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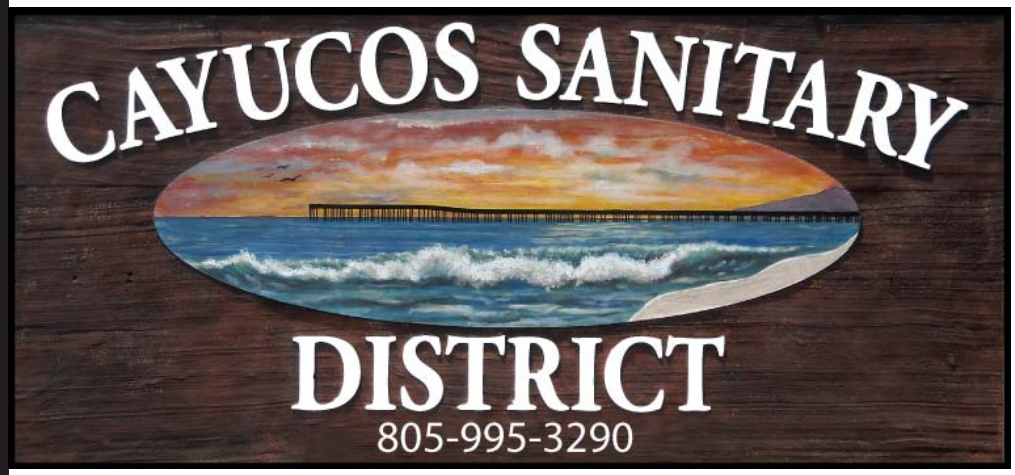
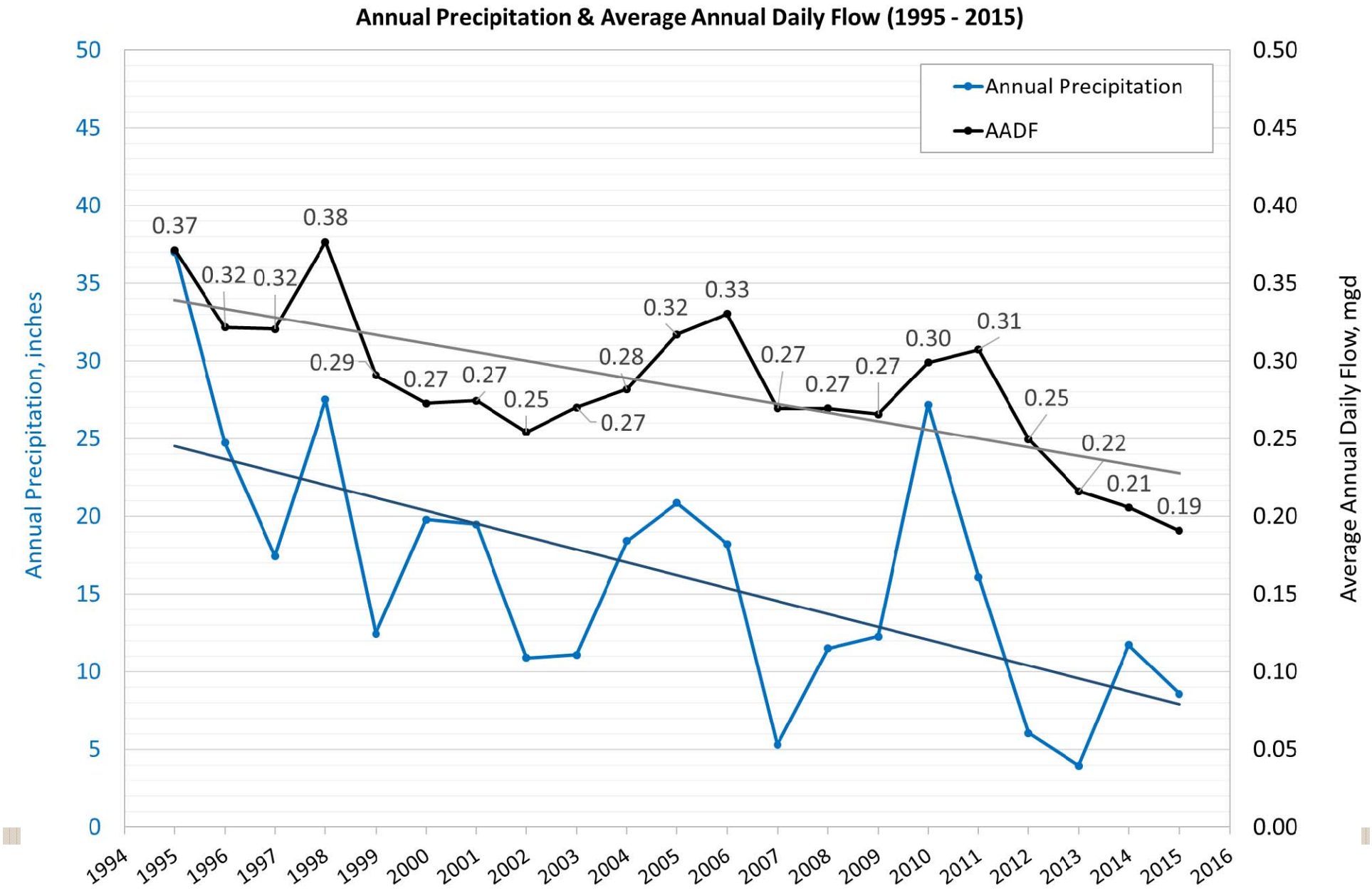
Cayucos Sustainable Water Project

Flows and Loading Update



May 19, 2016



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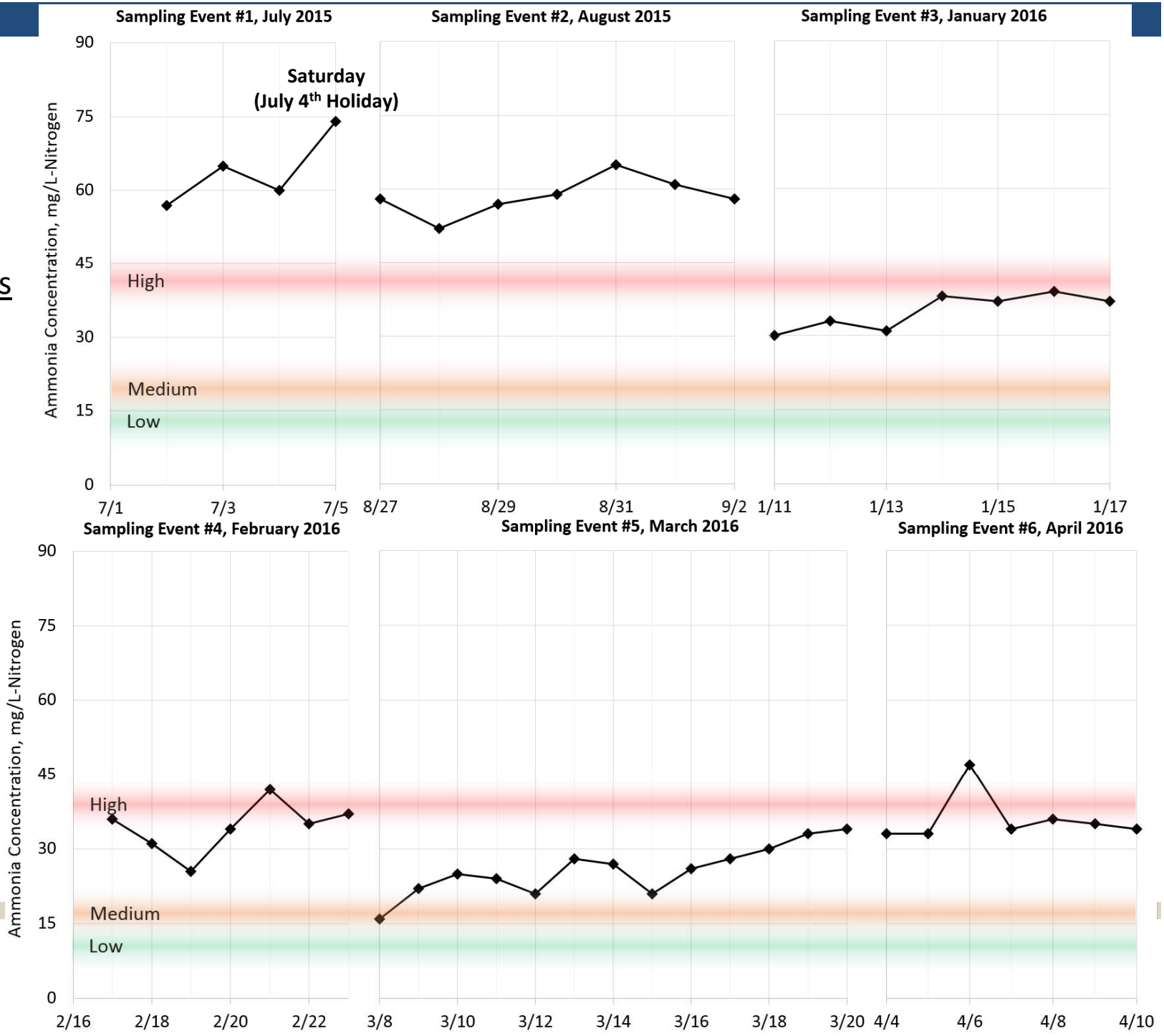
Ammonia Results

