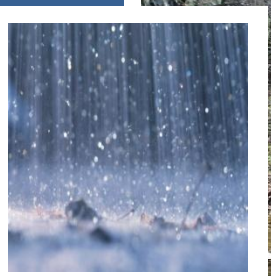
Lower Mill Creek Partial Remedy

Hamilton County
Board of County
Commissioners
Public Hearing

September 26, 2012



METROPOLITAN SEWER DISTRICT of greater CINCINNATI

Today's Agenda

- Why we are here today
- Lower Mill Creek Study
- MSD's Recommendation
- Relevant Criteria
- Next Steps

LMCPR Alternatives

- These alternatives must conform first and foremost with EPA requirements, because the Regulators must approve any alternative. If an alternative does not meet those requirements, the Regulators can not approve it.

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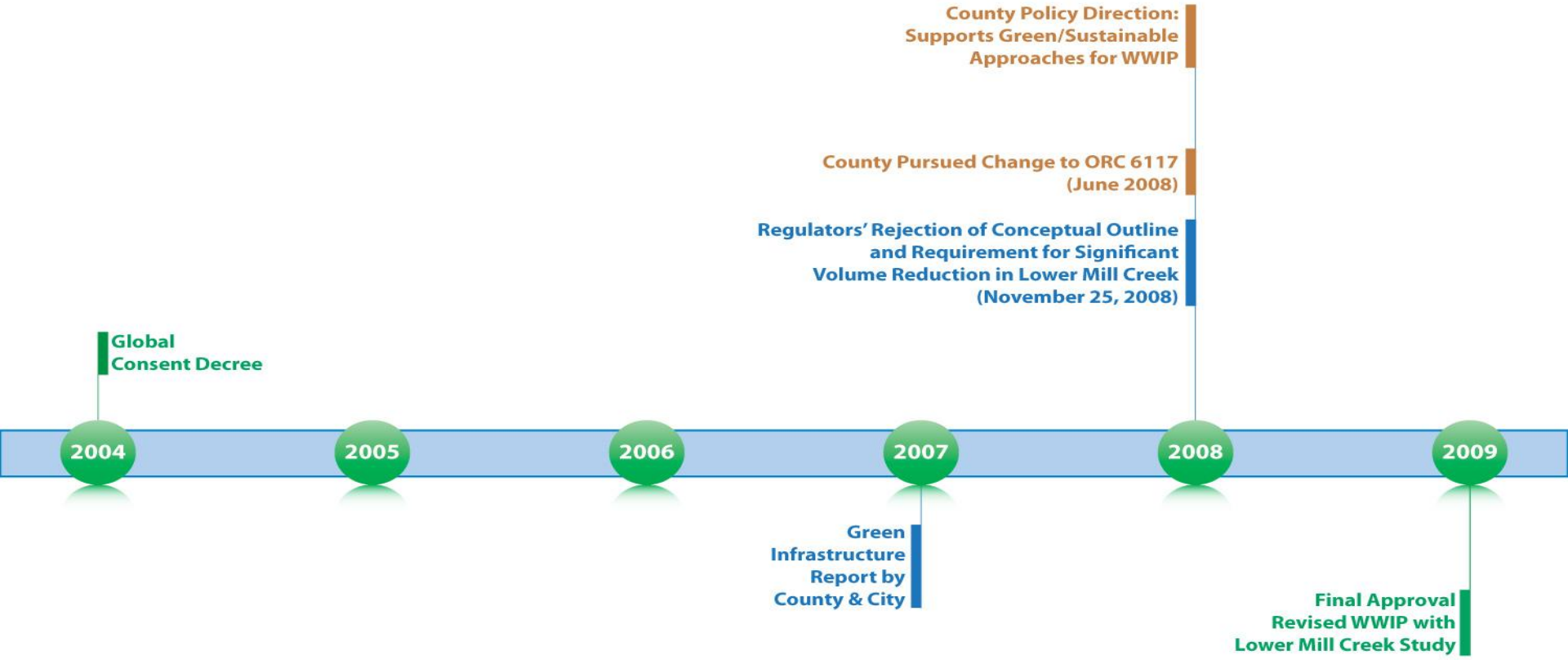


LEGEND

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

2004-2009

Lower Mill Creek Study

3-Year Study

Grey Alternative	Sustainable Alternative
▪ **Real-time control** *(four total)* ▪ **West Fork Channel grate modifications** ▪ **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 facility** *(84 mgd)*	▪ **Real-time control** *(five total)* ▪ **West Fork Channel grate modifications** ▪ **New Storm Sewers** *(varying diameter, 104,400 feet in length in 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)*
$537,409,000	**$316,069,000**

MSD's recommendation today is grounded by the policy direction received from the Commission's July 18th Resolution regarding cost control within WWIP estimates.

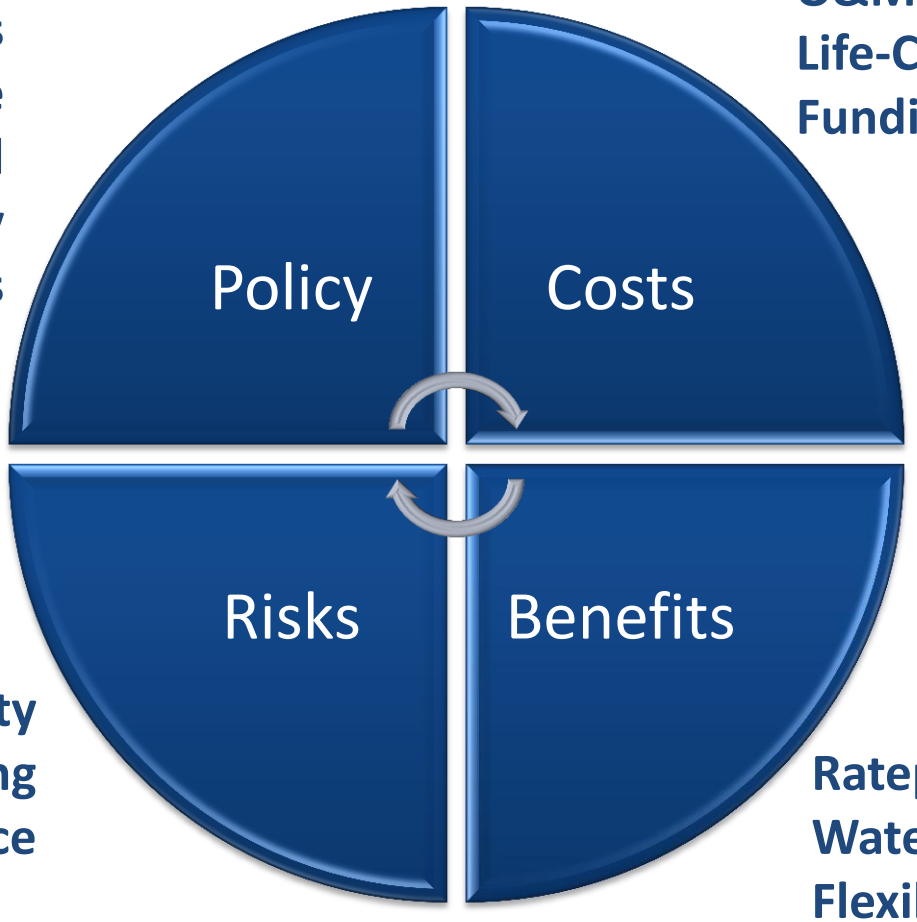
The Sustainable Alternative achieves the 2 BG CSO reduction at a cost much closer to the $244M WWIP estimate.

Relevant Criteria

Applied to LMC Study Alternatives

Compliance & Conformance
Final WWIP
State & Federal Laws
USEPA's Sustainable Guidance
Document & Integrated Planning Framework Policy
County Policy Directions

Capital
O&M
Life-Cycle
Funding Sources

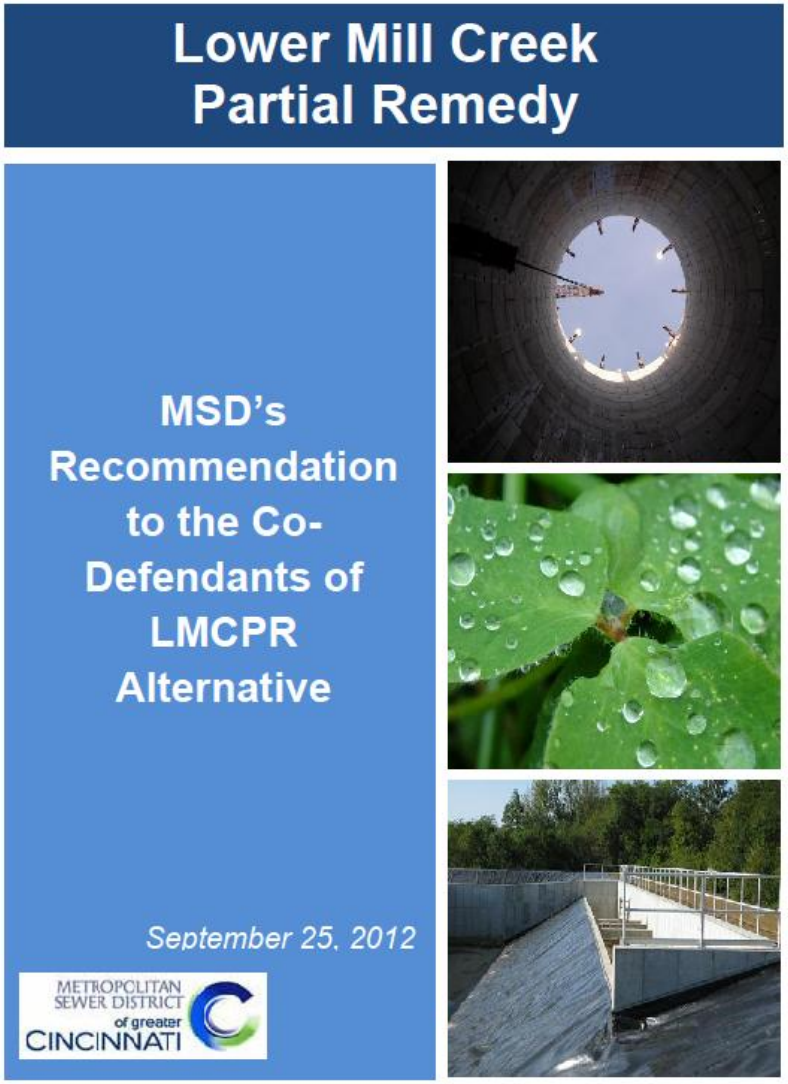


Level of Certainty
Flooding
Maintenance

Ratepayers
Water Quality
Flexibility

MSD's Recommendation

MSD has provided its official recommendation in the "*Lower Mil Creek Partial Remedy MSD's Recommendation to the Co-Defendants of LMCPR Alternative*".



Recommended Alternative

Sub-Basin	MG CSO Reduction	Capital Cost (2006$)	Cost/ Gallon	No. of CSOs	CSOs
Lick Run	726	$200,492,000	$0.28	1	5
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4 RTCs	737	--	--	2	5,125,482,485
Total	**2,058**	**$316,069,000**		**19**	

What a Sustainable Solution Accomplishes

Developing a solution that brings our historical water wealth normally below ground to the surface to create a benefit the community can see.

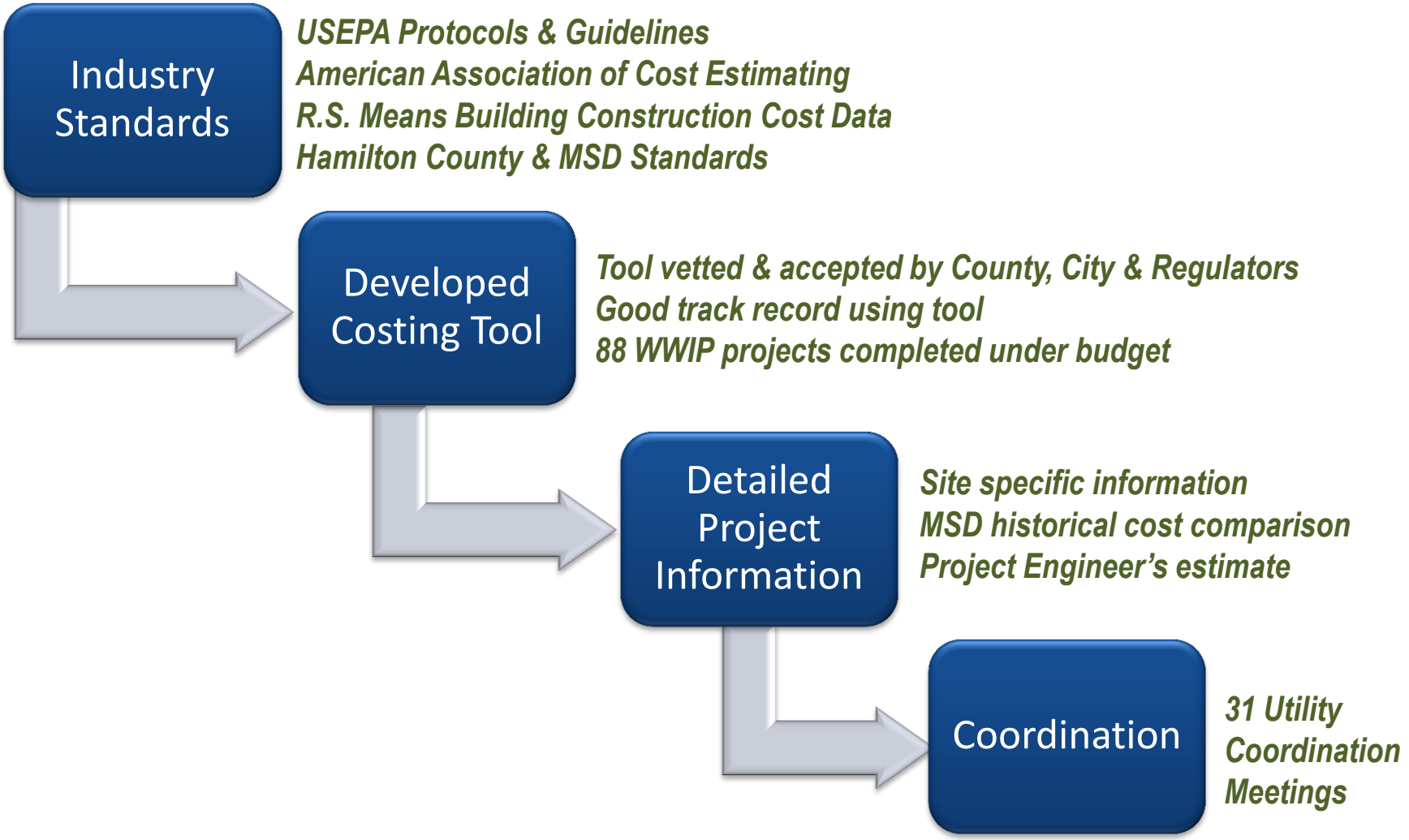
- ✓ Complies with 2 BG Consent Decree target
- ✓ Provides lowest cost solution
- ✓ Utilizes stormwater as a resource = sustainable
- ✓ Creates new class of green jobs
- ✓ Improves water quality
- ✓ Offers potential to leverage private side actions

Relevant Criteria = Policy

MSD's Recommendation complies with all applicable policies.

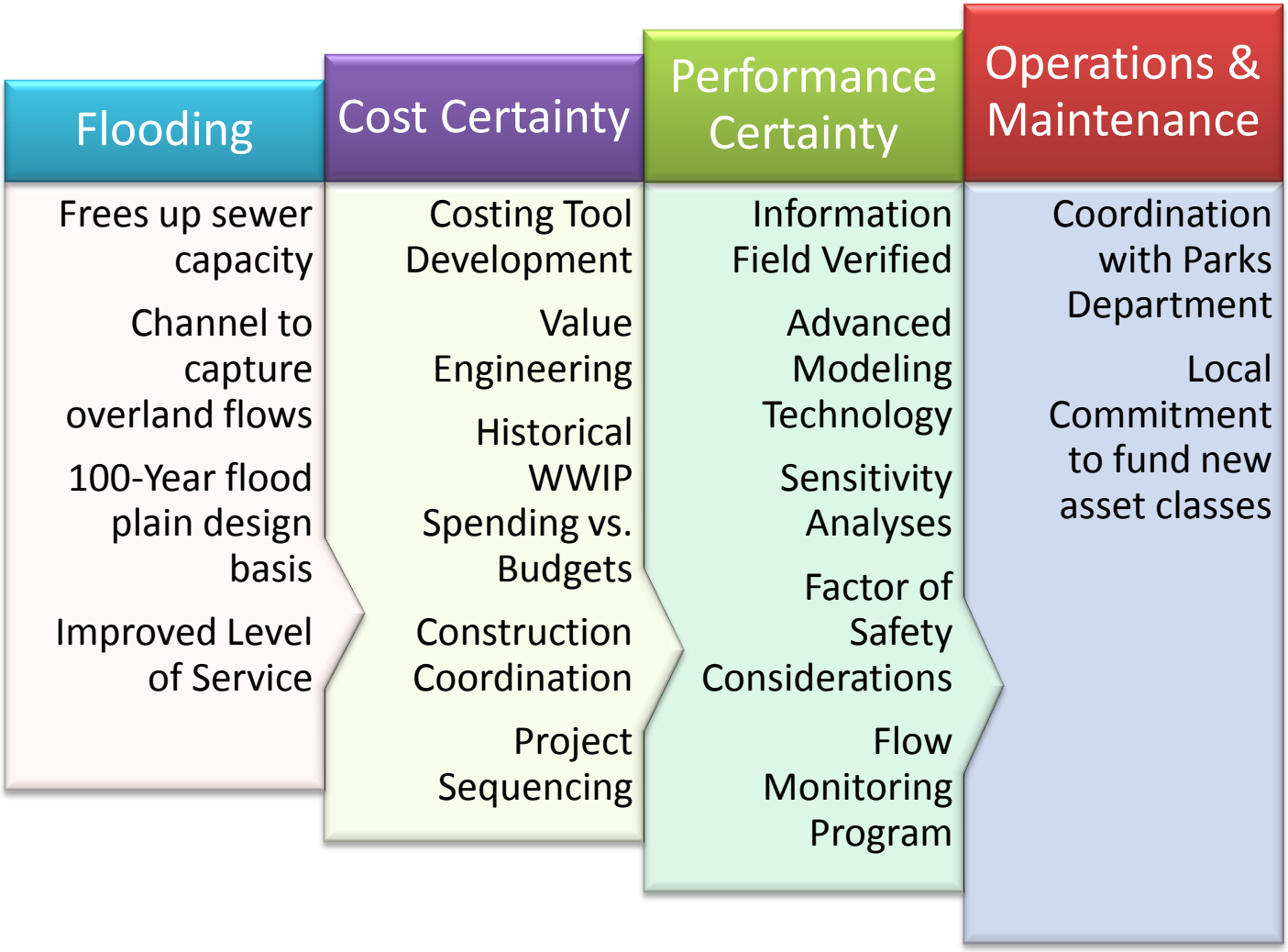
- ✓ 2 BG CSO reduction target of the WWIP
- ✓ USEPA guidance for development of a LMCPR alternative
- ✓ Hamilton County's July 18th resolution regarding cost control
- ✓ State and federal laws regarding stormwater management and flood control
- ✓ USEPA integration & sustainable policies

