Wastewater Treatment Challenges After Attracting a New Industry

Wapakoneta, Ohio

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Presentation Overview

- About Wapakoneta
- Wapakoneta’s New Industry
- Infrastructure Challenges
- Wapakoneta’s WWTP
- WWTP Expansion Needs
- Possible Solutions

Wapakoneta, Ohio

- County Seat of Auglaize County
- Population of approximately 9,800
- Birthplace of Neil Armstrong
- Will host the Summer Moon Festival July 12-21st to celebrate the 50th anniversary of the moon landing

(www.firstonthemoon.org)

New Industry

- Wapakoneta has attracted a new recycled paper mill and box plant, which is expected to provide 300 new jobs paying $22-$25/hr
- The new plant will be located on the south side of Wapakoneta and will depend on the City for water and wastewater services
- On average, the paper mill is expected to use 1 MGD of treated water and discharge 0.85 MGD of high-TDS wastewater to the WWTP

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Infrastructure Challenges

- City will need additional water treatment capacity
- City will need additional wastewater treatment capacity
- Paper mill is projected to discharge approximately 25,000 lb/day of TDS at 3,600 mg/L to the WWTP
- **Wapakoneta feels it is worth tackling these challenges to bring new jobs and economic activity to the City!**

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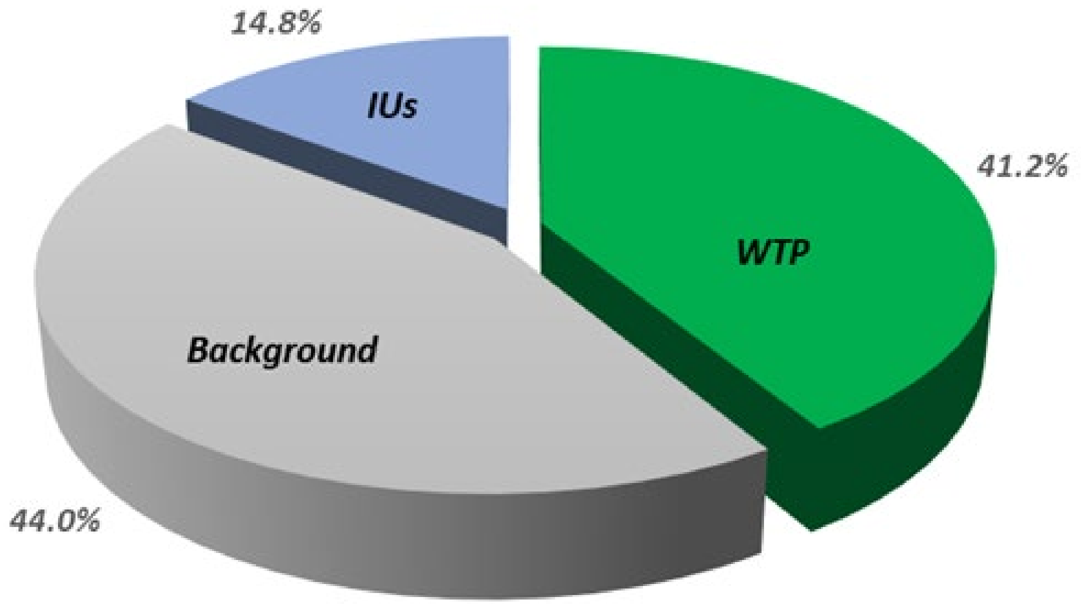
Planned WTP Upgrades

- Phase 1: Filter Expansion to increase capacity from 2.5 MGD to 4 MGD
  - Already under construction and scheduled to be complete before the paper mill begins operations
- Phase 2: New lime softening process and elimination of IX Softening
  - Eliminates regeneration brine discharges to the WWTP from the WTP
  - Reduces background concentrations of TDS

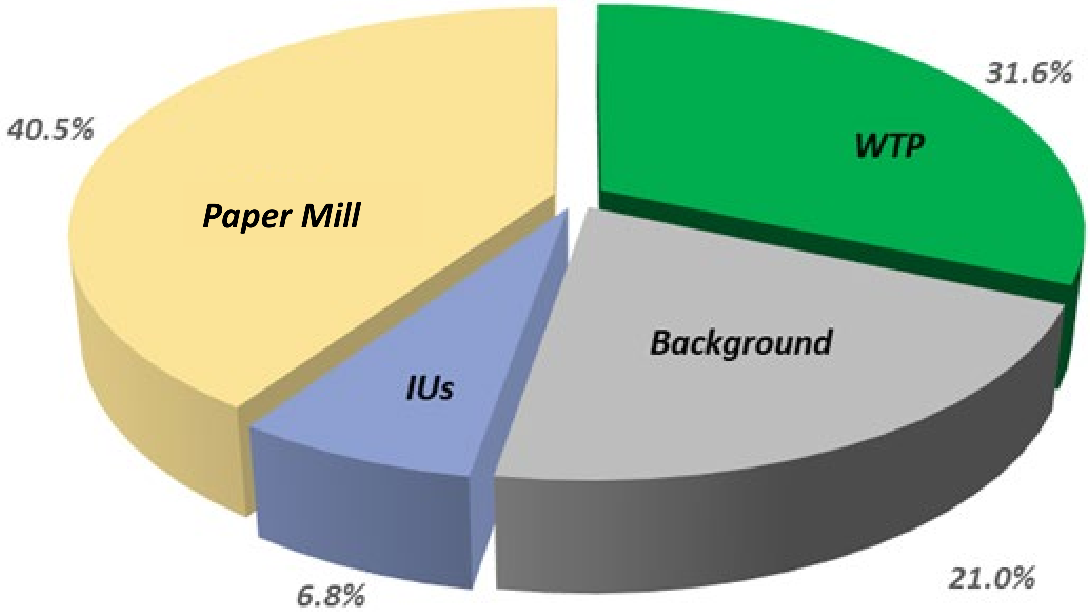
New Industry Impacts on WWTP

- Where does TDS currently come from?



New Industry Impacts on WWTP

- How much TDS is the new industry expected to contribute?



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New Industry Impacts on WWTP

- Wapakoneta has worked with Ohio EPA to prepare for the additional TDS load at the WWTP
  - Wapakoneta submitted a General Plan detailing plans for meeting TDS limits
  - OEPA issued Director's Final Findings and Orders (DFFOs) temporarily granting Wapakoneta's WWTP a higher effluent TDS limit:
    - NPDES Limit: 1,523 mg/l monthly avg.
    - DFFO Limits: 1,907 mg/L monthly avg., 2,429 mg/L daily avg.

