An Operator's Tale of Living Through a Facility Upgrade

NEWEA Annual Conference 2022 – Session 23
Plant Operations 3: Focus on Operations and Startup
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Session overview

1. Project Overview – Uxbridge WWTF Upgrade
2. Wastewater Treatment Process Highlights
3. Sludge Process Highlights
4. Construction
5. Questions

Project Overview

Uxbridge Effluent permit limits

Parameter	Limit Average – Monthly
pH Range	6.0 – 8.3 SU
(C) BOD_5 November – May June - October	 30 mg/L 20 mg/L
TSS November – May June - October	 30 mg/L 20 mg/L
Ammonia – Nitrogen Dec – April May – Nov June - October	 15 mg/L 10 mg/L 5 mg/L

Parameter	Limit Average – Monthly
Total Phosphorus April – October November – March	 0.2 mg/L 1.0 mg/L
Total Nitrogen May – October	 8 mg/L
E Coli April – October	 126 cfu/100 mL
Enterococci	73 cfu/100 mL
Total Residual Chlorine	0.24 mg/L
Dissolve Oxygen	5.0 mg/L
Total aluminum	87 ug/L

Design Flows

	Design Condition Wastewater Flows
Wastewater Flow	
Annual Average	1.5 MGD
Maximum Month	2.2 MGD
Peak Day	3.4 MGD
Peak Hourly	5.3 MGD

Uxbridge Existing plant flow

Uxbridge Updated plant flow

Wastewater Process Upgrade Highlights

Main pumping station

The Problem

- Influent Pumps that get clogged with wipes
  - Septage Overflow
  - Domestic Sewer
- Past their useful life (40 years old)

Main pumping station

The Solution

- Influent Pumps with Wipes Passing Capabilities
- Change in Septage Handling

Influent Pumping	
Influent Pump Location:	Main Influent Pumping Station
Pump Type:	Dry-Pit Vertical Centrifugal
No of Units:	4 (3 Duty, 1 Installed Spare
Firm Station Capacity:	4,200 GPM
Pump Flow (Each):	1,400 GPM

Preliminary treatment

The Problem

Comminutor

- Chopped up rather than screened and removed
- Accumulate in Grit Chamber
- Re-balls downstream of screenings

Preliminary treatment

The Solution

- Mechanical Fine Screen (6 mm)
  - 6 MGD Flow
- Flow reversal (Screenings then Grit)