Costs – How they were developed



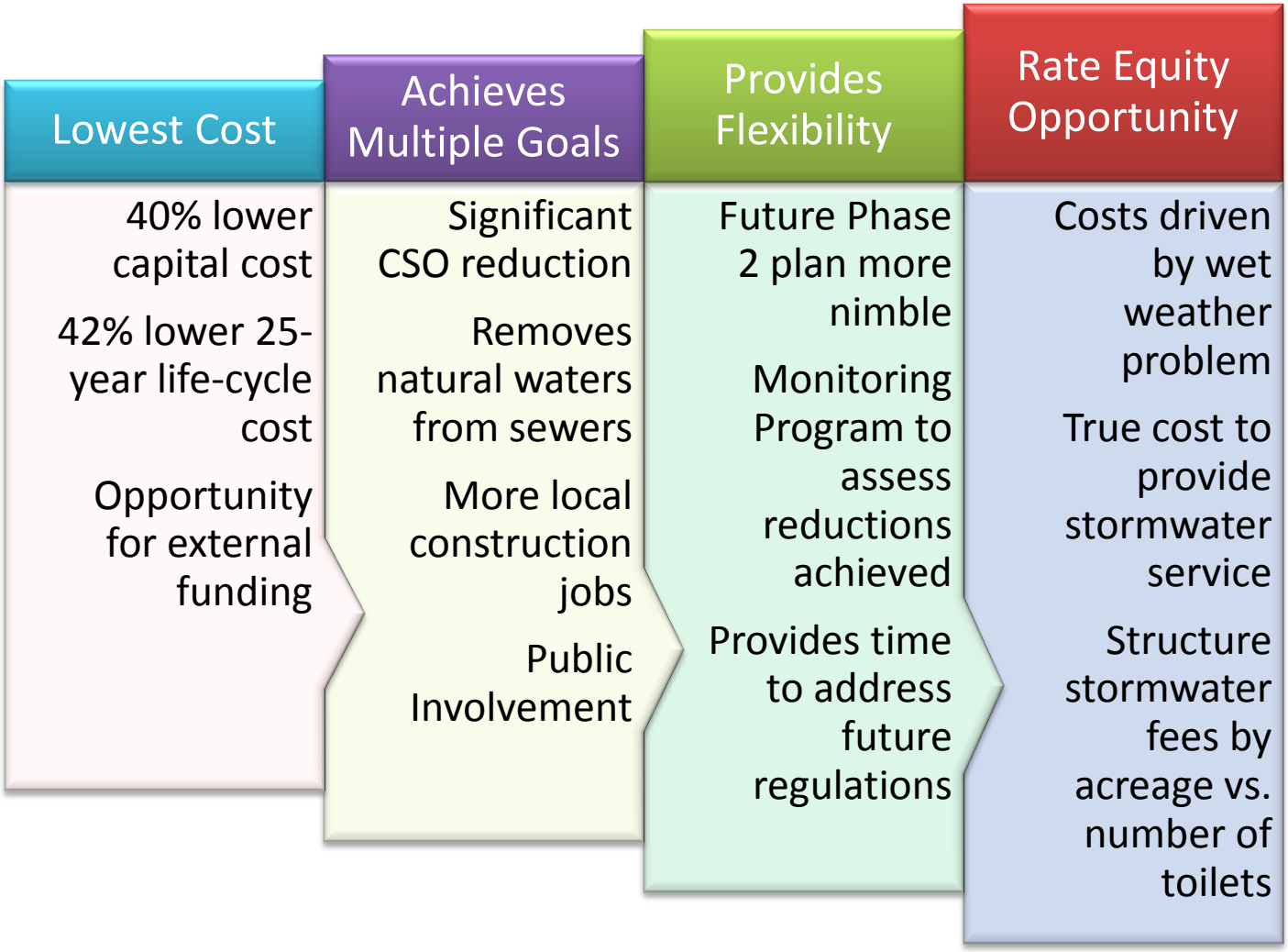
Relevant Criteria = Costs

Risks – Identification & Mitigation



All of these risks are discussed in MSD's Recommendation Report.

Benefits – Best Case for Ratepayers



All of these benefits are discussed in MSD's Recommendation Report.

Conclusions

- ✓ Lowest cost & lowest risk
- ✓ Supported & vetted with the Regulators
- ✓ Opportunities for external funding partners
- ✓ Similar approach used by others
- ✓ Increases base flow to tributaries and streams
- ✓ Flexibility to adapt to future conditions
- ✓ Best solution to achieve relevant criteria

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Lower Mill Creek Partial Remedy

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Public Hearing

October 3, 2012

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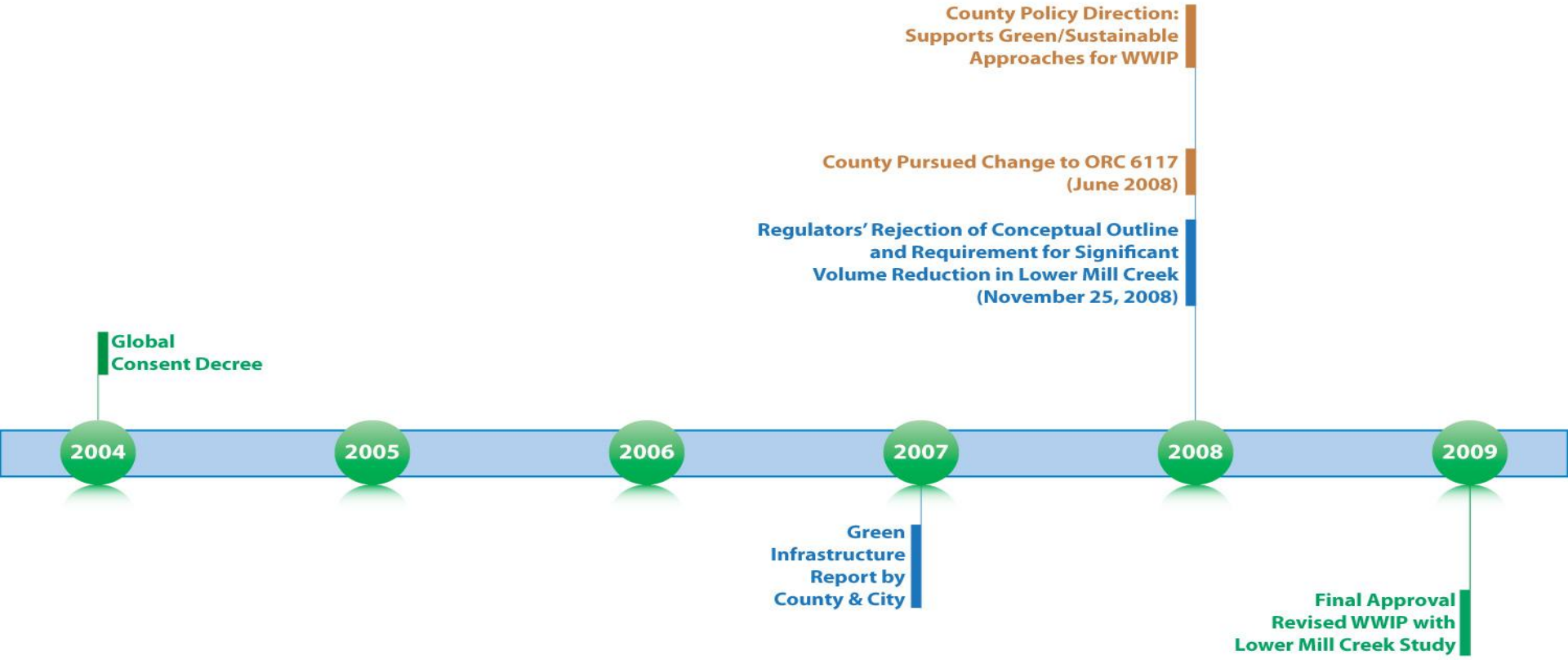

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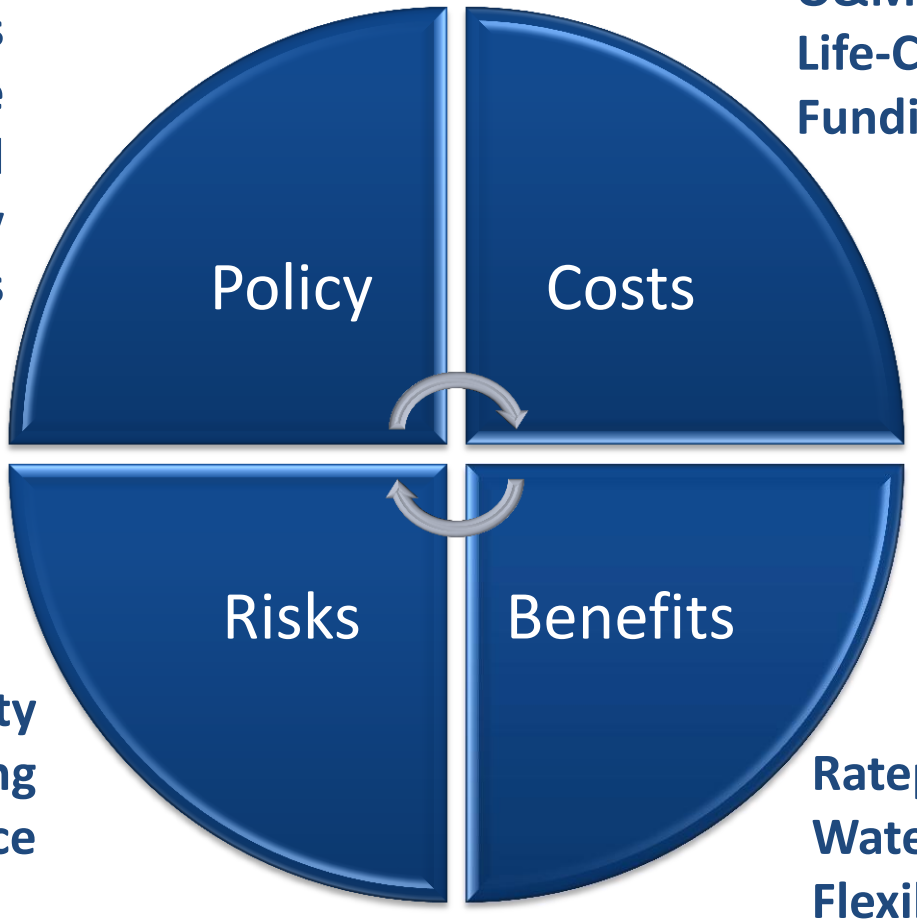

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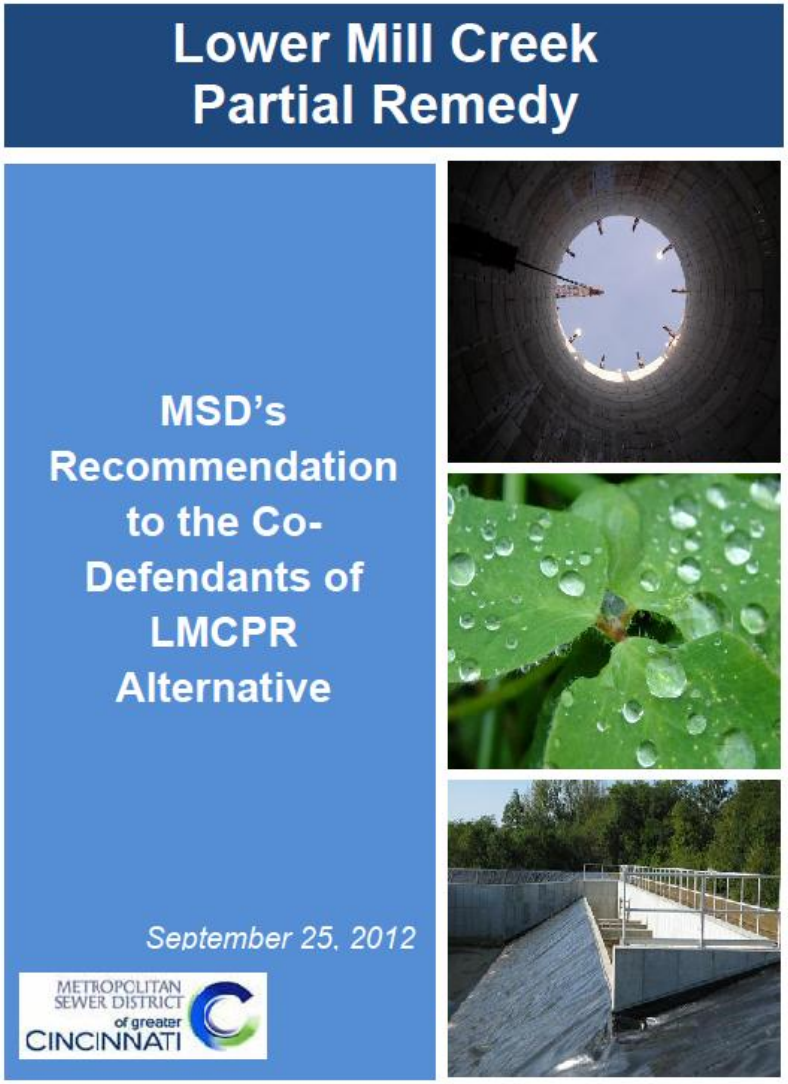

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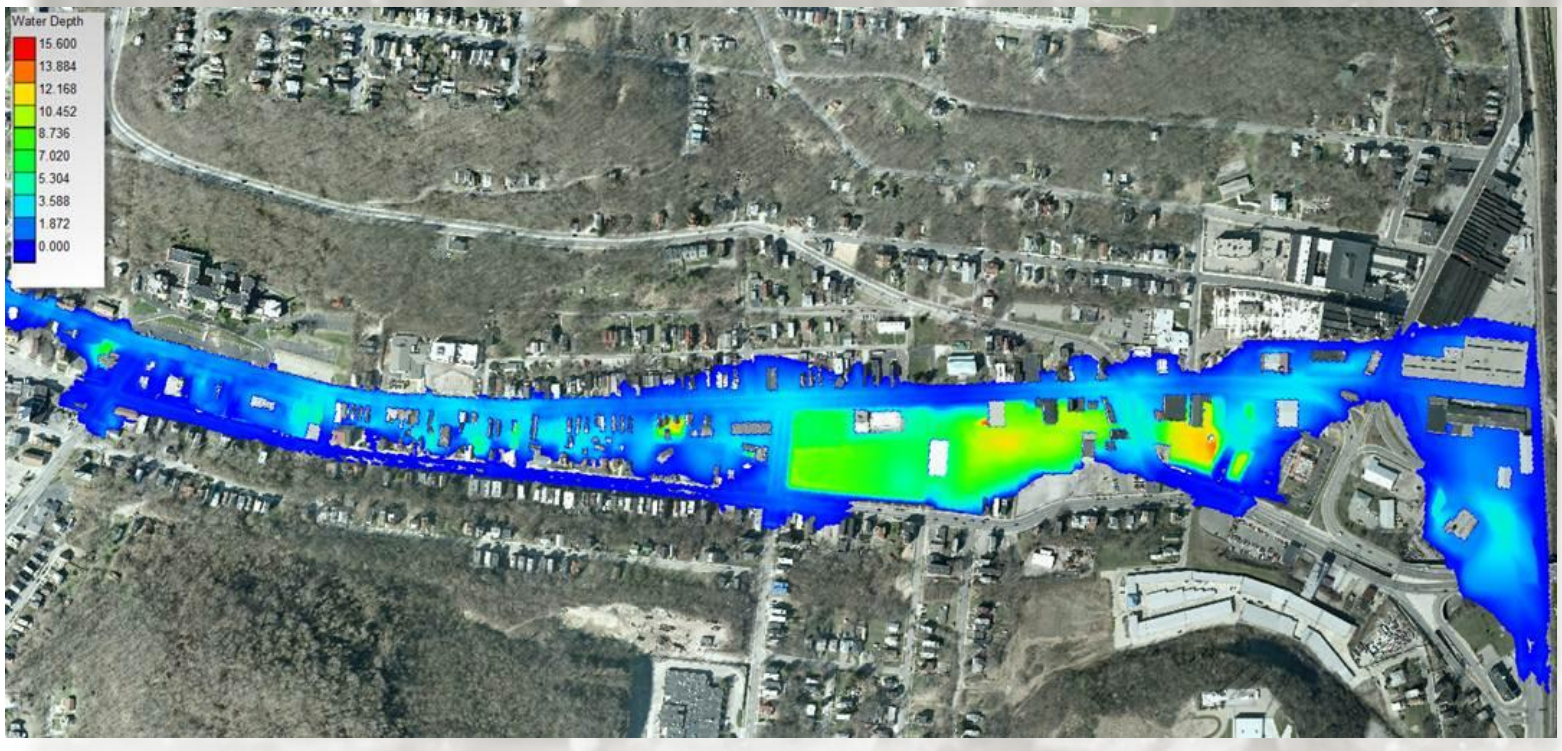
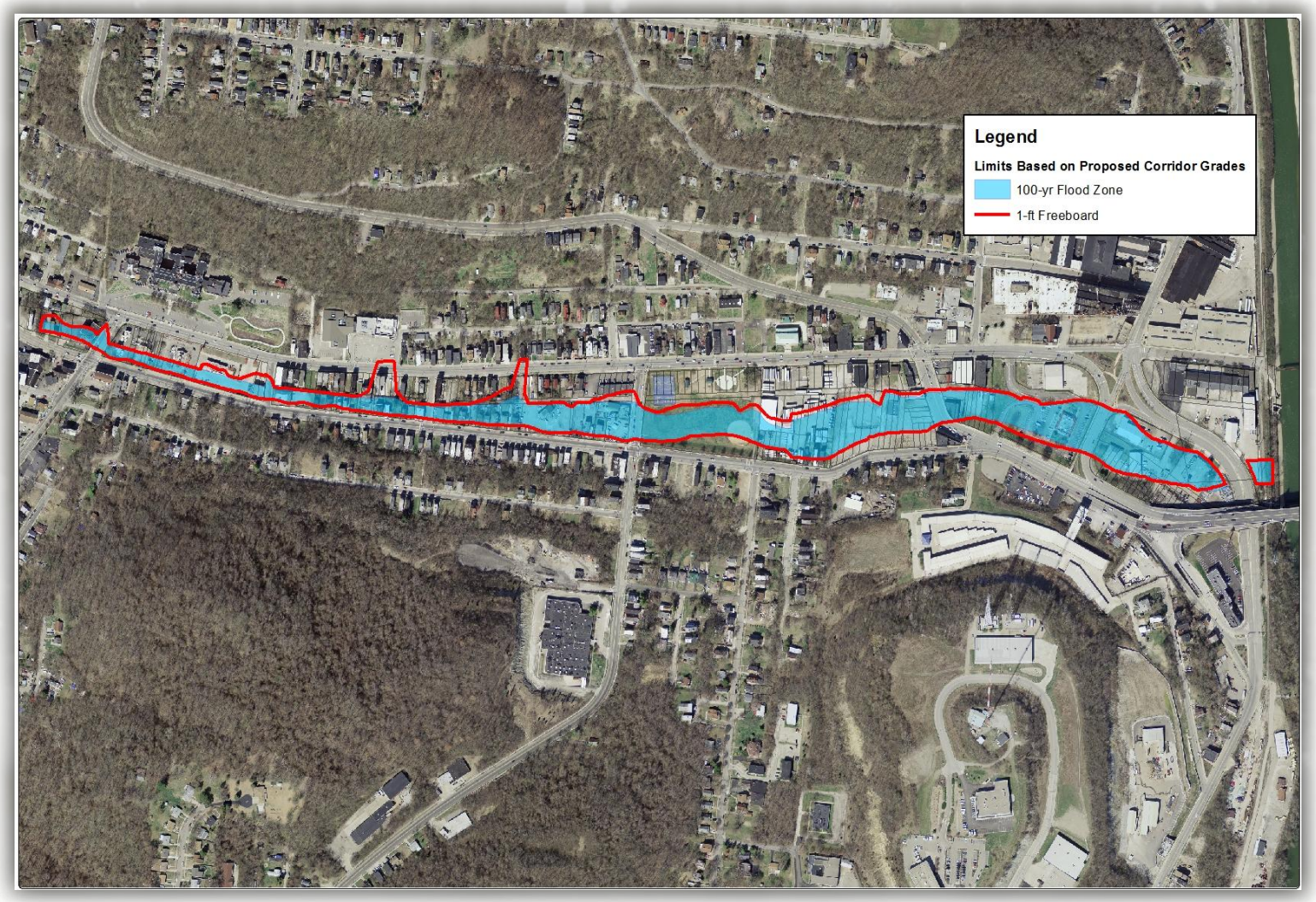
Existing Conditions Surface Flooding

