5 CITIES +

Conference

Achieving Compliance with Lexington's Consent Decree

Jennifer M. Carey, P.E.
Division of Water Quality
Lexington-Fayette Urban County Government

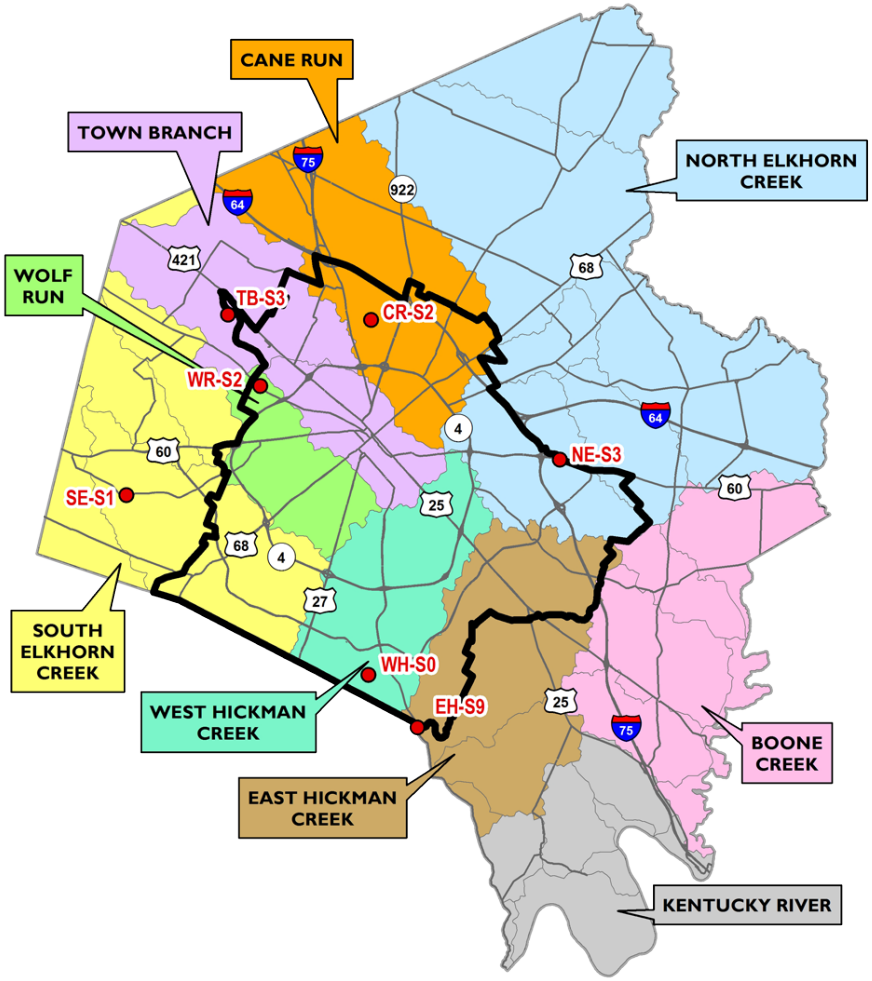
LEXINGTON

AGENDA

- Lexington's Consent Decree Overview
- Sanitary Sewer Decisions Made to Develop a $590 M Capital Program
  - Inflow and Infiltration
  - Design Storm
  - Offline Storage vs. Plant Upgrades
- Storm Sewer Compliance Immediate Actions
  - Staffing
  - Funding
  - Ordinances

A Bit About Lexington

- Merged government
- USA / RSA
- Sits on a hill / no major river
- Population > 310,000



Consent Decree Overview

- Alleged Violations of the Clean Water Act
  - Non-compliant MS4 (stormwater) program
  - Unpermitted wastewater discharges (overflows)
    - Dry weather SSOs
    - Wet weather SSOs

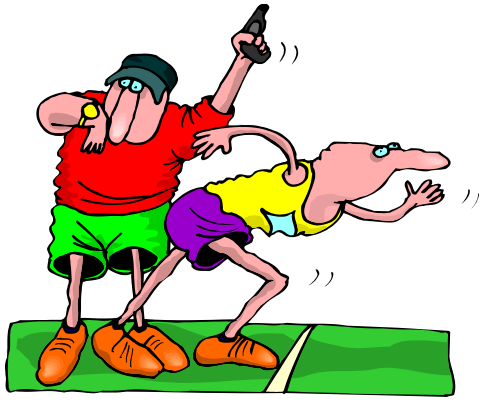
- Consent Decree (CD) Settlement Timeline
  - Negotiations: 2007
  - Lodged with District Court: March 14, 2008
  - ……. **APPEAL** …….!
  - Entered by District Court: January 3, 2011
  - Required Completion Date: December 31, 2026

