

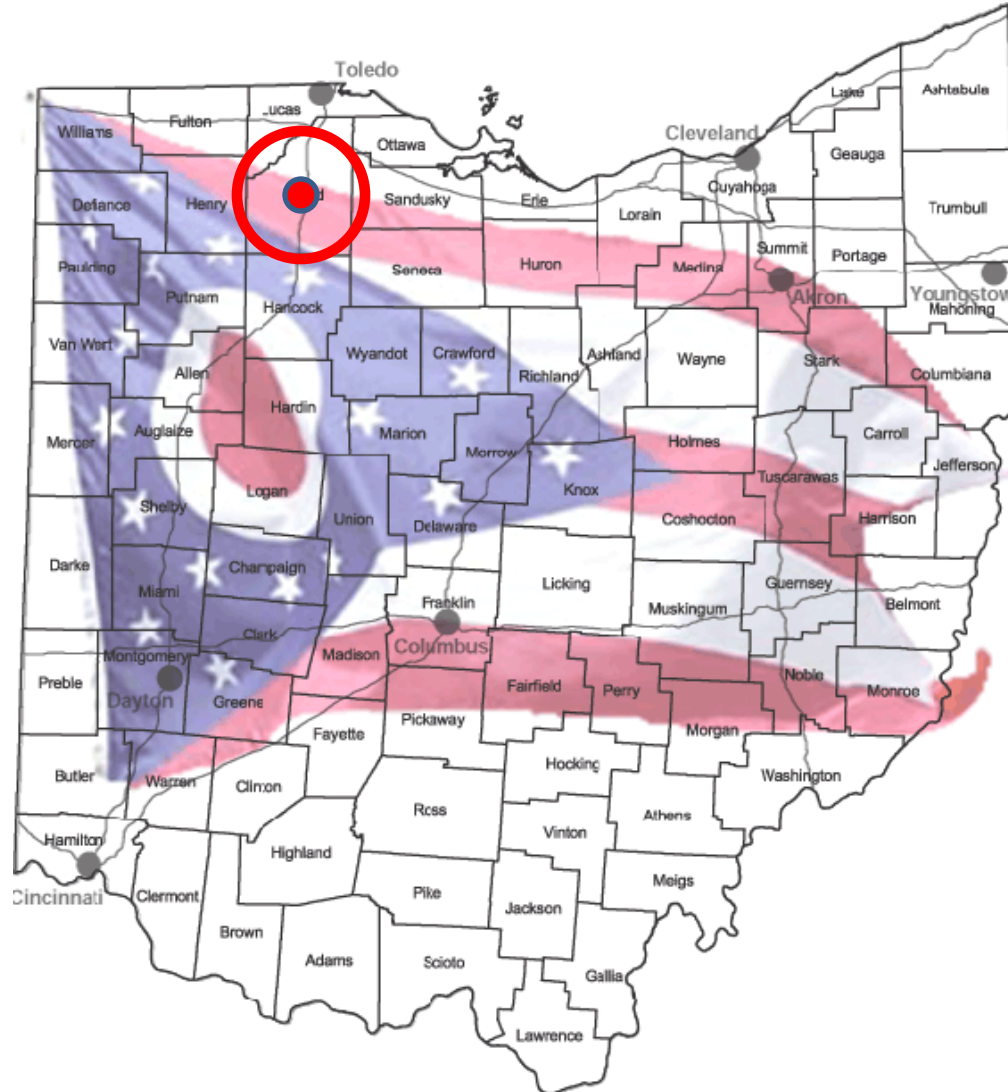
Establishing a Benchmark for CSO Mitigation at City of Bowling Green, Ohio



Douglas Clark, City of Bowling Green
C. Gibson Chen, Avetin Engineering

June 22, 2011

City of Bowling Green, Ohio

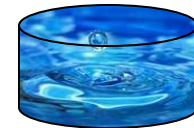


Water Pollution Control Facility Improvement Timeline

**1982 to
Nov 2007**

Bowling Green WPCF typical operation

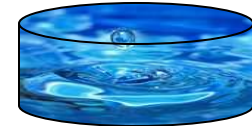
- 16 MGD maximum flow



**December
2007**

Modified WPCF standard operating procedures

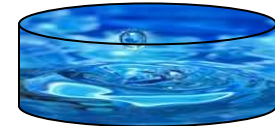
- Increased WPCF peak capacity from 16 to 21 MGD



**May
2009**

Replaced original sand filters with Aqua-Aerobics cloth media disk-type filters

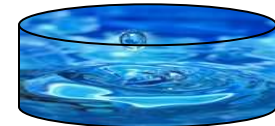
- Increased WPCF filtration capacity from 12 MGD to 30+ MGD



**May
2009**

Replaced 24-inch in-pipe influent meter with a 30-inch Doppler meter

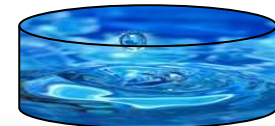
- Increased WPCF peak capacity from 21 to 23 MGD



**April
2010**

Installed new ultraviolet (UV) disinfection system

- Increased WPCF disinfection capacity from 14 MGD to 30+ MGD



**(2011-
2012)**

Upgrade Poe Road pumping station

- Replacing the station's four existing pumps to 10 MGD each
- Increasing the firm transfer capacity from 20 MGD to 30 MGD



**(2011-
2012)**

Install a third WPCF screw pump

- Ensuring all flow can be conveyed to the filtration and disinfection processes even with one screw pump out of service