Analysis of New Industry Impacts on WWTP

- Multiple future and potential future scenarios evaluated
  - New paper mill online and IX softening at the WTP
  - New paper mill online and lime softening at the WTP
  - Additional potential future scenarios to evaluate the impacts of other potential infrastructure changes

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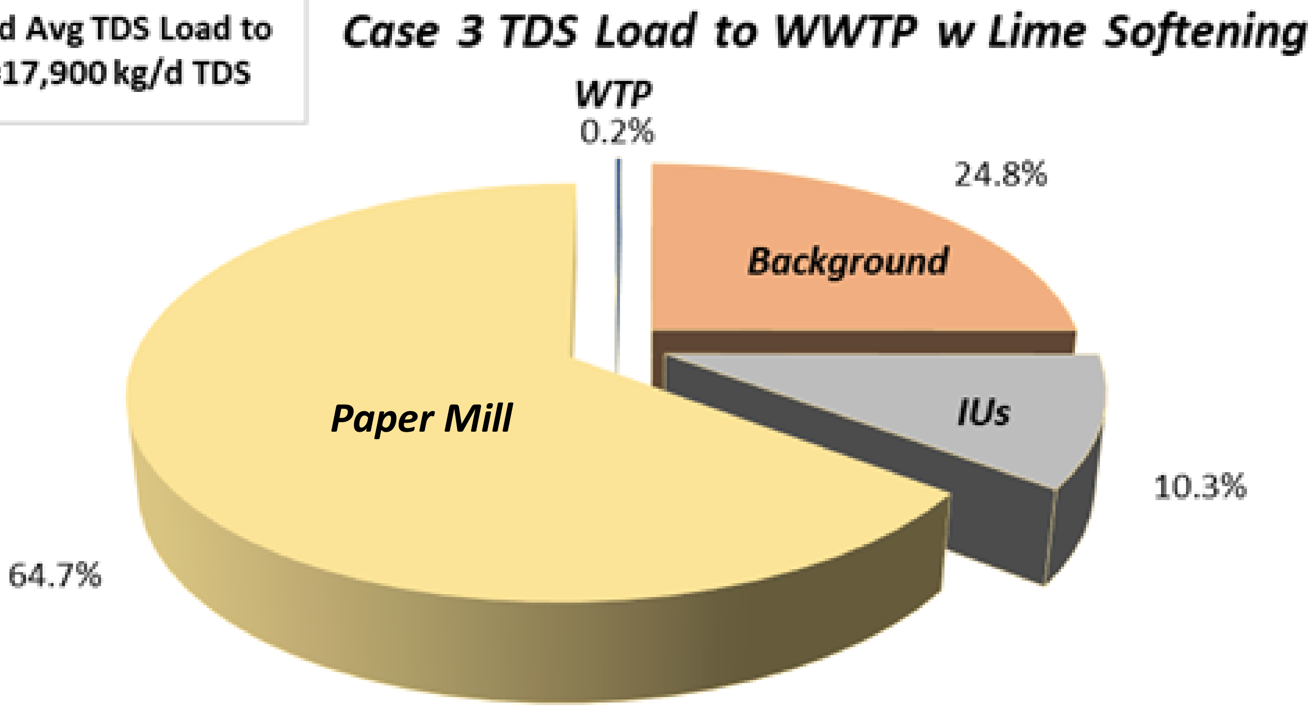
Analysis of New Industry Impacts on WWTP

- Mass balance approach:
  - Projected future flows and loads from various existing and future sources, including the new industry
  - Projected values are based on averages, don't capture the range of variability
- Historical data adjustment approach
  - Looked at historical data from January 2014 to March 2018
  - Adjusted historical flows and TDS loads based on changes expected for each scenario

Example of Average TDS Projections

Projected Avg TDS Load to WWTP =17,900 kg/d TDS



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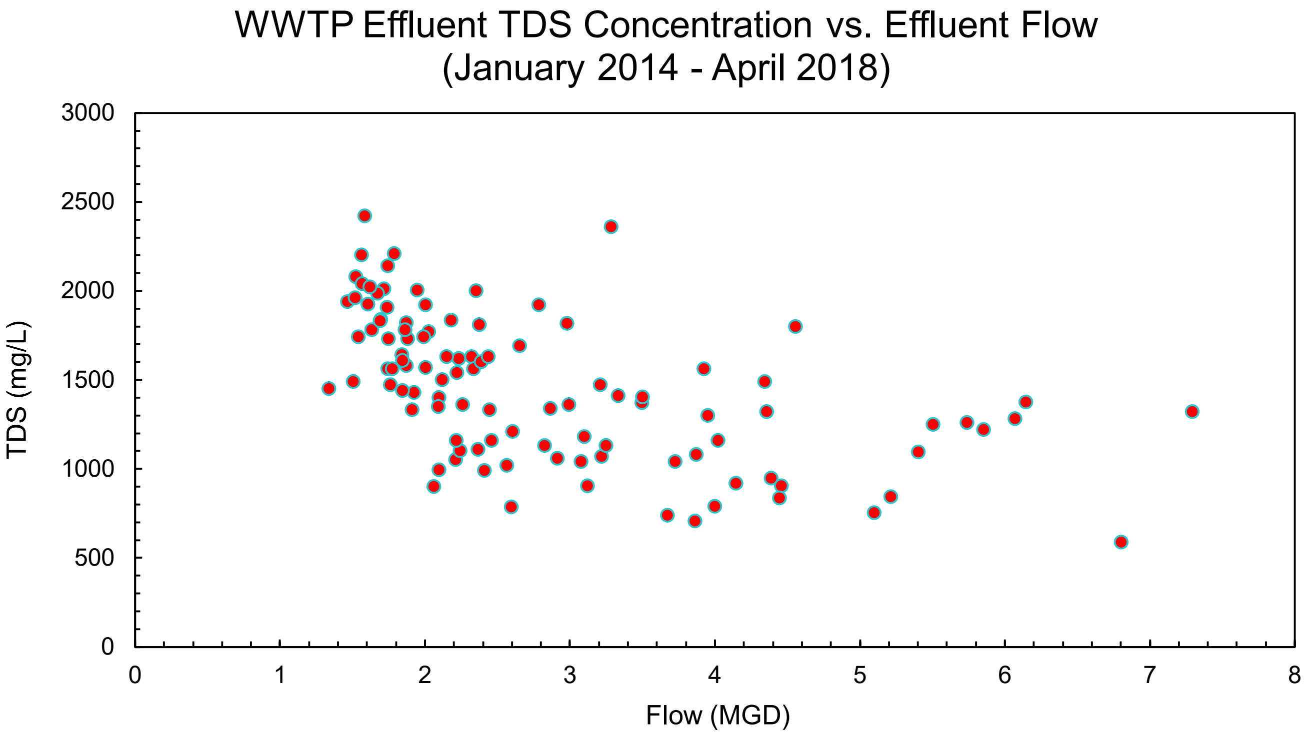
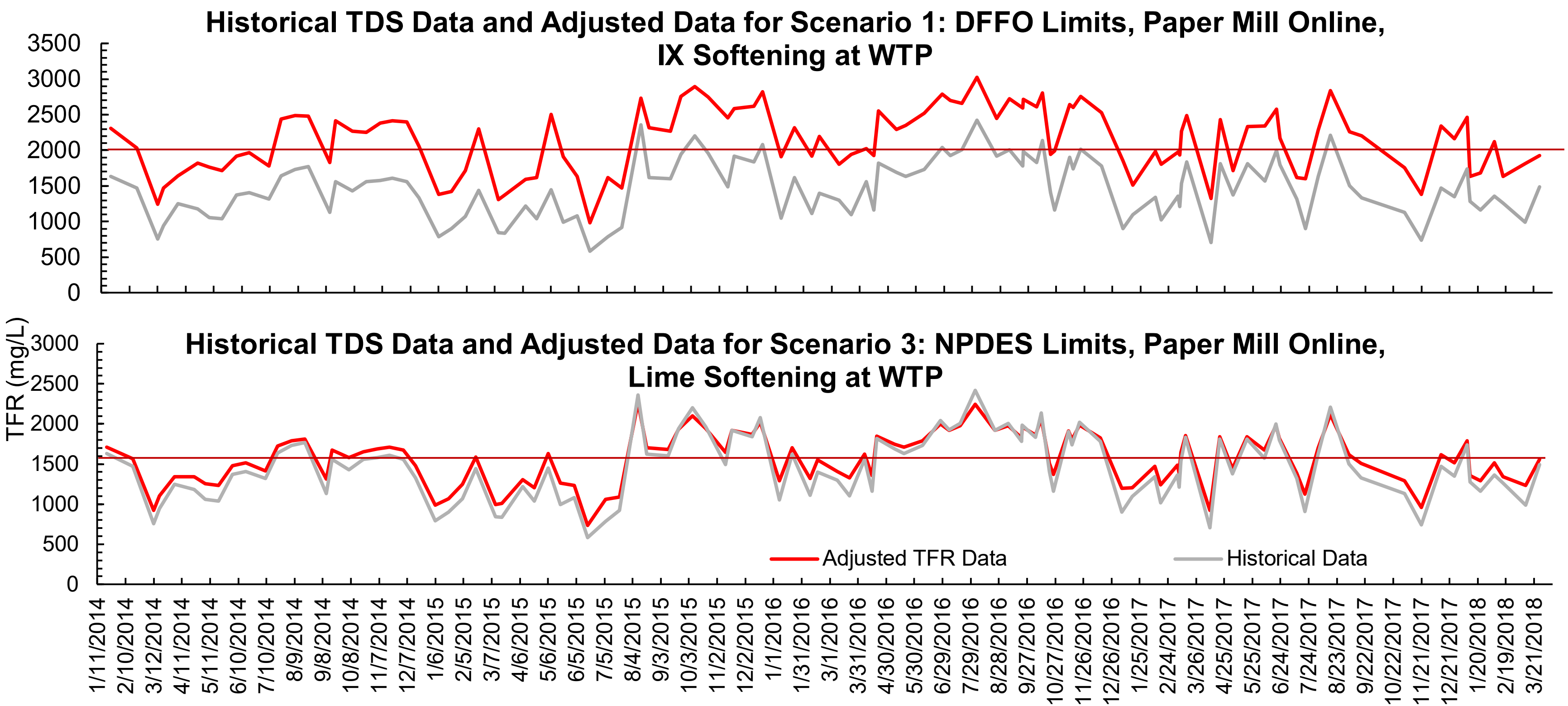
Historical Effluent Flow and TDS Concentration

