Upgrading Your WWTP

2015 CSEAO CONFERENCE

DECEMBER 8, 2015

It all starts with secondary treatment.

Agenda

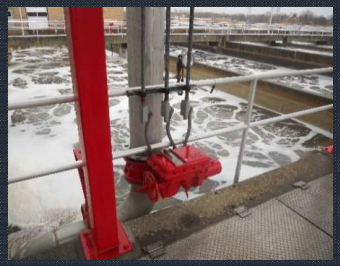
Upgrading your wastewater treatment plant

It all starts with secondary treatment.

- DRIVERS FOR CHANGE
- GROWTH PARAMETERS
- TREATMENT PROCESS
- SECONDARY FOCUS
- SECONDARY TREATMENT PROCESSES
- CASE STUDIES

Drivers for Change

REGULATORY



OPTIMIZATION

GROWTH

TECHNOLOGY

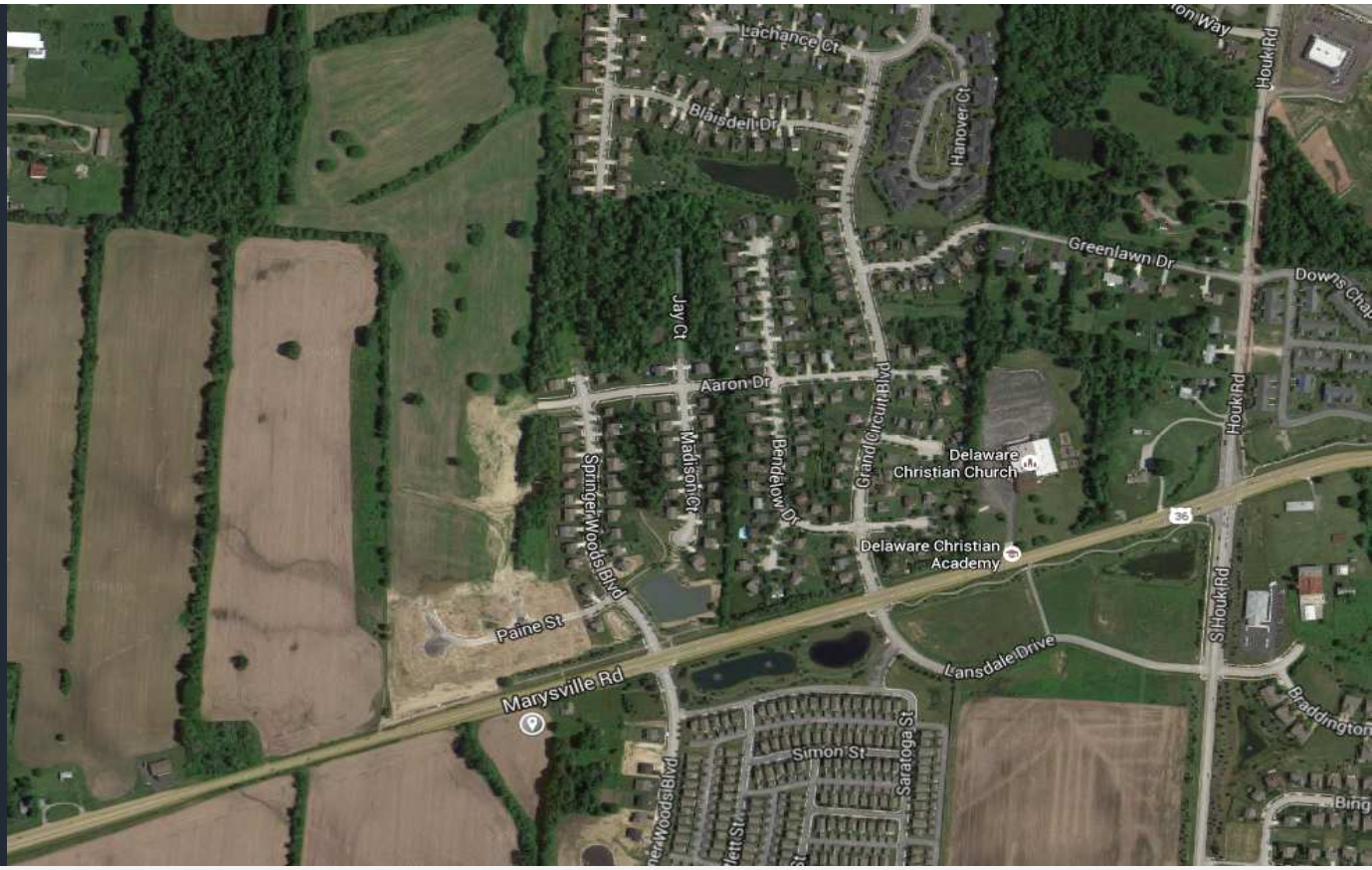
AGE

Fixed Conditions

- Flows
- Influent Pollutants
- Permitted Effluent Limits

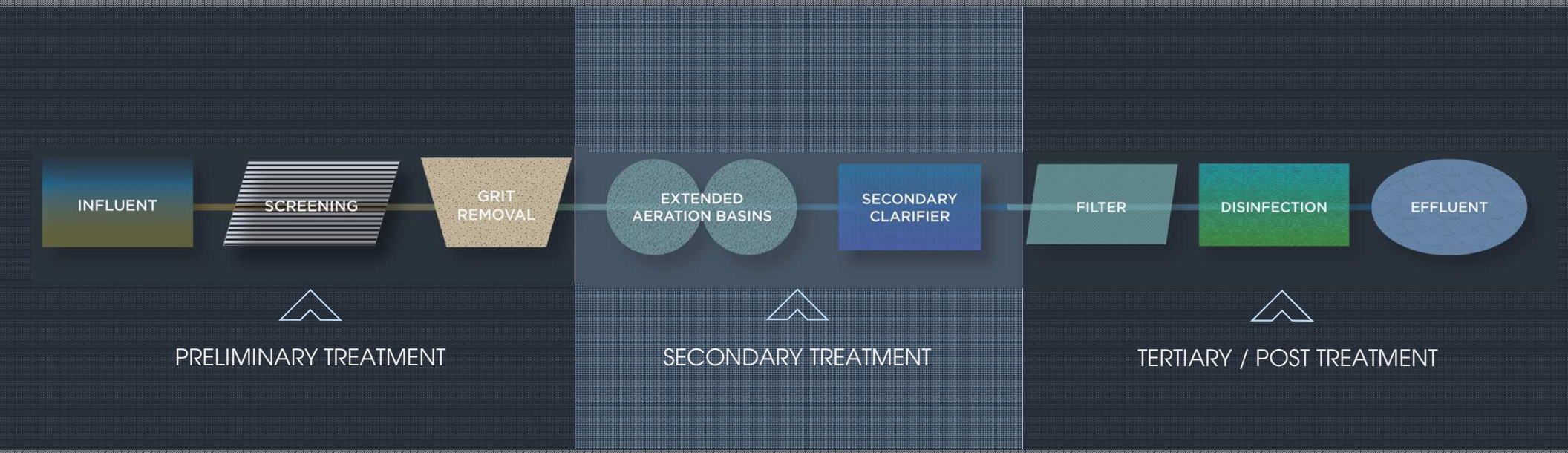
Variable Conditions

- Cost
- Timing
  - What are our immediate needs?
  - Where should we be in 5 years?
  - How do we plan for the long term?
  - How do we address future limits?



Growth Parameters

Treatment Process Overview



Why Focus on Secondary Treatment?

Technology

Wide range of treatment processes available

Traditional

Emerging

Time

Phasing – it can grow as you grow

Cost

Influences multiple cost items

O & M

Process controls

Solids handling and disposal

Recovered costs – nutrients, energy

FIXED FILM ACTIVATED SLUDGE

EXTENDED AERATION

ROTATING BIOLOGICAL REACTOR

CONVENTIONAL ACTIVATED SLUDGE

SEQUENCING BATCH REACTOR

Secondary Treatment Technologies

ADVANCED
ACTIVATED SLUDGE

MEMBRANE BIOREACTOR
ACTIVATED SLUDGE

INTEGRATED FIXED FILM
ACTIVATED SLUDGE

Secondary Treatment Technologies

Unique Features

- Upgrade to achieve more stringent effluent limits will likely require significant new tank construction
- Does not require advanced preliminary treatment
- Has largest volume of tanks and footprint or site
- Very forgiving process with regards to operation and maintenance
- Lower level of Operator skill required
- Modular construction possible
- More facility construction required at each phase

