

# Cayucos Sustainable Water Project

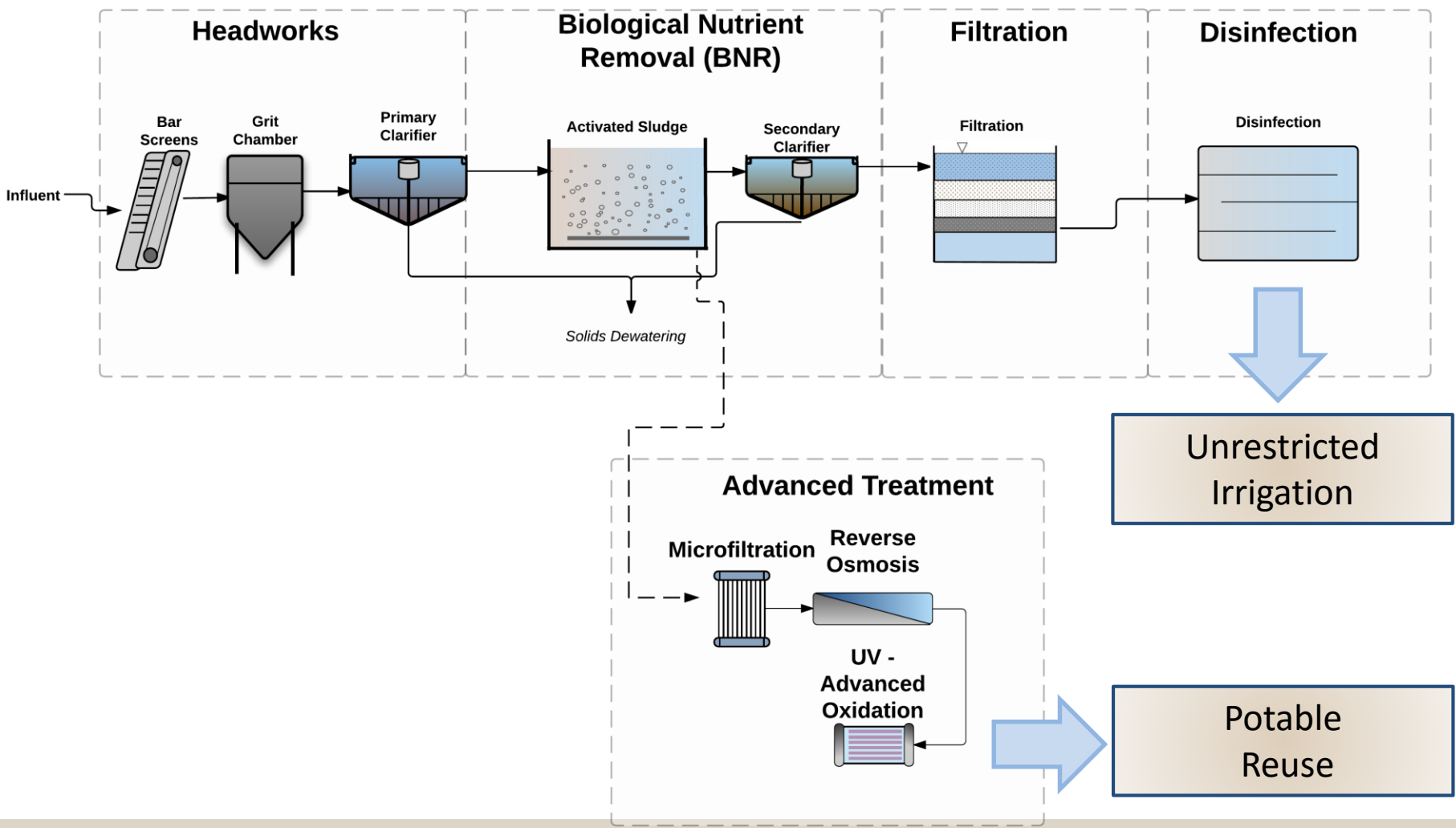
Treatment Process  
Technology Selection



# Presentation Overview

- Treatment Objectives
- Treatment Process Alternatives Recap
- Evaluation Criteria
- Cost Evaluation Assumptions
- Treatment Technology Screening Evaluation

# Wastewater Treatment Process Overview



# Treatment Process Objectives

Select a process technology that is...