WPCF Operating Procedures

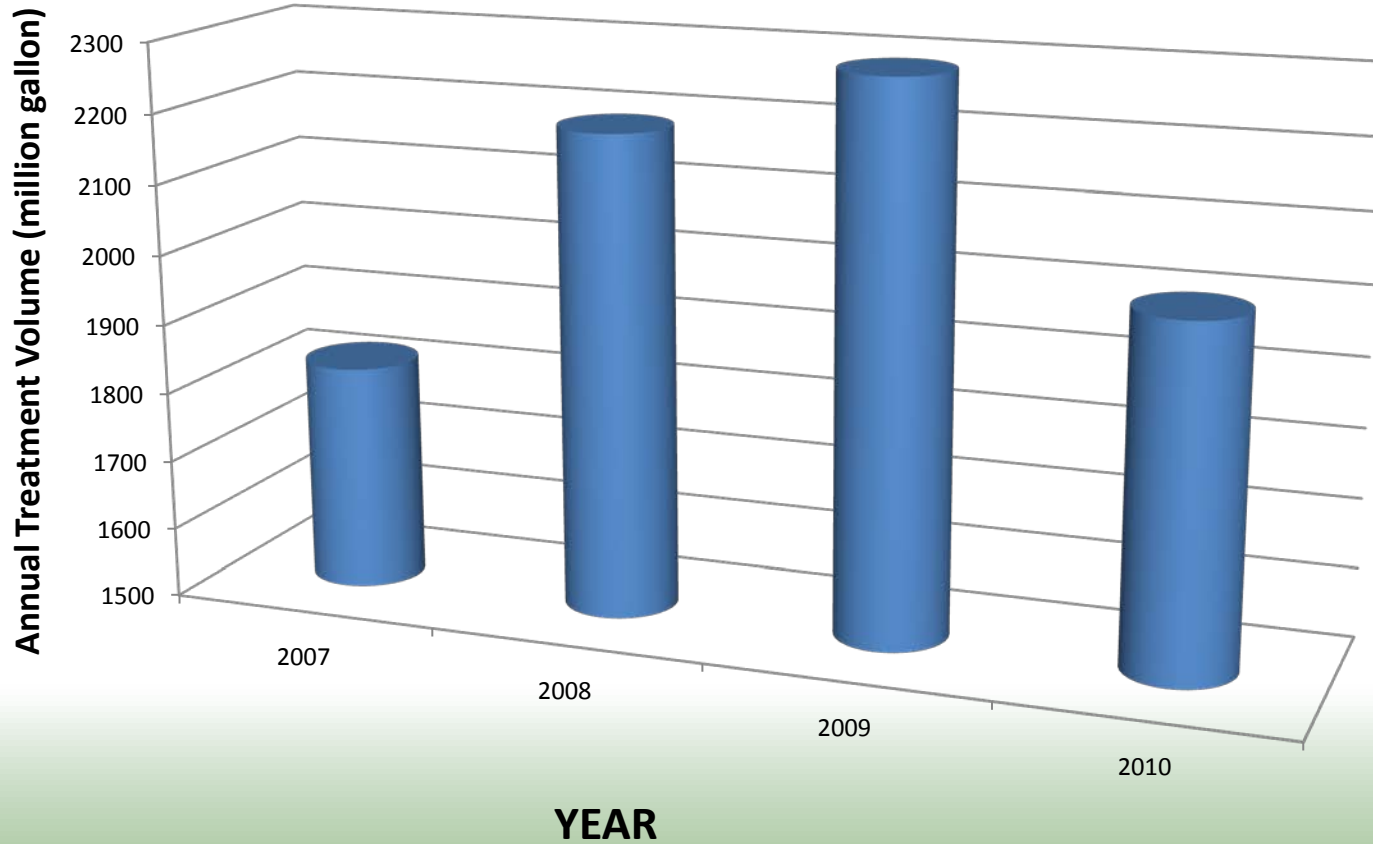
1982 to November 2007

- Overflow occurred
- Increased treatment flow rate

December 2007 to Present

- Increases treatment flow rate as soon as rain event occurs
- Maximizes storage and treatment capacity
- Overflow occurs if the rain event is significant

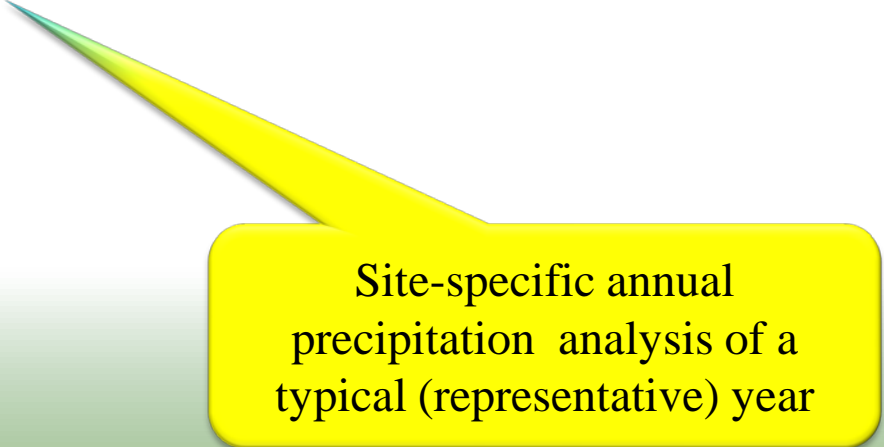
Increasing Treatment Volume



CSO Control Policy

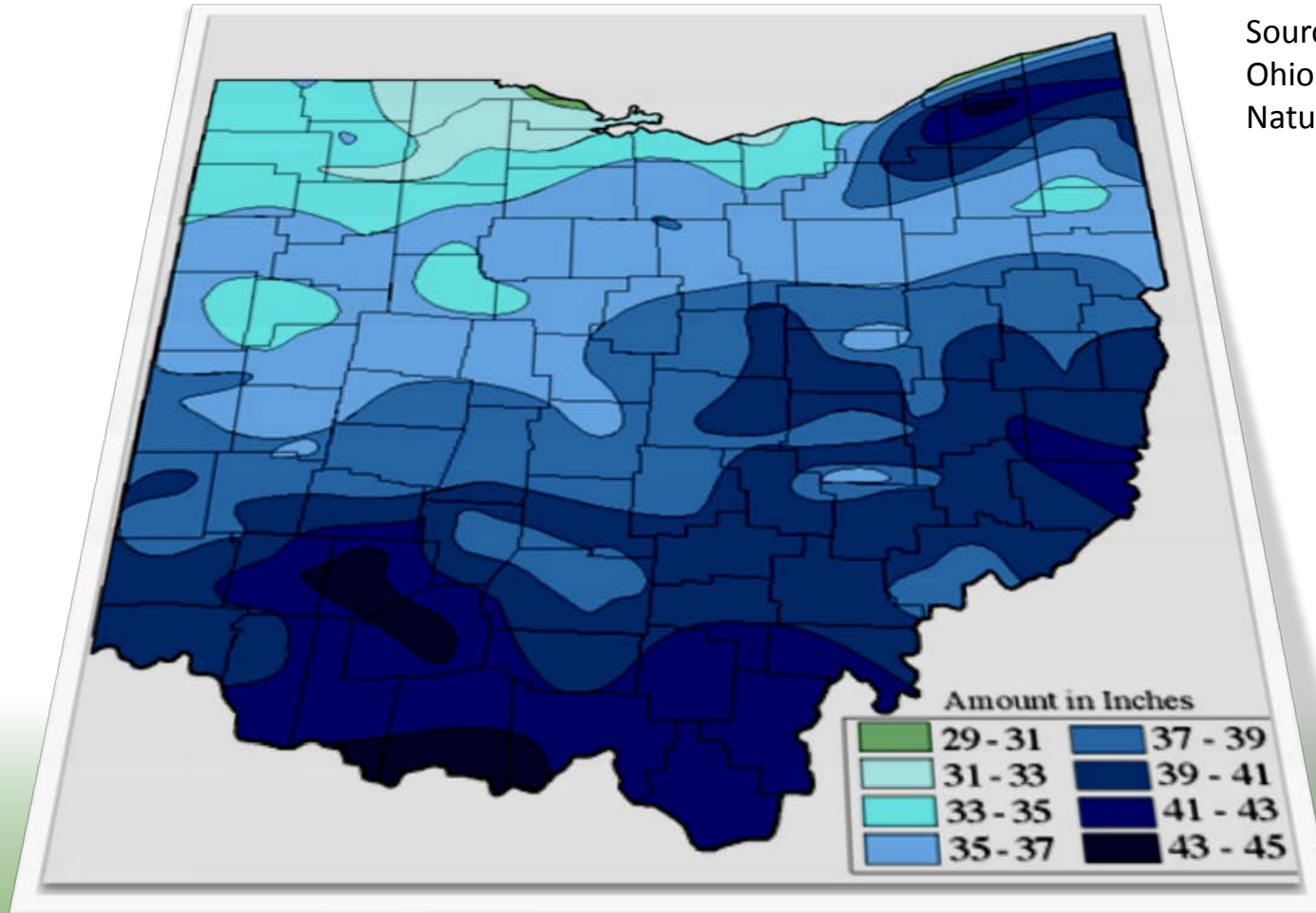
The U.S. EPA's CSO Control Policy Mitigation Requirement:

