maintaining new facilities and practices.*

# NYC Street Sweeping

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# New York City's Street Cleaning Practice

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- ~12,000 curb miles city-wide
- ~500 DOS street cleaning employees use mechanical sweepers to clean ~50% of the City's streets.
- Cleaning frequency varies. Maximum is 3x per week.  
(10% @ 3x/wk, 20% @ 2x/wk, 20% @ 1x/wk and 50% @ 0x/wk)
- ASP regulations are enforced.
- Some commercial districts augment the City's street cleaning with daily manual sweeping 5 to 7 days per week (Business Improvement Districts)
- Mayor's office has been "monitoring" street cleanliness since 1973. Scorecard Litter Rating (SLR). Range is 1 to 3 with five intermediate scores. A score of 1.5 is considered "acceptably clean." Cleanest streets are in low density residential areas.

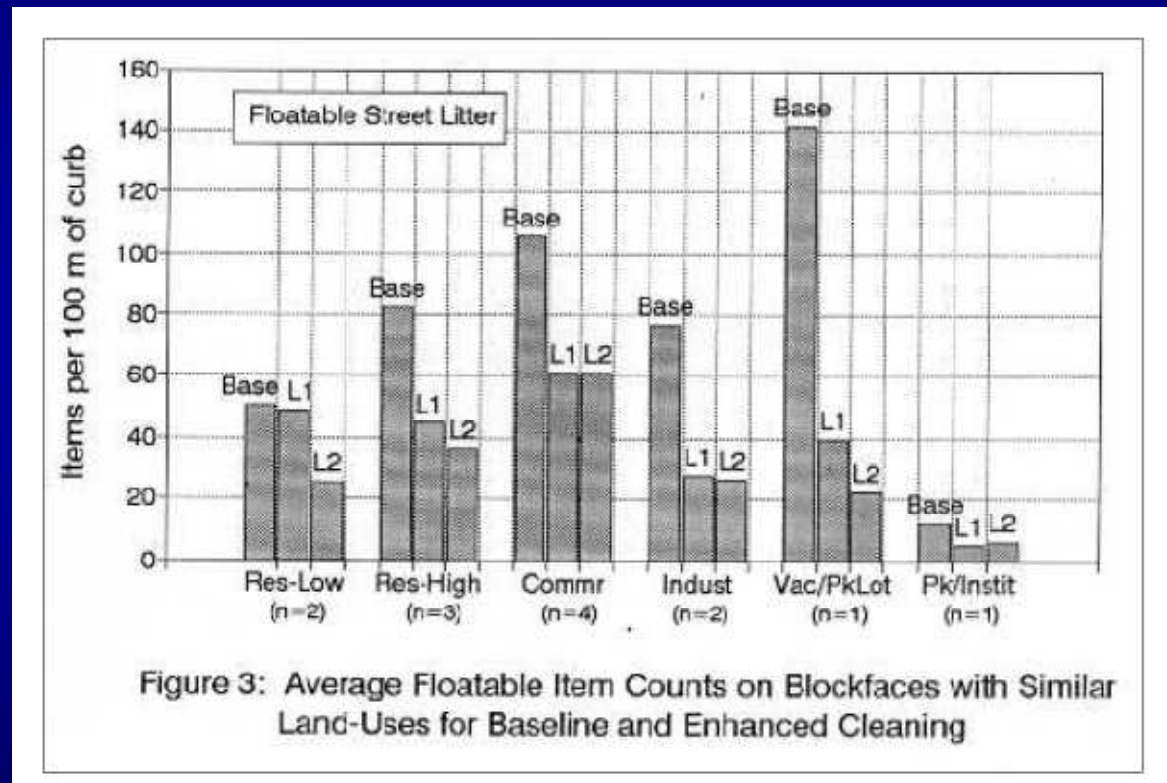
# NYC Street Cleaning Study

TABLE 1. NYCDOS CLEANING PRACTICES IN PILOT STUDY AREA

Cleaning Level	Implementated Time Period	Mechanical Sweeps per Week	Manual Sweeps per Week	Total Sweeps Per Week
Baseline	June-August 1994	2	0	2
Level 1	May, July 1993	2	4	6
Level 2	June, August 1993	2	10	12

- Field teams sampled street litter after the Mayor's office scored each blockface.
- >450 blockfaces were monitored and sampled.
- Primary blockface selection criteria were historic SLR and land use category.

# The Effect of Street Cleaning Effort Across Different Land Use Categories



The impact of enhanced street cleaning is greatest in high density residential, commercial, industrial, vacant lots and parking lot areas.

# Street Cleaning Costs

TABLE 8. COST ESTIMATE OF STREET CLEANING

Cleaning Description	Annual Cost Estimate <sup>(a)</sup> (\$/curb-km)
NYCDOS mechanical sweeping <sup>(b)</sup>	2,000 (3,200 \$/curb-mi)
NYCDOS Level 1 sweeping	5,800 (9,300 \$/curb-mi)
NYCDOS Level 2 sweeping	14,000 (22,500 \$/curb-mi)
BID sanitation services	62,000 (100,000 \$/curb-mi)

