OWEA Technical Conference

Reducing Odor Complaints through Air Dispersion Modeling and Odor Control Master Planning

Amy West, Brown and Caldwell
Sara Cramer, Metropolitan Sewer District of Greater Cincinnati
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Agenda

- Project overview
- Dispersion modeling process
- Goal setting
- Review odor sampling
- Baseline dispersion modeling
- Phase 1 and 2 alternative dispersion modeling
- Recommendations and Capital Improvement Program

Project Overview

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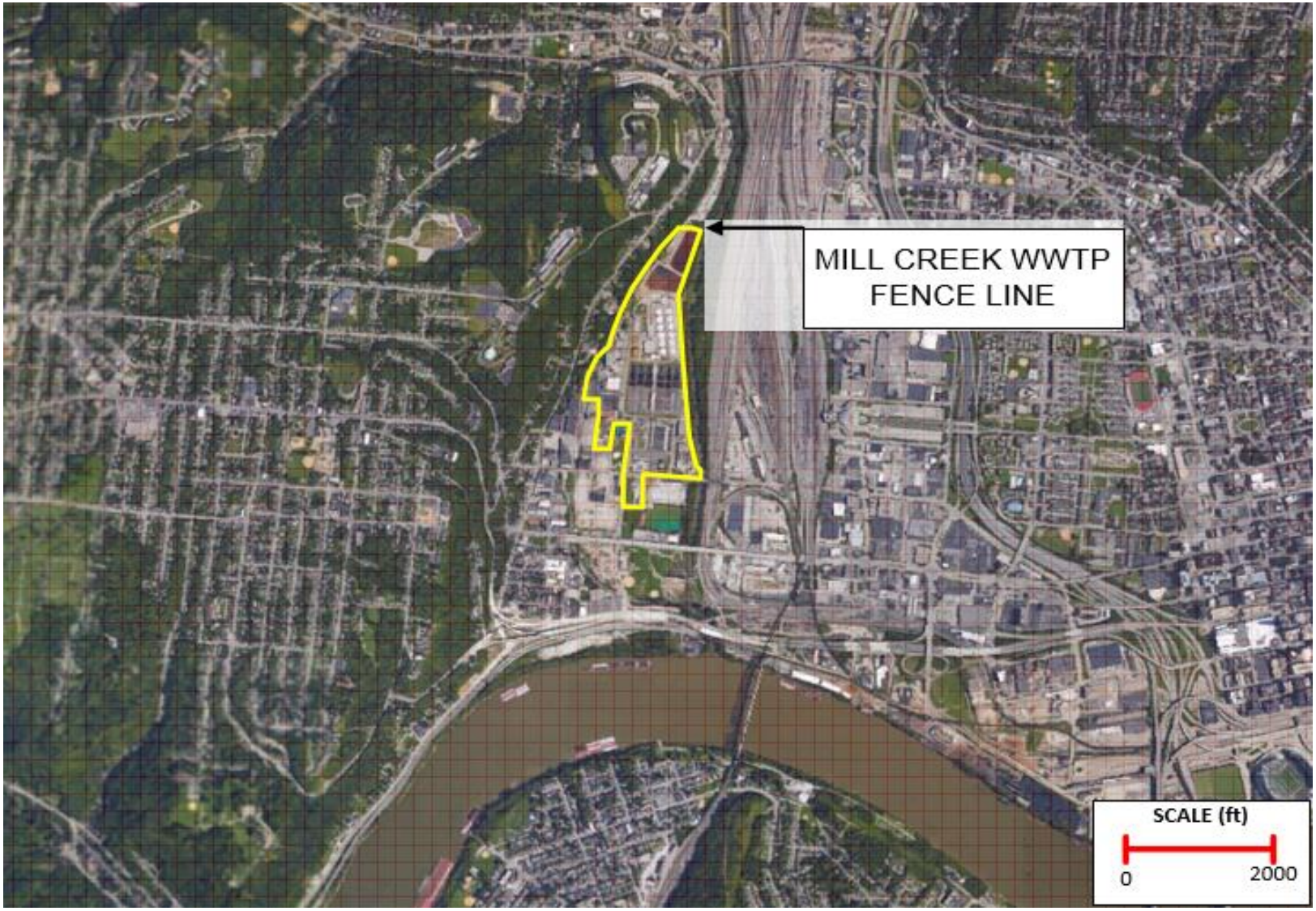
Mill Creek WWTP Fence Line



MSDGC Odor Control Improvements

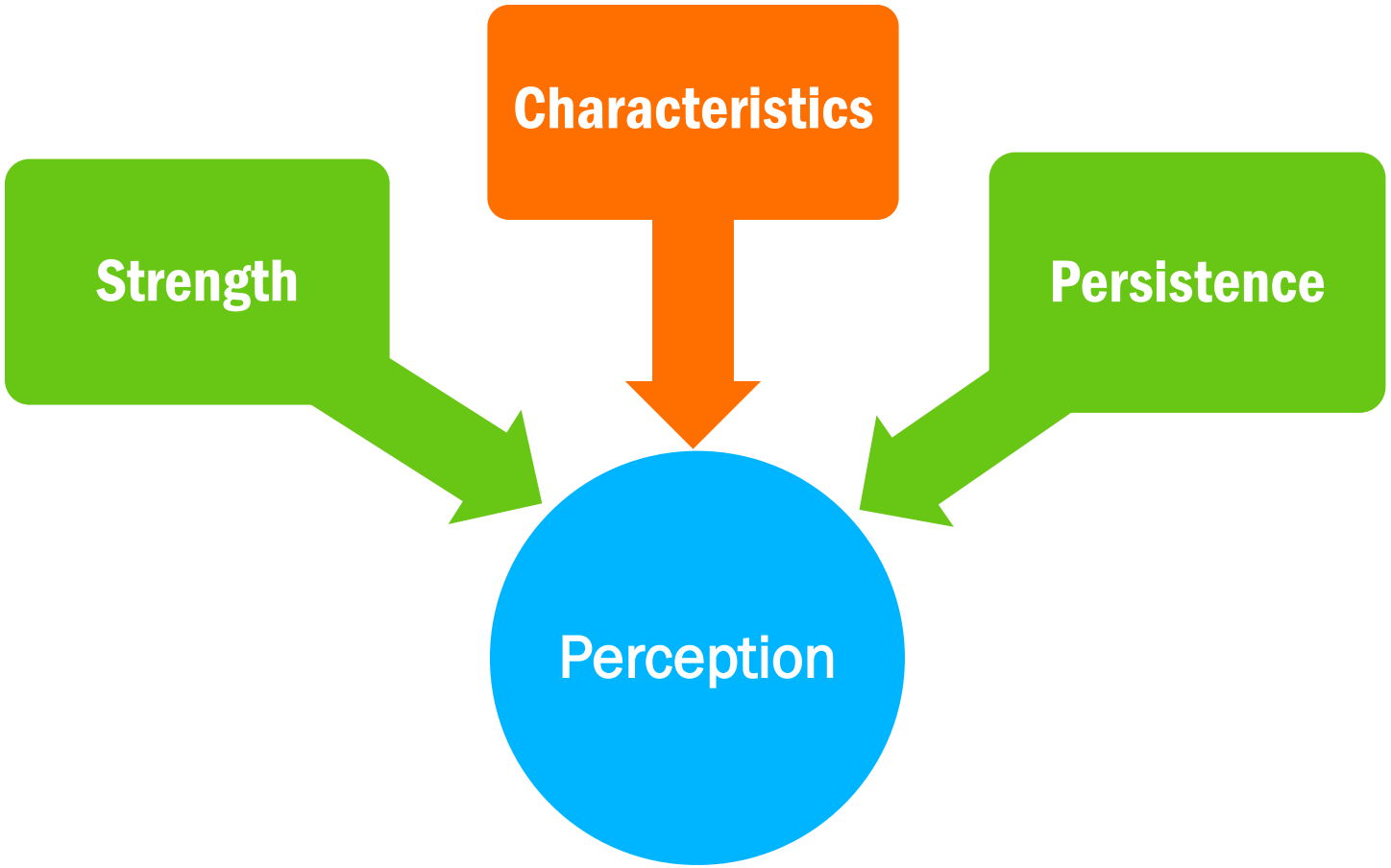
- Goal is no offensive odors off site
- Comprehensive odor control program launched
  - Odor sampling
  - Identification of improvements
    - Operational
    - Capital
- Dispersion model to be used as a tool to:
  - Evaluate odor control improvements
  - Evaluate future odor sources and odor control

Odor Complaint Hotline

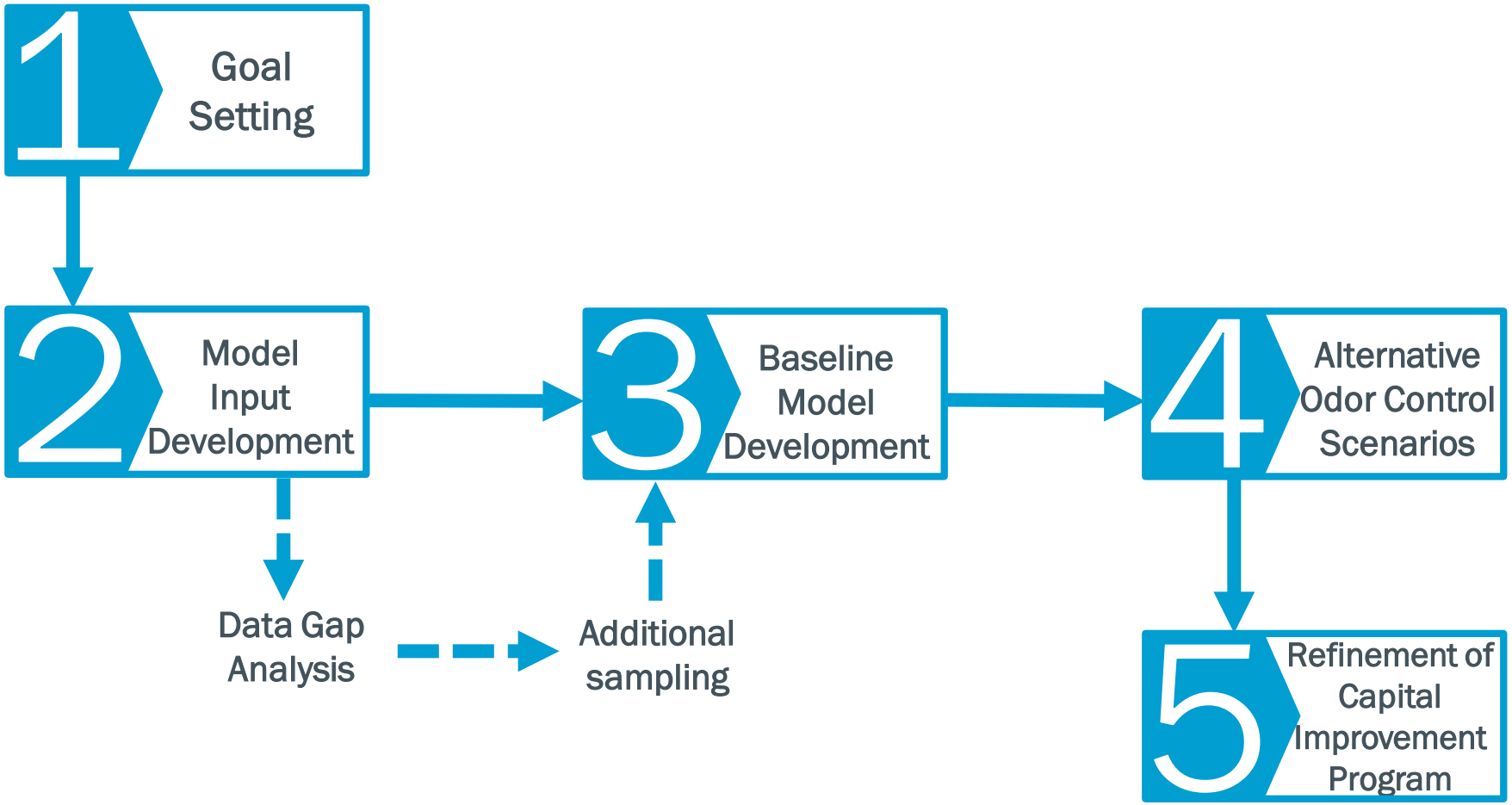
Plant Section	Complaint Date	Specific Location	Date Odor Noticed	Description of Odor	Possible Source of Odor	Action Taken to Remediate (if any)	Operator Comments	Supervisor Comments	Odor Control Team Review (OCT)
Mill Creek	8/28/2017	*Omitted*	8/28/2017	Smells like sewage.	The truck way due to sludge hauling	Contacted operators in all areas to check odor control units and make sure they were working properly. We are also making every effort to keep truck way and roadway clear of any sludge	No wind or hot/humid temps. cool and overcast day.	We have odors coming from truck way due to hauling sludge. We also have odors coming from high solid inventory.	Complaint is closed.