Average

39 mg/L

No. of Samples

45



Domestic Wastewater Strengths per: *Wastewater Engineering: Treatment and Resource Recovery.* Boston: McGraw-Hill, 2014. Print.

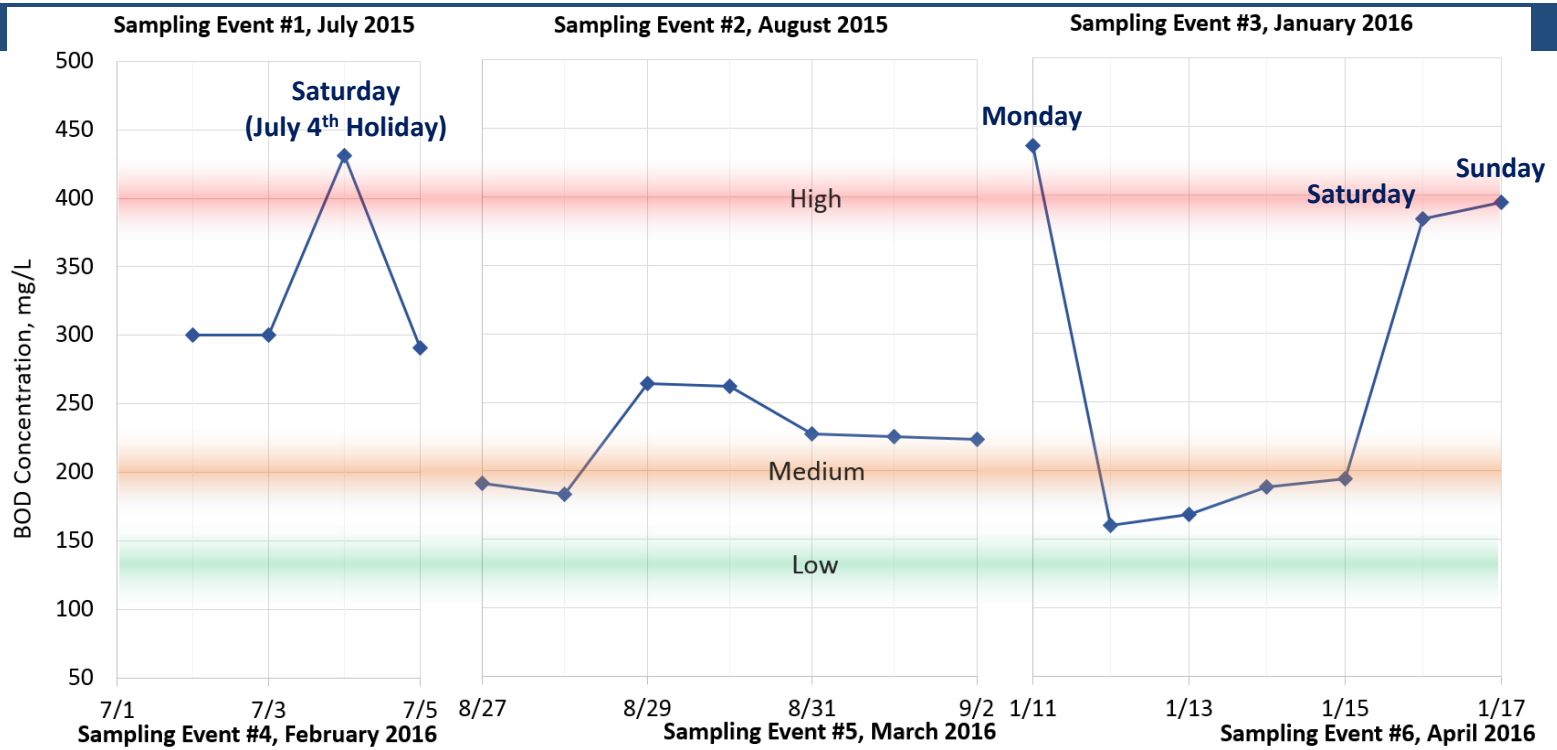
BOD Results

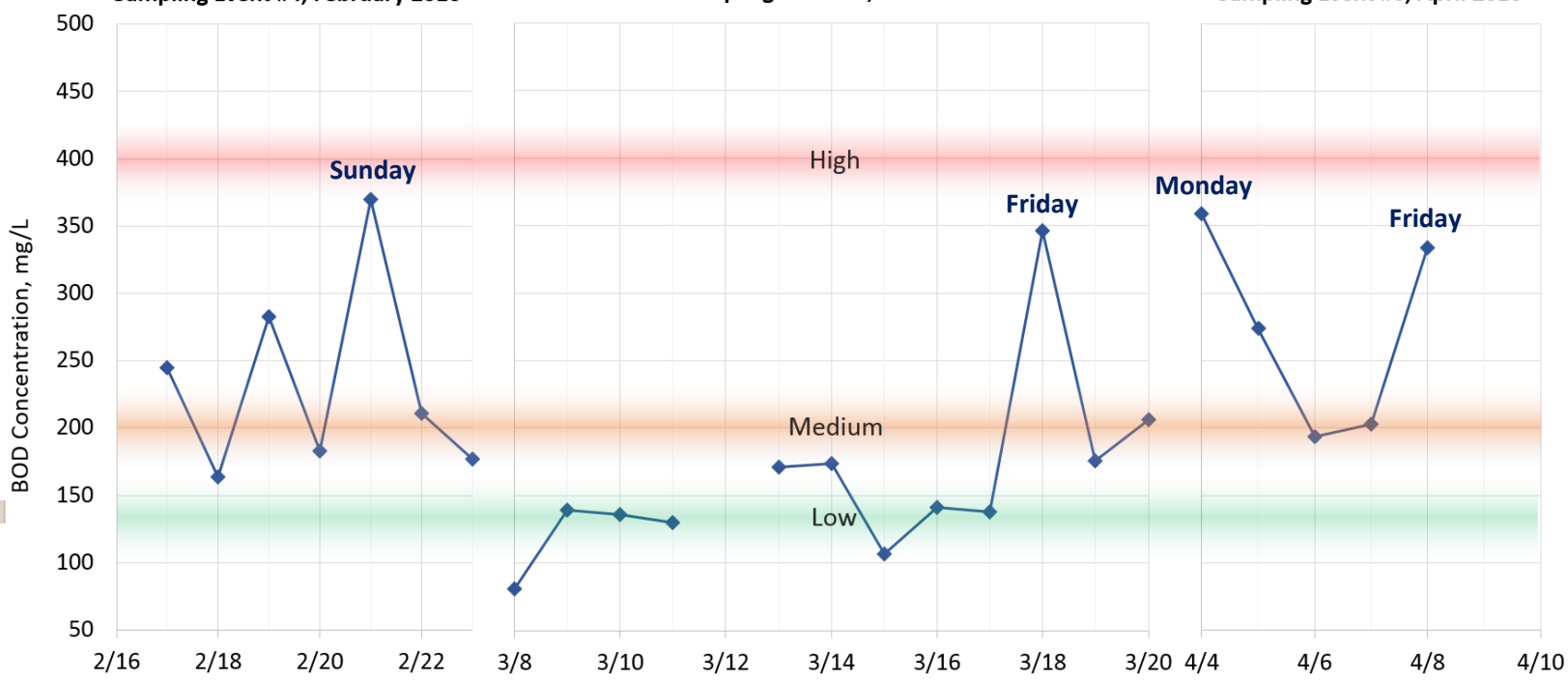
Average

232 mg/L

No. of Samples

42





Domestic Wastewater Strengths per:

Wastewater Engineering: Treatment and Resource Recovery. Boston: McGraw-Hill, 2014. Print.

