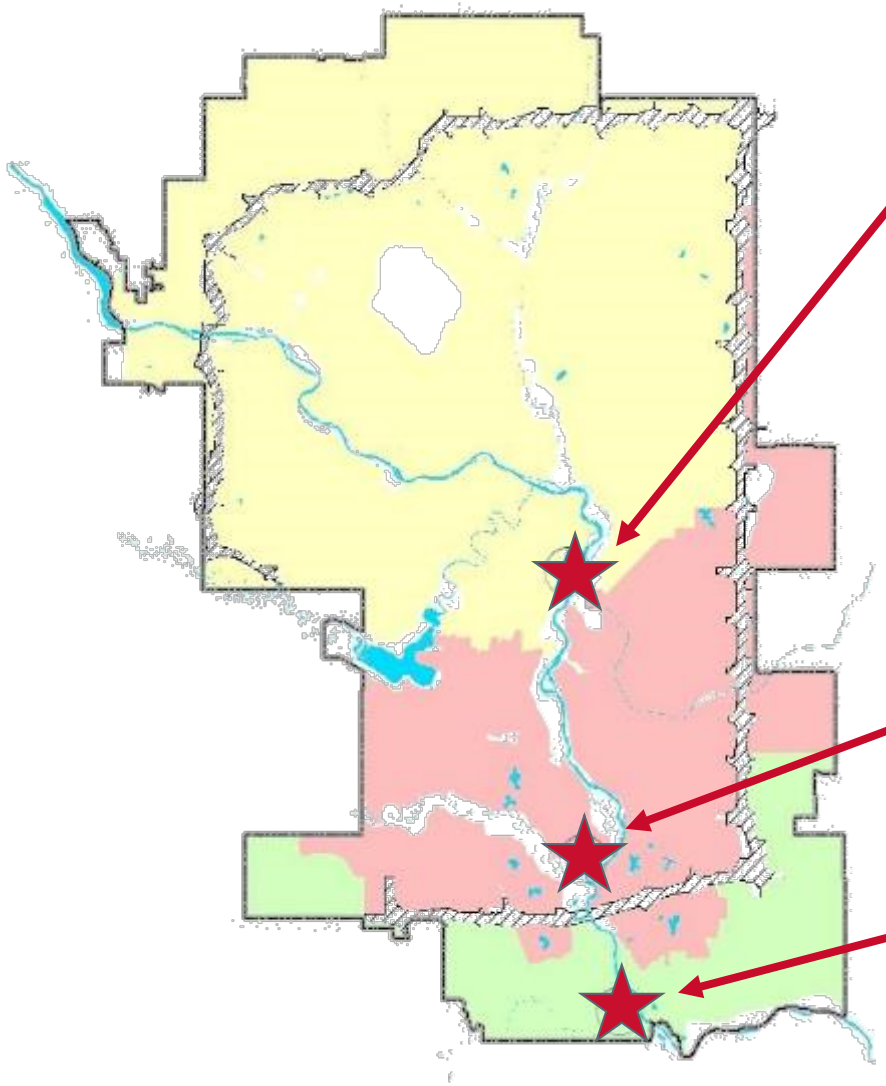
Bonnybrook Wastewater Treatment Plant

Plant D Expansion

Lal Amatya, PhD, P.Eng.
Senior Project Engineer
Process Infrastructure Delivery
City of Calgary

The City of Calgary
Wastewater Treatment



Bonnybrook WWTP

- Calgary's largest WWTP
- Serves North Calgary
- Regional Customers:
  - Airdrie
  - Cochrane
  - T'suu Tina
  - HWY 8 Corridor (Elbow Valley)
- Installed Capacity: 1,258,000 EP
- Serviced in 2023: 1,095,434 EP + FC Transfer 76,265 EP

Fish Creek WWTP

- Installed Capacity: 176,000 EP

Pine Creek WWTP

- Installed Capacity: 275,000 EP

Bonnybrook Wastewater Treatment Plant (History)

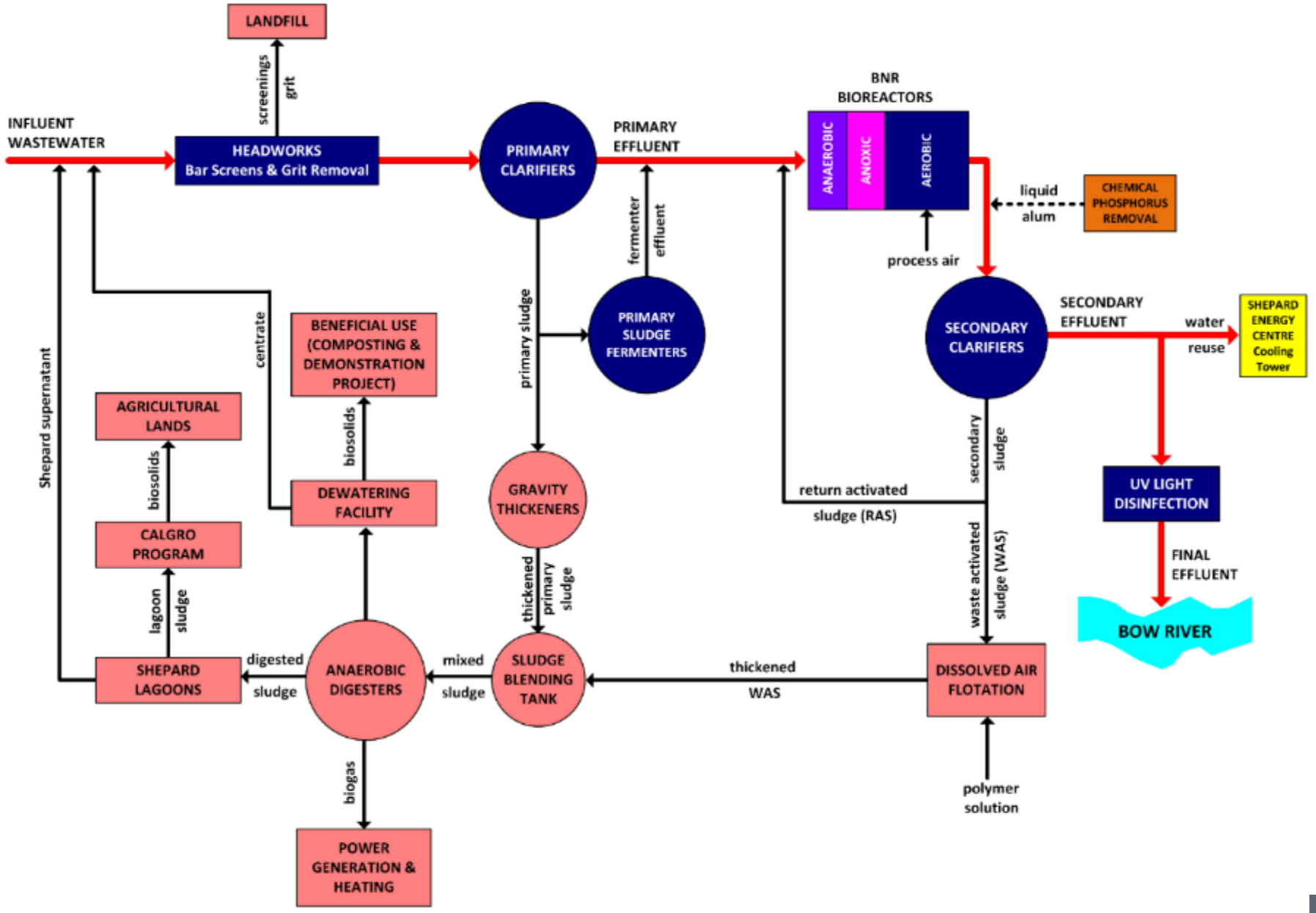
1932	Wastewater Treatment began in Calgary
1954–1958	Primary Treatment Expansion