- *MSD has made great strides to identify and work to close programmatic gaps to better reduce odors through program management, process optimization, and staff training.*
- Tracking complaints through the hotline allows MSD to track trends and process disruptions

Odor Complaint Influencers



Dispersion Modeling Process at Mill Creek



Dispersion Model Development

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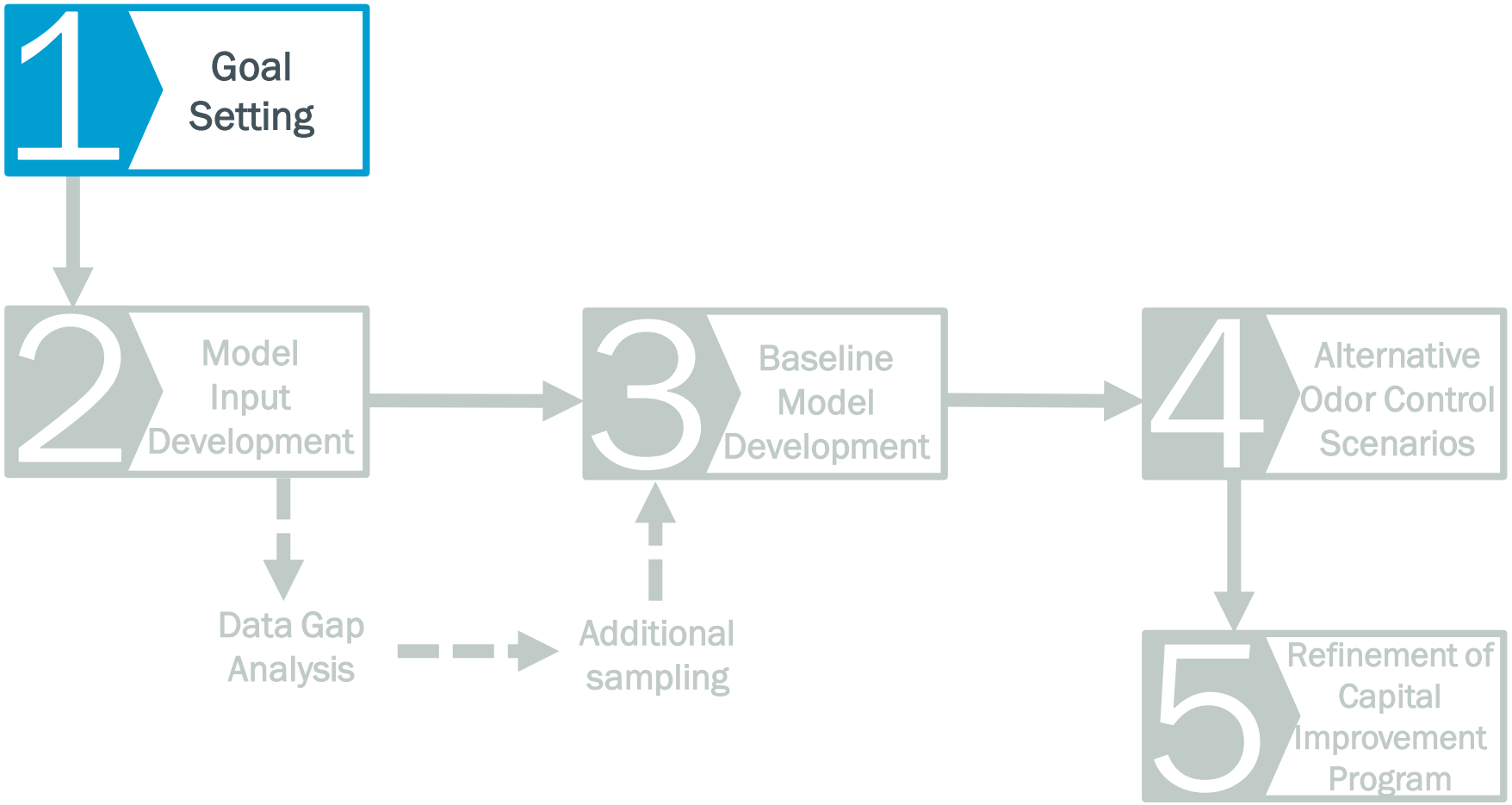
Dispersion Modeling Process at Mill Creek

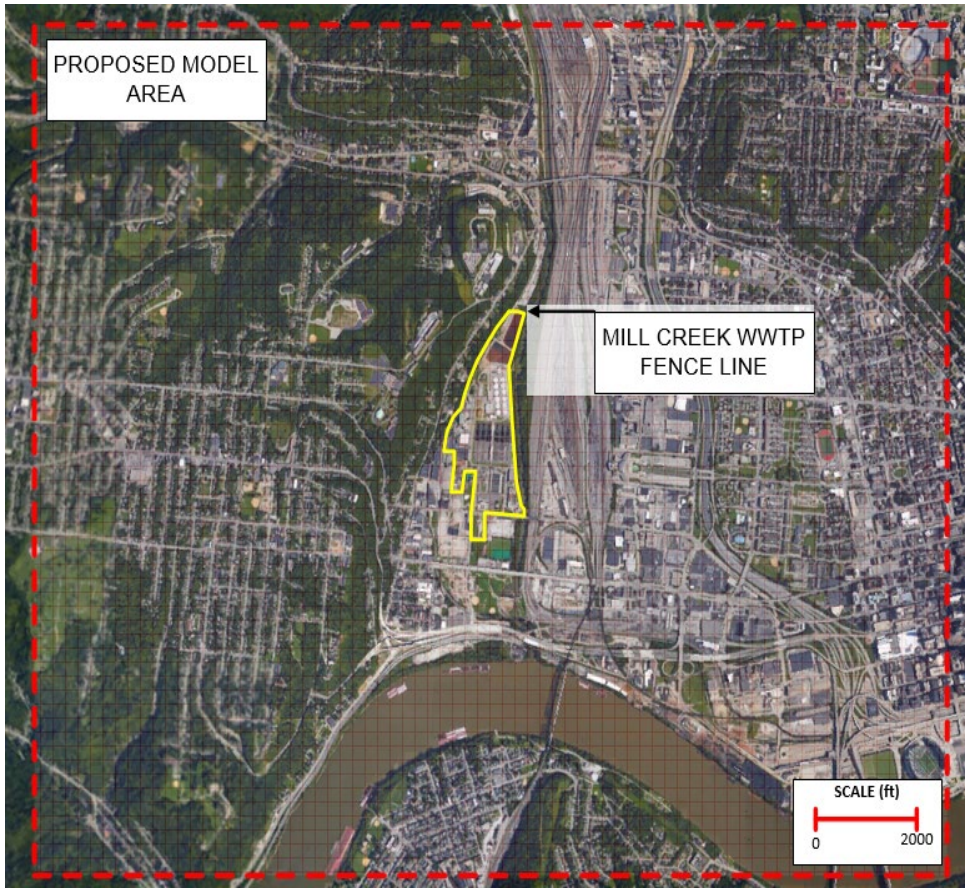


MSDGC Odor Control Goal Setting
Mill Creek Wastewater Treatment Plant

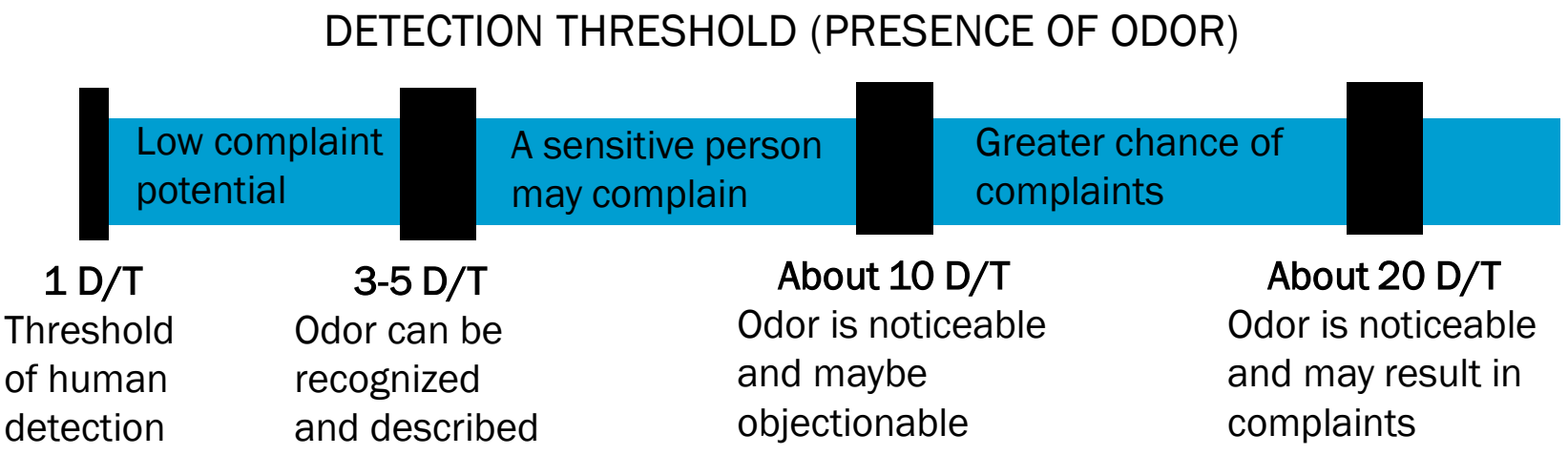
- Initial discussions with community advisory panel (CAP) refer to “zero odor impacts offsite”
  - The dispersion model takes into account worst-case conditions
  - Zero offsite odor impacts may be impossible per the model regardless of the amount of odor control