- No more than an average of four overflow events per year



Site-specific annual precipitation analysis of a typical (representative) year

Average Annual Precipitation (1931-1980) in Ohio

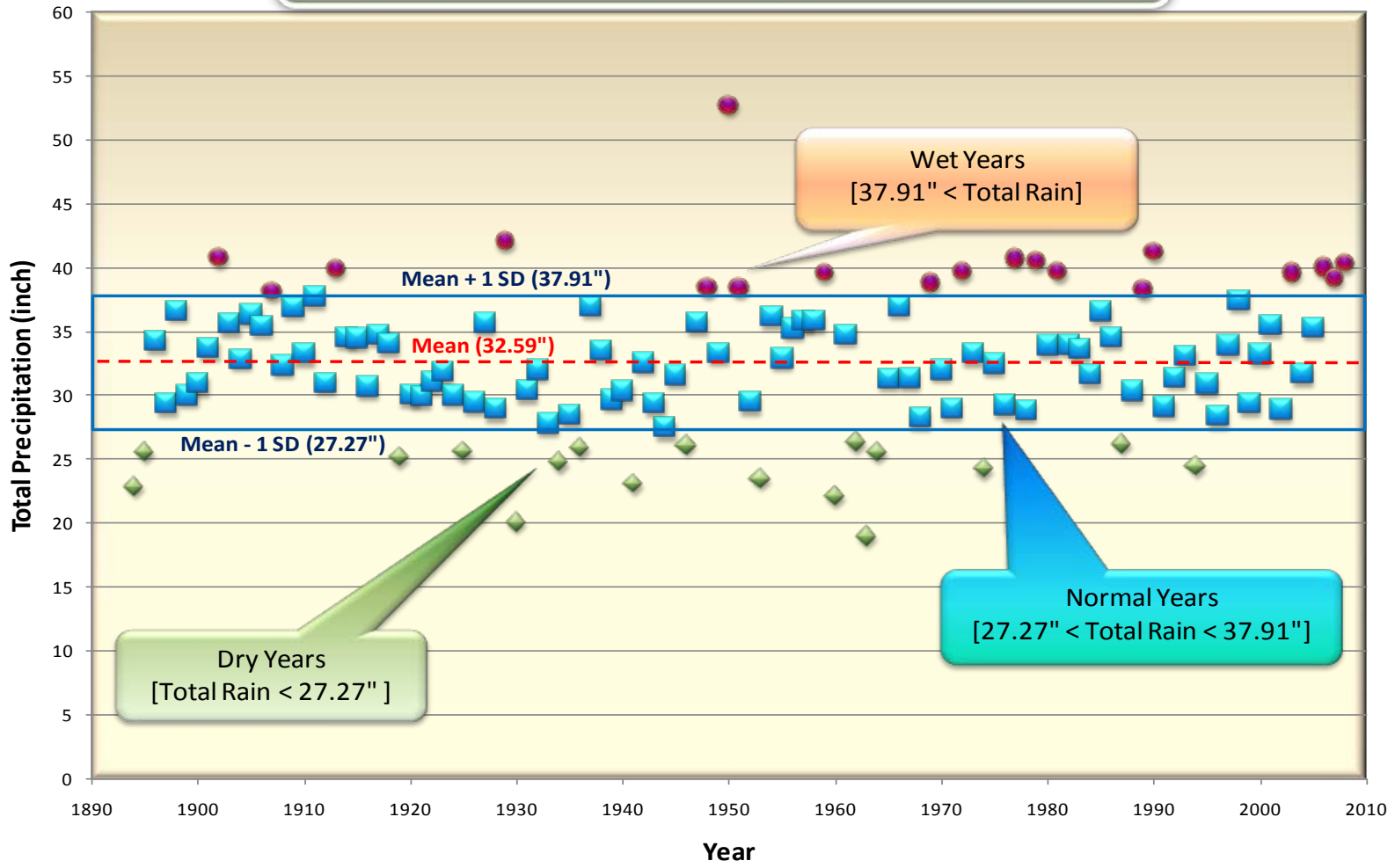


Source:
Ohio Department of
Natural Resources

Statistical Procedures for Daily Rainfall Data Analysis (1893-2009)

Rainfall Data	<ul style="list-style-type: none"> • NOAA Daily precipitation data (June 1, 1893 to October 25, 2009) 						
Data Preparation	<ul style="list-style-type: none"> • Excel spreadsheet – QA/QC 						
Statistical Analysis (I)	<ul style="list-style-type: none"> • Each year: count, minimum, maximum, mean, and total 						
Statistical Analysis (II)	<ul style="list-style-type: none"> • All years combined: count, minimum, maximum, mean, median, standard deviation, 90% confidence, 95% confidence, 99% confidence, and $\pm 5\%$ range from mean 						
Statistical Results (I)	<ul style="list-style-type: none"> • Mean rainfall depth: 32.59" \pm 5.32" (standard deviation) 						
Statistical Results (II)	<table border="0"> <tbody> <tr> <td>• Dry years</td> <td>Normal years</td> <td>Wet years</td> </tr> <tr> <td>• <27.27"</td> <td>27.27" - 37.91"</td> <td>>37.91"</td> </tr> </tbody> </table>	• Dry years	Normal years	Wet years	• <27.27"	27.27" - 37.91"	>37.91"
• Dry years	Normal years	Wet years					
• <27.27"	27.27" - 37.91"	>37.91"					
Statistical Results (III)	<ul style="list-style-type: none"> • Typical year :1901 and 1942 (30.97" - 34.22", mean depth $\pm 5\%$) 						

City of Bowling Green, Ohio Wet/Normal/Dry Years Based on Annual Precipitation



Statistical Procedures for Hourly Rainfall Data Analysis (1983-2009)

Rainfall Data

Data Preparation

Statistical Analysis (I)

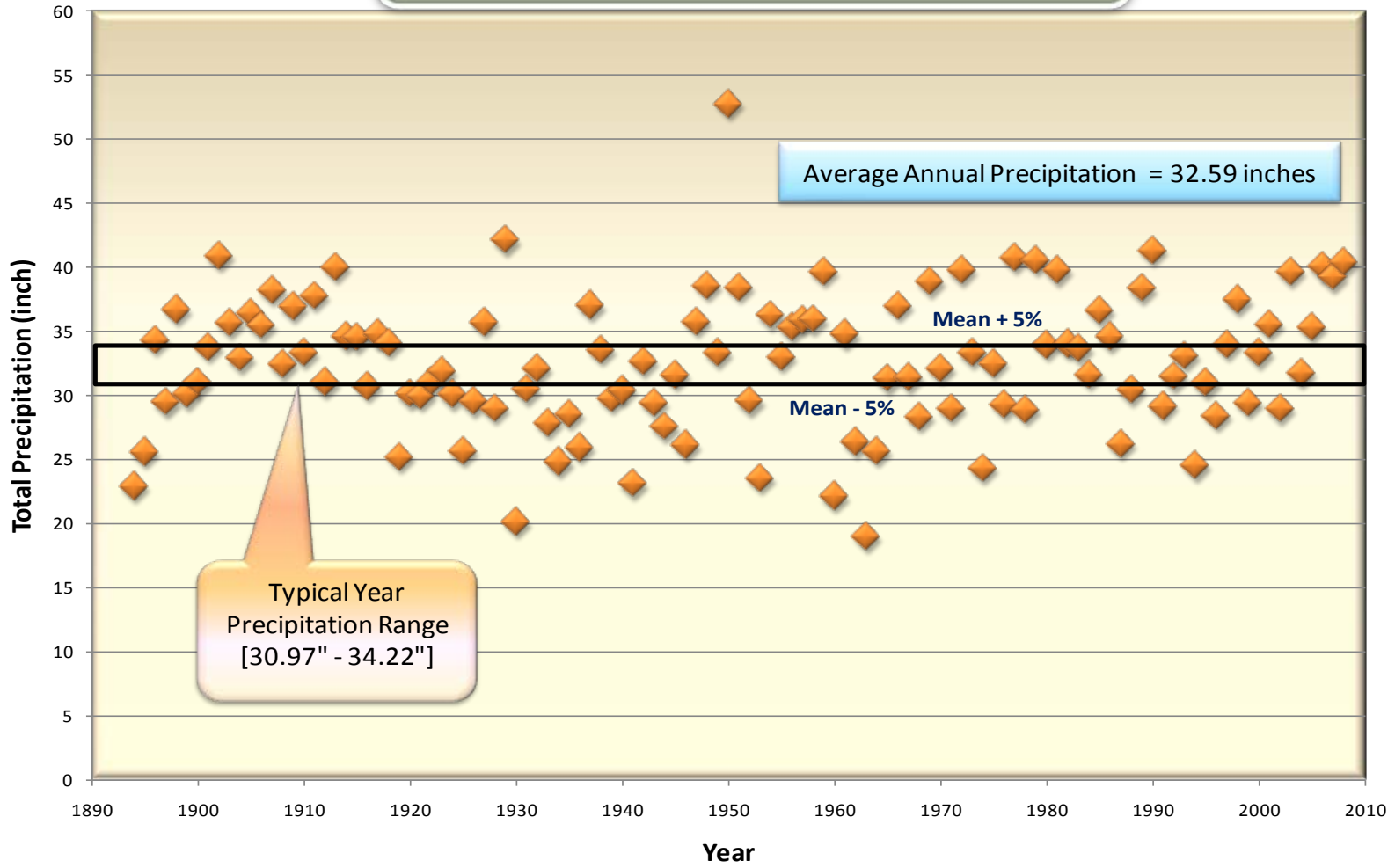
Statistical Analysis (II)