Consent Decree Overview

Requirements for / Challenges to SSO Abatement (Remedial Measures Plans – RMPs)

- CD Requirements:
  - Completion of phased Sewer System Assessments (SSAs) 36, 42, and 48 months from Lodging Date.
  - Submission of phased Remedial Measures Plans within 6 months of each SSA completion deadline.
- Lexington's Challenges in 2008:
  - Last "assessment" nearly 10 years old.
  - No hydraulic model of system existed.
  - Insufficient staffing to generate deliverables on compressed timelines.

Lexington was given 54 months to assess and model its system and develop a cost-effective and EPA-compliant capital improvement “plan” designed to abate 111 Recurring SSOs in an 11- to 13-year period.



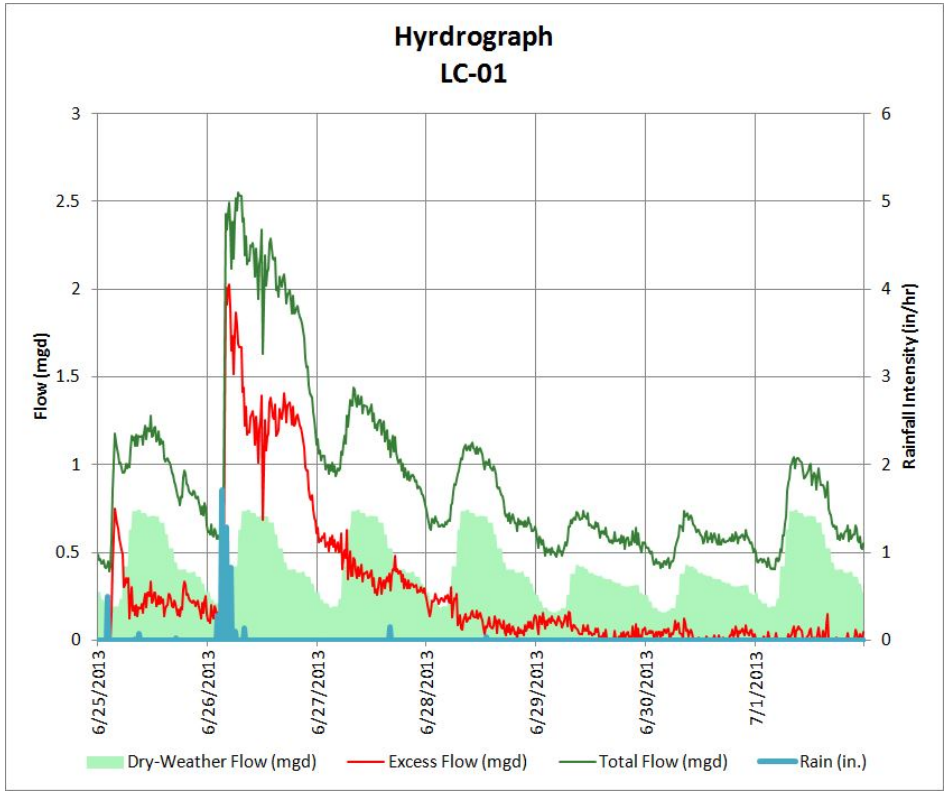
How do we do this?

- Hire consultants and vendors to bridge the staffing gap.
- Collect new data and merge with existing “reliable” data as much as possible.
- **Try our best to make good decisions with voluminous amounts of data and precious little time!**

LEXINGTON

Trust Concerns with the Data

- Reliable SSO data?
- Reliable flow monitoring data?