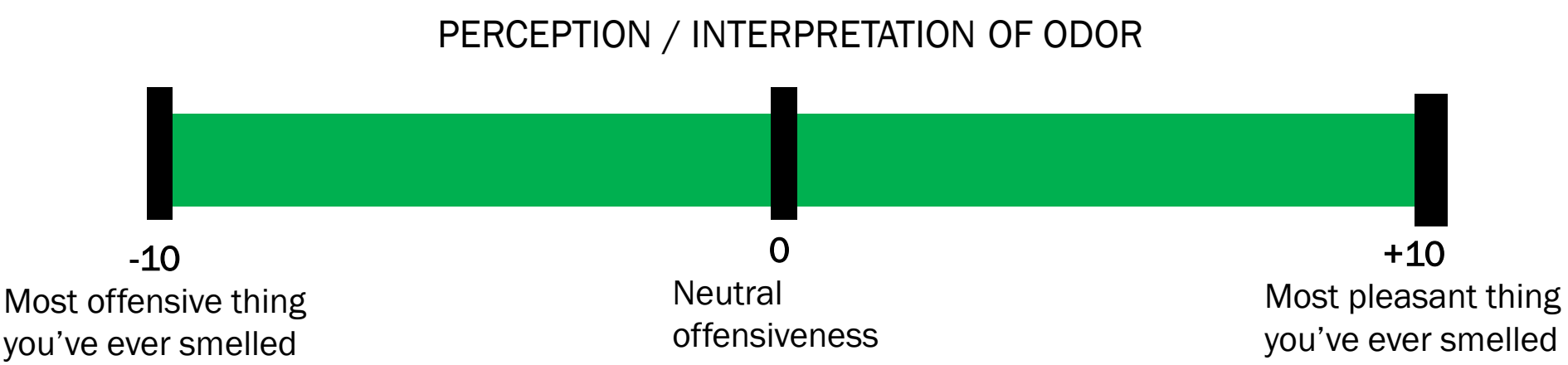
Goal Setting Elements

- Define plant “fence line” property boundary
- Identify maximum allowable odor at fence line
  - Odor Units = Dilutions-to-Threshold (D/T)
- Identify maximum number of hours exceeding an odor threshold at fence line



Odor Detection and Offensiveness

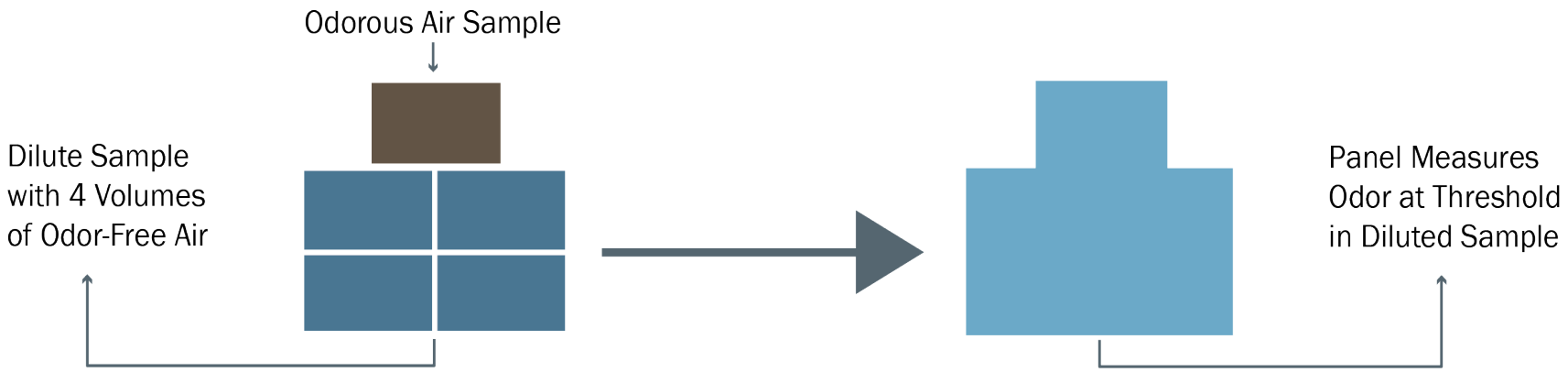




How Odor is Measured: Dilutions-to-Threshold (D/T)

Determine number of dilutions to make sample non-detectable

Example of Odor Panel Testing



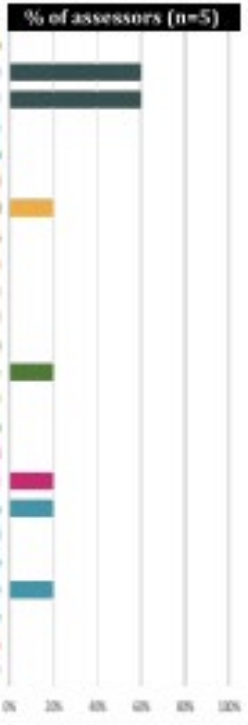
Therefore, original sample is defined as having 4 dilutions-to-threshold

Hedonic Tone

HT: -2.3
DR: - - -

Odor Descriptors

Strength	Descriptor
	Sensation
0.8	Decay
1.1	Sulfur
	Fish
	Sea
	Animal
0.1	Medicinal
	Plastics
	Petroleum
	Burnt
	Wood
	Earth
0.4	Sulfidic vegetable
	Non-sulfidic vegetable
	Vegetation
	Floral
0.2	Fruit
0.2	Grain
	Herbal
	Spice
0.2	Dairy
	Confectionary
	Taste
	No Odor



MSDGC Odor Control Goal Setting
Mill Creek Wastewater Treatment Plant

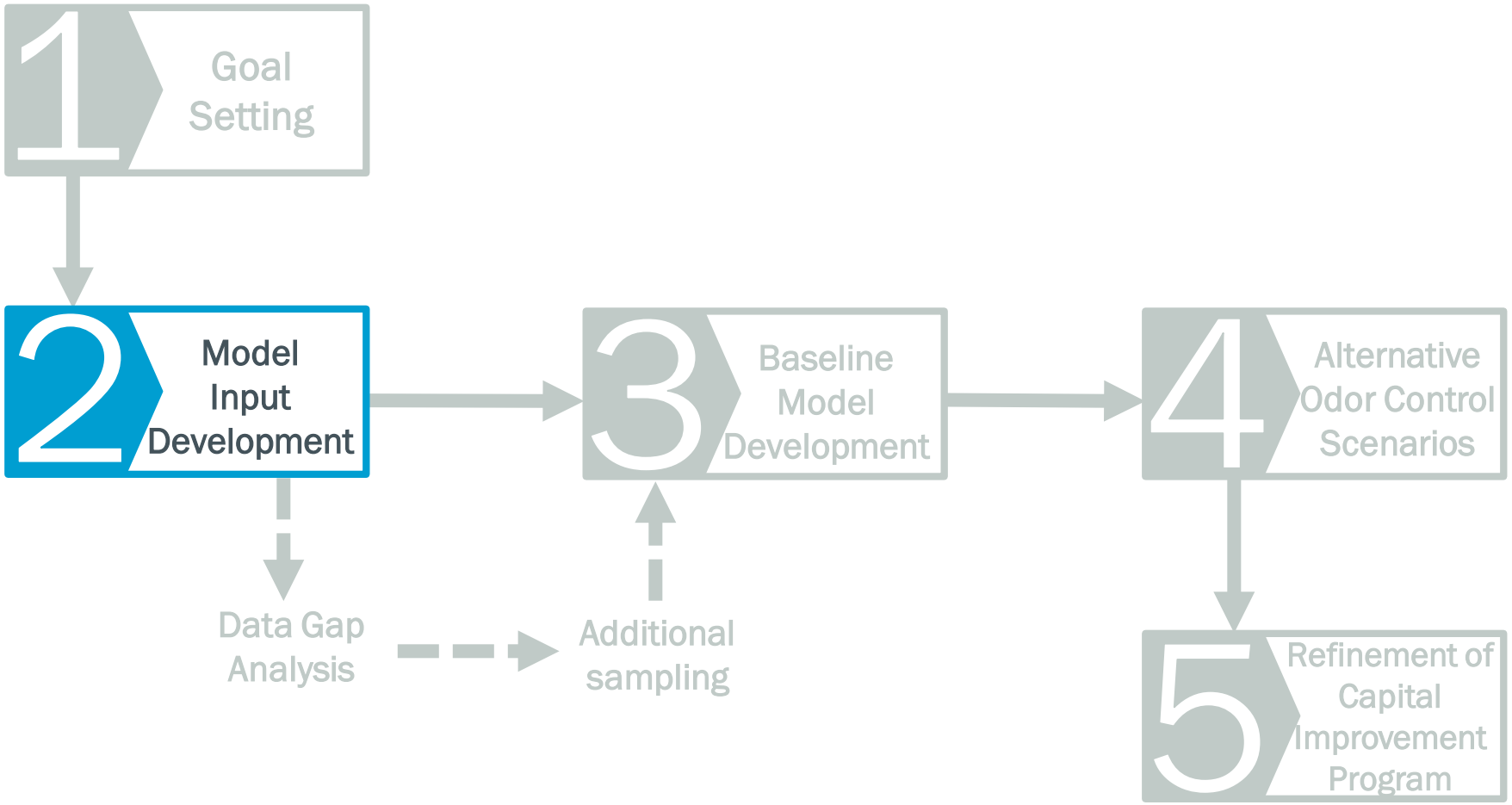
- BC referenced similar wastewater facilities with odor concerns
  - Goal may exceed 10 D/T at the plant fence line no more than 1% of a given year (88 hours)

Case Study Examples

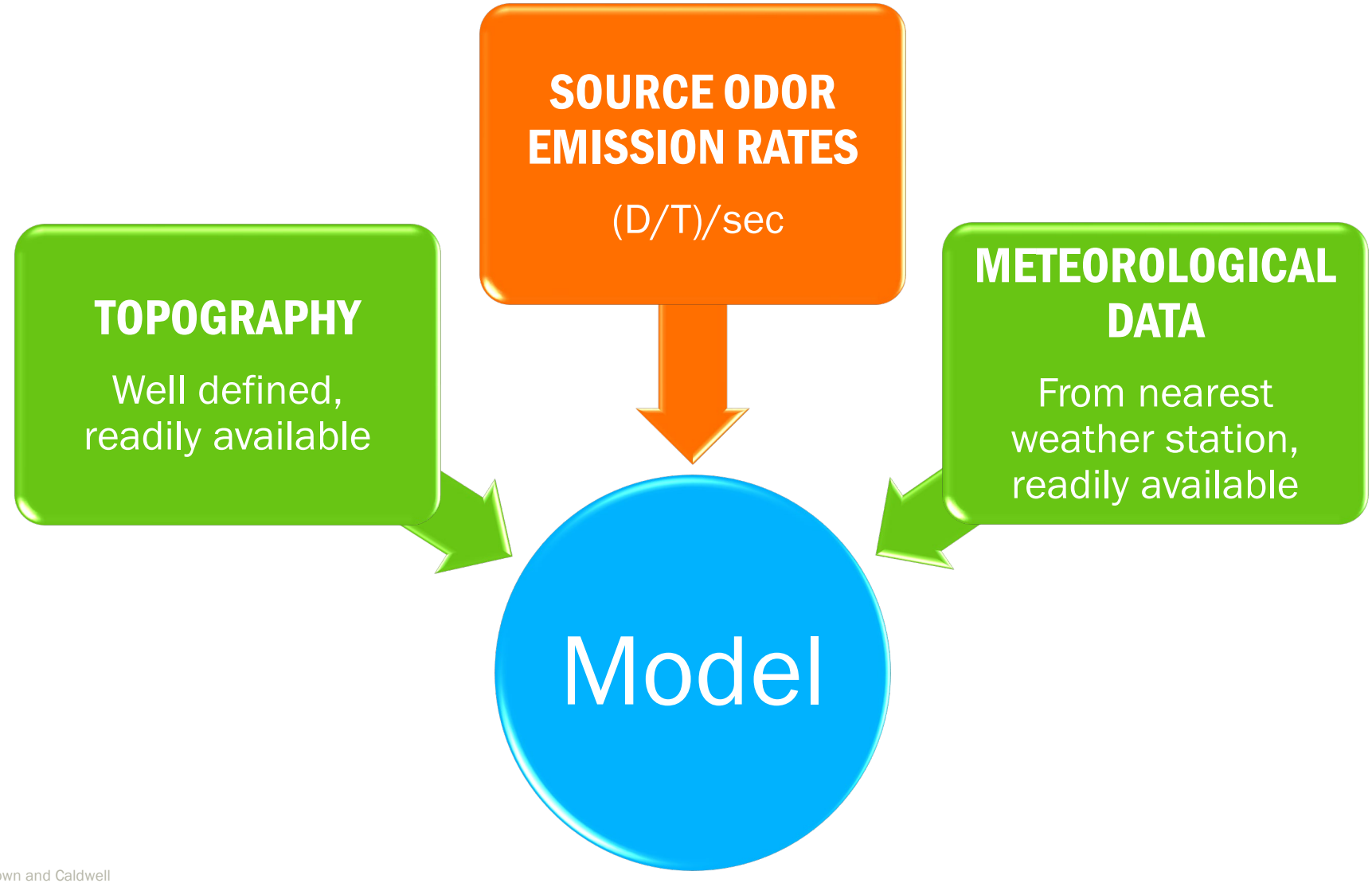
San Francisco Southeast Plant	5 D/T	1% of year
King County (WA) Brightwater Plant	1 D/T	1% of year
Union Sanitary District (CA) WWTP	30 D/T	None
Metro Vancouver Annacis Island WWTP	20 D/T	None
Orange County Sanitation District (CA)	17 D/T	None
King County (WA) West Point WWTP	7 D/T	None
Central Contra Costa Sanitation District (CA) WWTP	4 D/T	100 hours per year
City of Calgary (Canada) WWTP	20 D/T	100 hours per year
Clark County Water Reclamation District (NV) Central WWTP	20 D/T	100 hours per year
LOTT (WA) Bud Inlet WWTP	10 D/T	1% of year

