

# Lessons Learned in Construction: 1 Year Into The Construction of the Lake Oswego-Tigard WTP Expansion

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Lake Oswego · Tigard  
Water Partnership  
*sharing water · connecting communities*



**MWH**®

# Agenda

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Project Overview & Background

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Construction Sequence

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Construction Site Virtual Tour

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Engineering Lessons Learned During Construction

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Operations Perspective on Construction

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Next Steps for the LO-T WTP

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Questions?

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**Program  
Overview**

**Existing Plant**

**Process  
Overview**

**Site Layout**

# PROJECT OVERVIEW

Bonita Pump Station



Waluga Reservoir



Treated Water Pipeline



Clackamas River

Lake Oswego Water Treatment Plant



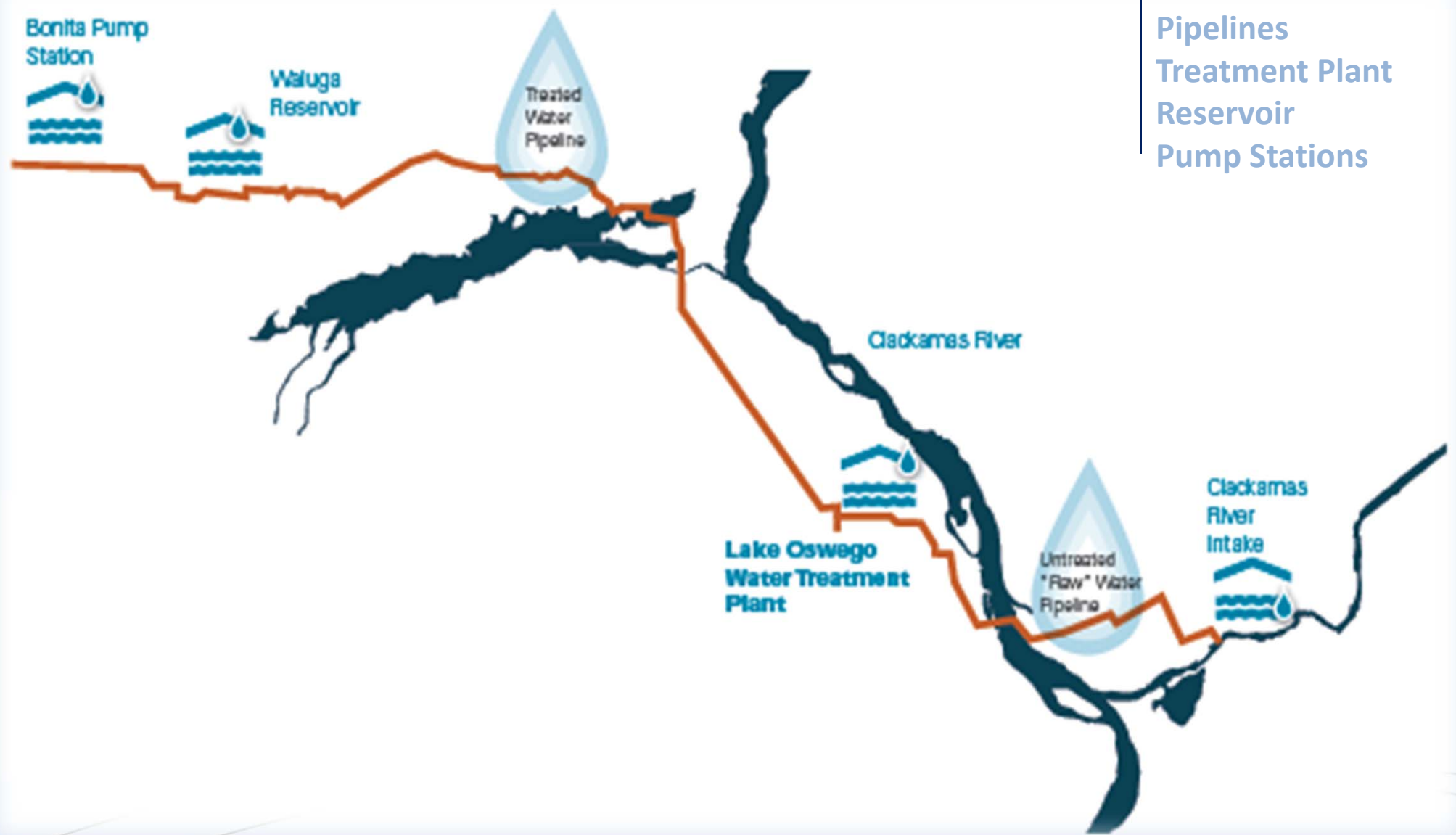
Untreated "Raw" Water Pipeline



Clackamas River Intake



Intake  
Pipelines  
Treatment Plant  
Reservoir  
Pump Stations



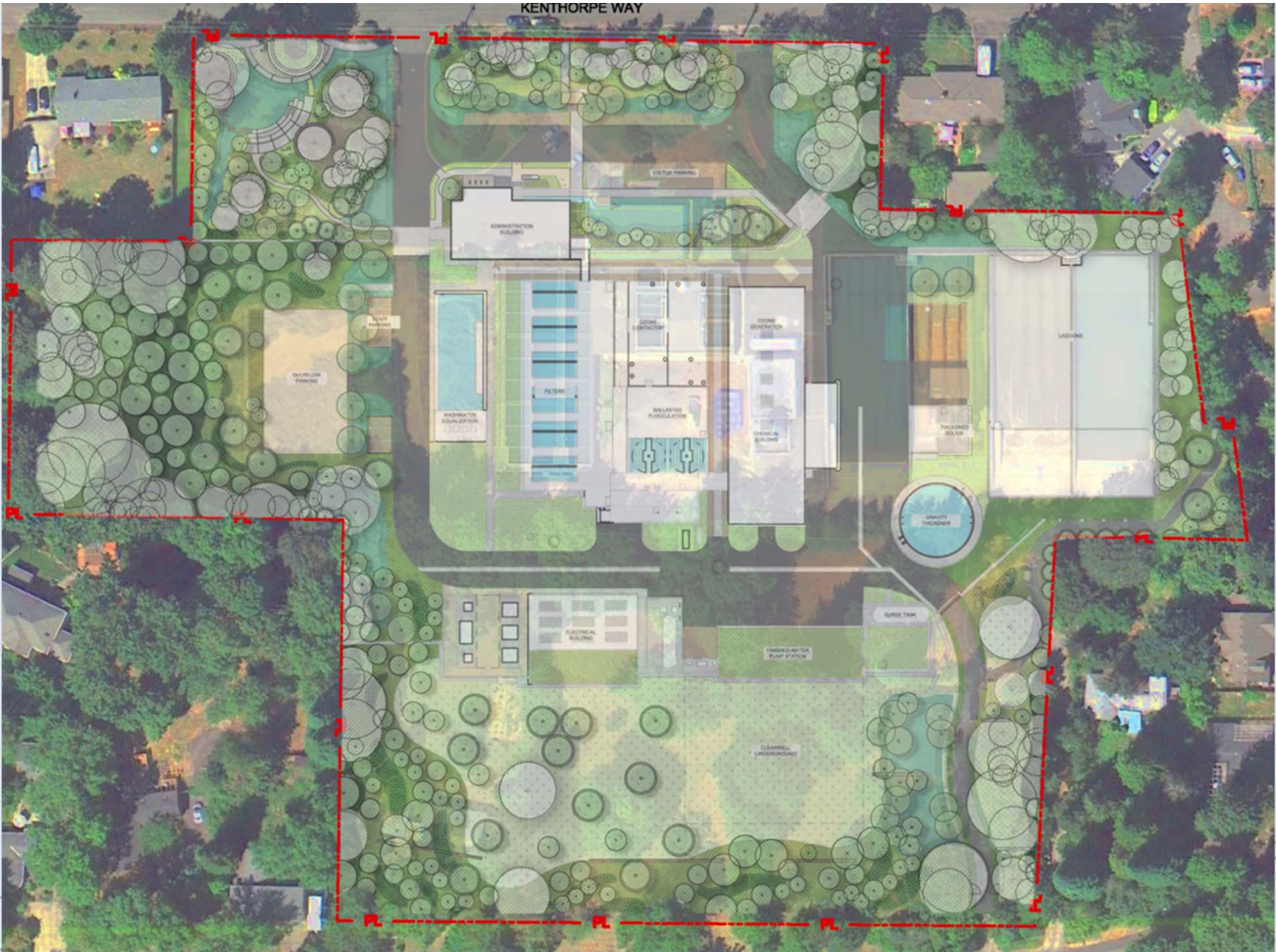


# Existing Plant





# Expanded Plant





# Expanded Plant



# LO-T WTP Expansion

## Current Plant

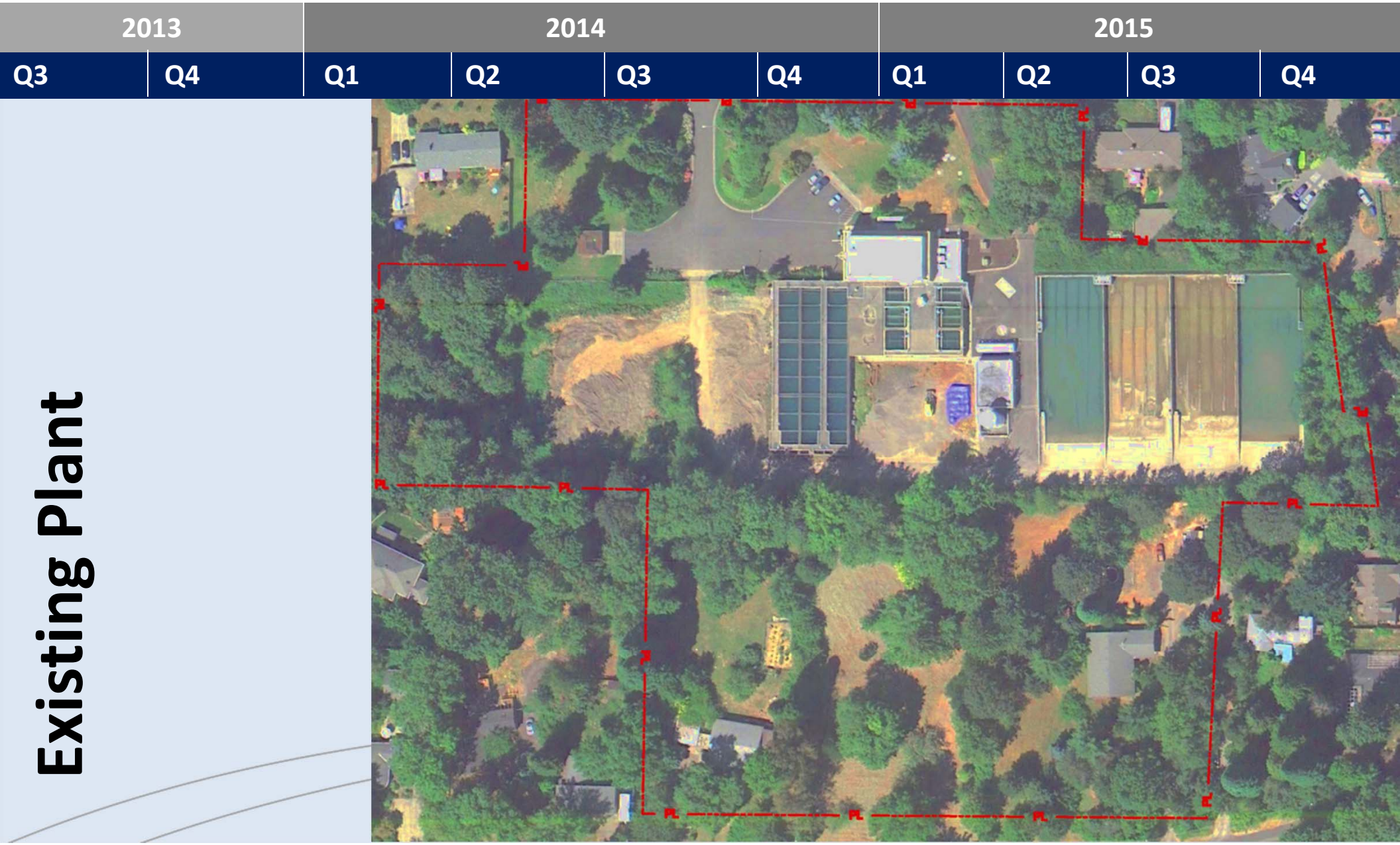
- 16 MGD Capacity
- Direct Filtration
- Solids Dewatering Lagoons