Bonnybrook Wastewater Treatment Plant (History)

1932	Wastewater Treatment began in Calgary
1954–1958	Primary Treatment Expansion
1968-1971	Plant A (Secondary Treatment)
1982	Chem-P Removal
1982-1985	Plant B (Secondary Treatment)
1992–1994	Plant C (BNR)
1996	UV Light Disinfection

Next Expansion - Bonnybrook Plant D

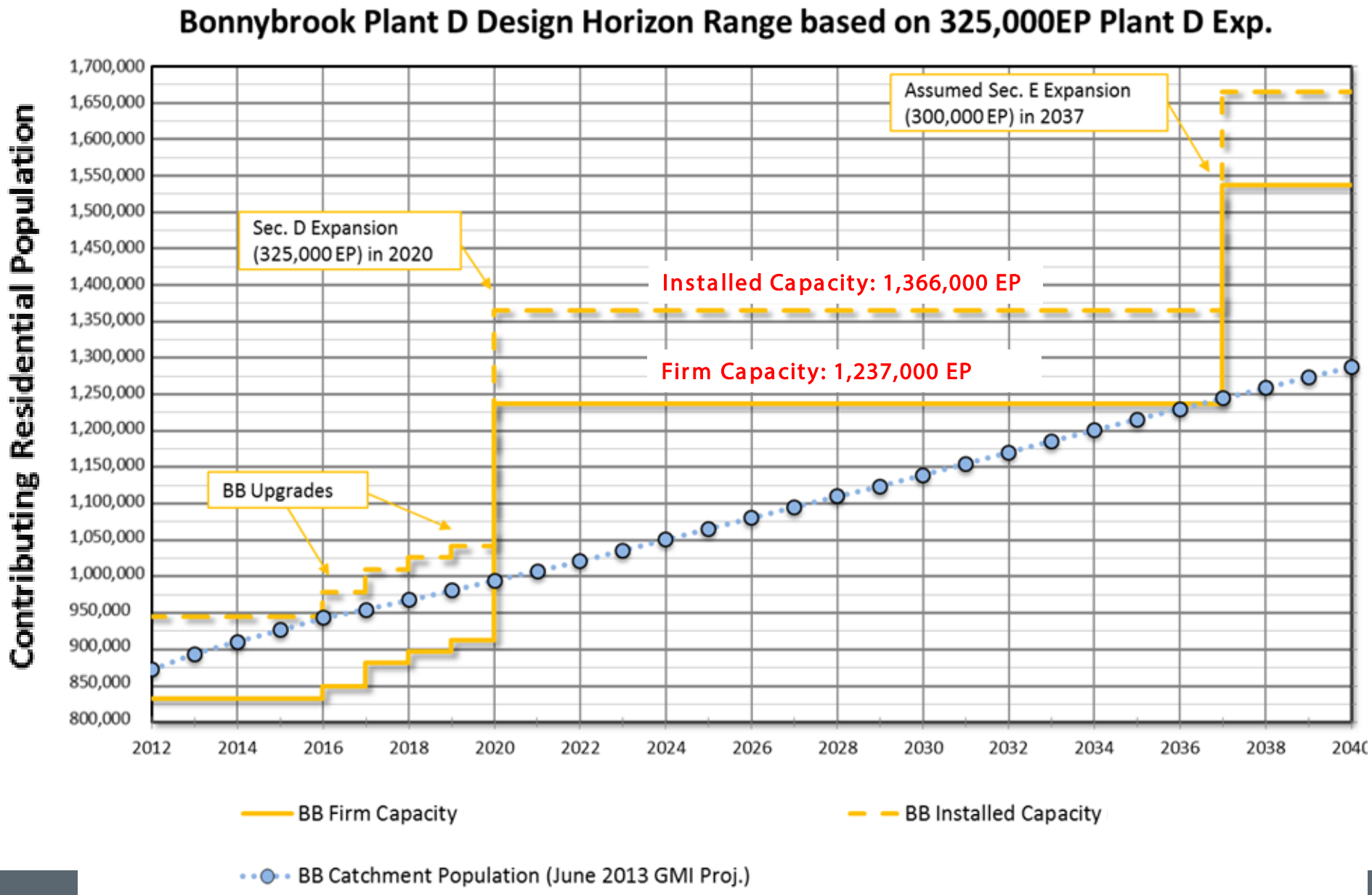
Bonnybrook Process Flow Diagram



Regulatory Requirements

Parameter	Current Effluent Limits for BBWWTP	Blended Effluent Limits for BBWWTP After Plant D
$CBOD_5$	15 mg/L	15 mg/L
TSS	20 mg/L	18 mg/L
Total Phosphorus (TP)	1 mg/L	0.9 mg/L
Total Nitrogen (TN)	n/a	15 mg/L - for Plant D only (Operating Objective)
Ammonia-Nitrogen (Oct 1 to Jun 30)	10 mg/L	10 mg/L
Ammonia-Nitrogen (Jul 1 to Sept 30)	5 mg/L	5 mg/L
E. coli or Fecal Coliform Counts	200 MPN or CFU /100mL	200 MPN or CFU /100mL

Bonnybrook Treatment Capacity



Bonnybrook Plant D Expansion

Project Drivers

Goal: Maintain exceptional wastewater treatment services for our citizens while protecting the Bow River by operating continuously and meeting all regulatory standards

Schedule: Expand treatment capacity by 2020

Cost: Reduce overall cost; meet cash flow constraints

Total recent & planned investment in Bonnybrook WWTP is in the order of $1.1B.