Statistical Results (I)

Statistical Results (II)

Statistical Results (III)

City of Bowling Green, Ohio Annual Precipitation From 1894 To 2008

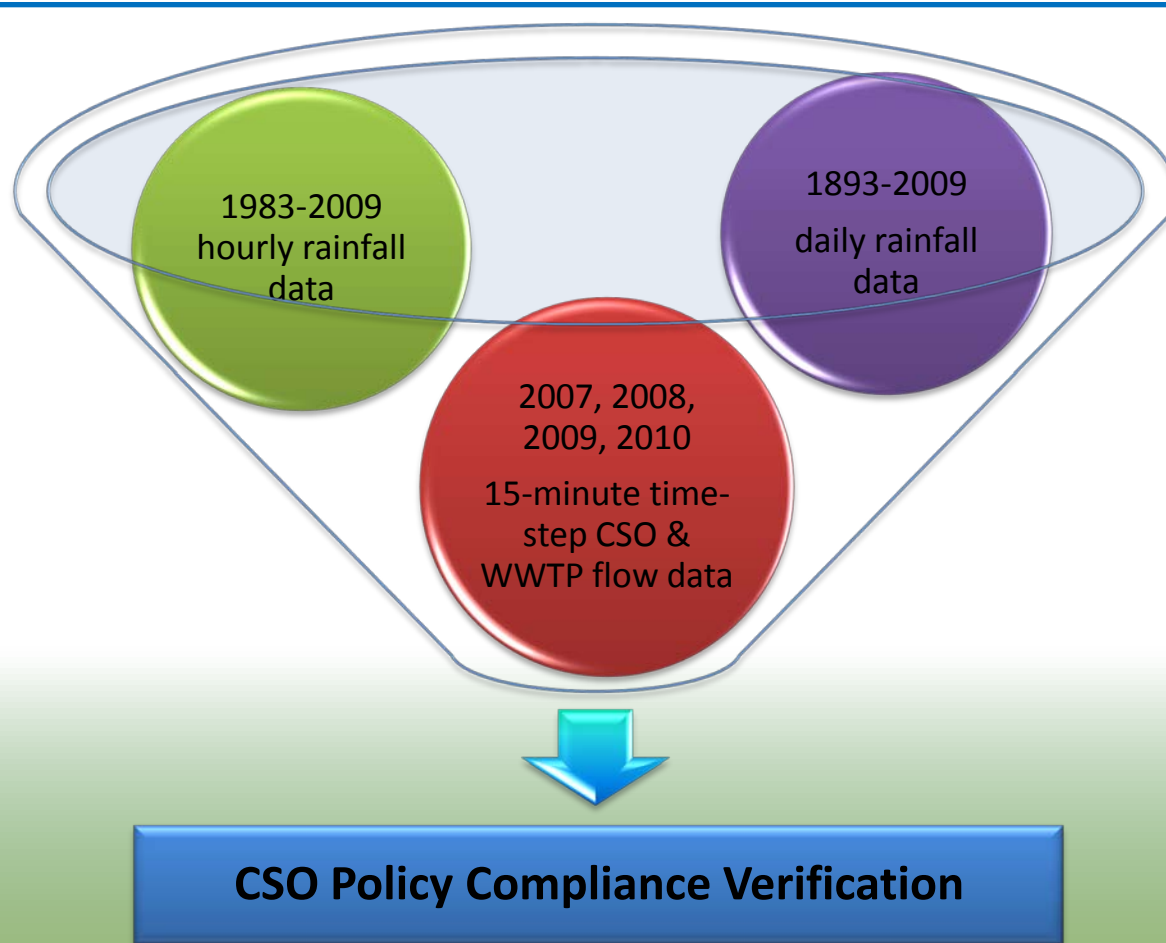


Typical Year Rainfall Analysis

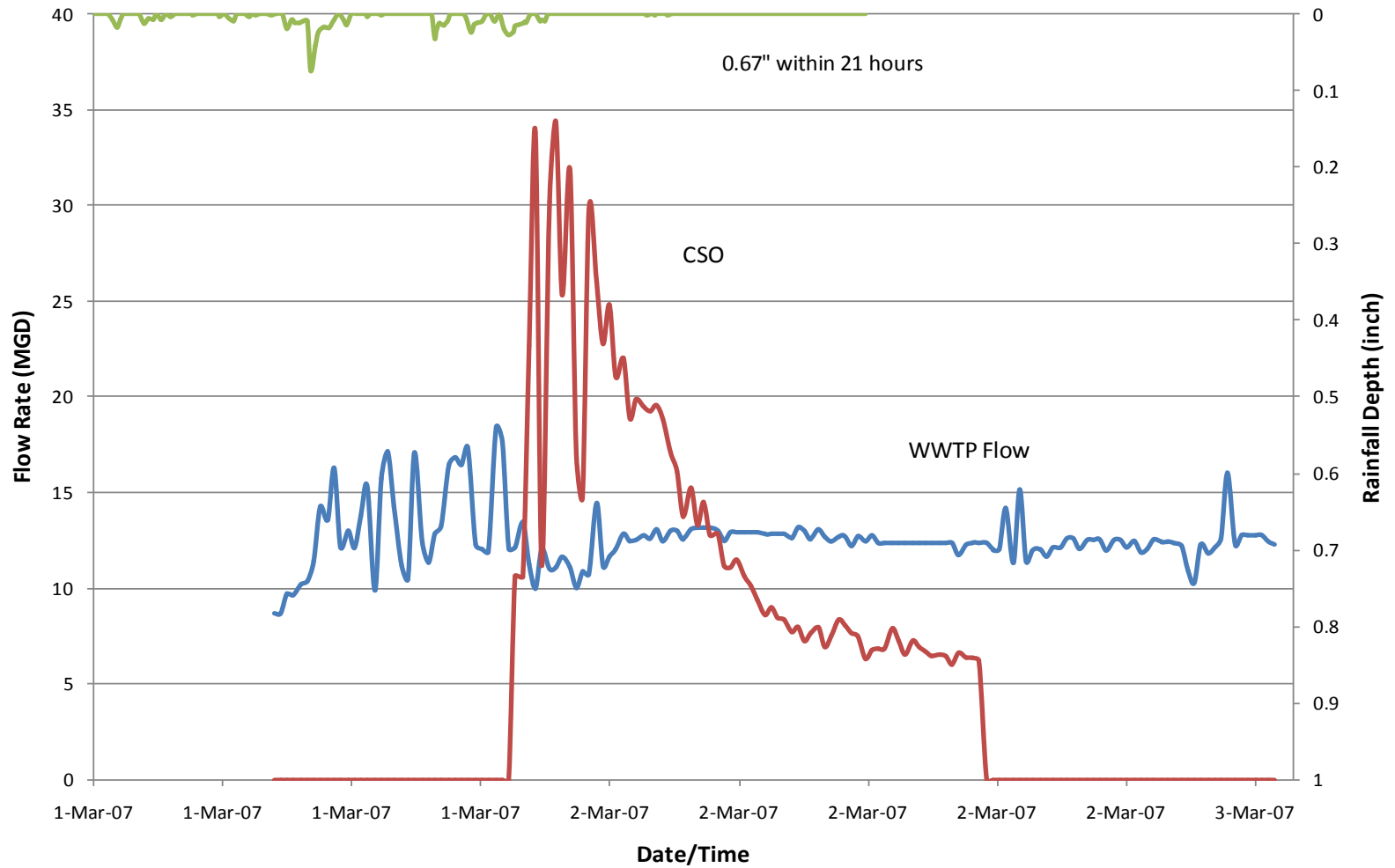
Target rainfall depths to comply with CSO policy:

- 1.40” for storm period of 24 hours and recurrence interval of 3 months
- 0.55” for storm period of one hour and recurrence interval of 3 months

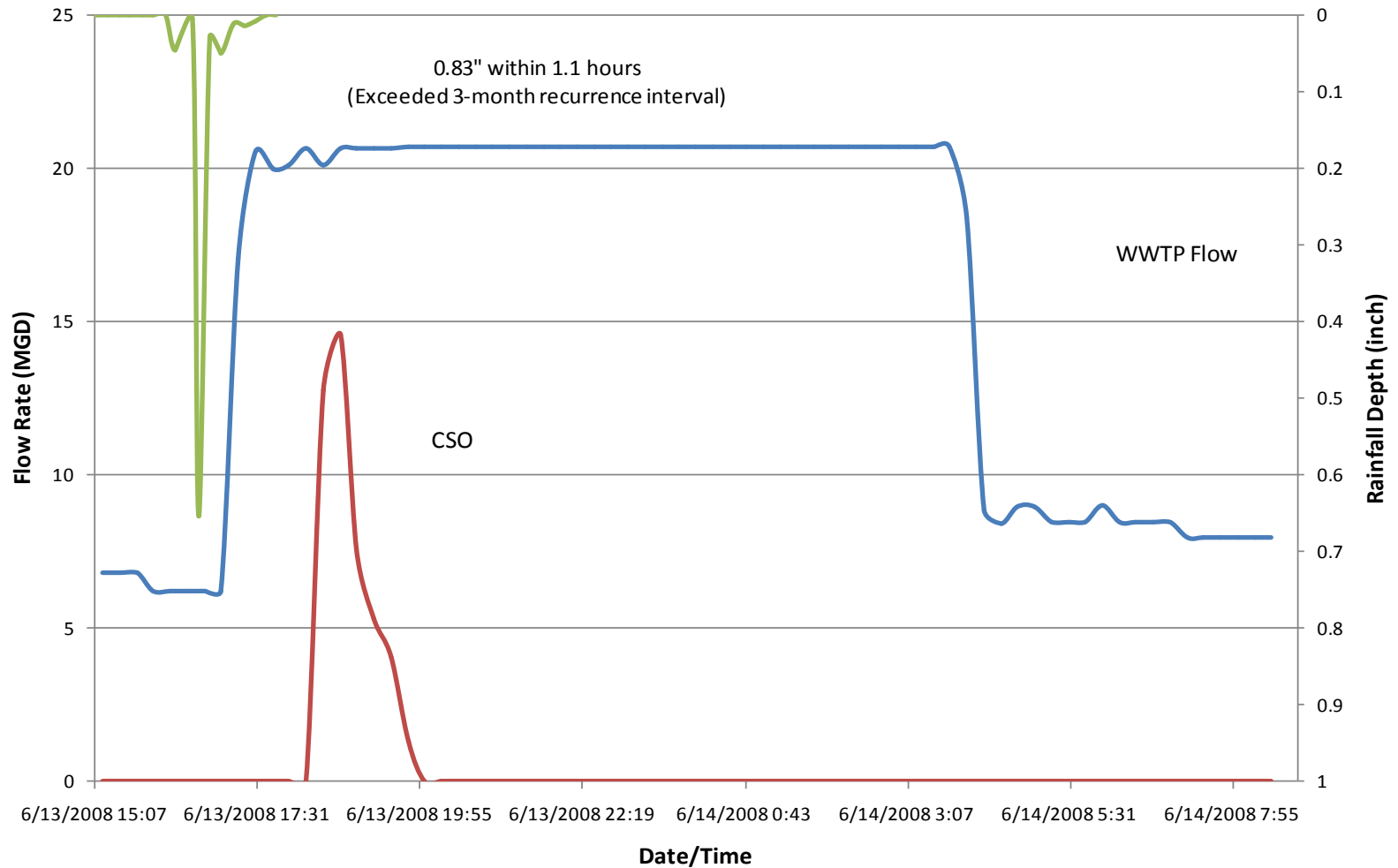
CSO and WWTP Operation Correlation Analysis



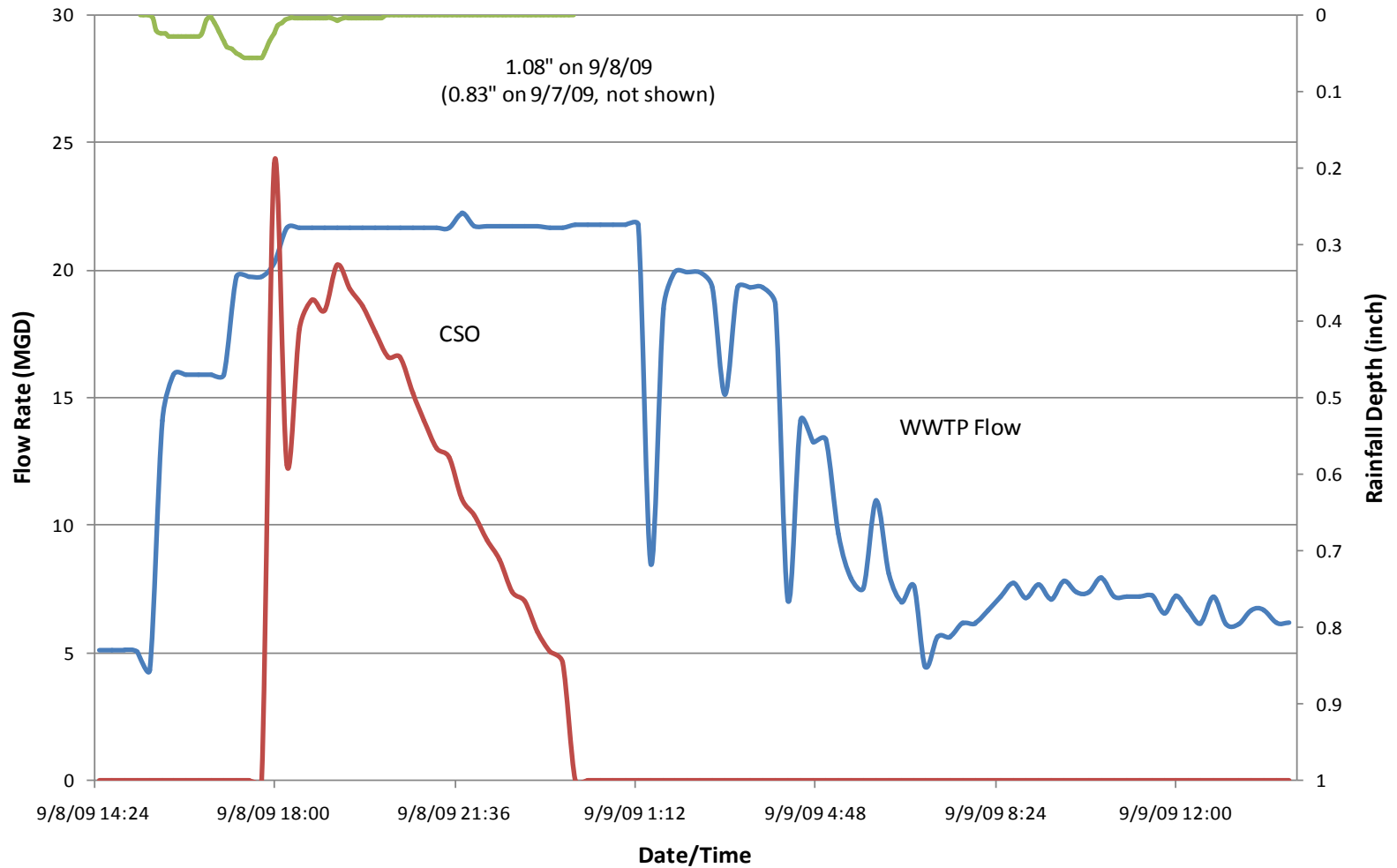
City of Bowling Green, Ohio CSO Occurrence on March 1, 2007