LEXINGTON

Trust Concerns with the Existing SSO Data

SSO Type	Pump Station	Watershed	Date	SSO Duration				Reason
O	THOROUGHBRED ACRES	TB	10/18/2004	18	HRS	5	MIN	EXCESS RAIN WATER
O	ARMSTRONG MILL	WH	10/19/2004	5	HRS	51	MIN	EXCESS RAIN WATER
O	BLUEGRASS FIELD	TB	10/19/2004	1	HRS	15	MIN	EXCESS RAIN WATER
O	DEEP SPRINGS	TB	10/19/2004	11	HRS	37	MIN	EXCESS RAIN WATER
O	EAST HICKMAN	WH	10/19/2004	10	HRS	5	MIN	EXCESS RAIN WATER
O	EAST LAKE	WH	10/19/2004	5	HRS	39	MIN	EXCESS RAIN WATER
O	HARTLAND # 1	WH	10/19/2004	3	HRS	55	MIN	EXCESS RAIN WATER
O	LOWER CANE RUN	TB	10/19/2004	16	HRS	37	MIN	EXCESS RAIN WATER
O	MCCUBBIN	TB	10/19/2004	0	HRS	13	MIN	EXCESS RAIN WATER
O	NORTH ELKHORN	WH	10/19/2004	15	HRS	45	MIN	EXCESSIVE RAIN WATER
O	SHANDON PARK # 1	TB	10/19/2004	3	HRS	12	MIN	EXCESS RAIN WATER
O	SHANDON PARK # 2	TB	10/19/2004	5	HRS	35	MIN	EXCESS RAIN WATER
O	SHARON VILLAGE	TB	10/19/2004	4	HRS	2	MIN	EXCESS RAIN WATER
B	TOWN BRANCH	TB	10/19/2004	2	HRS	9	MIN	BLOWN FUSE
O	WINBURN	TB	10/19/2004	3	HRS	20	MIN	EXCESS RAIN WATER
O	WOLF RUN	TB	10/19/2004	23	HRS	25	MIN	EXCESS RAIN WATER
O	DIXIE	TB	10/20/2004	17	HRS	22	MIN	EXCESS RAIN WATER
O	SOUTH ELKHORN	WH	10/20/2004	26	HRS	1	MIN	EXCESS RAIN WATER
O	SOUTH ELKHORN	WH	10/20/2004	1	HRS	2	MIN	EXCESSIVE RAIN WATER
O	GREENBRIER I	WH	10/24/2004	1	HRS	30	MIN	EXCESSIVE RAIN WATER
O	BLUEGRASS FIELD	TB	11/4/2004	0	HRS	56	MIN	MECHANICAL PROBLEMS
O	DIXIE	TB	11/4/2004	5	HRS	35	MIN	EXCESSIVE RAIN WATER
O	EAST HICKMAN	WH	11/4/2004	3	HRS	50	MIN	EXCESSIVE RAIN WATER
O	HARTLAND # 1	WH	11/4/2004	1	HRS	0	MIN	EXCESSIVE RAIN WATER
O	NORTH ELKHORN	WH	11/4/2004	6	HRS	30	MIN	EXCESSIVE RAIN WATER
O	SHARON VILLAGE	TB	11/4/2004	0	HRS	6	MIN	EXCESSIVE RAIN WATER
O	SOUTH ELKHORN	WH	11/4/2004	18	HRS	42	MIN	EXCESSIVE RAIN WATER
O	THOROUGHBRED ACRES	TB	11/4/2004	8	HRS	33	MIN	EXCESSIVE RAIN WATER
O	THOROUGHBRED ACRES	TB	11/4/2004	13	HRS	45	MIN	EXCESSIVE RAIN WATER
O	WOLF RUN	TB	11/4/2004	0	HRS	43	MIN	EXCESSIVE RAIN WATER

Date	Total Precipitation (inches)
10/12/2004	0.58
10/13/2004	0.22
10/14/2004	0.06
10/15/2004	0.44
10/16/2004	0.02
10/17/2004	
10/18/2004	0.66
10/19/2004	2.95
10/20/2004	0.01
10/21/2004	T
10/22/2004	
10/23/2004	0.44
10/24/2004	0.56
10/25/2004	
10/26/2004	T
10/27/2004	0.8
10/28/2004	
10/29/2004	0.01
10/30/2004	0.07
10/31/2004	
11/1/2004	0.91
11/2/2004	0.47
11/3/2004	0.01
11/4/2004	0.99
11/5/2004	T
Total	**9.2**

Trust Concerns with the Flow Monitoring Data

WATERSHED GROUP	FLOW MONITORING PERIOD	TOTAL INCHES RAINFALL DURING MONITORING PERIOD	TOTAL DAYS > 3.2 INCHES	TOTAL INCHES RAINFALL FOR YEAR
1	April - August 2008	19.4	1	47.24
2	February - June 2009	15.75	0	54.04

It's difficult to model a 2-year / 24-hour storm with 1 calibration event!

