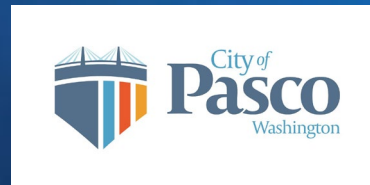


Prioritization Matters

How Aging Infrastructure, Treatment Needs, and Site Layout Inform the Butterfield WTP's Expansion

Joe West, Brandon Dunagan



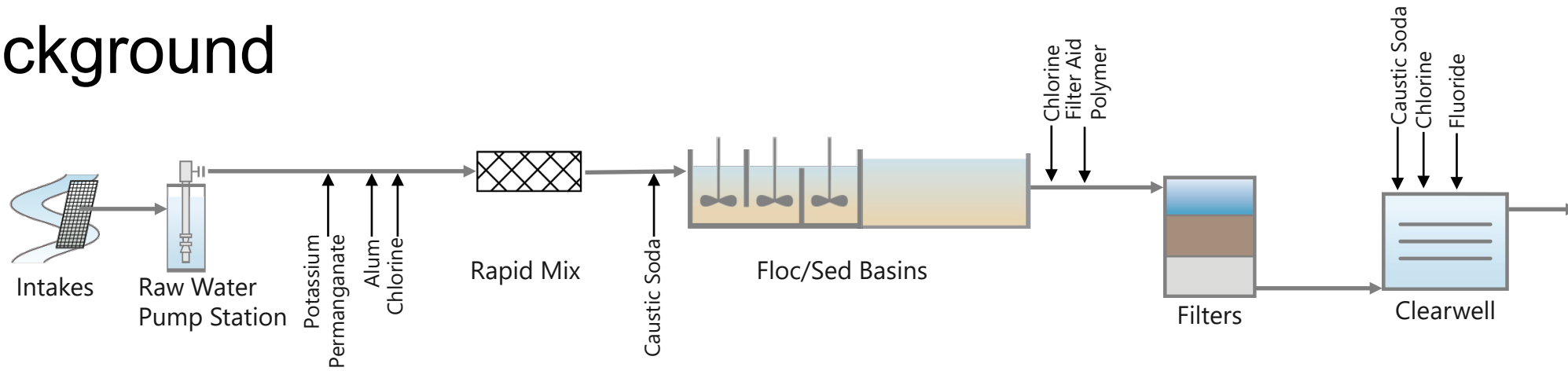
Agenda

- **Background and Goals**
- **Assessment Efforts**
- **Alternatives Analysis**
- **Phasing of the Selected Alternative**



Background and Goals

Background



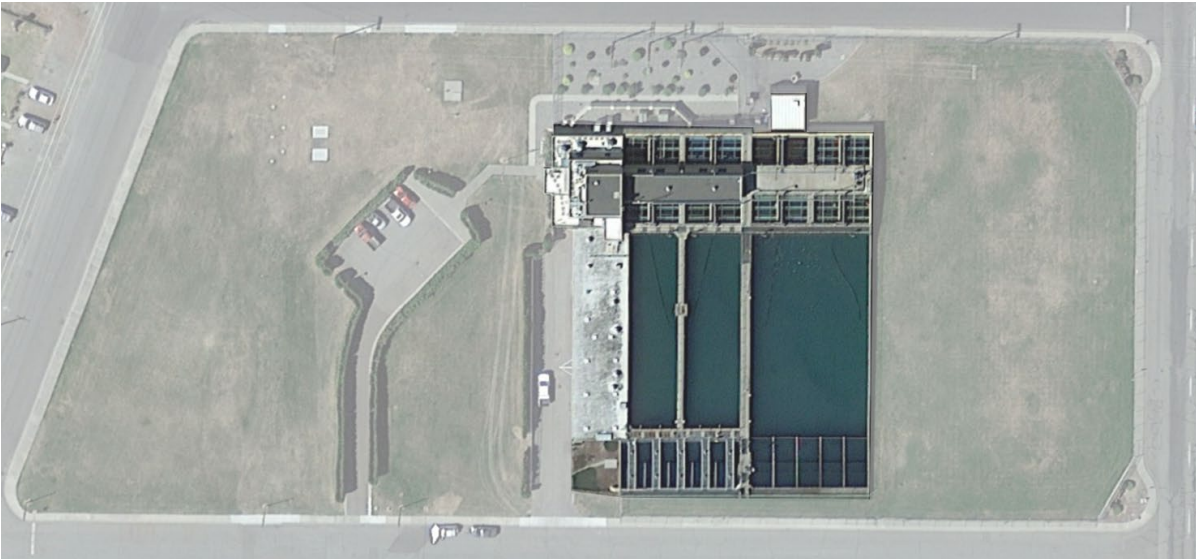
- Water system:
 - **Butterfield WTP (~30 mgd)**
 - West Pasco WTP
- Water source: Columbia River
- Originally constructed 1946, expanded in 1958



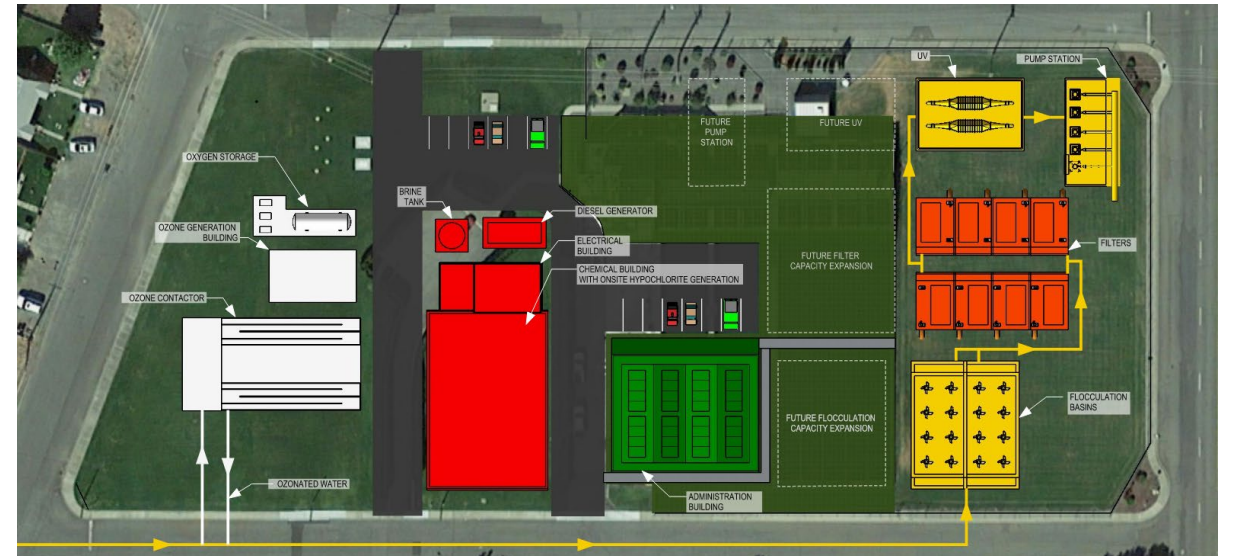
Goals of the Facility Plan

- Evaluate WTP
- Identify potential deficiencies
- Develop capital improvements plan

Existing Facility

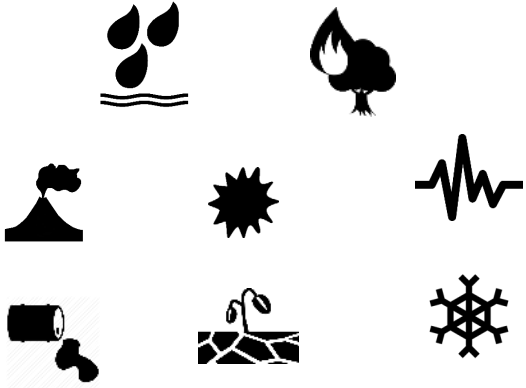


Selected Alternative



Assessment Efforts

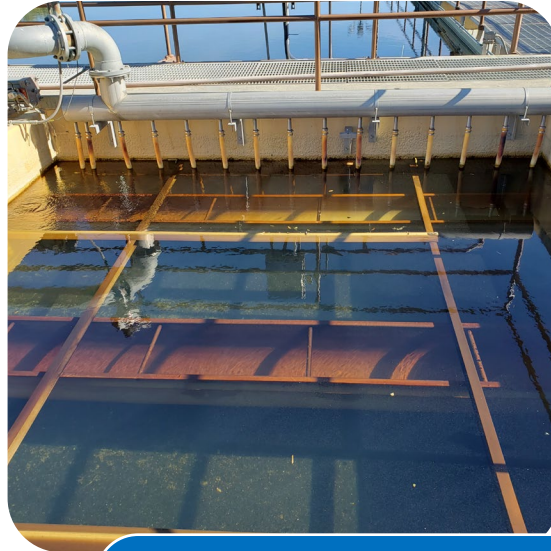
Assessing the Existing Treatment Plant



WTP Performance Requirements

- Reviewed quality data
- Identified water quality hazards
- **Established LOS goals**

Assessing the Existing Treatment Plant



WTP Performance Requirements

- Reviewed quality data
- Identified water quality hazards
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Process Assessment

- Process Evaluation
- Hydraulic Evaluation

Assessing the Existing Treatment Plant



WTP Performance Requirements

- Reviewed quality data
- Identified water quality hazards
- **Established LOS goals**

