Lower Mill Creek Partial Remedy

Community Town Hall Meetings

August 16, 2012

August 23, 2012

METROPOLITAN SEWER DISTRICT of greater CINCINNATI

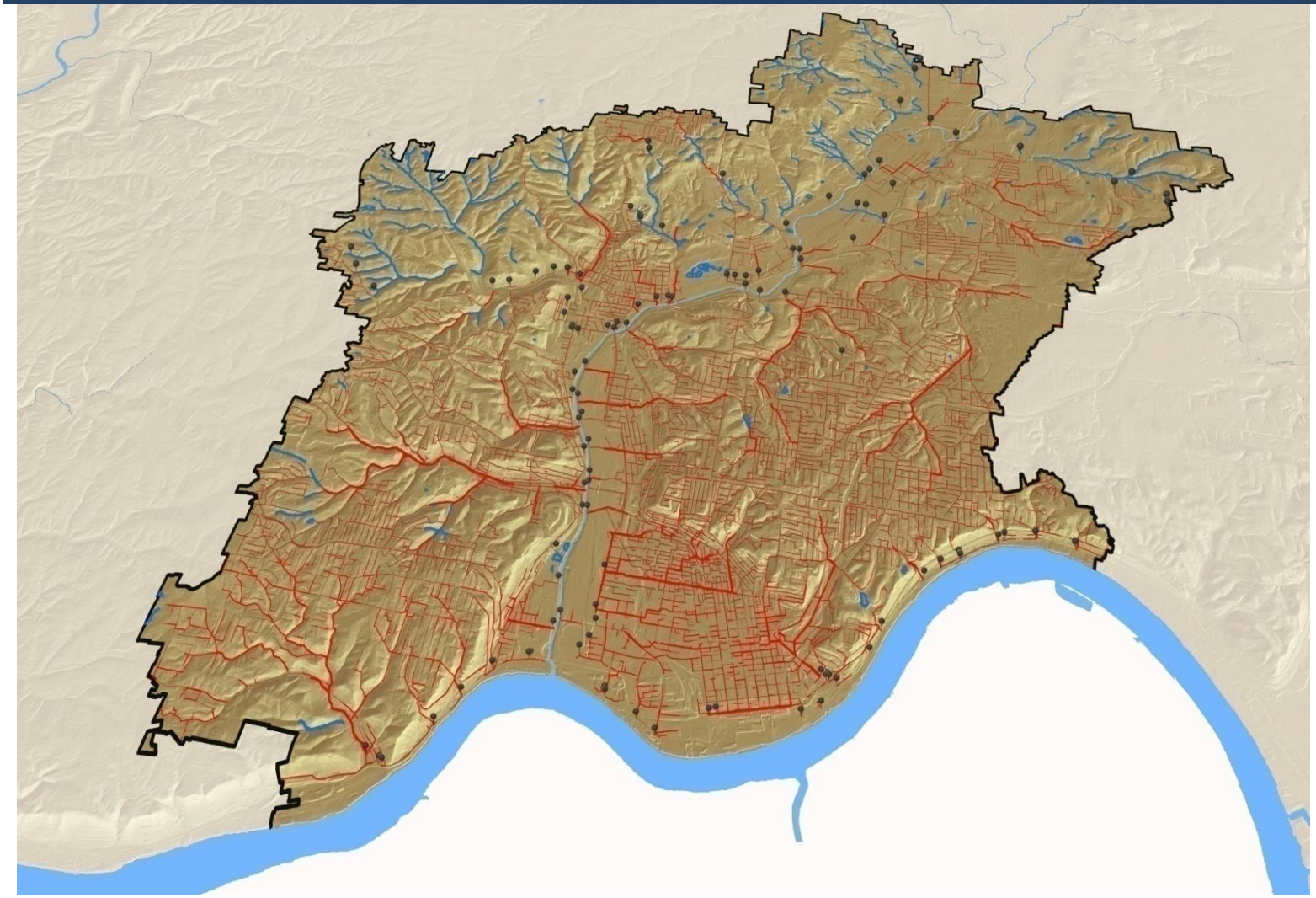
Today's Agenda

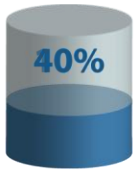
- **Why** *are we here today?*
- **Where** *is this project located?*
- **What** *is the LMC regulatory mandate?*
- **How** *is MSD going to comply?*
- **Who** *is involved?*
- **When** *will the report be submitted?*

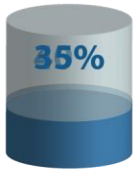
WHY

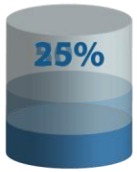
Historical Drainage Perspective

WHY









753 miles of sewers, 603 miles of combined sewers

Wet Weather Impacts

WHY

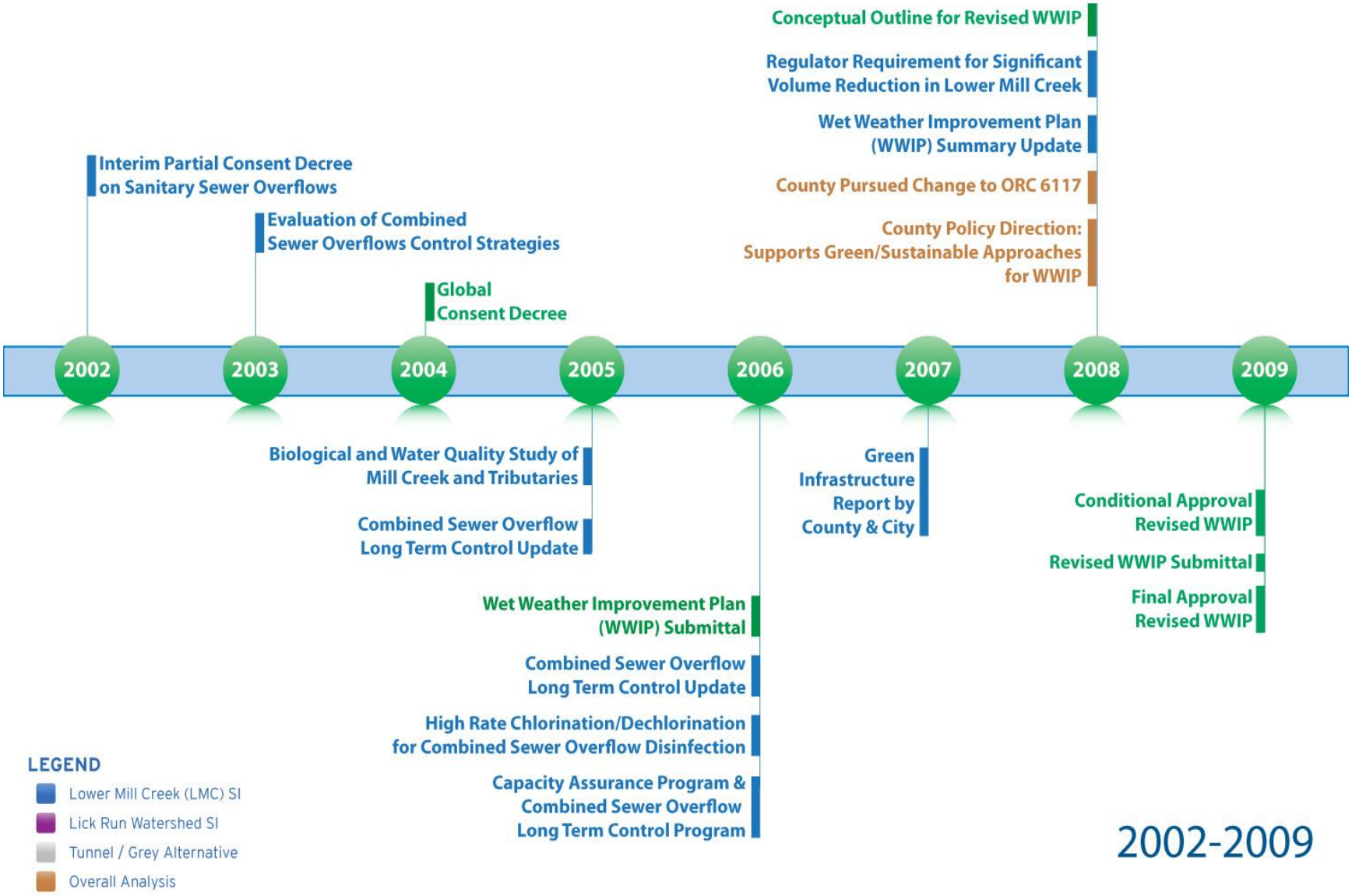
Guerley Road & Sunset Avenue
Lick Run Watershed

CSO #5
Lick Run

CSO #483
Kings Run

History of Consent Decree

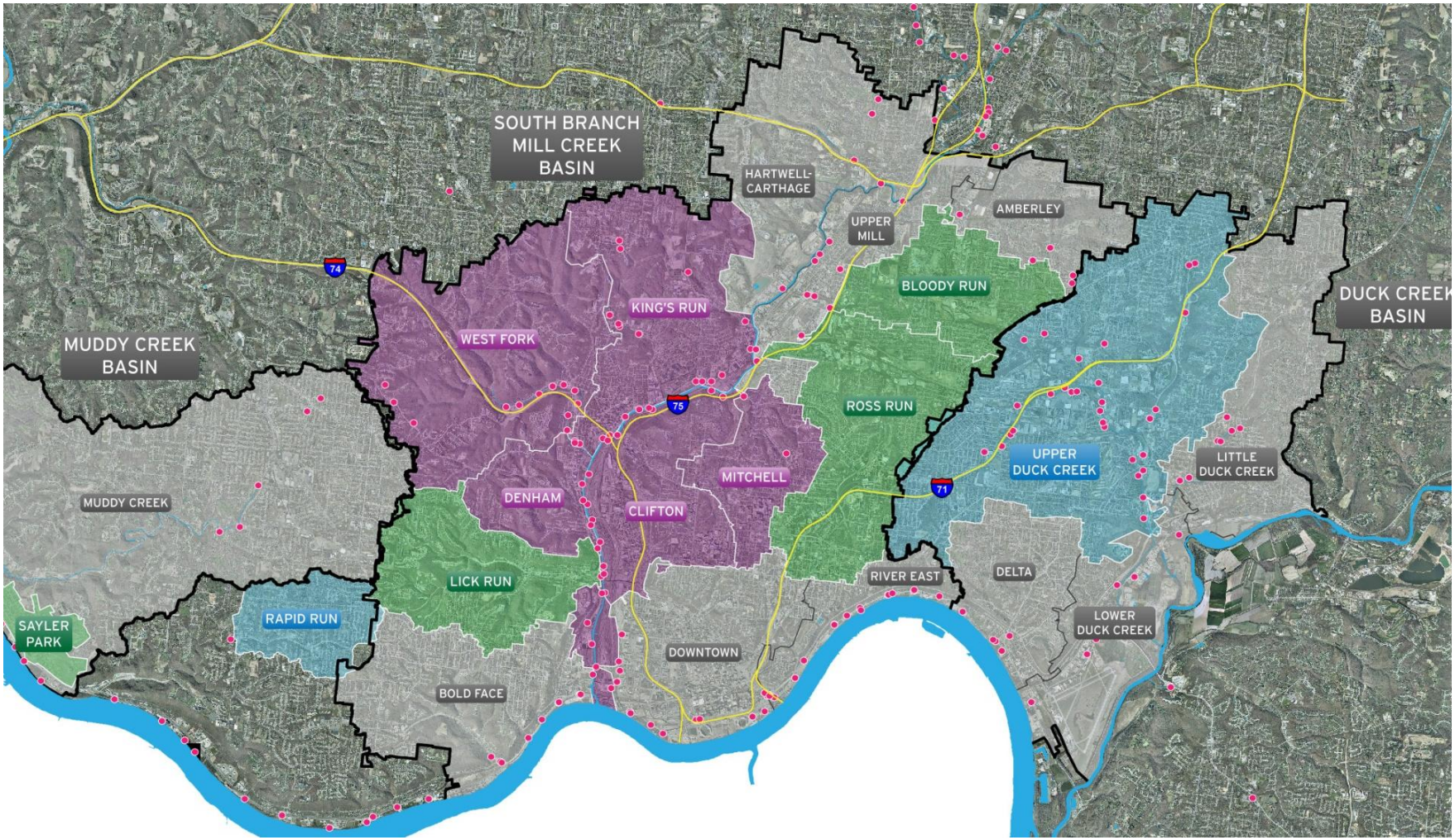
WHY



2002-2009

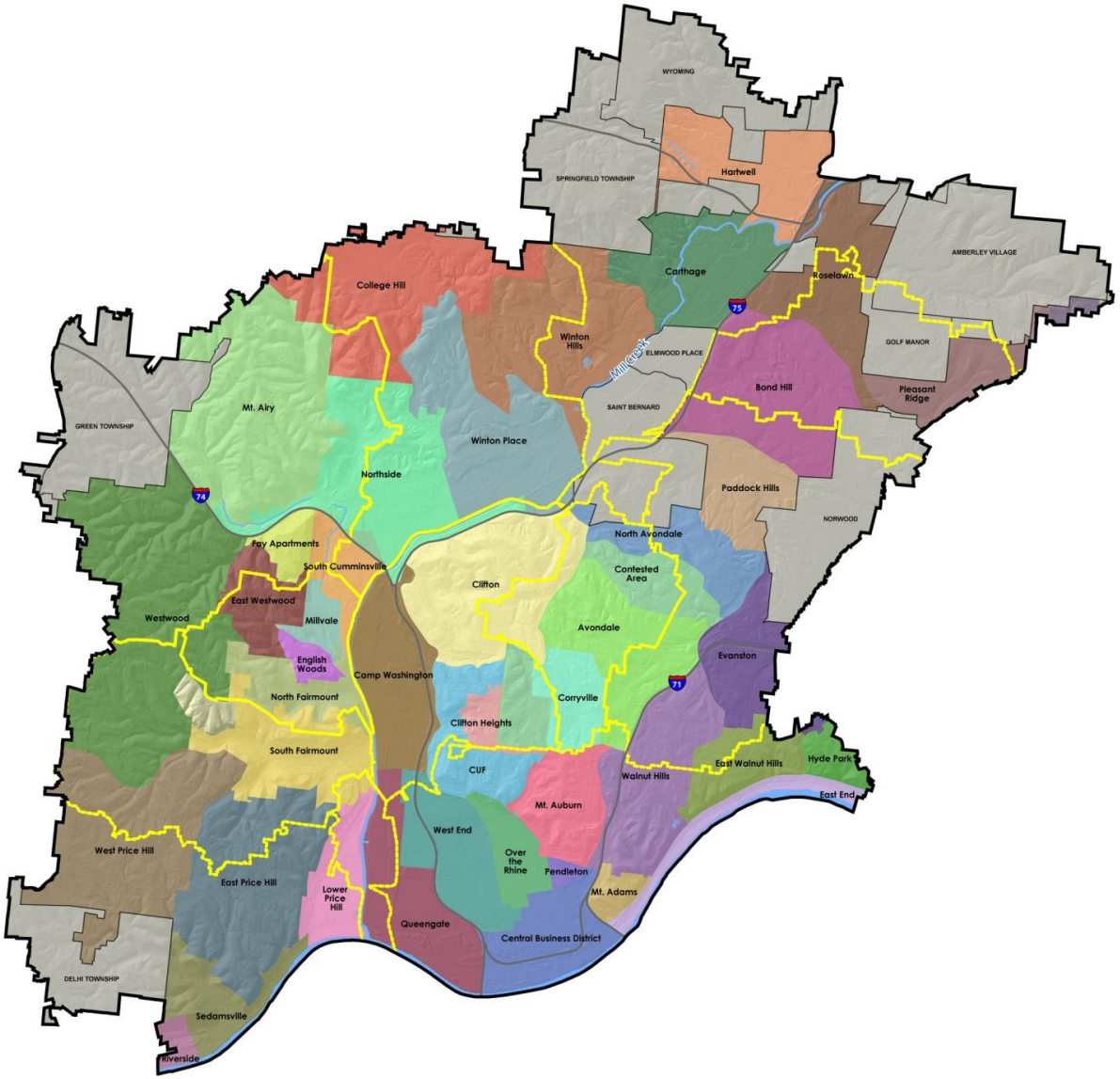
WHERE

MSD's Watersheds & Sub-Basins



“The Lower Mill Creek Watershed”