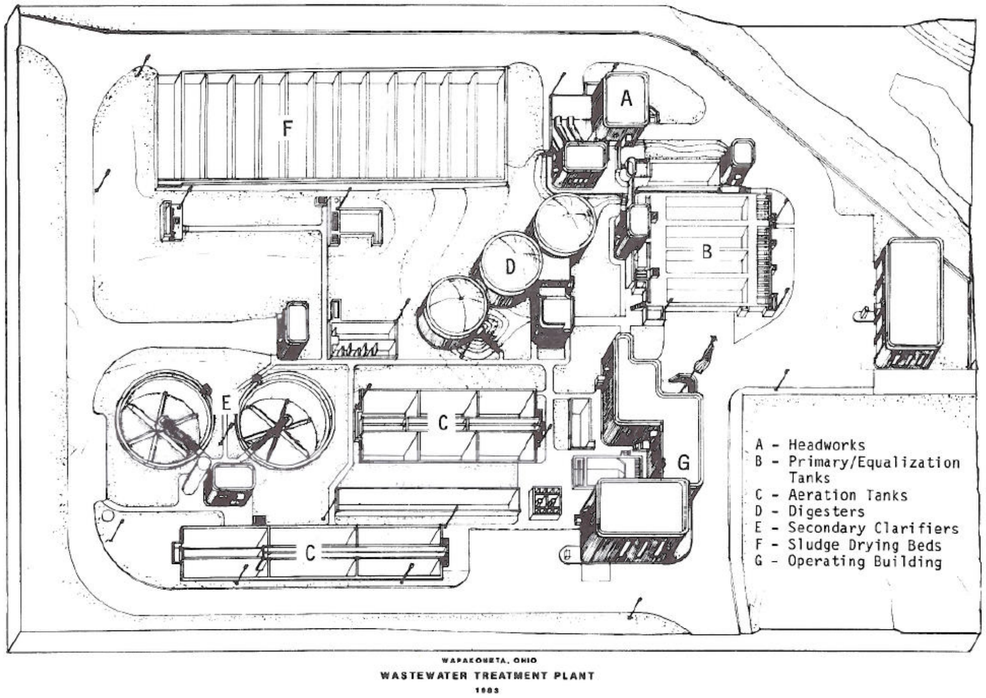


Examples of Adjusted Historical TDS Data



Wapkoneta's WWTP - History

- Originally constructed in 1937
- Expansions in 1957, 1970, 1983, 2001, and 2004
- Most of the current plant's facilities date from the 1983 (right) and 2004 expansions



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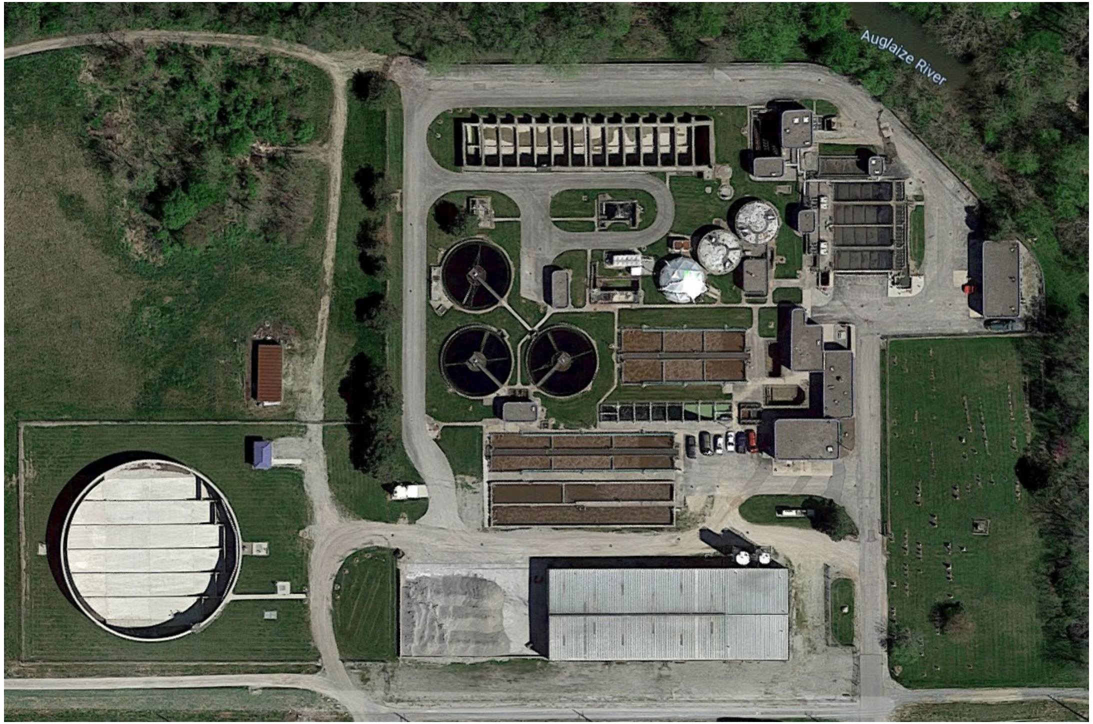
Wapkoneta's WWTP - Capacity