Process Assessment

- Hydraulic Evaluation
- Process Evaluation

Infrastructure Assessment

- Mechanical
- Electrical
- Instrumentation
- Structural

Infrastructure Assessment → Criticality Assessment

Likelihood of Failure	High:	<u>Long Term Repl./Rehab</u>	<u>Mid Term Repl./Rehab</u> <ul style="list-style-type: none"> Raw Water PS Reliability Improvements Valve actuator replacement Flocculation and Sedimentation Basin Improvements 	<u>Short Term Action</u> <ul style="list-style-type: none"> Major WTP Electrical System Upgrade Chemical Systems Improvements Backwash system improvements Raw Water Pump Station Standby Power Air Compressor Replacement
	Medium:	<u>Long Term Rehab</u> <ul style="list-style-type: none"> Raw Water and Backwash Lift Station Security Improvements 	<u>Mid Term Rehab</u> <ul style="list-style-type: none"> General Structural Repairs Major WTP Instrumentation System Upgrade Finished Water Pump Station Improvements Residuals Improvements (Phase 2) 	<u>Mid Term Rehab and Frequent Monitoring</u> <ul style="list-style-type: none"> Residuals Improvements (Phase 1) Backwash Lift Station Redundancy Improvements Passive Underdrain Over-pressurization Protection
	Low:	<u>Infrequent Monitoring</u> <ul style="list-style-type: none"> Minor Instrumentation and Controls Improvements WTP Building Repairs 	<u>Regular Monitoring</u> <ul style="list-style-type: none"> Painting, Coating, and Corrosion Control 	<u>Frequent Monitoring / Evaluation</u> <ul style="list-style-type: none"> Seismic and Life Safety Improvements
		Low:	Medium:	High:
		Consequence of Failure		

Aging Infrastructure on a Compact Site

How do you implement improvements?

- Rehabilitate
 - Core is over 60 years old
 - Several groups are near or beyond their useful life
- Construct new
- **Incrementally replace**



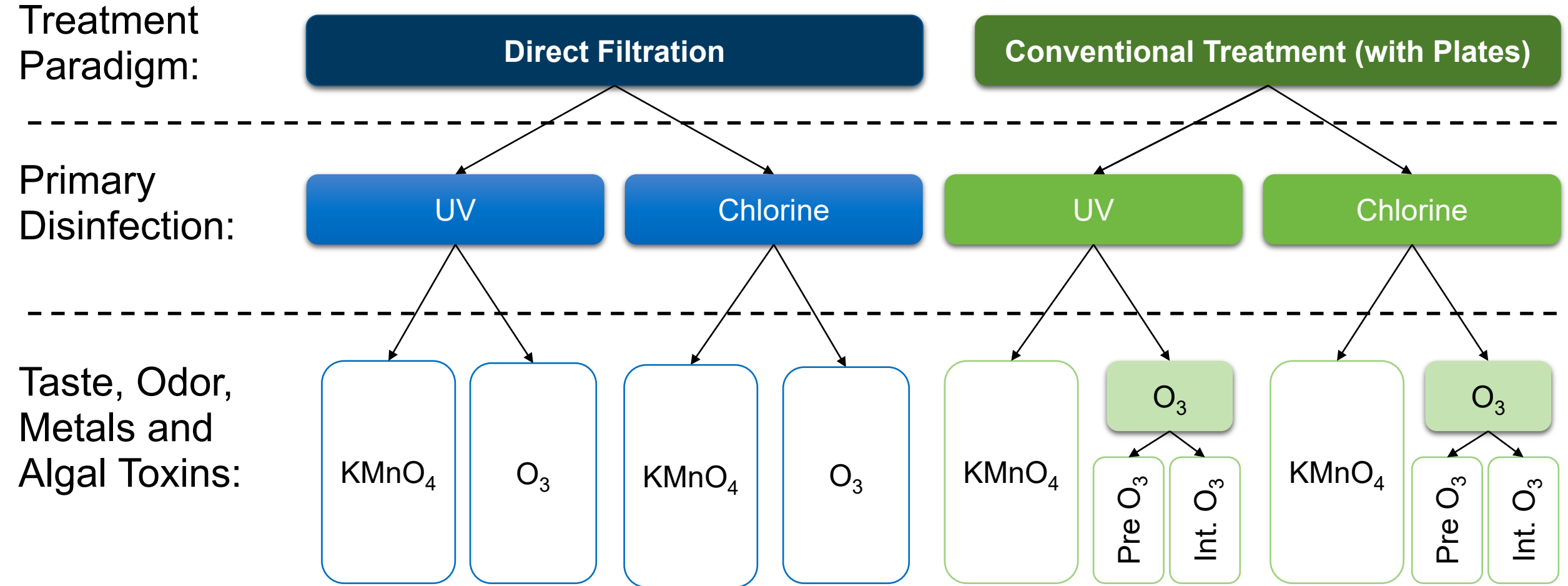
Alternatives Analysis

Alternatives Analysis

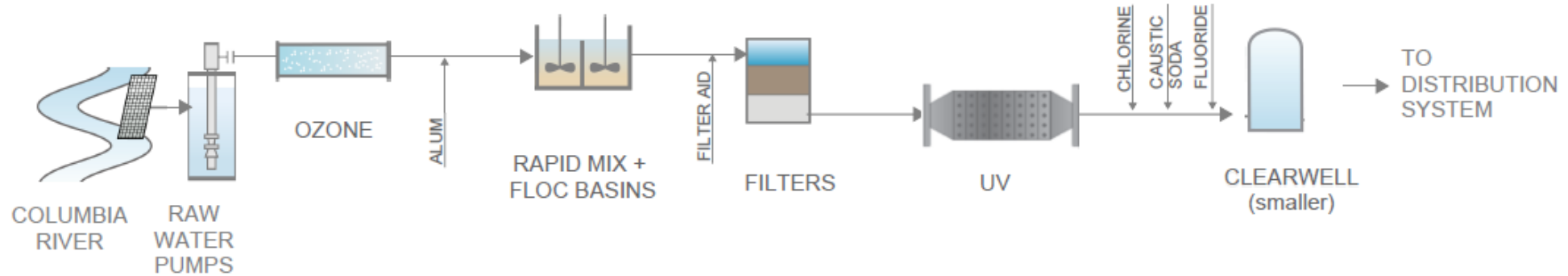
1. Combine technologies into treatment trains
2. Evaluate each trains' ability to meet water quality challenges
3. Prepare site layouts and construction phasing
4. Compare costs and non-economic factors
5. **Select a treatment train for capital improvements plan**



Step 1: Combine Technologies into Treatment Trains



Step 2: Evaluate Ability to Meet Water Quality Challenges

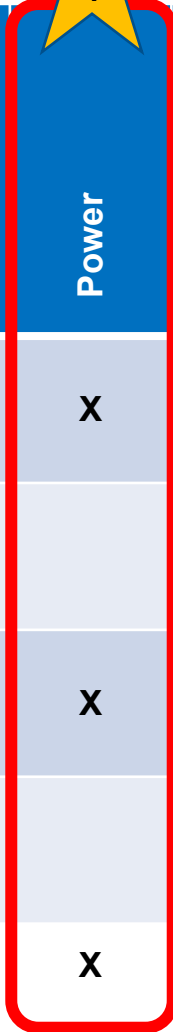
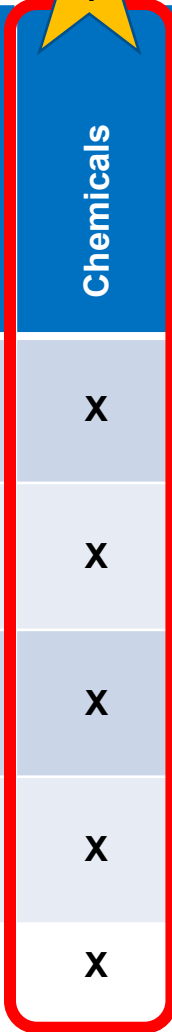


	High Turbidity	TOC/DBPs	Metals	Taste and Odor	Algal Toxins
Treatment Ability					
Treatment Technology Providing Benefit	Filtration only	Ozone	Ozone	Ozone	Ozone

LEGEND: RISK OF DEGRADED WATER QUALITY LITTLE OR NO TREATMENT PROVIDED SOME TREATMENT PROVIDED WITH LIMITATIONS ROBUST TREATMENT PROVIDED