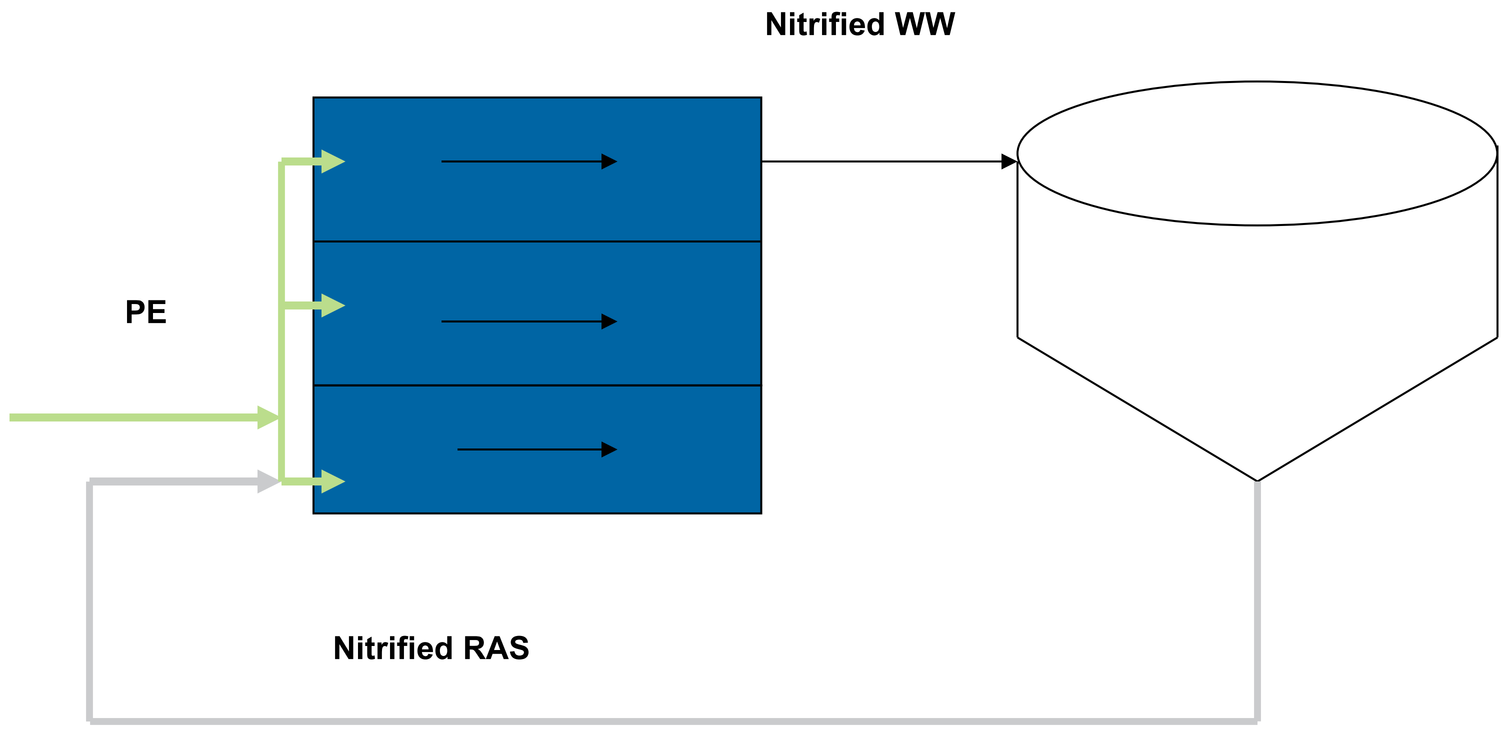
Secondary treatment

The Problem

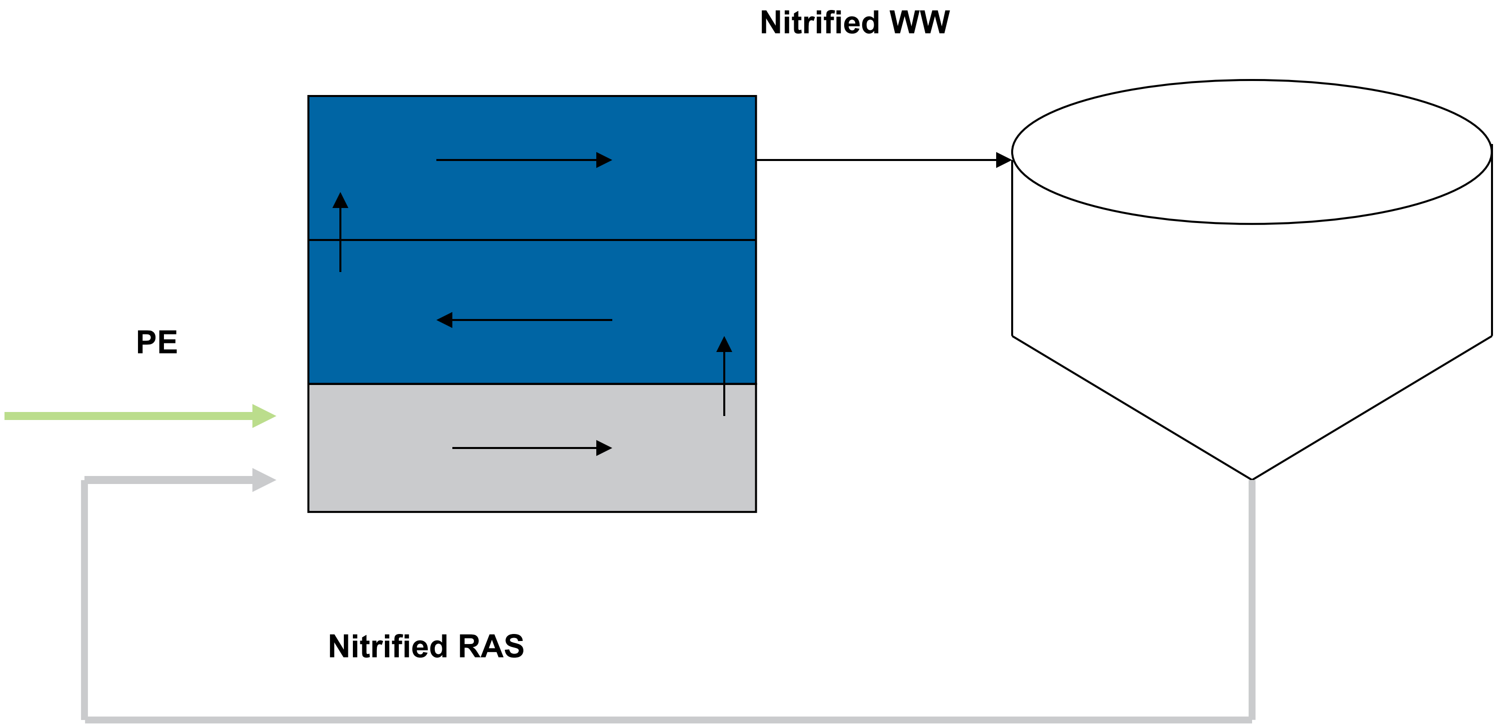
Was not designed for full nitrification, phosphorus removal, ammonia (under design conditions)