## Expanded Plant

- 32/38 MGD Capacity
- Conventional Treatment
  - High-rate Clarification
  - Intermediate Ozonation
  - High-rate GAC Filtration (10 gpm/sf)
  - Mechanical Dewatering

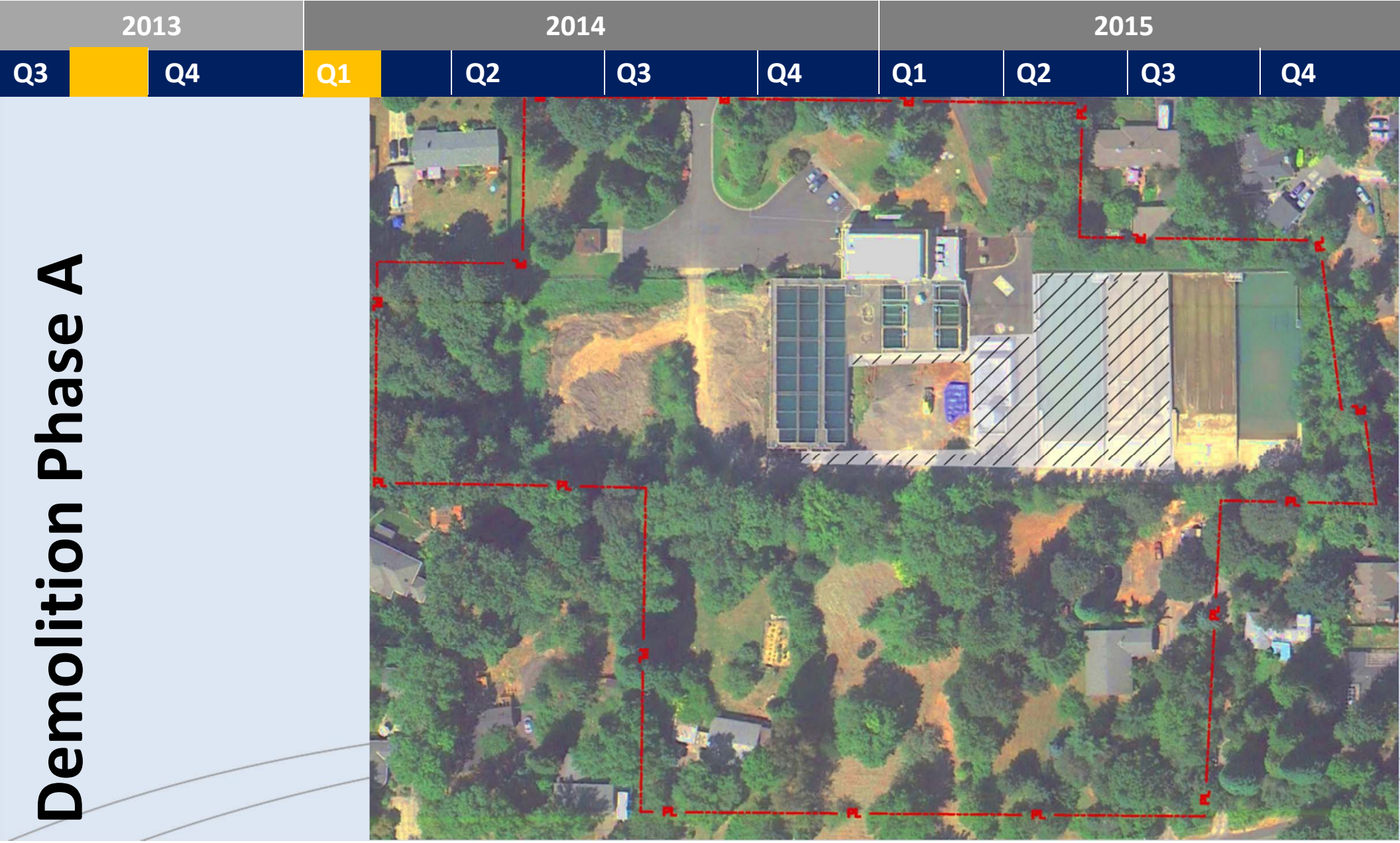