Step 3: Develop Site Layouts and Construction Phasing

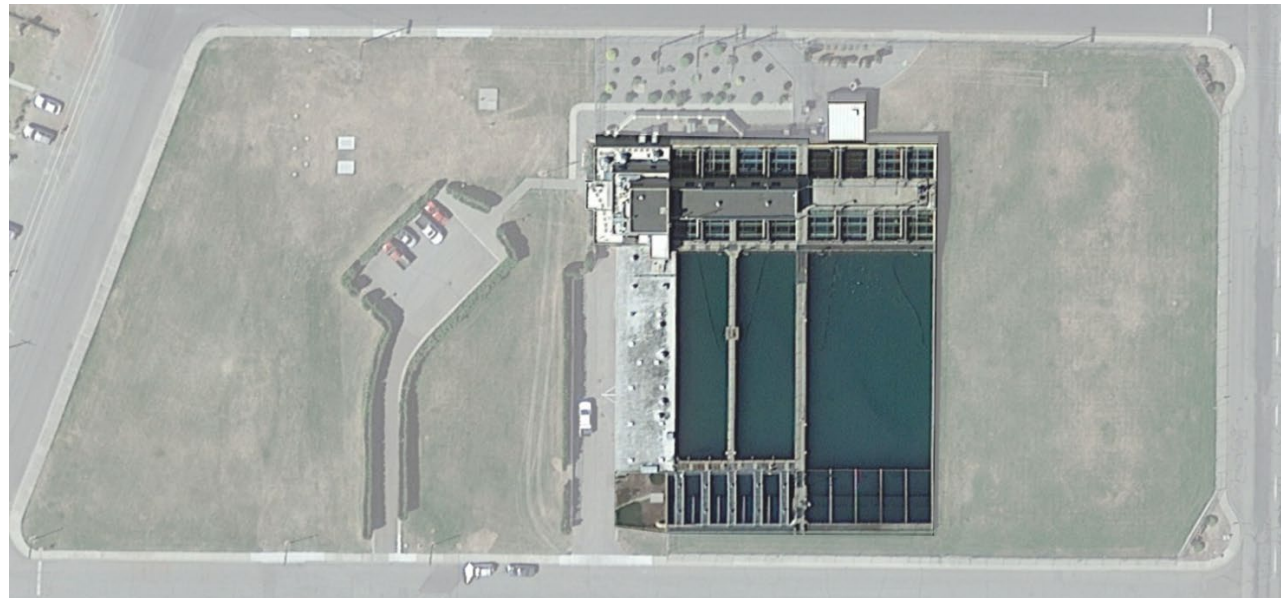
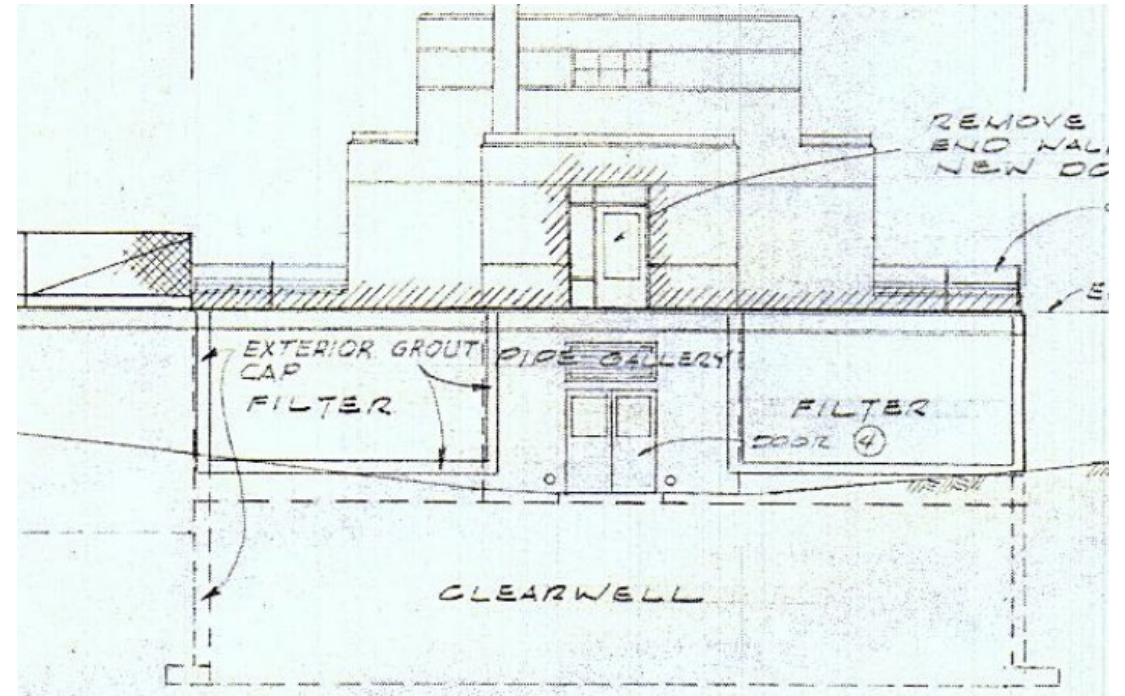
	Process	Intake/PS	Rapid Mix	Floc/Sed	Filters	Disinfection	Chemicals	Decant/Drying Beds	Backwash Lift Station	Plant Air Systems	Power	Controls/SCADA
DRIVER												
Capacity		X			X	X	X	X	X		X	
Safety							X					
Aging Infrastructure		X	X	X	X	X	X	X	X	X	X	X
Water Quality Challenges				X			X					
Condition Assessment: High Priority Based on Risk					X		X			X	X	