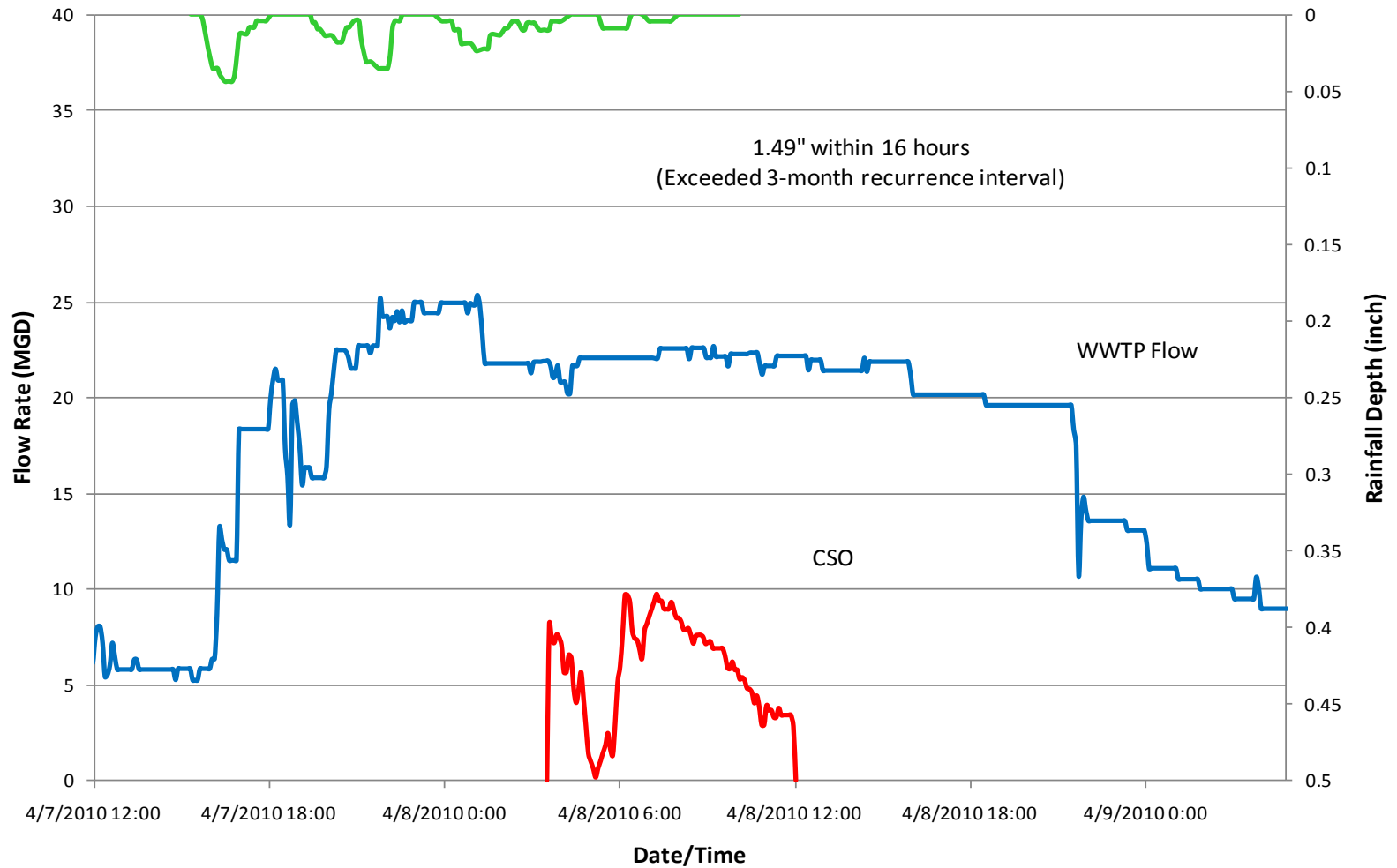
City of Bowling Green, Ohio CSO Occurrence on June 13, 2008



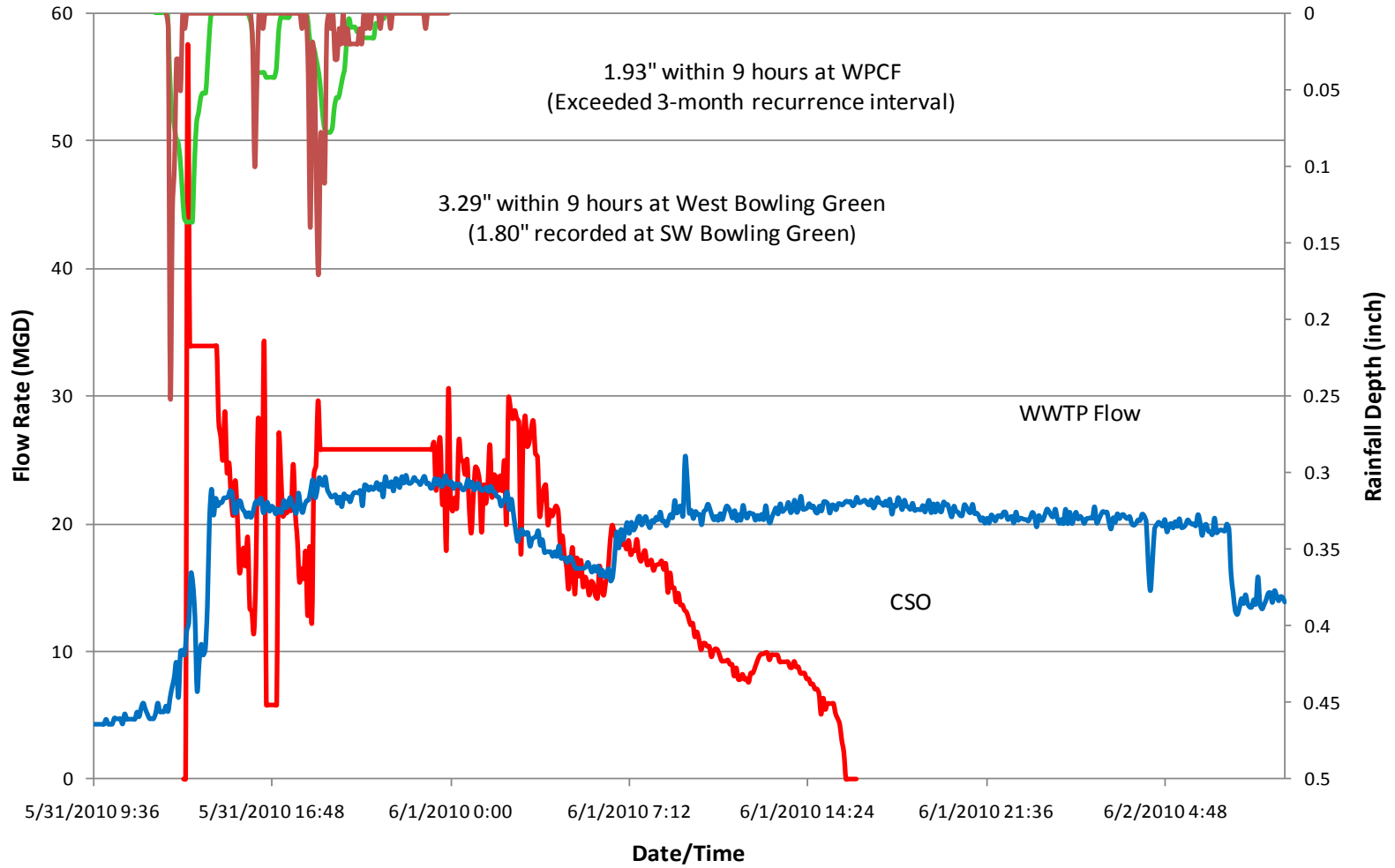
City of Bowling Green, Ohio CSO Occurrence on September 8, 2009