Advanced Activated Sludge

Unique Features

- Use of the fixed media submerged in the activated sludge process reduces need for new tank construction
- Optimizes existing tank usage
- Required 5 mm fine screening and more advanced preliminary treatment system
- Requires proactive operator attention and higher operator skill
- May be able to upgrade in existing tanks to more stringent effluent limits with no new tank construction
- Modular construction possible
- Reduces need for new facility construction at each phase

Integrated Fixed Film Activated Sludge

Unique Features

- Consistently produces a high quality effluent
- Effluent is reuse quality
- Smallest overall plant footprint possible based on today's technologies
- Submergence of filtering system eliminates need for secondary clarifiers and tertiary filters
- Able to provide significant expansion in existing tanks
- Requires less than 3 mm screening in advanced preliminary treatment system
- Requires proactive operator attention and higher operator skill
- Modular construction possible with prefabricated units
- Little to no new facility construction at each phase
- Easy to conceal in populated areas

Membrane Bioreactor Activated Sludge

Treatment Process Impacts

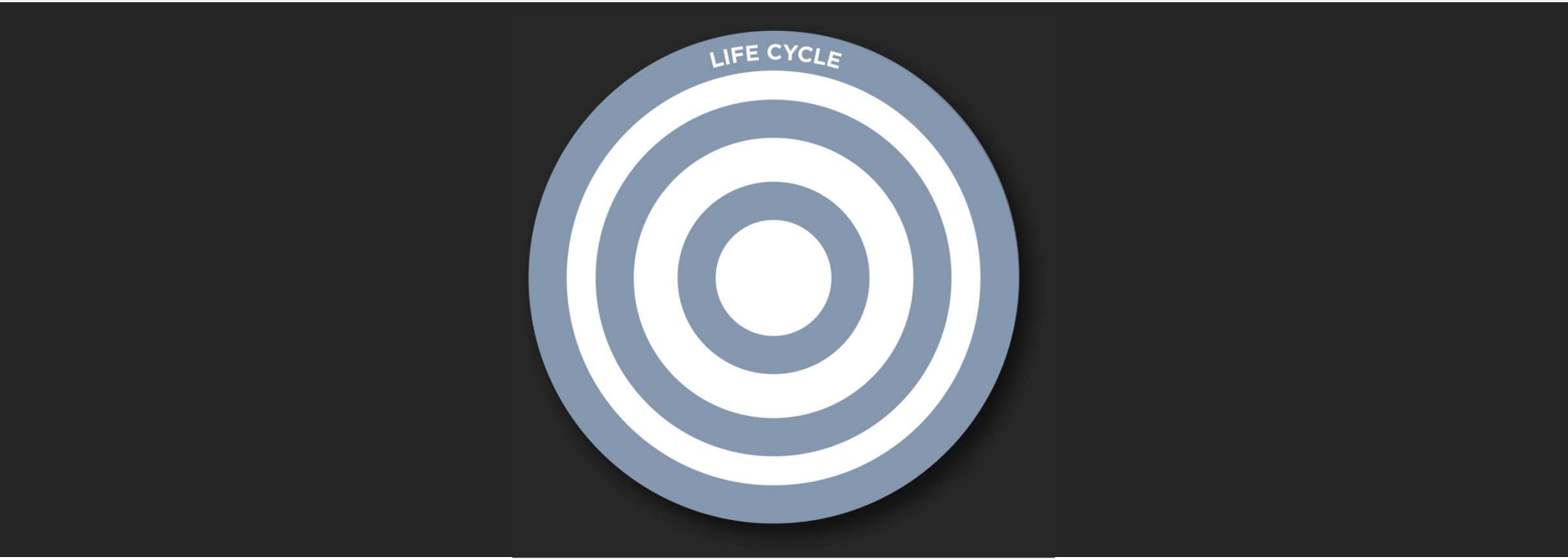
Preliminary Treatment			
Coarse Screening			
Pumping			
Grit/Grease Removal			
Pre-Aeration			
Fine Screening			
Primary Clarifiers			
Equalization			