# The Cost of Enhanced Street Cleaning

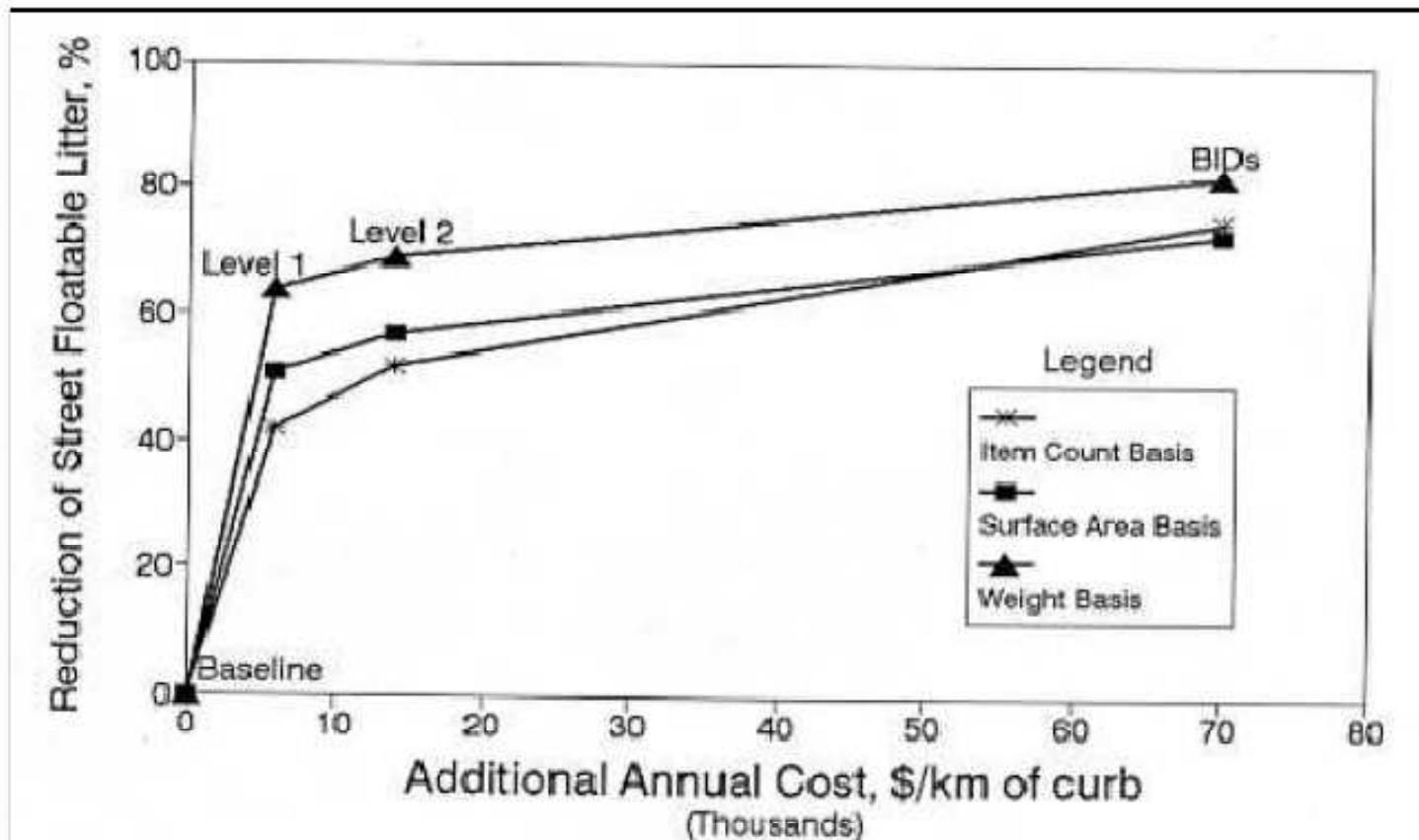


Figure 4: Incremental Benefits and Costs of Manual Sweeping with respect to Baseline Conditions

# CATCH BASINS

Beijing, China  
Forbidden City



Kiev, Ukraine



Paris, France



Prague, Czech Republic

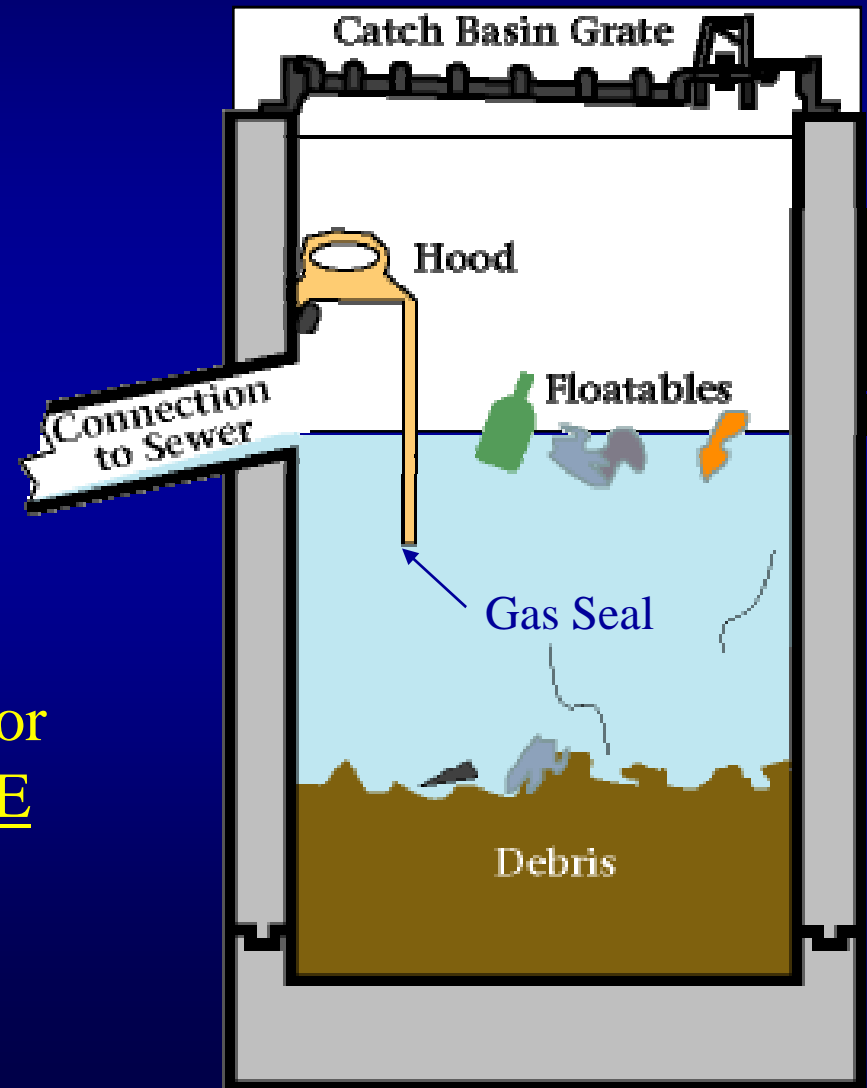


# Catch Basins Are Traditionally For Street Drainage



# How Do Catch Basins Function as a BMP

- Hoods are standard elements of catch basins in most urban areas served by combined sewers.
- Original function was to control odors
- Hoods retain floatables
- Sumps capture settleable solids
- Periodic maintenance is needed for catch basins to be an EFFECTIVE BMP