- Proven and dependable
- Robust and minimizes compliance risk
- Capable of providing potable reuse opportunities
- Cost effective and maximizes value for ratepayers' investment
- Sustainable for future regulations and population growth
- Energy efficient

# Nutrient Removal Treatment Process Alternatives

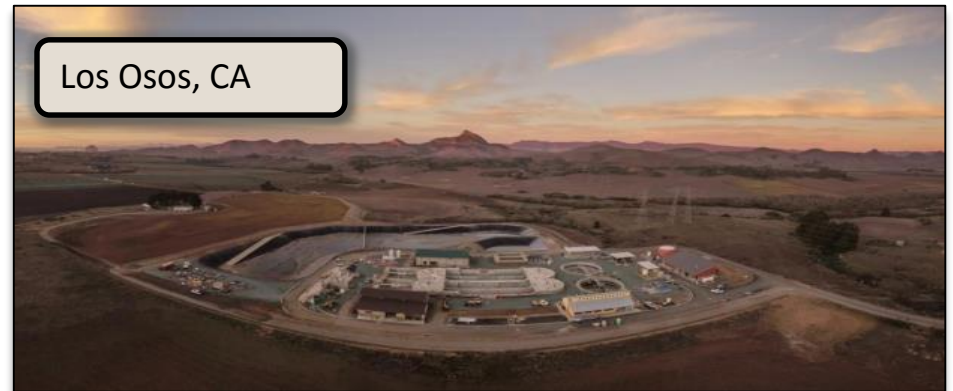
## Alternative 1

Conventional Activated  
Sludge (CAS)



## Alternative 2

Oxidation Ditch

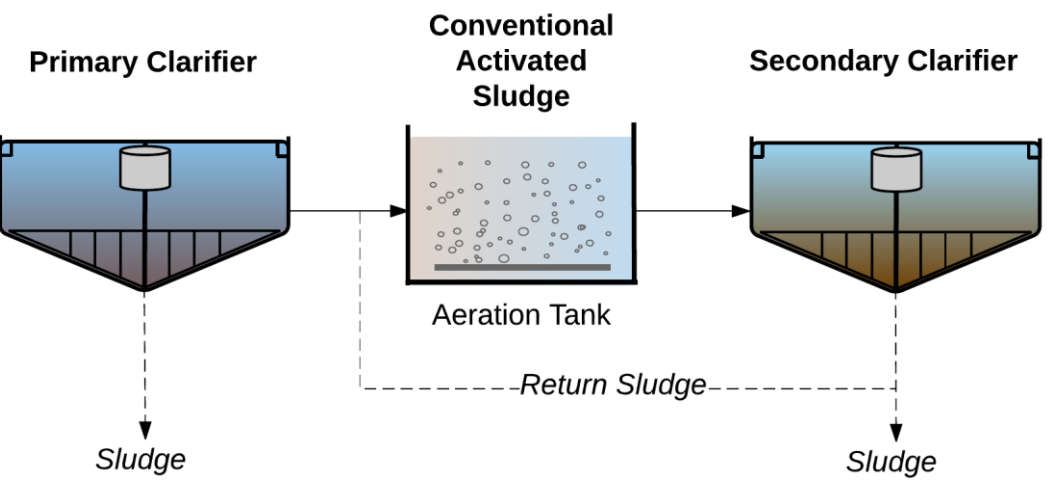
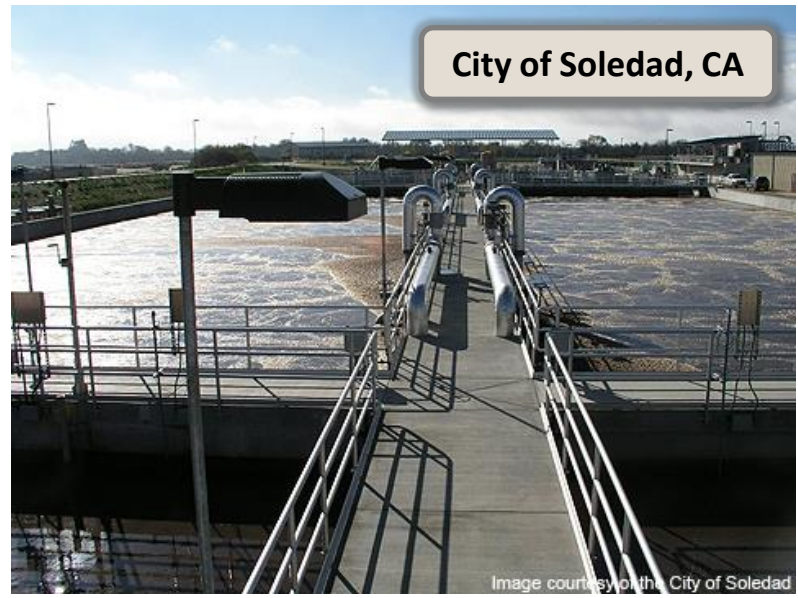