WHERE

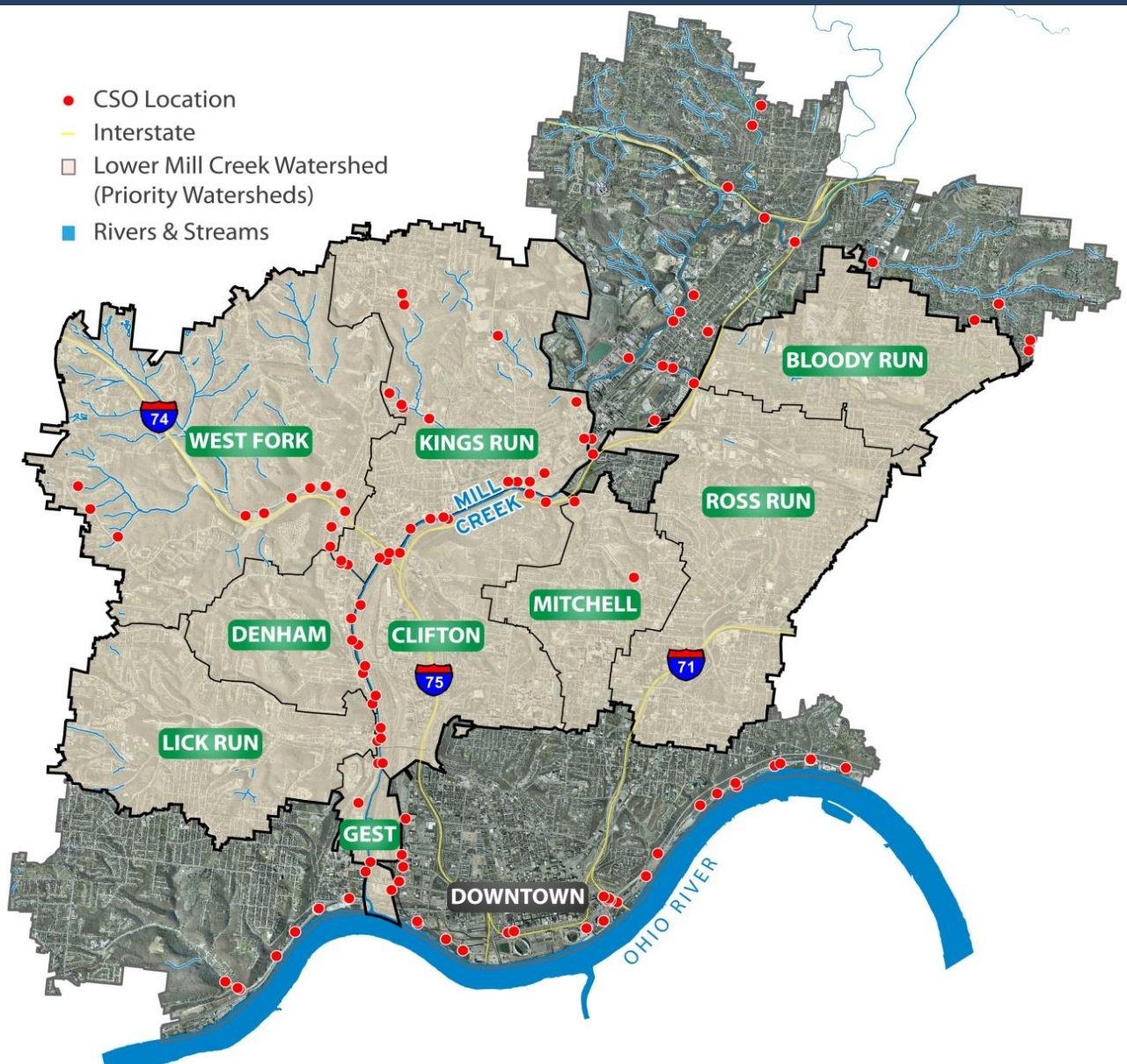


NEIGHBORHOODS

- Camp Washington
- Clifton
- College Hill
- East Price Hill
- Lower Price Hill
- Mt. Airy
- Northside
- Queensgate
- S. Cummingsville
- S. Fairmount
- Spring Grove
- Westwood Twp
- Winton Hills

“The Lower Mill Creek Watershed”

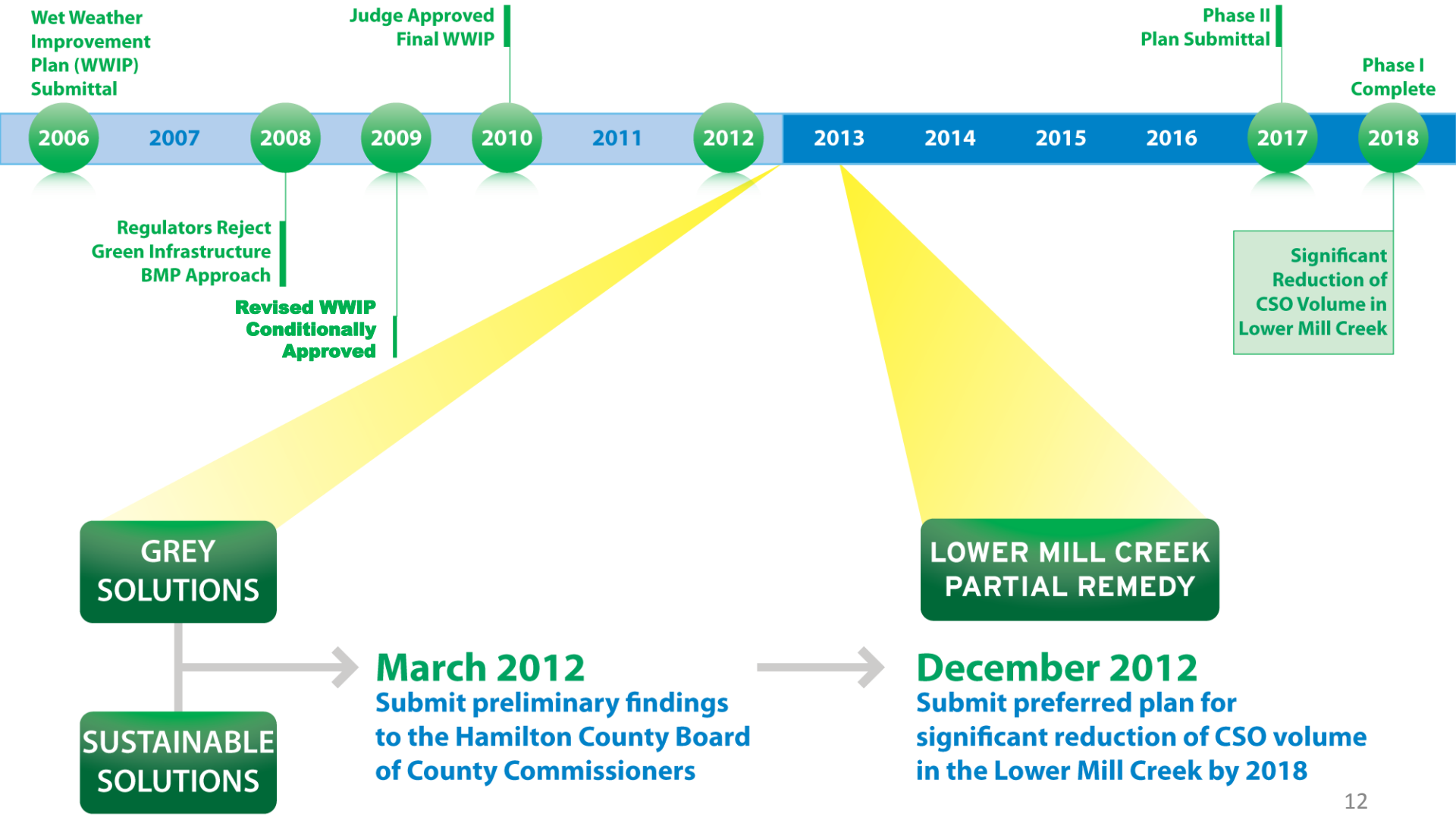
WHERE



WHAT

CSO LMC Control Mandates

WHAT



USEPA Guidance Criteria for LMCPR

Information required to be included in the LMC Study report for the Regulators to consider an alternative solution.

Guidance Pertaining to Consideration of Any Proposed Revised Original Lower Mill Creek Partial Remedy Defendants May Choose to Submit in Accordance With Paragraph A.2 of the Wet Weather Improvement Program
Draft for Discussion

Under the consent decrees between the United States, State of Ohio and Ohio River Water Sanitation Commission (the Regulators); and the Board of County Commissioners for Hamilton County and City of Cincinnati (Defendants), Defendants are required under to construct the Lower Mill Creek Partial Remedy (LMCPR) described in Attachment 1C to the Wet Weather Improvement Program (WWIP); in accordance with the schedule, performance criteria and design criteria set forth in Attachments 1A and 1B of the WWIP.

Paragraph A.2.a of the WWIP provides:

> Phase 1 will include a 3-year study/detailed design period to examine green measures and other measures to refine the Original LMCPR approach and cost estimates. Defendants may submit to the Regulators proposed changes to, or improvements on, the Original LMCPR remedy as a result of this study, provided the proposed revised remedy ("Revised Original LMCPR") provides equal or greater control of CSO annual volume as the Original LMCPR and is completed by the Phase 1 End Date. Defendants shall submit to the Regulators a LMCPR Study Report and any proposal for a Revised Original LMCPR by December 31, 2012.

The purpose of this document is to provide the Metropolitan Sewer District of Great Cincinnati (MSDGC) with guidance on certain issues that Defendants should consider if they choose to submit a proposed Revised Original LMCPR to the Regulators in accordance with Paragraph A.2.a of the WWIP. This document does not replace, revise, or amend the WWIP itself, or the consent decrees.

1. The primary means of determining if green control measures are equivalent to a planned grey infrastructure control measure will be model runs. The Hydrology and Hydraulic Model would be used to simulate the effects of the source control and green infrastructure measures (along with grey infrastructure elements that would be built) and provide specific information on the volume of overflows in a typical year. The Regulators will need to have a good understanding of the assumptions that were used in the model run, e.g., adjustments to the Hydrology inputs to reflect the source control/green infrastructure projects in order to conduct a review and concur on the model run results.

2. In addition to the model runs, a proposed Revised Original LMCPR should include the following:

(a) A detailed description of the source control/green infrastructure project(s), including specific technologies to be employed, project dimensions and configurations, material specifications and characteristics, project drawings that include the drainage area tributary to the proposed project, intended mode(s) of operation, and any other available information that may aid the Regulators in their assessment of the proposed project.

USEPA Policy Memo

"Cincinnati's 2004 consent decree (CD) … opportunities to incorporate green infrastructure solutions by substituting "green for grey" on a project by project basis."

"The city is currently evaluating potential green infrastructure projects and has a three year study and detailed design period to examine green solutions in the Lick Run Watershed, in Mill Creek Valley on the west side of Cincinnati."

"One promising project in the Lick Run drainage area, a corridor that includes an environmental justice community, would remove storm water flows from the combined sewer system and create a new above-ground drainage feature with surrounding park land. "

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
WASHINGTON, D.C. 20460

APR 20 2011

MEMORANDUM

SUBJECT: Protecting Water Quality with Green Infrastructure in EPA Water Permitting and Enforcement Programs

FROM: Nancy Stoner
Acting Assistant Administrator
Office of Water (OW)

Cynthia Giles
Assistant Administrator
Office of Enforcement and Compliance Assurance (OECA)

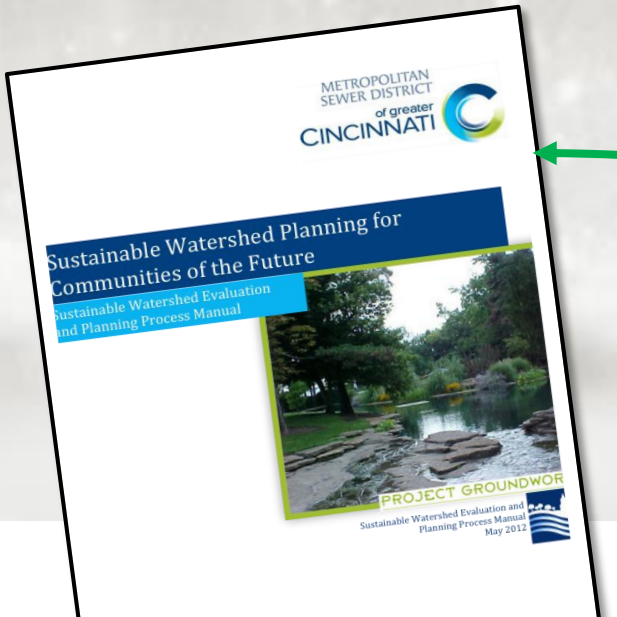
TO: EPA Regional Administrators, OW & OECA Office & Division Directors

The United States Environmental Protection Agency (EPA) strongly encourages and supports the use of green infrastructure approaches to manage wet weather through infiltration, evapotranspiration, and rainwater harvesting. As stated in previous memoranda,[1] EPA recognizes that green infrastructure can be a cost-effective, flexible, and environmentally-sound approach to reduce stormwater runoff and sewer overflows and to meet Clean Water Act (CWA) requirements. Green infrastructure also provides a variety of community benefits including economic savings, green jobs, neighborhood enhancements and sustainable communities. The benefits of green infrastructure are particularly enhanced in urban and suburban areas where green space is limited and environmental damage may be more extensive. The Office of Water (OW) and the Office of Enforcement and Compliance Assurance (OECA) are committed to working with interested communities and water resource managers to successfully incorporate green infrastructure into National Pollutant Discharge Elimination System (NPDES) permits, as well as remedies designed to address non-compliance with the CWA, to better manage both stormwater runoff and sewer overflows.

Given the multiple benefits associated with green infrastructure, EPA encourages the use

USEPA Integrated Planning Framework

Nancy Stoner, County Commissioner Portune, Director Parrott touring Lick Run Watershed



UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
WASHINGTON, D.C. 20460

JUN - 5 2012

MEMORANDUM

SUBJECT: Integrated Municipal Stormwater and Wastewater Planning Approach Framework

FROM: Nancy Stoner
Acting Assistant Administrator
Office of Water

Cynthia Giles
Assistant Administrator
Office of Enforcement and Compliance Assurance

TO: EPA Regional Administrators
Regional Permit and Enforcement Division Directors

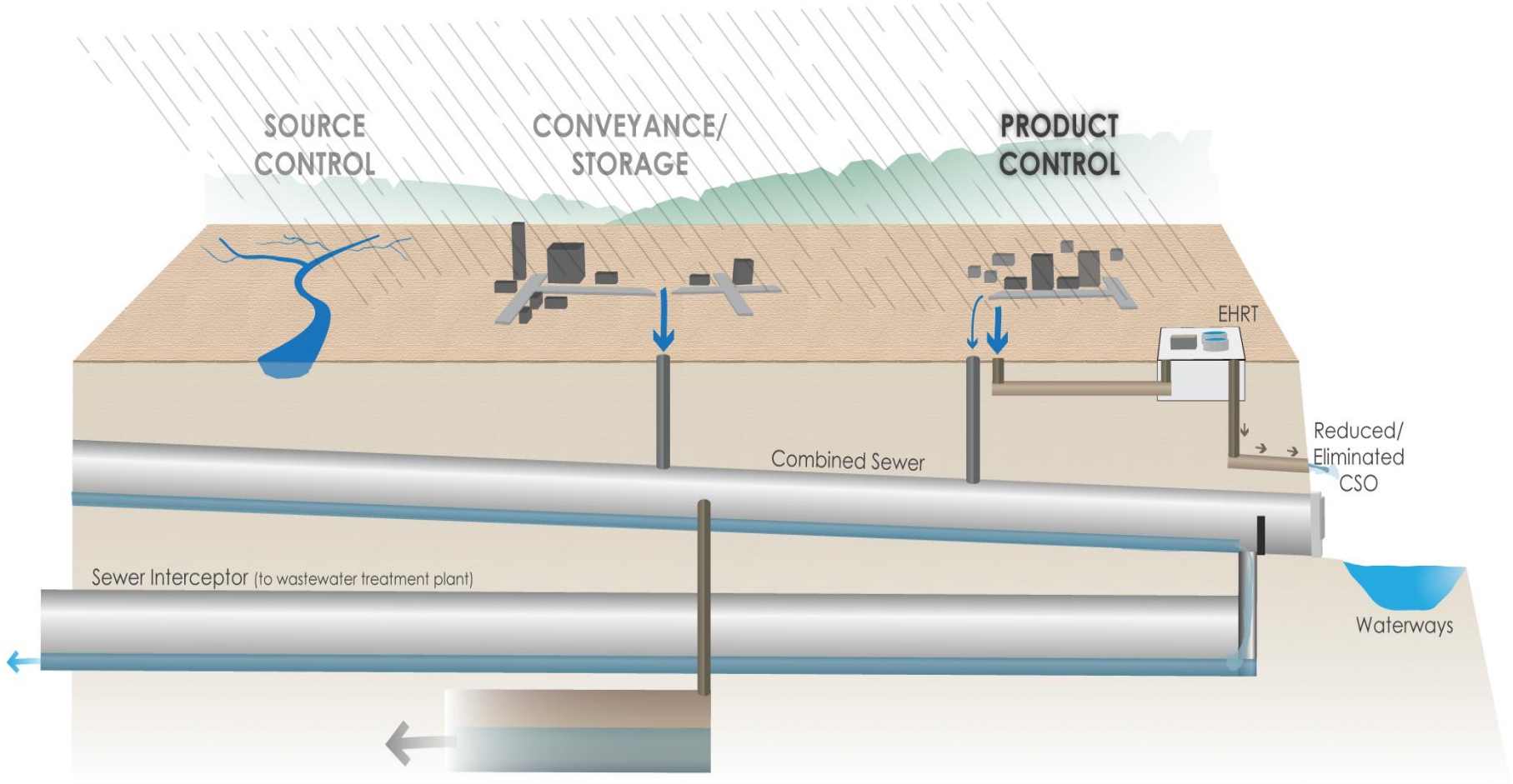
In recent years, EPA has increasingly embraced integrated planning approaches to municipal wastewater and stormwater management. EPA further committed to work with states and communities to implement and utilize these approaches in its October 27, 2011 memorandum *"Achieving Water Quality Through Municipal Stormwater and Wastewater Plans."* Integrated planning will assist municipalities on their critical paths to achieving the human health and water quality objectives of the Clean Water Act by identifying efficiencies in implementing requirements that arise from distinct wastewater and stormwater programs, including how to best prioritize capital investments. Integrated planning can also facilitate the use of sustainable and comprehensive solutions, including green infrastructure, that protect human health, improve water quality, manage stormwater as a resource, and support other economic benefits and quality of life attributes that enhance the vitality of communities.