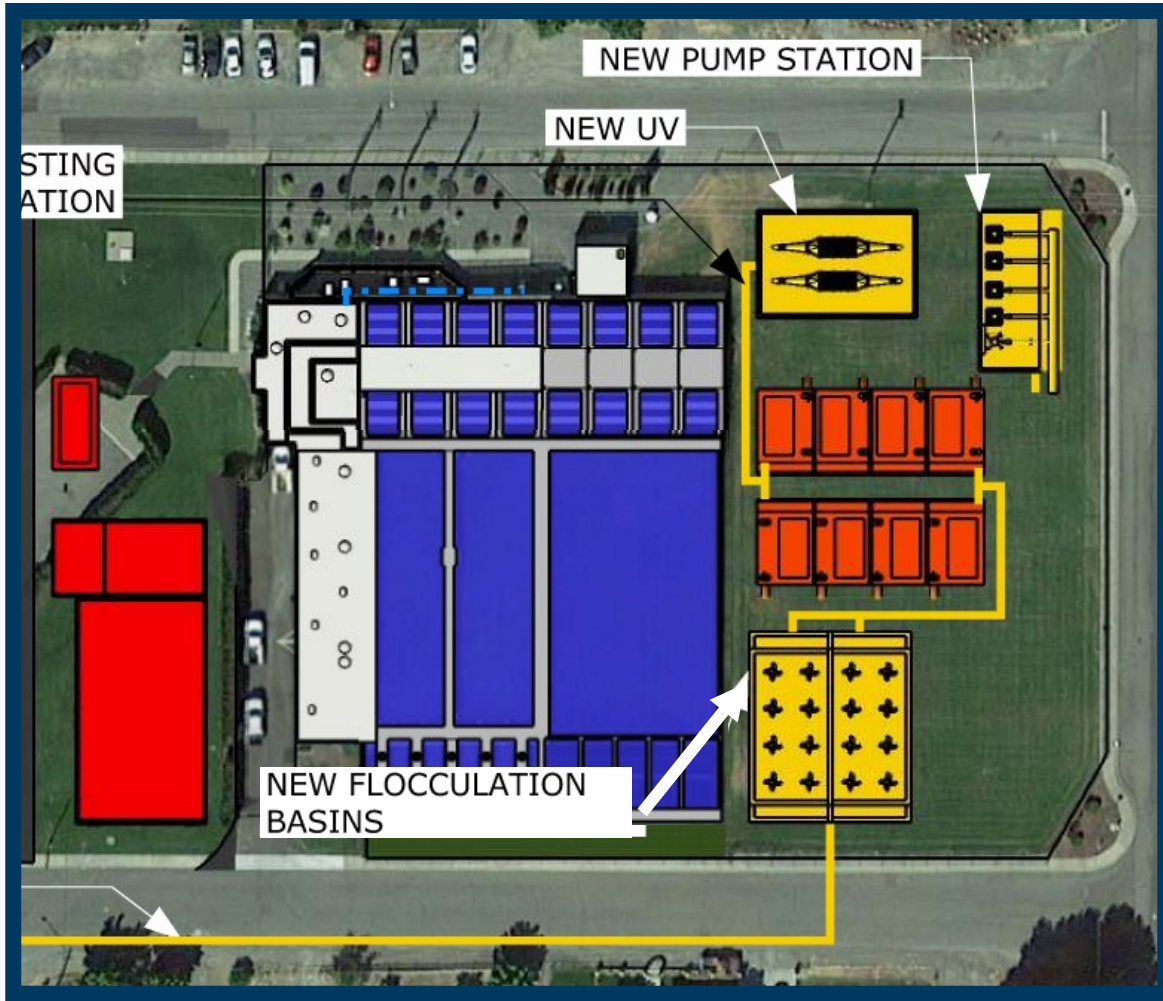
Site Layout Challenges

Stacked infrastructure

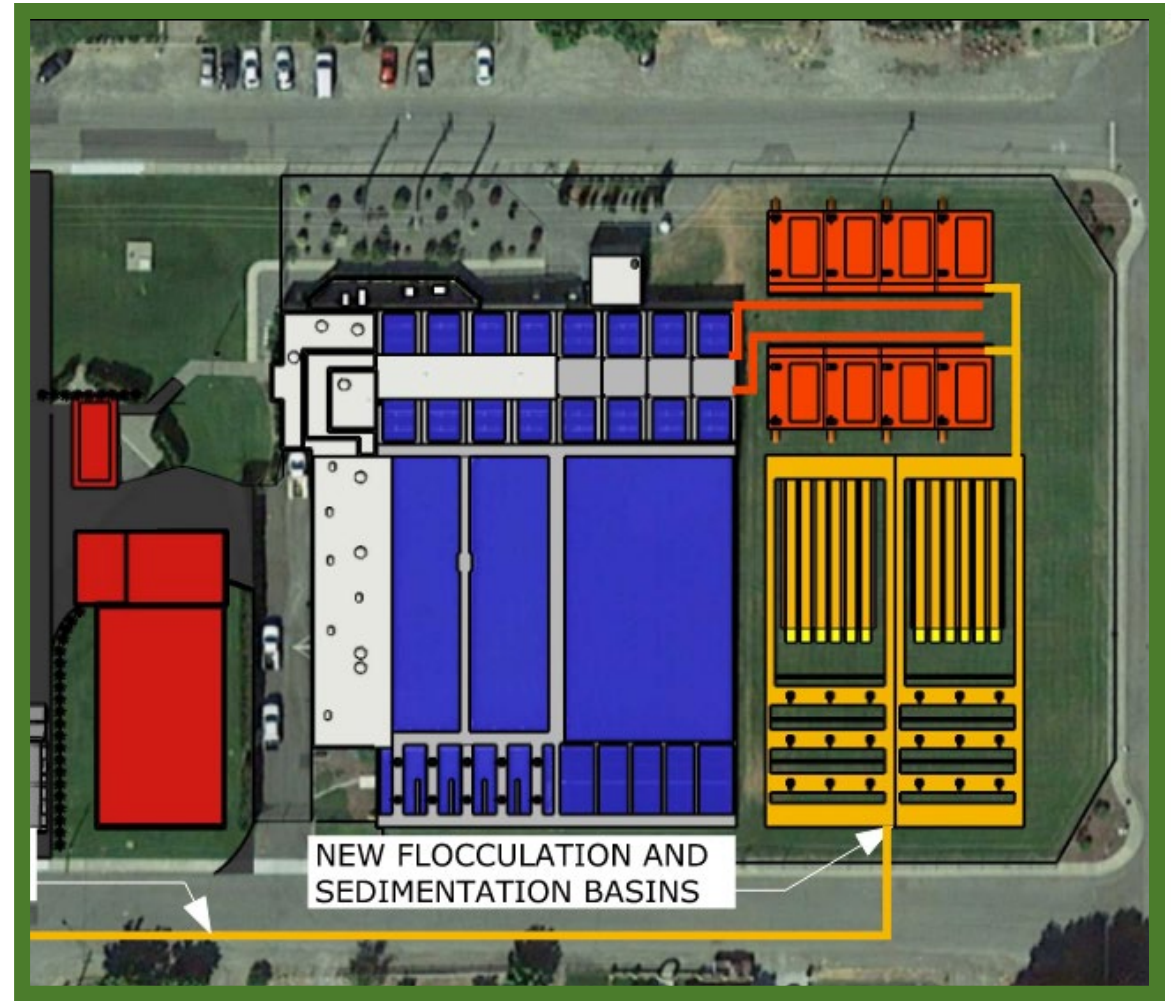
Existing WTP is in the middle of the site