This image illustrates where surface flooding occurs under 100 year storm conditions.

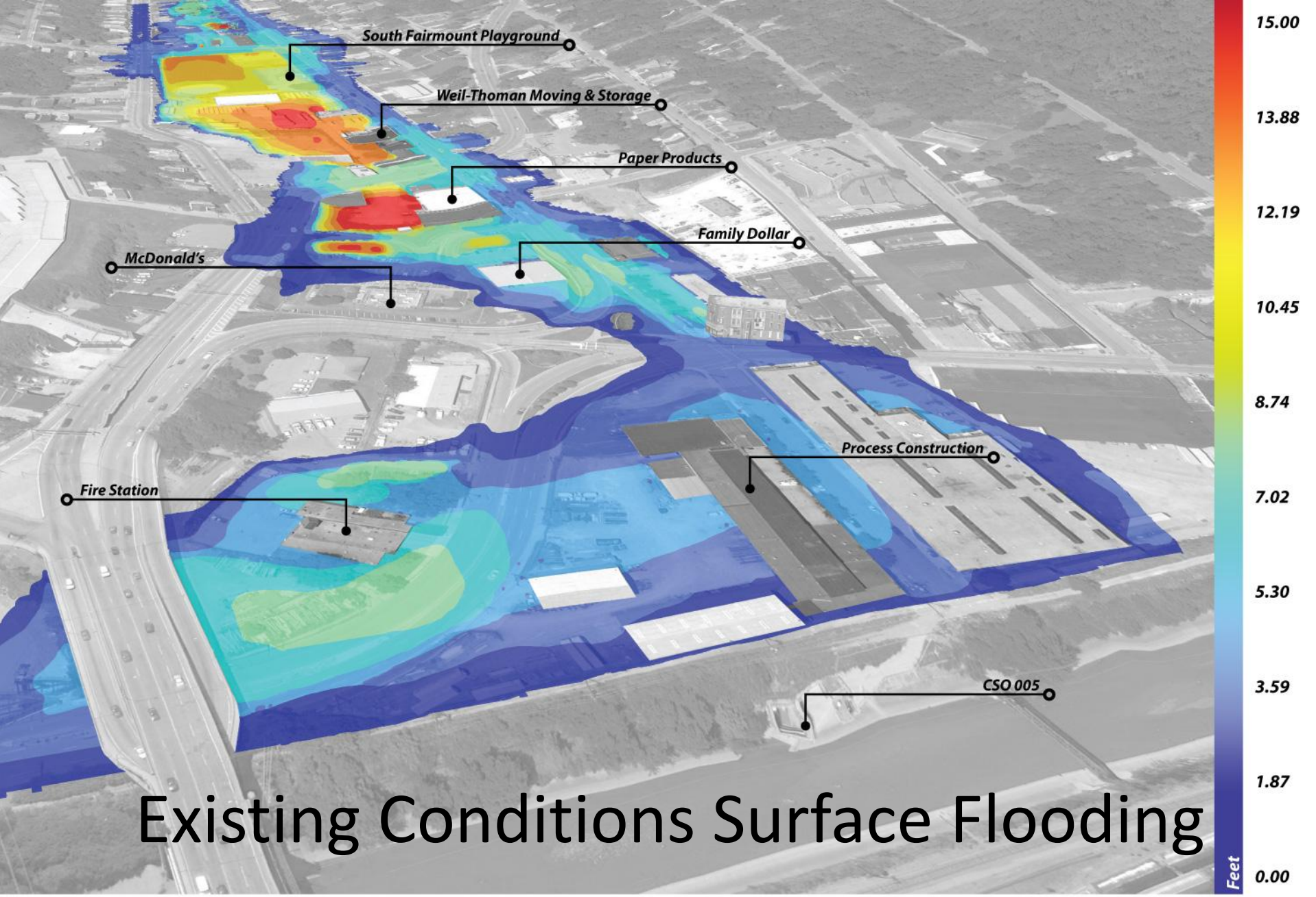


Future Conditions Flood limits based on **Proposed** Corridor Grades

This graphic shows flood limit areas resulting after riparian & floodplain grading associated with the VCS.



Impacted properties are identified for acquisition due to potential impact and grading plan.



Existing Conditions Surface Flooding

100-YEAR FLOOD WATER DEPTHS

EXISTING CONDITIONS: LOOKING WEST FROM MILL CREEK

HUMAN NATURE, INC. | STRAND ASSOCIATES, INC.

Proposed Solution Surface Flooding

LICK RUN 100-YEAR FLOOD LIMITS

LOOKING UPSTREAM (WEST) FROM MILL CREEK

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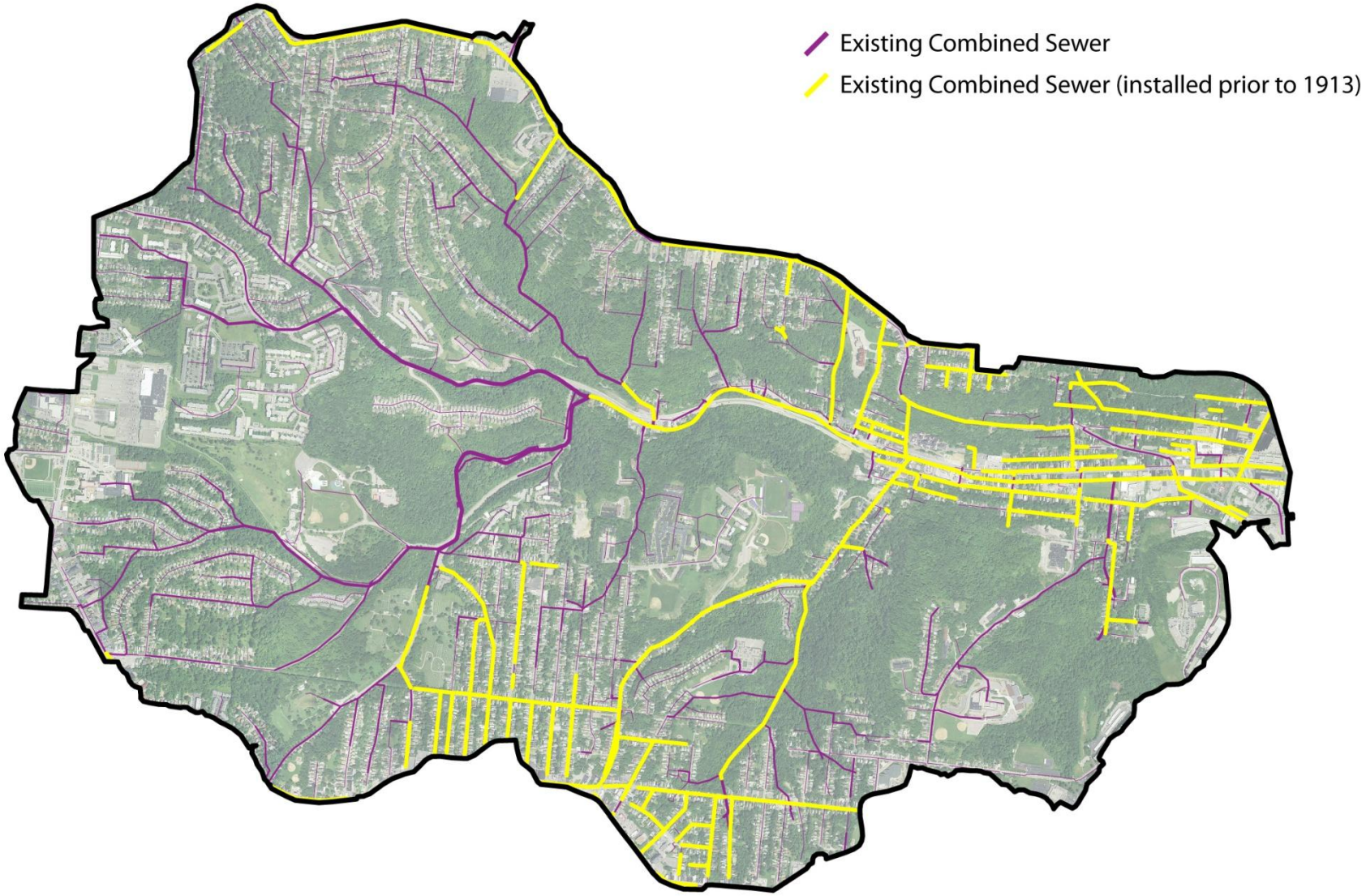

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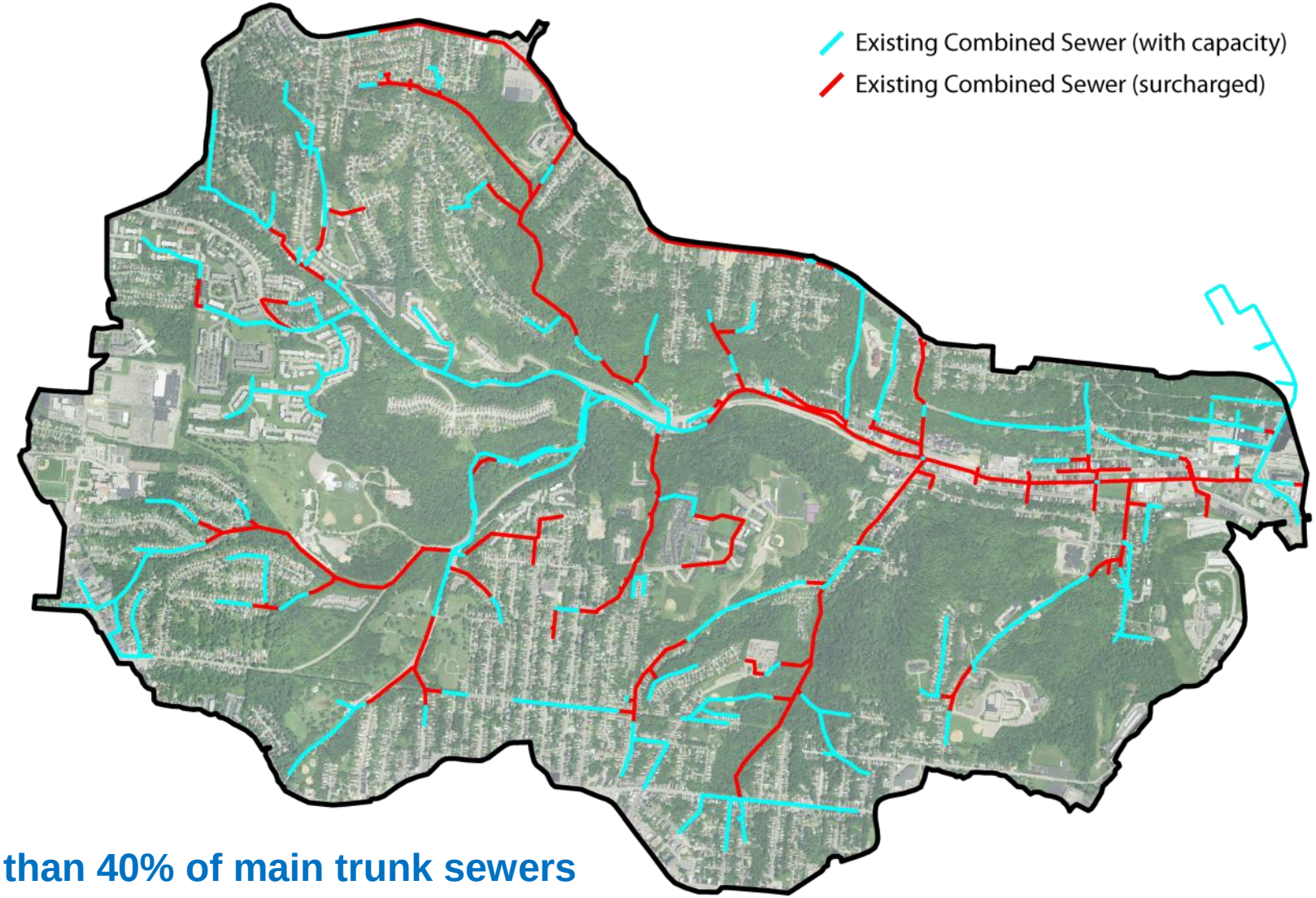
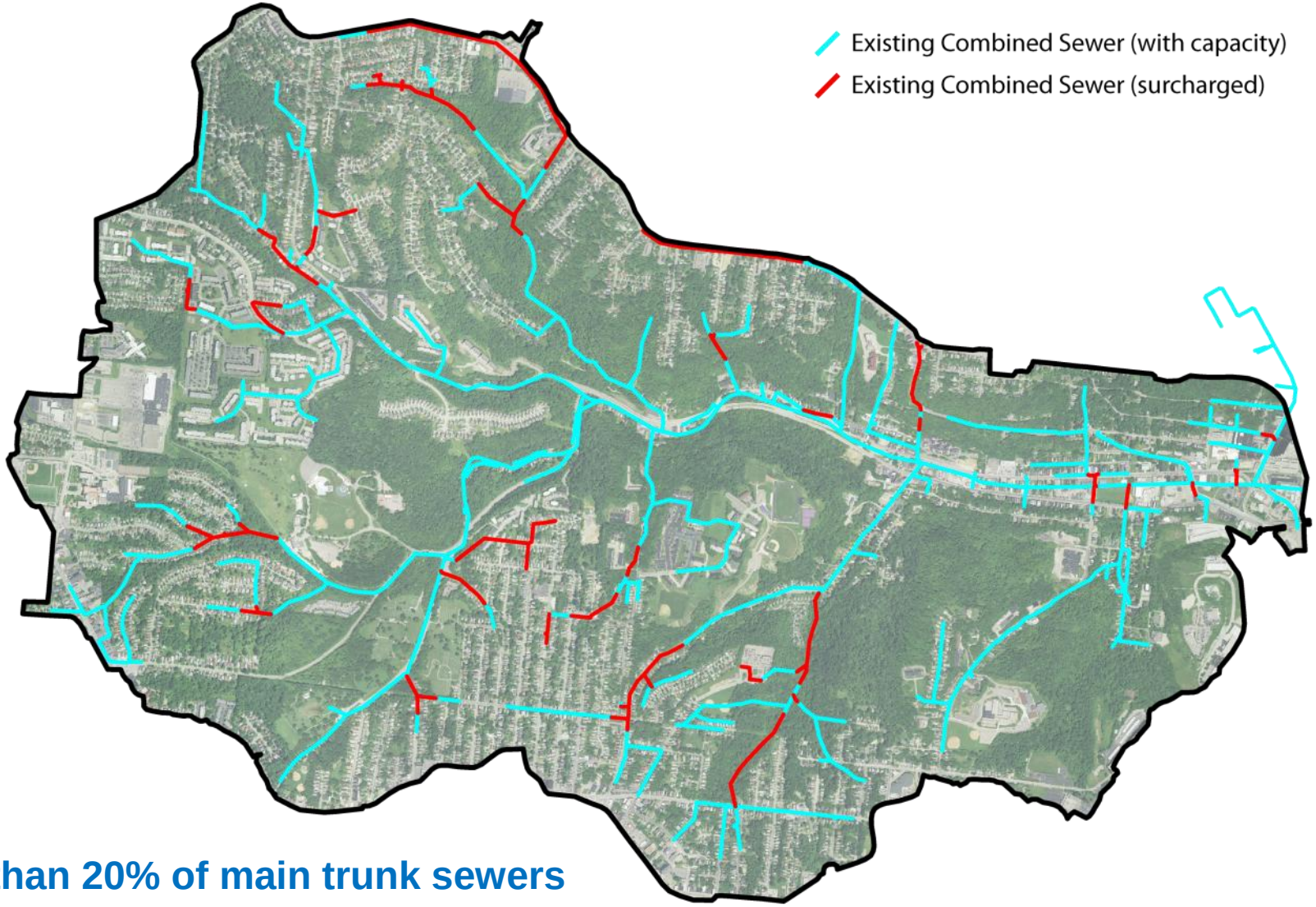