2013 Flood in Calgary

2013 Flood – Impacts on Bonnybrook

- $13.5 M in damages from 2013 Flood
- Major Impacts:
  - Process infrastructure (tankage/ channels) surcharged
  - Flooded tunnel systems
  - Lost electricity to the entire site
  - UV facility and equipment flooded
  - Headworks flooded / bypassing
  - Lost treatment capabilities ~ 15 days to recover process
  - Solids deposition throughout facility
  - Extensive post flood clean up was required

BB Plant D Expansion - Project Objectives

- Increase the capacity of Bonnybrook by 325,000 equivalent population (EP)
- Increase treatment capacity to service Calgary's population growth over an approx. 15-year horizon (until 2037)
- Provide flood protection for the plant
- Increase effluent quality

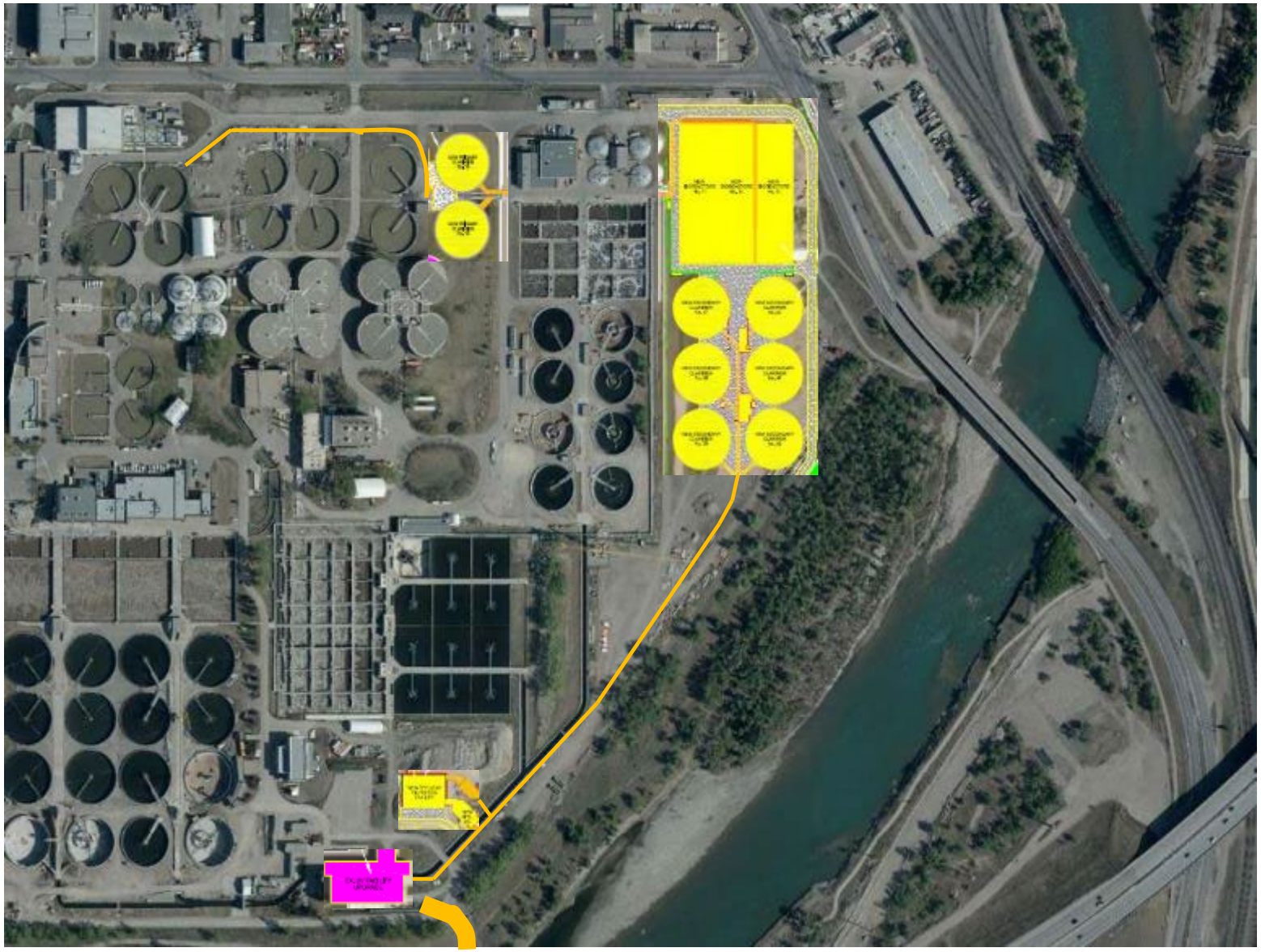
Engineering Design

The Stantec Bonnybrook Plant D Expansion Team

CH2M HILL
AECOM
WPC SOLUTIONS

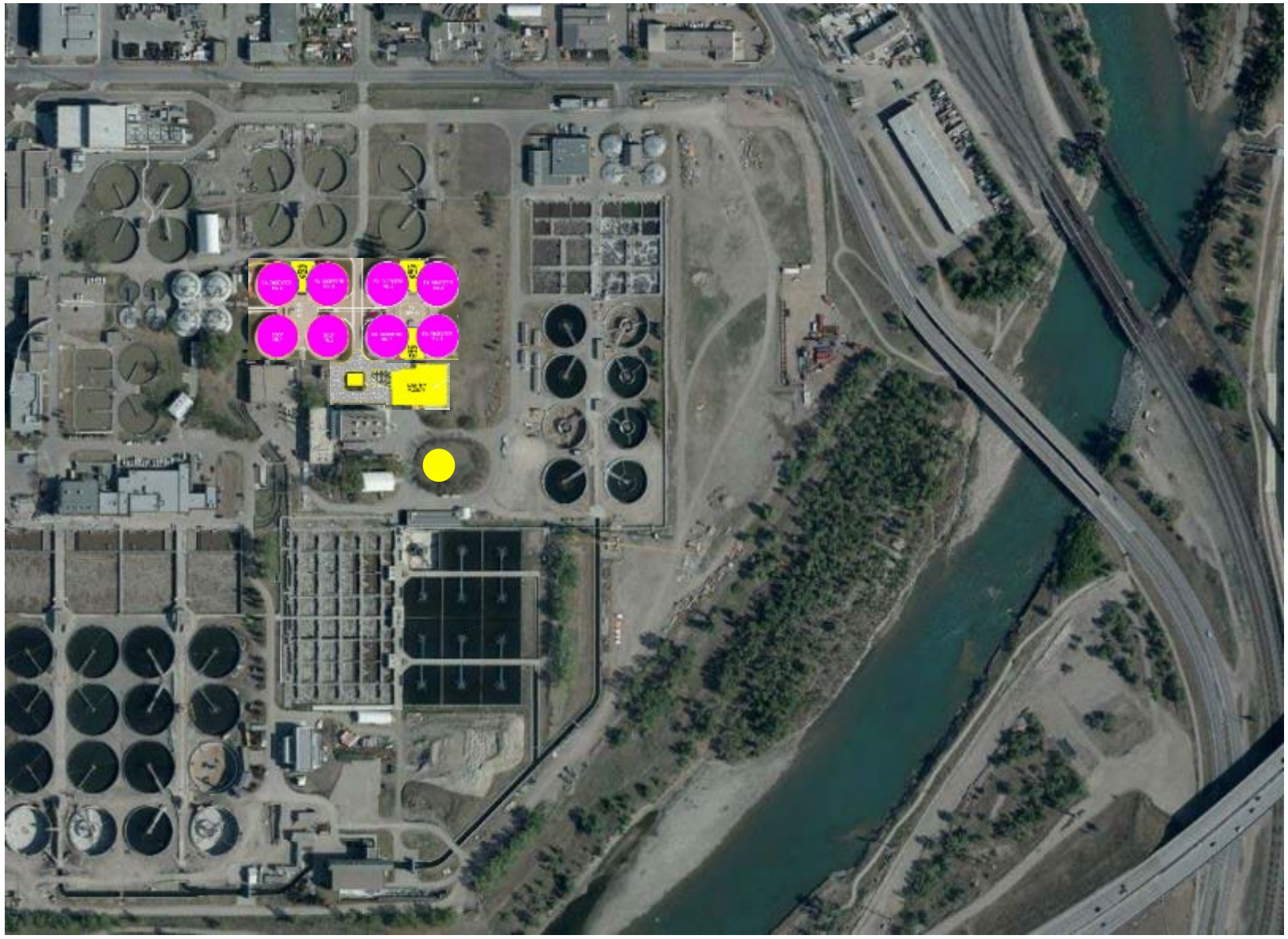
- Conceptual Design: 2014
- Preliminary Design: 2015
- Detailed Design: 2018