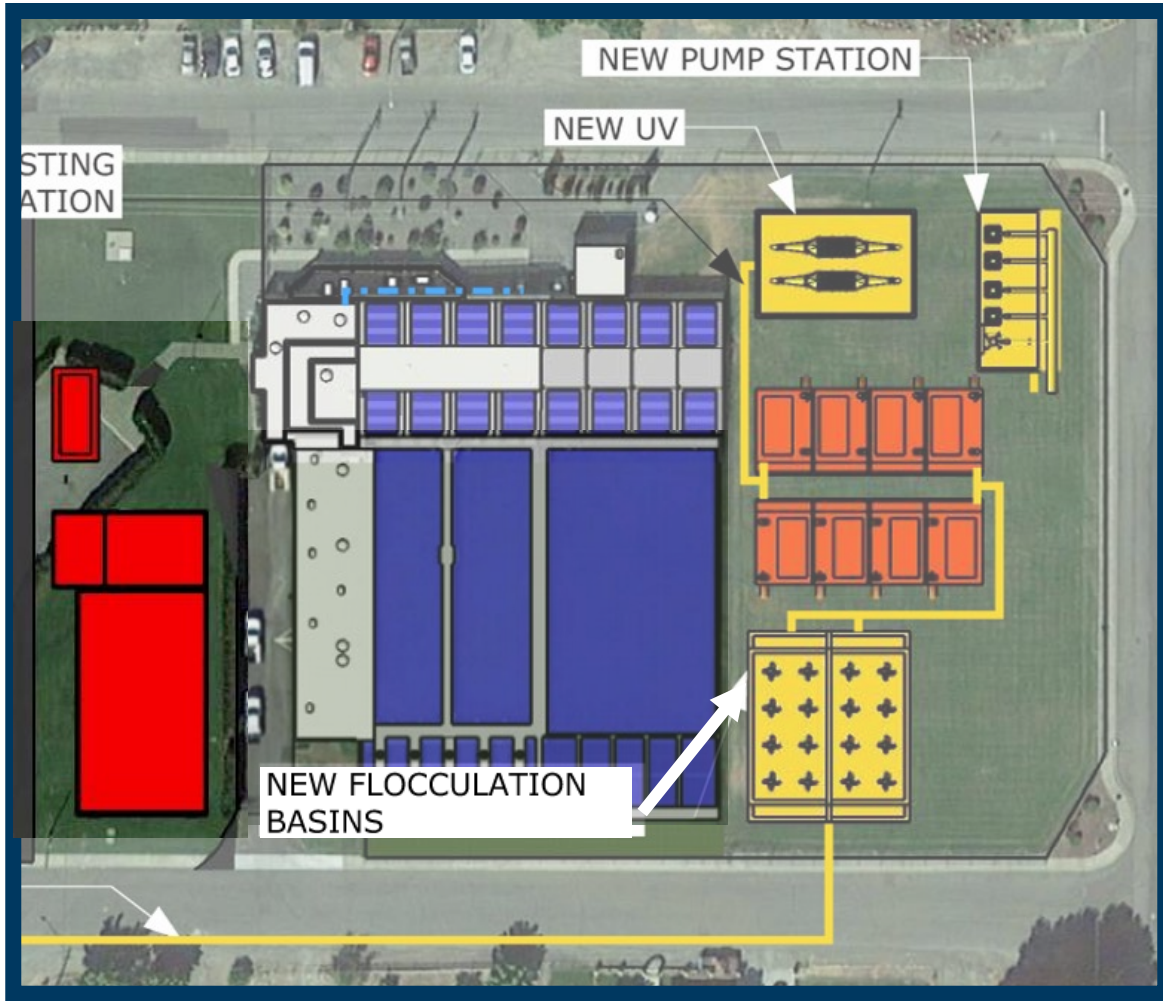
Direct Filtration



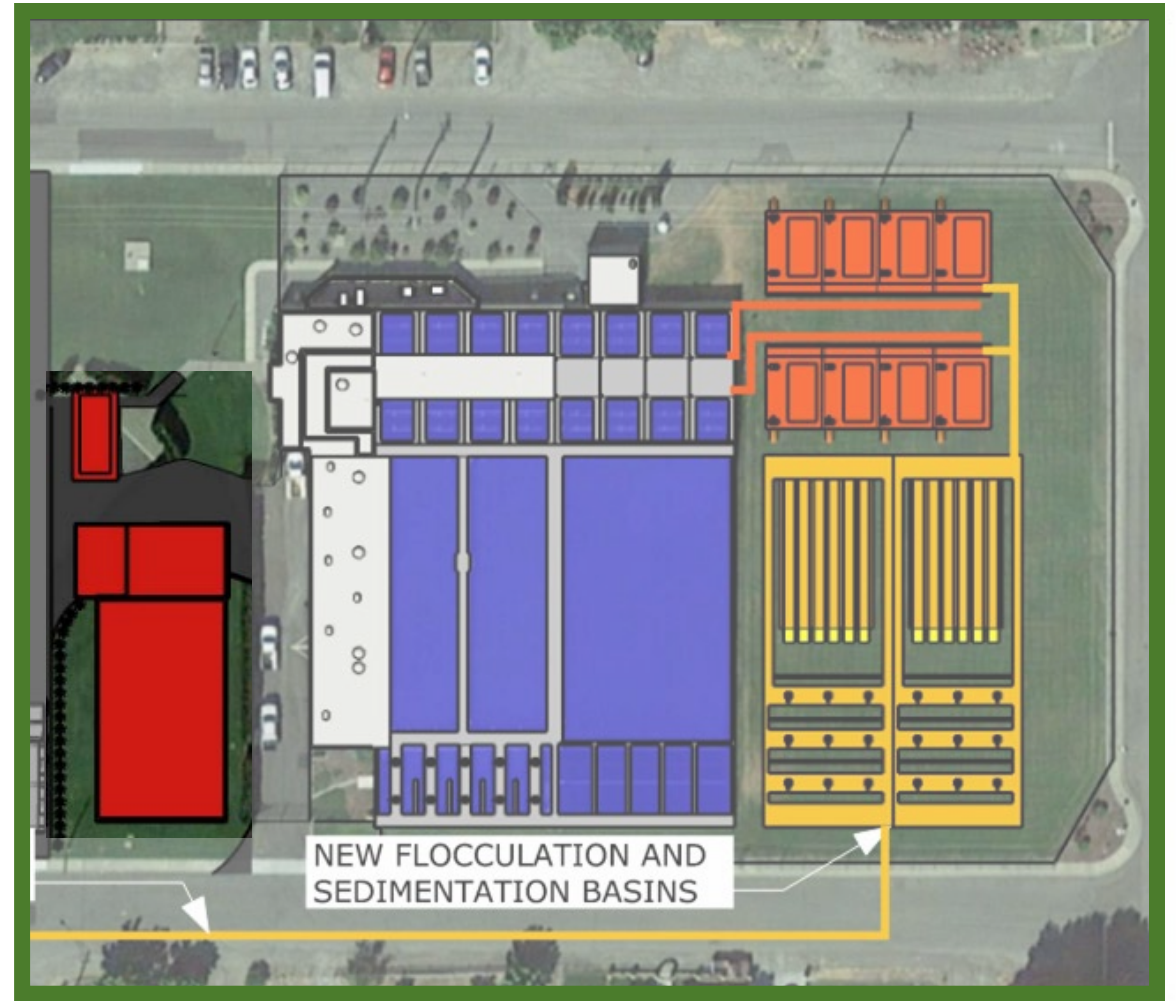
Conventional Treatment



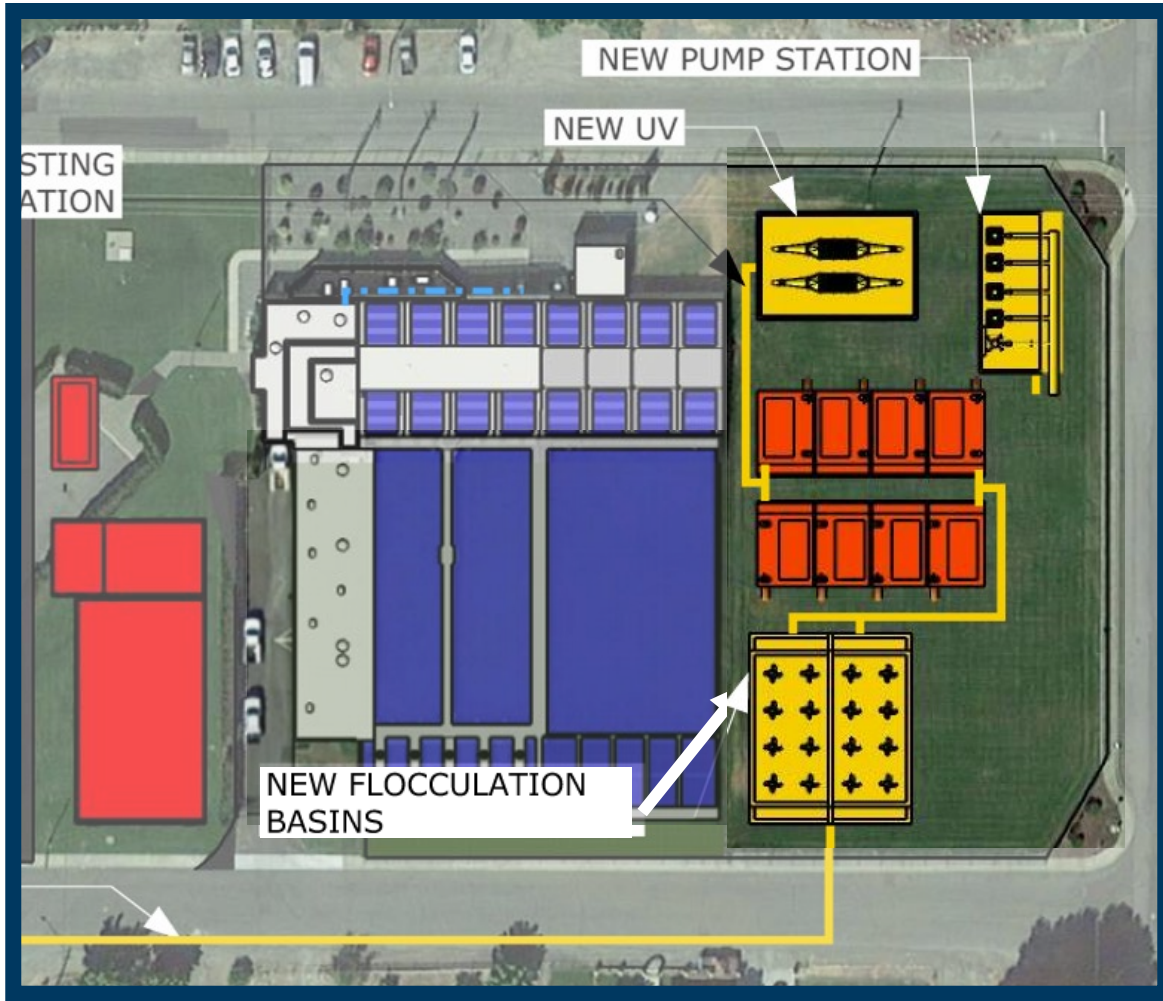
Direct Filtration



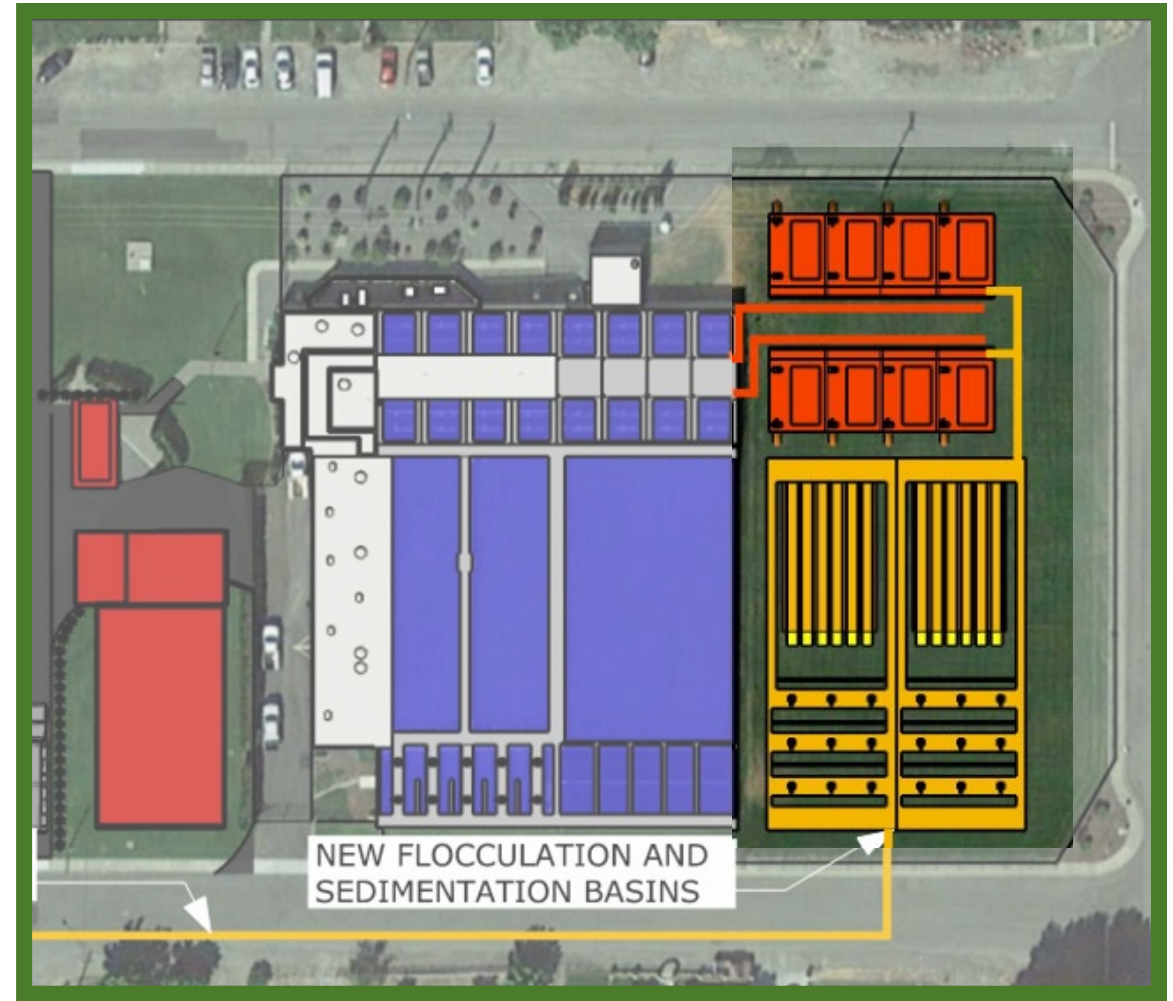
Conventional Treatment



Direct Filtration



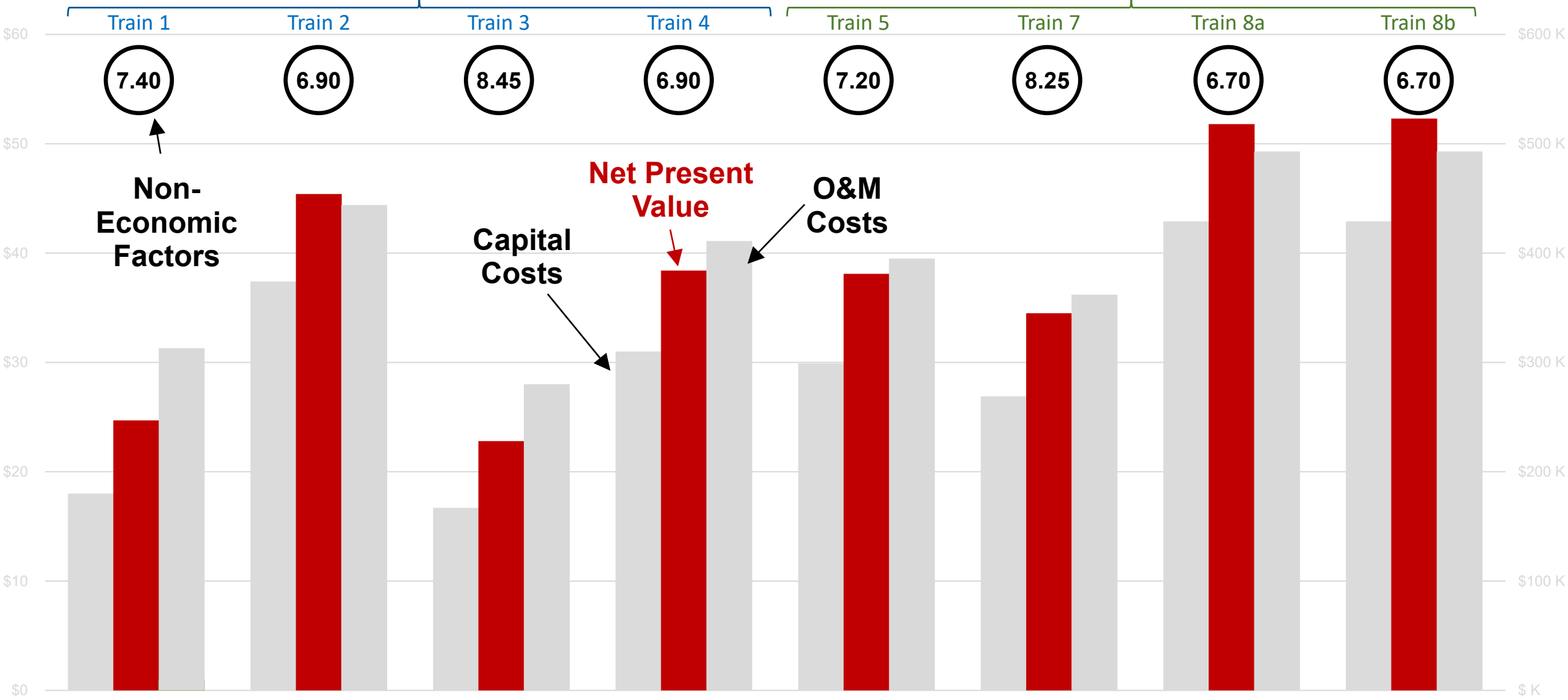
Conventional Treatment



Step 4: Compare Costs and Non-Economic Factors

Direct Filtration