Sensitive community, developing, close to plant

Dispersion Modeling Process at Mill Creek



Basic Dispersion Model Inputs



Baseline Model Elements

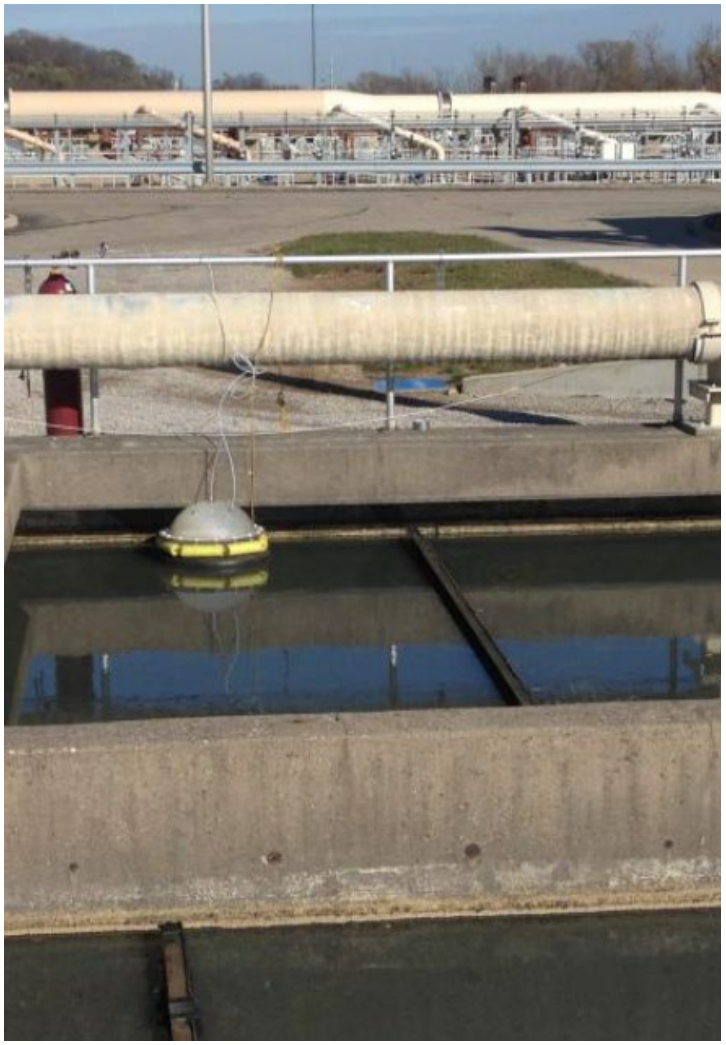
- Odor source data
  - Includes new sampling (2016 and 2017)
- Meteorological data (1 or 5 yrs)
- Topography
- Buildings and structures
- Fence line
- Offsite receptors (grid)
- Model conditions
  - Odor contours, **or**
  - Exceedance contours

Buildings and Structures added to Model

- Input into model:
  - Building or structure dimensions
  - Building or structure height
  - Do not consider small or far away sources
- Buildings / structures create *downwash* (typically increase offsite impacts)

Source Odor Emission Rates

- Source dimensions
- Odor “concentration”
  - Given in units of D/T
  - Can be estimated or measured directly through sampling
  - Mill Creek WWTP sources have been extensively sampled
- Air flow rate (for point sources)
- Temperature (for point sources)
- Source elevation



Odor Source Types

- Odor control units (scrubbers)
- Fugitive Emissions
- Characterized by a measurable velocity
- Easiest to model

Point Sources

Odor Source Types

Area Sources

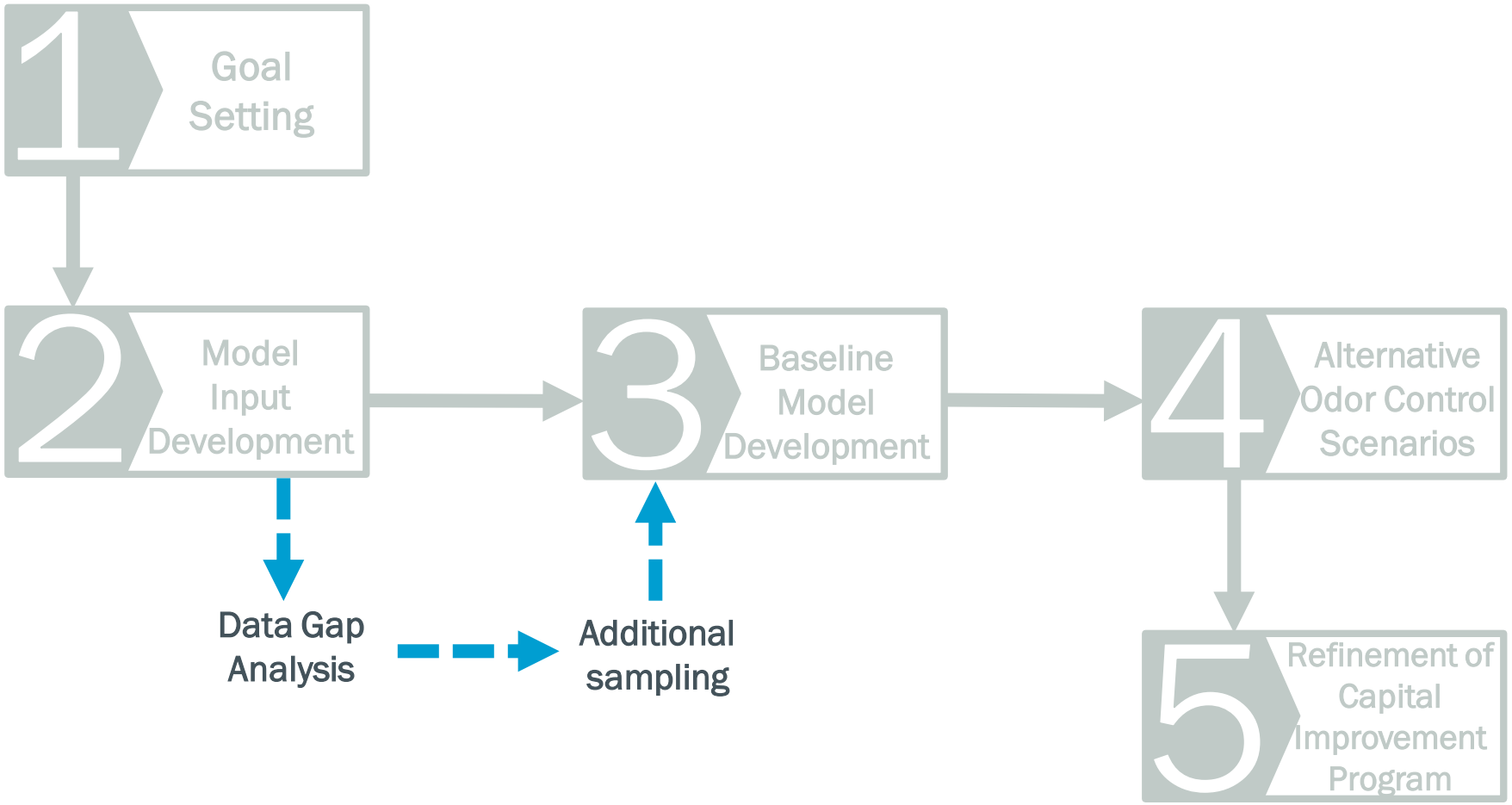
- Area Source Examples:
  - Liquid tanks or ponds
  - Biofilters
- Emission rate calculation is challenging
- Can be overstated in models

Odor Source Types

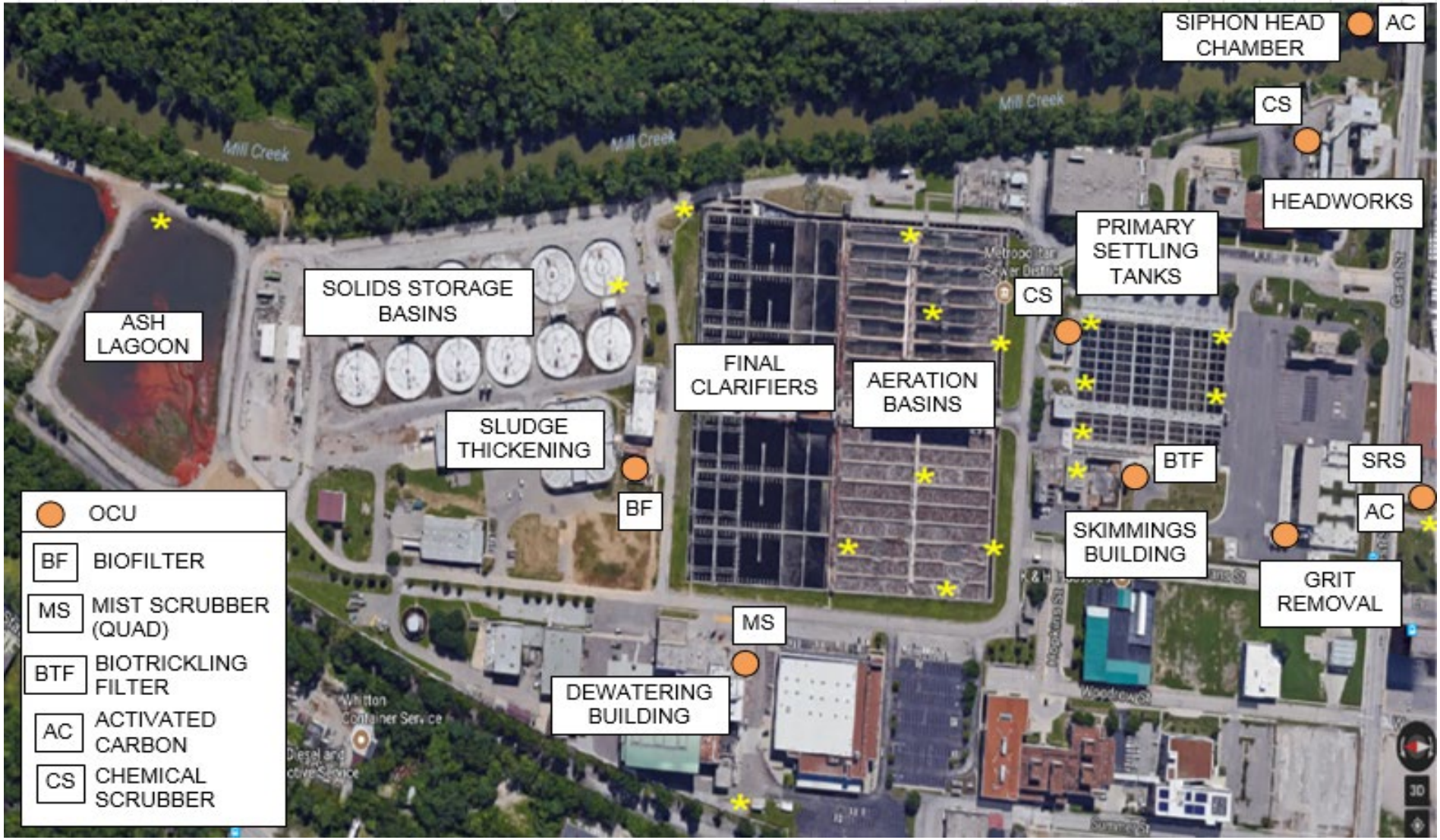
- Room emissions to atmosphere:
  - More significant than fugitive emissions
  - Inconsistent emission rate
- Emission rate calculation is complicated
- Sometimes ignored in models