Secondary Treatment	Advanced Activated Sludge	IFAS	MBR

Post Treatment			
Secondary Clarifiers			
Tertiary Filters			
Nitrifying Filters			
Disinfection			
Post Aeration			

Required	
May Be Required	
Not Required	

Best Process Selection



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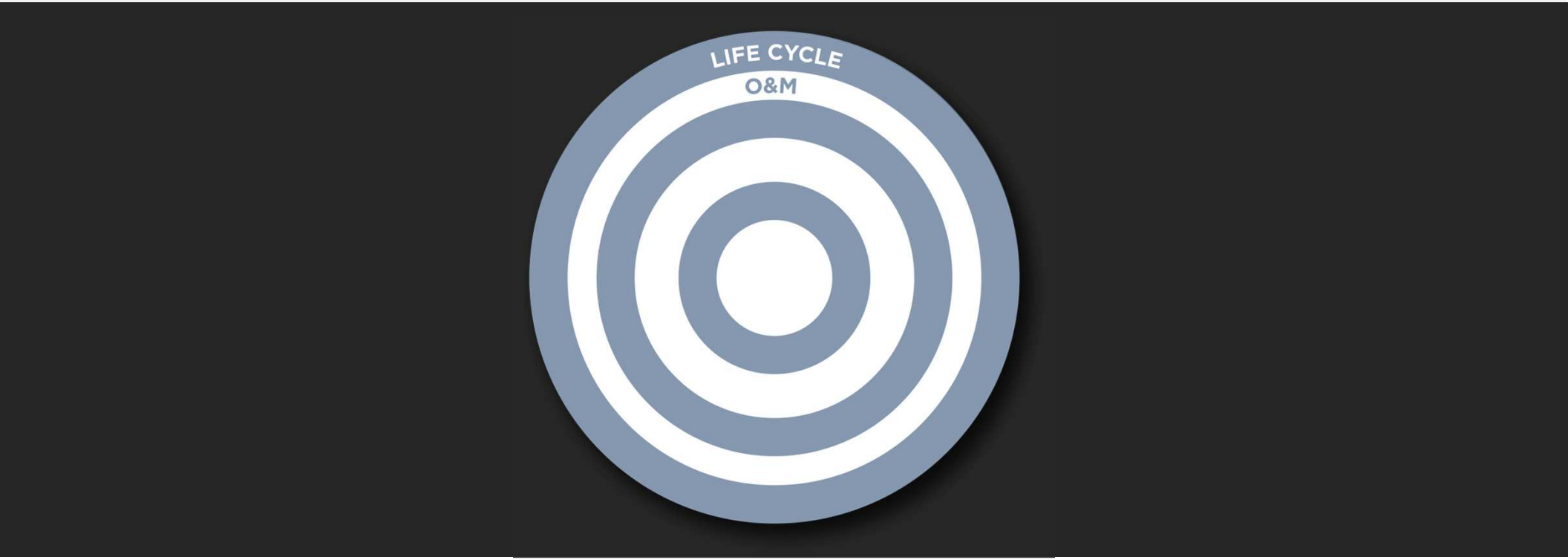