Conventional Treatment



Non-Economic Factors

Net Present Value

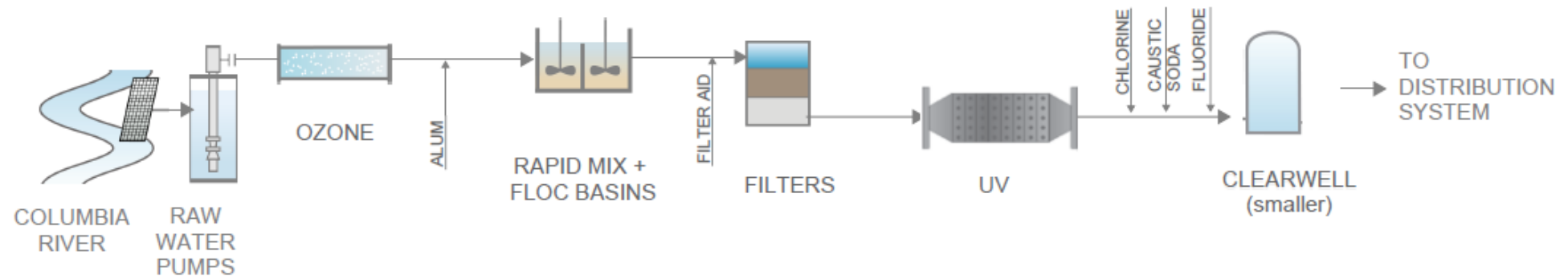
Capital Costs

O&M Costs

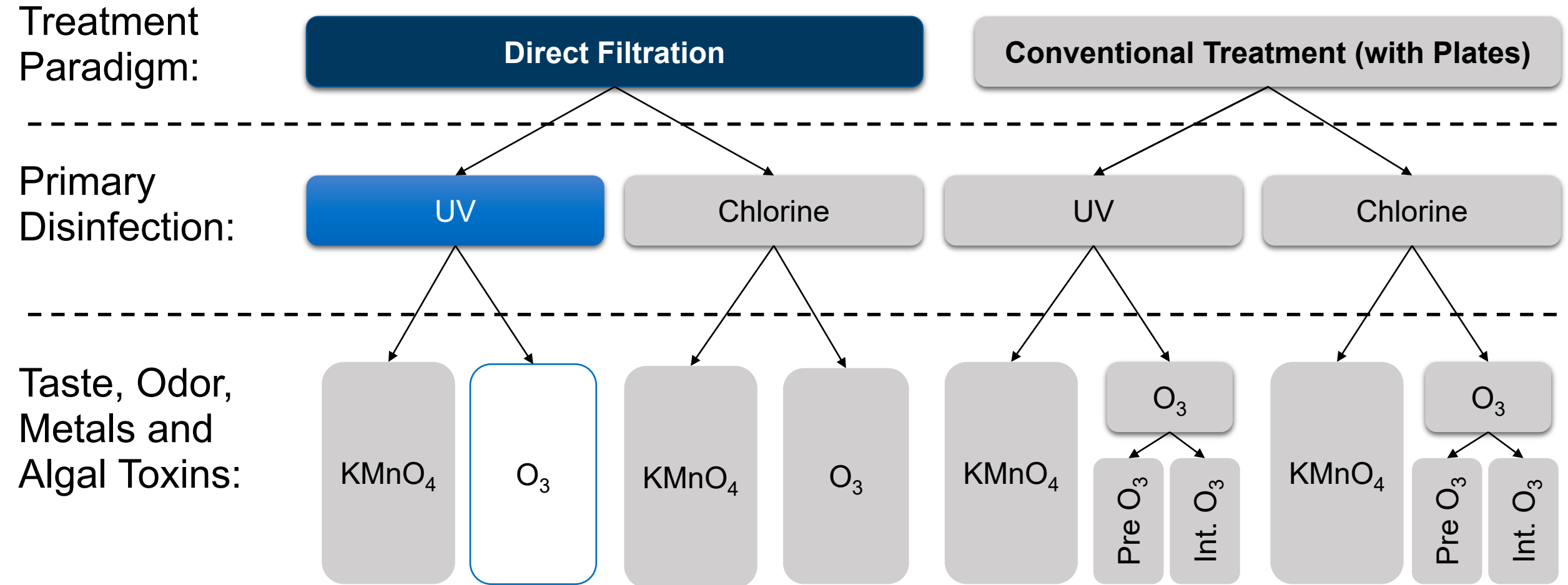
Step 5: Select an Alternative

How the City selected the treatment train:

- Direct vs. conventional
- UV vs. clearwell
- Ozone provides robust treatment barrier
- OSHG vs. bulk delivery
- Economic and non-economic factors