Volume Sources

Dispersion Modeling Process at Mill Creek



Odor Sampling Locations



Odor Sampling Methods

- Jerome Analyzer field H_2S concentration measurements:
  - Multiple "snapshot" concentration measurements taken at each location
  - Identify locations for bag sampling
  - Used to evaluate removal efficiency for odor control units (OCUs)
- Bag samples for laboratory analysis
  - Odor panel laboratory (D/T)
  - Reduced sulfur compound speciation
- OdaLogs for continuous H_2S monitoring
  - Installed at odor sources
  - Installed at western fence line

Dispersion Model Results

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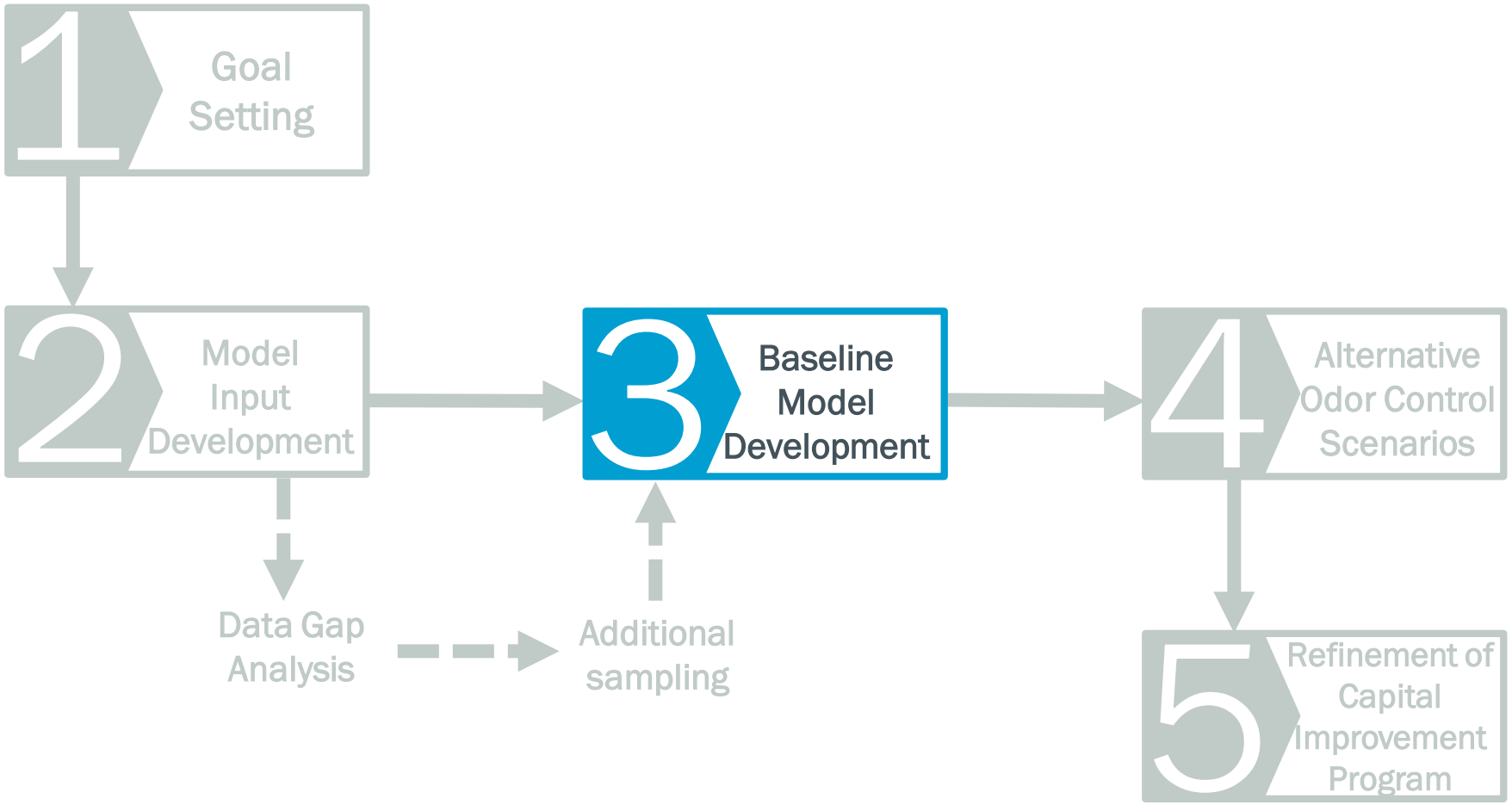
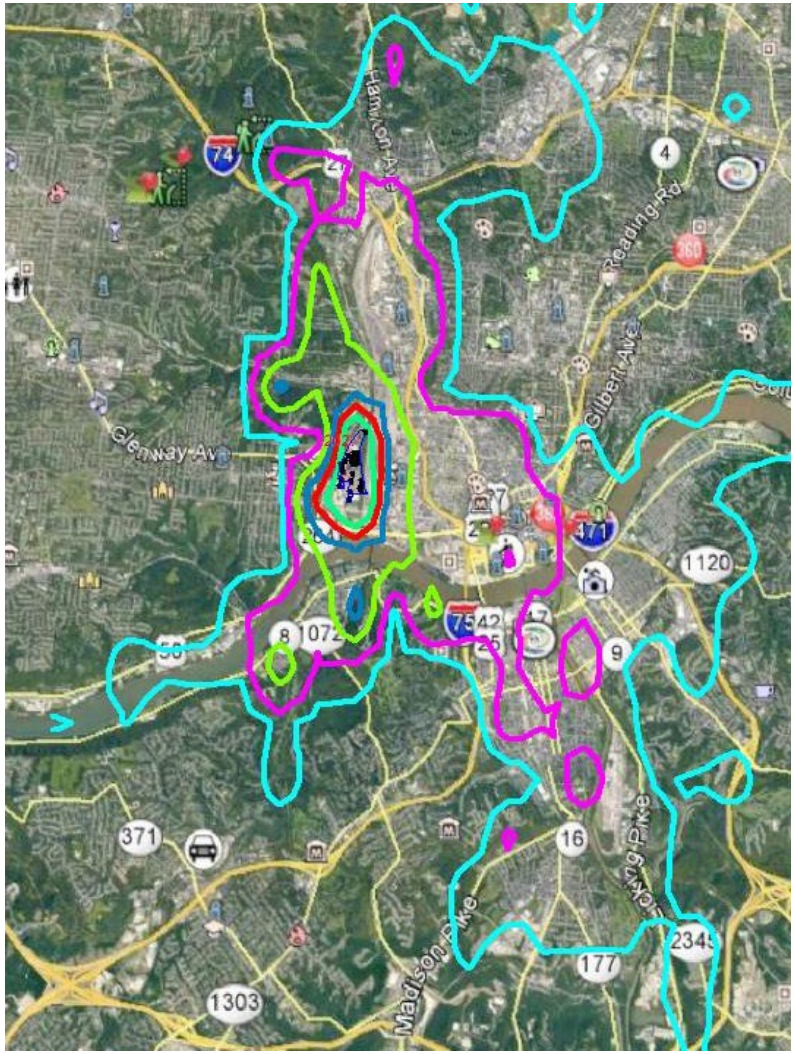
Dispersion Modeling Process at Mill Creek

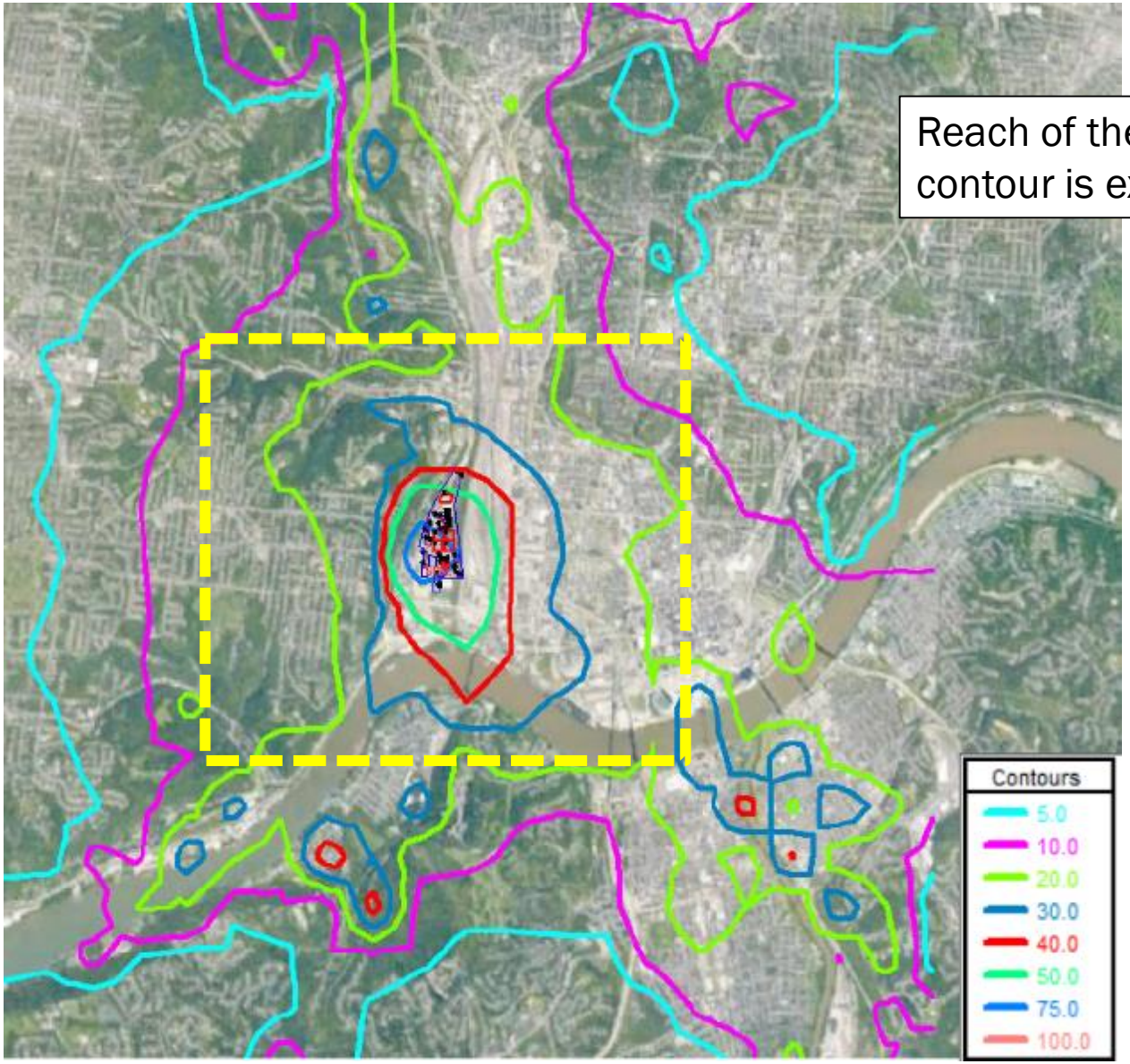


Example Dispersion Model Output Plot

- Model creates a grid of receptors around the plant
- Odor values are calculated at each receptor every hour for 5 years
- Locations are connected to make contour lines
- Plot shows worst-case over 5 years