To provide further guidance on developing and implementing effective integrated plans under this approach, we have developed, with extensive public input, the attached Integrated Municipal Stormwater and Wastewater Planning Approach Framework document. We are posting the framework document on our website and, as they become available, will provide practical examples of how municipalities are implementing this approach. We would like to thank Regions 2, 4, 5, 7 and 10 for their assistance in conducting public workshops to gain input on the draft framework. We encourage all Regions to work with their States to identify

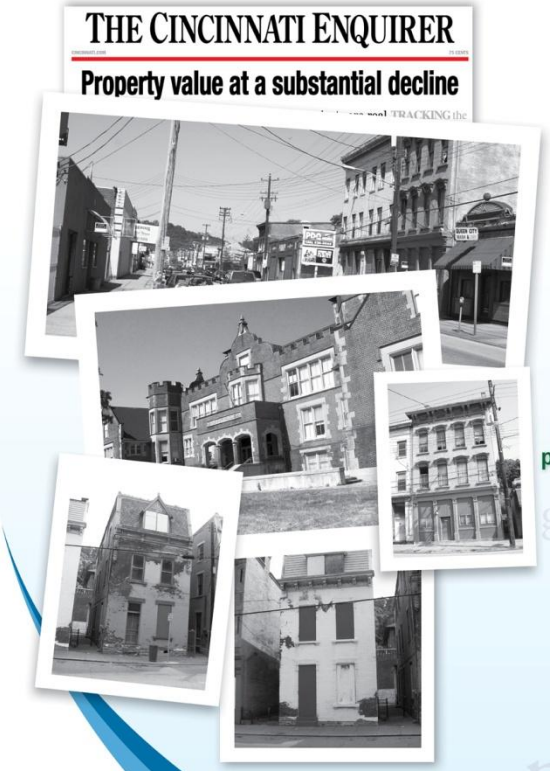
HOW

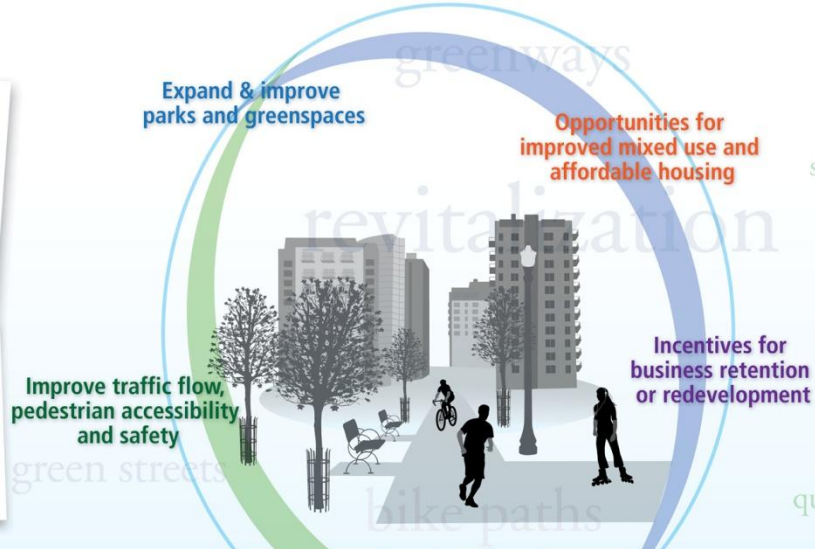
MSD's Wet Weather Strategy

HOW



Current Conditions in the Community → **Leverage MSD's Investment** → **Community's Vision for the Future**

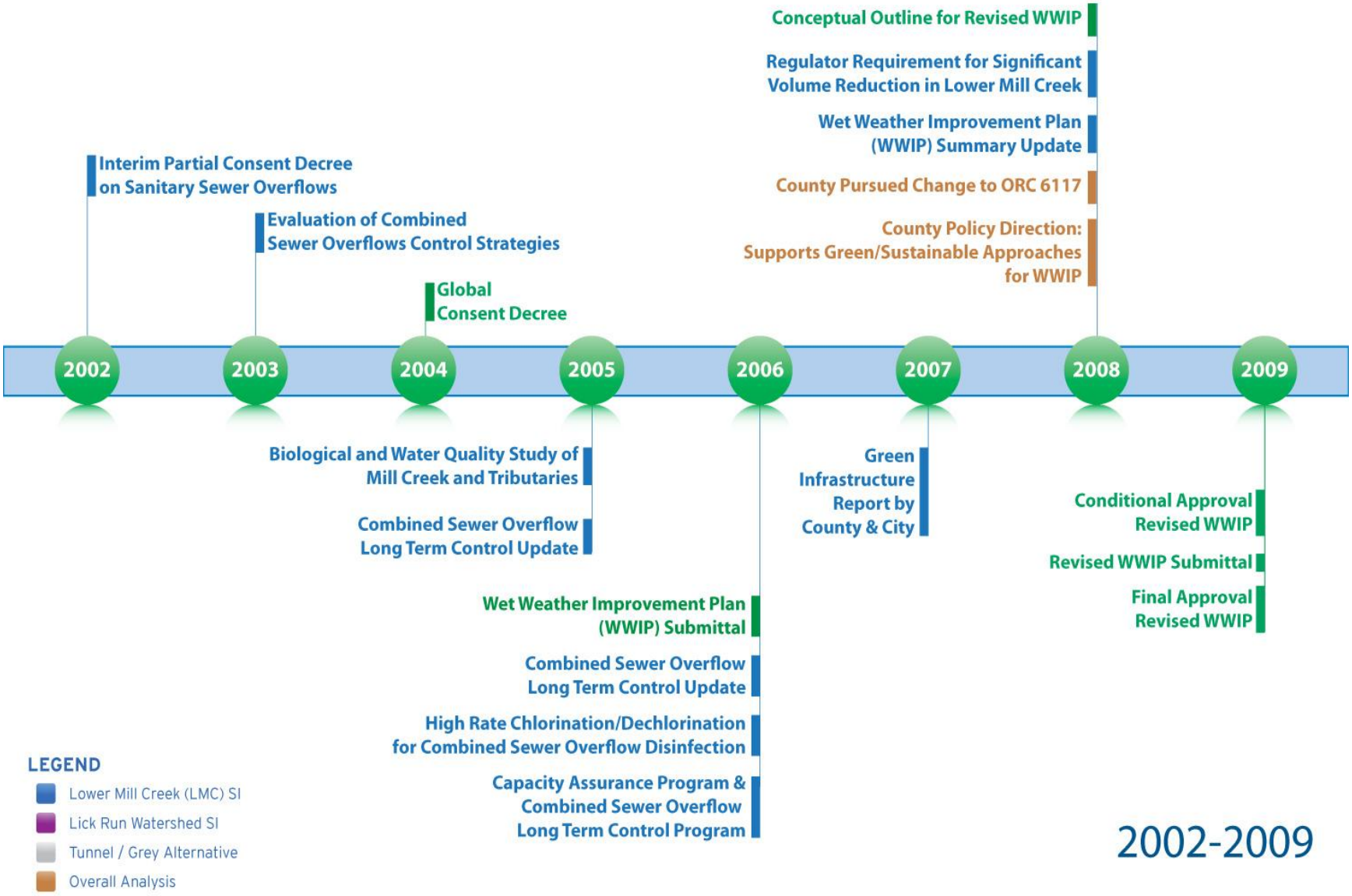




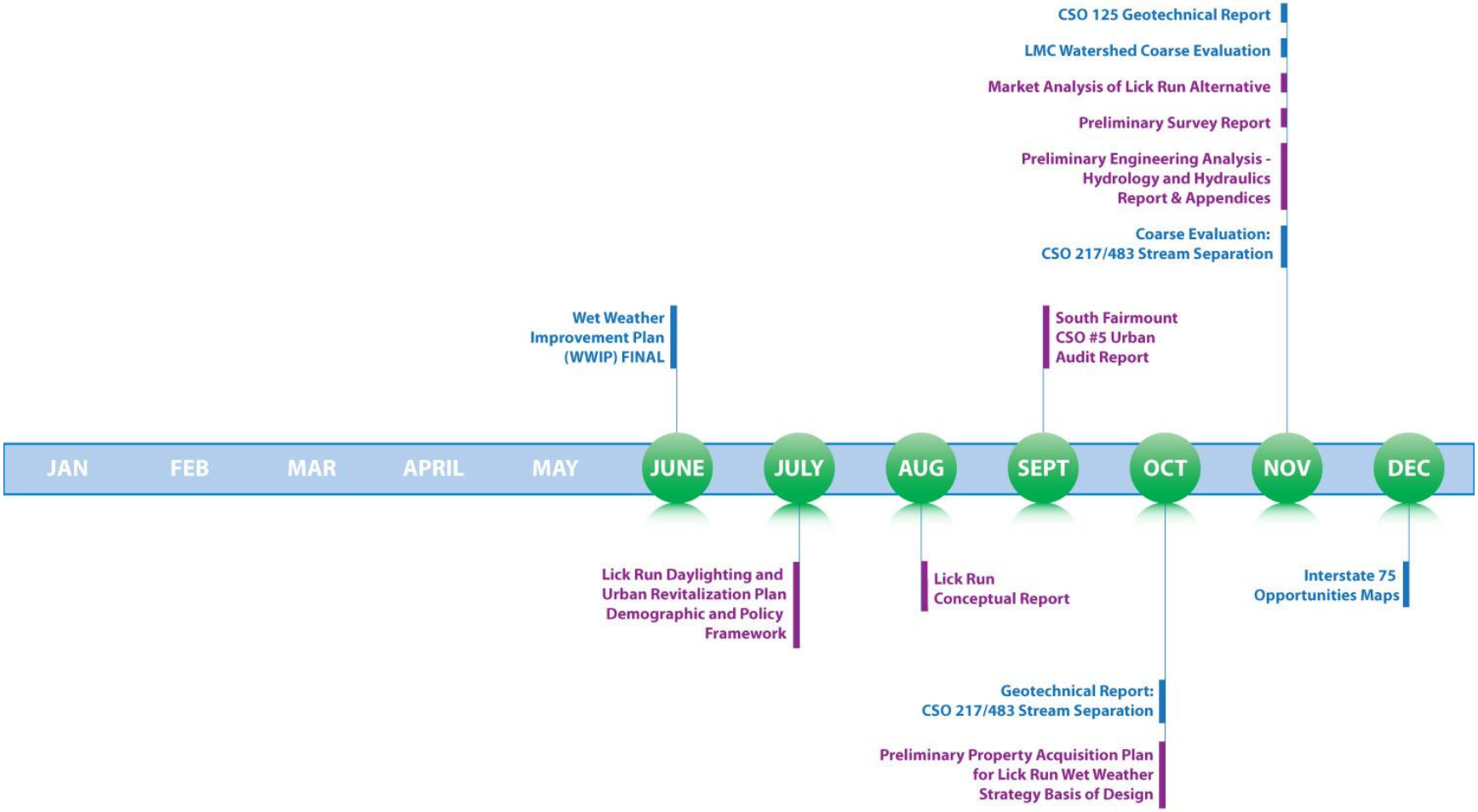
MSD
Metropolitan Sewer District
Investment to reduce sewer overflows and meet federal mandates

METROPOLITAN SEWER DISTRICT of greater CINCINNATI

History of Consent Decree



LMC Study Technical Evaluation & Analysis 2009

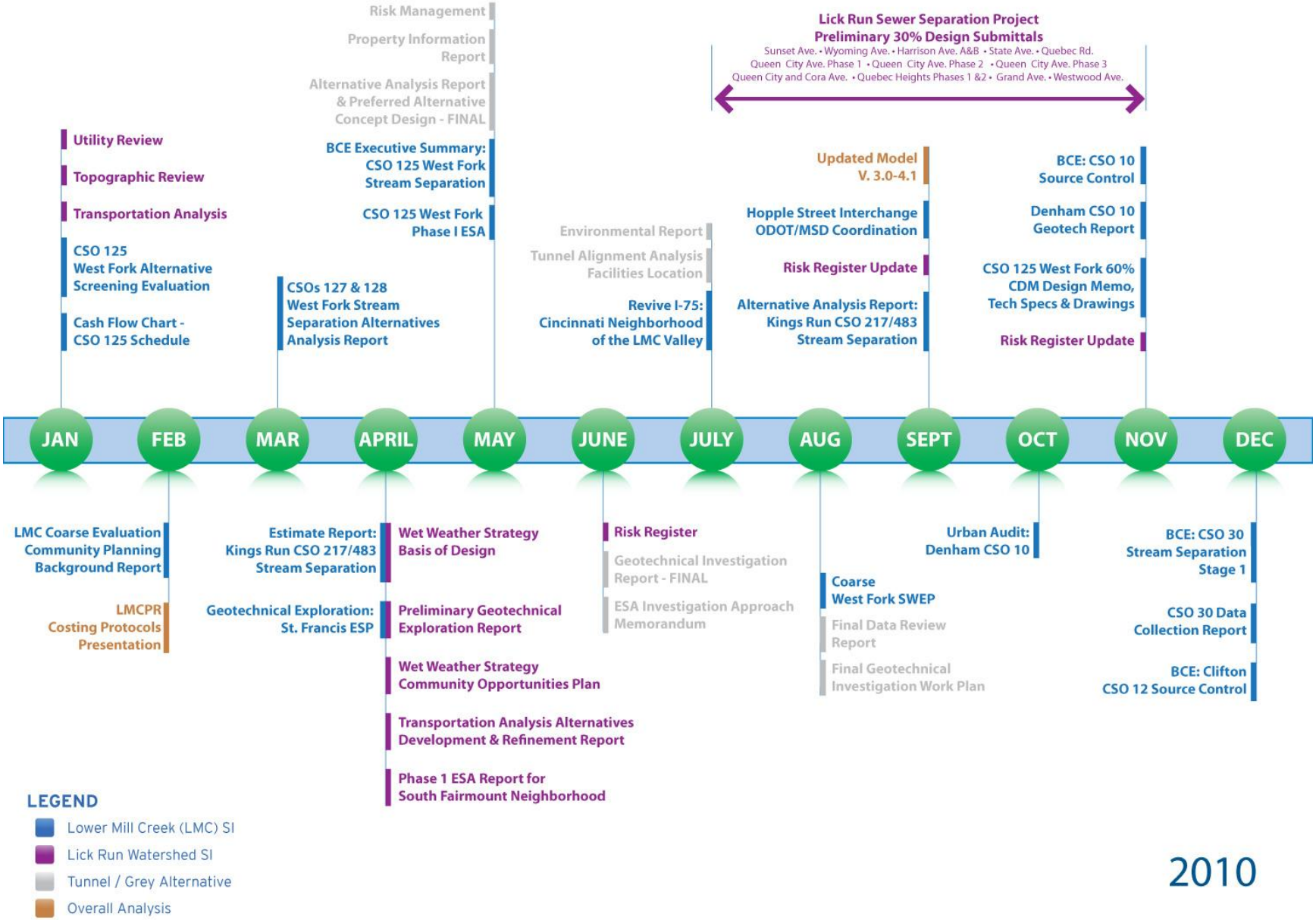


LEGEND

- Lower Mill Creek (LMC) SI
- Lick Run Watershed SI
- Tunnel / Grey Alternative
- Overall Analysis