# Existing Plant





# Demolition Phase A





# Construction Phase A

2013

2014

2015

Q3

Q4

Q1

Q2

Q3

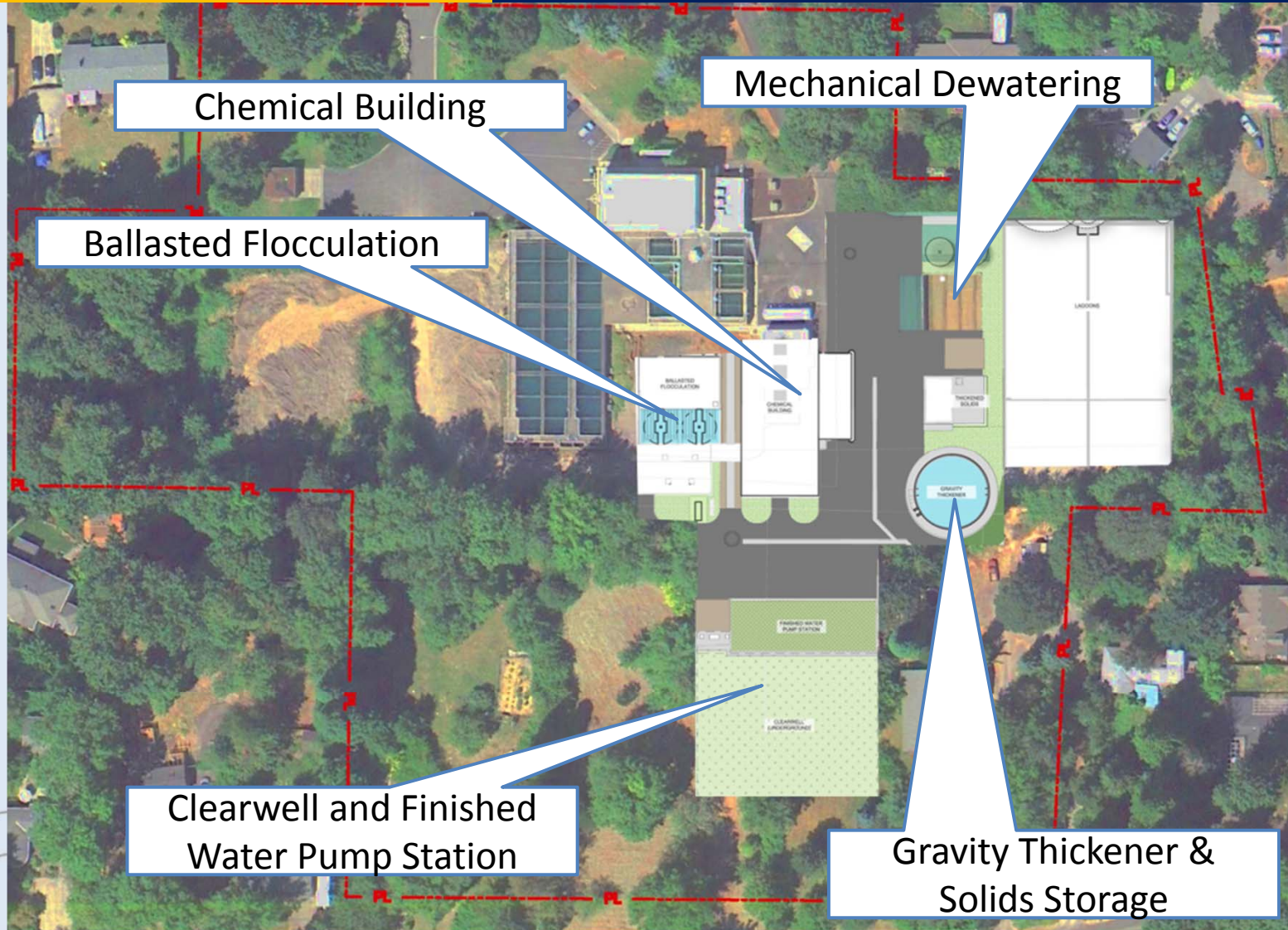
Q4

Q1

Q2

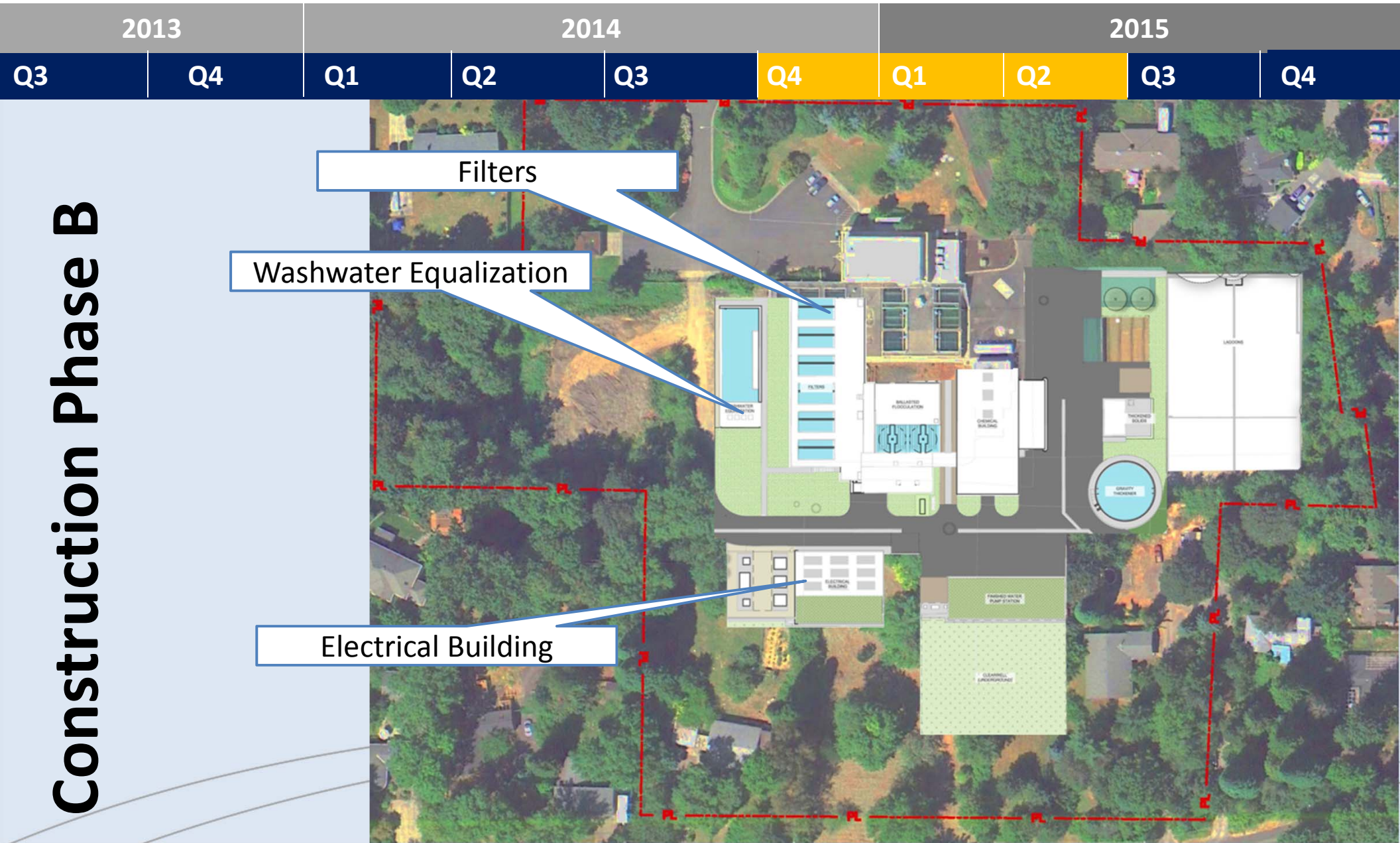