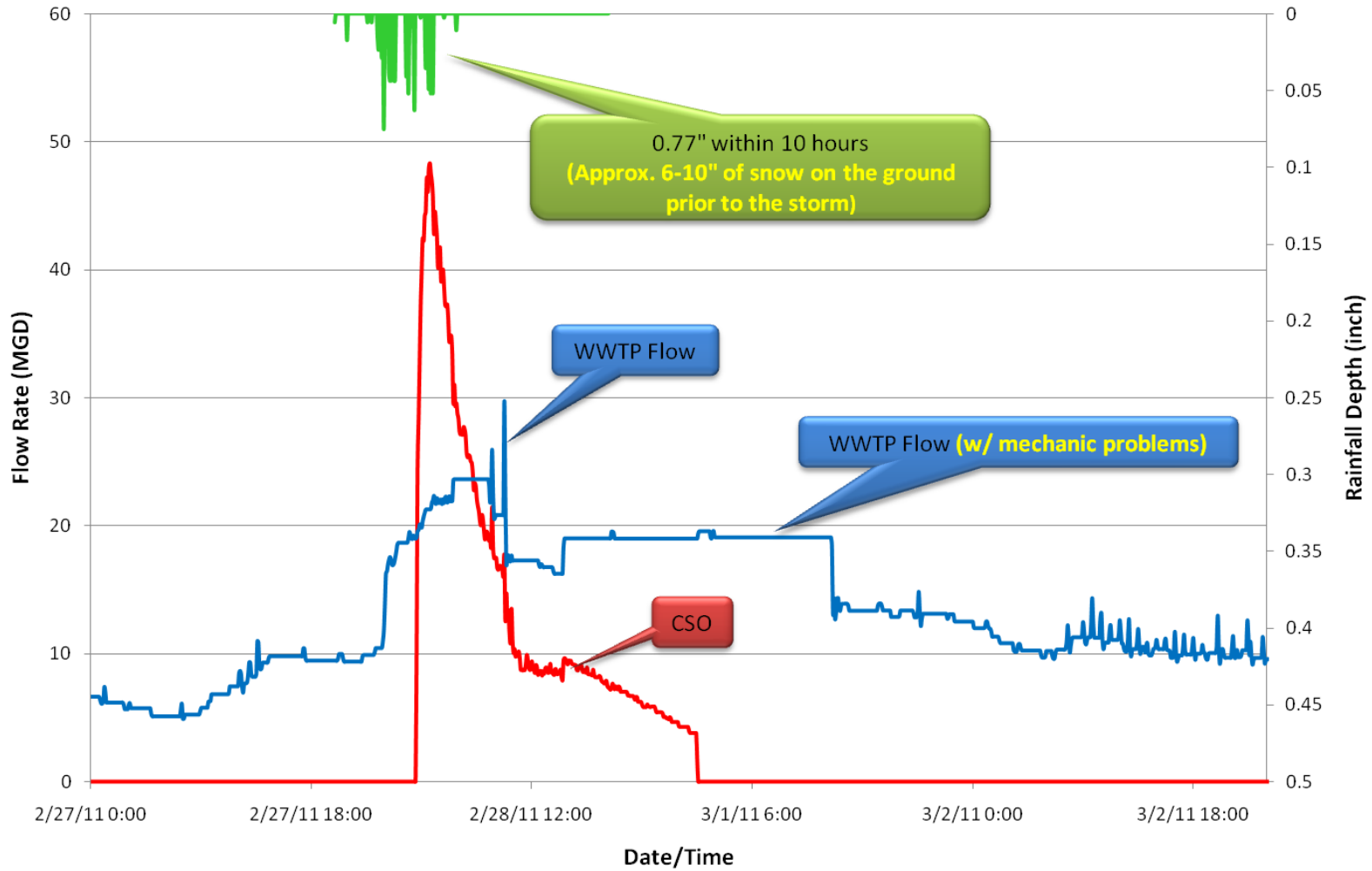
City of Bowling Green, Ohio CSO Occurrence on April 8, 2010



City of Bowling Green, Ohio CSO Occurrence on May 31, 2010



City of Bowling Green, Ohio CSO Occurrence on Feb 28, 2011

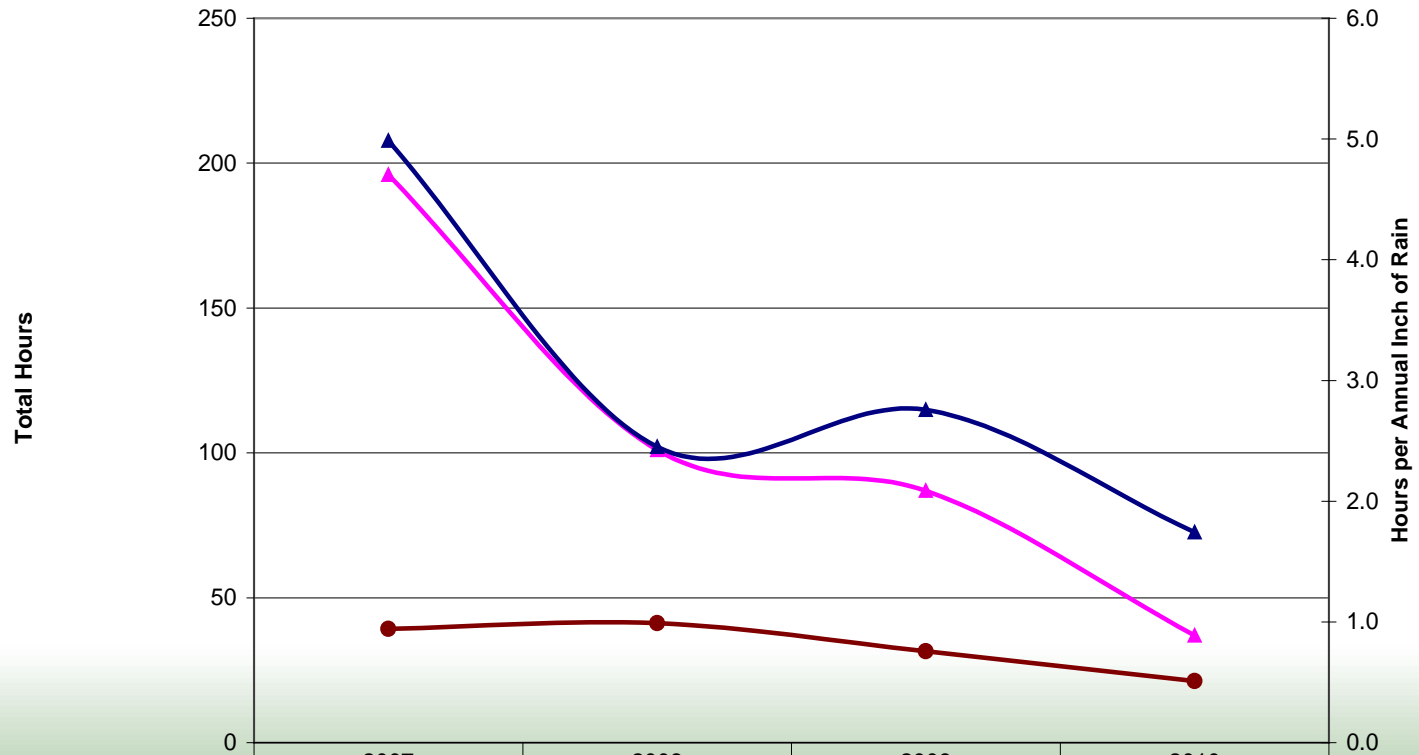


CSO Occurrences (2007-2010)