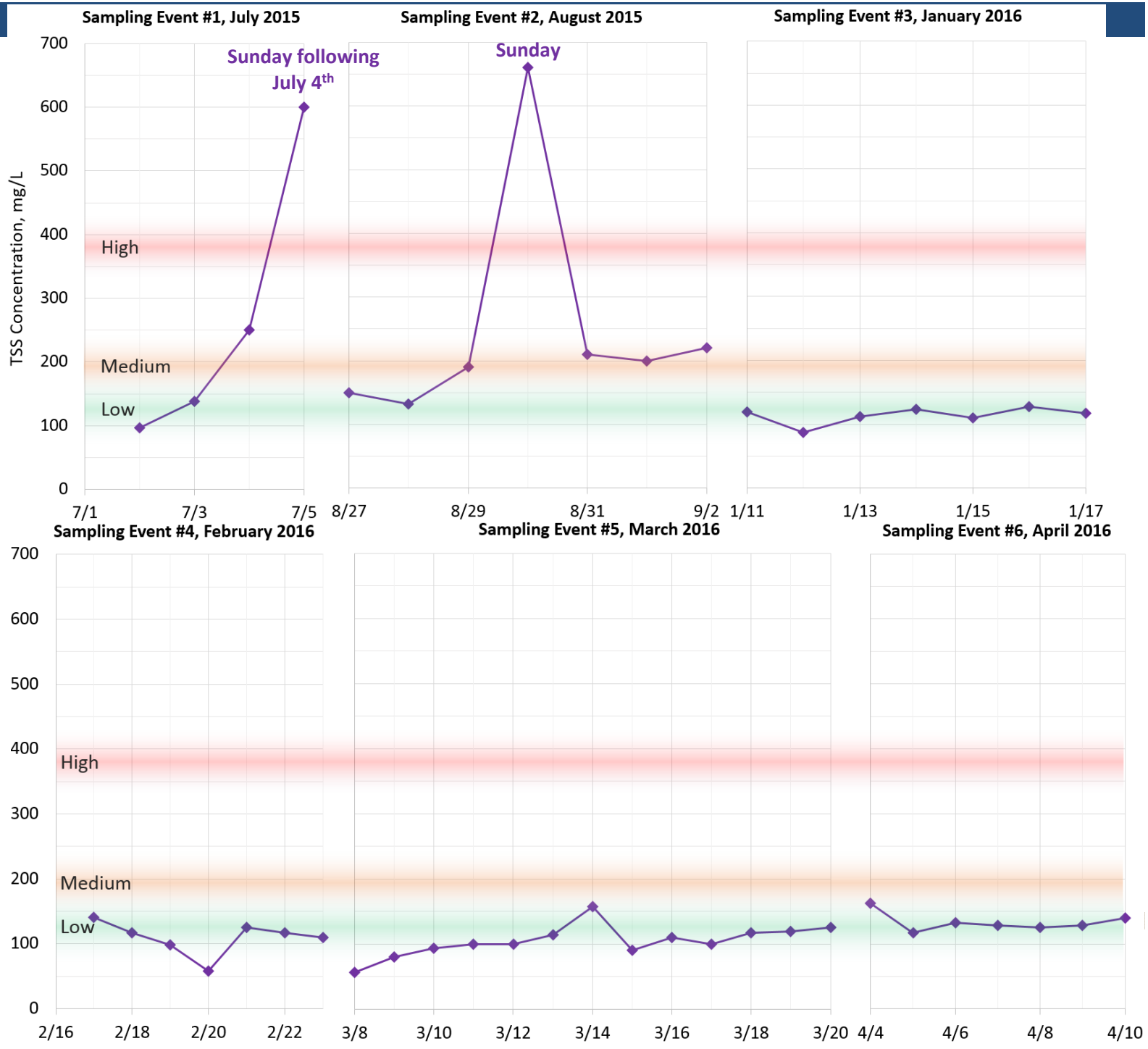
TSS Results

Average

149 mg/L

No. of Samples

45



Domestic Wastewater Strengths per: *Wastewater Engineering: Treatment and Resource Recovery.* Boston: McGraw-Hill, 2014. Print.

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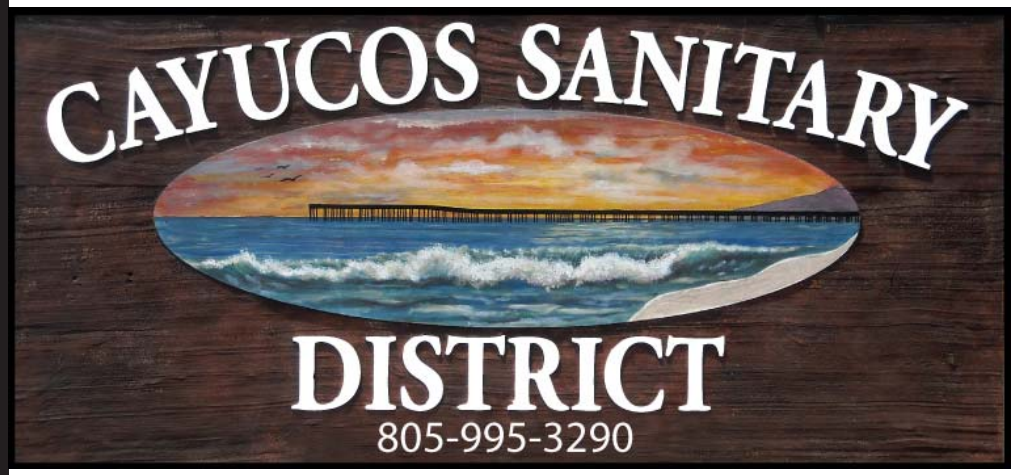
Treatment Process Alternatives Evaluation