Q3

Q4





# Construction Phase B





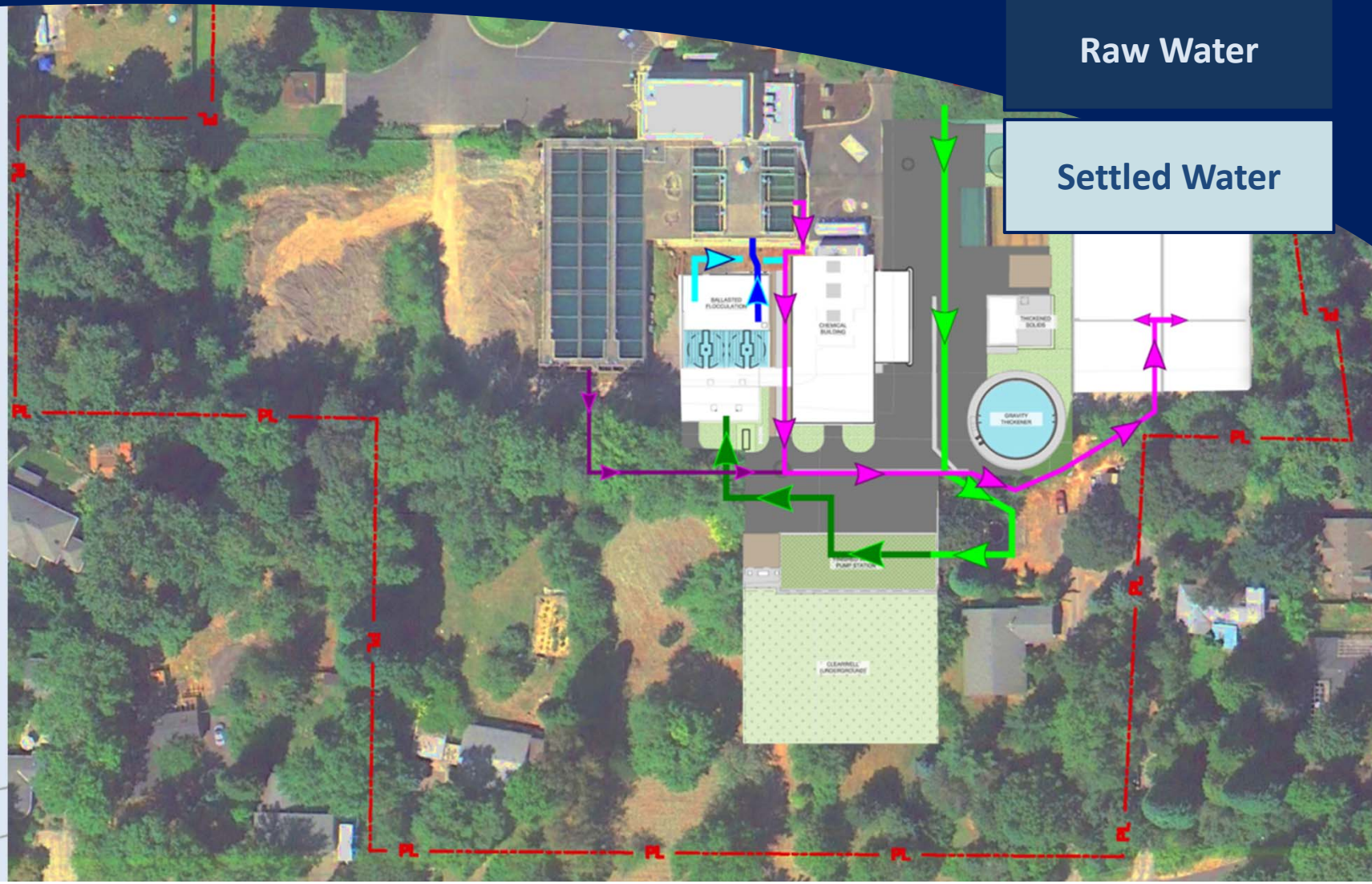




# Temporary Systems

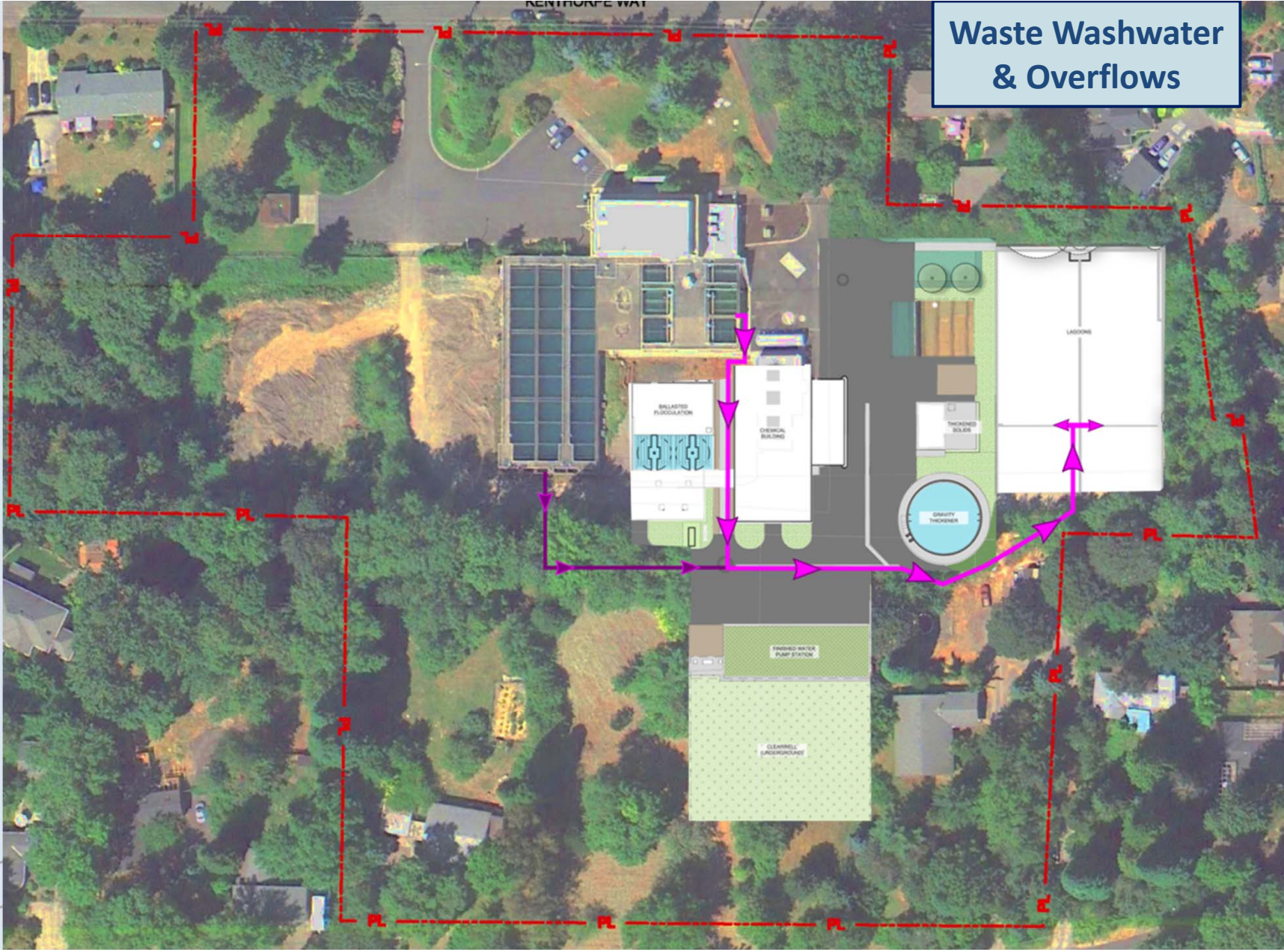
- Waste Washwater & Overflows
- Raw Water
- Settled Water