Baseline Dispersion Model Output



Reach of the 10 D/T contour is extensive

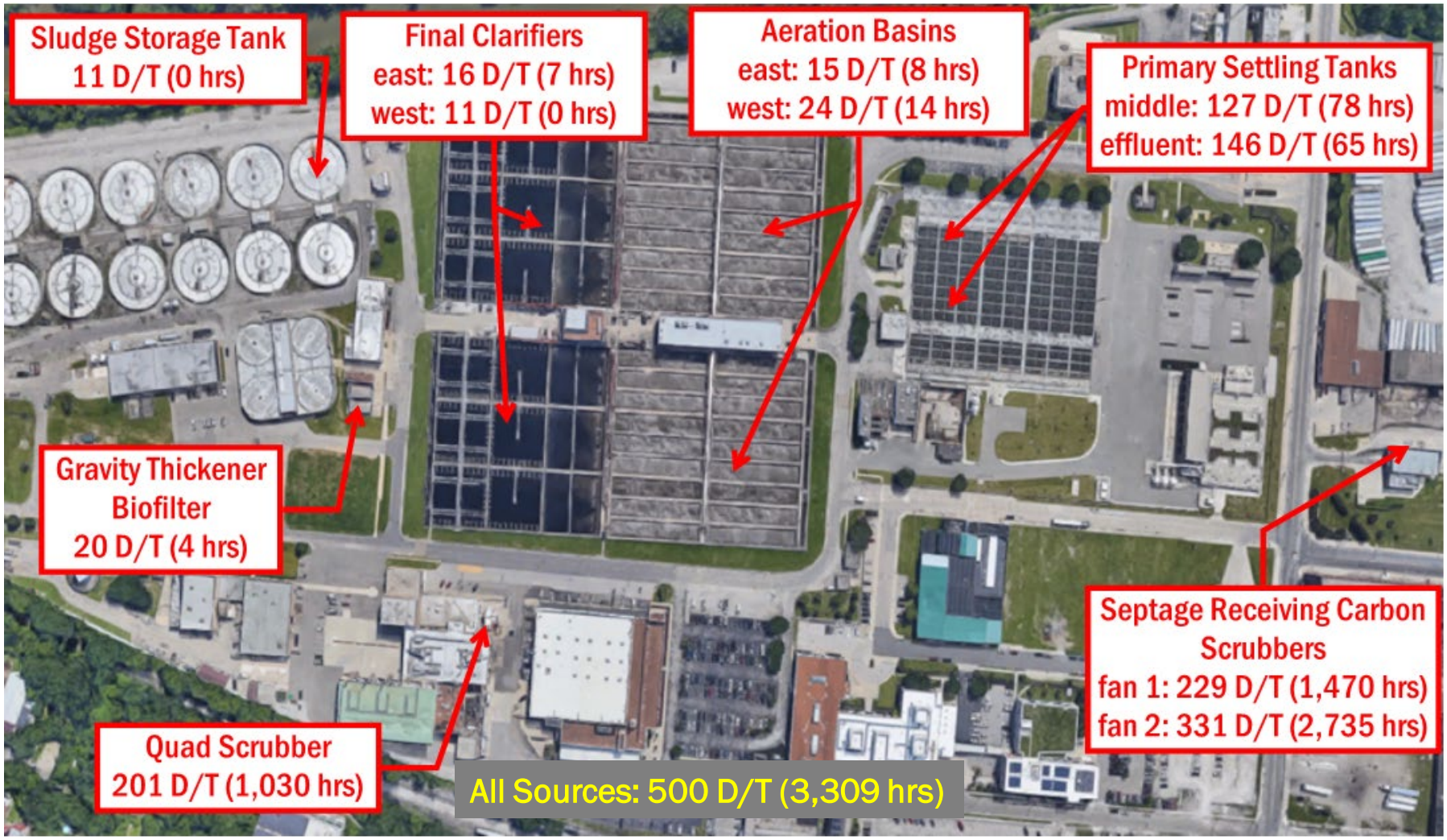
Major Baseline Scenario Sources

Mill Creek WWTP Sources with Offsite Impacts > 10 D/T

Odor Source	Max Offsite Odor (D/T)	Yearly Hours Exceeding 10 D/T
All Sources Combined	500	3,300 (38%)
SRS Building Exhaust Fan 1	229	1,470 (17%)
SRS Building Exhaust Fan 2	331	2,735 (31%)
Sludge Dewatering Bldg East Quad Chemical Scrubber	201	1,030 (12%)
Primary Settling Tanks (middle area)	127	78
Primary Settling Tanks (effluent area)	146	65
West Aeration Basins	24	14
East Aeration Basins	15	8
West Final Clarifiers	11	0
East Final Clarifiers	16	7
West Gravity Thickener Biofilter	20	4
Sludge Storage Tank A-2	11	0

Goal:
<88 hours (1%) exceeding 10 D/T

Baseline Model Results



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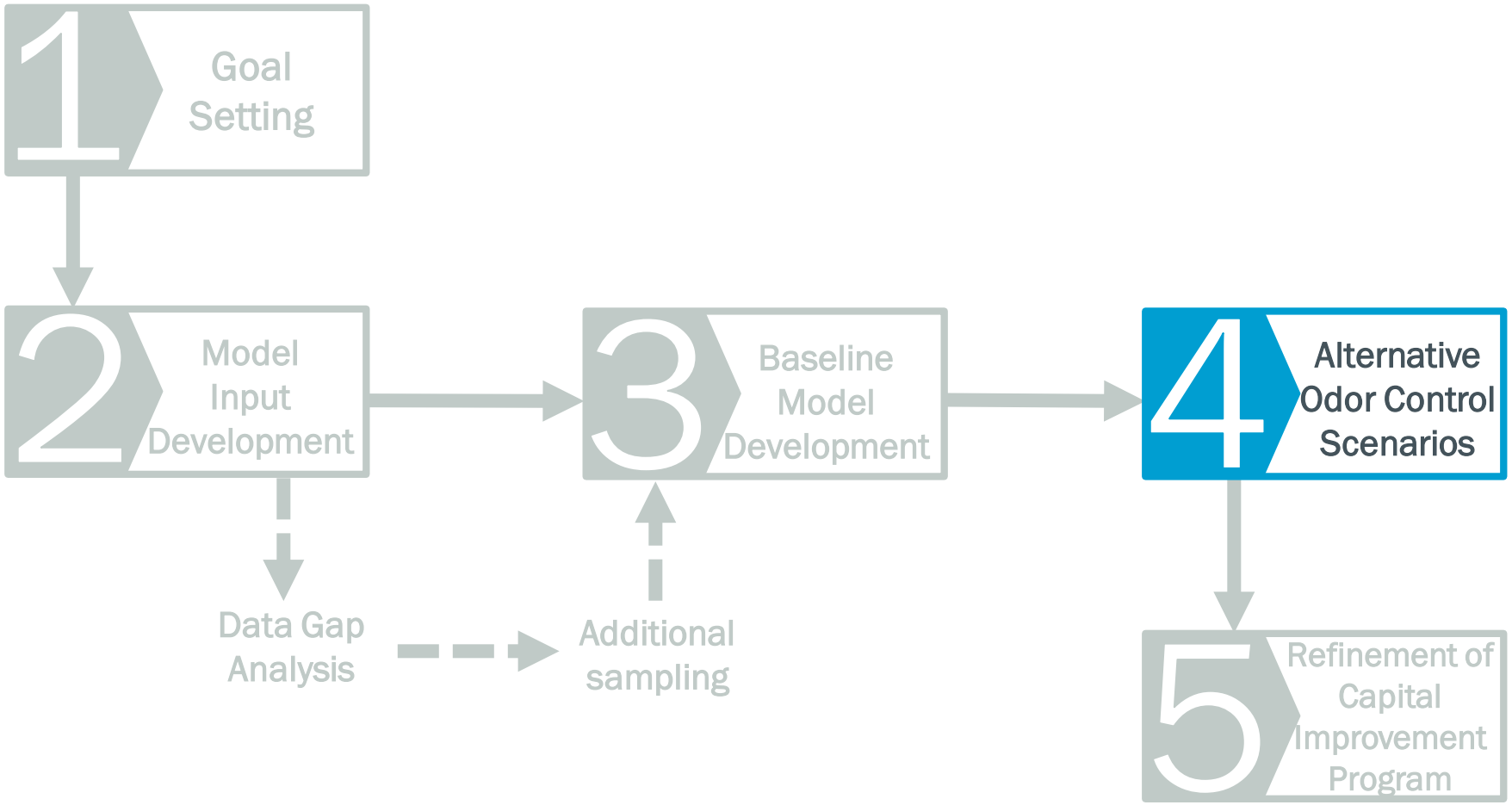
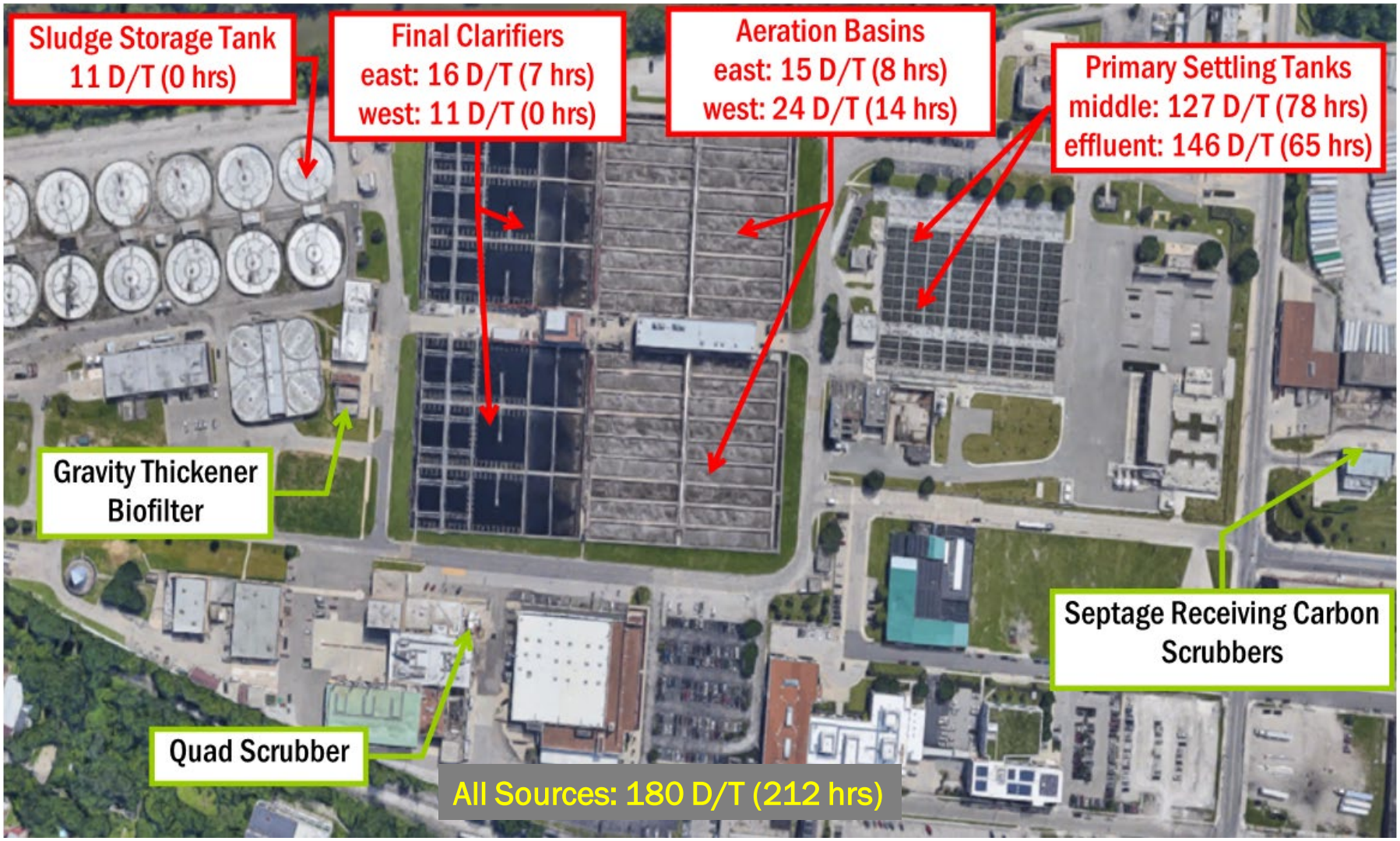