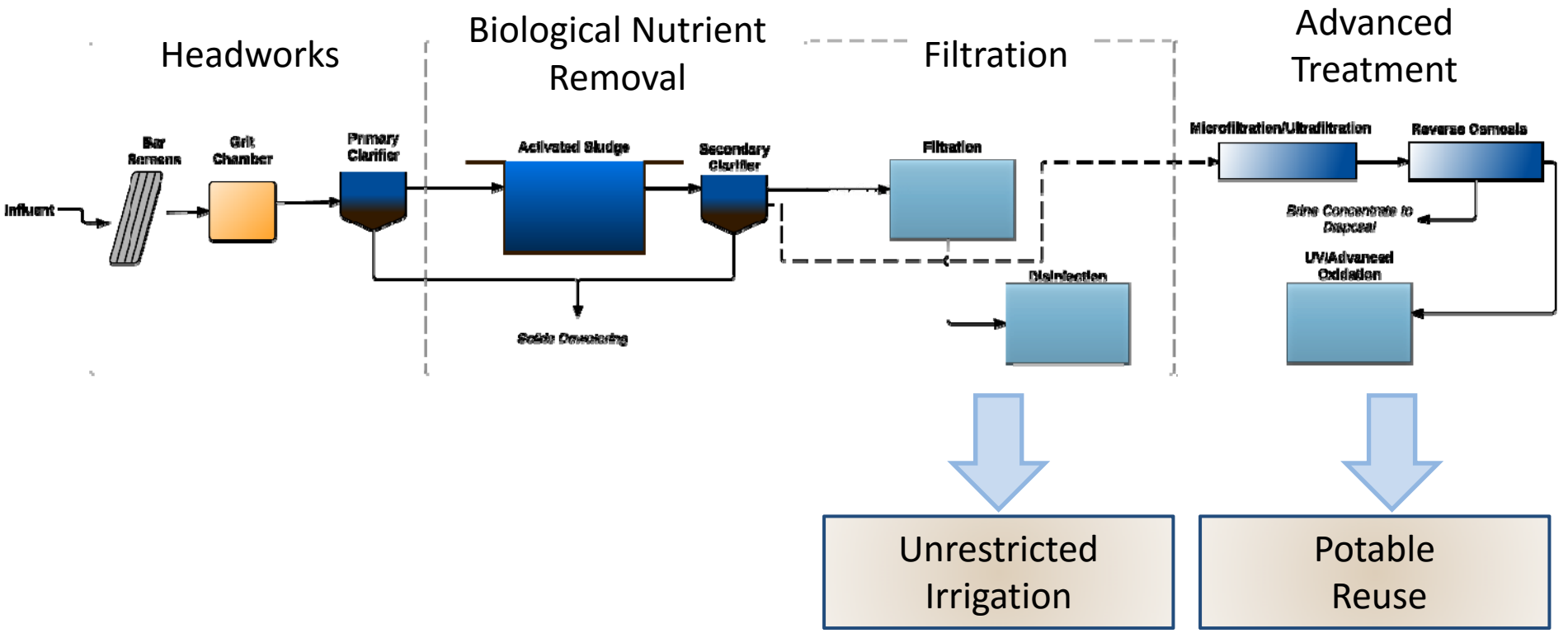


May 19, 2016

Presentation Overview

- Wastewater Treatment Process Overview
- Feasible Technologies Screening
- Treatment Process Alternatives
  - Process Flow Diagrams
  - Existing Installations

Wastewater Treatment Process Overview



Headworks → BNR → Filtration → Disinfection → Advanced

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Feasible Technology Screening Evaluation

Treatment Level	Treatment Technology	Type	Representative Models	Facility Examples		Resilience	Maintenance	Odor	Footprint	GHG Emissions / Energy Efficiency	Total
Primary	Coarse Screen (0.25" - 1.25")	Chain-driven	Nordic Water Multi Rake Screen MRS			2	2	1	3	2	10
		Reciprocating rake	Vulcan Monarch Severe Duty™ Bar Screen	Camarillo WWTP		3	3	1	2	2	11
	Fine Screen (<- 0.25")	**Continuous-element perforat**	HUBER Belt Screen EroaMax			3	3	2	3	1	**12**
		Multiple-rake screen	Vulcan WMR Multi-Rake	Turlock Regional Water Quality Control Center		3	2	2	3	2	**12**
		Drum screen	Andritz Separation Aqua Drum			3	2	2	1	1	9
		Helical Basket	HUBER Fine Screen ROTAMAT Ro1			3	2	2	1	3	11
	Grit Removal	Aerated grit basin		SLO WRRF		3	2	1	1	1	8
		Vortex	PISTA 360			3	2	2	2	2	11
		No grit removal				1	3	3	3	3	**12**
	Clarification	Conventional sedimentation		SLO WRRF		2	2	1	1	2	8
	Combined pre-screer	**Primary treatment for MBR**	GE LEAP primary			2	2	2	3	3	12
			Evoqua								

Treatment Level	Treatment Technology	Type	Representative Models	Facility Examples		Ada p r
Secondary	Suspended Growth Processes	**CAS**		City of SLO		
		Extended Aeration AS				
		Ox-ditch	Evoqua Vertical	City of Corona WRF #1B		
	Attached Growth Processes	Trickling filter		SSLOCSD		
	Membrane Bioreactor (MBR)	**Integrated**	GE LEAP mbr	Lathrop, CA		
			Evoqua			

Treatment Level	Treatment Technology	Type	Representative Models	Facility Examples		Ada y (t upg
Tertiary	Depth filtration	GMF		SLO WRRF/Fallbrook PUD		Obs
	Compressible media filtration	**Fuzzy filters**	Schreiber Water Fuzzy Filter	Saloda WWTP		
	Surface filtration	Disc filters	WesTech SuperDisc Disc Filter			

Treatment Level	Treatment Technology	Type	Representative Models	Facility Examples		Mai ce
Filtration	Low pressure membranes	Microfiltration	GE ZeeWeed Module	IRWD Michelson		
		Ultrafiltration	Pentair X-Flow Module			
	High pressure membranes	Nanofiltration	GE, Oxania		Don't do it unless you need to, dep. On	
		Reverse Osmosis	Evoqua Vantage			
Disinfection	Chlorination	Free chlorine			Dep. on conceptual alternative	
		Chloramination				
	Ozone	Ozone				
	UV	LPHO	Trojan UV3000 Plus, Oxania Aquaray 40 H	IRWD Michelson (Oxania)		
		MPHO	Oxania Aquaray SMP			
AOP	TOC Reduction	UV/Peroxide	Evoqua Vanox			
		Ozone/Peroxide	APT HiPOx			

Qualitative Criteria

- Adaptability for Potable Reuse
- Operational Flexibility
- Maintenance Requirements
- Chemical Needs
- Odor
- Footprint
- GHG Emissions/Energy Efficiency

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Treatment Process Alternatives

Biological Process Alternatives

- Alternative 1 – Conventional Activated Sludge (CAS)
- Alternative 2 – Oxidation Ditch
- Alternative 3 – Membrane Bioreactor (MBR)