- Original Configuration
- Operator Modifications

Original configuration



Original configuration – Operator ingenuity

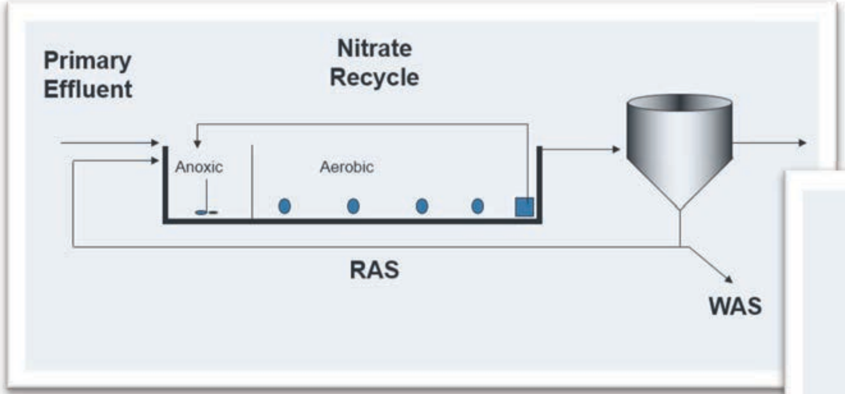


Secondary treatment

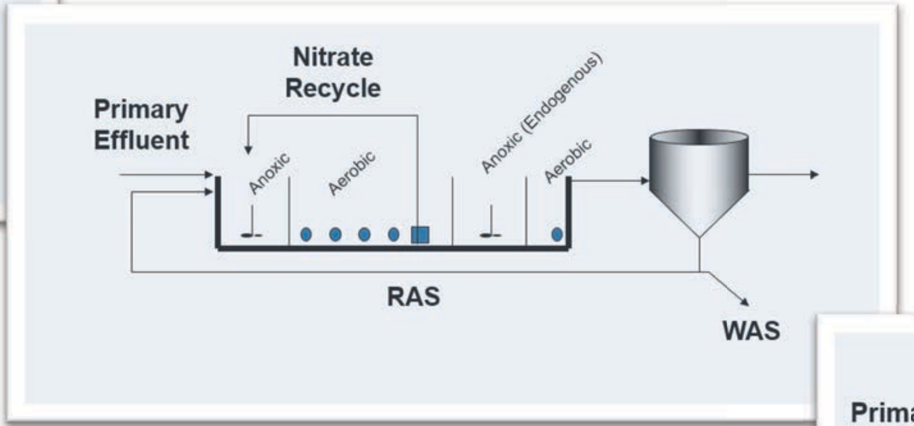
The Solution

- Extended Aeration Basins with multiple trains
- Multiple modes of operation
  – MLE and Bardenpho (also with supplemental carbon addition)
- Ferric OR Aluminium based chemicals