Phase A – Temporary Piping



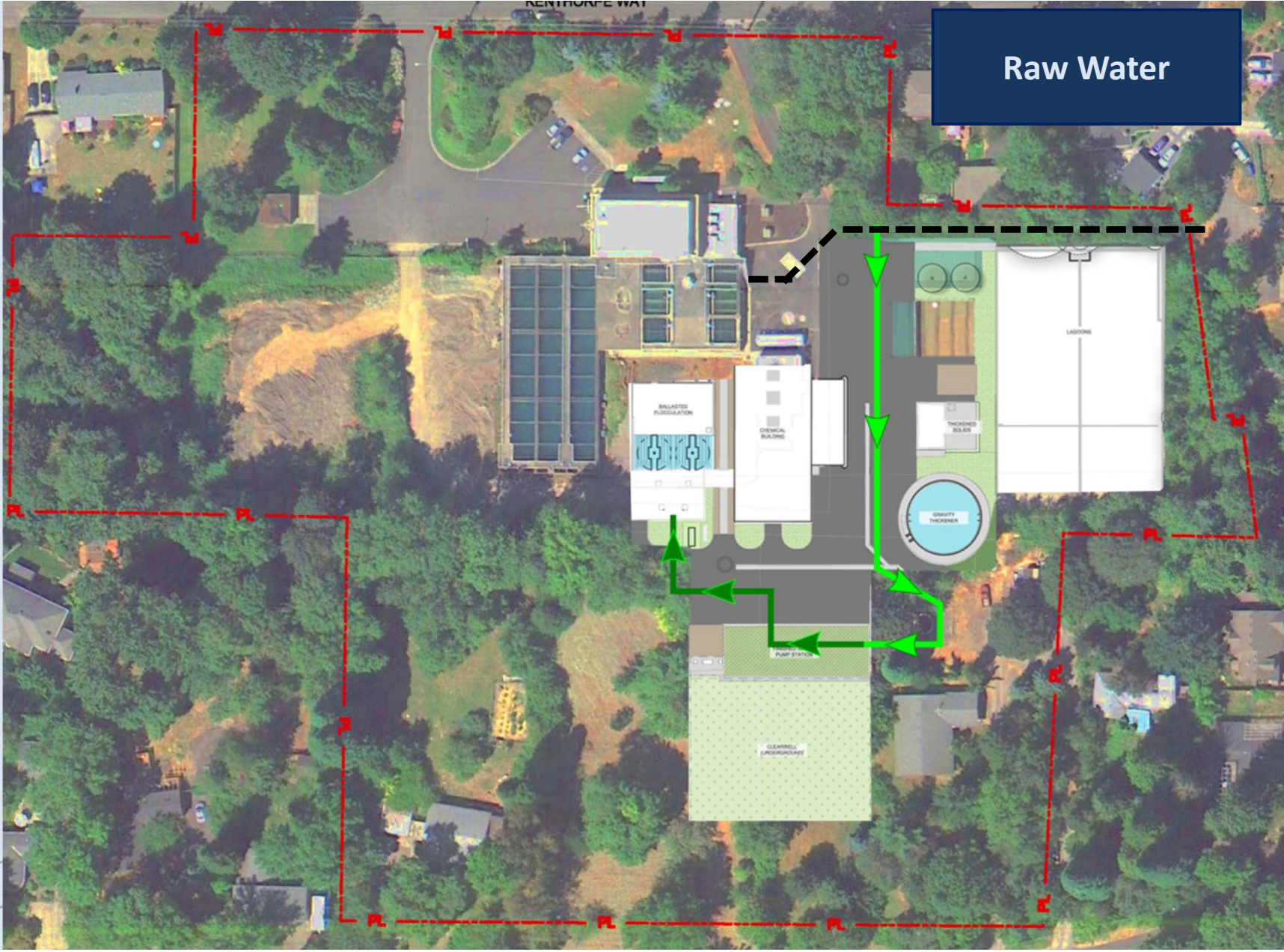


# Temporary Waste Washwater and Overflow Connections



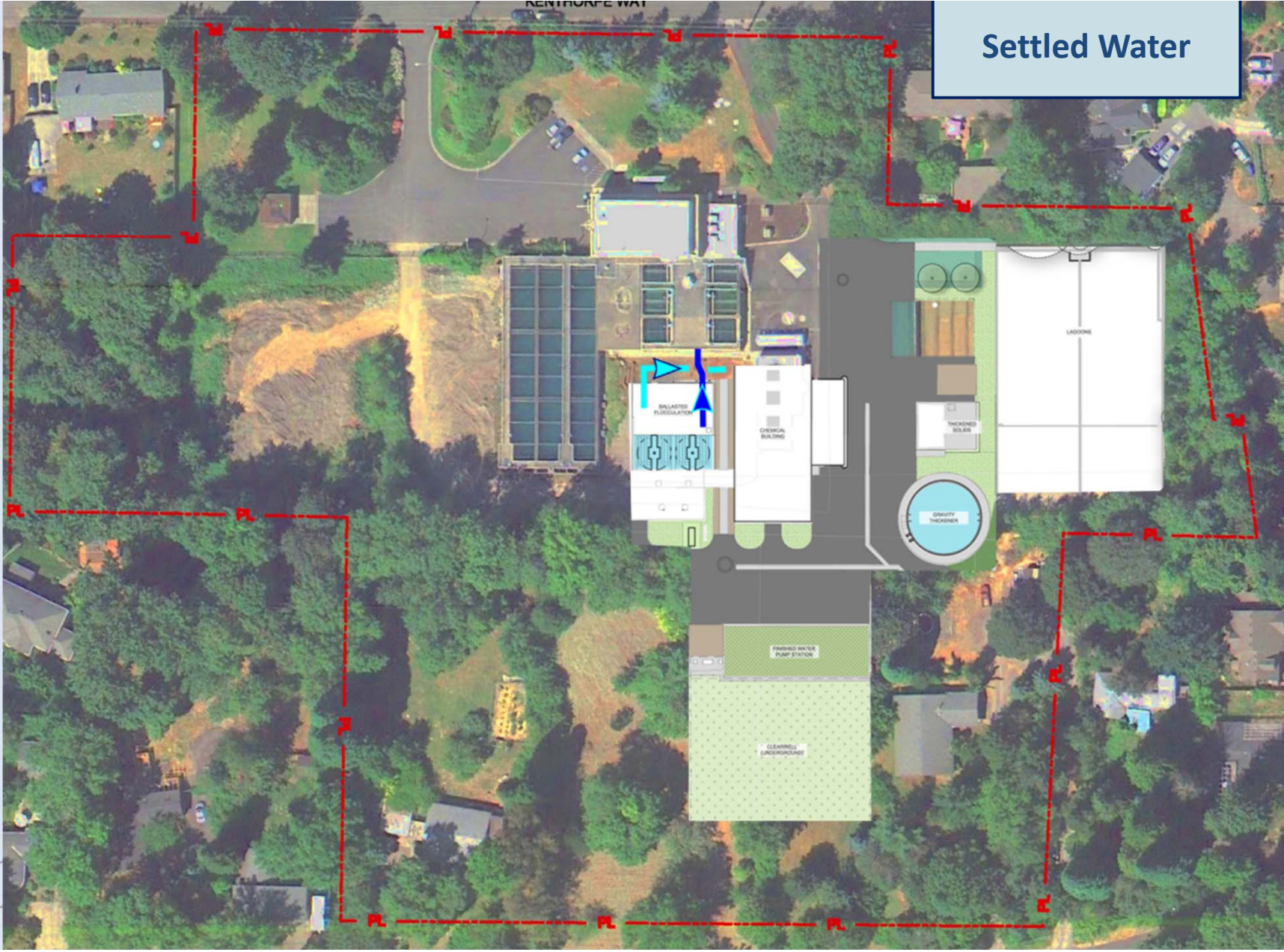


# Temporary Raw Water Connection





# Temporary Settled Water Connections



# Other Temporary Systems in Phase A

- Temporary Chemical Feed
- Temporary Chemical Fill
- Temporary Relocation of Electrical and Controls
- Many other small pipeline relocations





**Clearwell**

**Ballasted  
Flocculation**

**Gravity  
Thickening**

**Mechanical  
Dewatering**

**Chemical  
Building**

# CONSTRUCTION SITE VIRTUAL TOUR





# Pile Drilling Activities









# Gravity Thickener & Solids Storage