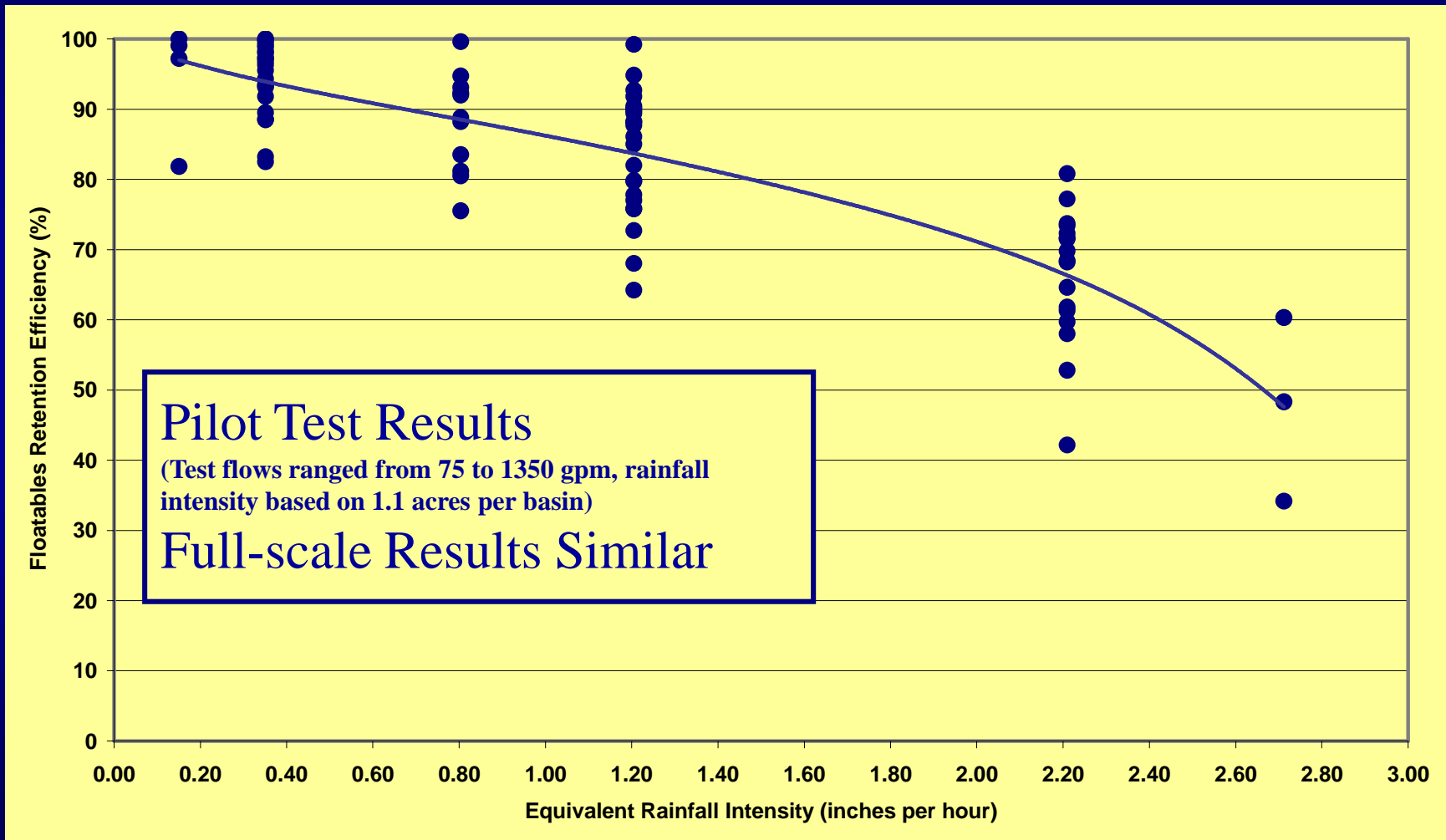


# Hoods Really Do Retain Floatables

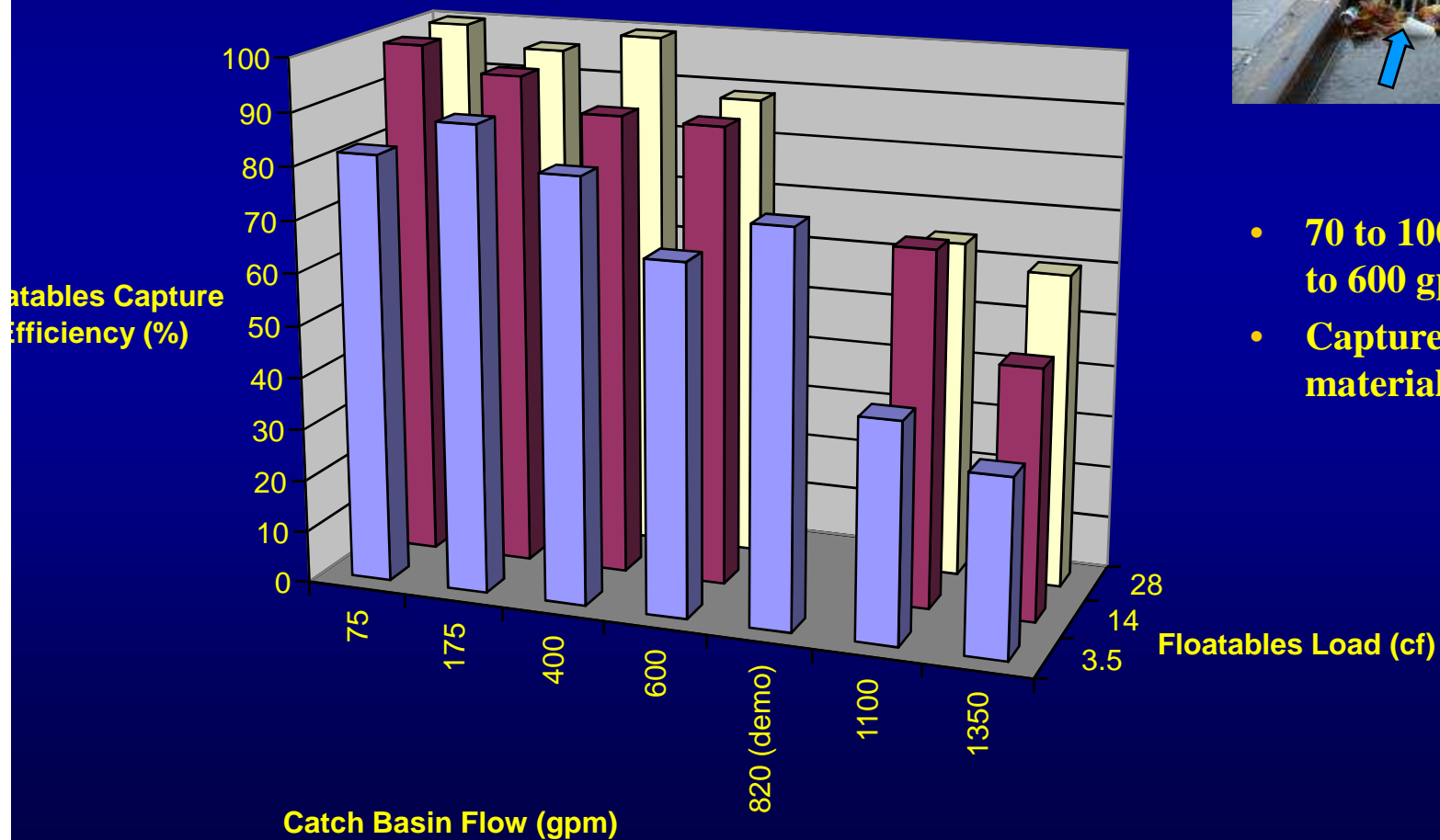
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# Floatables Retention