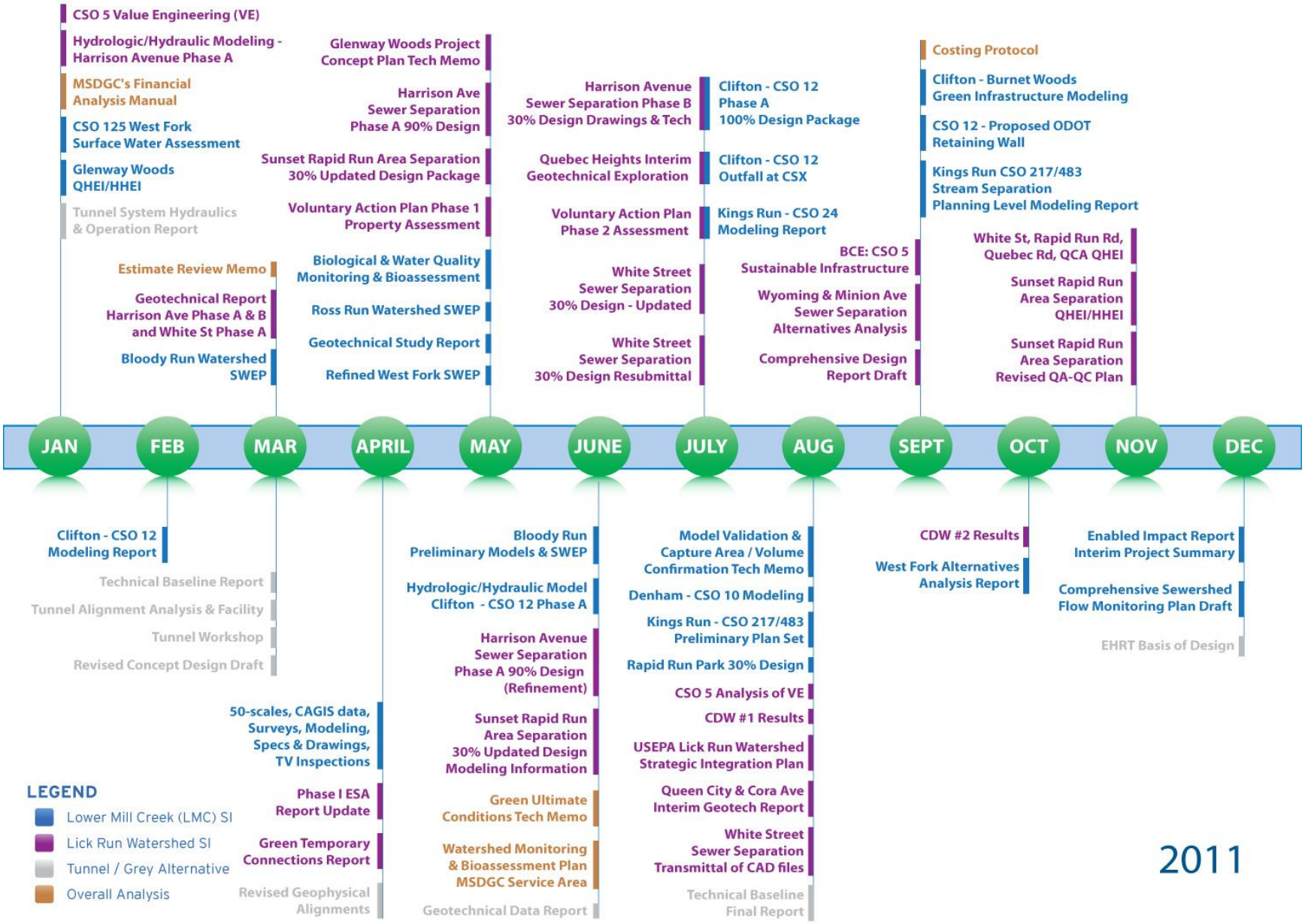
2009

LMC Study Technical Evaluation & Analysis 2010

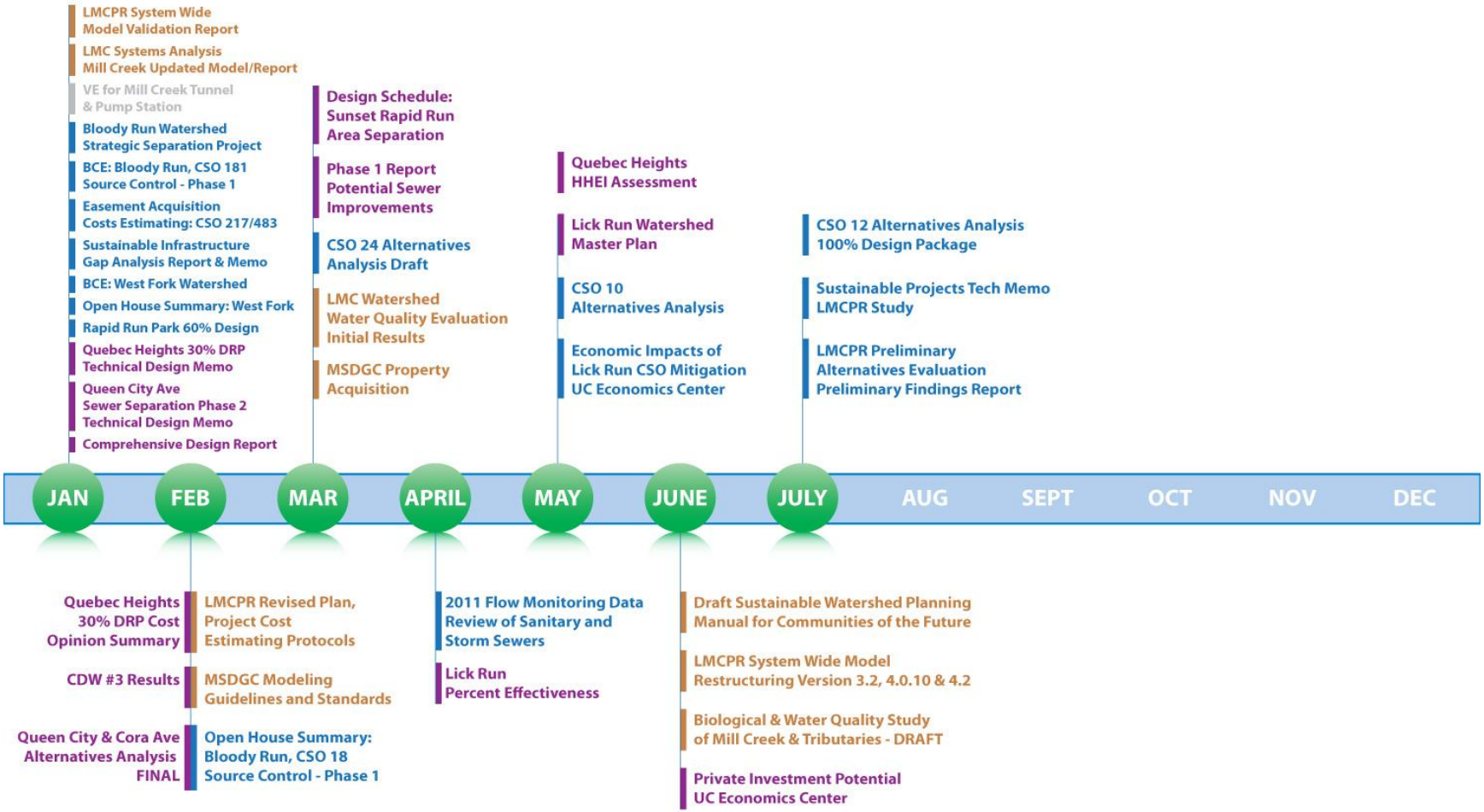


2010

LMC Study Technical Evaluation & Analysis 2011



LMC Study Technical Evaluation & Analysis 2012



2012

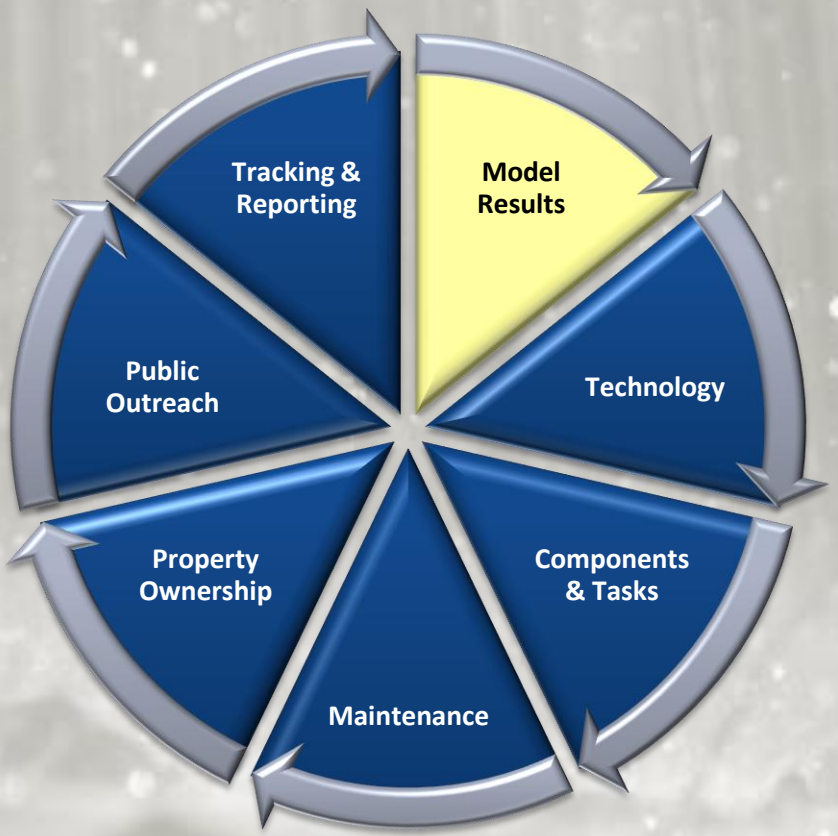
THE STUDY

Activity #1 = Model Updates

Model Results

"The primary means of determining if green control measures are equivalent to a planned grey infrastructure control measure will be model runs."

- Simulations for grey & green infrastructure
- Volumes overflow reduction
- Understanding of assumptions
- Hydrology inputs



Source: "Guidance Pertaining to Consideration of Any Proposed Revised Original Lower Mill Creek Partial Remedy Defendants May Choose to Submit in Accordance with Paragraph A.2 of the Wet Weather Improvement Program", USEPA, October 11, 2011.

Model Technology - 2005

EPA-SWMM Software *(version beta G)*

State of the Art software 2004-2006

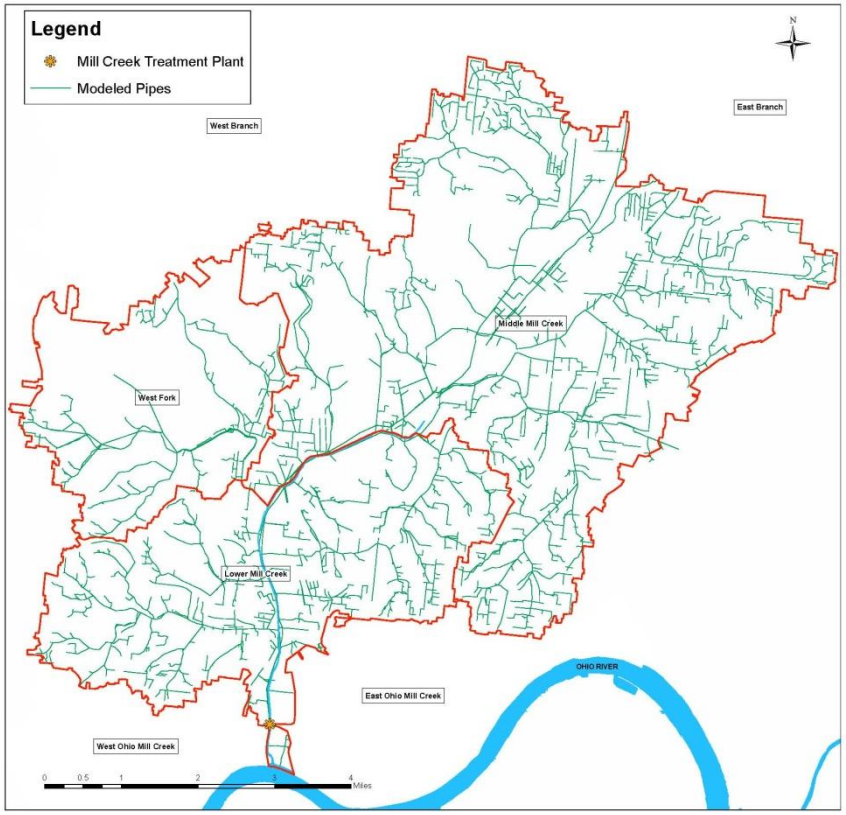
EPA Approved MSD Modeling Work Plan

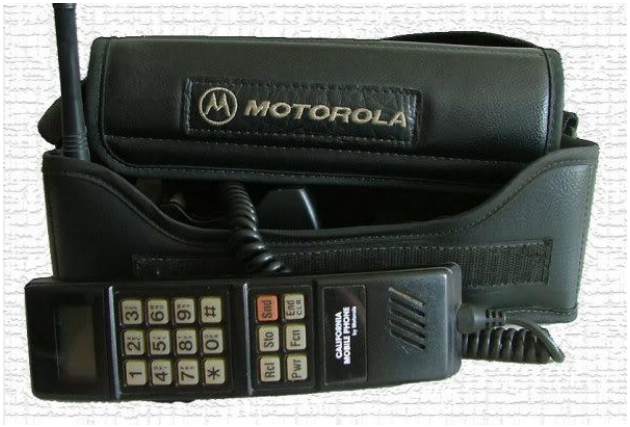
Long computational run times for updates

Limited hydraulic interaction

Limits on output file size = limits on simulations that can be evaluated

Generates planning level size, capacity, and performance





System Infrastructure from GIS

Model Technology Advances - 2011

Model Software

Updated EPA-SWMM Software

(version 5.0.13)

Advanced methodology uses calculations in lieu of fixed values

More realistic modeling of pumps, gates, RTCs, and hydraulics

Added evaporation to the model

Hydrologic parameters reviewed via GIS data, aerials, drawings, site visits

Hydraulics adjusted for pipe diameter & shape, sediment accumulation

CSO structures modeled to consider backflow conditions

Model calibrated using system flow monitoring data

Field verification

Pipe condition adjustments

Customize climate data

Realistic operation of pumps, gates, RTCs

System backflow

Scenario Planning

Advanced calculations in lieu of fixed values

System Infrastructure from GIS

Updated Baseline LMCPR Model

The updated baseline model better reflects operational behavior of MSD's combined sewer system due to advances in modeling software and computing speed since 2006.

Modeled Volumes	Original WWIP Model	Updated Baseline Model 3.2
Inflow (MG)	13,282	10,160
Overflow (MG)	8,286	5,142
	2006 kinematic wave	*2012 fully dynamic*

Leveraging Benefits from Existing Infrastructure

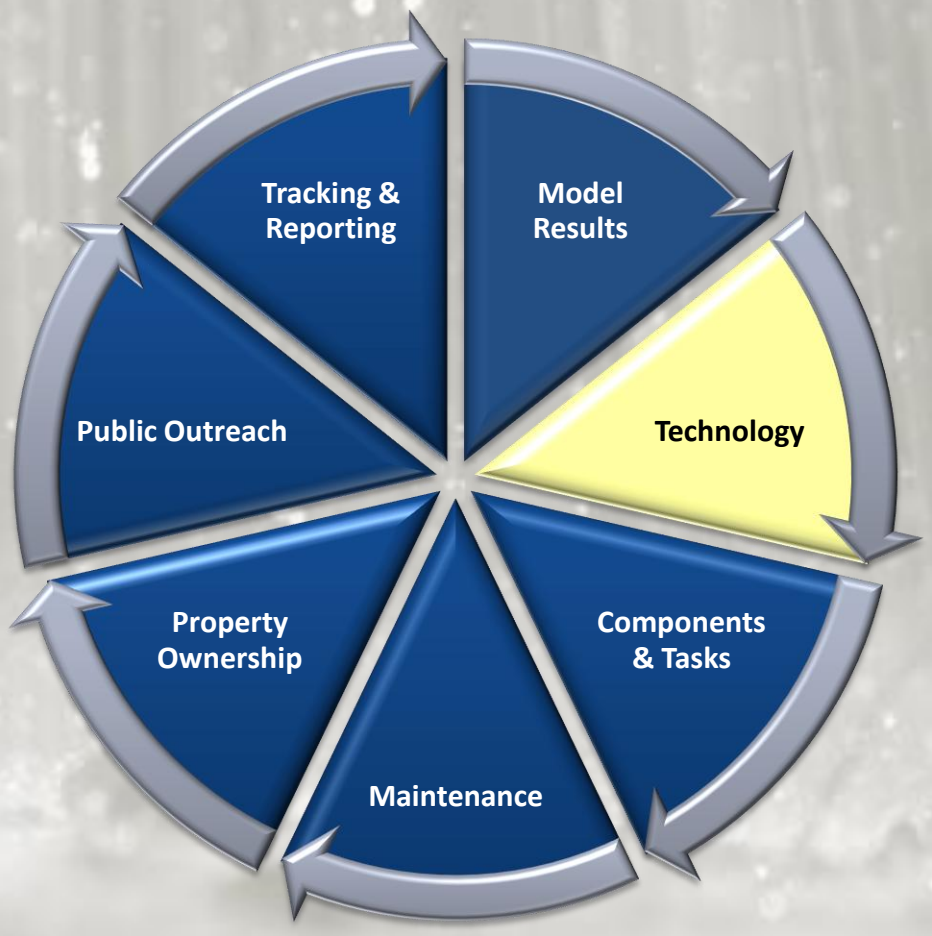
Real Time Control Facilities are designed to optimize the amount of combined sewage while minimizing overflows by storing wet weather flows until the interceptor has capacity.

- All four existing RTCs included in LMC Study
  - **CSO 5 Lick Run = 455 MG**
  - **CSO 125 Badgeley Run = 97 MG**
  - **CSO 482 Mitchell Avenue = 34 MG**
  - **CSO 487 Ross Run = 151 MG**
- Updated baseline model demonstrates **0.74 BG** CSO reduction with the four RTCs

Activity #2 = Default Remedy Evaluations

Technology

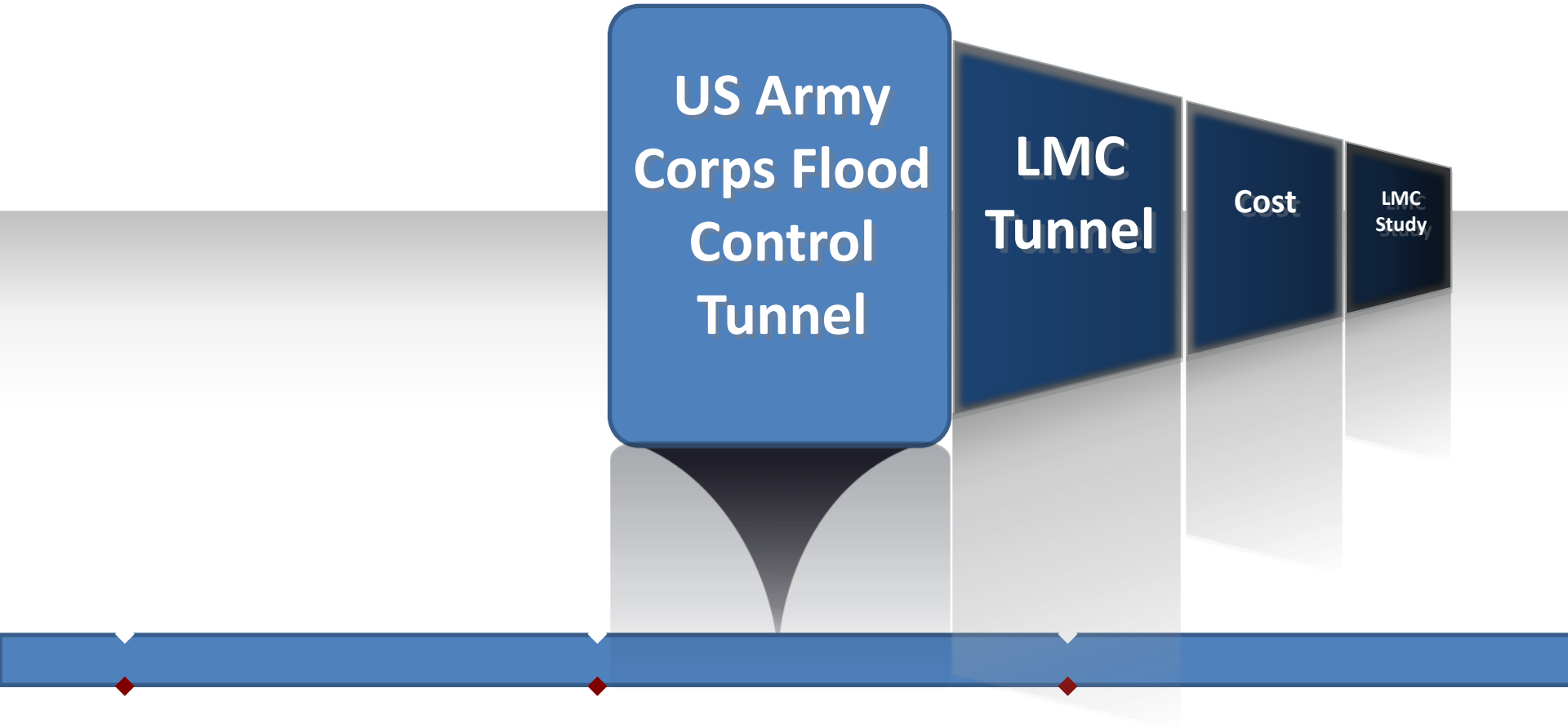
Detailed description of technologies and intended mode of operation



Source: "Guidance Pertaining to Consideration of Any Proposed Revised Original Lower Mill Creek Partial Remedy Defendants May Choose to Submit in Accordance with Paragraph A.2 of the Wet Weather Improvement Program", USEPA, October 11, 2011.