Project Scope - Liquid Stream



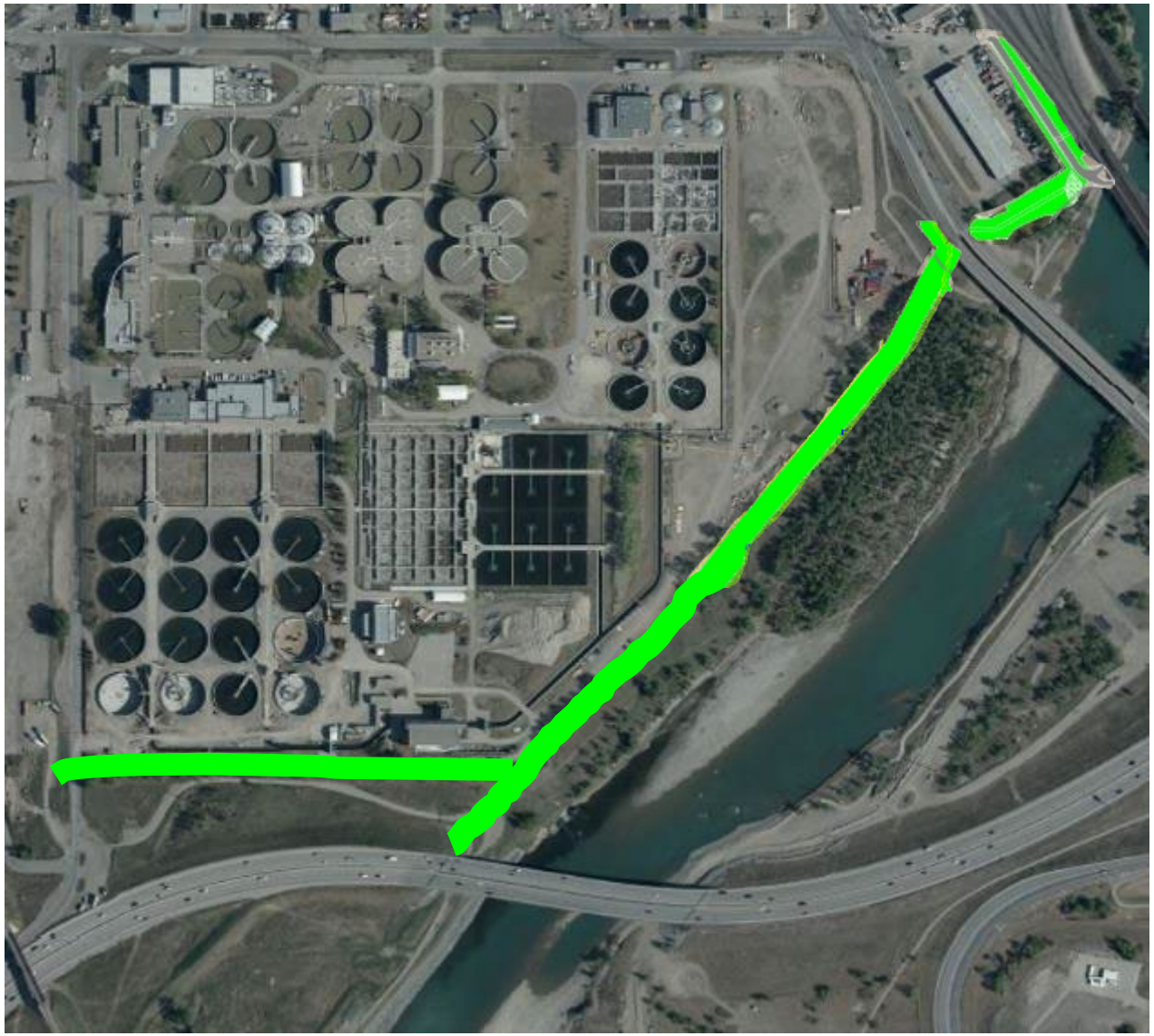
- Primary Treatment
- Secondary Treatment
- Effluent Filtration
- UV Disinfection
- Effluent Outfall (not shown here)

Project Scope – Solid Stream



- Upgrades to Existing Digesters
- Low Pressure Gas Holder and Piping
- Waste Gas Burners
- Thermal Hydrolysis Process (THP)

Project Scope – Flood Protection



- Flood Berm
- New Effluent Outfall (not shown)
- Stormwater modifications
- Modifications to the existing plant bypass conduit

Construction

- Construction Management At Risk (CMAR) GRAHAM
- Major equipment was pre-selected during Preliminary Design
- Scope of project broken out into work packages
- Construction started in 2016 with the Digester Upgrades (critical path - can only upgrade 1 digester/ year)
- Project Cost: $490M Incurred to date
- Total Projected Cost: $750M

Project Execution Phasing

Construction Phase	Phase 1	Interim	Phase 2
Capacity Increase	216,667 EP	-	108,333 EP
Schedule	2016 - 2021	2021 - 2024	2024 - 2028
Scope	Primary Treatment Secondary Treatment Ph 1 UV Facility Upgrades Outfall Flood Berm Digester Upgrades Ph 1 LPGH	Digester Upgrades Ph 2 Waste Gas Burners	Secondary Treatment Ph2 Effluent Filtration THP Facility (on Hold)