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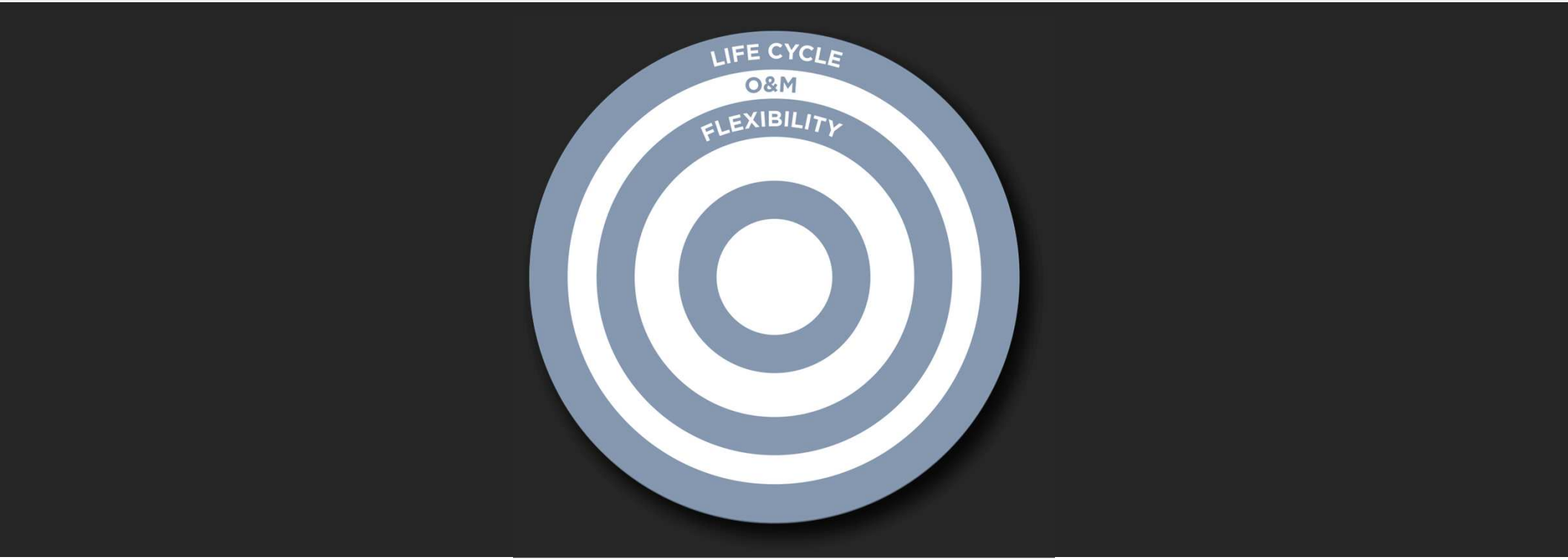

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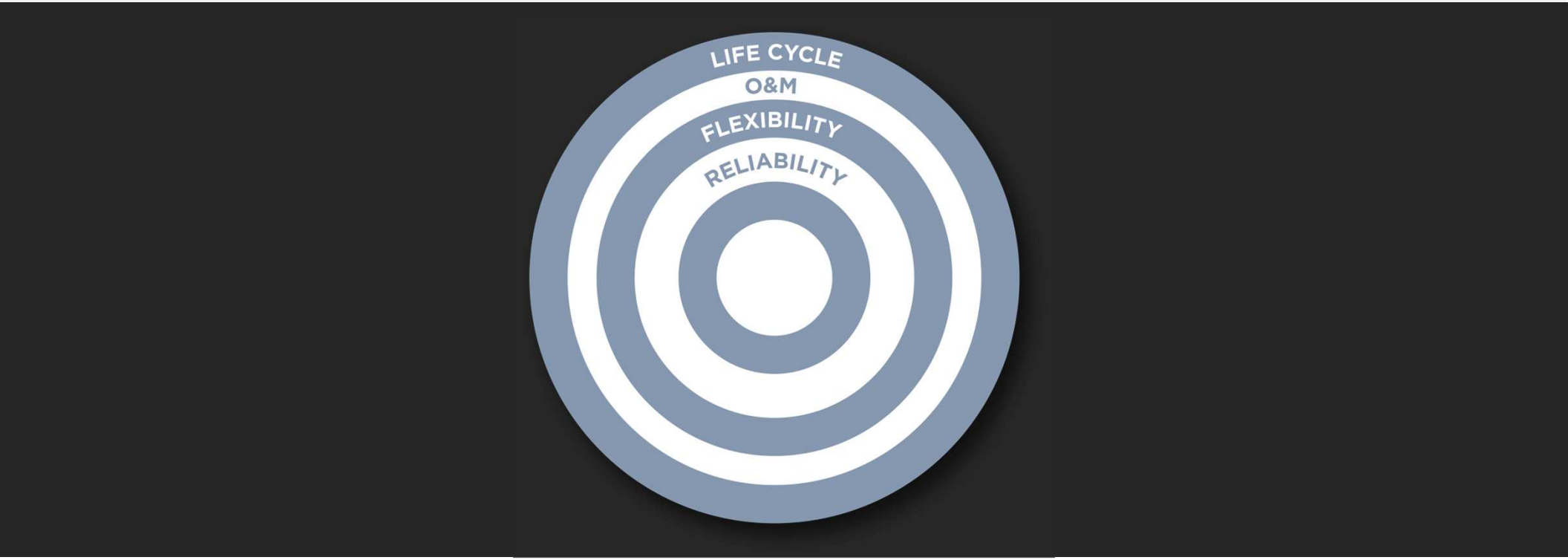