LMCPR Default Project

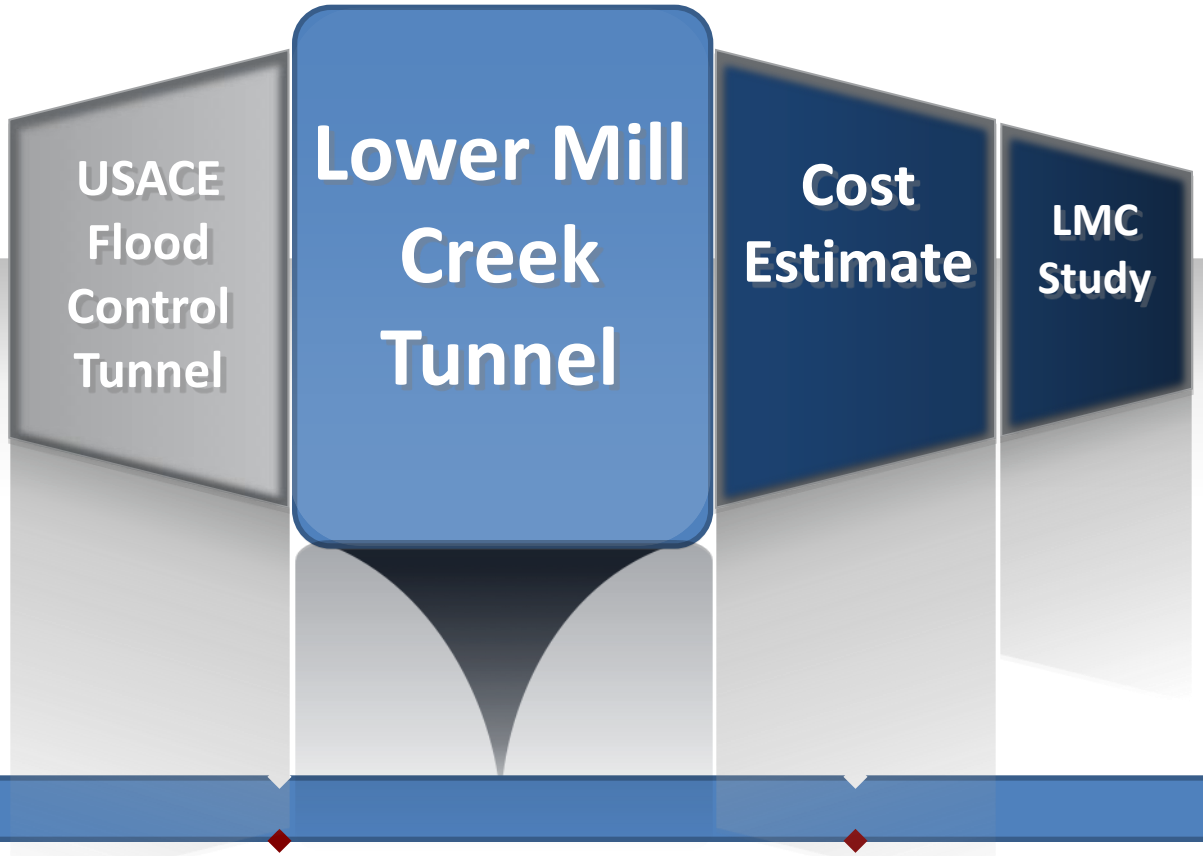
Initial Purpose



2000-2004 Global Consent Decree negotiated in context of potential 16-mile USACE flood control tunnel in Mill Creek

LMCPR Default Project

CSO Tunnel



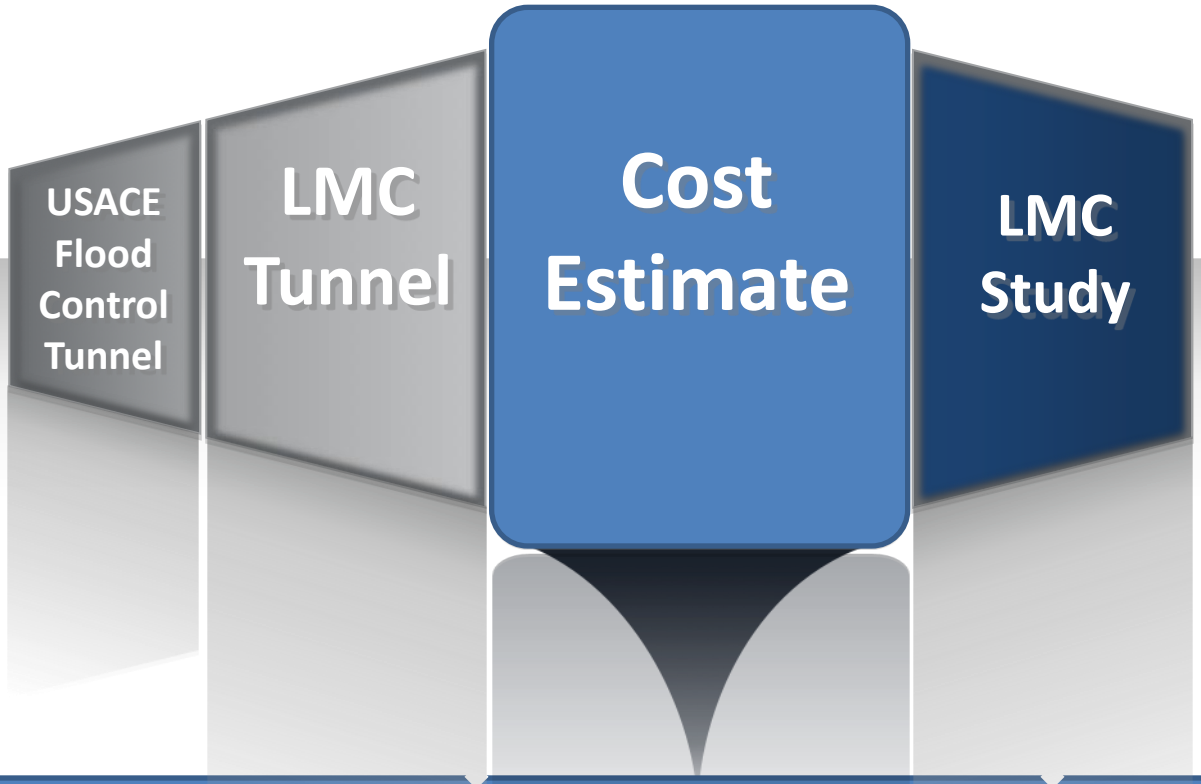
2006-2008 USEPA & OEPA insisted on developing CSO control measures in Mill Creek

Conceptual Outline for tunnel to Mitchell Avenue

Concept based on similar projects across US and assumed geotech conditions

LMCPR Default Project

Original Cost Estimate

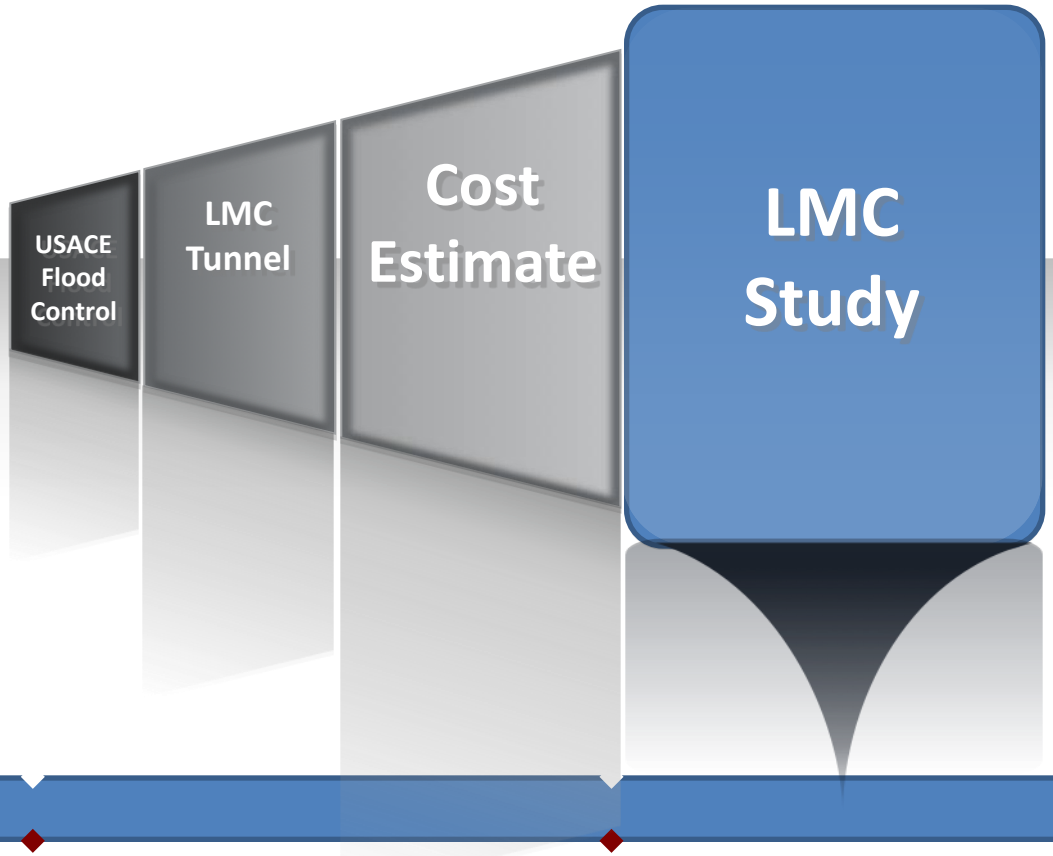


Considerable review and vetting 2008-2009 by PMC & Consultants

Wet Weather Improvement Program estimates approved by USEPA, OEPA, County, and MSD

Costs were planning level and additional site-specific studies and detailed design was necessary to evaluate costs.

LMCPR Default Project



All parties recognized costs were highly conceptual.

Due to considerable uncertainty over costs and the impact of such a large project on the overall affordability of the WWIP, Regulators approved a three year LMC Study because they recognized uncertainty inherent in moving from planning to detailed design.

LMCPR Default Project

Cost Refinement

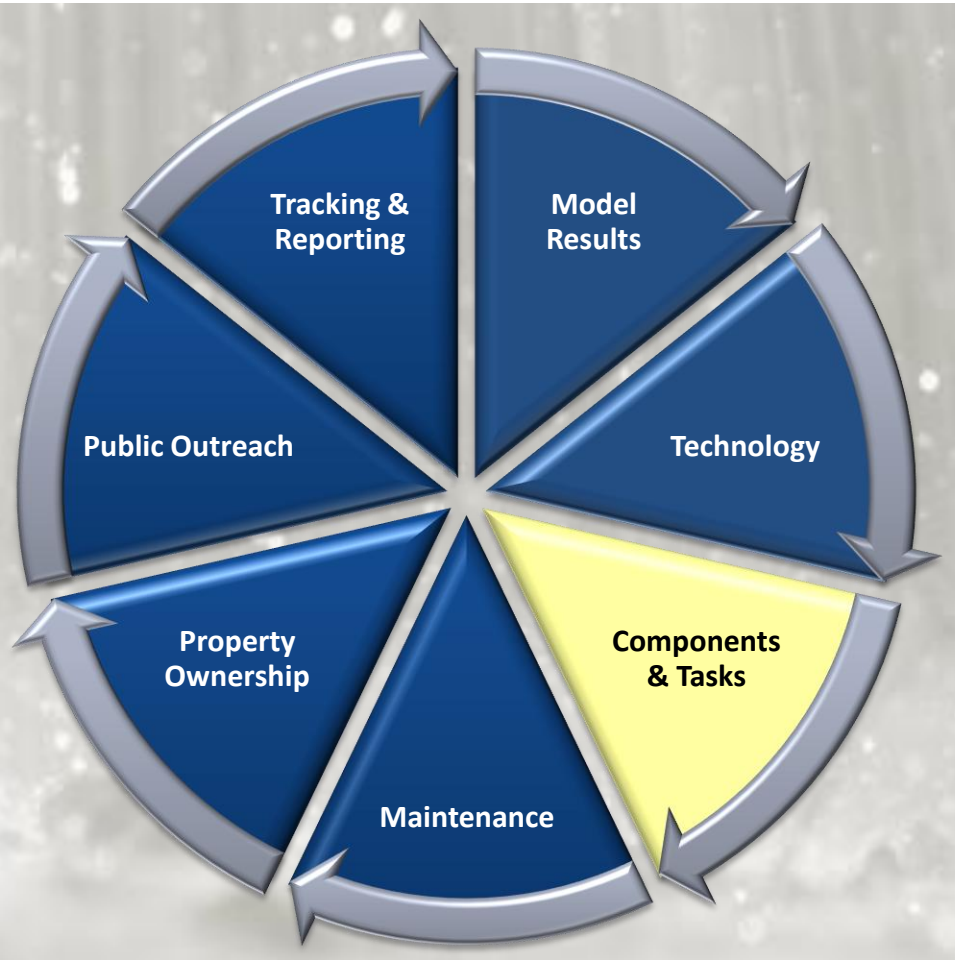
	2005	2009		2011	
Project Component	**Original Project Estimate**	**Updated Original Project**		**Revised Project Estimate**	
Tunnel	**$ 104,783,000**	*thicker walls required for drop shafts*	**$ 137,498,000**	*shallower depth for tunnel, extension on northern terminus for future connection*	**$ 120,776,000**
Consolidation Sewers	**$ 12,128,000**	*additional 5,000 ft sewers, higher unit prices*	**$ 32,305,000**	*4 CSO diversion relocations, extra 1,350 ft long, 72-in dia, 230-ft deep microtunneled sewer crossing CSX rail yards*	**$ 50,750,000**
Pump Station	**$ 15,688,000**	*screening, electrical, control building*	**$ 24,618,000**	*screening structure, cavern style station for hydraulics and safety, 2 deep shafts*	**$ 54,235,000**
Enhanced High Rate Treatment	**$ 13,712,000**	*higher unit prices*	**$ 19,638,000**	*no change*	**$ 19,638,000**
Contingencies	**$ 36,579,000**	*% of higher prices*	**$ 53,515,000**	*% of higher prices*	**$ 65,031,000**
Soft Costs	**$ 61,452,000**	*% of higher prices*	**$ 89,907,000**	% of higher prices	**$ 104,016,000**
Total	**$ 244,342,000**		**$ 357,481,000**		**$414,446,000**

Costs are presented in 2006 dollars

Activity #3 = Develop Alternatives

Components & Tasks

List of tasks required for implementation with cost and schedule



Source: "Guidance Pertaining to Consideration of Any Proposed Revised Original Lower Mill Creek Partial Remedy Defendants May Choose to Submit in Accordance with Paragraph A.2 of the Wet Weather Improvement Program", USEPA, October 11, 2011.

Basis for LMC Study Alternatives Evaluation

- The Final Wet Weather Improvement Program required that any Lower Mill Creek PARTIAL Remedy alternative provide equal or greater control of CSO annual volume as default project, be completed by applicable WWIP deadlines, and work within a plan for a Lower Mill Creek FINAL Remedy.

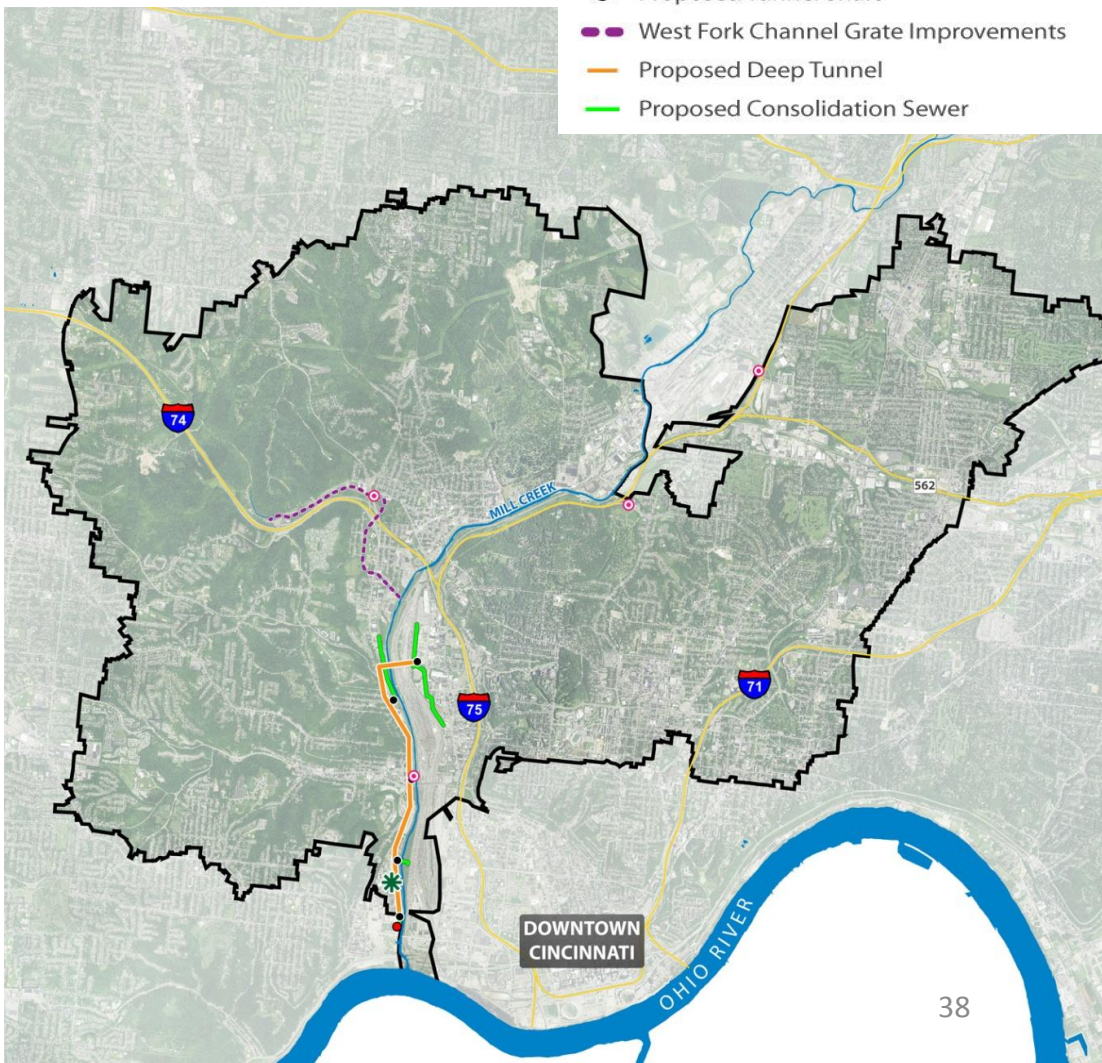
- The alternatives that follow are based on a target volume capture of 2 BG *under the updated modeling,* which recognizes less overflow from the system than did the original model.