Construction – Phase 1

Construction Phase	Phase 1	Interim	Phase 2
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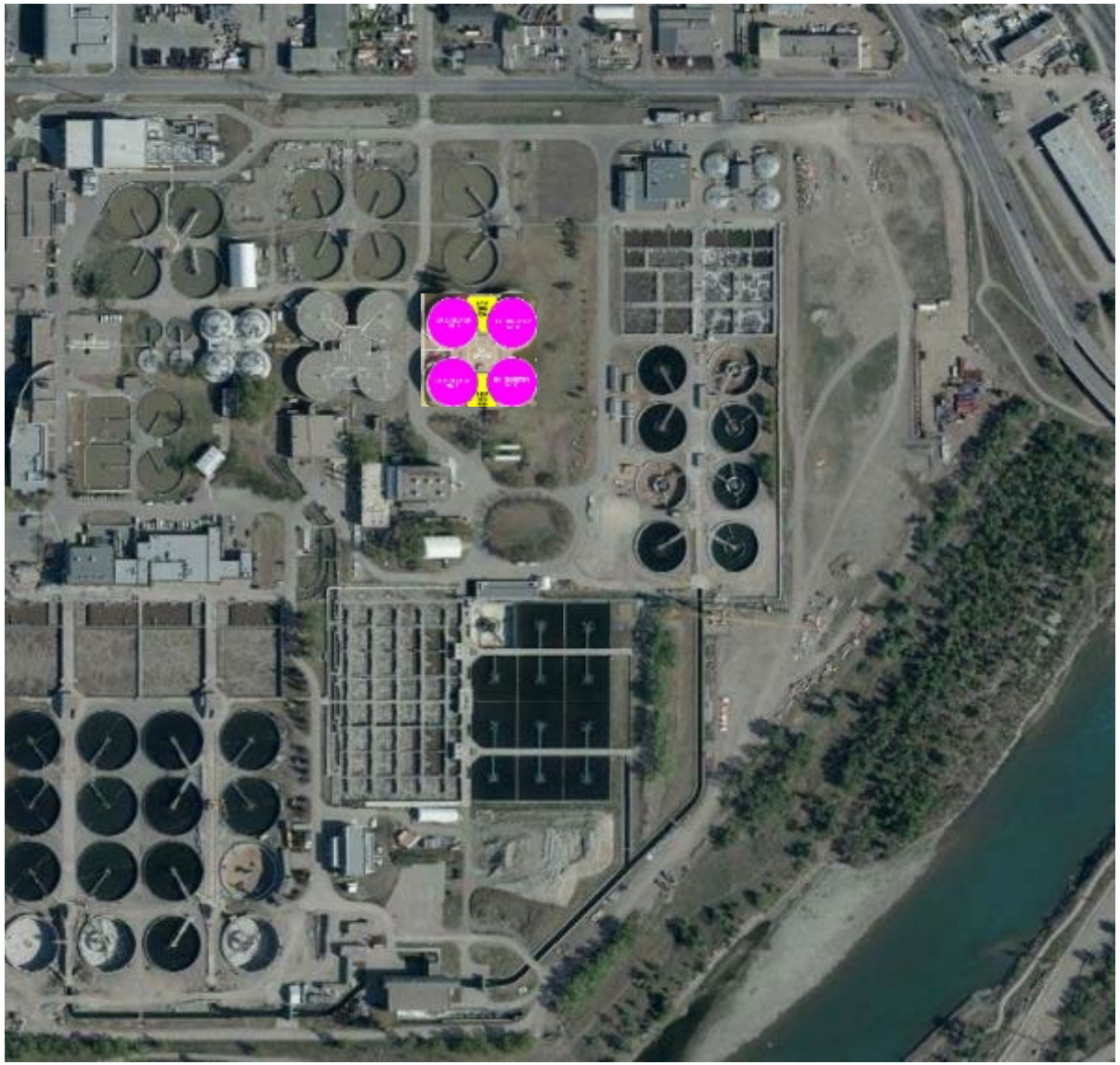
Digester Upgrades Phase 1



Scope: Upgrading 4 existing digesters with mechanical mixing and

2 new pumphouse extensions

Construction Cost: $38M

Construction Schedule:

2016 – 2021 (1 digester/year)

Digester Upgrades Phase 1

Digester Upgrades Phase 1

Low Pressure Gas Holder

Scope: New low pressure gas holder and biogas piping

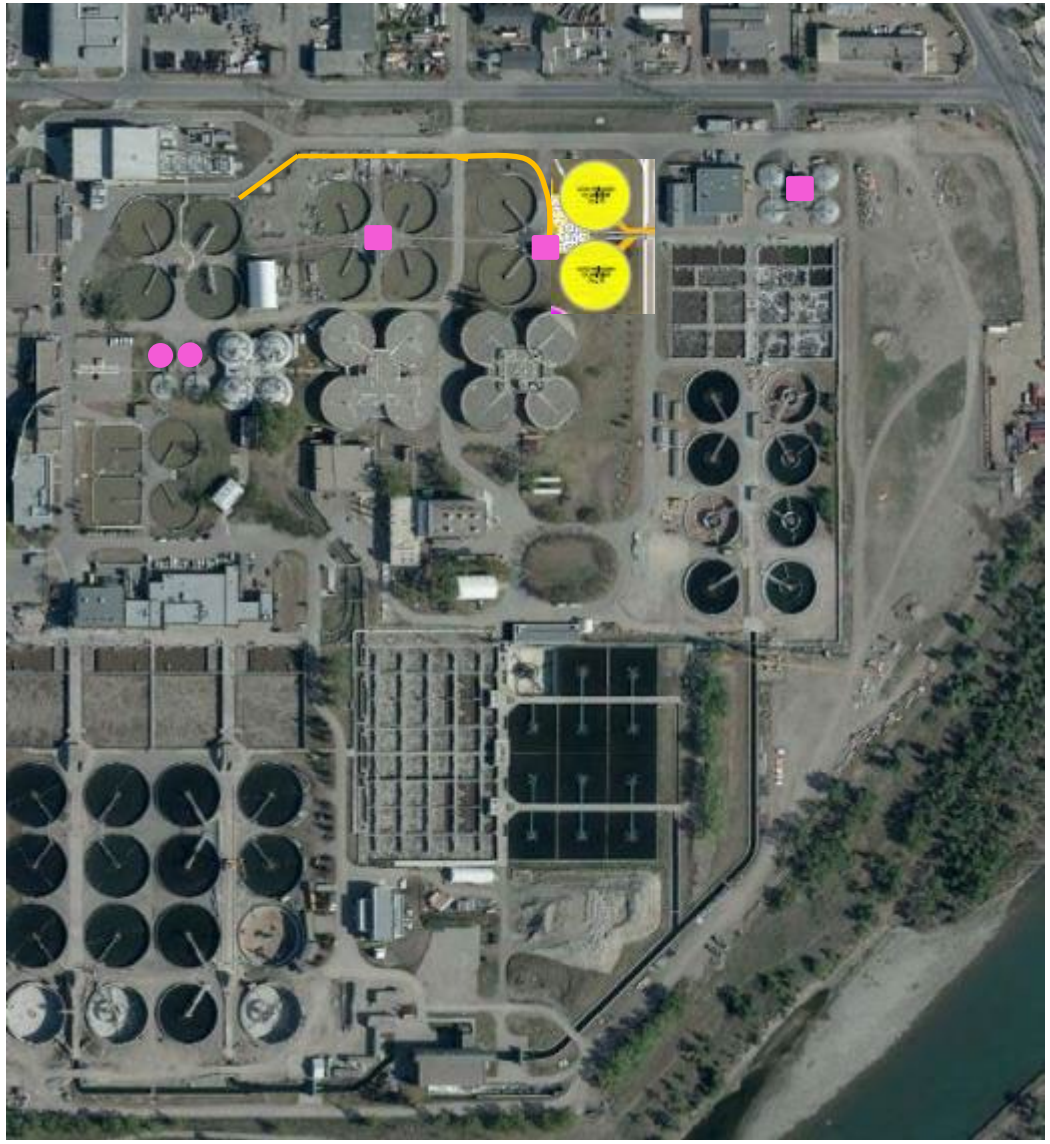
Construction Cost: $11M

Construction Schedule: 2019 – 2021

Commissioned: January 2021

Low Pressure Gas Holder

Primary Treatment



Scope:

- 2 new primary clarifiers (45.5m dia)
- Replaced 8 primary sludge (PS) pumps
- new influent channel
- effluent channel widening
- covers on the PS gravity thickeners

Construction Cost: $32M

Construction Schedule: 2018 – 2020

Commissioned: March 2021

Primary Treatment

Primary Treatment

Secondary Treatment Phase 1

Scope:

- 2 new bioreactors
- 4 new secondary clarifiers
- new tunnel and 2 pumphouses
- new effluent channel
- utility tie-ins

Construction Cost: $167M

Construction Schedule: 2018 – 2021

Commissioned: Sept 2021

Secondary Treatment Phase 1

Secondary Treatment Phase 1

Secondary Treatment Phase 1

Secondary Treatment Phase 1

Hyperboloid Mixers (Invent)
in non-aerated zones of Bioreactors

Multilayer Energy Dissipating Inlet Column (MEDIC)
in Secondary Clarifiers

Secondary Treatment Phase 1

UV Disinfection

Scope: Upgrade with new DURON UV Light Disinfection system, new control system

Construction Cost: $11M

Construction Schedule:

2018 – 2021 in 3 phases.

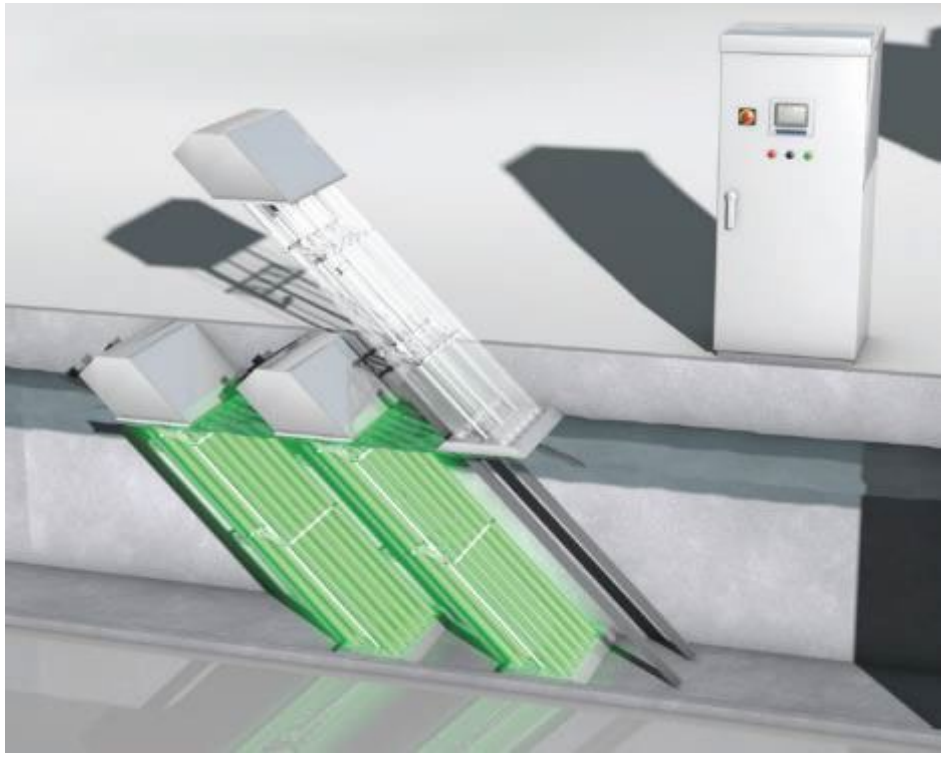
Commissioned: *Phase 1*: April 2019

Phase 2: April 2020

Phase 3: April 2021

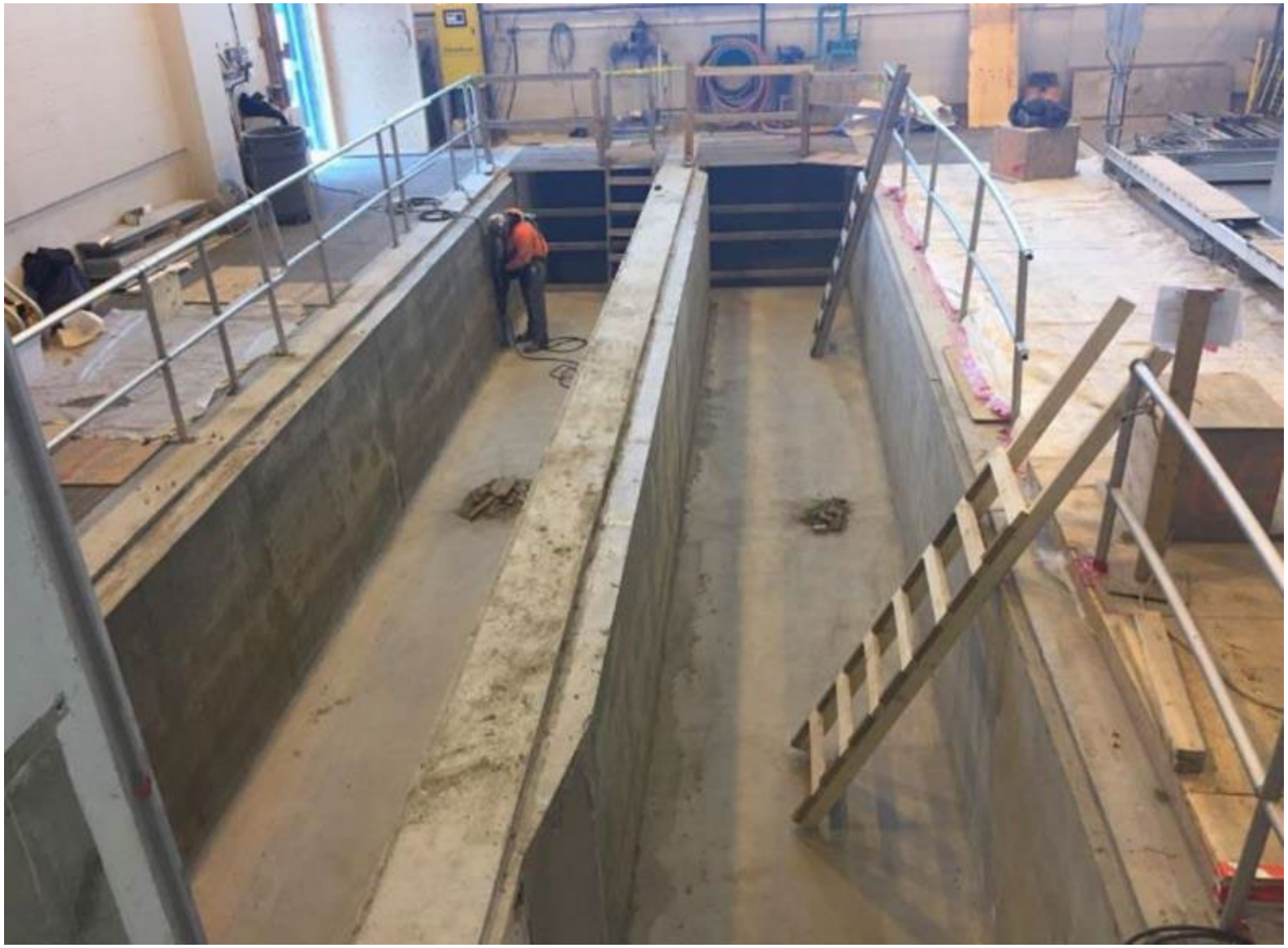
UV Disinfection

Old Lamp Bank: 13,824 UV Lamps (65W ea.)