## Alternative 3

Membrane Bioreactor  
(MBR)



# Nutrient Removal Alternative 1 - CAS



### + Advantages

- Several non-proprietary configurations
- Many operational variants
- Technology is well understood

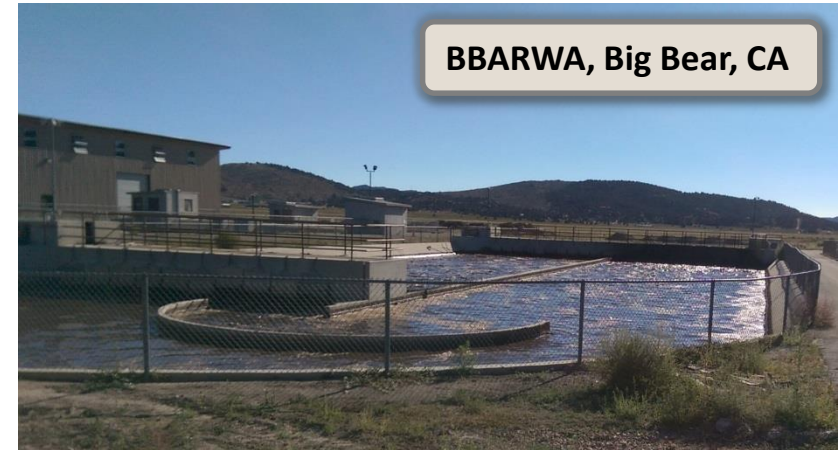
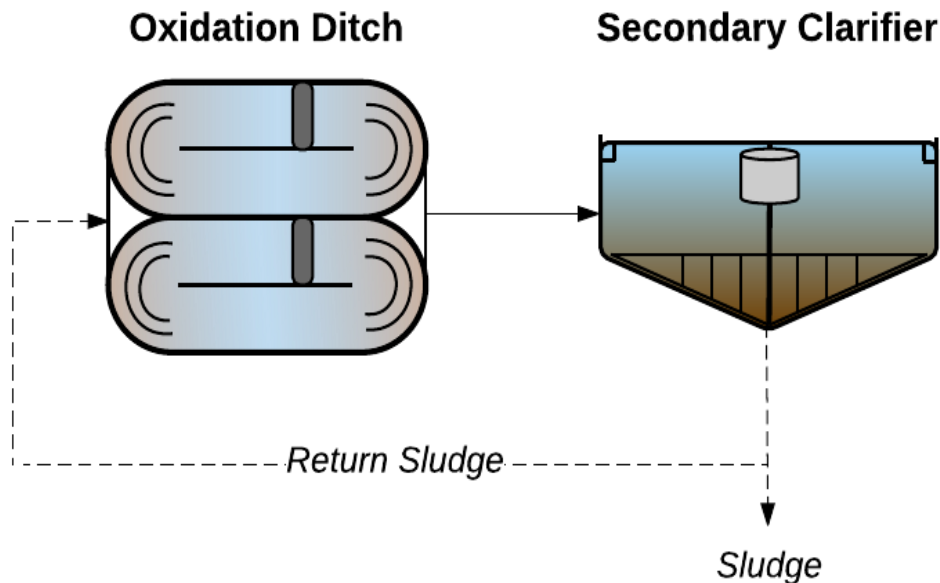
### - Disadvantages

- Large process footprint
- Susceptible to process upsets due to load and flow variations