- The 2 BG figure is used here merely to illustrate potential grey and sustainable alternatives and does not necessarily represent a final requirement for an LMCPR alternative submission.

- Lower Mill Creek overflows that are not addressed in the LMCPR in Phase 1 will be addressed in Phase 2 of the WWIP in the Lower Mill Creek FINAL Remedy.

Grey Alternative Components

- **Real-time control (RTC)** *(four total)*
- **West Fork Channel grate modifications** ***vs. as-is condition***
- **Deep tunnel** *(25 feet in diameter, 15,300 feet in length)* ***vs. 7,600 feet***
- **Consolidation sewers** *(varying diameter, 10,400 feet in length* ***vs. 5,000 feet***
- **Deep tunnel pump station** *(84 million gallons per day)*
- **Enhanced high-rate treatment (EHRT) facility** *(84 mgd)*



Grey Alternative

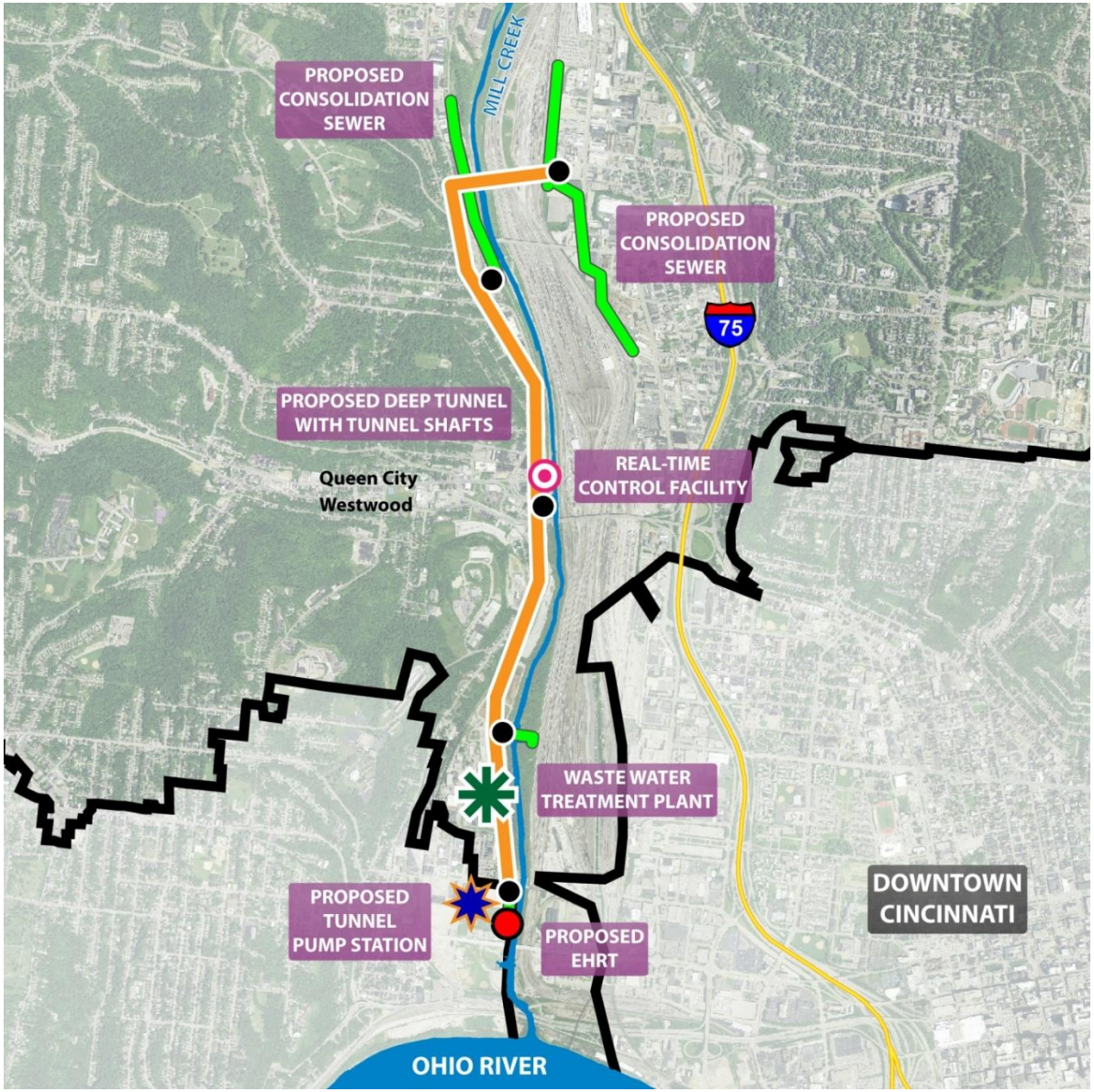
Cost Update

Project scope and cost based upon updated model.

Project Component	Revised Project Estimate	Grey Alternative	
Tunnel	**$ 120,776,000**	*extended tunnel 7,700 feet to pick-up overflows from CSO 15, reduced tunnel diameter to 25 ft*	**$ 164,460,000**
Consolidation Sewers	**$ 50,750,000**	*additional sewers to collect flows from CSOs 12, 13, 14, and 15*	**$ 46,962,000**
Pump Station	**$ 54,235,000**	*no change*	**$ 54,235,000**
Enhanced High Rate Treatment	**$ 19,638,000**	*no change*	**$ 19,638,000**
Contingencies	**$ 65,031,000**	*% of updated prices*	**$ 99,853,000**
Soft Costs	**$ 104,016,000**	% of updated prices	**$ 152,261,000**
Total	**$ 414,446,000**		**$537,409,000**

Costs are presented in 2006 dollars

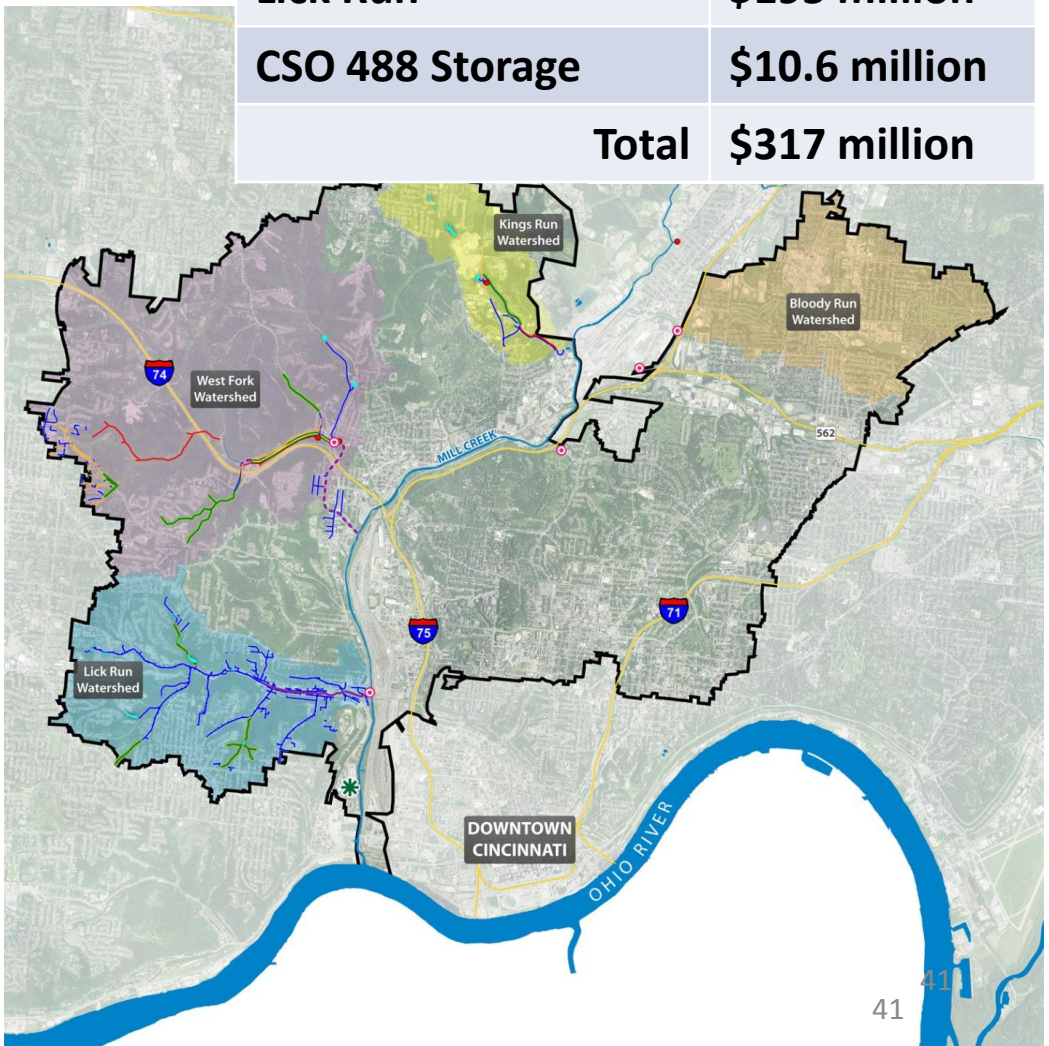
Preliminary Tunnel Concept serving CSO 15



Sustainable Alternative Cor

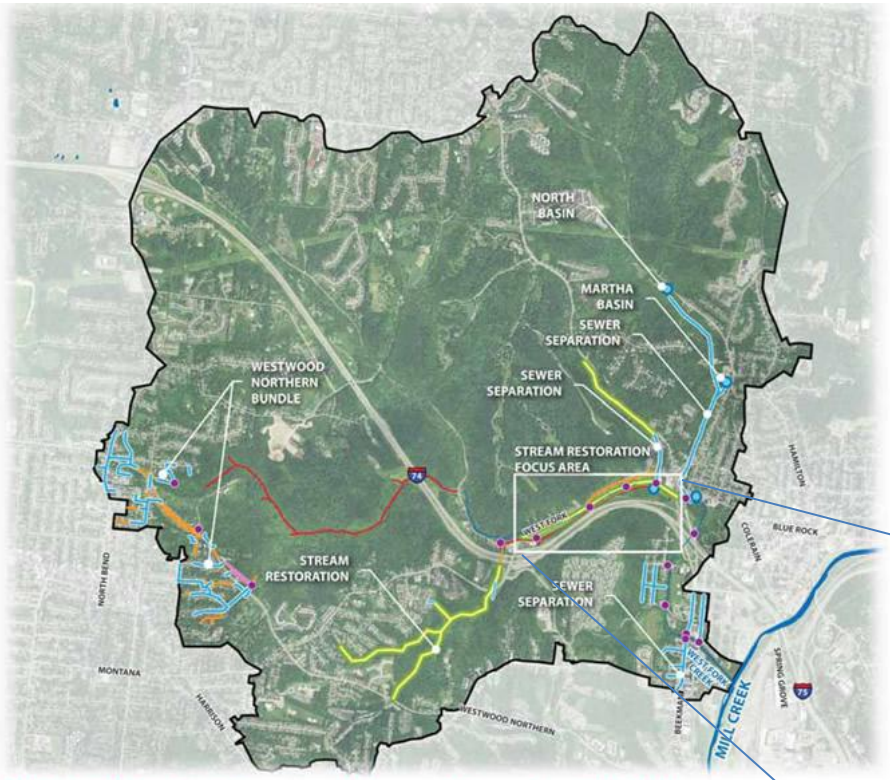
- **Real-time control (RTC)** *(five total)*
- **West Fork Channel grate mods**
- **New Storm Sewers** *(varying diameter, 104,400 feet in length)*
  - *West Fork, Kings Run, Lick Run*
- **Relocated combined sewers** *(varying diameter, 21,500 feet in length)*
- **Naturalized channels** *(5,500 feet in length)*
- **Valley conveyance system** *(8,100 feet in length)*
- **Stream separation** *(20,000 feet in length)*
- **Stormwater detention basins** *(80 acre-feet)*
- **Storage tanks** *(6.5 million gallons)*

Component	Cost (2006 $)
Kings Run	$35 million
West Fork	$73 million
Bloody Run	$3.4 million
Lick Run	$195 million
CSO 488 Storage	$10.6 million
Total	$317 million



41

Preliminary West Fork Source Control/Stream Restoration



West Fork Watershed: Overview of Proposed Source Control Solutions

Legend

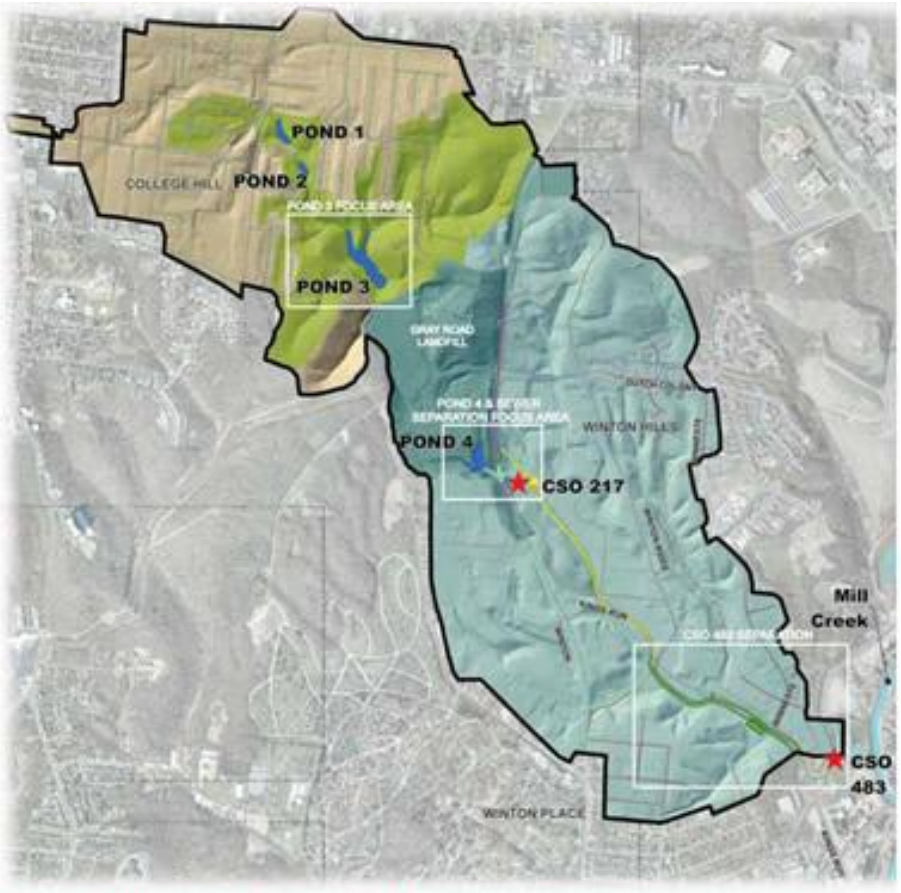
- Combined Sewer Overflow (CSO)
- Proposed Interceptor
- Proposed Sanitary Sewer
- Proposed Stream Restoration
- Proposed Open Channel
- Proposed Storm Sewer
- Proposed Detention / Storage
- West Fork Watershed Boundary
- River/Stream

Existing Condition: Concrete channel w/grates and overflow structures

Potential Solution: Separate flow from combined, consolidate overflows and construct natural conveyance

West Fork Open House January 2012 http://www.projectgroundwork.org/projects/lowermillcreek/sustainable/westfork/

Preliminary Kings Run Source Control



Kings Run Sub-Watershed: Overview of Proposed Source Control Solutions

Legend

- Phase 2 Treatment/Storage
- Proposed Sanitary Sewer
- Proposed Storm Sewer
- Proposed Combined Sewer
- Potential Phased Stream Restoration
- Proposed Storage Tank
- Proposed Detention Basin
- Proposed Detention Basin Drainage
- Proposed Separation Drainage (CSO 483)
- Proposed Separation Drainage (CSO 217)
- Existing Combined Sewer
- Existing Sanitary Sewer
- Existing Storm Sewer

Potential Solution: Intercept stormwater runoff and release it back into combined sewer system, stabilize stream banks, direct stormwater to Mill Creek

- Stormwater detention basins
- Separate storm & sanitary sewers
  - Dedicated storm sewer along Winton Road, Kings Run Road, & Winton Ridge Road (to Kings Run stream)
  - New combined sewer along Kings Run Road & convert existing to storm (to Mill Creek)
- Stream Restoration
  - Stabilize banks & minimize erosion
  - Improve CSO discharge conveyance