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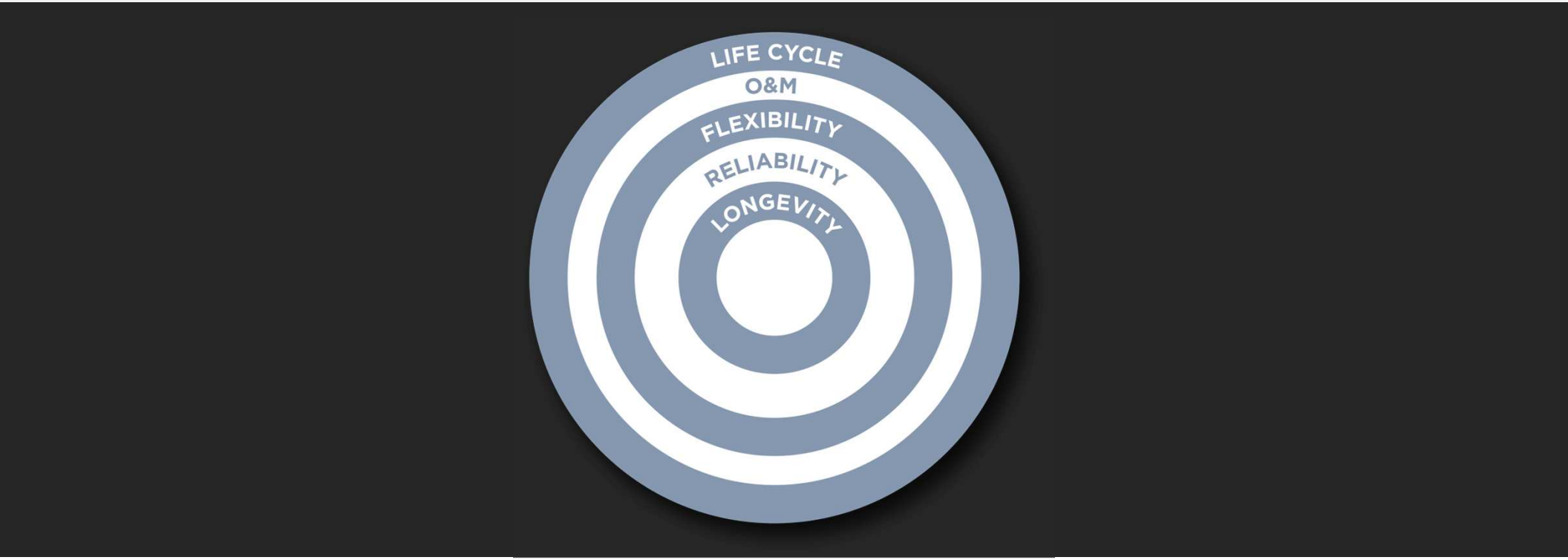
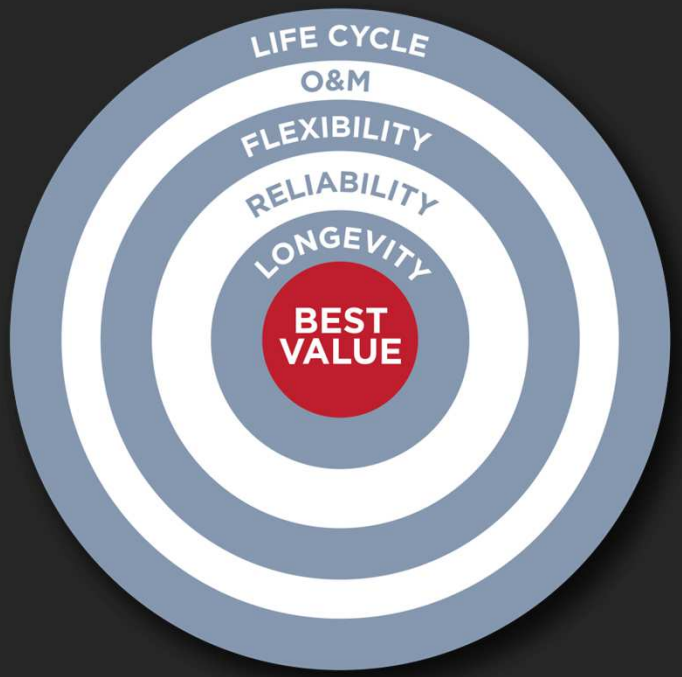