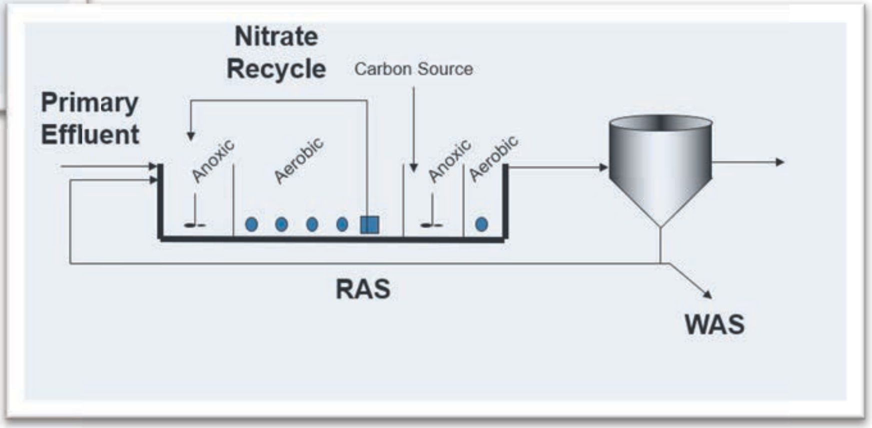
Operation Flexibility



Modified Ludzack-Ettinger (MLE)



Bardenpho



Bardenpho (with carbon addition)

Tertiary treatment

The Problem

- Unable to meet proposed Phosphorus permit levels (under Design Conditions)
  - Phosphorous removal only through chemical addition

Tertiary treatment

The Solution

Add cloth media filters to achieve 0.2 mg/L

- Seasonally
- Year Round to reduce solids and increase transmissivity for UV Disinfection


Disinfection and post aeration

The Problem

- Could not meet proposed permit disinfection limits
- Tank sizes did not allow for sufficient contact time.

Parameter	Concentration Limits	
	Average Monthly	Maximum Daily
Total Residual Chlorine	0.24 mg/L	0.42 mg/L
Escherichia Coli (April 1 to October 31)	126 cfu/100 mL	409 cfu/100 mL
Enterococci	73 cfu/100 mL	236 cfu/100 mL

Disinfection and post aeration

The Solution

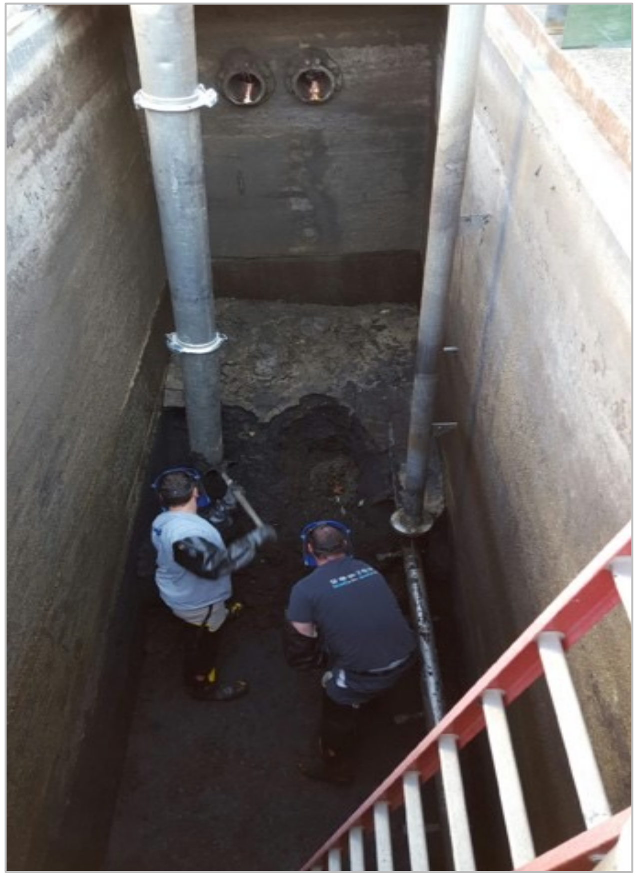
- Upgrade to UV disinfection (vertical orientation) to achieve guaranteed bacteria limits
  - Smaller footprint than for chlorine disinfection
  - Reuse existing Chlorine Contact Basin (for UV and Post Aeration)
  - Capital costs were cheaper (than adding third channel)