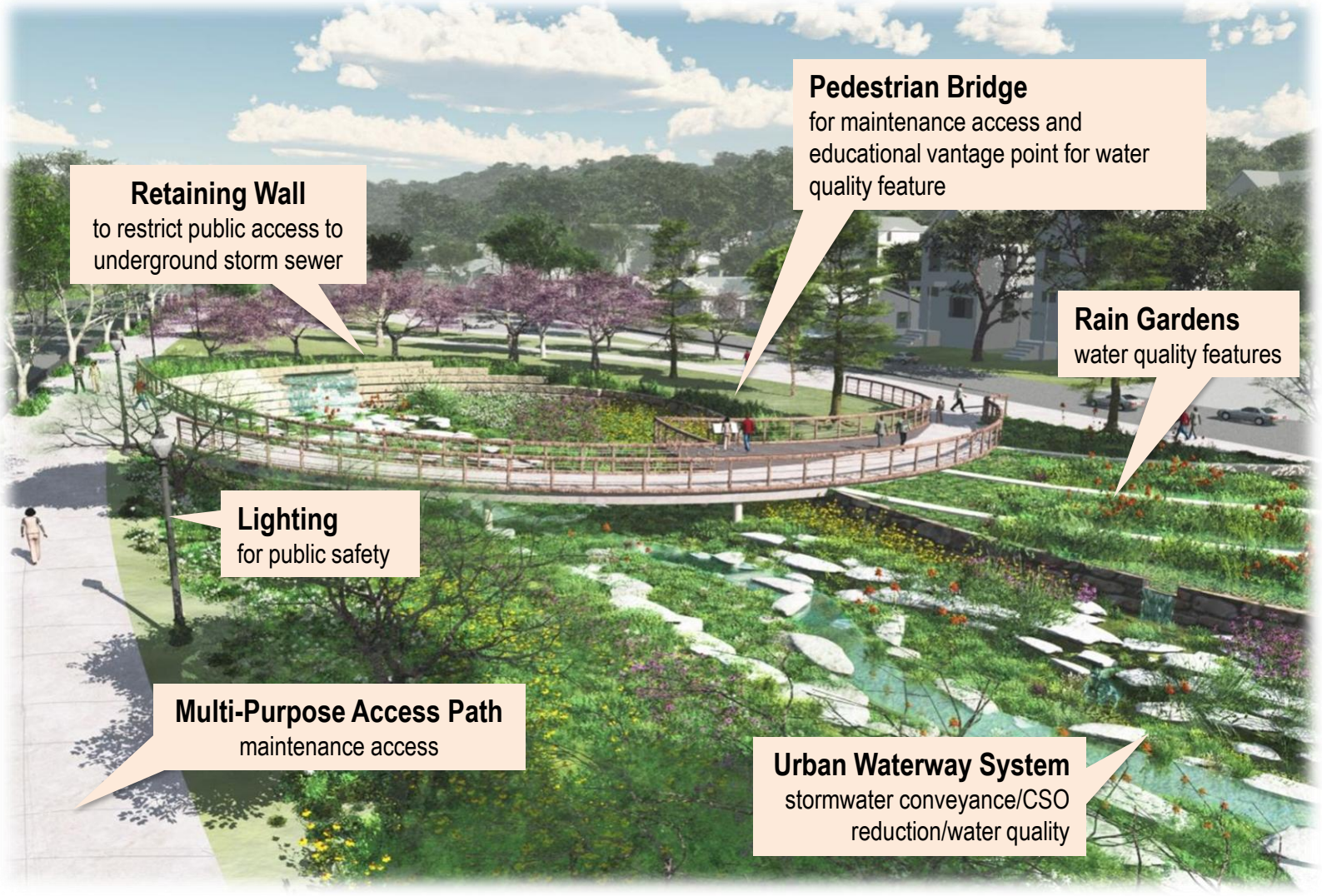
Kings Run Open House March 2012 http://www.projectgroundwork.org/projects/lowermillcreek/sustainable/kingsrun

Preliminary Lick Run Urban Waterway Concept

Lick Run Open House January 2011 http://www.projectgroundwork.org/projects/lowermillcreek/sustainable/lickrun

Leveraging Benefits of Integrated Solutions

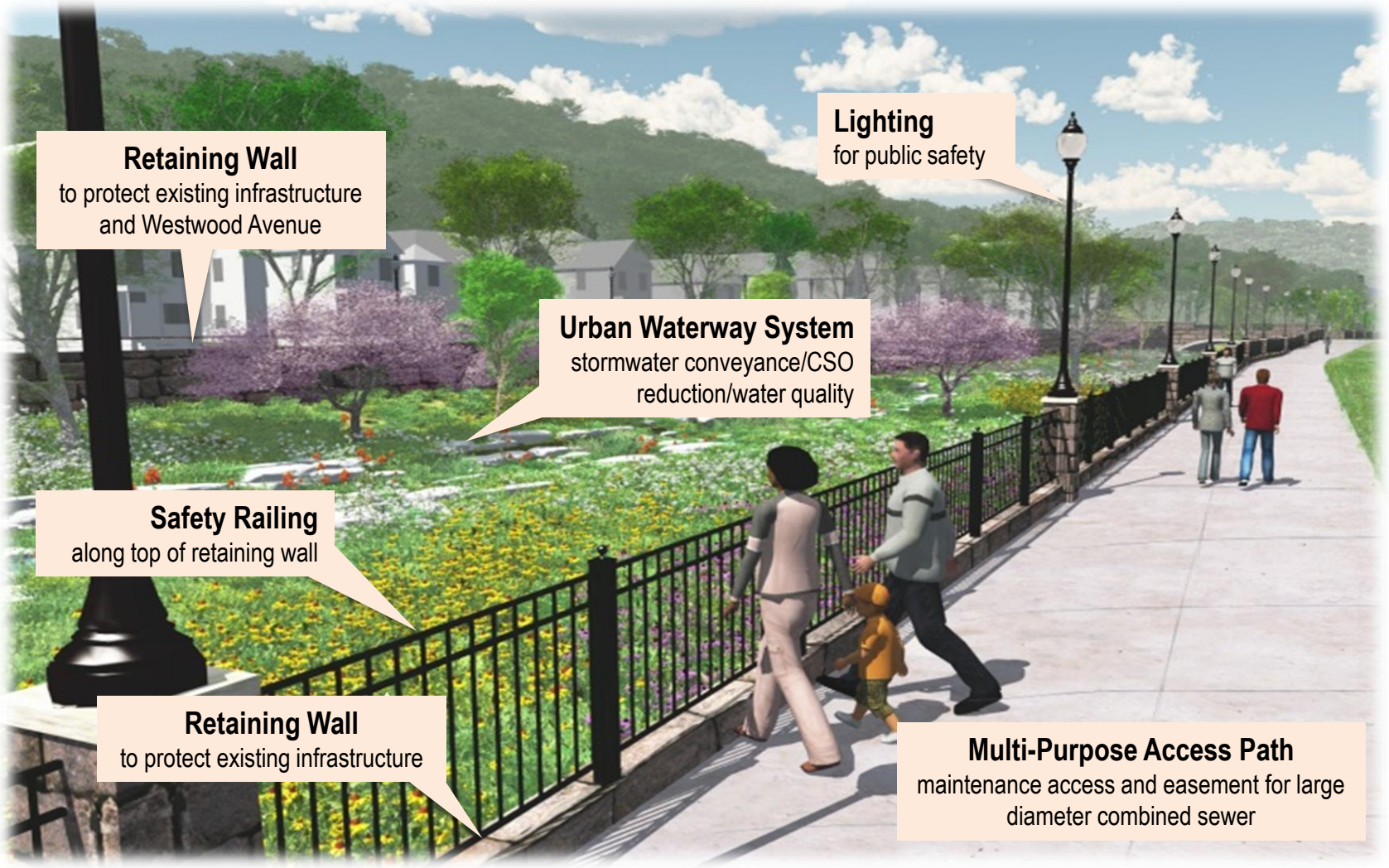
Western Gateway Zone



Looking north towards Queen City

Leveraging Benefits of Integrated Solutions

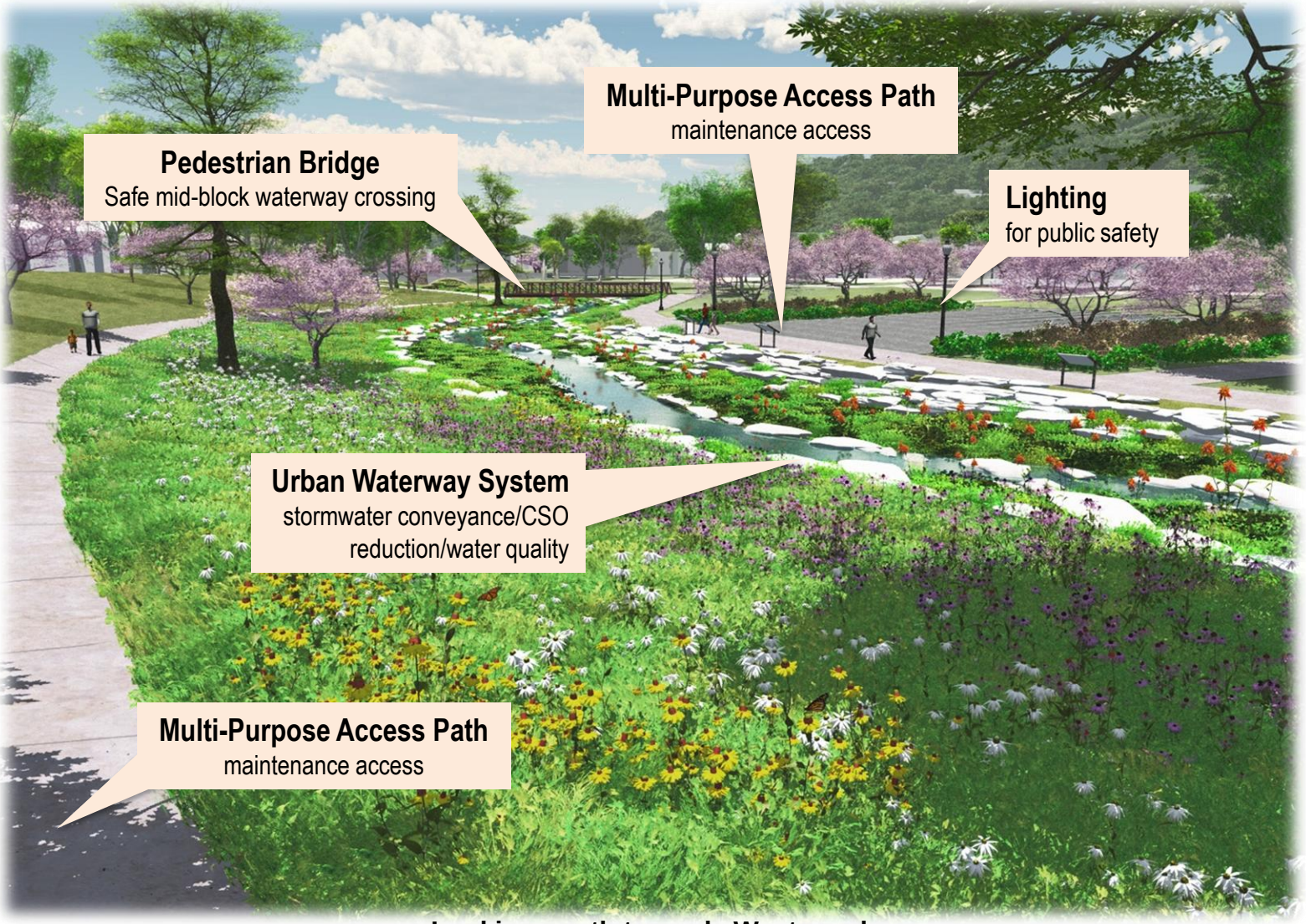
Narrow Channel Zone



Looking south towards Westwood Avenue

Leveraging Benefits of Integrated Solutions

Civic Recreation Hub



Looking south towards Westwood

THE RESULTS

Model Results Comparison

Baseline Model 3.2
(current conditions)

Grey Alternative

Sustainable Alternative

Model Results Comparison

Baseline Model 3.2
(current conditions)

Grey Alternative

Sustainable Alternative

Benefit & Risk Comparison

Significant CSO reduction
Greater reduction of bacteria in Mill Creek
Returns more base flow to Mill Creek
Reduction of rainwater volume to WWTP
Scalable for increased CSO reductions
Opportunity for private/public $
Construction jobs for local workforce
Less purchased energy
Adaptable to future needs
Repurposing of land
Community revitalization

Benefits

Significant CSO reduction
More flexibility for interceptor maintenance
Bacteria reductions

Risks

Solution not adaptable long-term
Complex construction methods
Limited local construction participation
Higher energy demand & cost
Potential future NPDES regulations

Additional assumptions for modeling
Potential future stormwater regulations

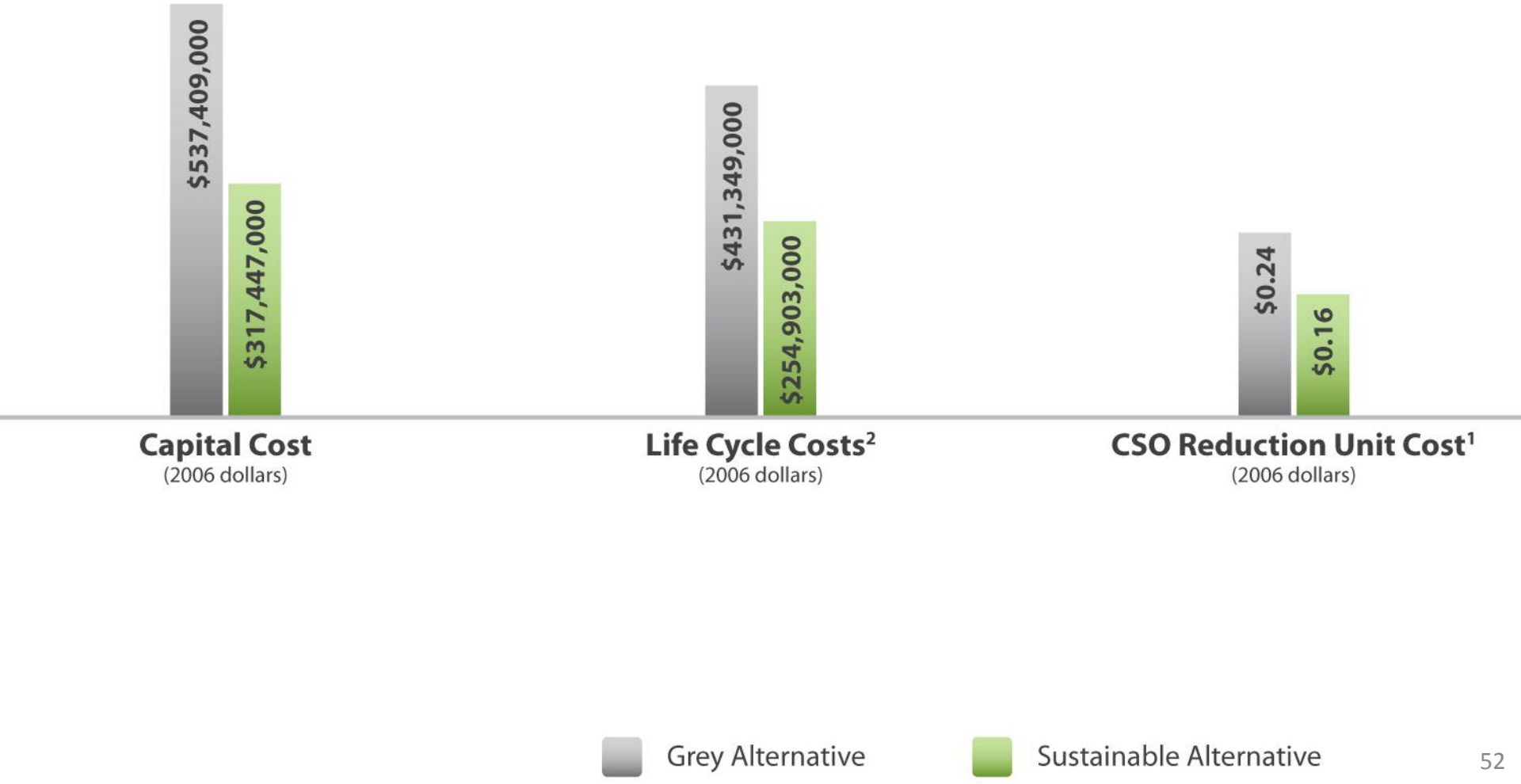
Sustainable Alternative

Grey Alternative

Cost Comparison

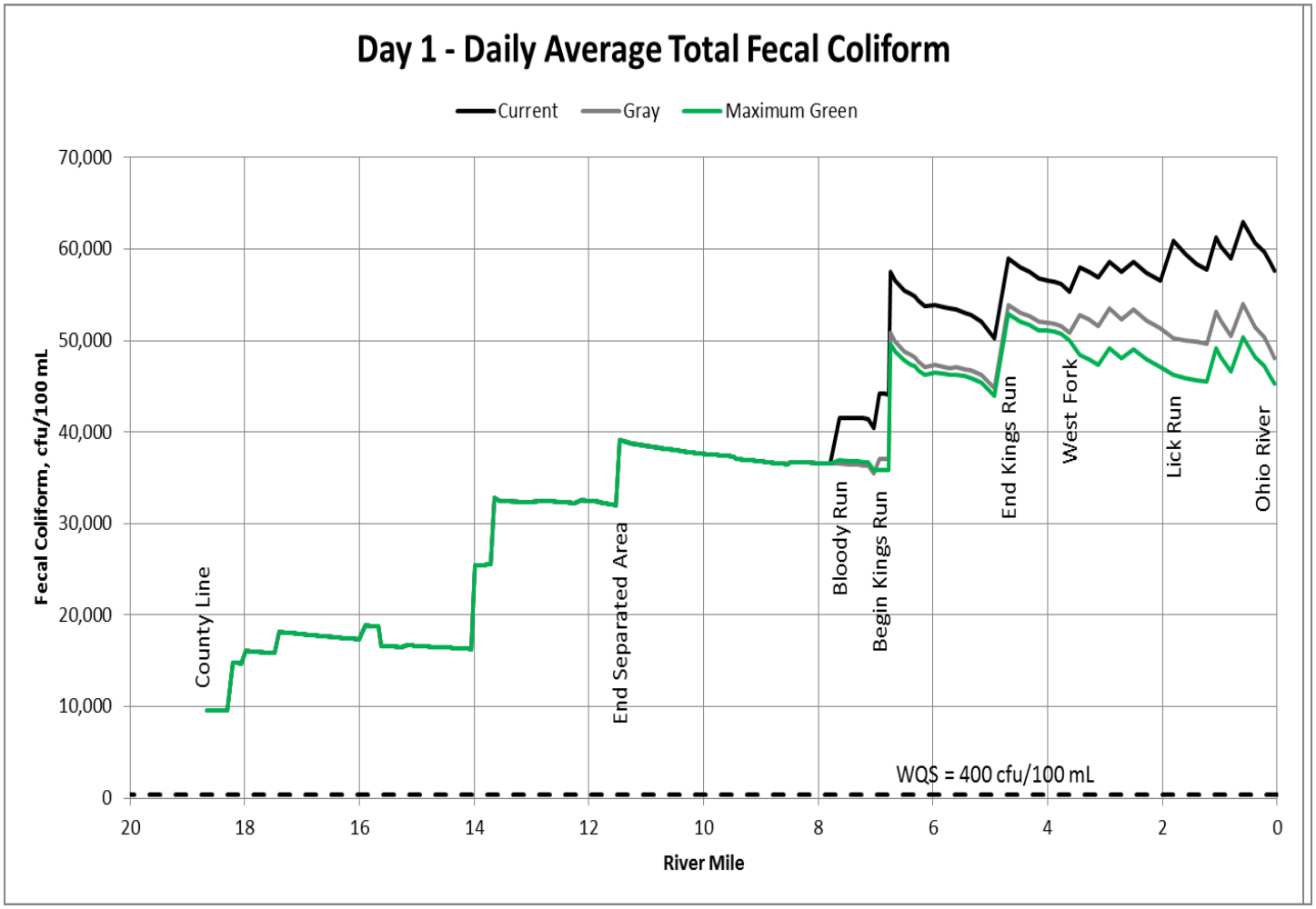
All project costs continue to be evaluated and refined as designs are advanced.