- 4 MGD design average daily flow (ADF)
- Current annual ADF is 2.7 MGD, maximum month ADF is 4.3 MGD
- 6 MGD peak hourly flow (PHF), limited by influent pumping capacity and open-channel hydraulics across the plant



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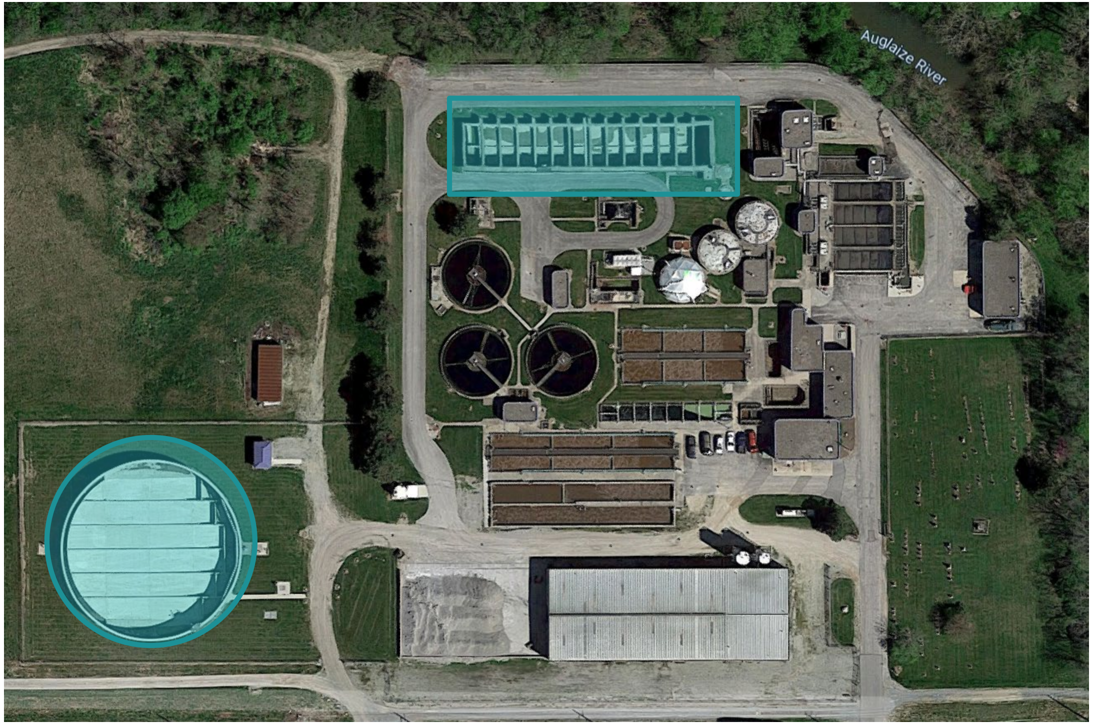
Wapkoneta's WWTP – Existing Facilities

- Wet weather facilities:
  - 25 MGD Stormwater Pump Station→2.5 MG Wet Weather Storage Tank (drains back to collection system)
  - Equalization Pump Station→1.3 MG Equalization Tank (Overflows to UV Disinfection, can be drained back to the headworks)



Wapkoneta's WWTP – Existing Facilities

- Headworks: Flow Regulator →Mechanical Bar Screens→Screw Pumps→Comminutors
- Aerated Grit Removal
- 4 Rectangular Primary Clarifiers

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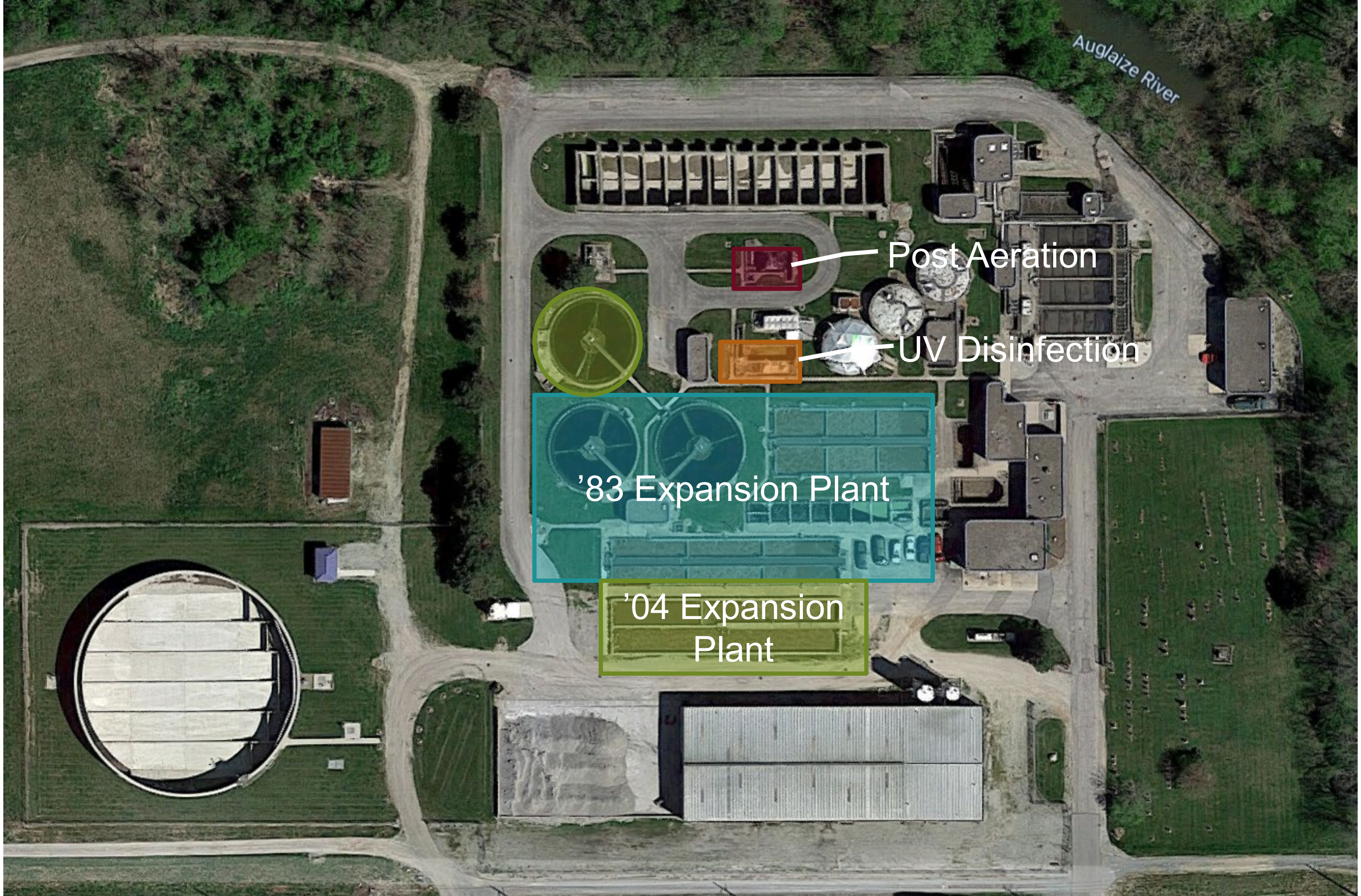
Wapkoneta's WWTP – Existing Facilities (Cont'd)