Sludge Process Upgrades Highlights

Septage receiving

The Problem

- labor intensive process without fine screening or grit.
- Taxed wastewater processes (addition of grit and screenings from Septage)



Septage receiving

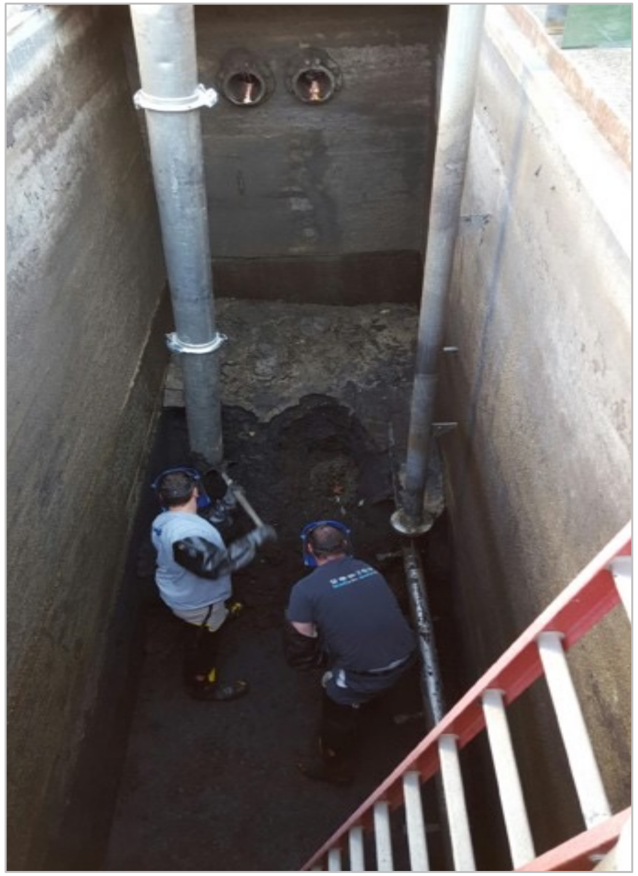
The Solution

- Pre-Engineered screenings, grit collection, and grease removal unit (Huber)
  - Septage discharged into solids stream (or optional liquids)
  - Invoice by discharge volume