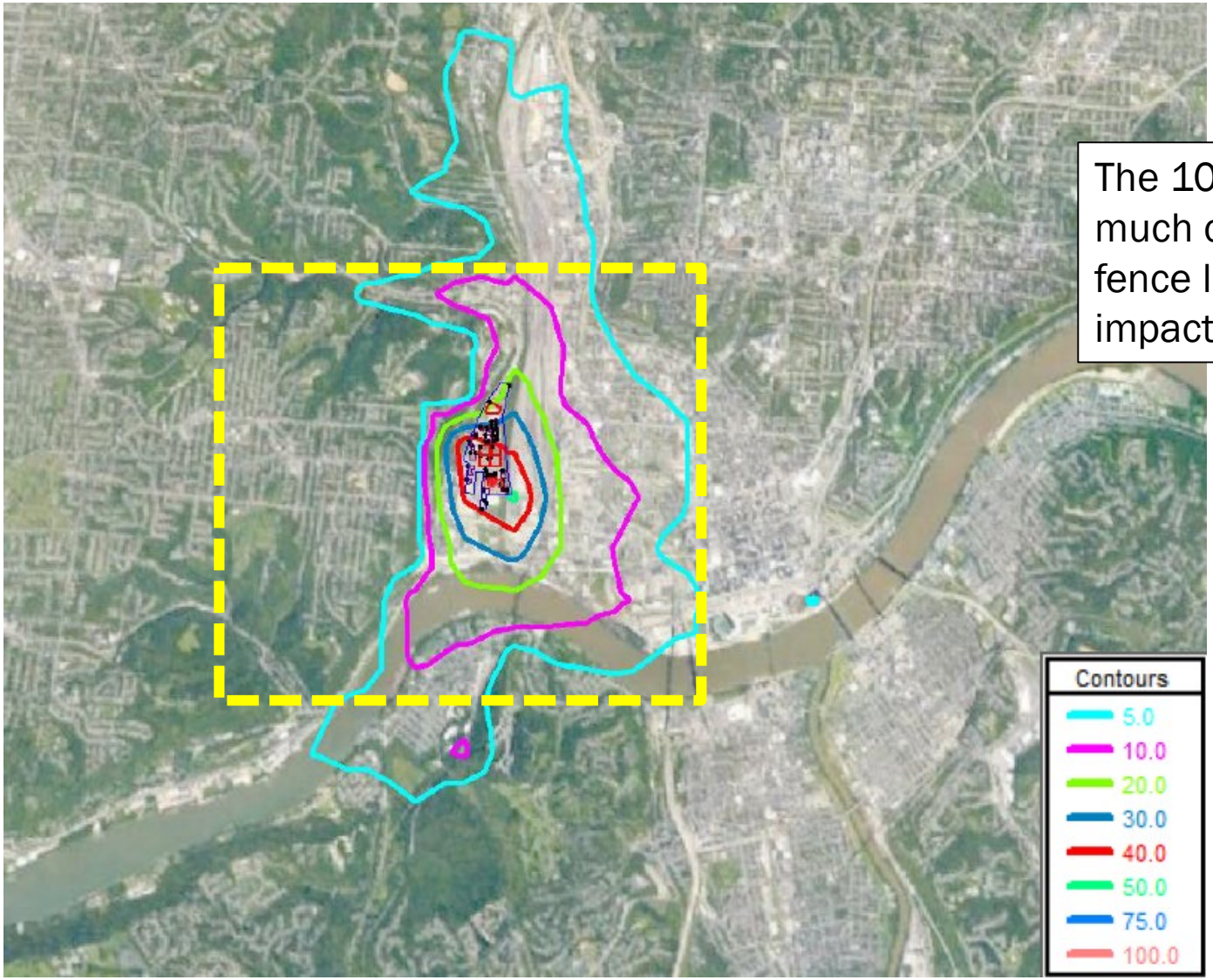
Alternative Odor Control Scenarios

- Model further evaluates identified odor control improvements at Mill Creek WWTP
  - Shows offsite impacts from control units
  - Identifies specific processes and areas impacting offsite
  - Identifies potential additional needs
- Model will be used to identify control scenarios that will meet odor goals
- Model can consider future conditions

Phase 1 Dispersion Model Scenario

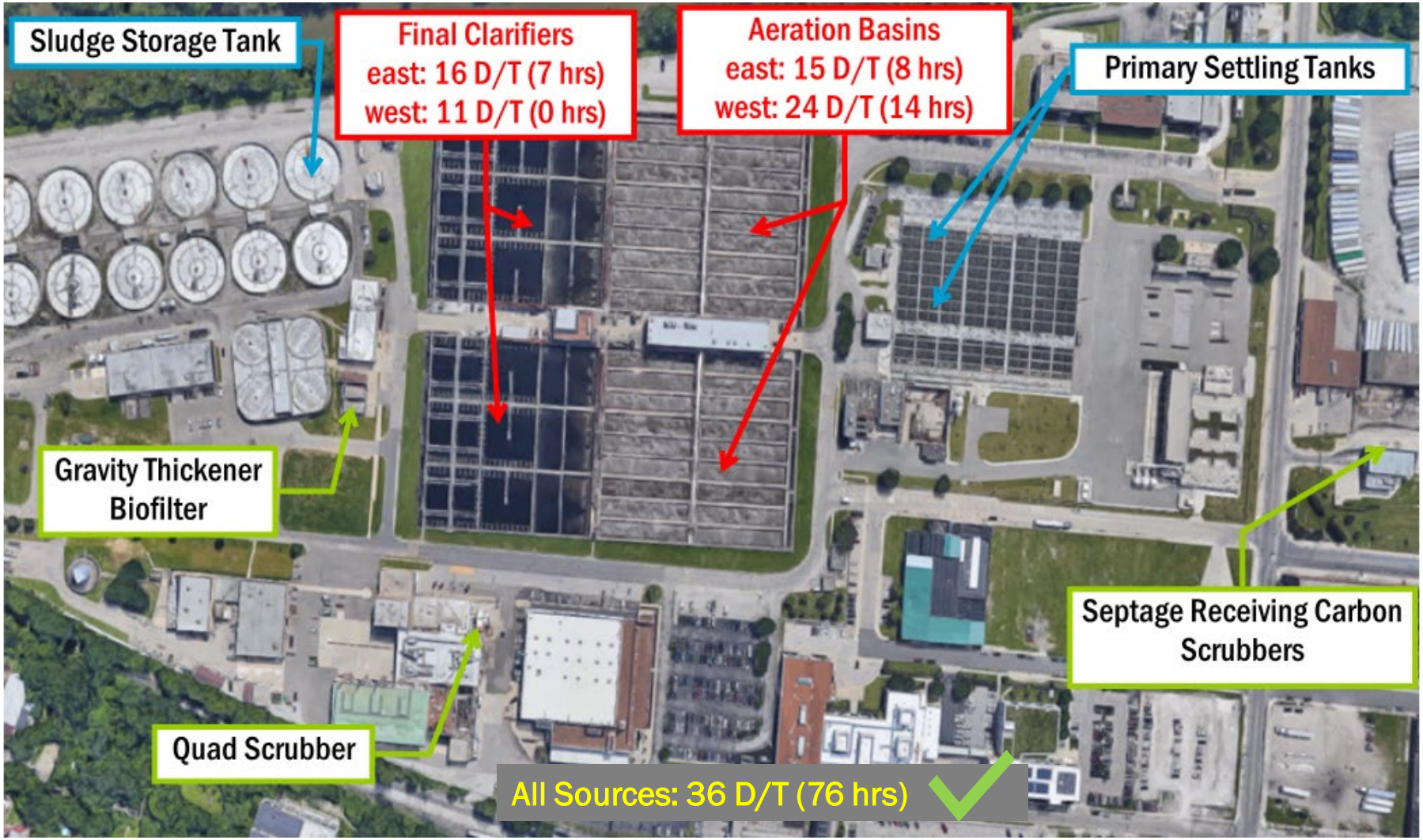


Phase 1 Dispersion Model Output

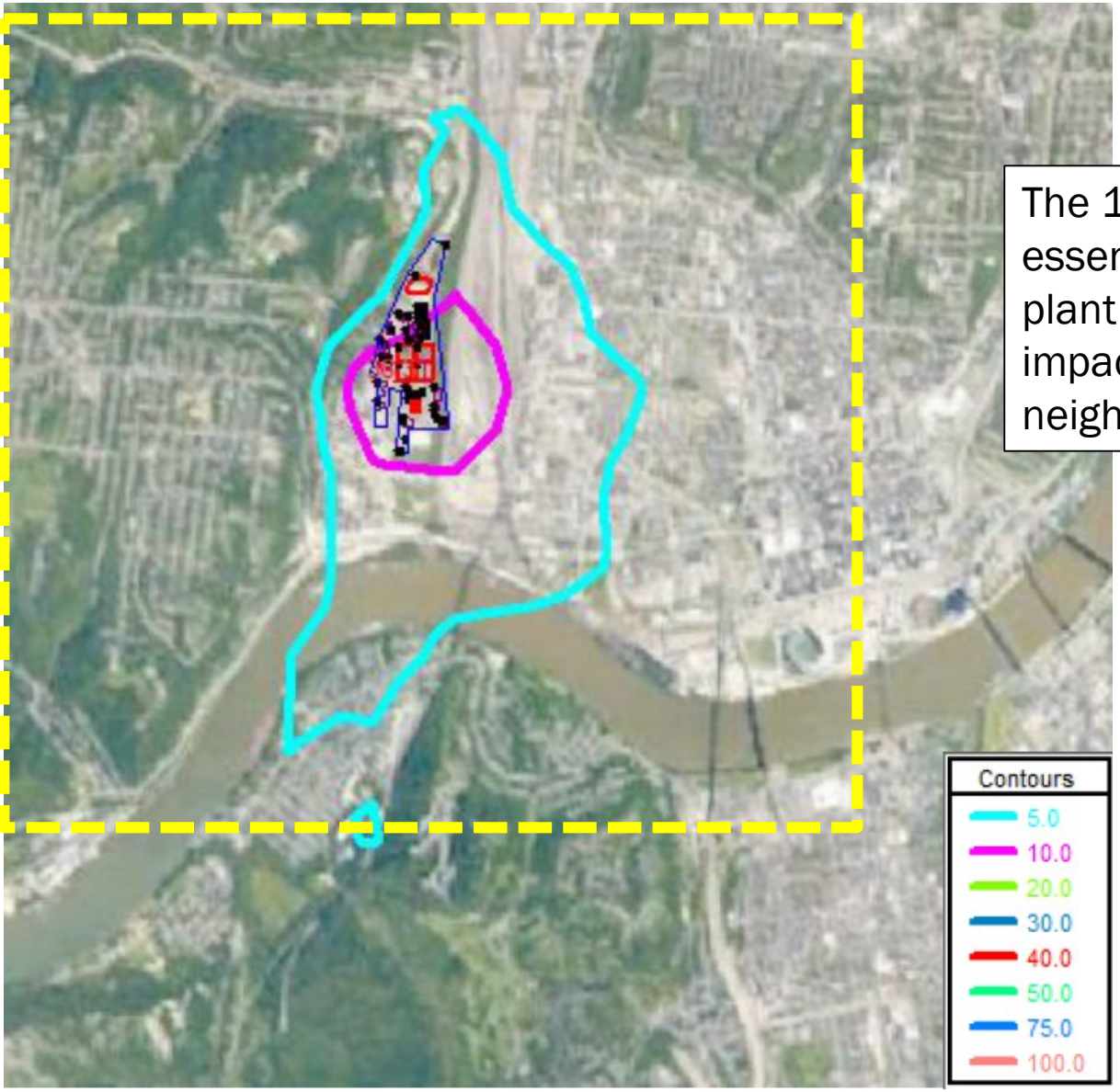


The 10 D/T contour is much closer to the fence line but still impacts off-site

Phase 2 Dispersion Model Scenario



Phase 2 Dispersion Model Output



The 10 D/T contour is essentially within the plant site and does not impact the residential neighborhood to west