Year	Total Number of Overflow	Exceed typical year condition	Under typical year condition
2007	14	5	9
2008	9	6	3 ✓
2009	8	4	4 ✓
2010	4	4	0 ✓

Water Quality Improvement

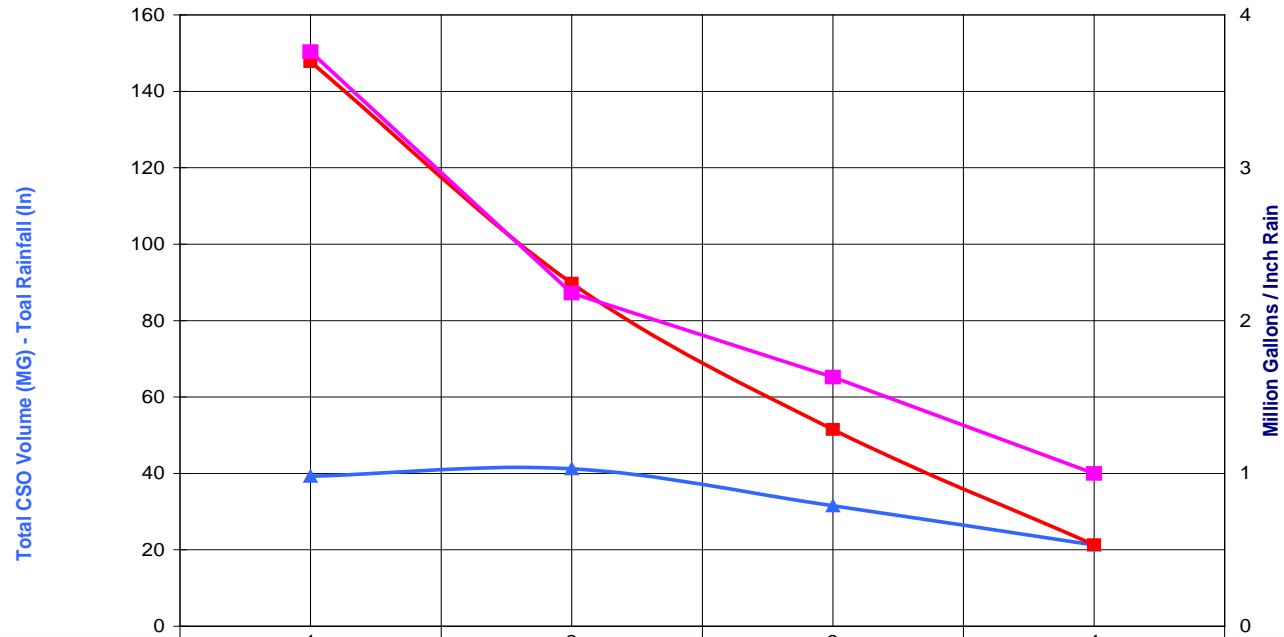
CSO Event Time vs. Annual Rainfall



● Total Inches Rain	39.3	41.23	31.55	21.24
▲ CSO Time / Hrs	196	101	87	37
▲ CSO Time / Inches Rain	5.0	2.4	2.8	1.7

Water Quality Improvement (Conti.)

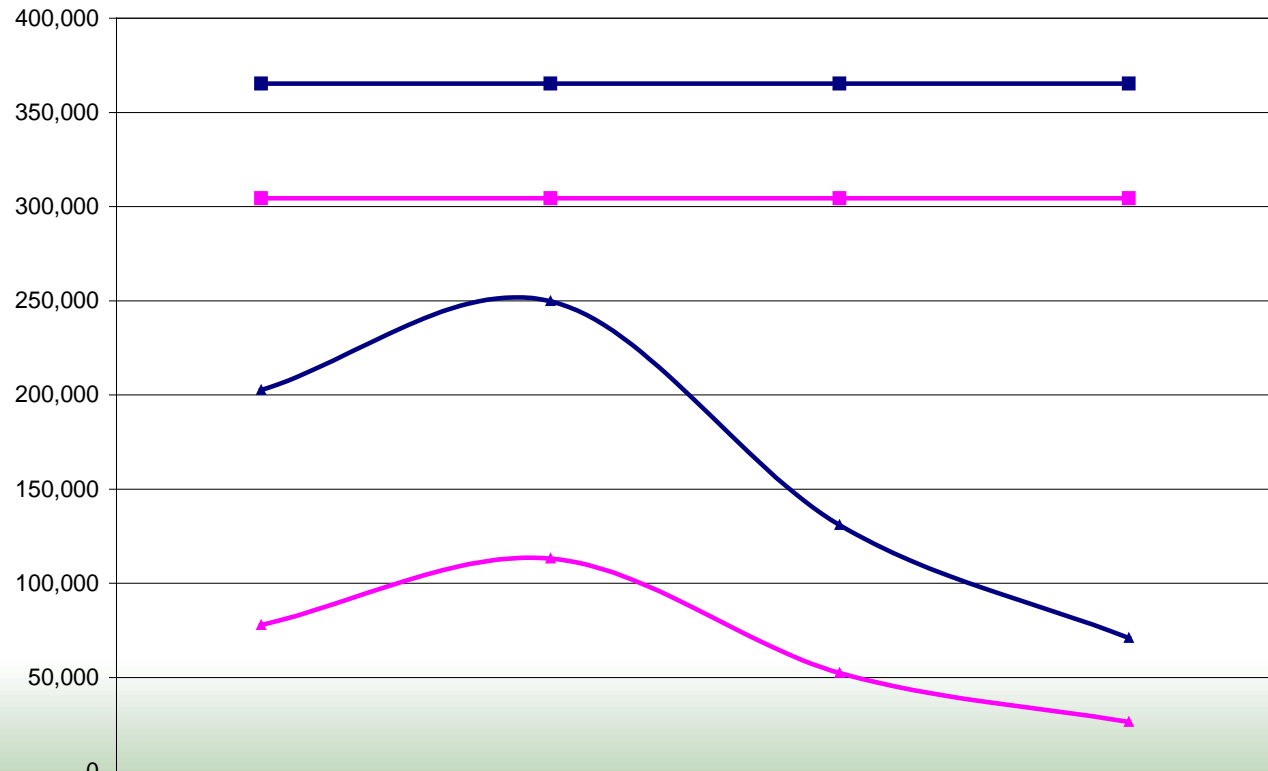
Annual CSO Discharge
(valid thru July 2010)



◆ YEAR	2007	2008	2009	2010
▲ Total Inches Rain	39.3	41.23	31.55	21.24
■ CSO Volume	147.8	89.8	51.5	21.34
■ CSO Volume / Inches Rain	3.76	2.18	1.63	1.00

Water Quality Improvement (Conti.)

Annual Pounds Discharged vs Annual Allowed in NPDES Permit



	2007	2008	2009	2010
—▲— Total Lbs. TSS (Eff & CSO)	202,571	249,711	130,854	70,932
—▲— Total Lbs. CBOD (Eff & CSO)	77,811	113,134	52,366	26,297
—■— Annual Permitted Lbs. TSS	365,292	365,292	365,292	365,292
—■— Annual Permitted Lbs. CBOD	304,410	304,410	304,410	304,410

Working On The Same Goal

- *Communication Communication Communication*
- Talk to EPA
- Share your issues
- Put all heads together





TEAMWORK

Large ambitious goals usually require that people (or panda) work together.

Thank You!

Q&A