Two activated sludge treatment trains:

- '83 Plant: 4 aeration basins and 2 circular secondary clarifiers
  - Aeration basins have anoxic/anaerobic zone with mixing
  - Not effective for biological P removal, supplement with ferrous chloride for chemical P removal
  - WAS is sent to the primary clarifiers
- '04 Plant: 1 aeration basin and 1 circular secondary clarifier
  - Anaerobic zone with mixing for biological P removal
  - WAS is sent to the '83 Plant (and ultimately disposed through the primary clarifiers
- Secondary treatment is followed by Post Aeration and UV Disinfection before discharge into the Auglaize River


Auglaize River
Post Aeration
UV Disinfection
'83 Expansion Plant
'04 Expansion Plant

Wapkoneta's WWTP – Existing Facilities (Cont'd)

Sludge Handling Facilities:

- Sludge is initially stored in an aerated storage tank
- Dewatered with a belt filter press
- Alkaline stabilization process (N-Viro) using lime and kiln dust produces Class A biosolids
- While many WWTPs have a hard time getting rid of their biosolids, Wapakoneta is able to sell theirs as a soil amendment!

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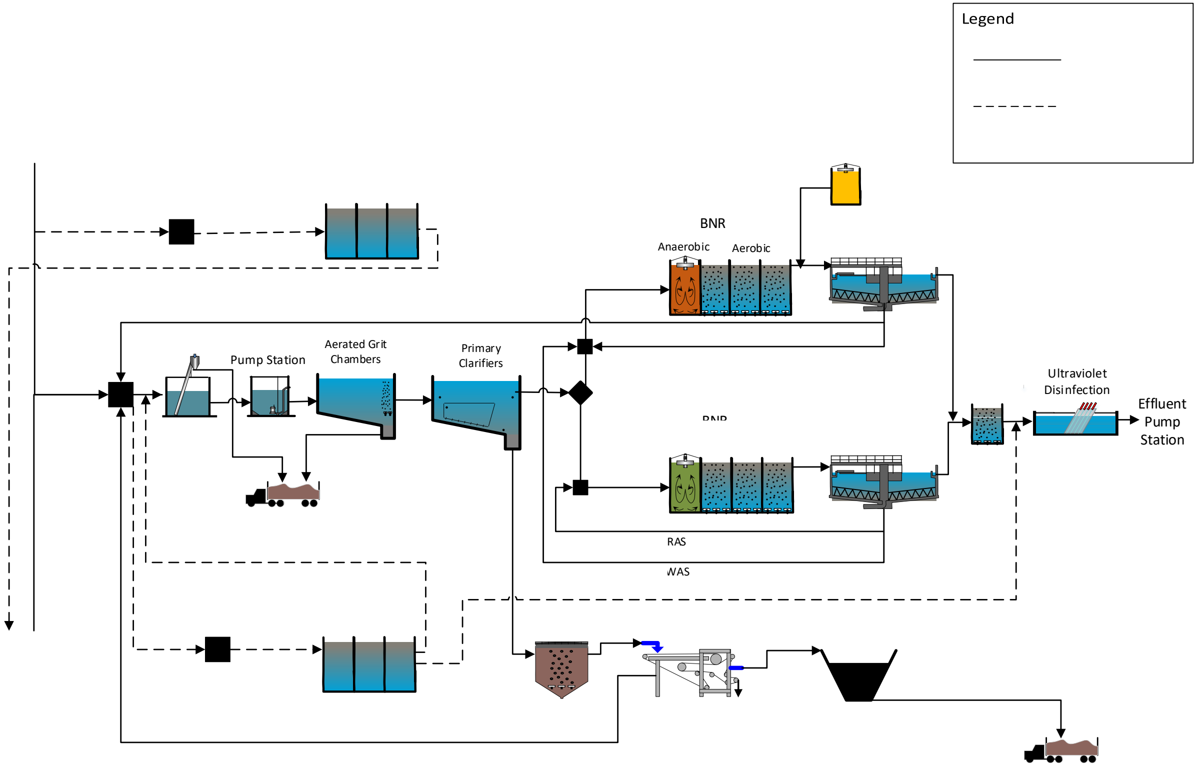
Wapakoneta's WWTP



Existing WWTP Facilities - Maintenance Needs

- Equipment Replacements:
  - Flow Regulator
  - Mechanical Bar Screens
  - Grit Tank Equipment
  - Slide Gates
  - Diffuser Membranes
  - Sludge Pumps
  - Anaerobic/Anoxic Zone Mixers
  - UV Disinfection
  - Alkaline Stabilization Mixer
  - Numerous other instruments, controls, and small pumps and motors

WWTP Expansion and Upgrade Needs

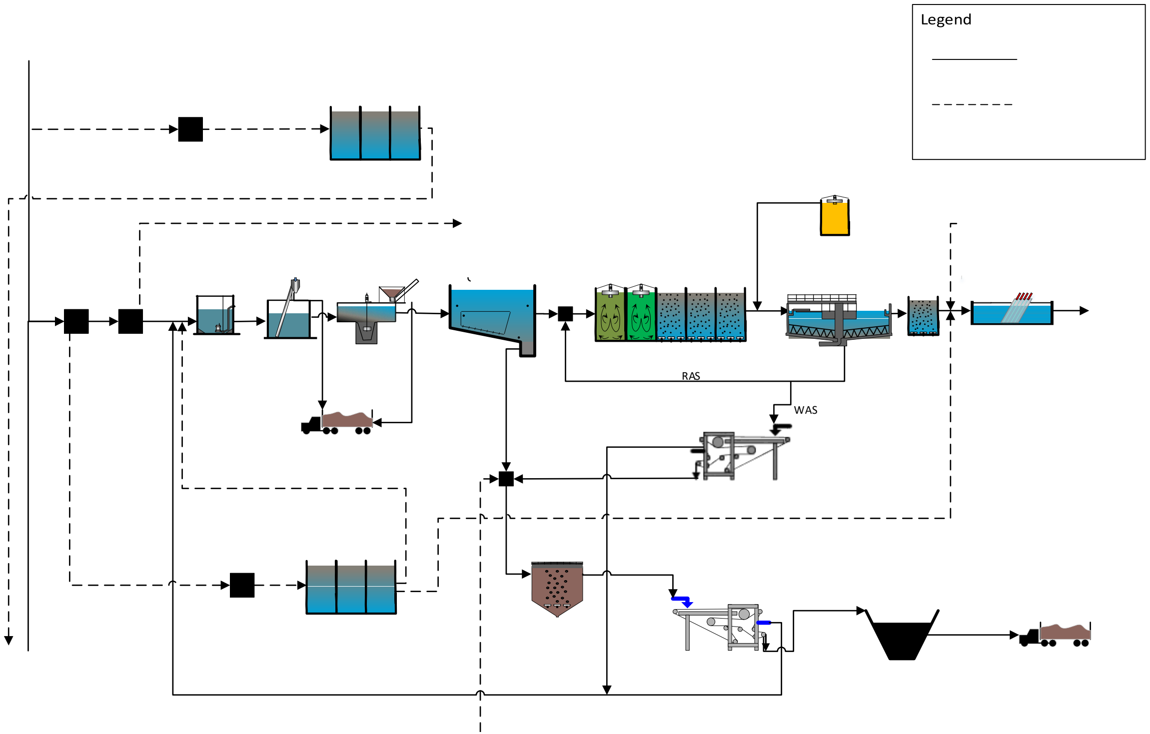
- Add additional wet-weather equalization capacity
  - One additional 2.5 MG Wet Weather Storage Tank
- Expand rated treatment capacity
  - 6 MGD ADF
  - 12 MGD PHF
- Expand solids-handling facilities
  - Additional belt filter press
  - Larger mixer for alkaline stabilization process
  - Additional cake storage