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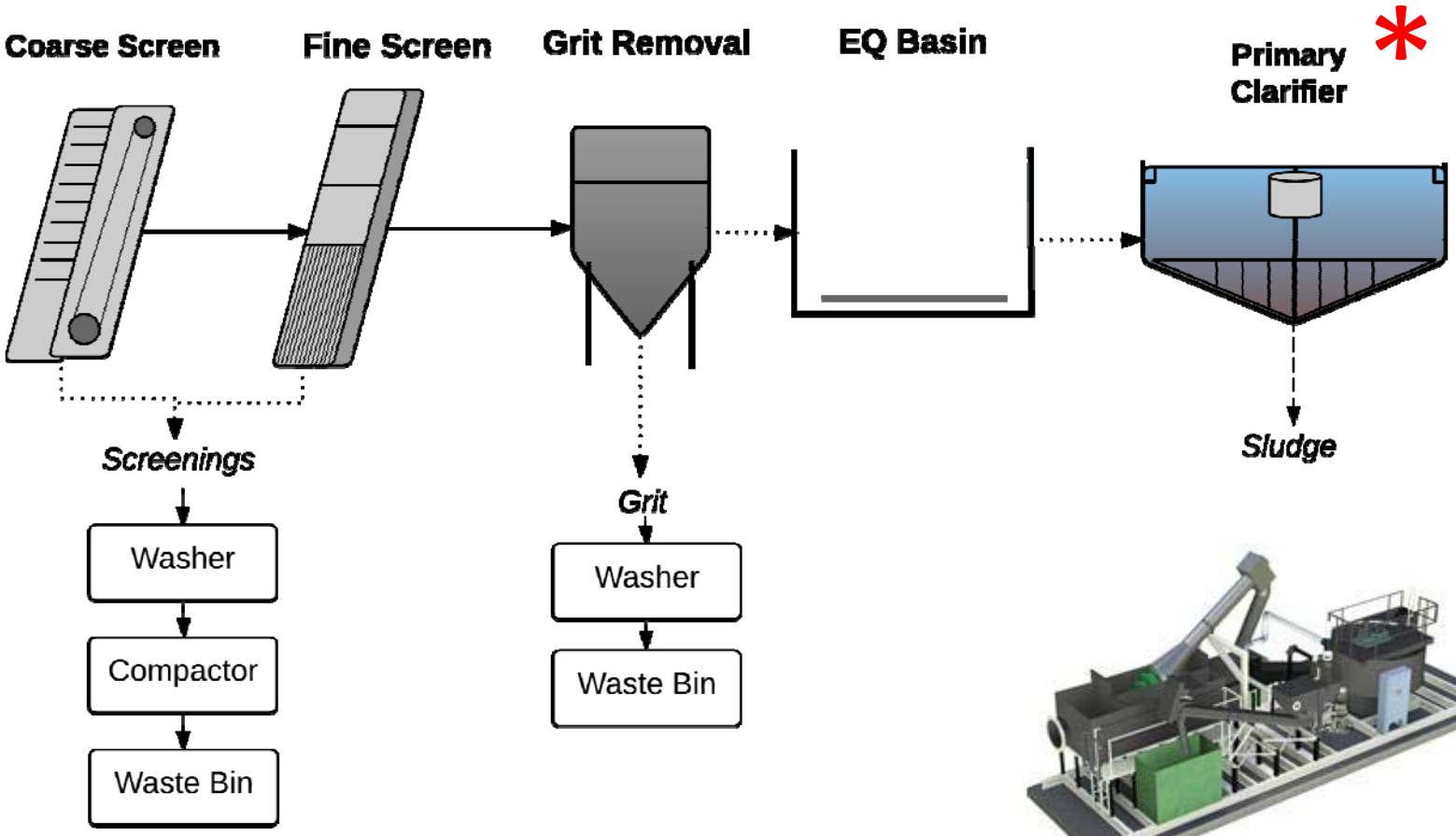
Headworks



*For CAS only

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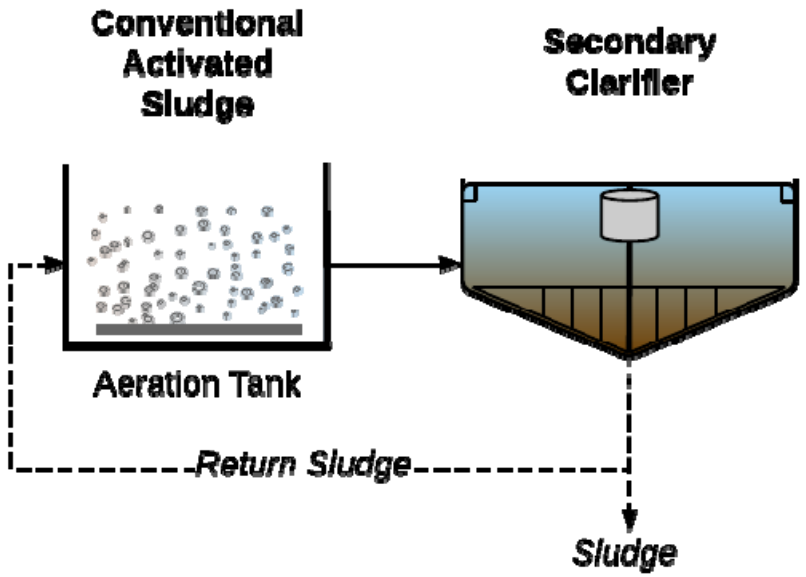
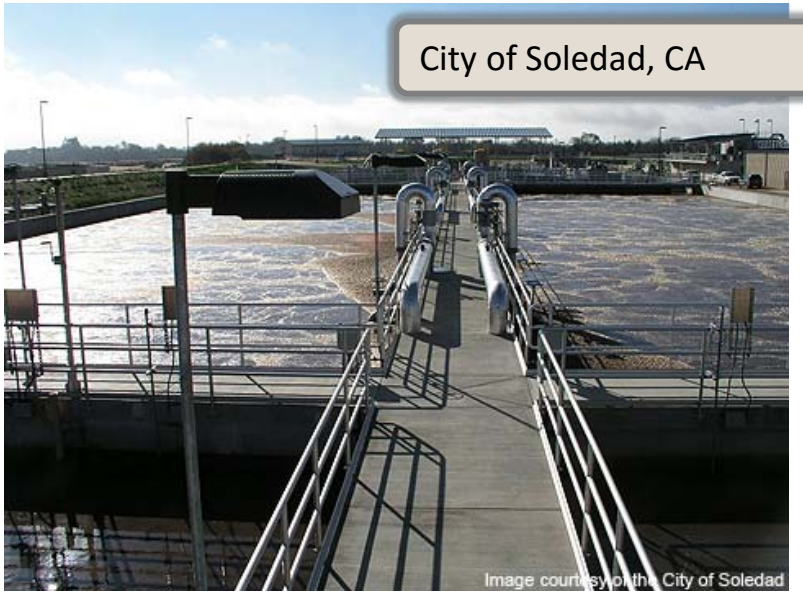
Biological Nutrient Removal (BNR)