New Lamp Bank: 1,008 Duron Lamps (600W ea.)

UV Disinfection



UV Disinfection

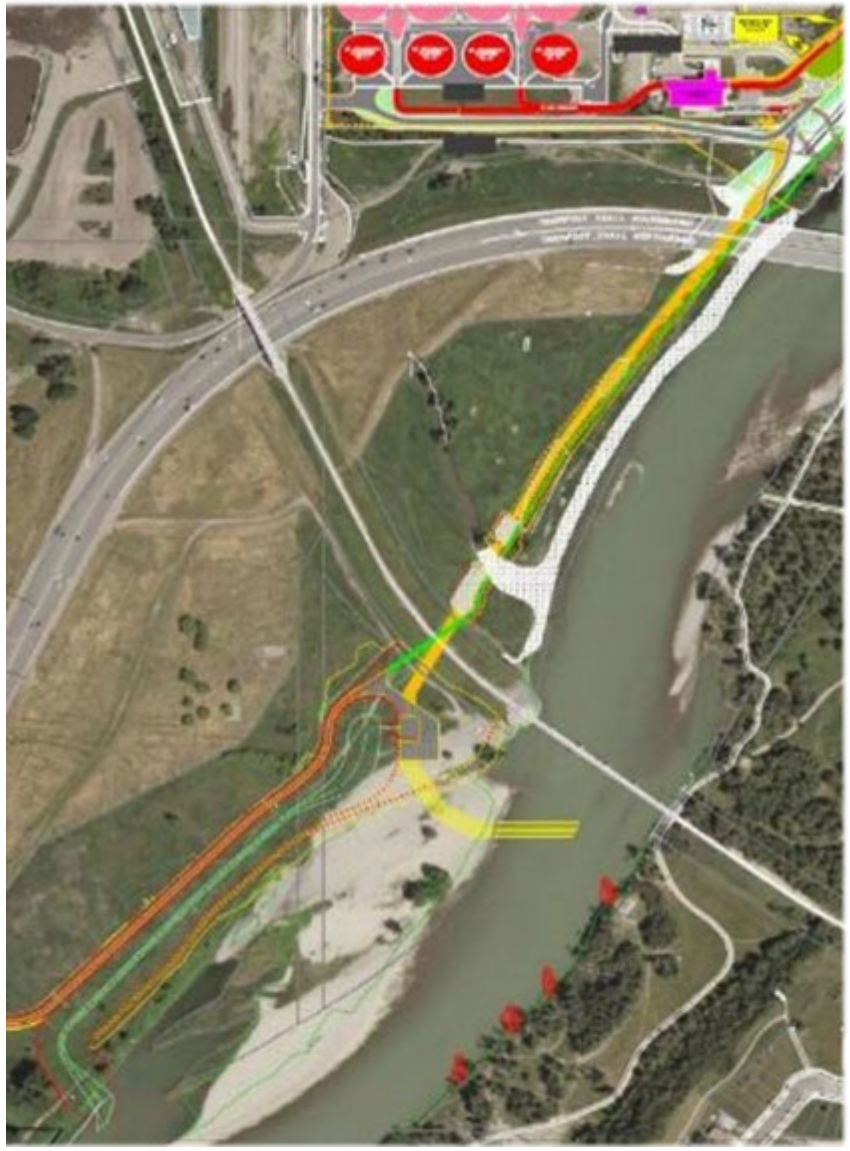
UV Disinfection

Old UV Disinfection System

UV Disinfection

New UV Disinfection System

Outfall



Scope: Two final effluent conduits from BB to new outfall location, new stormwater conduit from BB to the new outfall location, instream diffusers, emergency overflow channel, outfall control structure, multi-use pathway

Construction Cost: $72M

Construction Schedule: 2018 – 2021

Commissioned: April 2021

Outfall


Old Bank Outfall
Two Final Effluent Conduits and a Storm Conduit
Outfall Control Structure
Emergency Overflow Channel
Instream Diffusers