Costs presented are inclusive of work through April 2012.



“Voluntary” Water Quality Comparison

After a ¾-inch rainstorm, the Mill Creek as it enters Hamilton County does not meet the bacteria standard.



WHO

Who is involved?

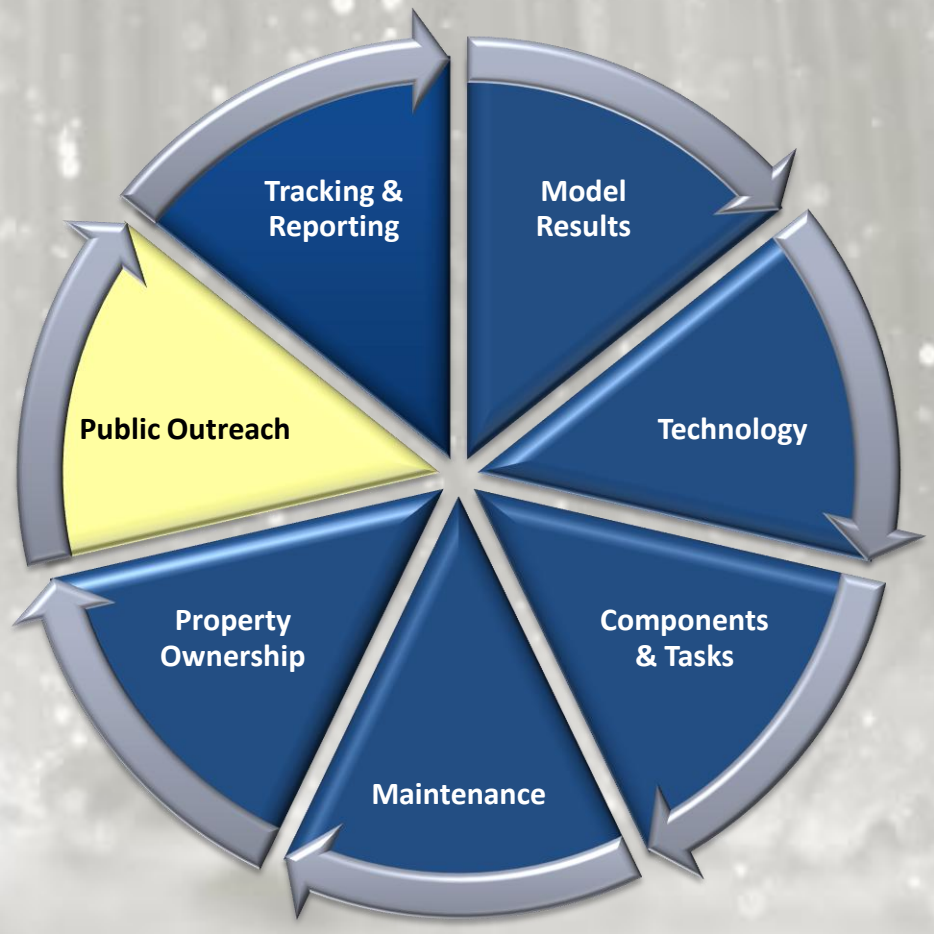
WHO

Community Feedback

Public Outreach

Stakeholder outreach and public participation program.

Identify areas of low household incomes, poor educational attainment, or concentrated minority population.



Source: "Guidance Pertaining to Consideration of Any Proposed Revised Original Lower Mill Creek Partial Remedy Defendants May Choose to Submit in Accordance with Paragraph A.2 of the Wet Weather Improvement Program", USEPA, October 11, 2011.

Lower Mill Creek Open Houses

Outreach

Over 300 people attended 4 open houses

West Fork Neighborhoods

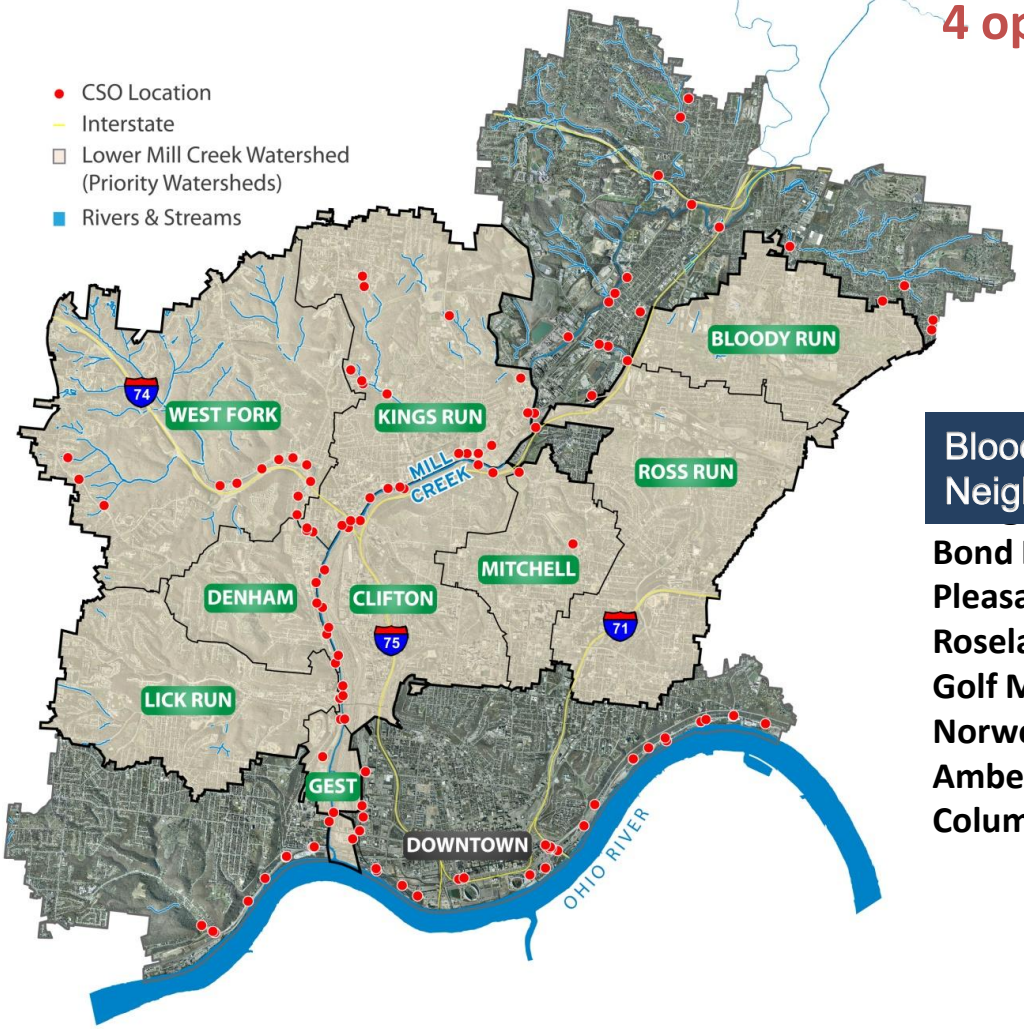
- College Hill
- East Westwood
- Fay Apartments
- Mt. Airy
- Northside
- South Cummingsville
- Westwood
- Green Township

Kings Run Neighborhoods

- College Hill
- Spring Grove Village
- Winton Hills
- Northside

Lick Run Neighborhoods

- Westwood
- South Fairmount
- Lower Price Hill
- East Price Hill



Bloody Run Neighborhoods

- Bond Hill
- Pleasant Ridge
- Roselawn
- Golf Manor
- Norwood
- Amberley Village
- Columbia Twp

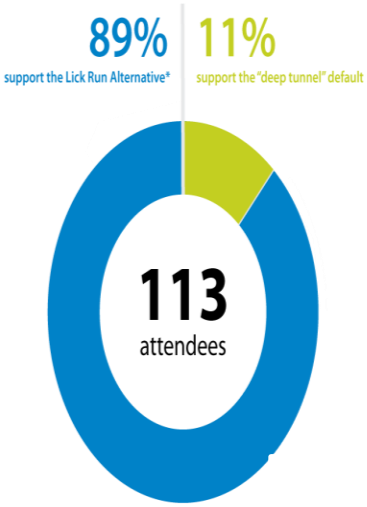
Lower Mill Creek Feedback

Public Outreach

✓ **More than 60 Meetings**

MSD has engaged residents, property owners, and stakeholders to gain input on the deep tunnel and proposed sustainable infrastructure projects.

Community Design Workshop #1

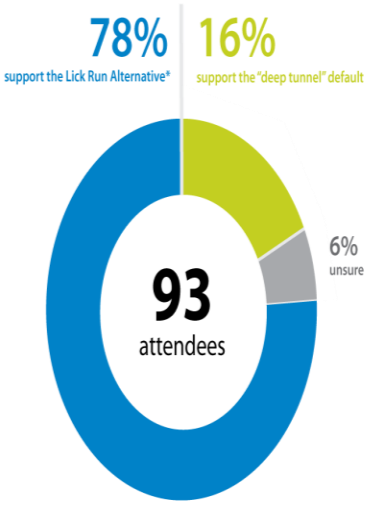


Workshop Content:

Visual Preferences

Open Space Corridor
Community Core
Historic Fabric
Hillside & Ridgetop Neighborhoods

Community Design Workshop #2

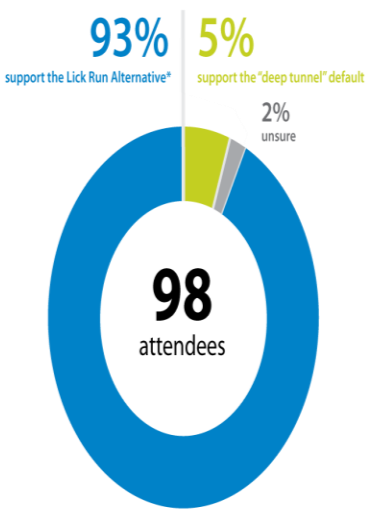


Workshop Content:

Concept Development

Western Gateway Zone
Narrow Channel Zone
Eastern Gateway Zone
Transportation & Trails Network
Green Planning Principles

Community Design Workshop #3



Workshop Content:

Preliminary Master Plan

"Base Plan"
Waterway Character
CSO Reduction Solutions
Vision Plan
Transportation Network & Trails

WHEN

Next Steps

WHEN

- USEPA & Ohio EPA Continuation of Technical Review and Discussions
- Continue Flow Monitoring & Model Refinements
- Potential Joint Session with City/County in late August to receive public comment
- City Council Action following public comment period on Recommendation for USEPA submittal
- County Commission Action following public comment period on Recommendation for USEPA submittal
- MSD to prepare submittal to USEPA

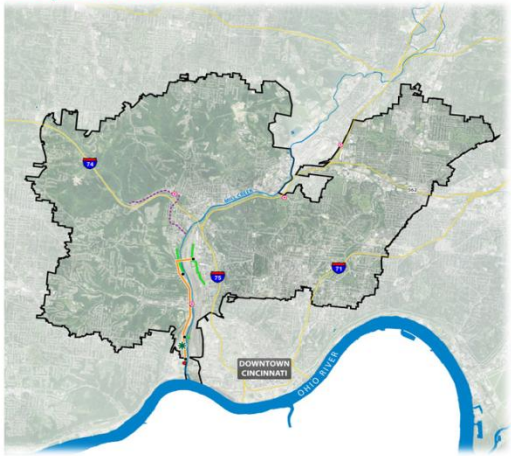
Complete submittal due to USEPA by December 31, 2012

We want your feedback!

HOW DO THE POTENTIAL SOLUTIONS COMPARE?

MSD is required to control a significant volume in the Lower Mill Creek by 2018. The City and County have until December 2012 to submit a Lower Mill Creek Partial Remedy plan to the Regulators. MSD developed performance metrics to compare the grey solutions and the sustainable solutions to overarching goals. A grey and a sustainable solution are compared below.

Grey Solution



LEGEND
- Mill Creek Wastewater Treatment Plant
- Interstate
- River/Stream
- Lower Mill Creek Watershed Boundary

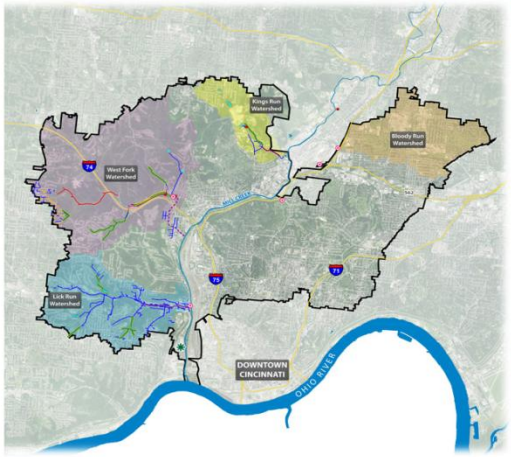
Phase 1 Grey Solution Components
- Real-Time Control Facility
- Proposed EHRT
- Proposed Tunnel Shaft
- West Fork Channel Grate Improvements
- Proposed Deep Tunnel
- Proposed Consolidation Sewer

BENEFITS
- Significant reduction in CSO volume
- Fewer assumptions in modeled results
- Higher degree of operational flexibility for interceptor maintenance
- Flexibility to incorporate various solutions for Carthage and SSO 700
- Provides bacteria reduction

RISKS
- Long-term solution not adaptable
- Future NPDES regulations
- Potential large cost variance
- Complex construction methods
- Limited local construction participation
- Higher energy demand & cost
- Larger carbon footprint

Total Capital Cost (2006 dollars) **$537,409,000** »» **Cost per Gallon**[1] **$0.24**

Sustainable Solution



LEGEND
- Mill Creek Wastewater Treatment Plant
- Interstate
- River/Stream
- Lower Mill Creek Watershed Boundary

Phase 1 Sustainable Solution Components
- Real-Time Control Facility
- Proposed Combined Storage
- West Fork Channel Grate Improvements
- Proposed Sanitary Sewer
- Proposed Stormwater Detention
- Proposed Combined Sewer
- Proposed Storm Sewer
- Proposed Natural Conveyance
- Proposed Stream Restoration
- Proposed Valley Conveyance

BENEFITS
- Significant reduction in CSO volume
- Surface improvements & increased public acceptance
- Opportunities to leverage private/public funding
- Construction jobs available for local workforce & SBEs
- Less purchased energy
- Adaptable to future water quality needs
- Ability to capture more flow by adding separation areas
- Brownfield remediation and repurposing of land for source control
- Reduction in rain water and natural drainage volume to WWTP
- Greatest reduction in peak bacteria levels in Mill Creek
- Returns more base flow to the hydromodified Mill Creek

RISKS
- Additional assumptions for modeling
- Potential future stormwater regulations

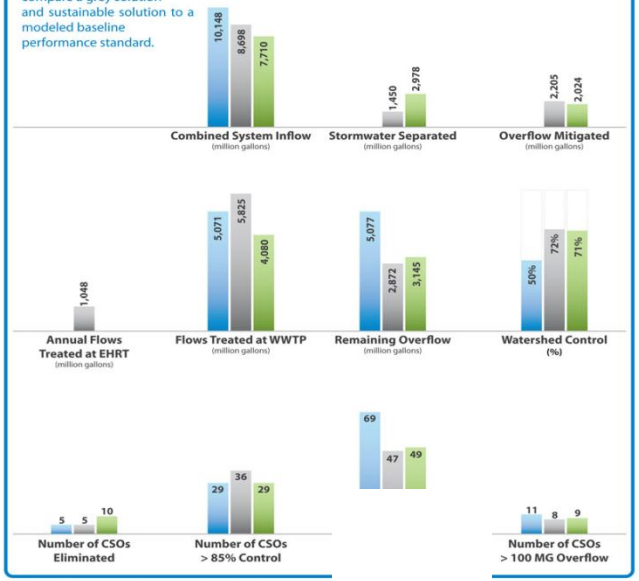
Total Capital Cost (2006 dollars) **$317,447,000** »» **Cost per Gallon**[1] **$0.16**

LEGEND: Baseline Model 3.2 | Grey Solution | Sustainable Solution

Phase 1 Cost Comparison

Phase 1 Performance Metrics

Phase 1 performance metrics compare a grey solution and sustainable solution to a modeled baseline performance standard.



[1] Cost per gallon refers to the CSO reduction unit cost of a solution capital cost (in 2006 dollars) by the estimated annual CSO reduct the 4 completed real-time control (RTC) facilities.

[2] Life cycle costs are reported in terms of present worth (in 2006 dc rate of 4.2%

ulated by dividing costs per gallon include

25 years and a discount

Questions & Comments