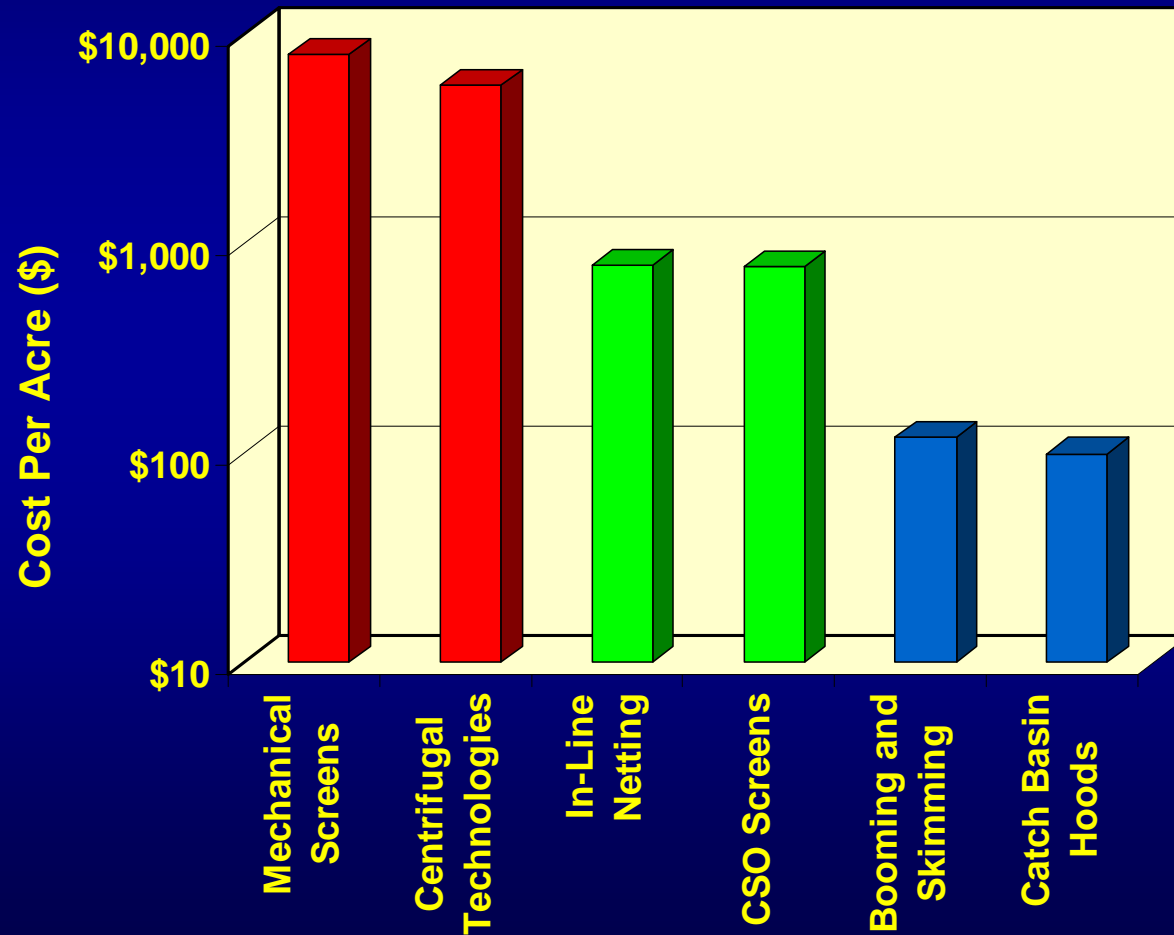


# 90° Outlet Orientation



- 70 to 100% capture up to 600 gpm (~1.3 in/hr)
- Capture increases as material accumulates

# The Capital Cost Of Floatables BMPs



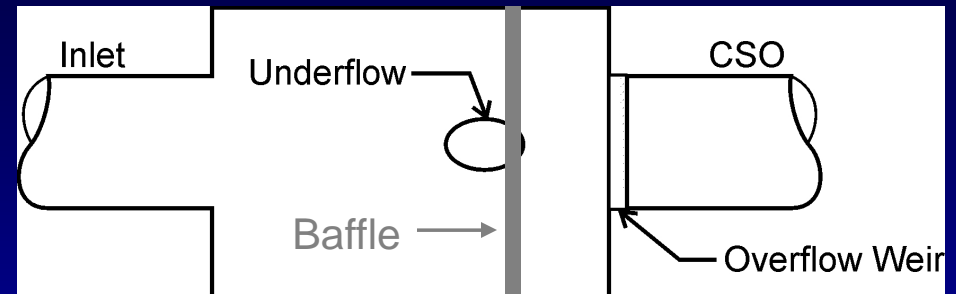
# Conclusions

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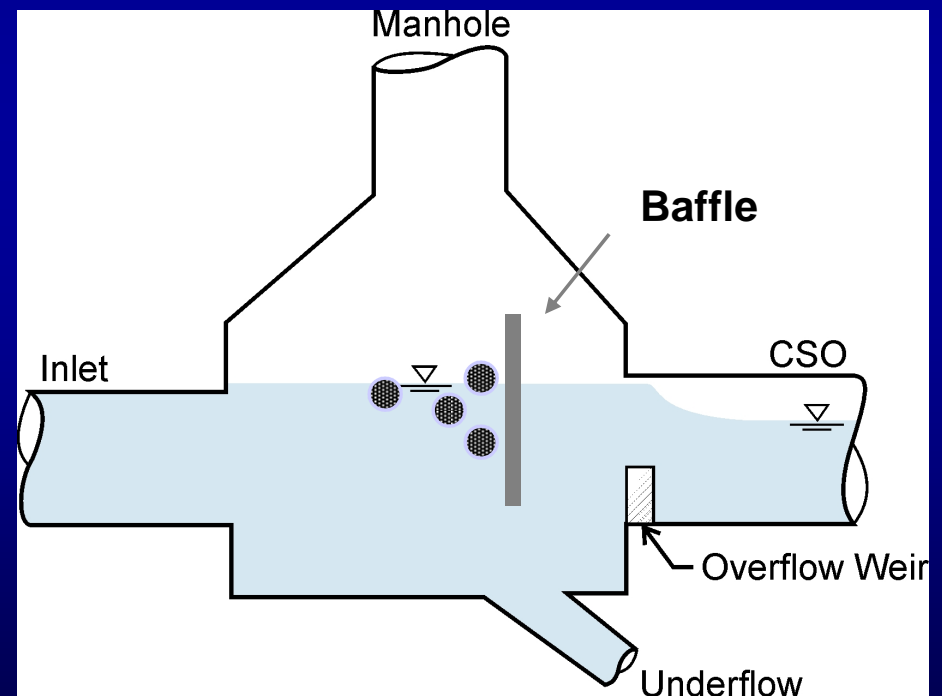
- Catch basin hoods can capture and retain >80% of street litter based floatables
- Capture starts to deteriorate between 600 and 1100 gpm (rainfall intensity equivalent of 1.3 to 2.7 in/hr).
- Capture improves as material accumulates in the basin, therefore, hoods don't increase the need for cleaning.
- Grit doesn't have a significant effect on capture except to entrap some floatables
- Catch basin hoods are cost effective controls

# Baffles

- Retrofit into existing regulators or new chambers
- Baffle intercepts and retains floatables as water surface elevation increases during wet weather.
- Design details important to performance:
  - turbulence of flow in chamber,
  - flow velocity,
  - chamber dimensions,
  - open flow area under and behind baffle,
  - elevation of bottom of baffle relative to chamber invert and overflow weir crest.