# Nutrient Removal

## Alternative 2 – Ox Ditch



### + Advantages

- Established technology
- Resilient under flow and load variations
- Low biosolids production

### - Disadvantages

- Large process footprint
- Plant capacity expansion can be difficult
- Some modifications are proprietary

Headworks

Nutrient Removal

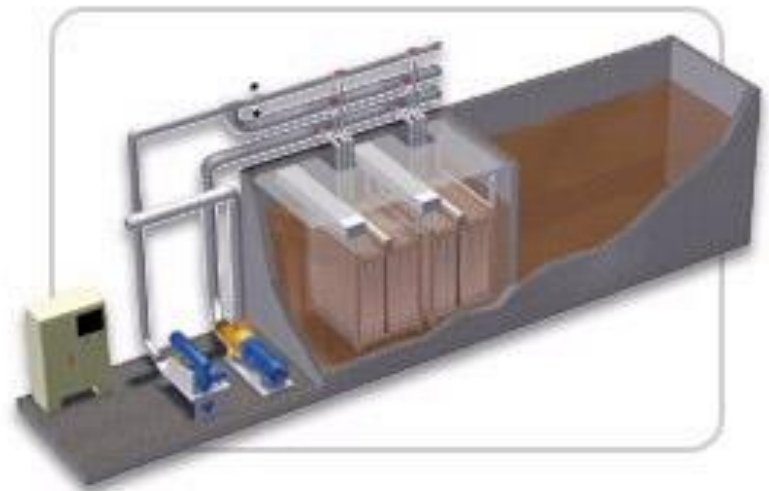
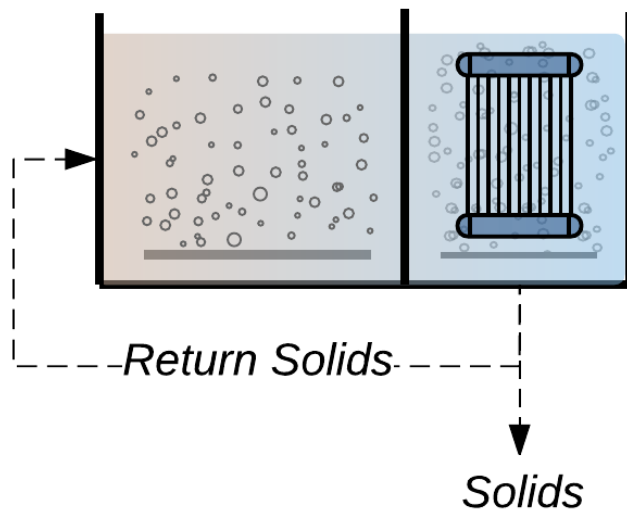
Filtration

Disinfection

Advanced

# Nutrient Removal Alternative 3 - MBR

## Membrane Bioreactor



### + Advantages

- Compact footprint suitable for expansion
- Combines biological treatment and membrane filtration to enable effective disinfection
- Effluent quality provides great potable reuse potential

### - Disadvantages

- Membrane replacement relatively expensive
- Requires equalization or additional units to handle peak flow events
- Membranes need regular cleaning

Headworks

Nutrient Removal

Filtration

Disinfection

Advanced



# Evaluation Criteria

## Economic Criteria

- Life cycle cost

## Non-Economic Criteria

- Adaptability for Potable Reuse
- Peak Loading Resiliency
- Peak Flow Resiliency
- Maintenance Requirements
- Chemical Needs
- Odor Potential
- Process Footprint
- GHG Emissions/Energy Efficiency
- Water Quality Reliability
- Adaptability to Phase Tertiary Treatment

# Cost Evaluation Assumptions

- Apples to apples treatment technology cost comparison:

Process	Alternative 1 CAS	Alternative 2 Ox-Ditch	Alternative 3 MBR
Headworks	PC		Fine Screening Equalization
BNR	BNR SC	BNR SC	BNR MF/UF
Filtration	MF/UF	MF/UF	
Solids Treatment	Thickening / Stabilization	Thickening / Stabilization	