WWTP – Initial Upgrade Alternatives

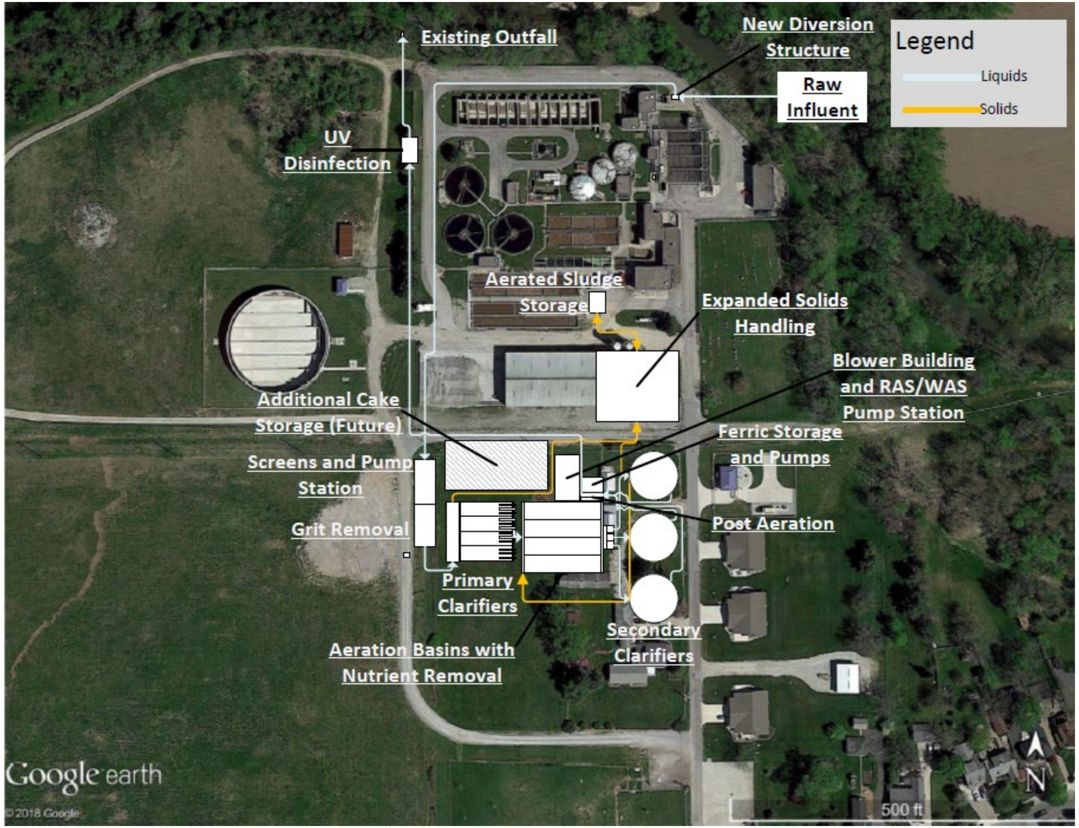
- **Alternative 1**: Build a new plant adjacent to the existing plant with an average design flow of 4 MGD and peak flow of 6 MGD. Sustained flows in excess of 4 MGD (~2 MGD design average) are diverted to the old plant.
- **Alternative 2**: Build a parallel treatment train adjacent to the existing plant and split the influent between both the existing plant and the new treatment train. The new treatment train will have an average design flow of 2 MGD and a peak flow of 6 MGD.
- **Alternative 3**: Build a new plant adjacent to the existing plant with an average design flow of 6 MGD and a peak flow of 12 MGD. The existing plant would be decommissioned.

Alternative 1 - Process Flow Diagram

- Average design flow of 4 MGD and peak flow of 6 MGD
- Sustained flows in excess of 4 MGD (~2 MGD design average) are diverted to the old plant.



Alternative 1 - Conceptual Site Layout



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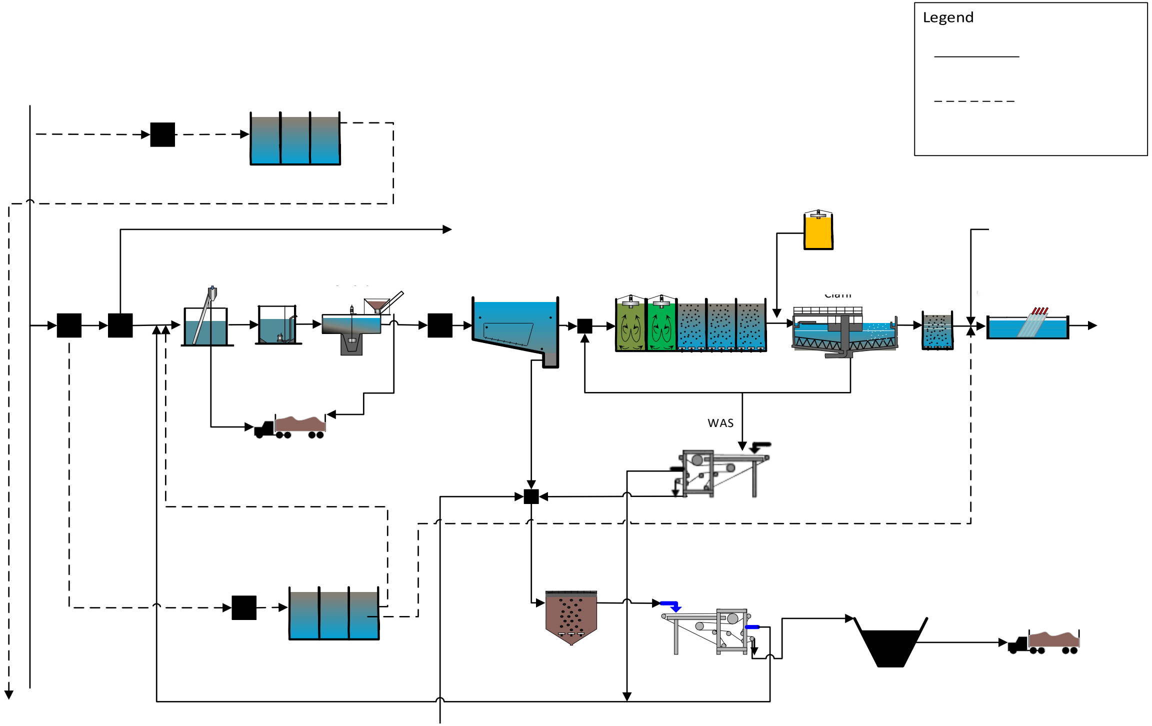
Alternative 2 – Process Flow Diagram