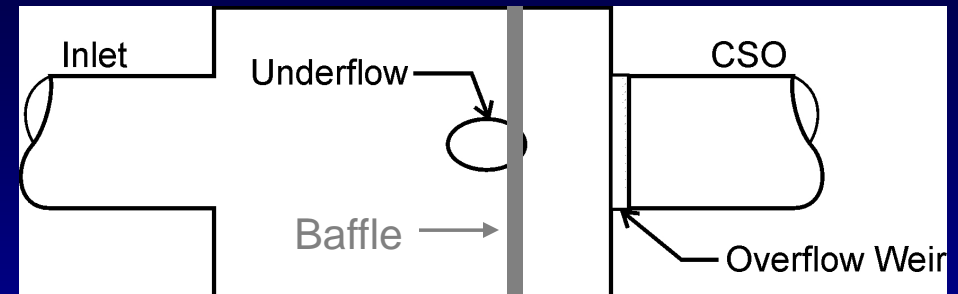
Plan View



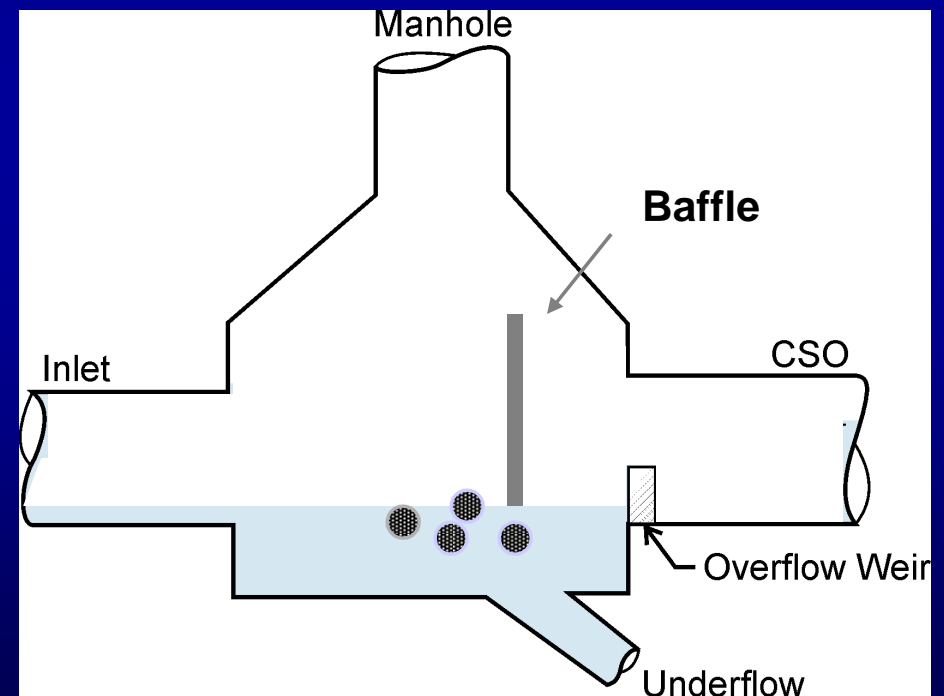
Section View

# Baffles

Floatables are retained by the baffle until the water surface elevation drops below the invert of the overflow weir and the bottom elevation of the baffle.



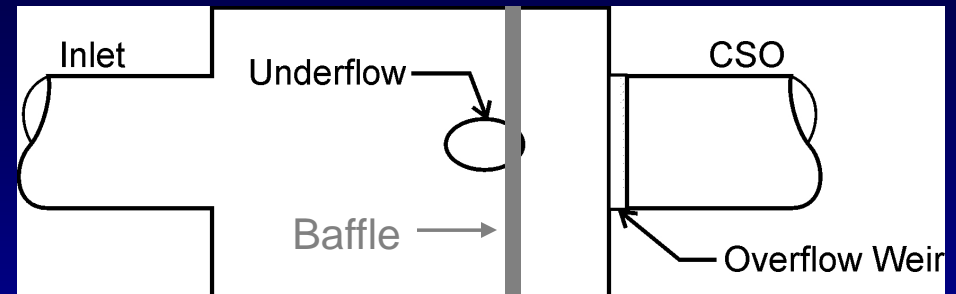
Plan View



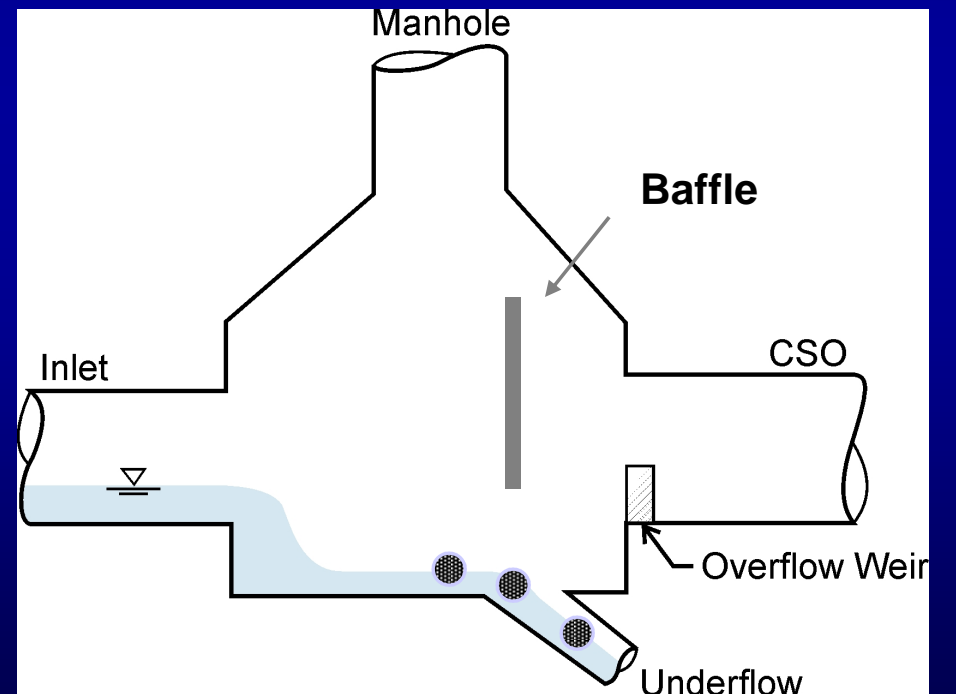
Section View

# Baffles

Floatables discharge through underflow outlet when water surface elevation drops to dry weather condition.



Plan View



Section View



# QUESTIONS AND DISCUSSION

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# The Effect of Street Cleaning Effort on Street Cleanliness

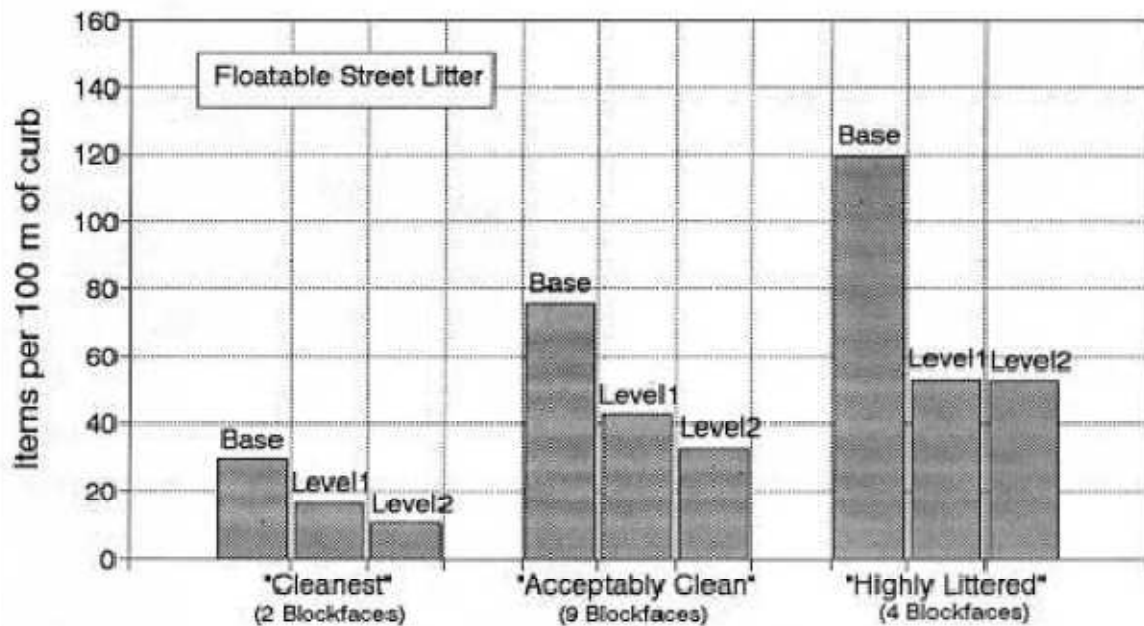


Figure 2: Average Floatable Item Counts on Blockfaces with Similar Baseline Cleanliness for Baseline and Enhanced Cleaning