# Ballasted Flocculation & Gallery





# Lagoon Modifications



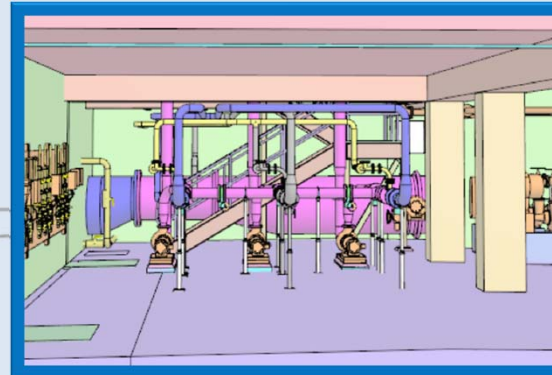
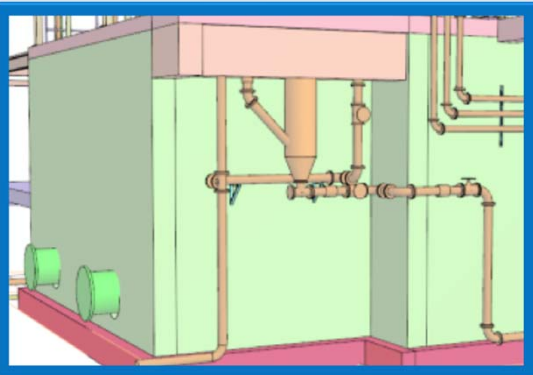


# Engineering Lessons Learned During Construction

- Adapting design to Contractor means, methods and ideas
  - Sometimes cost savings ideas cost too much to re-design
- Early Operations Staff involvement is critical and helps inform decisions throughout construction
  - Ensure capital savings decisions in construction don't lead to increased operational expenditures in the future.
- Early procurement of core equipment is very valuable to determine building geometries and appurtenances
  - The earlier you start the better.