Alternative 1 - CAS





Advantages

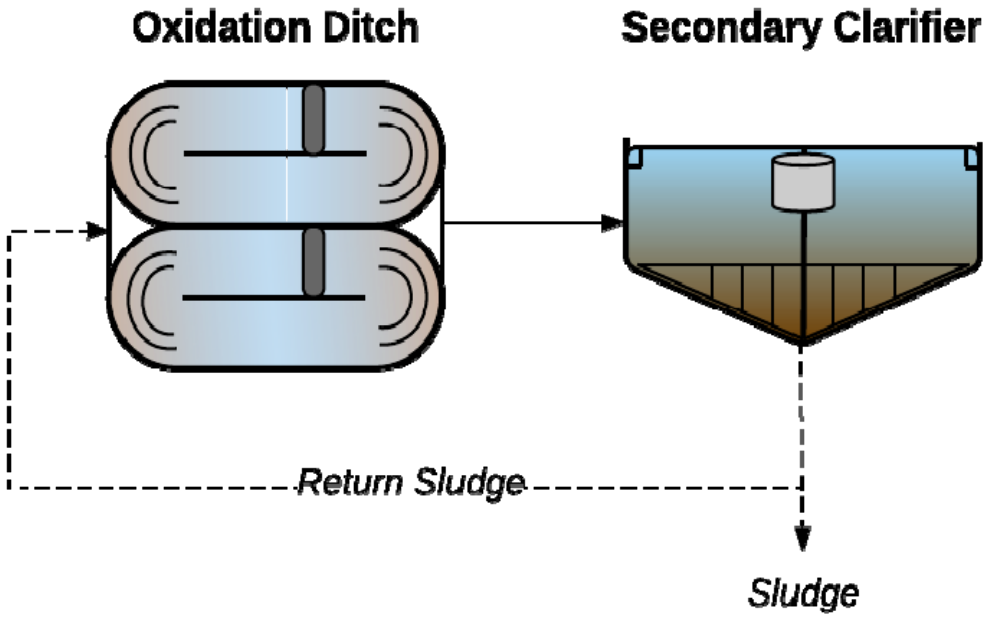
- Best documented and most widely used
- Many operational variants
- Simple design and operation

Disadvantages

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

Biological Nutrient Removal (BNR)

Alternative 2 – Ox-Ditch



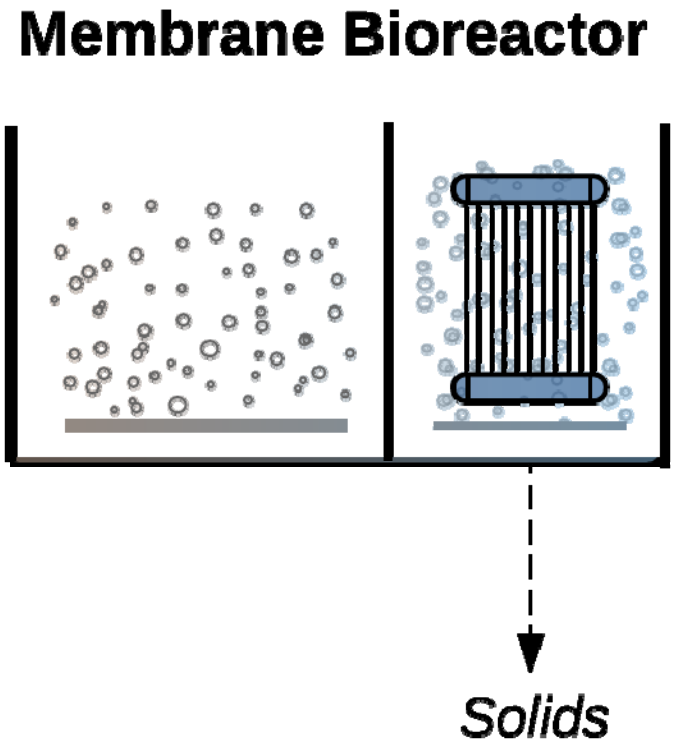
Advantages

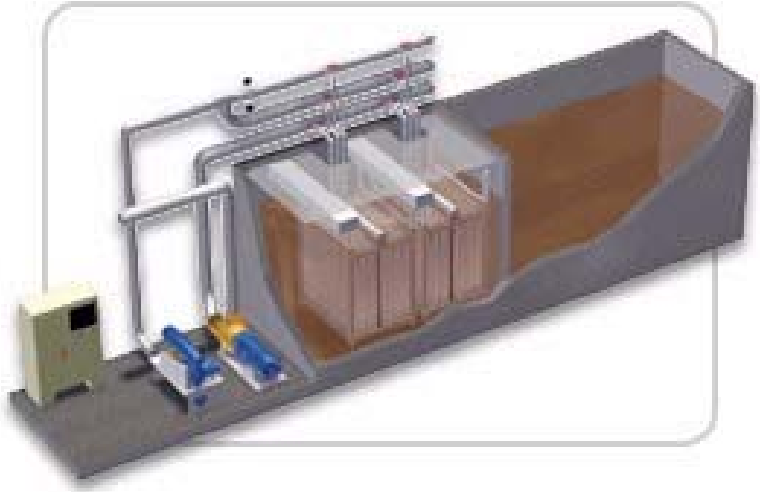
- Proven technology
- Resilient under flow and load variations
- Low O&M cost for small plants
- Reliable and simple to operate

Disadvantages

- Large footprint
- Difficult to modify/expand

Biological Nutrient Removal (BNR) Alternative 3 - MBR





Advantages

- Provides tertiary treated water suitable for reuse after disinfection
- Combines biologic treatment and filtration
- Compact footprint

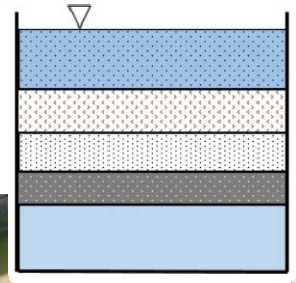
Disadvantages

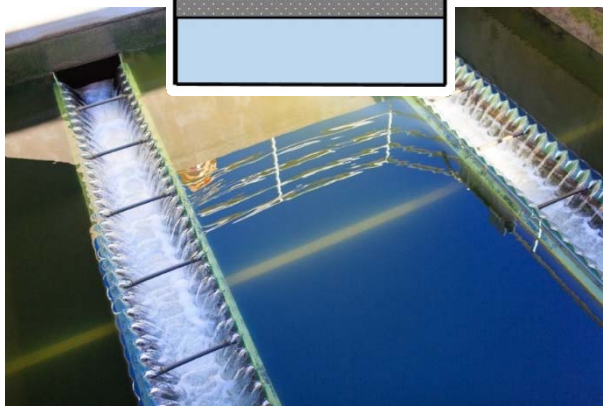
- Energy intensive
- High O&M cost

Filtration

A

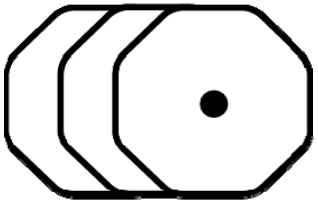
Granular Media Filtration





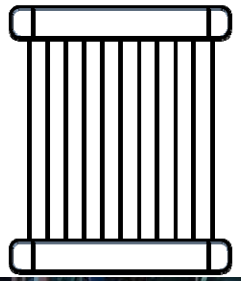
B

Discfilter



C

Microfiltration



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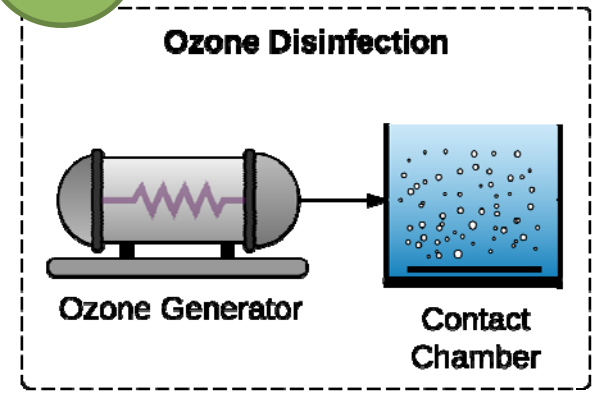
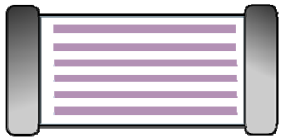
Disinfection