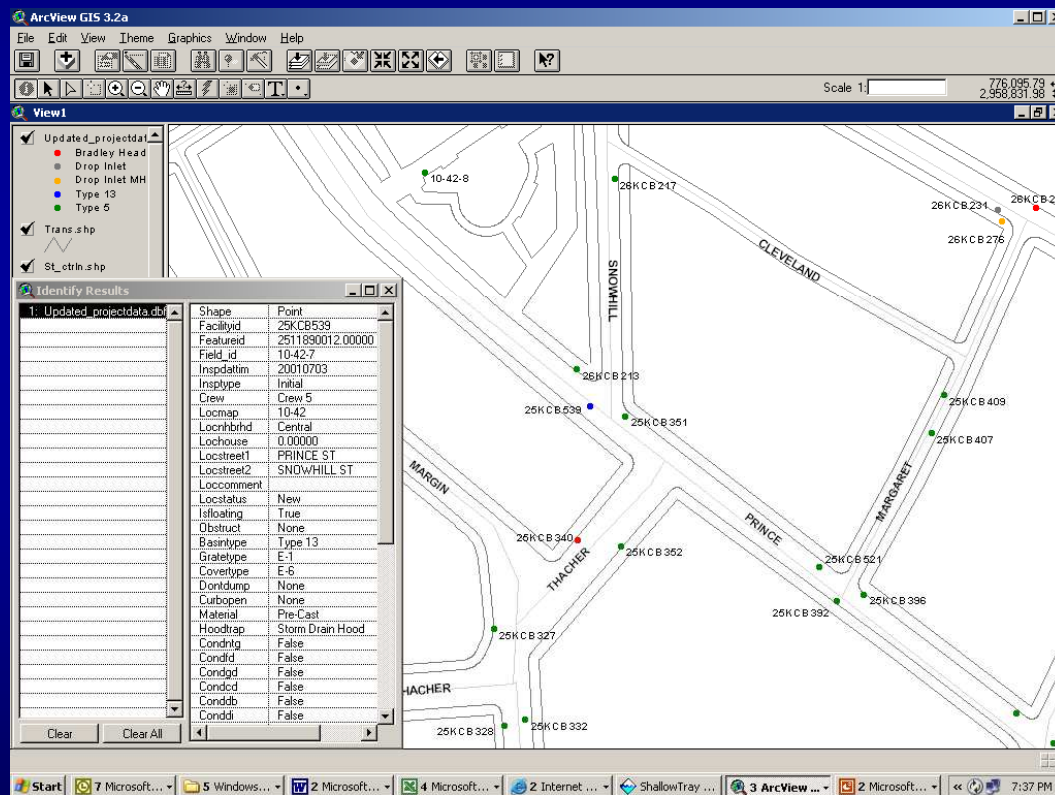
Increased street cleaning is beneficial but there is a diminishing return.

# Elements of an Effective Catch Basin Preventative Maintenance Program

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- Catch Basin GIS (where are they and what condition are they in?)
- Characterize Grit and Floatables Accumulation Rates (grit accumulates at 0.5 to 1 ft per year, floatables accumulation is lower)
- Develop and Implement a Preventative Maintenance Plan (needs based maintenance rather than geographic or complaint based)
- Periodic Inspections Will Optimize the PM Program
- Integrate into Asset Management Programs

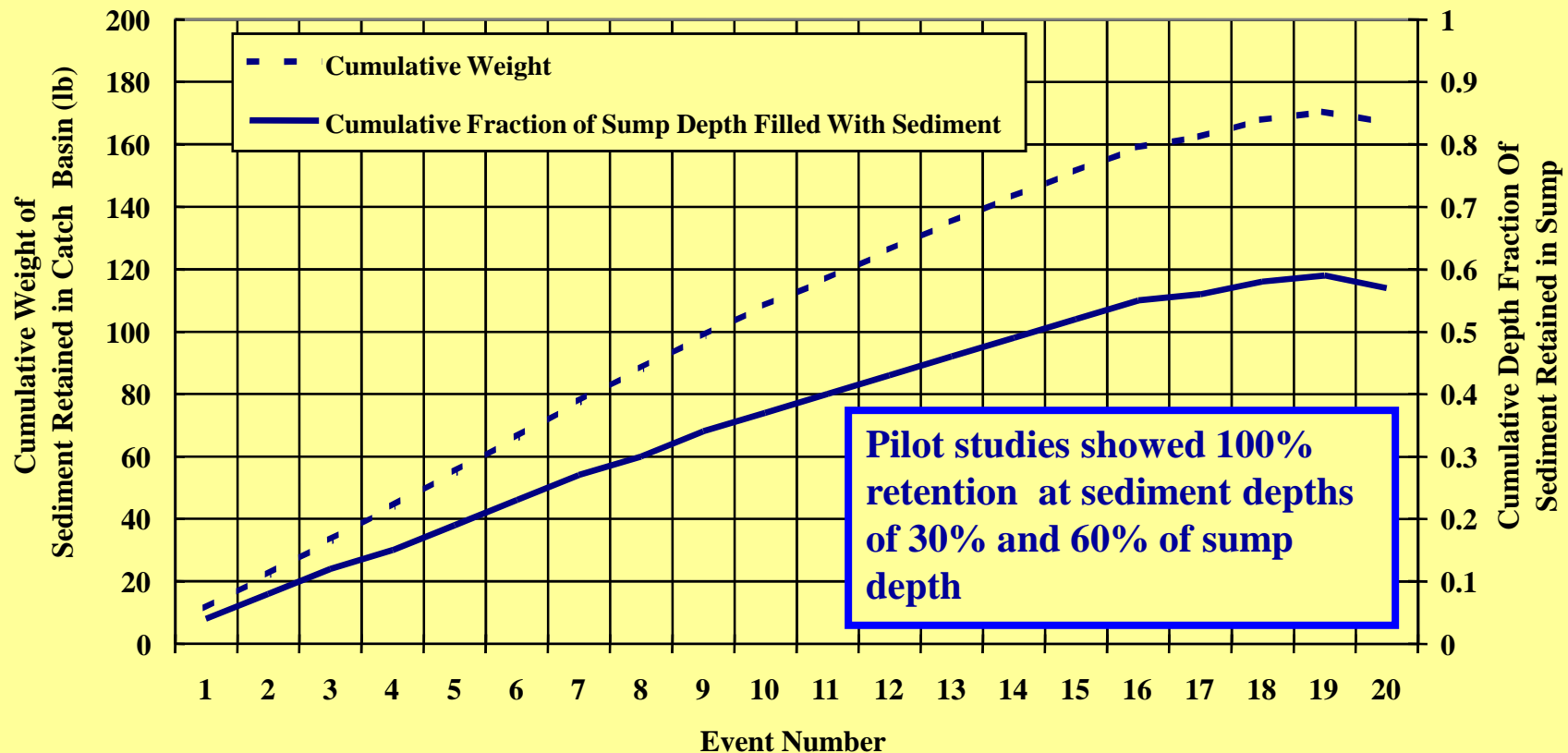
# Catch Basin BMP Implemented Through GIS