- New parallel treatment train with an average design flow of 2 MGD and a peak flow of 6 MGD
- Influent split between new and old facilities, with both operating on a daily basis



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Alternative 2 – Conceptual Site Layout

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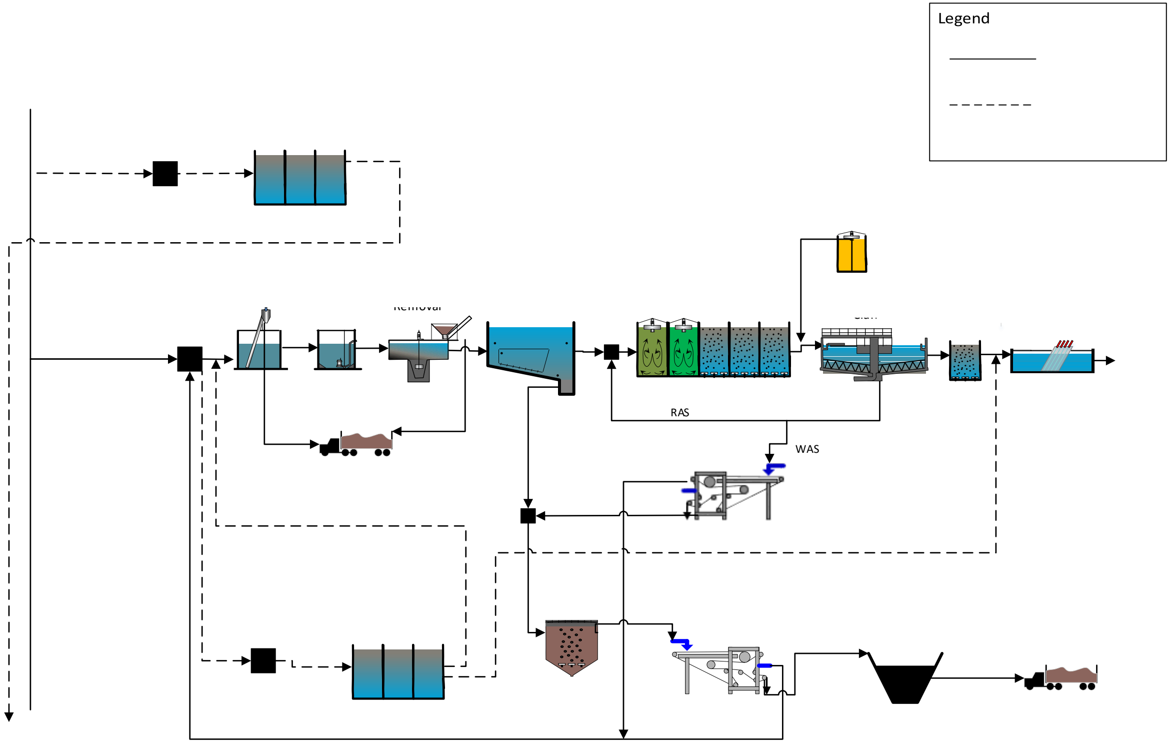
Alternative 3 – Process Flow Diagram

- New plant with an average design flow of 6 MGD and a peak flow of 12 MGD.
- Existing plant would be decommissioned Except for wet weather facilities and solids handling facilities, which would be expanded



Alternative 3 – Conceptual Site Layout

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Alternative 4 – New Industrial Park WWTP

- Existing WWTP would not be expanded
  - Still need equipment replacements and expanded solids handling, plus 2 new 2.5 MG Wet Weather Storage Tanks
- New 1.5 MGD WWTP to serve Wapakoneta's Industrial Park
- Discharge to Pusheta Creek, a tributary that joins the Auglaize River downstream from the outfall of the City's existing WWTP
- Redirecting the discharges from industrial users, including the new paper mill, would enable the existing WWTP to consistently meet TDS limits

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Industrial Park WWTP Feasibility

- Industrial Wastewater can be challenging to treat
- There are few feasible options for TDS reduction
- Industrial Park Wastewater Characterization:

Source	Avg. Flow (gpd)	COD (mg/L)	BOD5 (mg/L)	TFR (mg/L)	P (mg/L)	NH3-N (mg/L)	TSS
Paper Mill	850,000	400	200	3600	10	25	250
Metal Finishing 1	2,000			2000			
Metal Finishing 2	1,000			1700			
Textile Services	91,000	2909	1277	1879	2.99		384
Greenhouse	30,000	258	129	6500	128	4.42	
Total	**974,000**						
Weighted Average		**629**	**298**	**3523**	**13**	**22**	**254**

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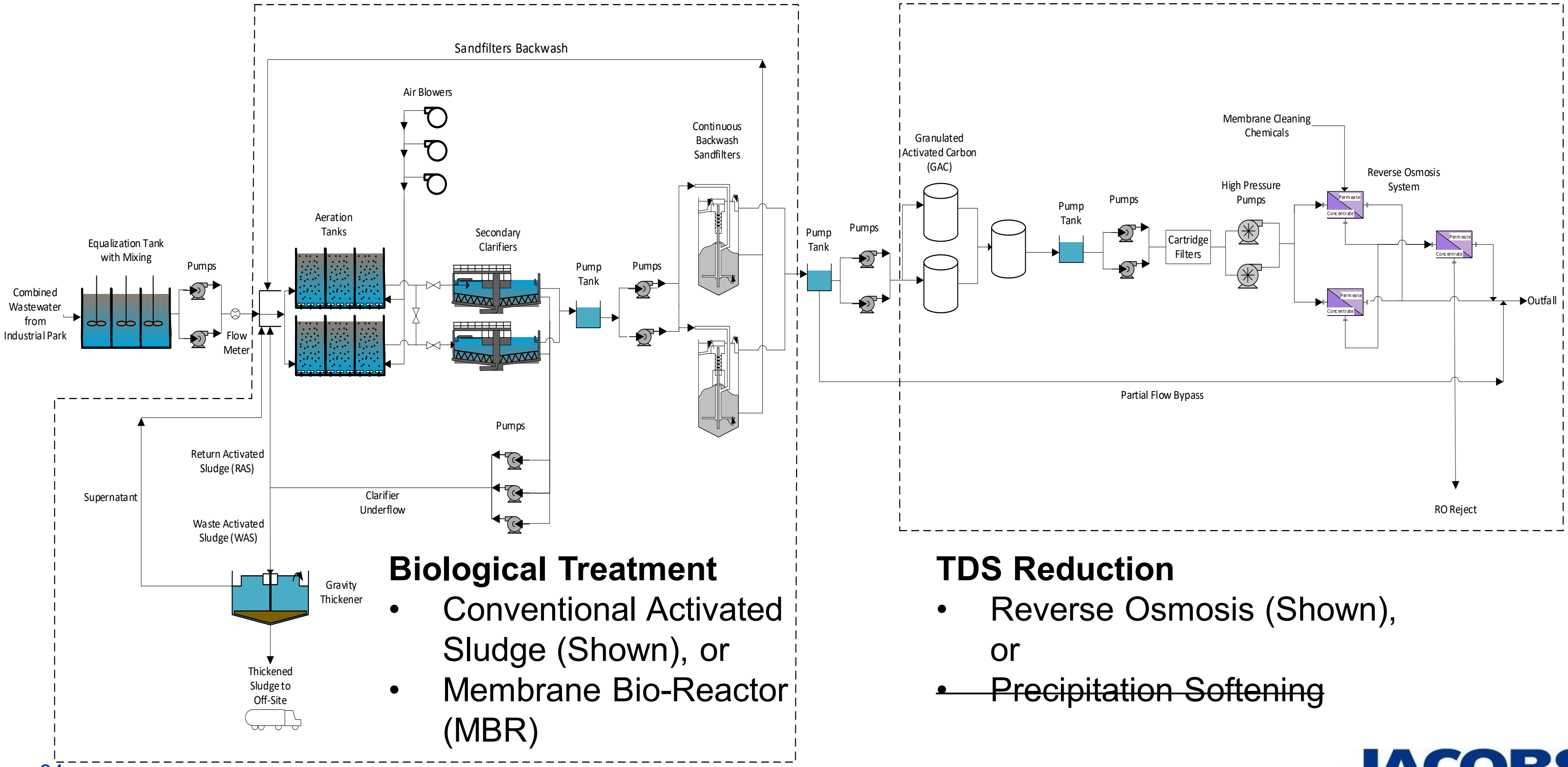
Industrial Park WWTP – Treatment Overview