Trust Concerns with the Data

- Reliable SSO data?
- Reliable flow metering data?
- Model assumptions and simulation of real rain events.

CLOCK IS TICKING!!!!!

RMP Decision Points

1. Inflow & Infiltration (I&I) removal
2. Design storm selection
3. How to best manage the resulting peak flows

LEXINGTON

RMP Decision Point 1: I&I Removal

- Review of trends nationwide seemed to indicate a low return on investment when pursuing high percentages of I&I removal.

- Lexington's own experience with reducing peak flow mimicked trends.
  - Chevy Chase 2004: $2.5 M collection system rehabilitation, post-rehab flow monitoring showed peak flows 2.5 times higher the pre-rehab flow monitoring

RMP Decision Point 1: I&I Removal

Risks in choosing a target I&I removal percentage:

- Evidence was that you'd more likely fail than succeed and spend a lot of money doing so.
- Public and elected officials would not understand and consider the entire Consent Decree a failure due to:
  - Uncontrolled / escalating capital costs
  - Manholes and pump stations that still overflow during heavy rains

RMP Decision Point 2: Design Storm

- What design storm threshold had EPA approved in other SSO enforcement cases?
- Would there be a cost-effective design storm that EPA would approve?
- Team decided to focus on two design storms to develop draft solutions and costs:
  - 2-year / 24-hour: approximately **3.2** inches of rain in a 24-hour period = $600 M
  - 5-year / 24-hour: approximately **3.7** inches of rain in a 24-hour period = $900 M

LEXINGTON

RMP Decision Point 3: Managing Peak Flows

	2010 Average Day Flow	Projected Future Peak Wet Weather Flow
	(MGD)	(MGD)
Town Branch WWTP	18.062	107.4
West Hickman WWTP	18.62	77.0

RMP Decision Point 3: Managing Peak Flows

Key question – cost aside, how can a plant reliably go from 18 MGD to over 100 MGD?

- Standby crews to staff plant and bring additional treatment trains on line?
- Automation instead of people: Is there a $26 M “easy button” to switch from activated sludge to contact stabilization?
- Tunnels in the collection system?
- Storage tanks at the head of plant?

RMP Decisions Made: What's the Plan?

- Formulating a plan based on a specified I&I removal percentage seemed risky.
- Accounting for peak flow rate factors at both plants hovering around 10x, even at the lowest threshold design storm seemed risky.
- Peak flow management at plants anticipated to be challenging given current staffing and existing treatment process layout, therefore some form of offline storage to regulate peak flow spikes was considered essential.

RMP Decisions Made: Mitigating CD SSOs

- Zero I&I removal – a target nobody can miss.
- Convey all peak flow to each treatment plant, with zero SSOs, based on selected design storm.
- Manage peak flow at plants by designing offline storage to limit plant in-flow to existing hydraulic capacities:
  - Town Branch WWTP: 60 MGD
  - West Hickman WWTP: 70 MGD

RMP Decisions Made: What's the Plan?

LEXINGTON REMEDIAL MEASURES PLAN COST ESTIMATE	
2-Year / 24-Hour	$600,000,000
5-Year / 24-Hour	$900,000,000

RMP Decisions Made: Summary

- Zero I&I removal "required"
  - It's a "can't miss target"
  - Current programs do remove I&I ($5 M in rehab, plus $200 K annually for sump pump redirects, plus $750 K for neighborhood rehab - NEW)
- 2-year / 24-hour design storm
  - $300 M less than 5-year / 24-hour storm cost estimate
  - At $5,000 per SSO in post-RMP stipulated penalties, it would take 60,000 wet weather SSO events to reach break even
  - Lexington currently averages about 278 wet weather SSOs annually
- No plant capacity increases
  - Storage tanks considered necessary in any case
  - Avoid other permit modification risks

RMP Decision Loose Ends: What About the Plants?

- Last significant plant upgrades:
  - Town Branch: 1988
  - West Hickman: 2001
- Uncertainty of future KPDES permit requirements
- After a $537 M investment in wet weather collection and conveyance, who will want to invest in the wastewater plants?