Best Process Selection

Option 1 :
Make choice on lifecycle costs only

Option 2:
Make choice based on lifecycle costs plus



- ***Lifecycle***
- ***O&M***
- ***Flexibility***
- ***Reliability***
- ***Longevity***

Case Study: *Upper Tuscarawas*

Overview

Under the control of Summit County Department of Environmental Services (DOES)

Covers 3 mile radius

Serves 39,000 people

Drivers for Change

Technology: antiquated process

Age: old equipment past life expectancy

Regulatory: phosphorus removal / total nitrogen reduction

Growth: needed phasing for anticipated growth

Process Comparison

Combinations	RBC & Orbal	RBC & MBR	Orbal & Orbal	MBR & MBR
Immediate Improvements	**RBC**	**RBC**	**Orbal**	**MBR**
Influent Pumping	0	0	0	0
Headworks	1,950,000	1,950,000	1,950,000	2,100,000
Primary Settling	70,000	70,000	0	0
Secondary Process	1,000,000	1,000,000	7,000,000	10,500,000
Secondary Settling	70,000	70,000	70,000	0
Post Treatment	1,950,000	1,950,000	1,950,000	0
Site Work	0	0	400,000	300,000
Subtotal	**5,040,000**	**5,040,000**	**11,370,000**	**12,900,000**

Process Comparison

Combinations	RBC & Orbal	RBC & MBR	Orbal & Orbal	MBR & MBR
Future Improvements	**Orbal**	**MBR**	**Orbal**	**MBR**
Headworks	0	400,000	0	400,000
Primary Settling	0	0	0	0
Secondary Process	12,500,000	18,000,000	5,500,000	7,500,000
Secondary Settling	3,700,000	0	3,700,000	0
Tertiary	0	0	0	0
Post Treatment	0	0	0	0
Site Work	1,000,000	400,000	600,000	0
Subtotal	**17,200,000**	**18,800,000**	**9,800,000**	**7,900,000**

Process Comparison

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Present Worth	**19,130,000**	**20,430,000**	**19,400,000**	**19,370,000**

Case Study: *City of Canton*

Overview

Tertiary treatment facility designed for an average flow of 39 MGD and a peak flow of 67 MGD

Undergoing largest upgrade project in its history – $90 M

Drivers for Change

Regulatory: phosphorus reduction and total nitrogen removal

Growth: increase peak hydraulic capacity and increase secondary

Process Comparison

TECHNOLOGY	CONVENTIONAL ACTIVATED SLUDGE CHEMICAL	CONVENTIONAL ACTIVATED SLUDGE BIOLOGICAL	IFAS	MBR
Total Capital Cost	103.7	109.4	88.0	72.1
O&M	41.8	45.3	48.7	43.3
Total	**145.5**	**154.7**	**136.7**	**115.4**

Summary

Upgrading your wastewater treatment plant

It all starts with secondary treatment.

- OFFERS THE MOST FLEXIBILITY FOR GROWING COMMUNITIES
  - TECHNOLOGY
  - TIMING
  - COST
- DRIVES PRELIMINARY AND POST TREATMENT UPGRADE DECISIONS
- EVALUATES TECHNOLOGIES THAT MEET YOUR GROWTH NEEDS BASED ON LIFECYCLE OR BEST VALUE
- OPTIMIZES THE OVERALL TREATMENT PLANT

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Questions?