Biological Treatment

- Conventional Activated Sludge (Shown), or
- Membrane Bio-Reactor (MBR)

TDS Reduction

- Reverse Osmosis (Shown), or
- ~~Precipitation Softening~~

Industrial Park WWTP – Challenges and Drawbacks

- Additional data and analysis needed to verify metals and other inhibitory substances not present at levels that would inhibit biological treatment
- Concerns about increasing the flow in Pusheta Creek
- WLA for Pusheta Creek is already allocated to an existing industrial discharger, OEPA indicated TDS limit could be <1,500 mg/L
- Technologies capable of reducing TDS to meet effluent limits produce a concentrated residual that must be disposed of

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Industrial Park WWTP – RO and Concentrate Disposal

- RO systems typically have high capital and operating costs.
- Approximately 45,000 to 110,000 gpd of brine would be generated (Depending on final TDS limits, RO System Design, etc.)
- Disposal of concentrated RO “reject” is difficult and expensive. Options include:
  - Further Concentration using brine concentrator/ evaporator and crystallizer
  - Disposal in a Class I deep injection well (UIC well)
    - Currently only 10 active Class I UIC wells in Ohio, and of those only 4 are owned by a commercial waste disposal company that accepts wastewater from outside sources
    - Extensive siting, permitting, and construction requirements
    - Typically between 1,700 and 10,000 ft deep (OEPA, https://www.epa.ohio.gov/ddagw/uic#114042765-class-i-wells)
- The City ultimately decided to eliminate this alternative

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Alternatives Analysis - Process Modeling

- Process modeling was carried out for the new facilities proposed in Alternatives 1-3 using Jacobs's proprietary Pro2D^2 (Professional Process Design & Dynamics) whole-plant wastewater treatment simulation software
  - Determine unit sizing
  - Evaluate process performance, residuals production, etc.
  - Can output directly to cost estimating software

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Alternatives Analysis - Cost Estimating

- Jacobs's proprietary CPES (Conceptual and Parametric Engineering System) cost estimating software
  - Outputs from process modeling and additional user inputs
  - Parametric engineering algorithms with quantity take-offs and a material unit-cost approach
  - Generate Class 4 Estimate (-30% to +50%) including capital and O&M costs

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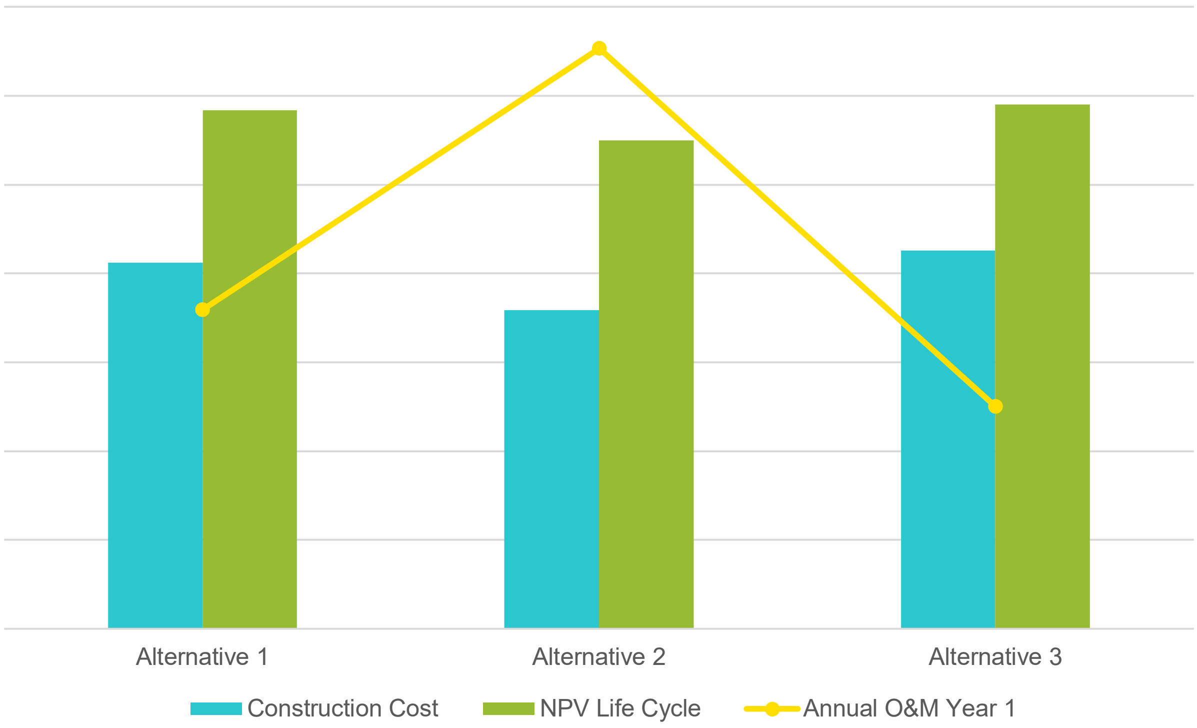
Alternatives Analysis – Cost Estimating



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What about TDS?

- Alternatives 1-3 address WWTP expansion needs, but not TDS
- Wapakoneta is currently investigating options for flow augmentation and flow-based TDS limits
  - Groundwater treated to remove iron mixed with WWTP effluent to dilute TDS
  - Higher TDS limits when river flow is higher

Questions?

Thank you!

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