RMP Decision Point: Utilizing the Consent Decree to Ensure Simultaneous Investment in Plant Reliability

Town Branch WWTP	$25,859,000
West Hickman WWTP	$27,350,000

RMP Decisions Made: Summary

- Zero I&I removal “required”
- 2-year / 24-hour design storm
- No plant capacity increases
- Capital construction plan based on:
  - Recurring wet weather SSO mitigation
  - Ensuring long-term WWTP reliability throughout duration of wet weather SSO mitigation program
- A project cost estimate that minimizes escalation risks most effectively

LEXINGTON

RMP Decisions Made: Summary

LEXINGTON REMEDIAL MEASURES PLAN COST ESTIMATE	
SSO Abatement Costs	$537,160,000.00
WWTPs Reliability Costs	$53,209,000
TOTAL	**$590,369,000.00**

- ✓ 2-Year / 24-Hour Storm
- ✓ Sizing for 0% I&I Removal

Consent Decree
Stormwater Compliance Measures

- 1st city in the nation to negotiate a CD for both sanitary and storm sewers
- Immediate MS4 issues to address in the CD
  - Staffing
  - Funding
  - Ordinances

LEXINGTON

The MS4 Program – Then and Now

2008	2017

• 1 full-time person
• MS4 Permit – 6 pages
• Annual Funding of ~$150 to 200K
• Erosion Control Ordinance
• Post-Construction Stormwater Manual
	• 15 full-time staff (supported by additional 100 staff)
	• MS4 Permit – 47 pages
	• Annual funding of $13M (quantity, too)
	• New Ordinances:
	  • Water Quality Management Fee
	  • Private Property BMP Maintenance
	  • Enforcement
	  • Illicit Discharges
	  • Industries / High-Risk Commercial
	  • Reduction of Soil Erosion

The MS4 Program – Staffing

	Quantity	No. of Annual Inspections
Construction Sites	500	6000+
Detention Basins	1200	2400+
Retention Ponds	95	1100+
Water Quality BMPs	800	800
Industries / High-Risk Commercial	70	35
Critical Culverts	45	600+

The MS4 Program – Funding

- Stormwater Fee Task Force Formed by Vice Mayor Gray
  - Cross-Section of the Community
  - Work completed in 5 months
- Fee of $4.78 per ERU
- Funds the MS4 Program and the Stormwater Capital Program

The MS4 Program – Funding

- No exemptions: All property with impervious surfaces pays the fee, including farms and churches.
- No credit program: Instead, a grant program returns 10% of the revenue to the community.
- No rate increases since inception: Annual escalation based on CPI ($4.32 / ERU in 2010 → $4.78 / ERU in 2017)

The MS4 Program – Ordinances
Stormwater Controls / BMP Maintenance

- City maintains structures in single family residential areas.
- Property owner responsible for all maintenance in commercial areas.

The MS4 Program – Ordinances Enforcement

- Escalating Process
  - Verbal Warnings, Written NOVs, Fines, Permit Block, Stop Work
- Appeal Process - Infrastructure Hearing Board
  - Builder / Developer
  - Environmental Community
  - Civil Engineer
  - 2 At-Large

The MS4 Program – Ordinances
Illicit Discharges

- Prohibits non-stormwater discharges to the MS4

The MS4 Program – Ordinances
Industrial / HRC Facilities

- Stormwater Pollution Prevention Plan required for each facility
- KPDES permits and DMRs submitted to LFUCG annually

The MS4 Program – Ordinances
Reduction of Soil Erosion

- Land Disturbance Permit required locally for disturbance of 5,000 sf or greater
- Has the same requirements as the state permit for land disturbance of 1 acre or larger

Lexington's Consent Decree Summary

- Sanitary sewer capital construction plan based on:
  - Recurring wet weather SSO mitigation and long-term WWTP reliability.
  - Assumes zero I&I removal, while collecting and conveying design storm flow to a system of wet weather storage tanks.
  - No plant capacity increases, only rehabilitation of existing processes.
- MS4 program required immediate strengthening through
  - Staffing, Funding, and Ordinances
- Consent Decree implementation is challenging, but sometimes practical solutions to ongoing challenges can be identified during the implementation phase and have a profound, long-term benefit to your community.

QUESTIONS?

Trust Issues with the Existing Data

Year	Total Precipitation (inches)	Deviation
2000	42.31	-2.35
2001	38.84	-5.71
2002	49.29	+4.74
2003	52.13	+7.58
2004	62.39	+17.73
2005	33.72	-10.83
2006	52.99	+8.44
2007	43.28	-1.27
2008	47.24	+2.58
2009	54.04	+9.49
AVG	43.39	