Outfall

Final Effluent Conduits

Outfall

Diffuser Pipes

Outfall

Diffuser Pipes

Outfall

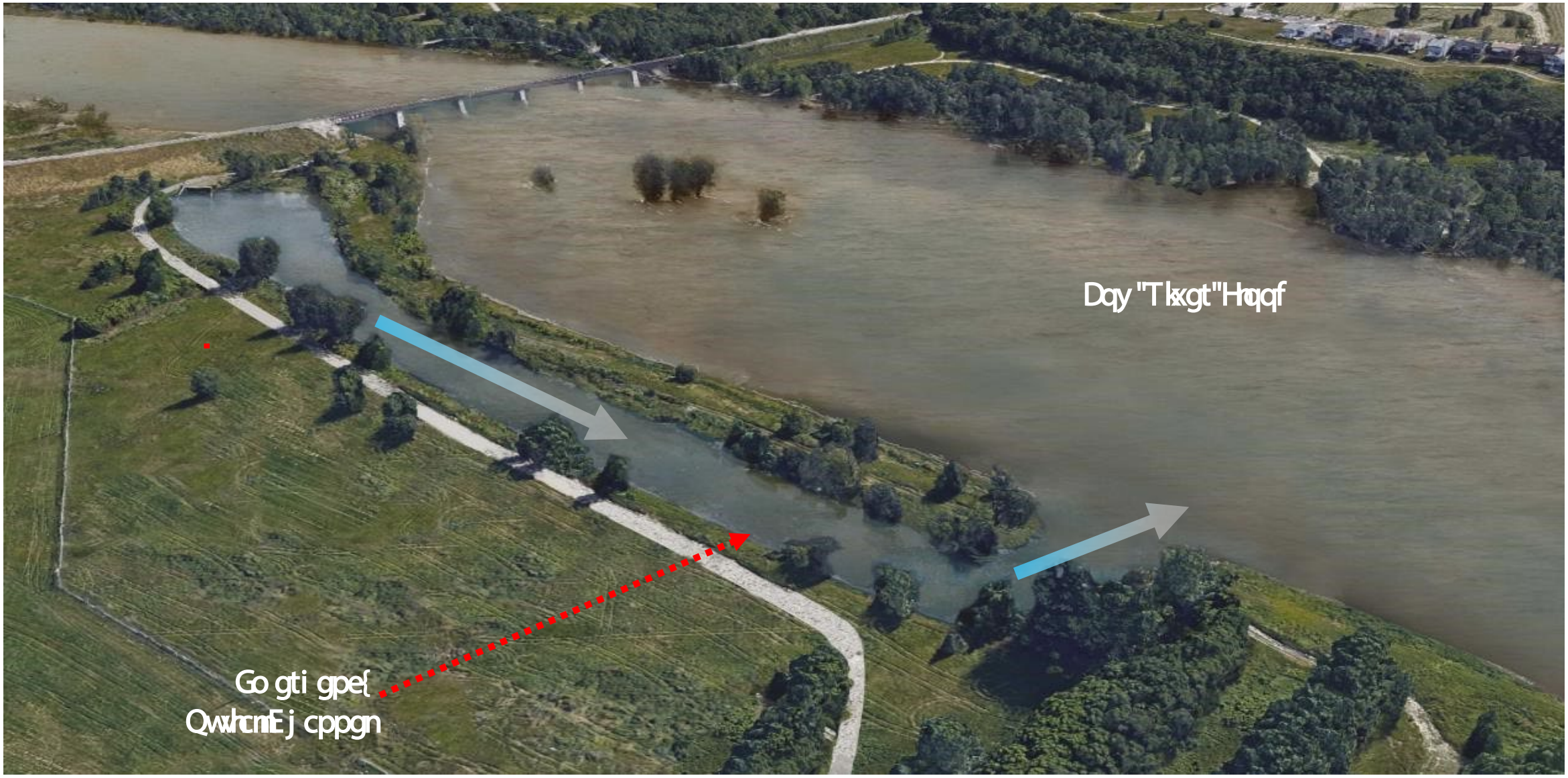
Emergency Overflow Channel

Outfall

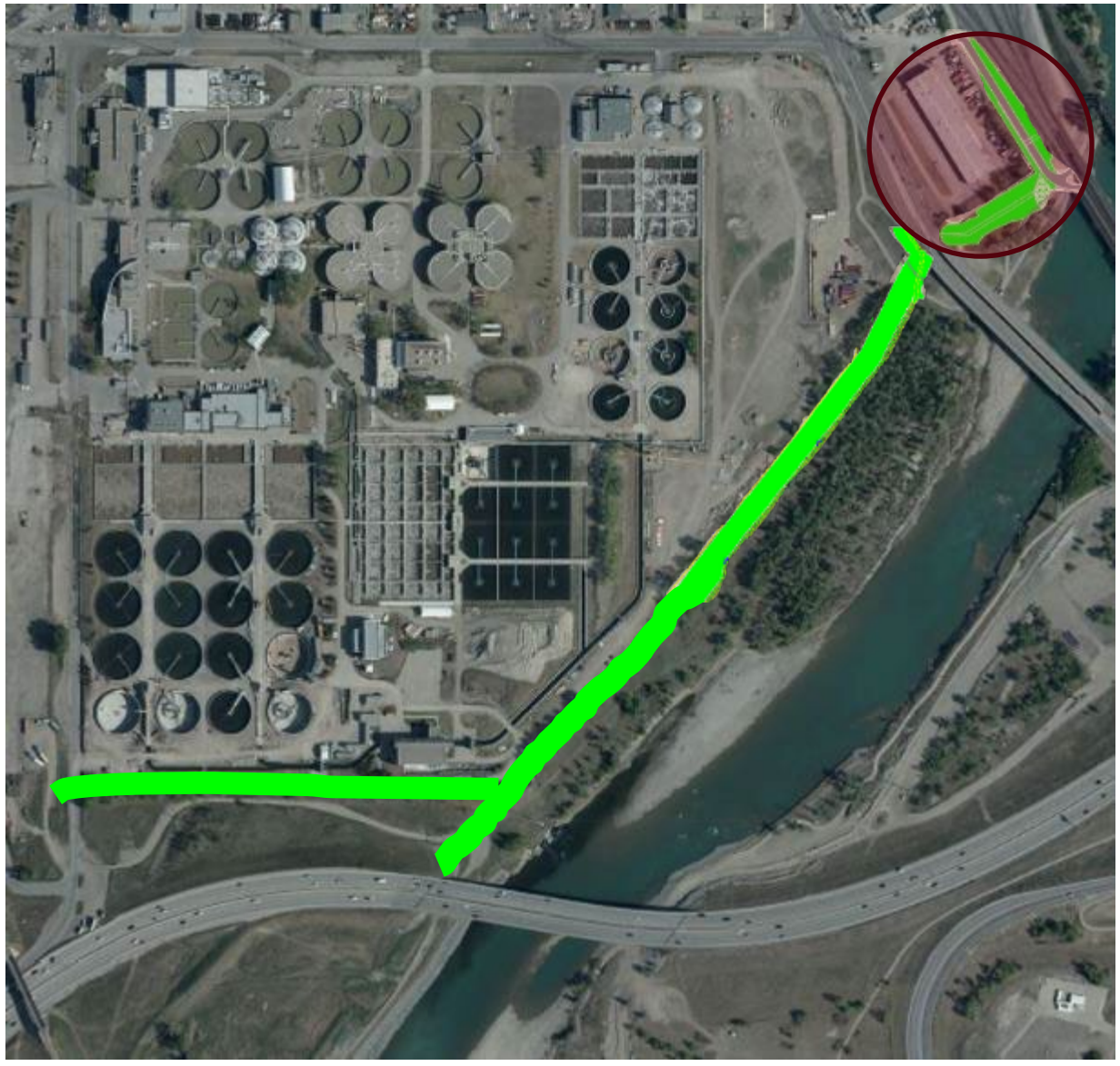
Outfall

Outfall

(Effluent diversion to emergency spillway channel scenario)



Flood Protection



Scope: Flood protection berm, stormwater upgrades, groundwater dewatering pipe, plant bypass modifications

Construction Cost: $11M

Construction Schedule: 2016– ongoing

Flood Protection

Flood Protection

Construction – Interim Phase

Construction Phase	Phase 1	Interim	Phase 2
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Waste Gas Burners

Scope: New Waste Gas Burners (WGB) building with 3 enclosed burners and decommissioning of old flare stacks

Construction Cost: $19M

Schedule: 2023 – Commissioned in 2024

Waste Gas Burners (Old)

Waste Gas Burners (New)

Digester Upgrades Phase 2

Scope: Upgrading 2 existing digesters with mechanical mixing and building 1 new pumphouse extensions

Construction Cost: $25M

Schedule: 2021 – 2024

Digester Upgrades Phase 2

Construction – Phase 2

Construction Phase	Phase 1	Interim	Phase 2
Capacity Increase	216,667 EP	-	108,333 EP
Schedule	2016 - 2021	2021 - 2024	2024 - 2028
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Secondary Treatment Phase 2

Scope:

- 1 new bioreactors
- 2 new secondary clarifiers

Cost: $70M

Construction Started: March 2024

Commissioning: mid 2026

Effluent Filtration

Scope:

- feed conduit
- effluent filtration building
- treated effluent pump station

Construction Cost: $45M

Construction Schedule: 2025 -2026

Calgary

Thank you

Questions?