Include processes that differentiate treatment alternatives

PC = Primary Clarification

BNR = Biological Nutrient Removal

SC = Secondary Clarification

MF/UF = Microfiltration/Ultrafiltration

# Cost Evaluation Assumptions

Exclude  
Common  
Elements

Influent pumping

Course screening

Grit Removal

Disinfection

Advanced Treatment

Solids Dewatering

# Cost Evaluation Assumptions

- Capital costs
  - 20% Contingency
  - 30% Indirect costs
- O&M costs included for primary, secondary, filtration, and solids handling
- Annualize costs over 30 years at 2% interest

# Treatment Technology Screening Evaluation

Normalize Annualized Life Cycle Cost

Score qualitative criteria  
(3= highest score, 2= mid-score, 1= lowest score)

Establish importance/weighting factors for qualitative and economic scores  
(Based on District's priorities and Project Charter)

Sum weighted scores and rank highest to lowest score

# Non-Economic Criteria Scoring

CRITERIA	Alternatives		
	Alternative 1 – CAS	Alternative 2 – Ox Ditch	Alternative 3 - MBR
Adaptability for Potable Reuse	3	3	3
Peak Loading Resiliency	2	3	3
Peak Flow Resiliency	2	2	1
Maintenance Requirements	2	3	1
Chemical Needs	2	2	2
Odor Mitigation	1	2	3
Process Footprint	1	1	3
Energy Requirements	2	2	2
Water Quality Reliability	2	2	3
Ability to Phase Tertiary Treatment	3	3	1

# Treatment Technology Screening Evaluation

## Criteria Ranking

CRITERIA	Importance/ Weighting Ranking
Total Annualized Cost	1
Adaptability for Potable Reuse	2
Peak Loading Resiliency	2
Peak Flow Resiliency	2
Water Quality Reliability	2
Maintenance Requirements	6
Odor Mitigation	6
Energy Requirements	8
Process Footprint	9
Chemical Needs	10
Ability to Phase Tertiary Treatment	11

# Treatment Technology Screening Evaluation

## Alternatives Scoring

CRITERIA	ALTERNATIVES (SCORING)		
	Alternative 1 CAS	Alternative 2 Ox- Ditch	Alternative 3 MBR
Total Annualized Cost	0.14	0.15	0.14
Adaptability for Potable Reuse	0.14	0.14	0.14
Peak Loading Resiliency	0.09	0.14	0.14
Peak Flow Resiliency	0.09	0.09	0.05
Water Quality Reliability	0.09	0.09	0.14
Maintenance Requirements	0.05	0.08	0.03
Odor Mitigation	0.03	0.05	0.08
Energy Requirements	0.04	0.04	0.04
Process Footprint	0.01	0.01	0.04
Chemical Needs	0.02	0.02	0.02
Ability to Phase Tertiary Treatment	0.01	0.01	0.00
<b>Total Score</b>	<b>0.72</b>	<b>0.82</b>	<b>0.81</b>



# Treatment Technology Screening Evaluation

## Alternatives Scoring

CRITERIA	ALTERNATIVES (SCORING)		
	Alternative 1 CAS	Alternative 2 Ox- Ditch	Alternative 3 MBR
Total Annualized Cost	0.14	0.15	0.14
Adaptability for Potable Reuse	0.14	0.14	0.14
Peak Loading Resiliency	0.09	0.14	0.14
Peak Flow Resiliency	0.09	0.09	0.05
Water Quality Reliability	0.09	0.09	0.14
Maintenance Requirements	0.05	0.08	0.05
Odor Mitigation	0.03	0.05	0.08
Energy Requirements	0.04	0.04	0.04
Process Footprint	0.01	0.01	0.04
Chemical Needs	0.02	0.02	0.02
Ability to Phase Tertiary Treatment	0.01	0.01	0.00
<b>Total Score</b>	<b>0.72</b>	<b>0.82</b>	<b>0.83</b>

# Key Findings

- Oxidation Ditch
  - Slightly lower cost
  - Peak flow and loading resiliency
  - Option to by-pass filtration process during peak flows
  - Ability to phase tertiary treatment
- MBR
  - High water quality reliability
  - Small footprint
  - Better odor mitigation options

# Recommendation

- Receive feedback from the BOD on priorities and preferences
- Select a preferred treatment process alternative

# Next Steps

- Refine preferred treatment alternative
  - Process sizing
  - Footprint requirements
  - Solids handling study
  - Supporting facilities needs assessment
- Conceptual Site Plan
- Facilities Plan