More than 40% of main trunk sewers are surcharged during the 10-year storm

Proposed Separate Stormwater Conveyance



Less than 20% of main trunk sewers are surcharged during the 10-year storm

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Public Hearing

October 8, 2012

METROPOLITAN SEWER DISTRICT of greater CINCINNATI

Today's Agenda

- MSD's Recommended Alternative
- MSD's Strategic Separation Approach
- Model & Local Data
- Confidence in Results
- Regulator Feedback

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Sustainable Alternative

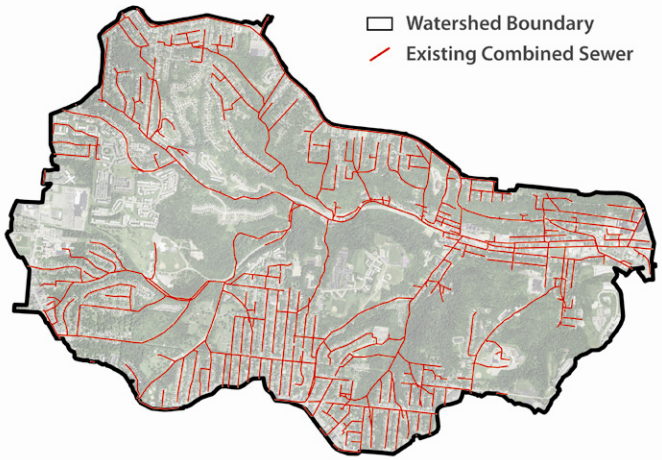
From April 2, 2012 LMCPR Preliminary Findings Report

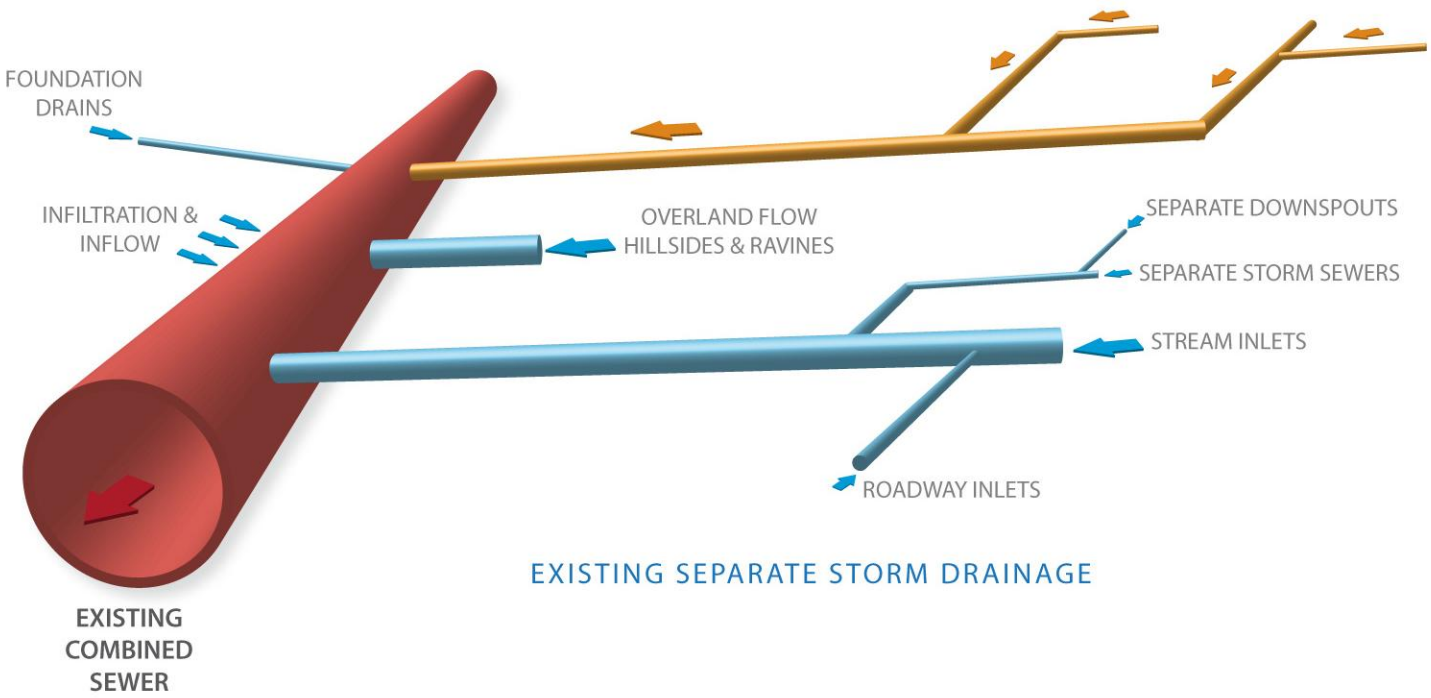
Real Time Control Facilities (CSOs)	5 ,125, 181, 482, 485/487
West Fork Channel Grate Modifications	YES
New Storm Sewers (ft)	104,400
Relocated Combined Sewers (ft)	21,500
Naturalized Channels (ft)	5,500
Valley Conveyance System (ft)	8,100
Natural Conveyance/Stream Separation (ft)	20,000
Non-Tunnel Storage Capacity (mg)	5
Additional EHRT Capacity (mgd)	20
Stormwater Detention Basins (acre - ft)	80

Phase 1 Highlights

- Kings Run Source Control & Storage
- Bloody Run, Mitchell, Ross Run RTC
- Storage at CSO 488
- West Fork Source Control, Storage & RTC
- Lick Run Source Control & RTC

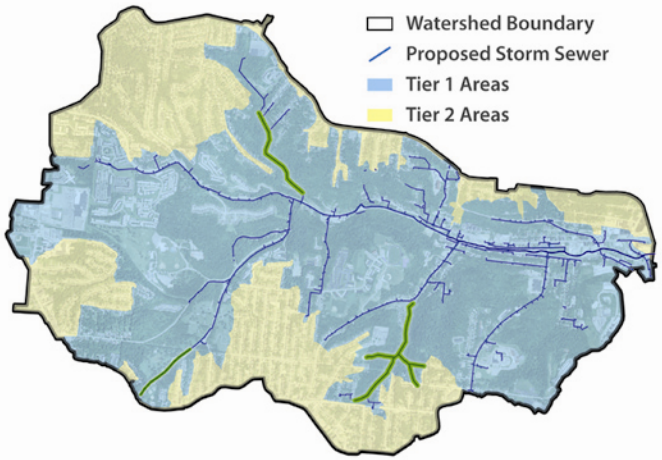
Existing CSS Infrastructure





CONFIGURATION OF THE COLLECTIONS SYSTEM
EXISTING CONDITIONS
IMAGE NOT TO SCALE HUMAN NATURE, INC.

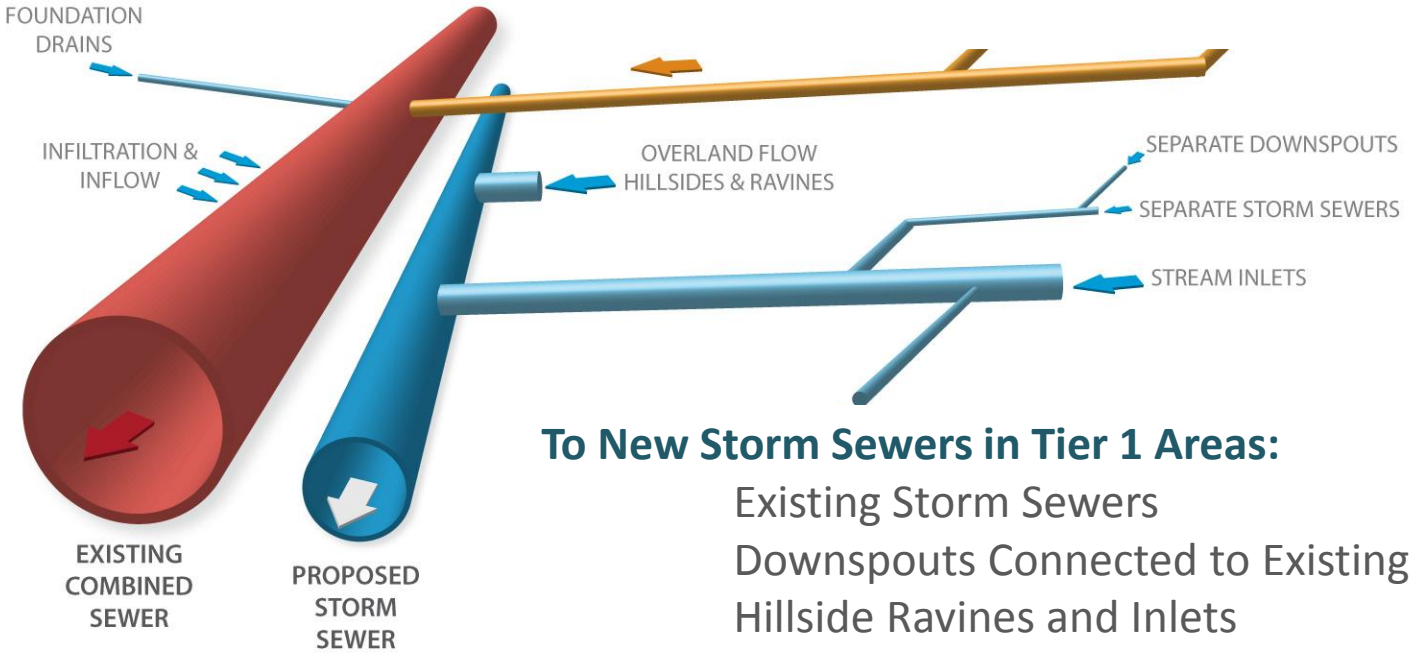
LEGEND
- EXISTING SEPARATE STORM DRAINAGE
- EXISTING COMBINED SEWER
- EXISTING SEPARATE SANITARY



Strategic Separation Approach

To Existing Combined Sewers:

- Foundation Drains
- Downspouts Connected to Existing CSS
- Inflow and Infiltration
- Stream Inlets In Tier 2 Areas
- Roadway Inlets in Tier 2 Areas



CONFIGURATION OF THE COLLECTIONS SYSTEM
PROPOSED CONDITIONS
IMAGE NOT TO SCALE HUMAN NATURE, INC.

To New Storm Sewers in Tier 1 Areas:

- Existing Storm Sewers
- Downspouts Connected to Existing Storm
- Hillside Ravines and Inlets
- Stream Inlets
- Roadway Inlets
- Overland Flow (Tier 2 also)

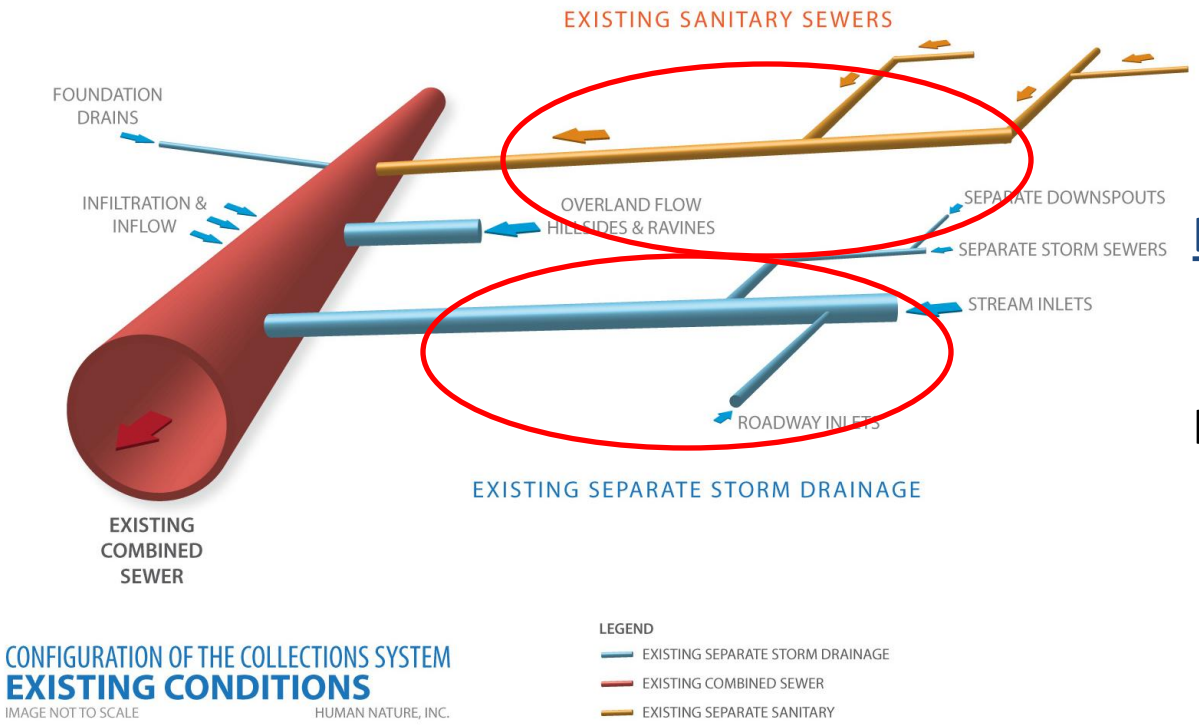
Model & Local Data

The Consent Decree requires a wet weather solution that is based on USEPA's hydraulic and hydrologic modeling software.

Local Data Used for Inputs
Pipe Sizes & Shapes
Invert Elevations
Hydraulic Interconnections
Sediment Depth
Underflow Pipe Diameters
Regulator Function
Topography & Land Use

Local Data to Refine Model's Assumptions
Pan Evaporation Data
300 Soil Borings – soil & groundwater
Ops Interviews – surcharges, pumps
Weir & Orifice Settings
Runoff Catchment Parameters

Local Data to Confirm Model's Results
Sanitary Flow Monitoring
Storm Flow Monitoring
Telog Overflow Data
USGS Mill Creek Level Gauges
RTC & Interceptor Level Monitors



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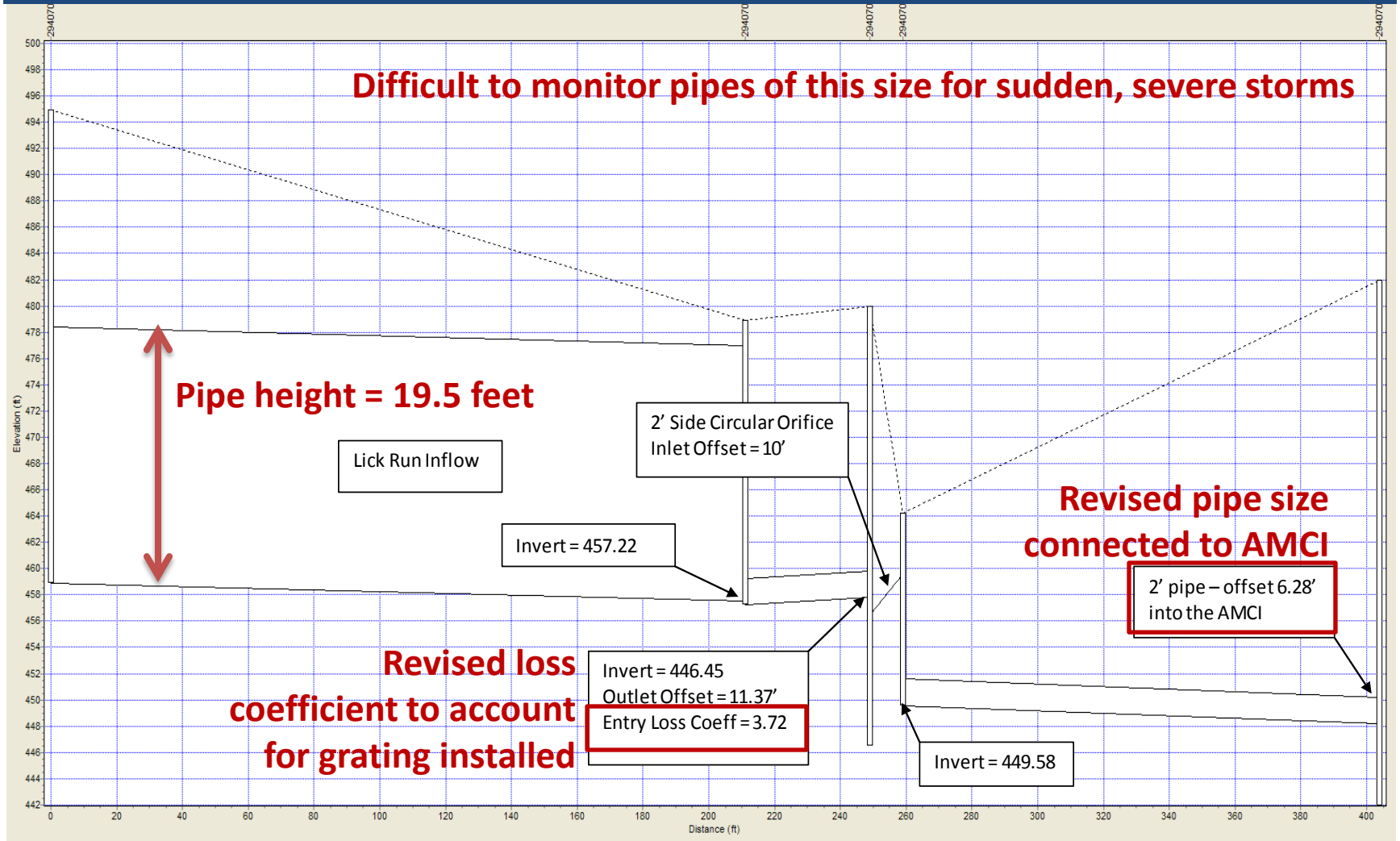
Local Data to