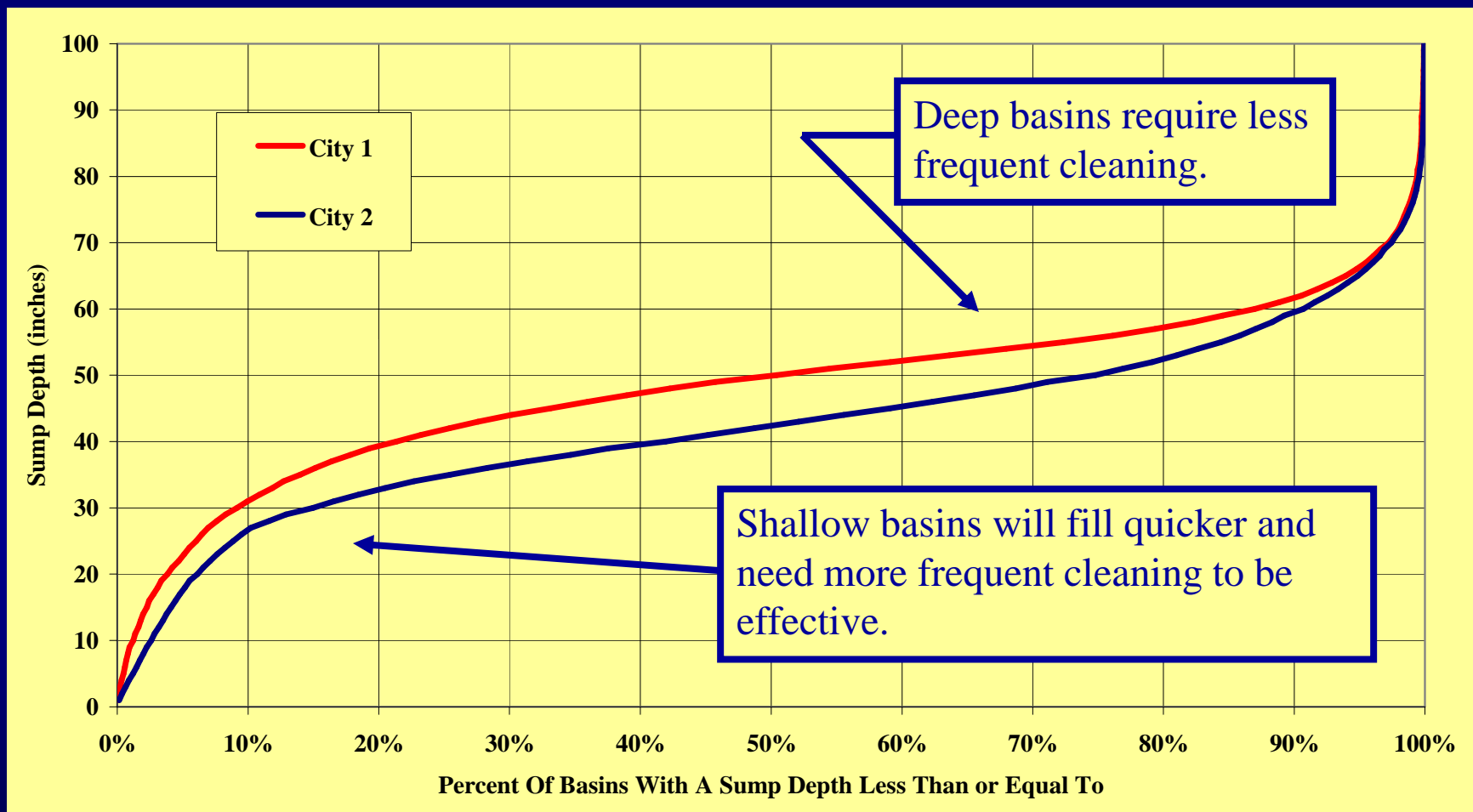
- Accurate Base Map
- Map Catch Basin Locations
- Add Attribute Data
- Dimensions (Sump Depth and Volume)
- Condition Assessment
- Log Maintenance and Repair Activities
- Develop a Needs Based Maintenance Program

# Settleable Solids Retention

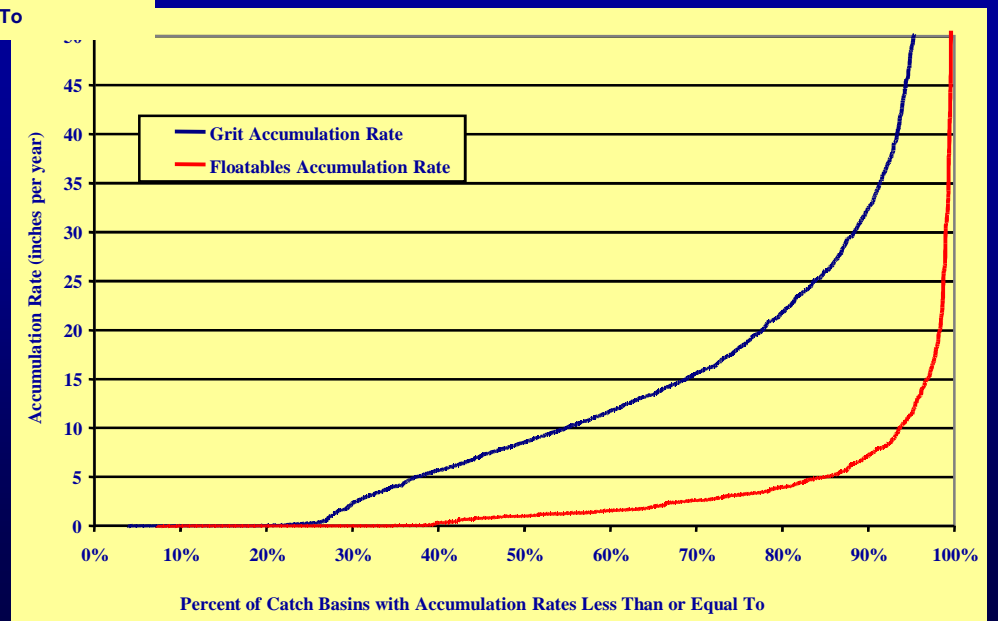
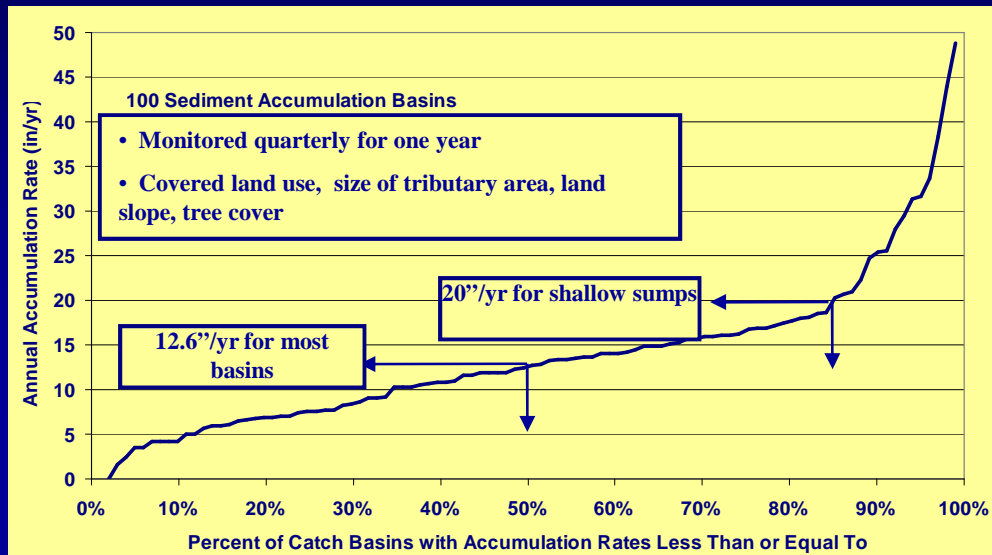
Sediment Accumulation For A Catch Basin With A Diameter and Sump Depth Equal to or Greater Than 4 Times the Outlet Diameter  
(Equivalent to a catch basin with a 4' diameter, 4' sump depth and 12" outlet)  
(from EPA 600/2-77-051)