A



B

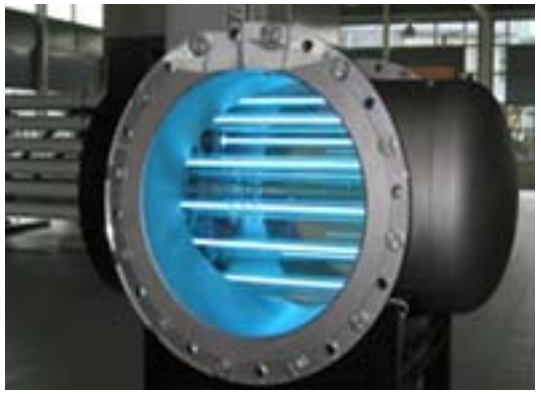
UV Disinfection

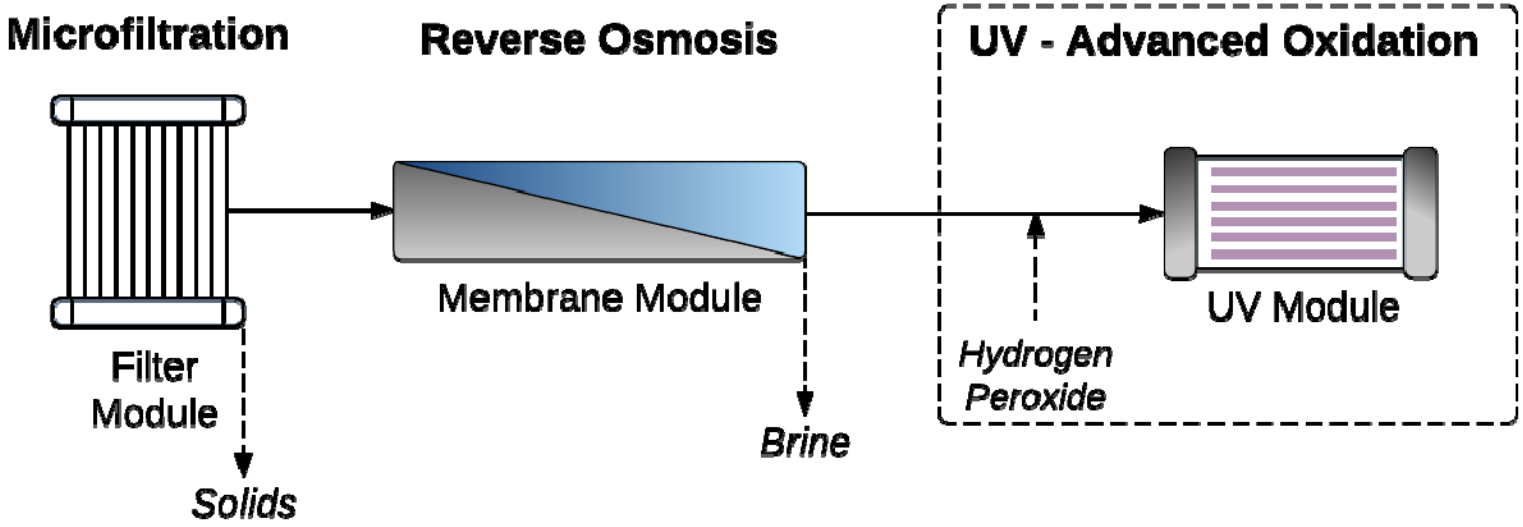


C

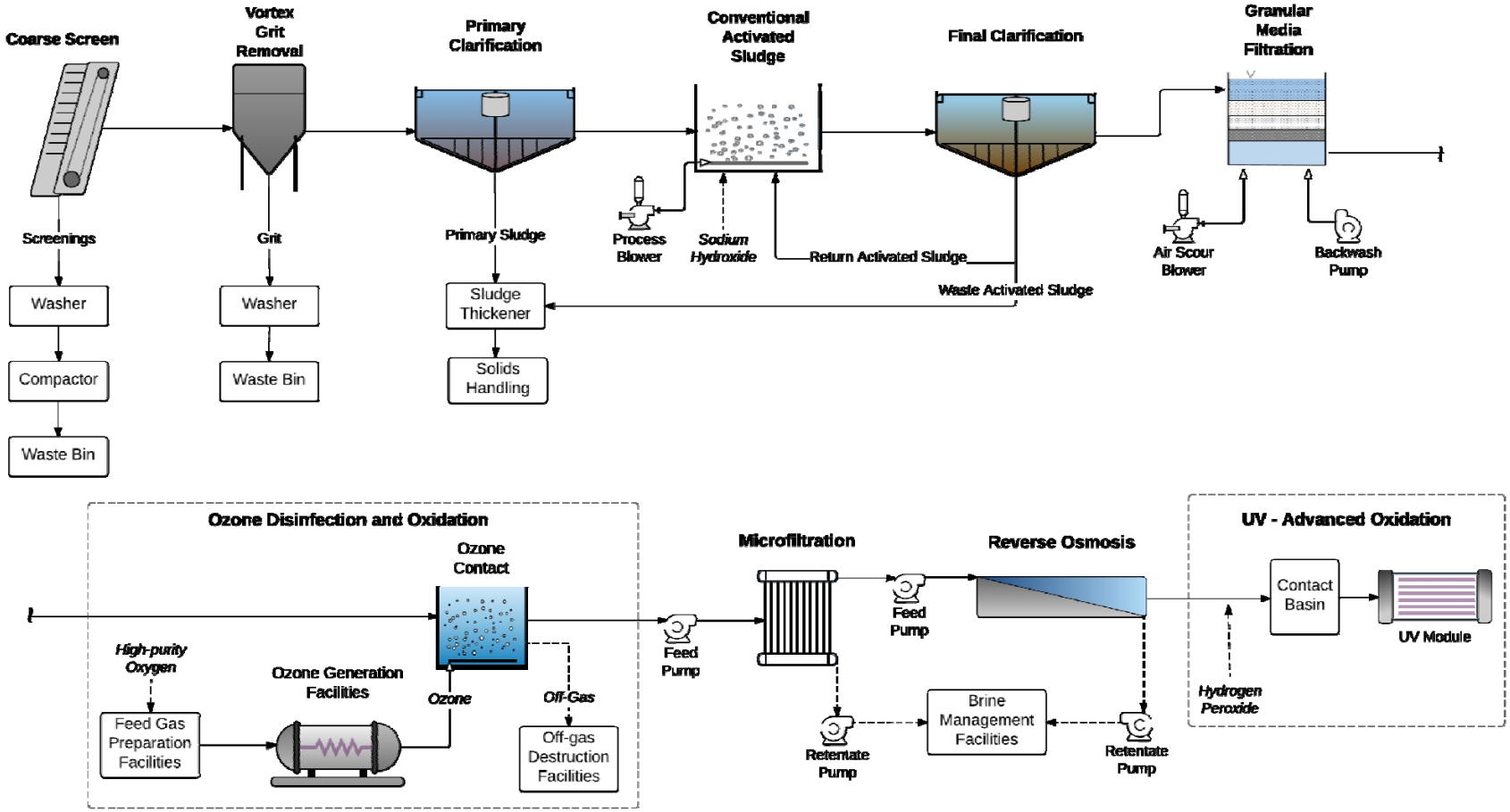
Chlorine Disinfection

Phase II - Full Advanced Treatment





Alternative 1
Conventional Activated Sludge



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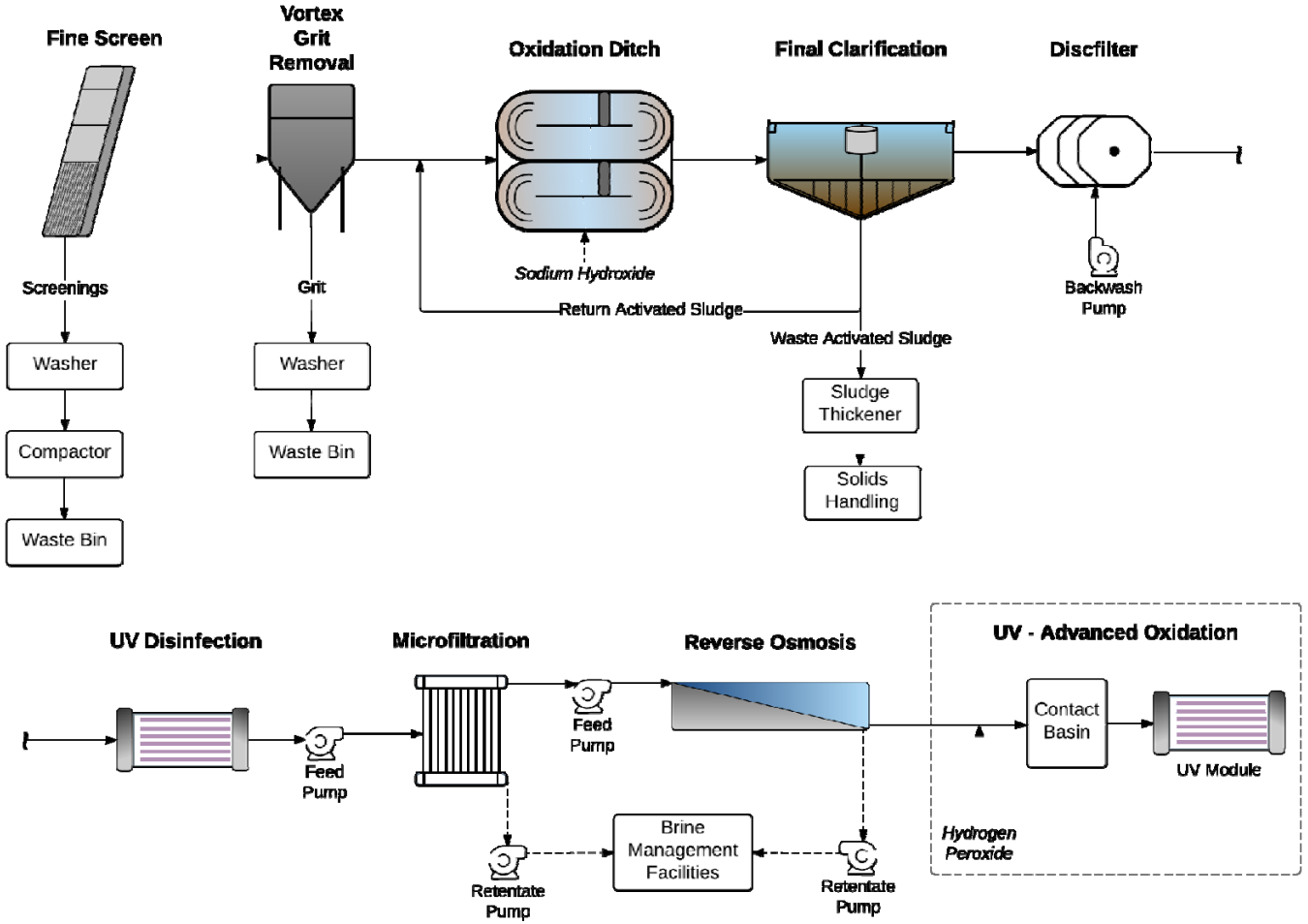
Alternative 2
Oxidation Ditch



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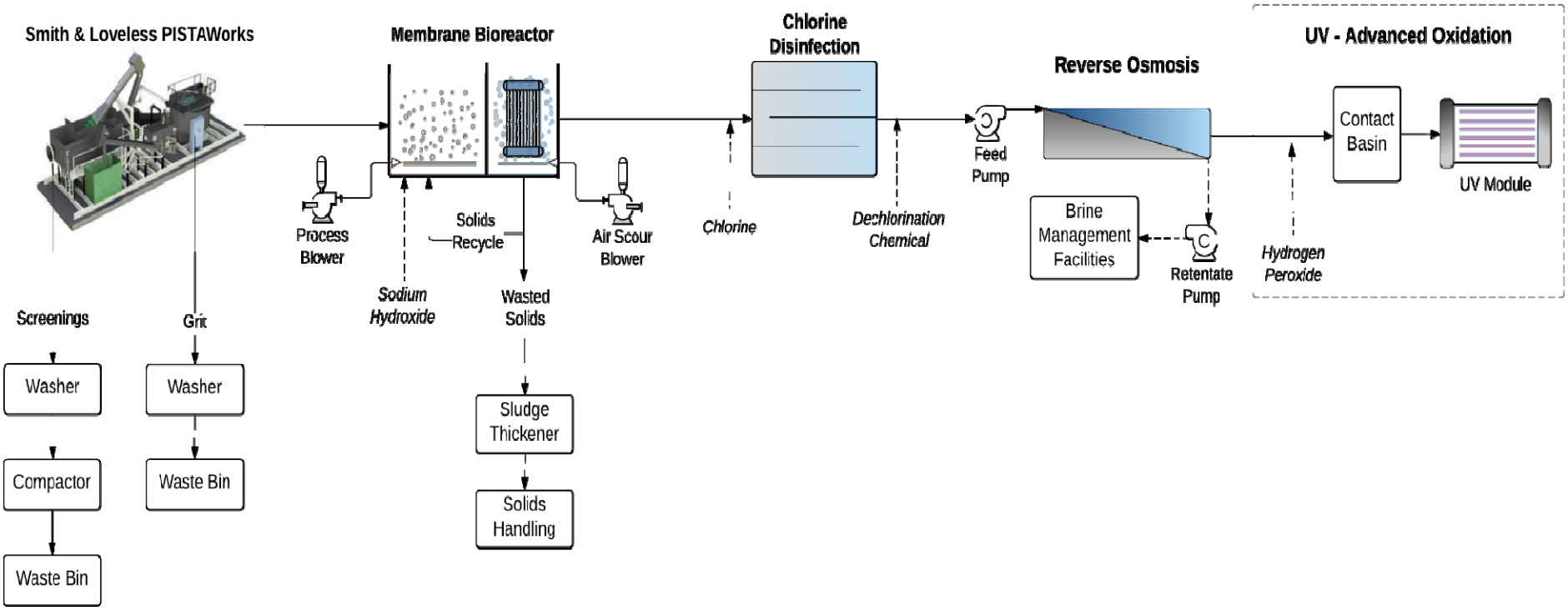
Alternative 3
MBR



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Next Steps

- Evaluate economic considerations
- Refine and evaluate alternatives based on identified criteria
  - Capital Cost
  - Life Cycle Cost
  - Adaptability for Potable Reuse
  - Operational Flexibility
  - Maintenance Requirements
  - Chemical Needs
  - Odor
  - Footprint
  - GHG Emissions/Energy Efficiency
- Bring recommendation to Board

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Alternative 1
Conventional Activated Sludge

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Alternative 2
Oxidation Ditch

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Alternative 3
MBR

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