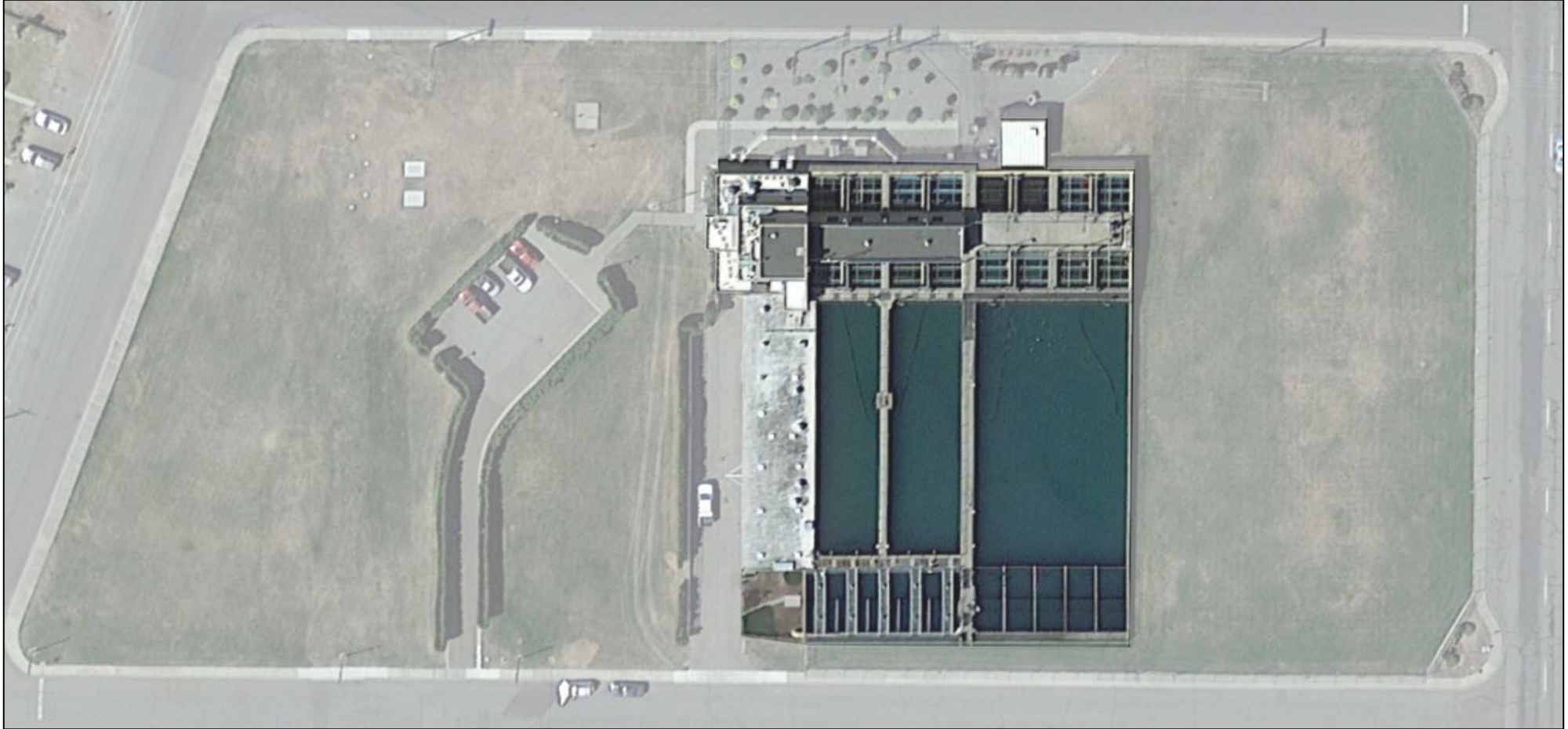


Selected Alternative – Train 2

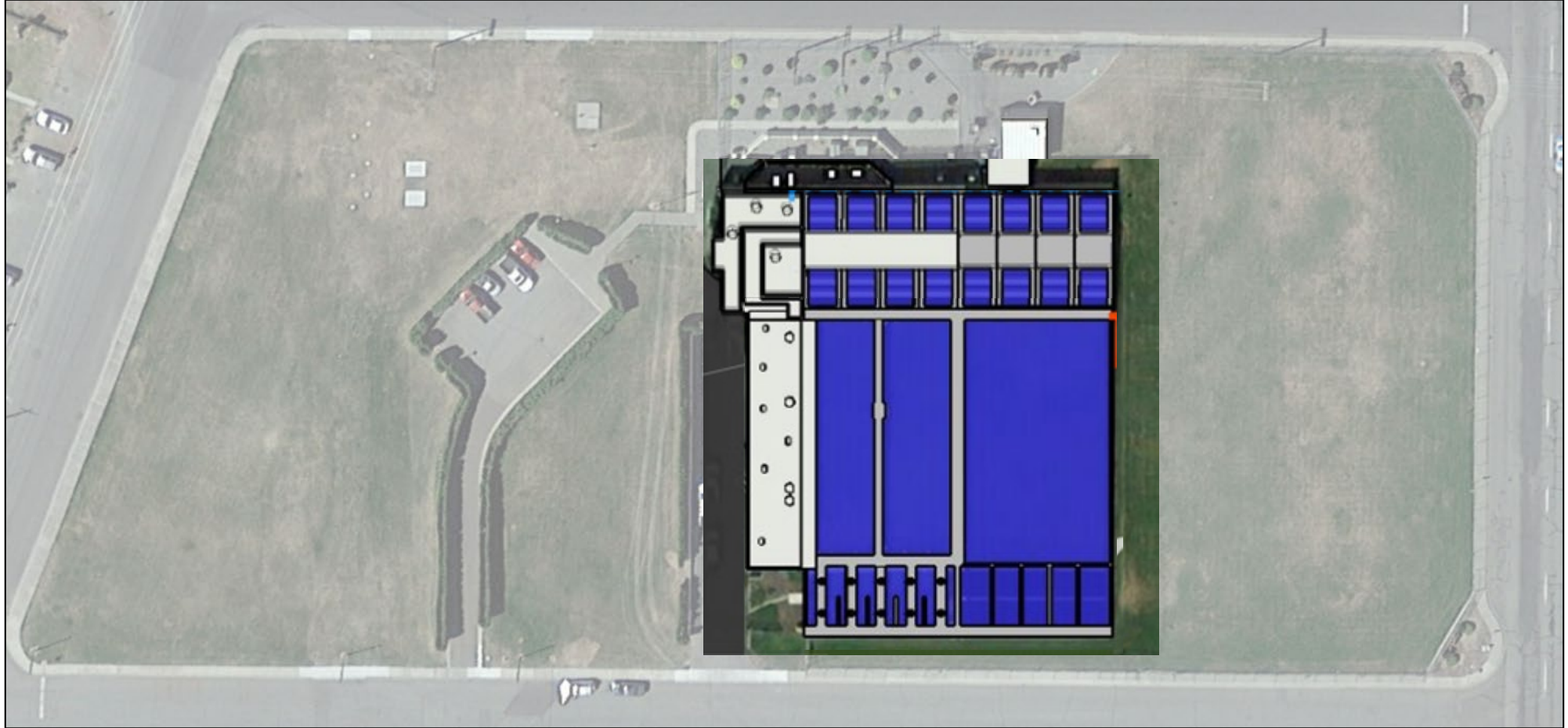


Phasing of the Selected Alternative

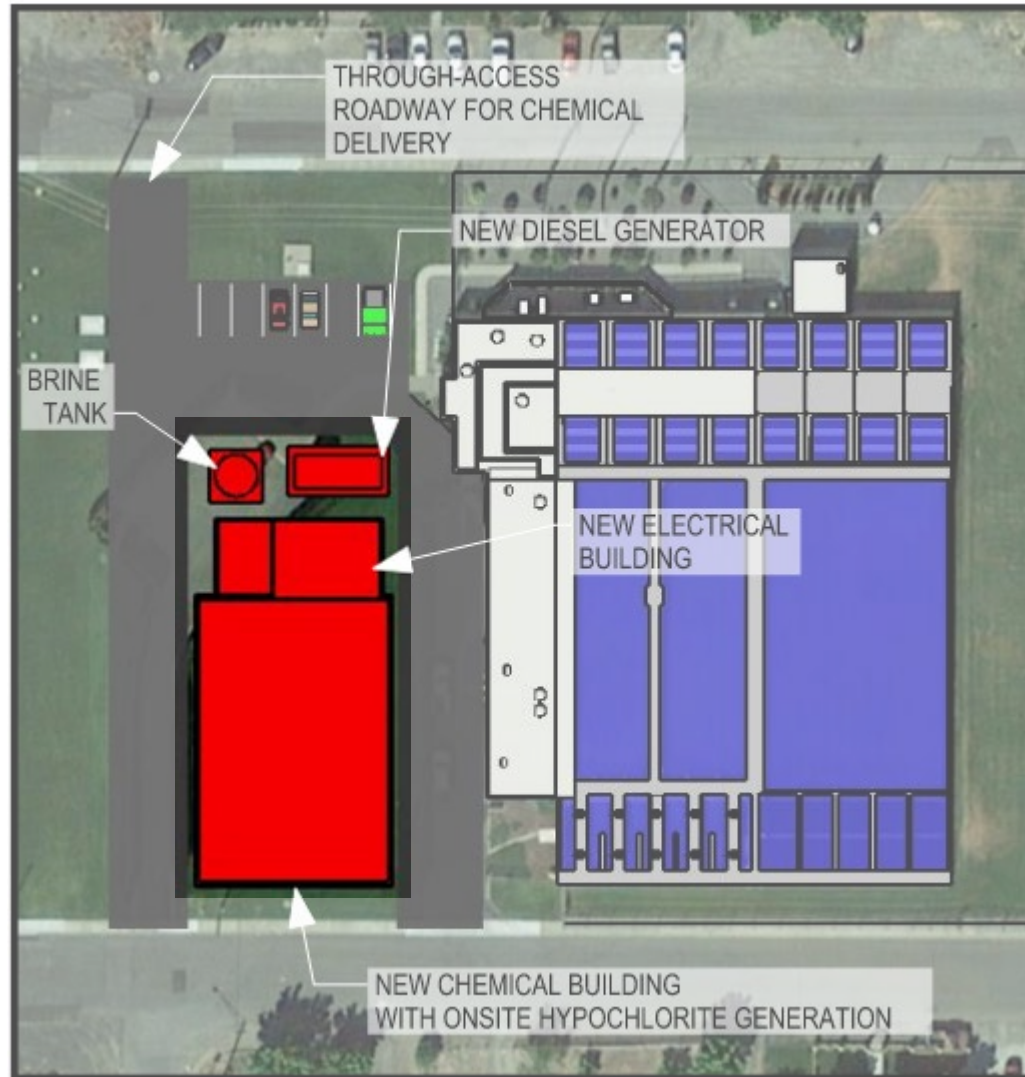
Phase 0 – Existing Site



Phase 0 – Existing Site



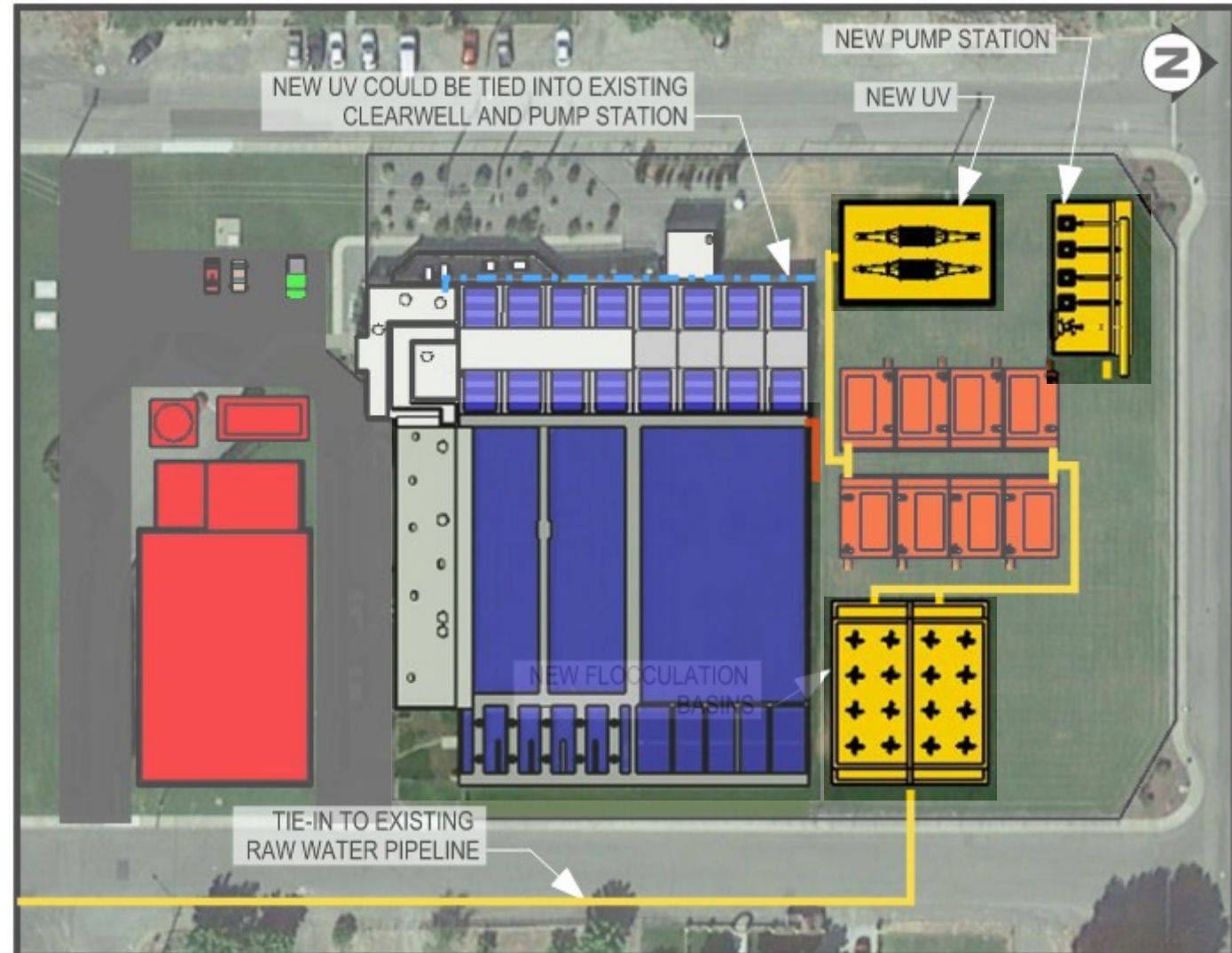
Phase – Chemicals and Power



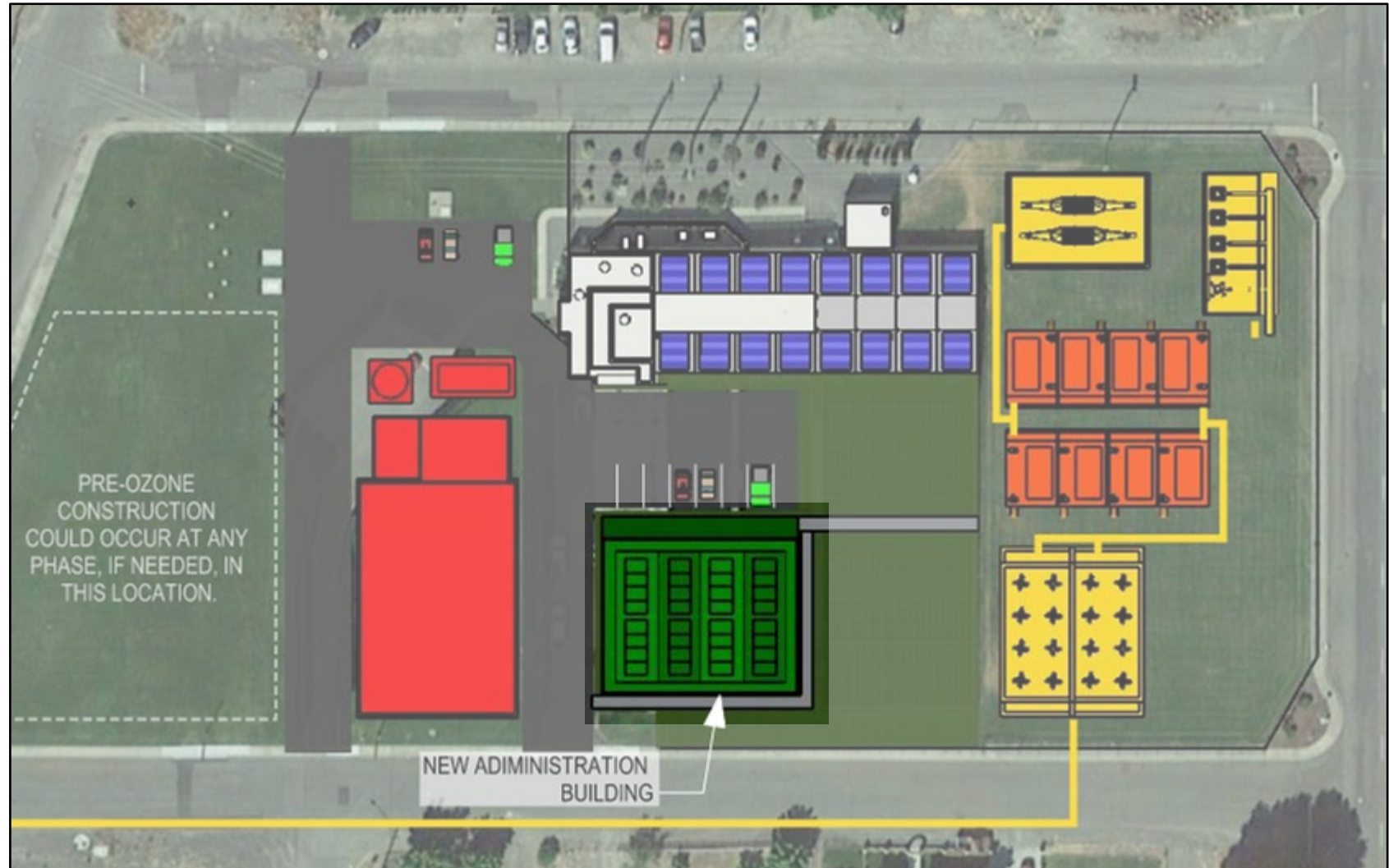
Phase - Filters



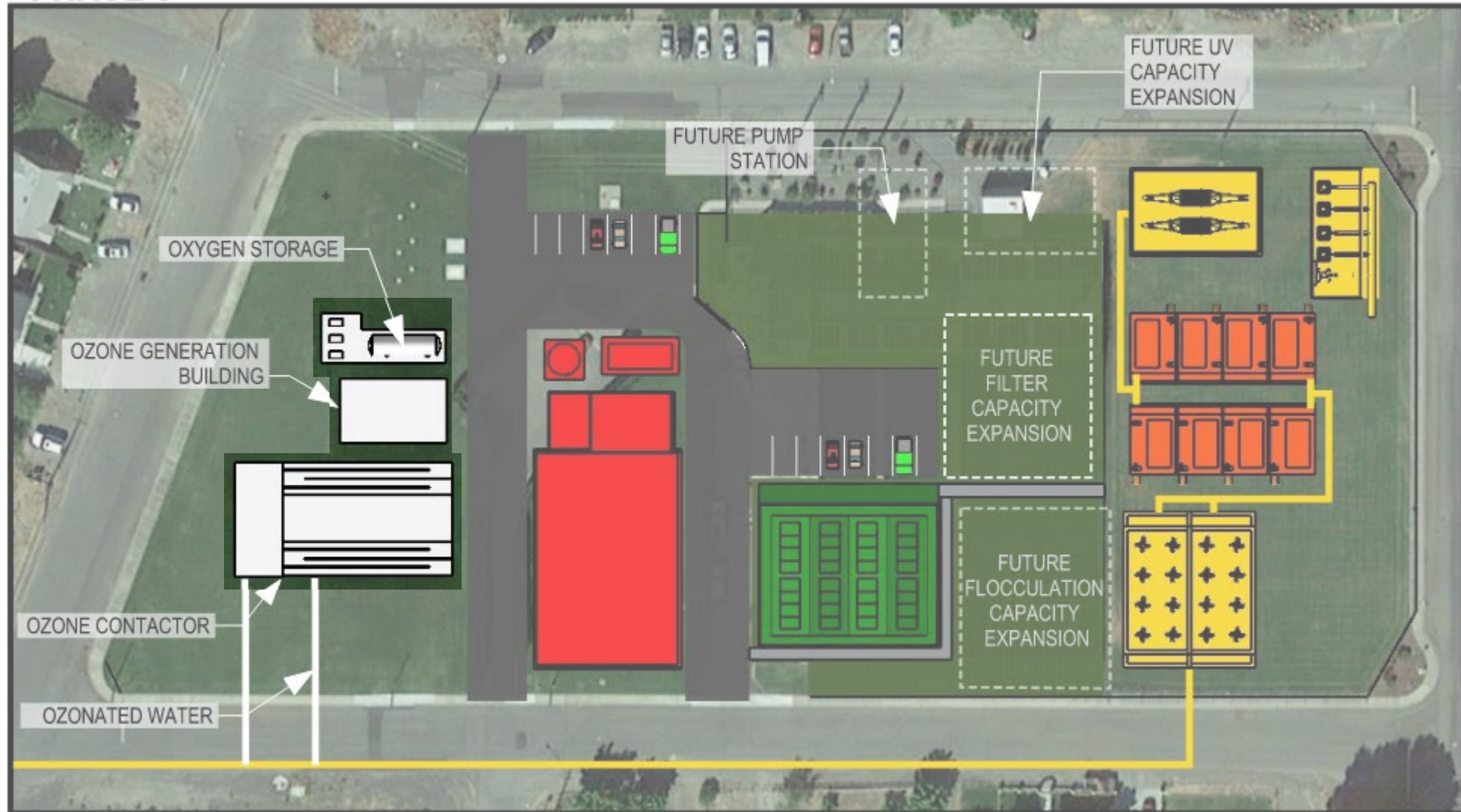
Phase 3 – Flocculation and Disinfection



Phase 4 – Administration Building



Phase 5 - Ozone



In Summary

How Do Aging Infrastructure, Treatment Needs, and Site Layout Inform the Butterfield WTP's Expansion?

- **Aging Infrastructure**: Informed the replacement approach
- **Treatment Needs**: Informed technology selection and phasing
- **Site Layout**: Limited where new facilities could be constructed

Questions?



Special Thanks to:
Ali Leeds,
Austin Peters,
Connor Mancosky,
Heath Bateman,
Jon Padvorac,
Maria Serra

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