INPUT INTO MODEL

Local Data – Model Inputs

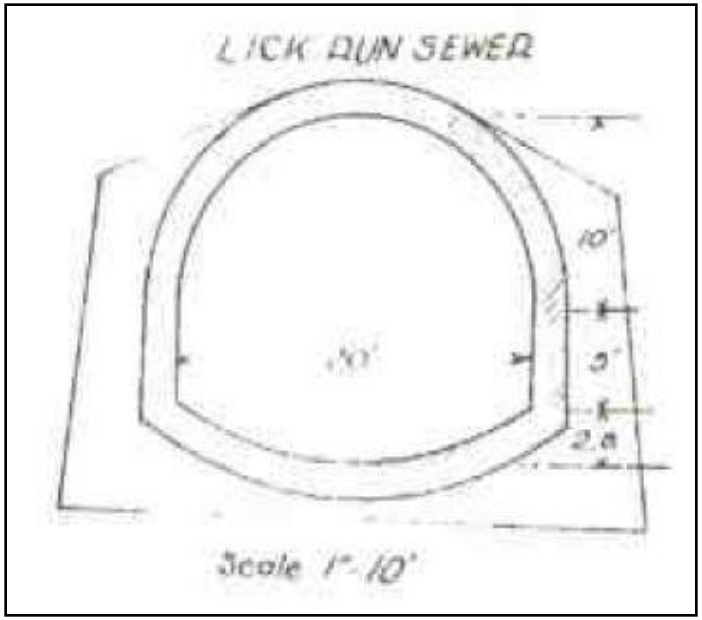
Updated Underflow Structure



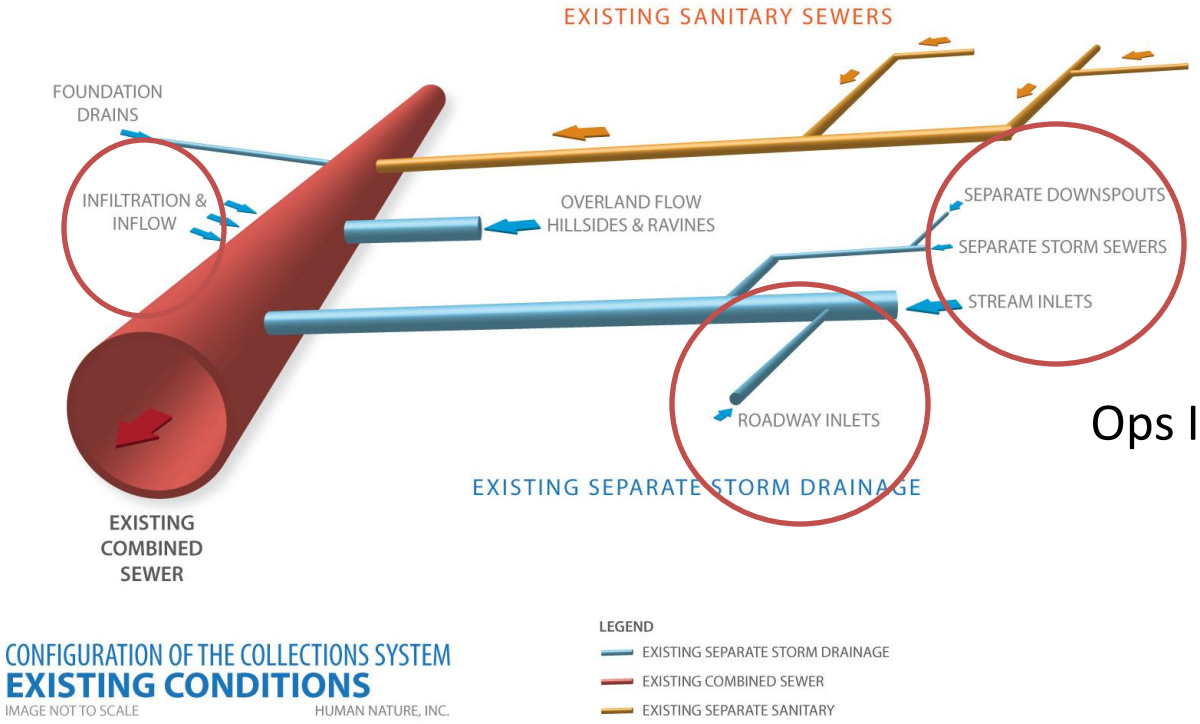
Model Updates

- ✓ Added 10,000 sf of area for each node
- ✓ 9 sealed manholes adjusted to prevent surcharge
- ✓ Created custom shapes for conduits

- Ponding turned on
- Blind MHs
- Shape/Size Updates



Conduit	Original Shape	Original Size	New shape	New size
28605024-28605025	HORIZ_ELLIPSE	17.83' x 20'	CUSTOM	17.8' x 20'
28605025-28605026	HORIZ_ELLIPSE	17.83' x 20'	CUSTOM	17.8' x 20'
28605026-28605029B	RECT_CLOSED	17.83' x 20.5'	CUSTOM	17.8' x 20'
28605029B-29408023	RECT_CLOSED	17.75' x 20.5'	CUSTOM	17.8' x 20.5'
29408023-29408050	CIRCULAR	14.5'	CUSTOM	17.8' x 20.5'
29408050-29408049	CIRCULAR	14.5'	CIRCULAR	19.5'



Local Data to Refine Model's Assumptions

Pan Evaporation Data

300 Soil Borings

Ops Interviews – surcharges, pumps

Weir & Orifice Settings

Runoff Catchment Parameters

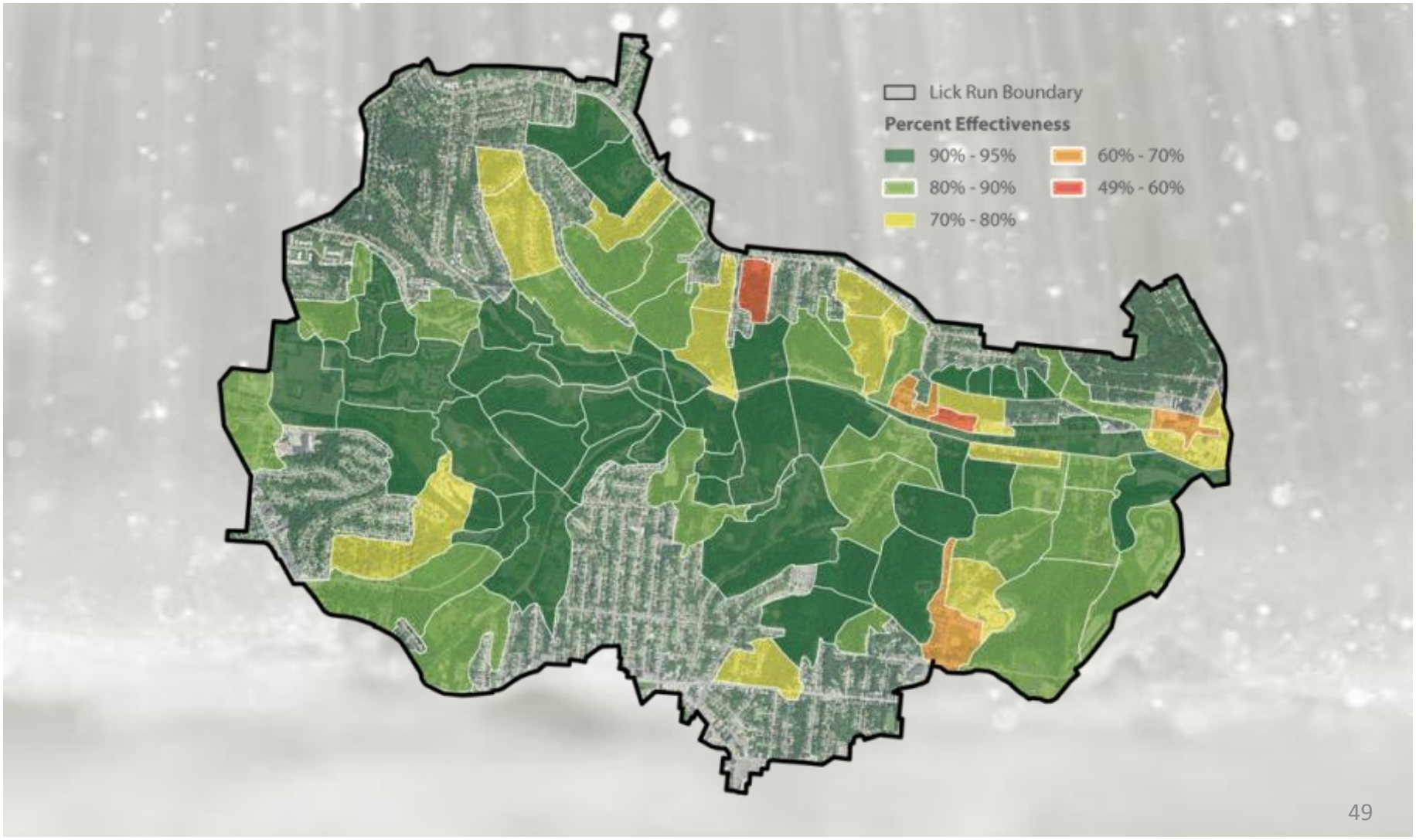
Local Data to

REFINE MODEL ASSUMPTIONS

Lick Run Separation Assumptions Summary

- Pan elevation data based upon local NOAA information added into the model to account for local climatic conditions in lieu of using regional information
- 300 soil borings were advanced to confirm soil conditions and the ground water elevation for the Lick Run area in lieu of using regional information
- Operational staff interviews conducted to gain an accurate understanding of locations of surcharges in the existing system and control settings
- Weir and orifice control setting and operational logic were adjusted to match actual conditions in lieu of using typical values
- Runoff catchment parameters were field verified to account for local data unique to each sub-catchment areas in lieu of using regional published information

Lick Run Percent Stormwater Capture Results



Local Data – Refine Assumptions

FA-2

Part of Queen City and Cora Avenues R/W Sewer Separation

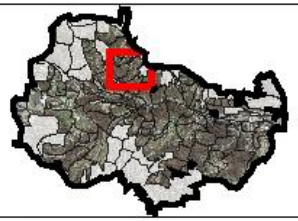
Lick Run Conceptual Plan:
Estimated Percent Effectiveness - 90%

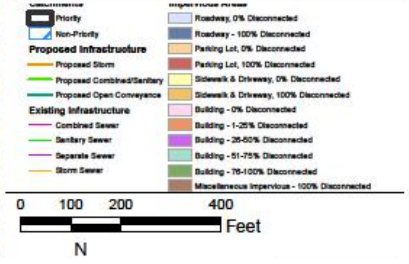
Detailed Impervious Evaluation:
Estimated Percent Effectiveness - 82%

Catchment Area: 27.18 Acres
Roadway: 0.15 Acres
Building: 1.72 Acres
Parking: 0.30 Acres
Driveways and Sidewalks: 1.08 Acres
Miscellaneous Impervious: 0.01 Acres
Total Pervious Area: 23.93 Acres

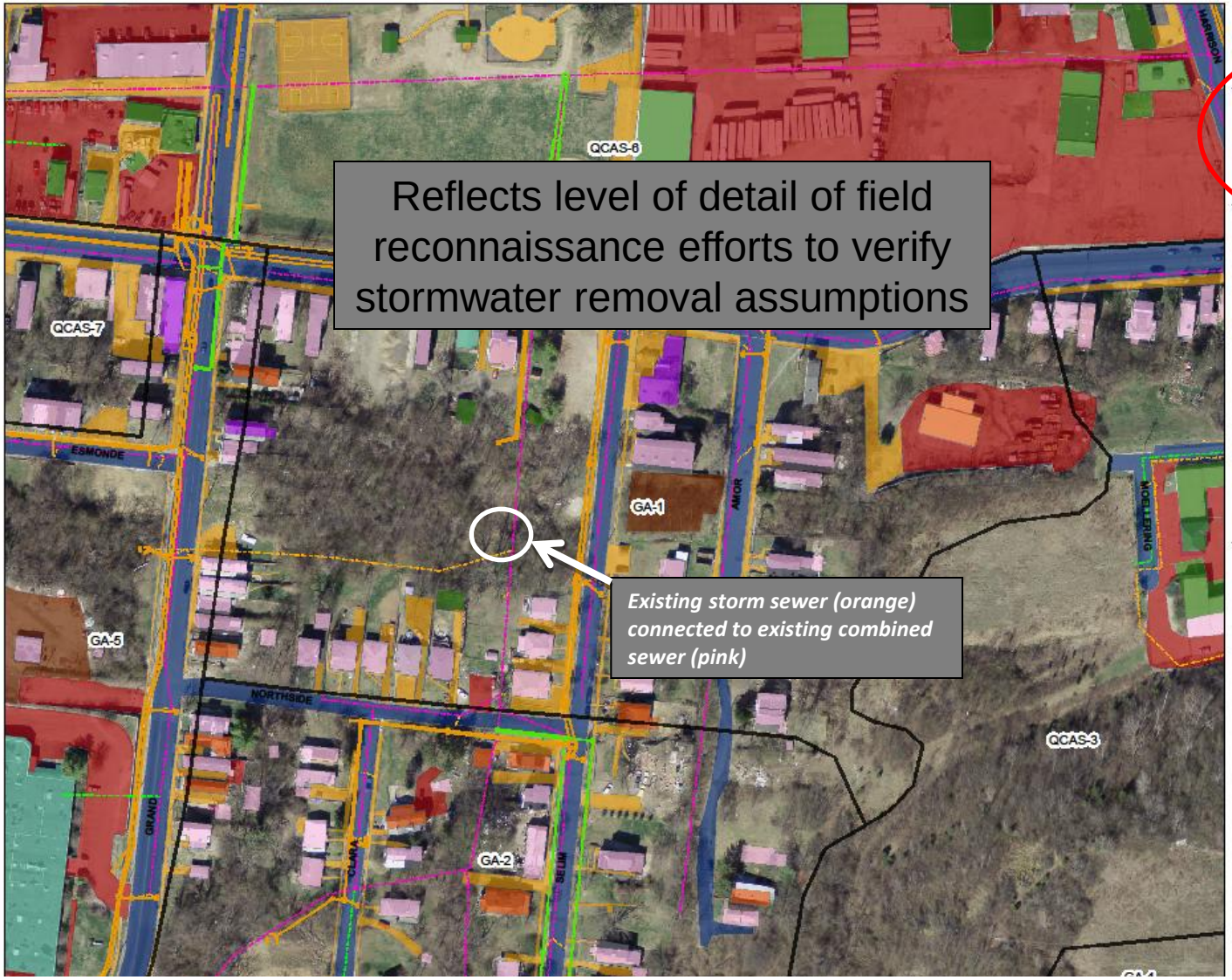
Percent Impervious: 12%

Area Removed:
Impervious: 1.60 Acres
Pervious: 23.93 Acres
Total Area: 25.53 Acres
Percent of Catchment Area: 94%





Local Data – Refine Assumptions



Reflects level of detail of field reconnaissance efforts to verify stormwater removal assumptions

Existing storm sewer (orange) connected to existing combined sewer (pink)

GA-1

Part of Grand and Selim Avenues Sewer Separation

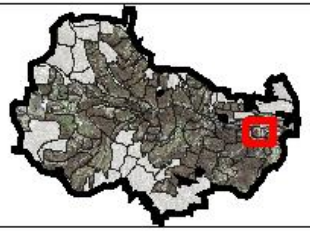
Lick Run Conceptual Plan:
Estimated Percent Effectiveness - 75%

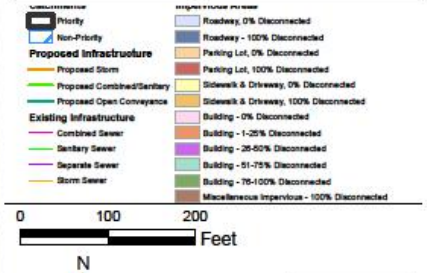
Detailed Impervious Evaluation:
Estimated Percent Effectiveness - 83%

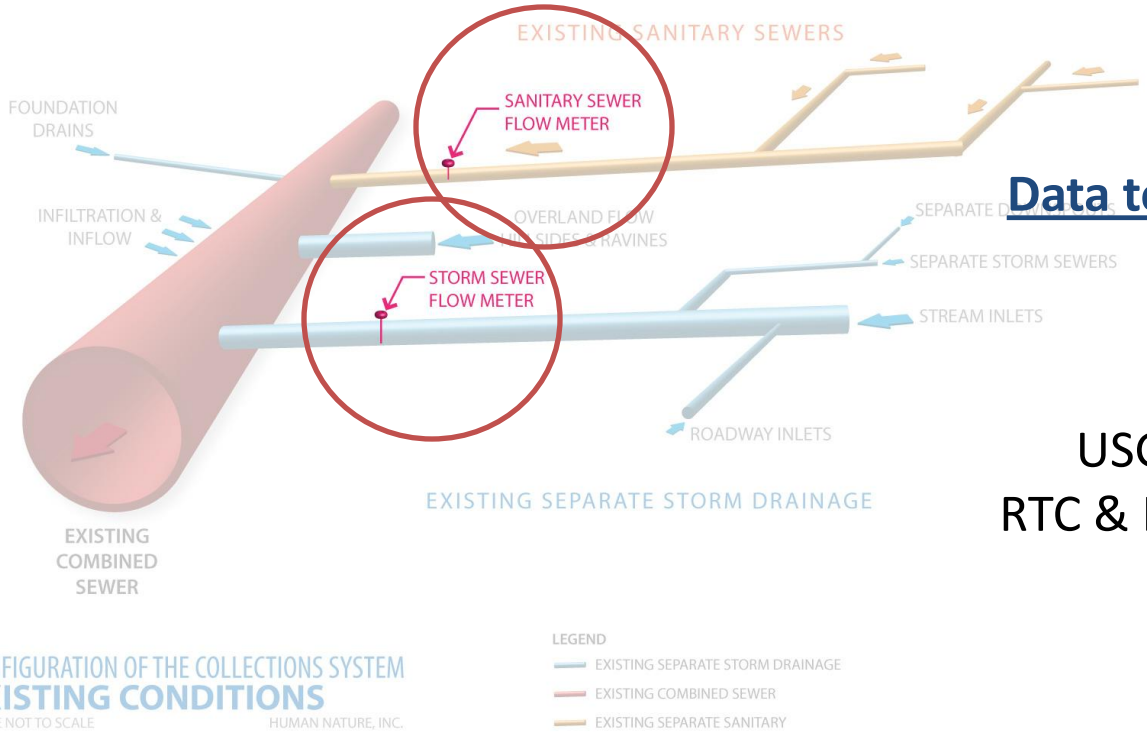
Catchment Area: 13.28 Acres
Roadway: 1.61 Acres
Building: 1.34 Acres
Parking: 0.51 Acres
Driveways and Sidewalks: 1.04 Acres
Miscellaneous Impervious: 0.20 Acres
Total Pervious Area: 8.57 Acres

Percent Impervious: 35%

Area Removed:
Impervious: 3.53 Acres
Pervious: 8.57 Acres
Total Area: 12.11 Acres
Percent of Catchment Area: 91%