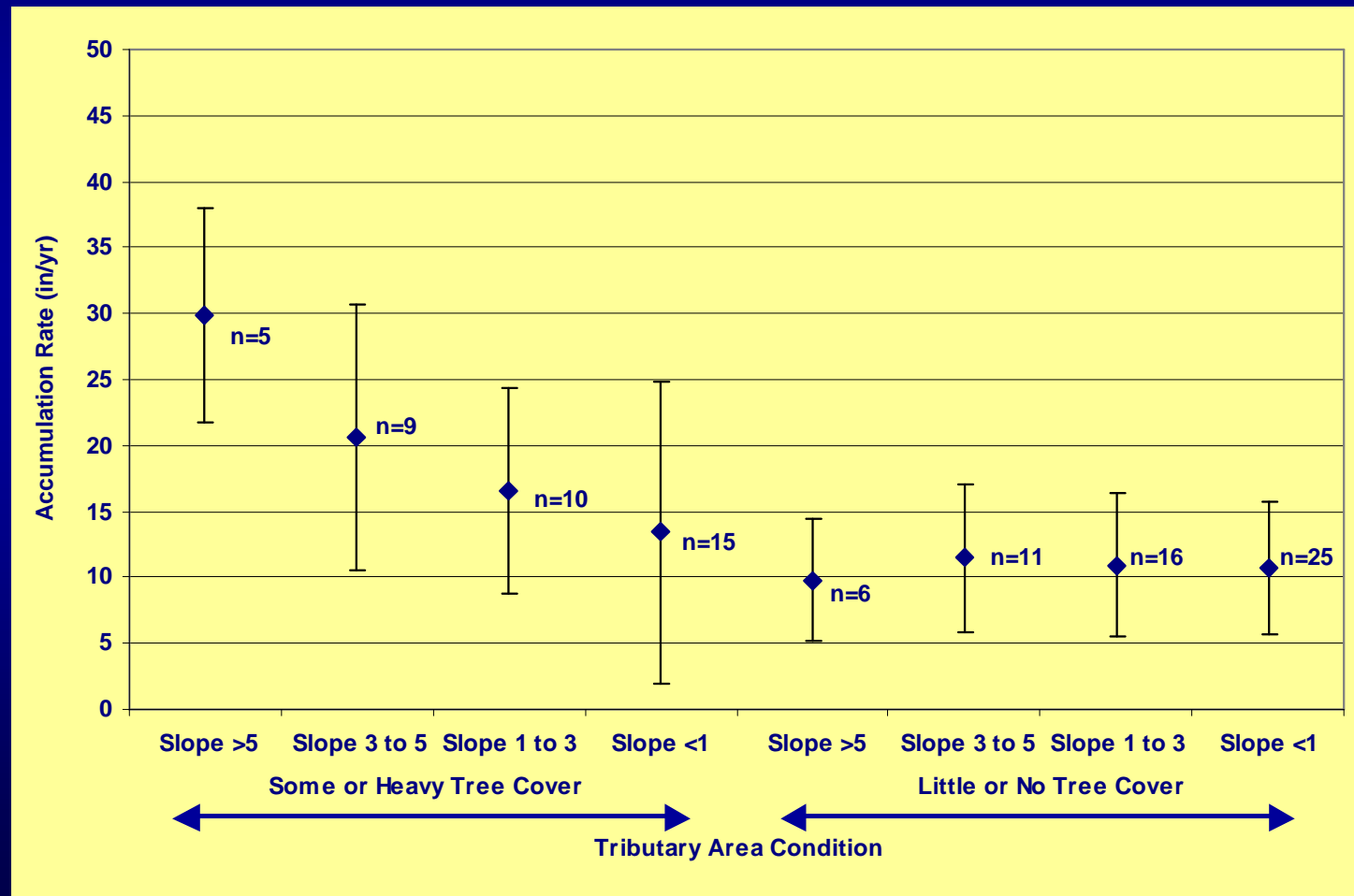
# Distribution of Catch Basin Sump Depths



# Grit Accumulation Rates



# Grit Accumulation Rate Correlations



# Periodic Inspections

- Identify repairs needs and structural failures
- Inventories new basins
- Refines cleaning requirements



# Comparison of Preventative Maintenance Program to Typical Programs

Sump Depth	No. CB's	Sump Capacity (inches)	Accum Rate (in/yr)	Cycle (yr)	No. CB's per Year	Annual Grit Volume					Max Grit Load (cy)
						PM Program (cy)	Annual Program (cy)	2-Year Program (cy)	3-Year Program (cy)	4-Year Program (cy)	
< 12	310	6.6	-	0.330	939	144	67	34	22	17	144
12 to 35	2860	10.56	20	0.528	5417	1331	1129	621	414	311	1331
36 to 47	7714	19.0	20	0.949	8131	3590	3046	2932	1954	1466	3590
48 to 59	10603	24.9	12.6	1.973	5374	4935	4187	4187	3454	2590	4935
> 59	3598	31.9	12.6	2.532	1421	1675	1421	1421	1281	960	1675
<b>Number of Annual Cleanings</b>					<b>21282</b>						
<b>Total Annual Grit Volume</b>						<b>11675</b>	<b>9850</b>	<b>9194</b>	<b>7125</b>	<b>5344</b>	<b>11675</b>
<b>Annual Grit Yield</b>						<b>0.55</b>	<b>0.46</b>	<b>0.86</b>	<b>1.00</b>	<b>1.00</b>	

- Small communities inspect annually and clean when basins become 1/3 to 1/2 full.
- Large municipalities clean on a 2 to 5 year schedule
- To be an effective BMP, basins should be cleaned based on their sump depth and observed grit accumulation rates

# Catch Basins Can Be An Effective BMP

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- Build a Catch Basin GIS
- Characterize Basins and Grit Accumulation Rates
- Develop and Implement an Needs-based Program
- Conduct Periodic Inspections to Optimize the Program