Automation highlight – SCADA

The Problem

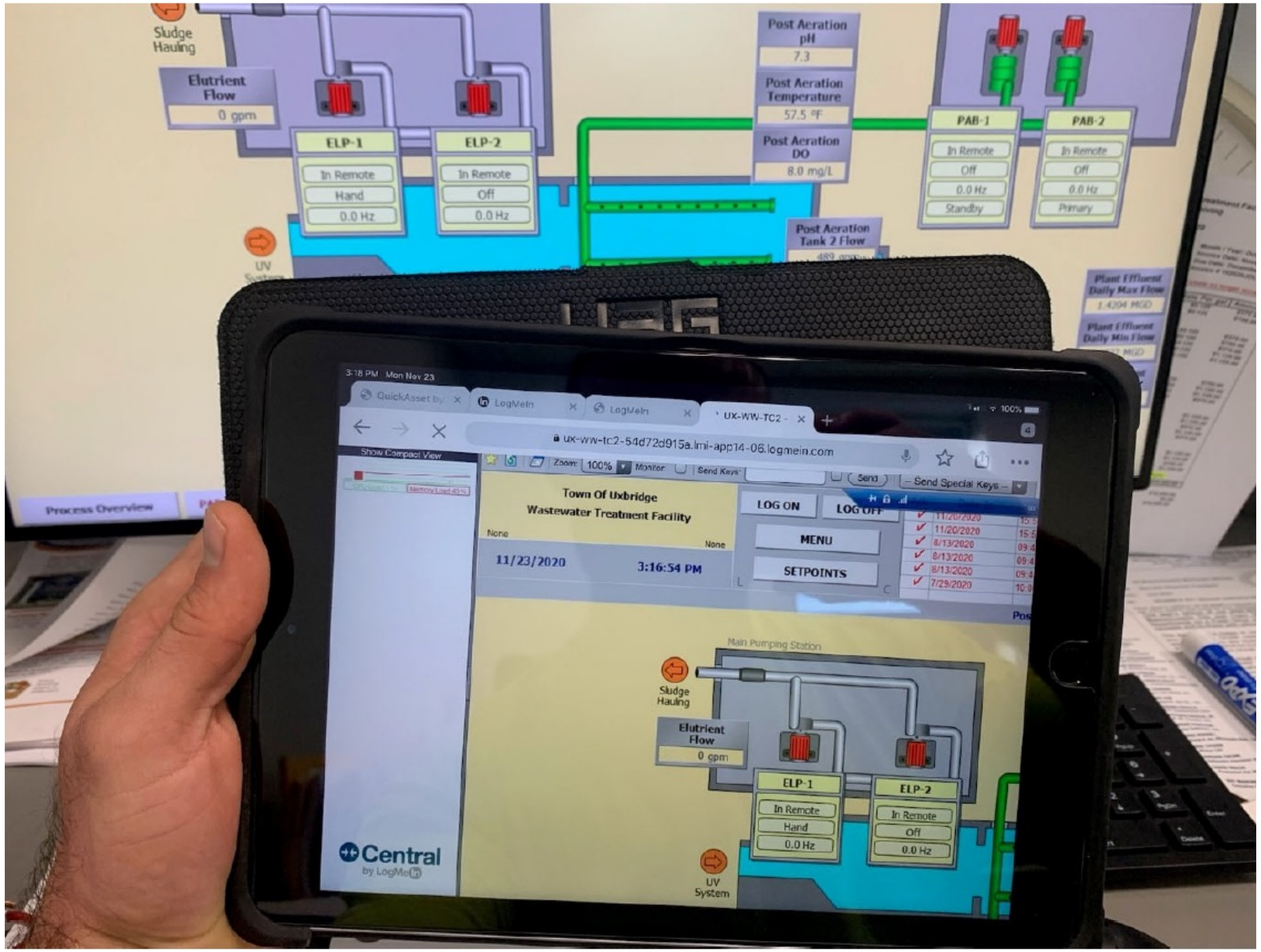
- Minimal Automation
- Manually intensive operation (For all processes and equipment)
  - E.g. aeration



Automation highlight – SCADA

The Solution

- SCADA system that operates or monitors processes and equipment
  - Automation of processes
    - Waste on a schedule, controllable aeration
  - Address problems more rapidly
  - More data available
  - Remote Login



Construction – Keeping the facility in Operation and Meeting Permit

Construction Goals

- Contractor, Operators, and design engineers **worked together** to complete the construction as efficiently as possible for the Contractor while keeping the facility in operation and meeting permit
- All **bypasses were at no cost to the Owner** – these were the Contractor's means and methods as accepted by the Owner.
- <u>**Goal of all parties was to keep plant running and meet permit.**</u>