Data to Confirm Model's Results

Sanitary Flow Monitoring

Storm Flow Monitoring

Telog Overflow Data

USGS Mill Creek Level Gauges

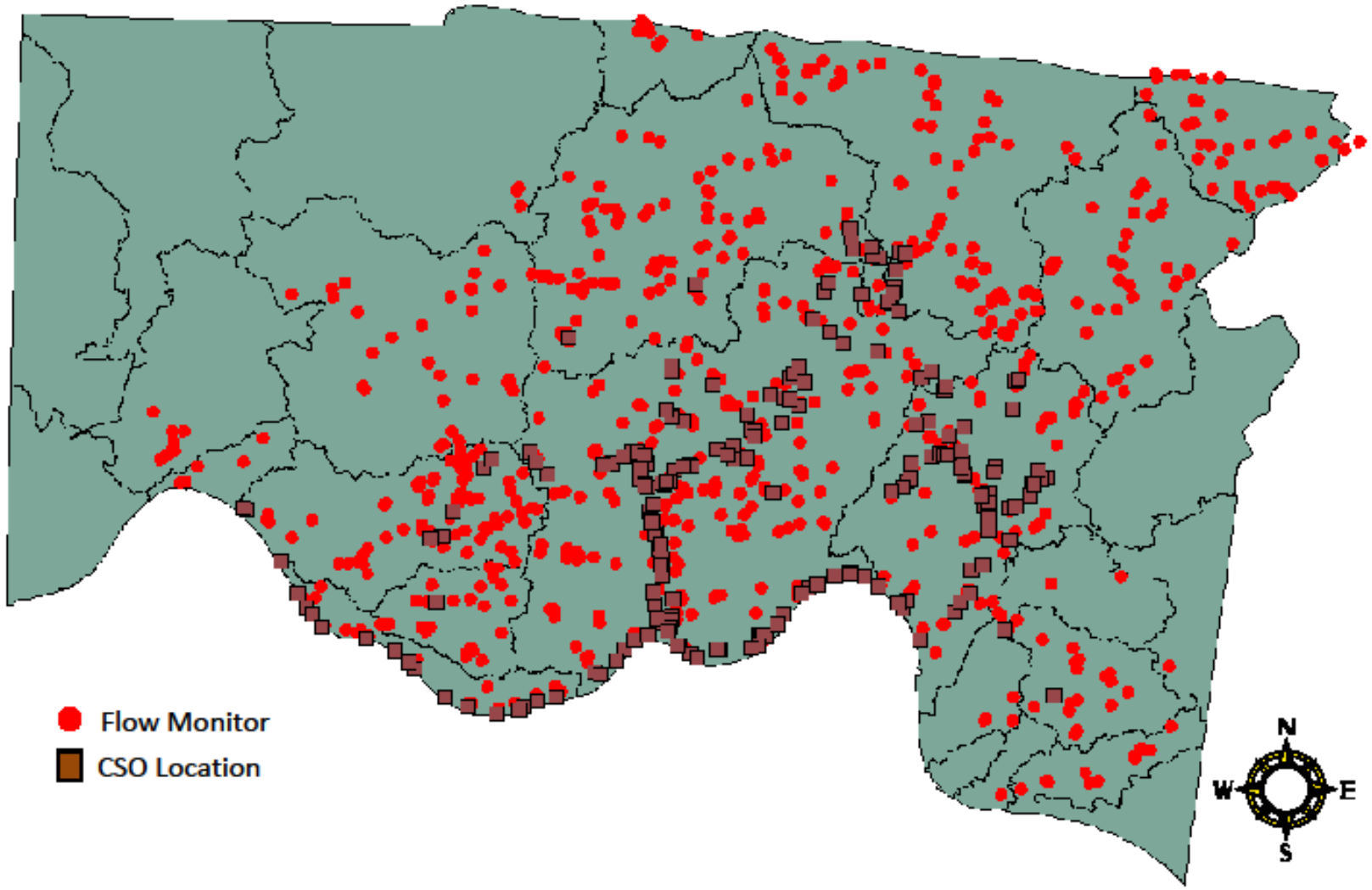
RTC & Interceptor Level Monitors

Local Data to

CONFIRM MODEL RESULTS

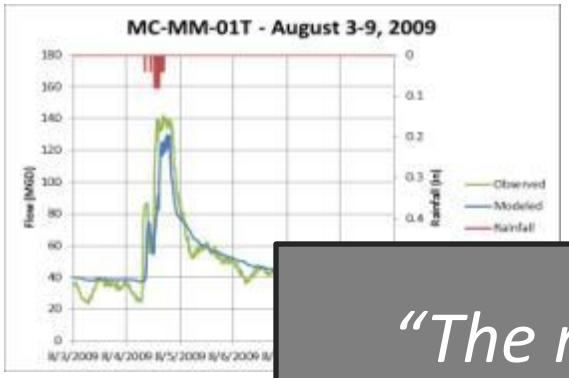
Local Data – Flow Monitoring Sites

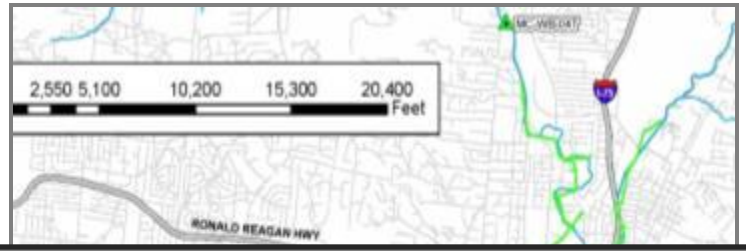
MSD utilizes flow monitoring data for planning and monitoring efforts throughout the service area.

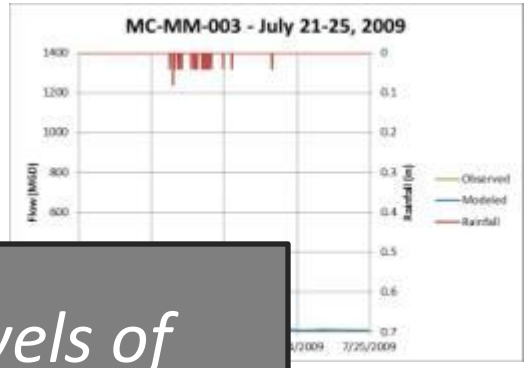


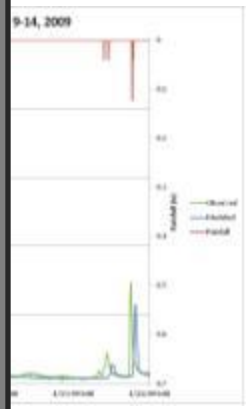
Local Data – Confirm Results

Flow Monitoring

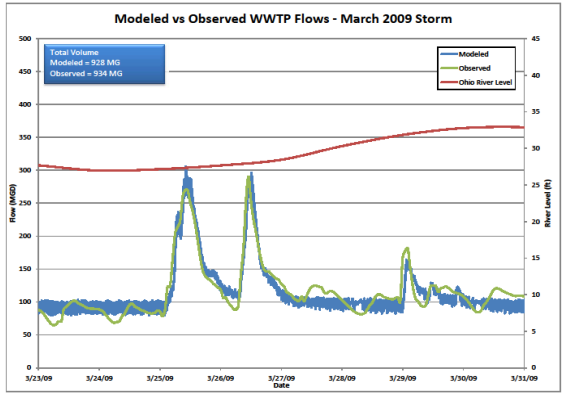


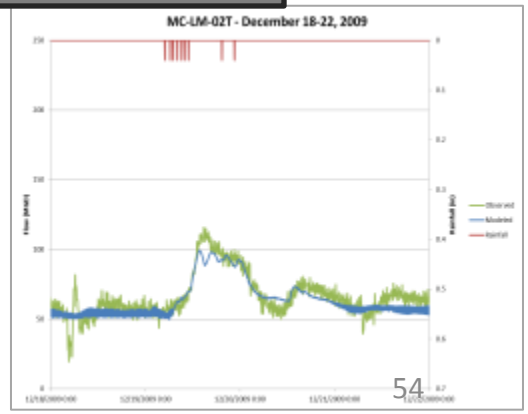






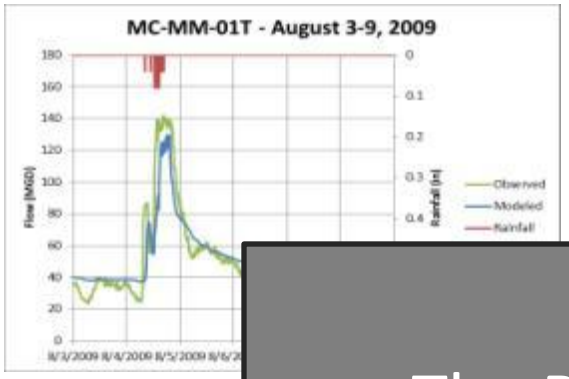
> *"The main differences in the levels of verification will be in the number of points at which the model is verified rather than the exactness of the fit."*
>
> Wastewater Planning Users Group (WaPug)
> *Code of Practice for Hydraulic Modeling of Sewer Systems*

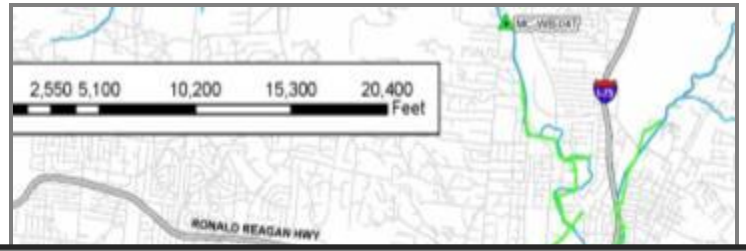


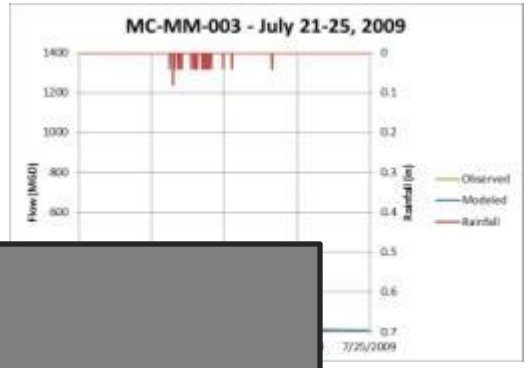


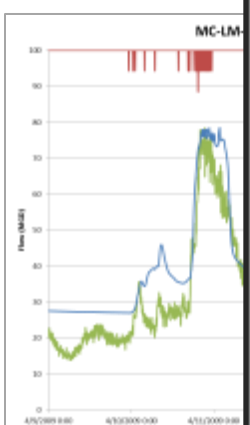
Local Data – Confirm Results

Flow Monitoring



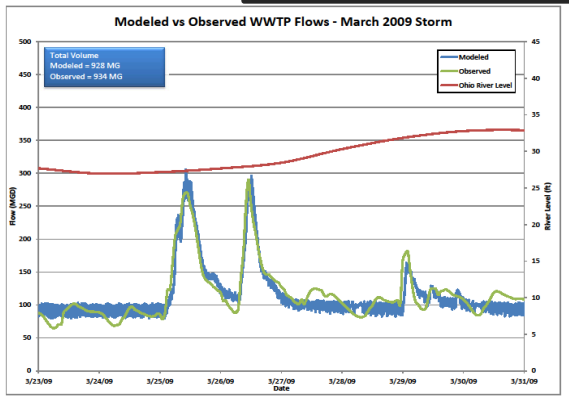


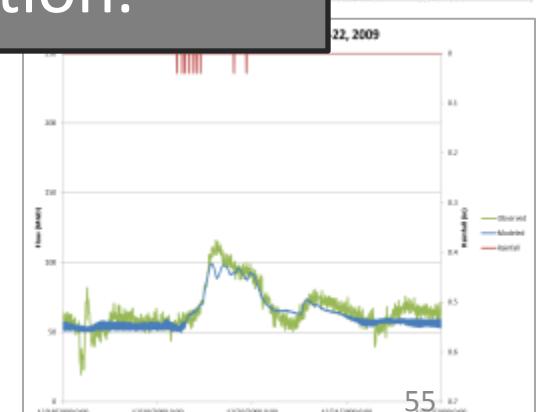




REGULATOR FEEDBACK

The Regulators have articulated the approach MSD used to model separation is the accepted method and they have confidence MSD's CSO model is effectively capturing the sewer separation.

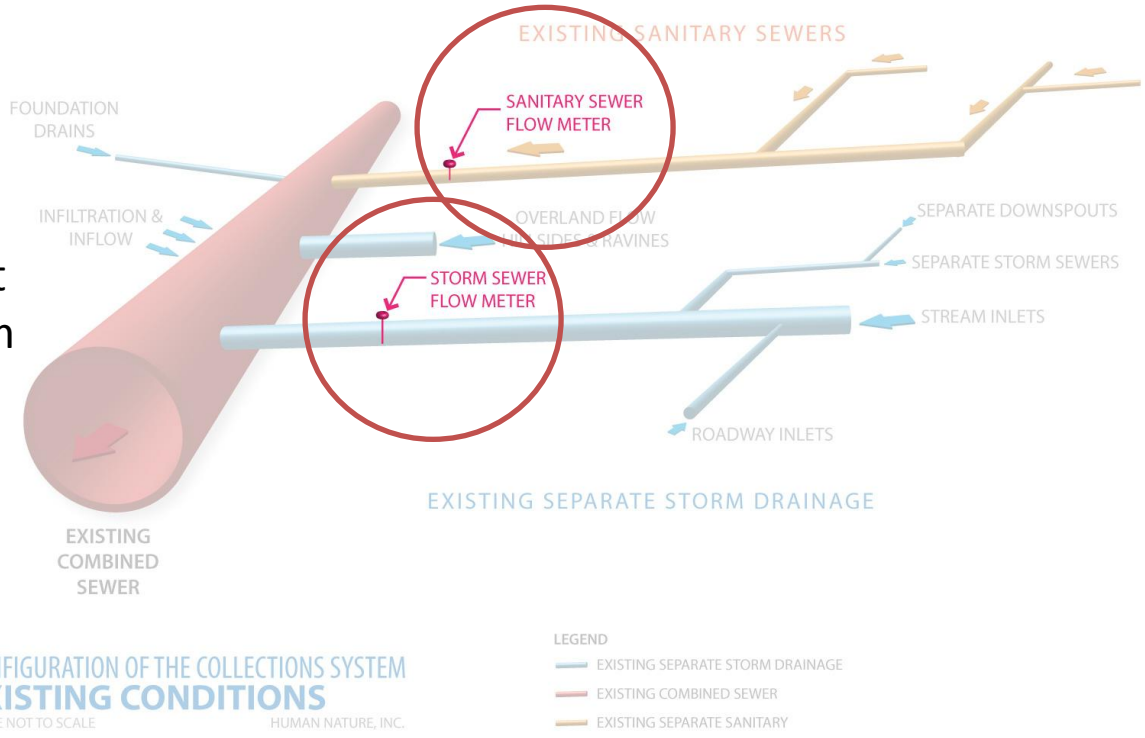




Local Data – Lick Run Flow Monitoring 2011

Lick Run Sanitary and Storm Sewer Flow Monitoring

- Collected data from 11 sites
  - 7 storm sewers
  - 4 sanitary sewers
- Collected during storm events over 10 months
- Data supported the model's assumptions for the amount of rainfall entering the storm and combined sewers
- Results within 1% of MSD's stormwater removal assumptions

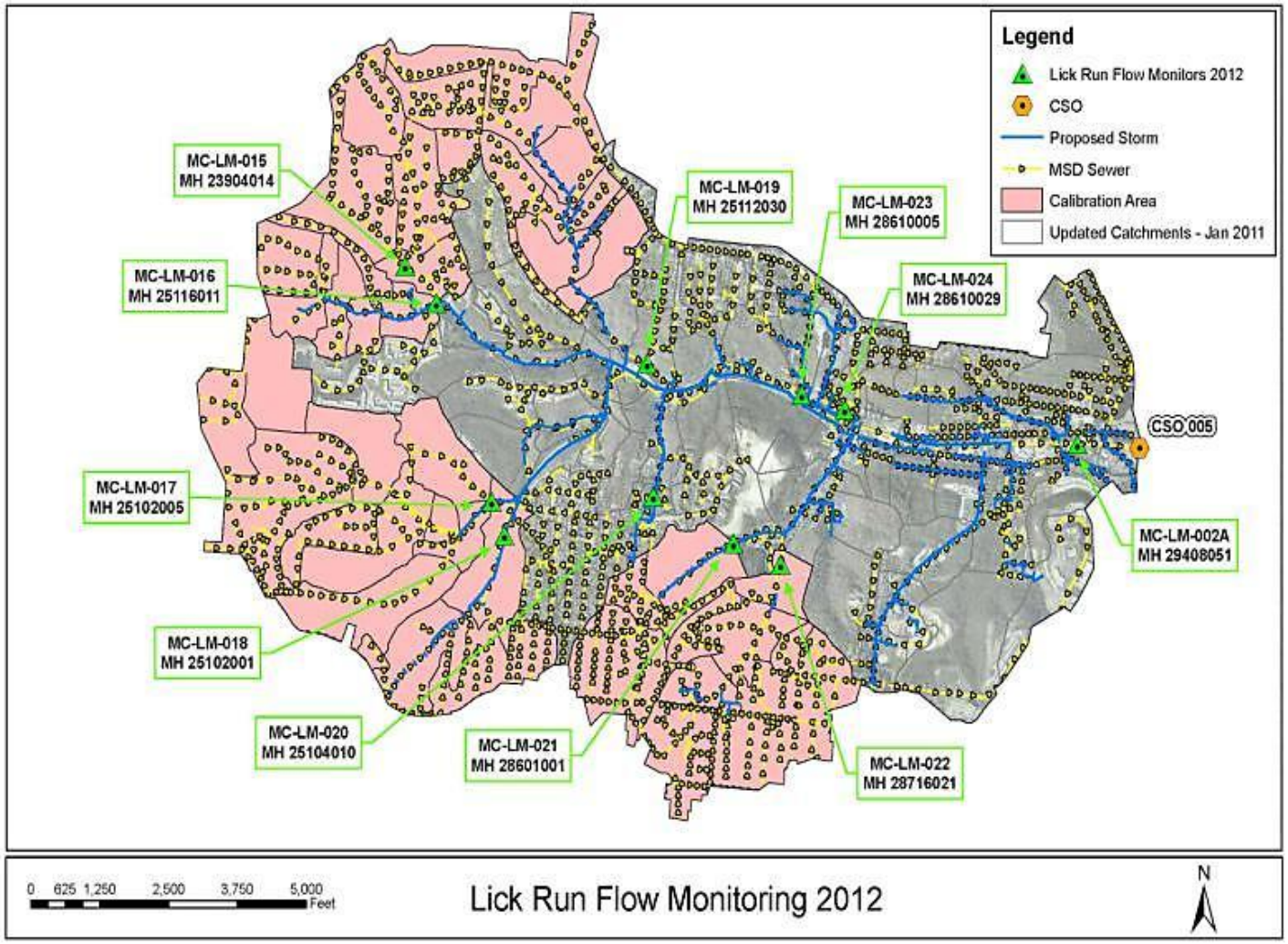


Flow Monitoring – 2012 Lick Run

- MSD's Current Flow Monitoring Plan:
  - Takes into account slope, debris, pipe size, velocity
  - Underwent refinement and verification through field inspection
  - Sites have smaller pipes and slower velocities
  - Will monitor flows in the upstream areas of the watershed in pipes no greater than 66-inch diameter and maximum velocities no greater than 12 feet per second

Flow Monitoring – 2012 Lick Run

Since modeling is an iterative process, MSD is continuing to collect flow monitoring data and has refined the locations to improve data reliability.