# Engineering Lessons Learned During Construction (continued)

- 3D design collaboration between disciplines greatly improves design quality and coordination.
  - Commitment to 3D design during construction continues to add value – even when it is less efficient.
- Constant communication and collaboration with the Contractor is critical for successful project delivery.





# OPERATIONS PERSPECTIVE ON CONSTRUCTION

**Temporary  
Facilities**

**Operator Safety**

**Communication  
& Notification**

**Lock-Out  
Tag-Out**

**Plant  
Shutdowns**

# Temporary Facilities Installation & Operation

## ➤ Pre-construction conversion of Hypochlorite to Caustic feed system

- Original concept was Contractor built, stand alone temporary Caustic feed facility; Estimate at \$100,000.
- Operators converted existing Hypochlorite tank to Caustic tank, saving \$80,000.
- Triggered LCR sampling in distribution system





# Backwash Water Lagoon Alterations and Demolition

- Installation of Temporary Backwash and Basin overflow lines
- Operation of lagoons with reduced capacity (from 4 to 2 to 1!)



# Operational Challenges with Lagoons

- Leaks and their associated problems
  - Risk to lagoon structure
  - Problems for Construction excavation work





# Operator Safety Concerns and Changing Old Habits

- Safety gear and increased awareness of surroundings.
- “Will the tower crane fall on the operations building overnight?”
- Construction site access; changing work routes, temporary paths, lighting.



# Changes to Chemical Deliveries

- Relocation of Alum Fill Station
- Temporary Chemical Delivery Containment.



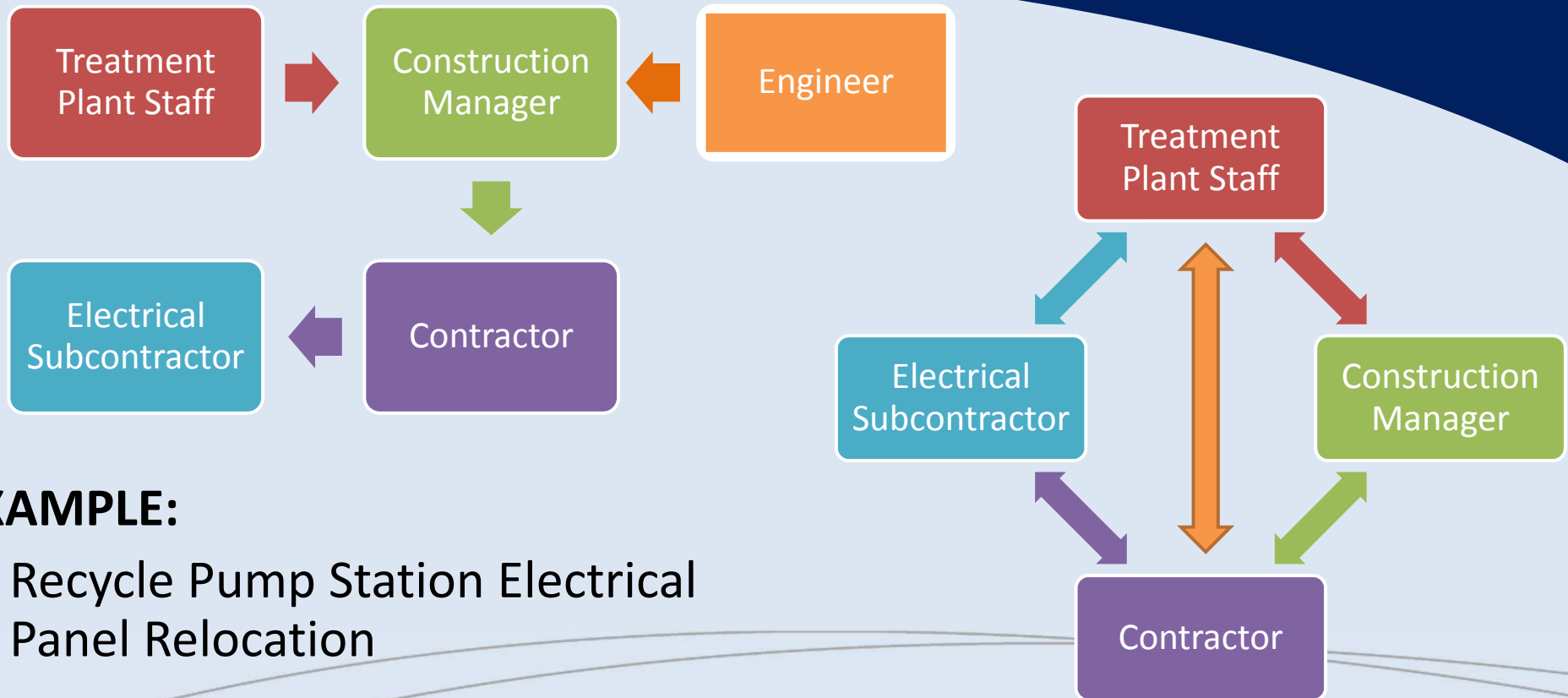


# Communication & Notification

- Notification regarding changes in:
  - SOP's
  - Outages
  - Alternative operation strategies
- Communication with Contractor
  - Opening direct communication pathways



# Indirect Communication Pathways



## EXAMPLE:

- Recycle Pump Station Electrical Panel Relocation



# Lock-Out Tag Out Coordination

- Complex WTP processes and hazards must be shut-down and hazardous energy controlled when contractors are working in an area.

## **EXAMPLE:**

- Draining Filter Inlet Channel to allow contractor to inspect



# Investment in Existing Equipment

- Invest in ongoing maintenance or allow soon to be replaced equipment to go unserviced?

## EXAMPLE:

- Filter Media Addition
- Pump and Motor Rebuilds





# Next Steps at the Plant

- Preparing for High Demand Season
- Plant shutdown to connect temporary raw water piping to existing raw water pipeline
- Completion of Phase A construction and transitioning to a conventional floc/sed treatment process.



# Questions?

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