Limitations to the Model - Example

- Model evaluates emissions as a constant which can exaggerate or under-predict odor goal violations
- Important to understand the system being modeled and how the model works

Baseline Model Odor Sources Contributions: Sludge Storage Tanks - Revised

Odor Source	Max Offsite Odor (D/T)	Yearly Hours Exceeding 10 D/T
Normal Operation	33	24
Sludge Storage Tanks Surcharge	569	741

Odor Control Improvements and Recommendations

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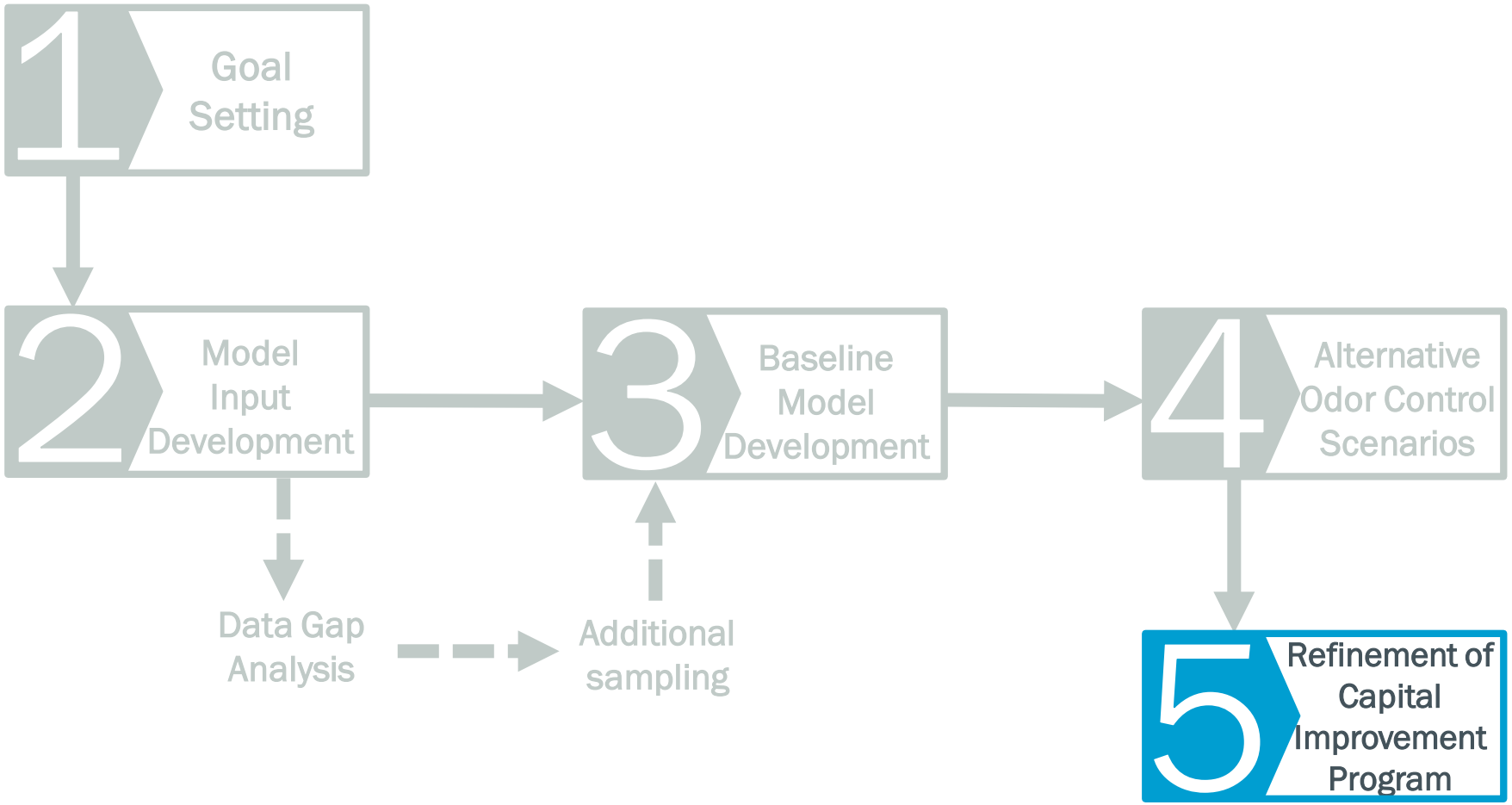
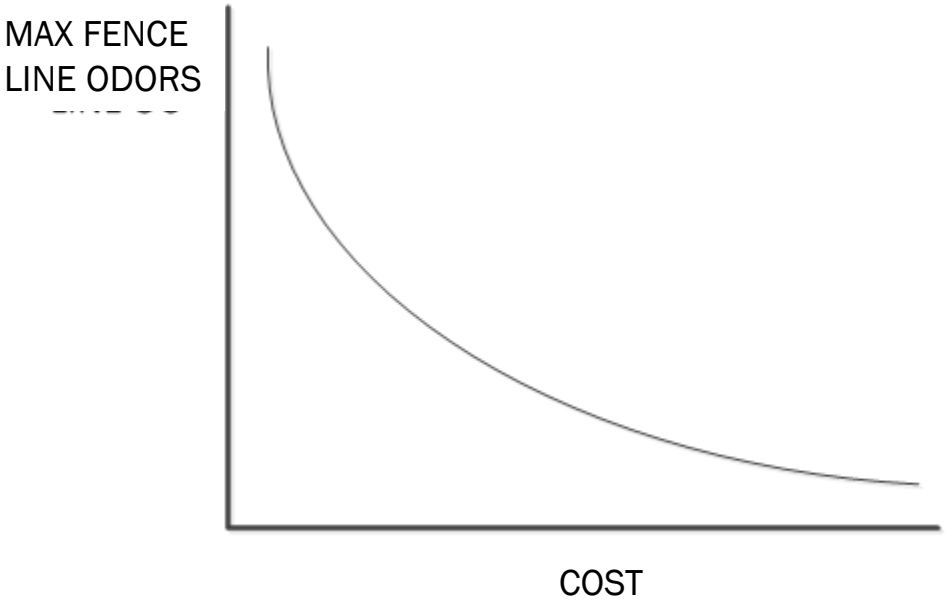
Dispersion Modeling Process at Mill Creek

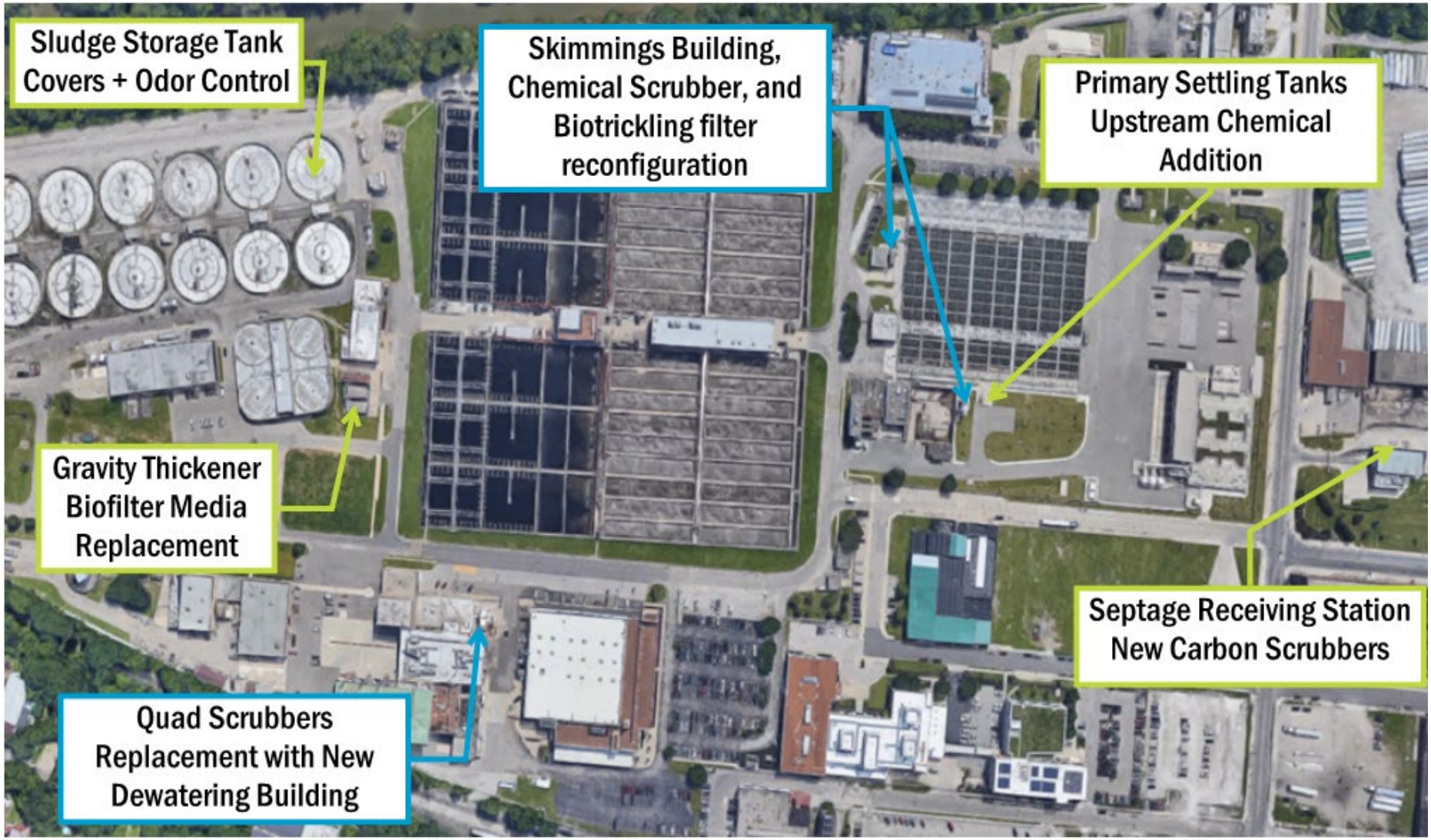


Capital Improvement Program Update

- Revised odor treatment needs
- Staging to meet odor goals



Projects Moving Forward



QUESTIONS?

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Amy West
awest@brwncald.com

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