Confidence in Results

The risk associated with limited flow monitoring data at CSO 5 is minimized through the collective wealth of local data and sophistication of the current modeling technology that has been deemed a rational tool by the Regulators.

Confidence in Stormwater Removal Volumes

Existing local data provides good understanding of quantities to be removed

Lick Run Model is Correct

Reasonable assumption due to validation of up and downstream sections

Model Input Fully Vetted

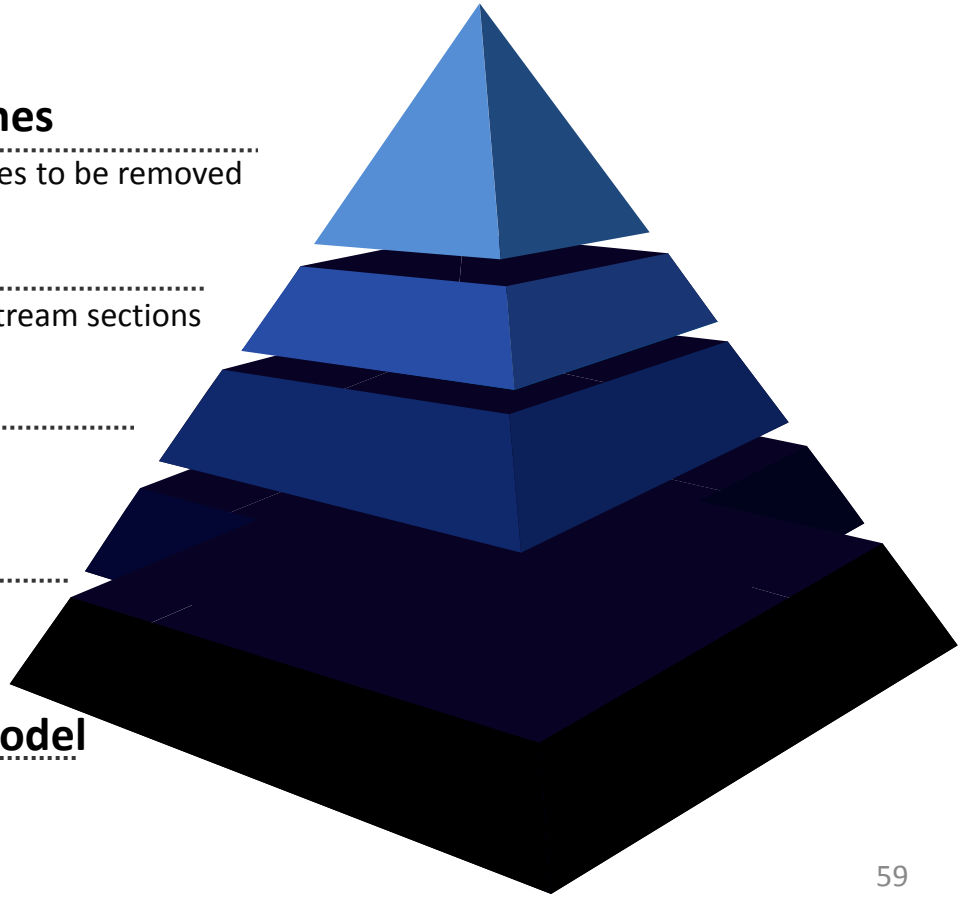
Leading industry experts and Regulators agree with inputs and assumptions

MSD has made Comprehensive Effort

Visual review of every pipe, manhole, parcel drainage pattern for all 87 sub catchments

LMCPR is Based on Results from USEPA Model

Regulators have indicated “NO RED FLAGS”



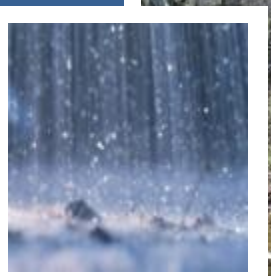
Regulator Feedback

MSD and the County team have been discussing the sewer separation approach, model update, and local data with the Regulators for the past four months.

- The Regulators have articulated the approach MSD used to model separation is the accepted method.
- The Regulators have confidence MSD's CSO model is effectively capturing the sewer separation.
- The Regulators have stated MSD's model leaves the infiltration & inflow component of stormwater in the combined sewer system. They said this a conservative approach and can be refined in the future if pipes are lined or more data is collected.
- The Regulators said for the alternatives analysis, MSD has a model that can be relied on to predict what will happen to a reasonable degree of accuracy.
- Both the Regulators and MSD are comfortable the information produced by the model is adequate for making decisions.
- The Regulators said they are not aware of any on-going discussions regarding changes at the state level for MS4 permits.

Lower Mill Creek Partial Remedy

QUESTIONS?

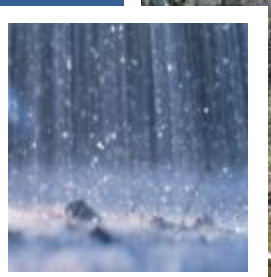


METROPOLITAN SEWER DISTRICT of greater CINCINNATI

Lower Mill Creek Partial Remedy

Hamilton County Board of County Commissioners Public Hearing

October 10, 2012



METROPOLITAN SEWER DISTRICT of greater CINCINNATI

Today's Agenda

- MSD's Recommended Alternative
- Valley Conveyance System Components
- Regulator Feedback

Recommended Alternative

Sub-Basin	MG CSO Reduction	Capital Cost (2006$)	Cost/ Gallon	No. of CSOs	CSOs
Lick Run	726	$200,492,000	$0.28	1	5
Wooden Shoe	156	$ 27,534,000	$0.17	2	217, 483
West Fork					
Bloody Run	93	$10,651,000	$0.04	1	181
CSO 488 Storage	47	$3,421,000	$0.23	1	488
4 RTCs	737	--	--	2	5,125,482,485
Total	**1,759**	**$242,098,000**		**6**	

Sustainable Alternative

From April 2, 2012 LMCPR Preliminary Findings Report

Real Time Control Facilities (CSOs)	5 ,125, 181, 482, 485/487
West Fork Channel Grate Modifications	YES
New Storm Sewers (ft)	104,400
Relocated Combined Sewers (ft)	21,500
Naturalized Channels (ft)	5,500
Valley Conveyance System (ft)	8,100
Natural Conveyance/Stream Separation (ft)	20,000
Non-Tunnel Storage Capacity (mg)	5
Additional EHRT Capacity (mgd)	20
Stormwater Detention Basins (acre - ft)	80

Phase 1 Highlights

- Kings Run Source Control & Storage
- Bloody Run, Mitchell, Ross Run RTC
- Storage at CSO 488
- West Fork Source Control, Storage & RTC
- Lick Run Source Control & RTC

Utility Coordination

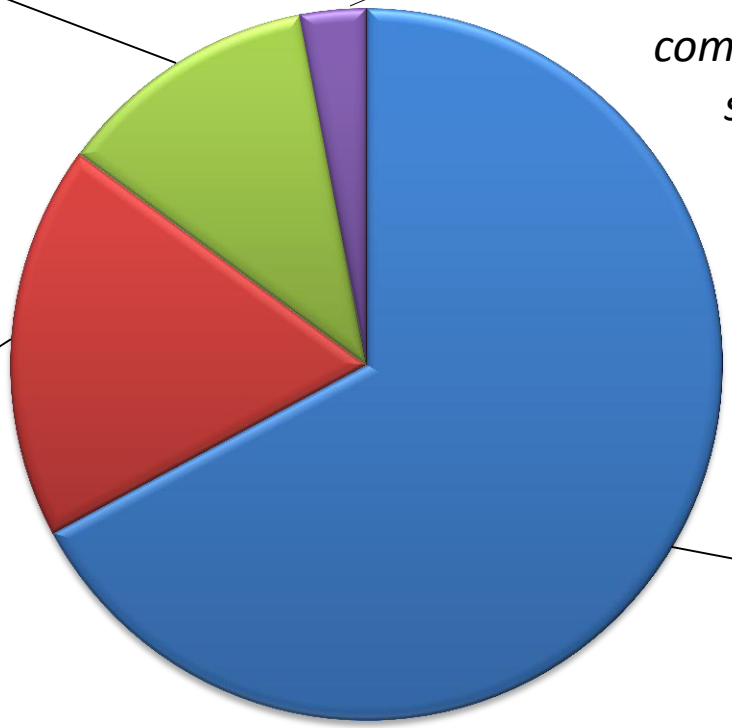
31 Coordination Meetings

Costs included in Base Project is AFTER coordination efforts.

- CDOTE *(projects sequencing/phasing plan)*
- Hamilton County Planning *(public engagement coordination)*
- Duke Energy *($400,000 avoided cost for 6,000 feet gas mains)*
- Time Warner Cable *(no utility impact)*
- Cincinnati Bell *(no utility impact)*
- Greater Cincinnati Water Works *(construction coordination for water main, hydrants, and valve vault improvements)*

Valley Conveyance System

$67 million



Multi-Purpose Components
$8 million
12%
Open spaces, Access & Maintenance Paths, Safety

Replaced Infrastructure
$2 million
3%
community park, sidewalks

Transportation Components
$12 million
18%
bridges & replaced Intersections

Conveyance Components
$45 million
67%
waterways, earthwork, utilities, culvert box, plantings, irrigation

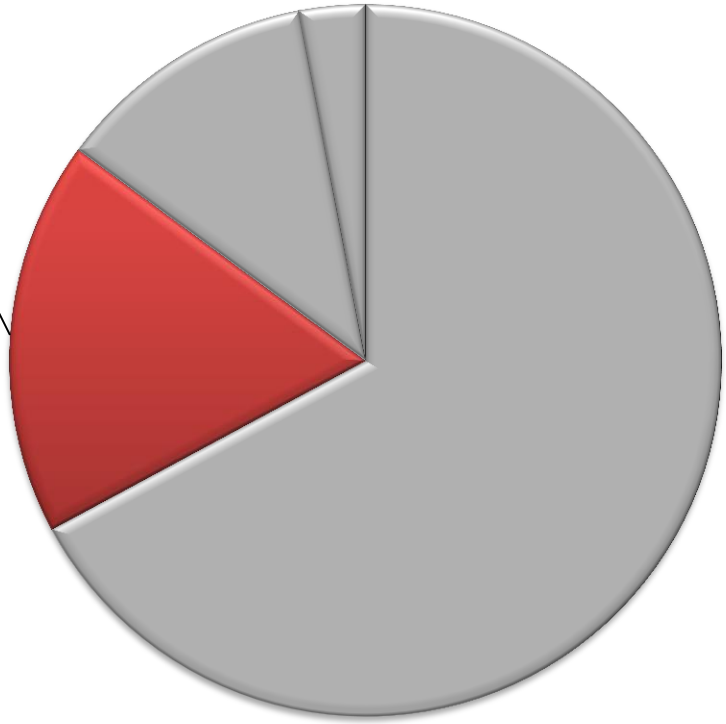
Transportation Components

Transportation

$12 million

18% of VCS Cost

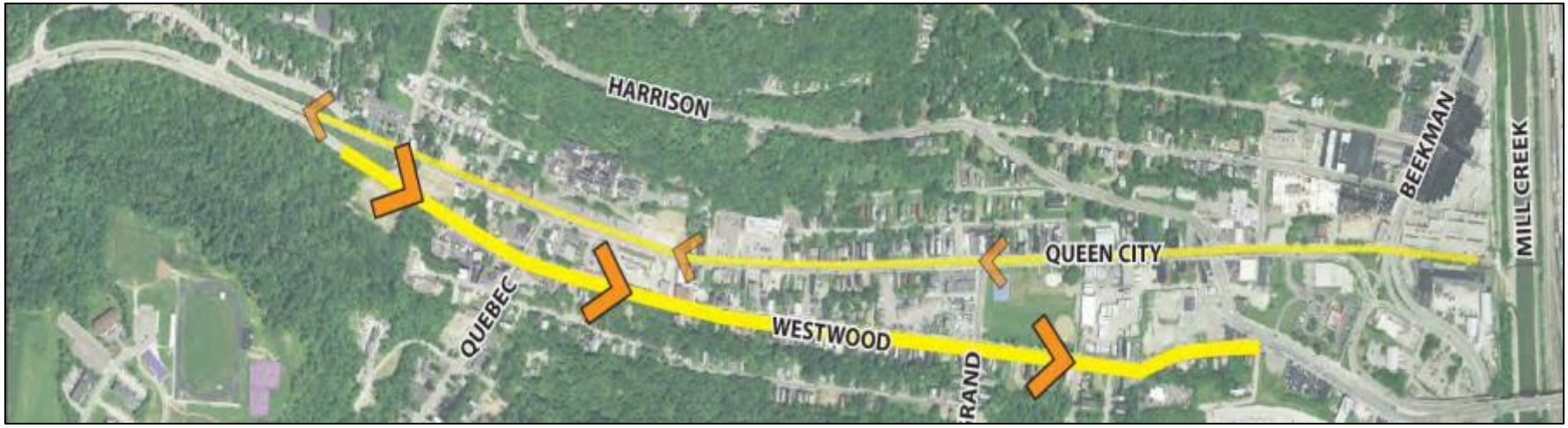
3.8% Base Project Cost



- Connectivity Bridges
- Intersection Replacements
- Pedestrian Safety

Transportation Components

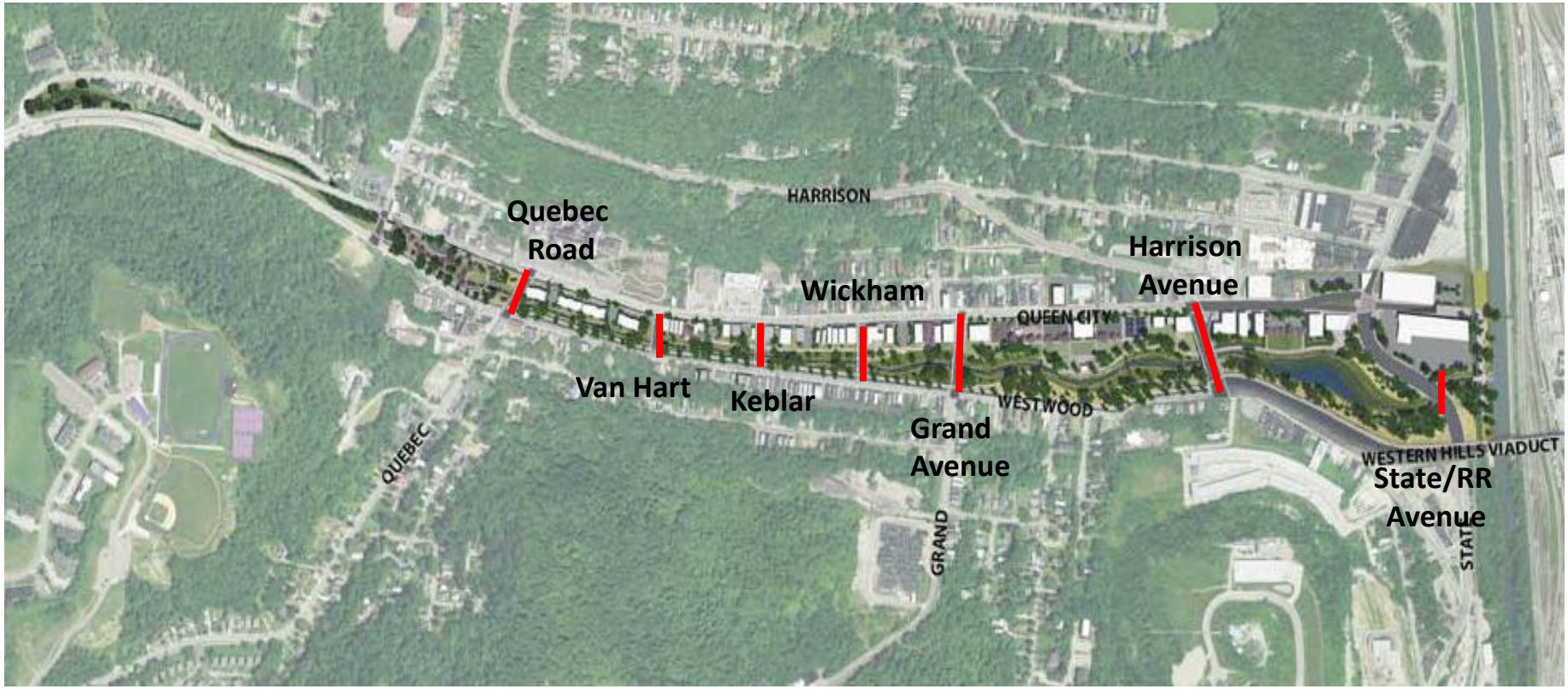
Existing Roadways



Component	Cost	Description
Bridges	$5.6 million	8 crossings of urban waterway between Queen City & Westwood Avenues
Intersection Reconnections	$5.2 million	Elimination of Beekman Avenue between Queen City and Westwood, pavement markings, traffic signals
Streetscape & Safety	$1.9 million	Highly visible crosswalks, signals, signage, trash receptacles, street trees & lights
Total	$12.7 million	