Temporary facilities



Bypass – Preliminary treatment

Preliminary Treatment Building Construction

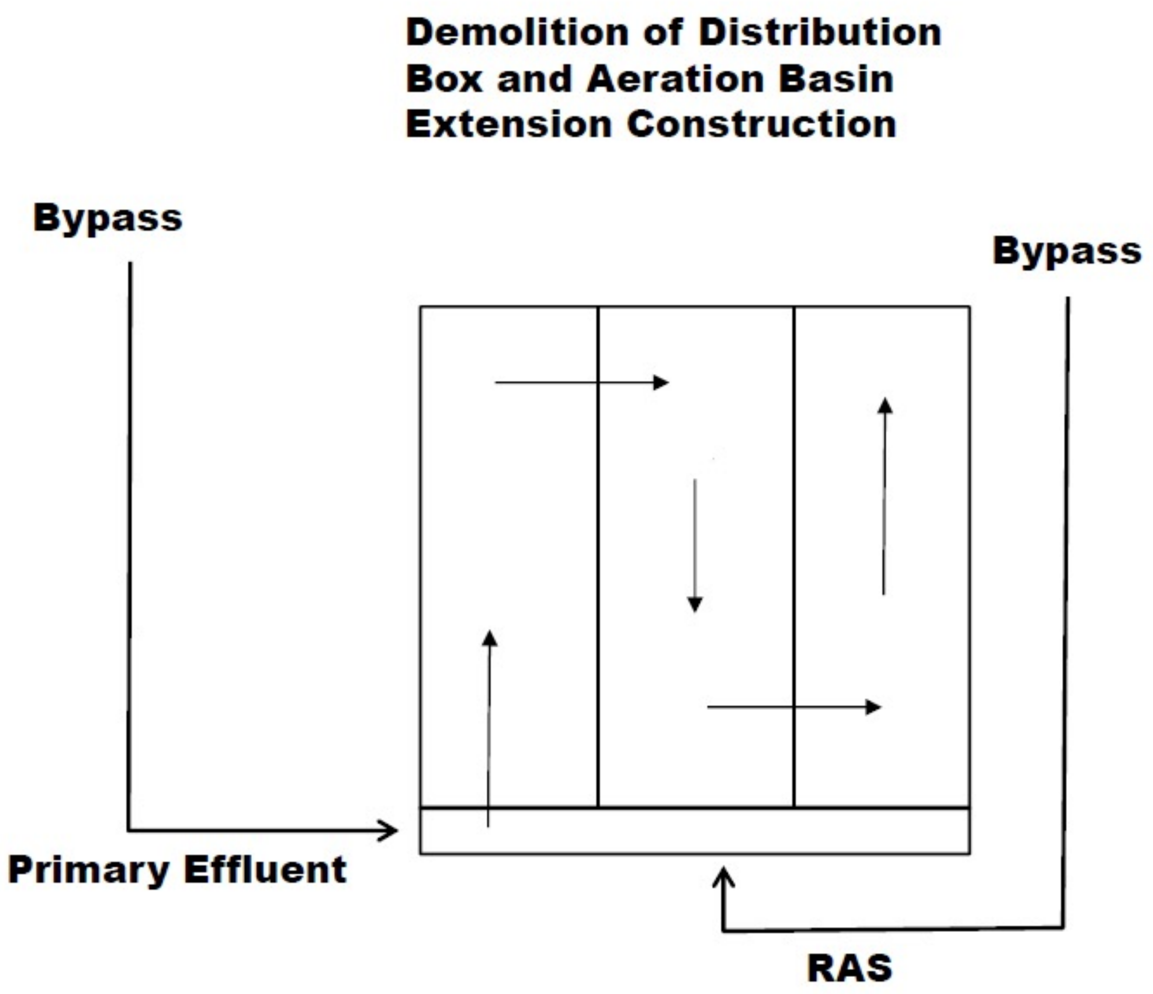
Preliminary Treatment Building Construction

Bypass – Preliminary treatment

Temporary Screenings and Grit Removal

Temporary Preliminary Treatment Bypass Piping

Flow Modification – Aeration Basins



Aeration Basin Extension

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Questions?