Bridges for Connectivity

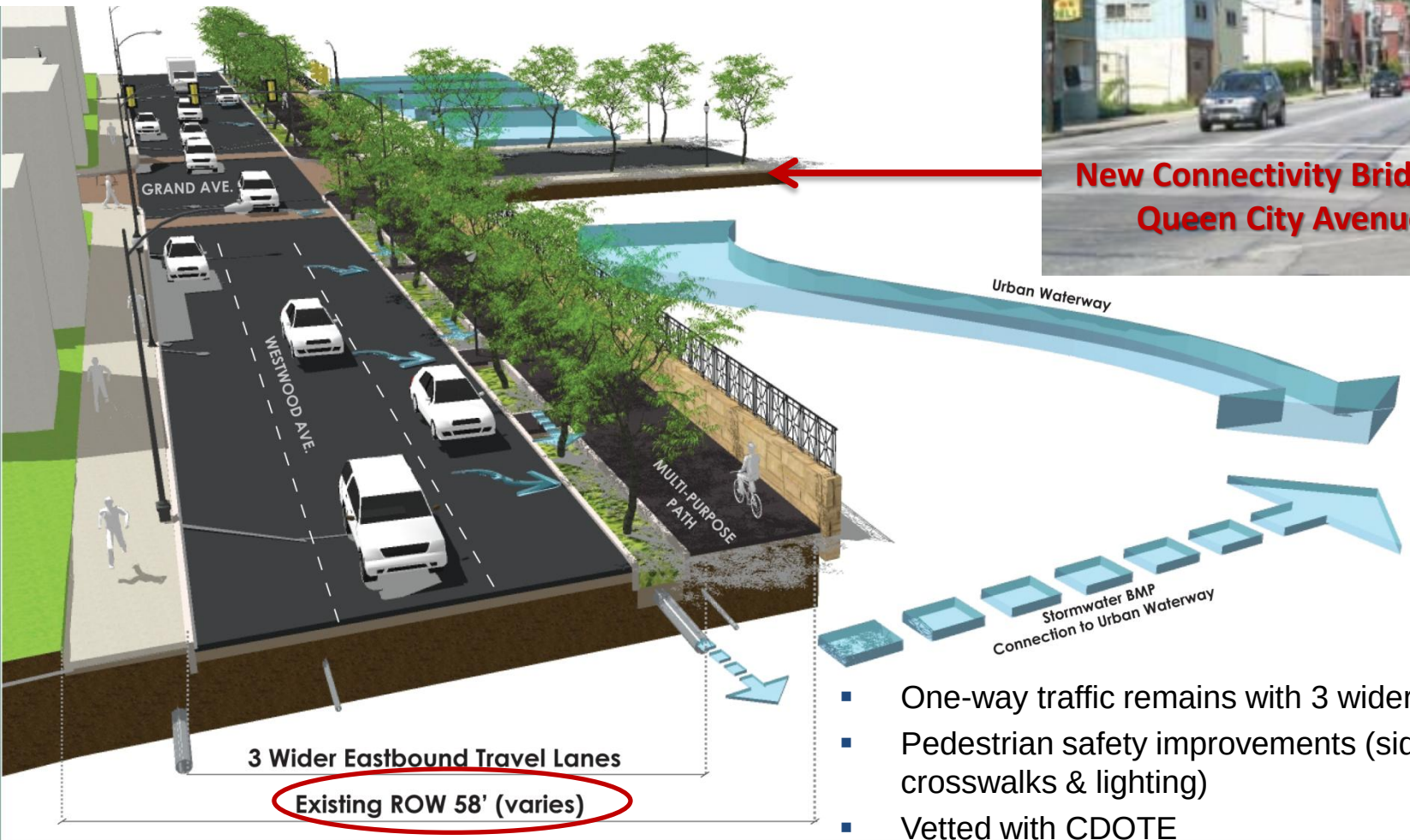
Transportation Components



- 8 crossings to maintain north-south connectivity
- Cost in base project = $5.6 million

Transportation Related Components

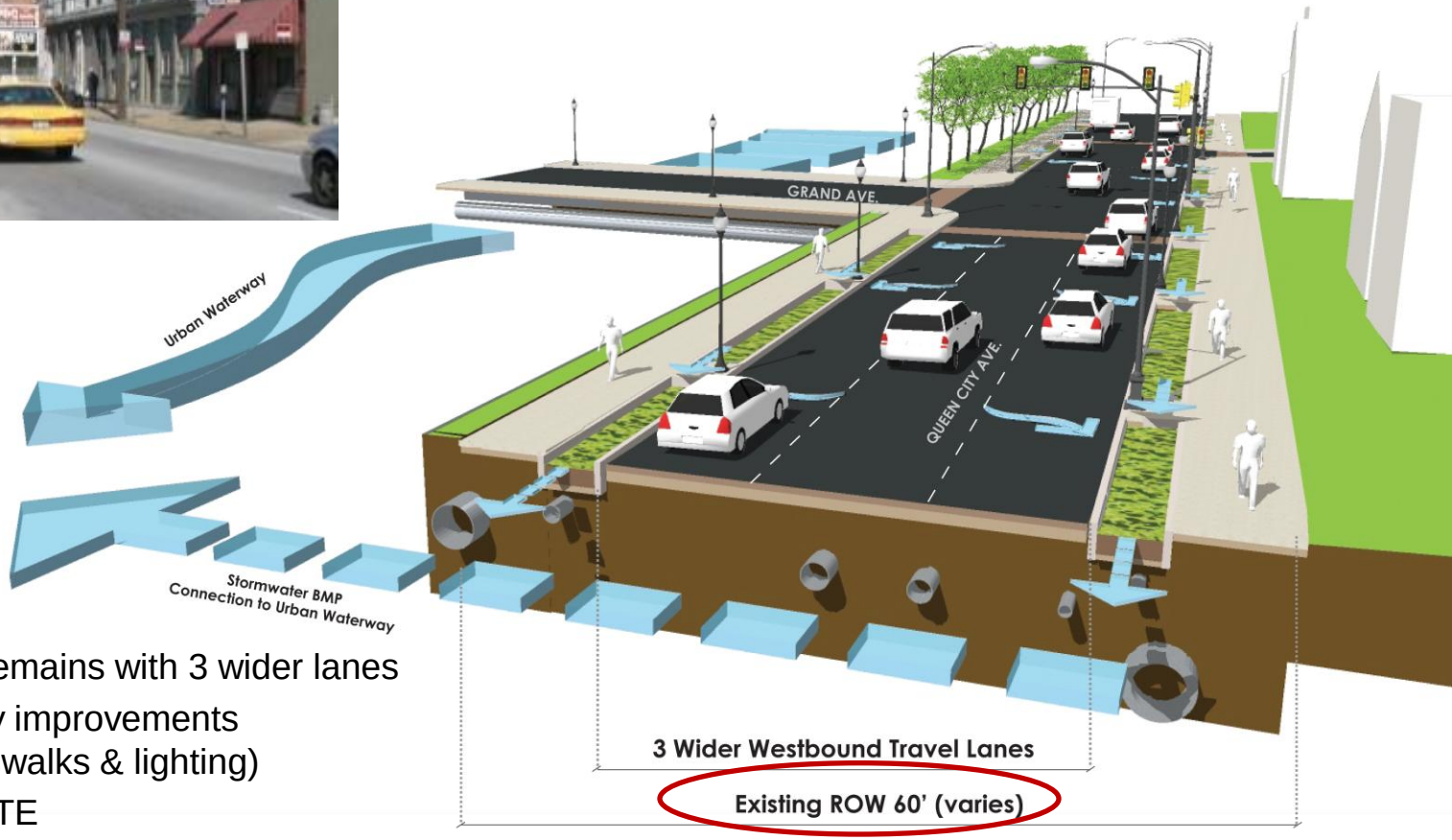
Westwood Avenue



- One-way traffic remains with 3 wider lanes
- Pedestrian safety improvements (sidewalks, crosswalks & lighting)
- Vetted with CDOTE
- Average right-of-way: 58 feet
- Traffic Volume: 23,000 vehicles per day

Transportation Related Components

Queen City Avenue



- One-way traffic remains with 3 wider lanes
- Pedestrian safety improvements (sidewalks, crosswalks & lighting)
- Vetted with CDOTE
- Average Right-of-Way: 60 feet
- Traffic Volume: 16,000 vehicles per day

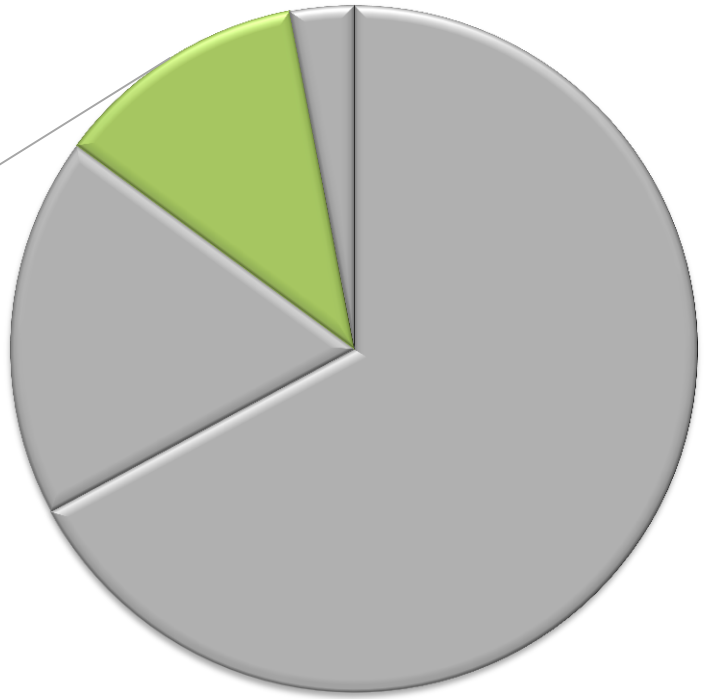
Multi-Purpose Features

Multi-Purpose

$8 million

12% of VCS Cost

2.5% Base Project Cost



- Stormwater Management
- Maintenance
- Safety
- Public Education
- Community Integration

Multi-Purpose Features

Stormwater Management

- **Stormwater Management = $4.3 million**
  open spaces, roadside planters
- Maintenance Components (irrigation, access)= $2.1 million
- Safety (lighting, railings, crosswalks) = $1 million
- Public Education (interpretive signage) = $230,000
- Community Integration = $620,000
  bike racks, benches, paver plazas, off-street parking

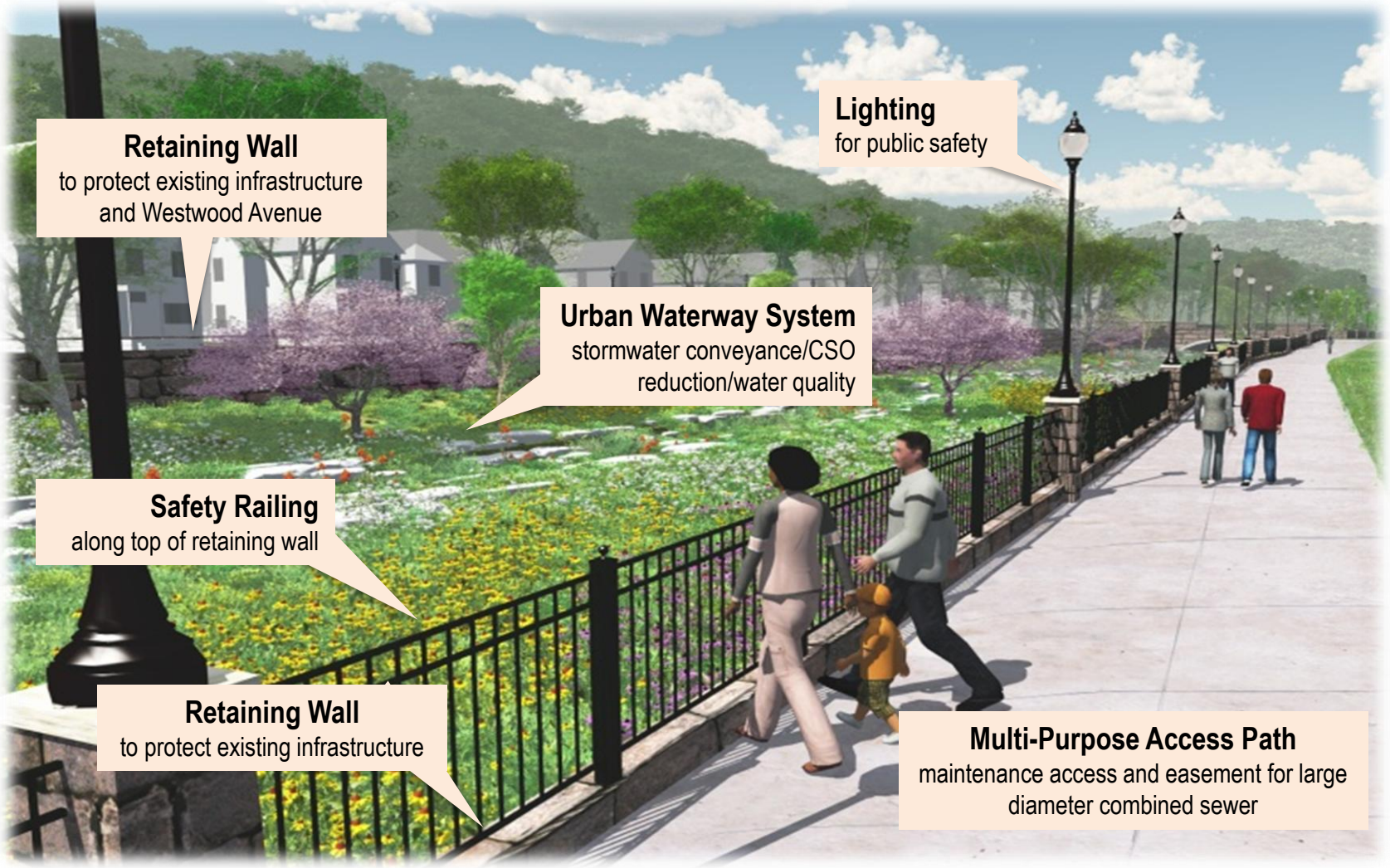
Open Spaces for Flood Control

Typical Stormwater Planters

Multi-Purpose Features

Safety & Maintenance

Narrow Channel Zone



Looking south towards Westwood Avenue

Multi-Purpose Features

Community Integration

- Stormwater Management = $4.3 million
  open spaces, retaining wall, roadside planters
- Maintenance (irrigation, access) = $2.1 million
- Safety (lighting, railings, crosswalks) = $1 million
- Public Education (interpretive signage) = $230,000
- **Community Integration = $620,000**
  bike racks, benches, paver plazas, off-street parking

Benches

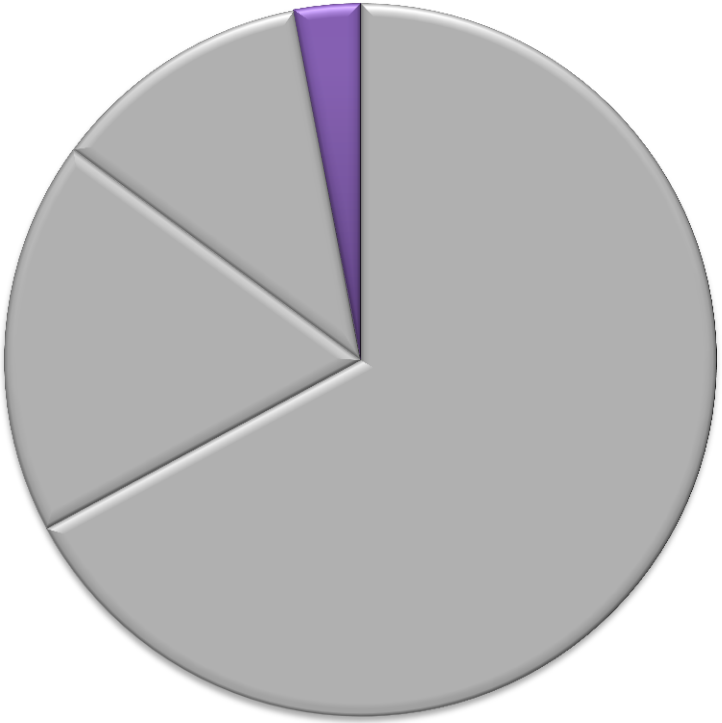
Picnic Areas

bike racks and benches to promote public involvement, six permeable paver plazas to provide access to maintenance path from the street and to aid in slowing water down and level of peak flows, and three off-street parking lots.

"Make Lick Run beautiful and exciting and bring it into a very urban setting, where many people can enjoy it." - *Citizen employed in South Fairmount*

Relocated Infrastructure

- Existing Sidewalks
- South Fairmount Community Recreation Park Features



Replaced Infrastructure

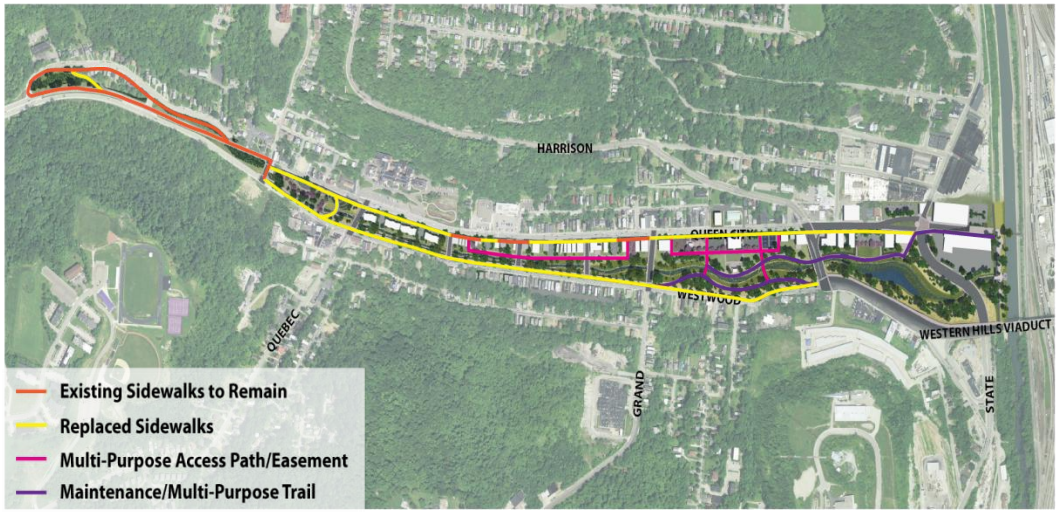
$2 million

3% VCS Cost

0.6% Base Project Cost

Relocated Infrastructure

Impacted by Project



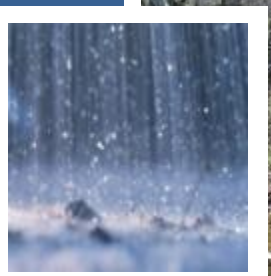
- Currently exist and disturbed by construction of project
- Sidewalks, parking lot
- Basketball courts
- Playground
- Picnic shelter/pavilion
- Cost in base project = $2 million

Regulator Feedback

- Understand these costs are included due to the unique nature of this CSO project.
- Acknowledged the look of features is different than traditional projects in order to fit into a public setting, but it accomplishes the same functionality.
- Agreed features needed for safety or to fit into neighborhood are appropriate costs.
- Noted, in general if a feature meets test of necessary and reasonable, then it is viewed as a project cost.
- Agreed the features included for safety, maintenance access, water quality, and restoration of impacted areas would be placed into the category of “necessary and reasonable.”

Lower Mill Creek Partial Remedy

QUESTIONS?



METROPOLITAN SEWER DISTRICT of greater CINCINNATI