



# Ship Canal Water Quality Project (SCWQP)

## Presentation to American Concrete Institute (ACI) Washington Chapter

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**SPU SCWQP Design Manager**

**March 18, 2021**



# Eleanor Jackson, P.E.

## Background:

- SPU SCWQP Design Manager since 2016
- 35 years of professional engineering experience
- 30+ years of wastewater and stormwater design experience
- Bachelor of Science in Civil Engineering from University of Washington

# Agenda

- Introduction
- Program Background
- Program Overview
- Projects
  - Ballard Early Work – Construction Complete
  - Storage Tunnel – In Construction
  - Pump Station – In Design
  - Ballard Conveyance
  - Wallingford Conveyance



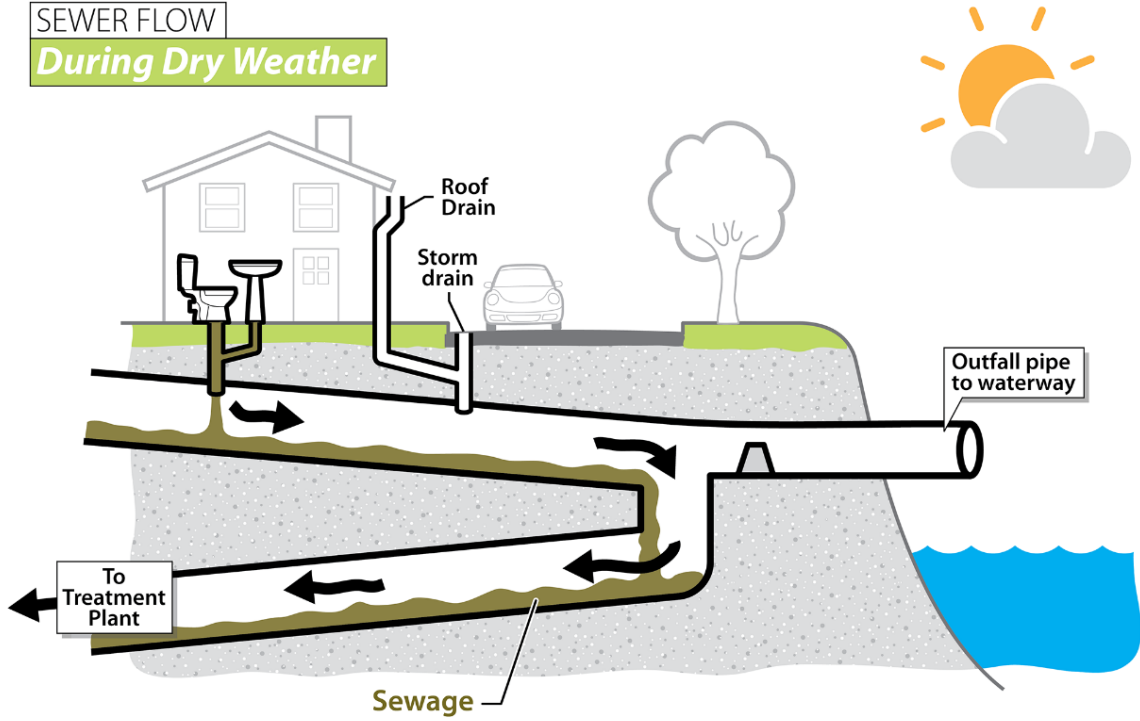
# Problem Statement

Ship Canal Water Quality Project is addressing water quality for the combined sewer overflows for 6 outfalls. 6 outfalls currently overflow approximately 144 times on average per year.

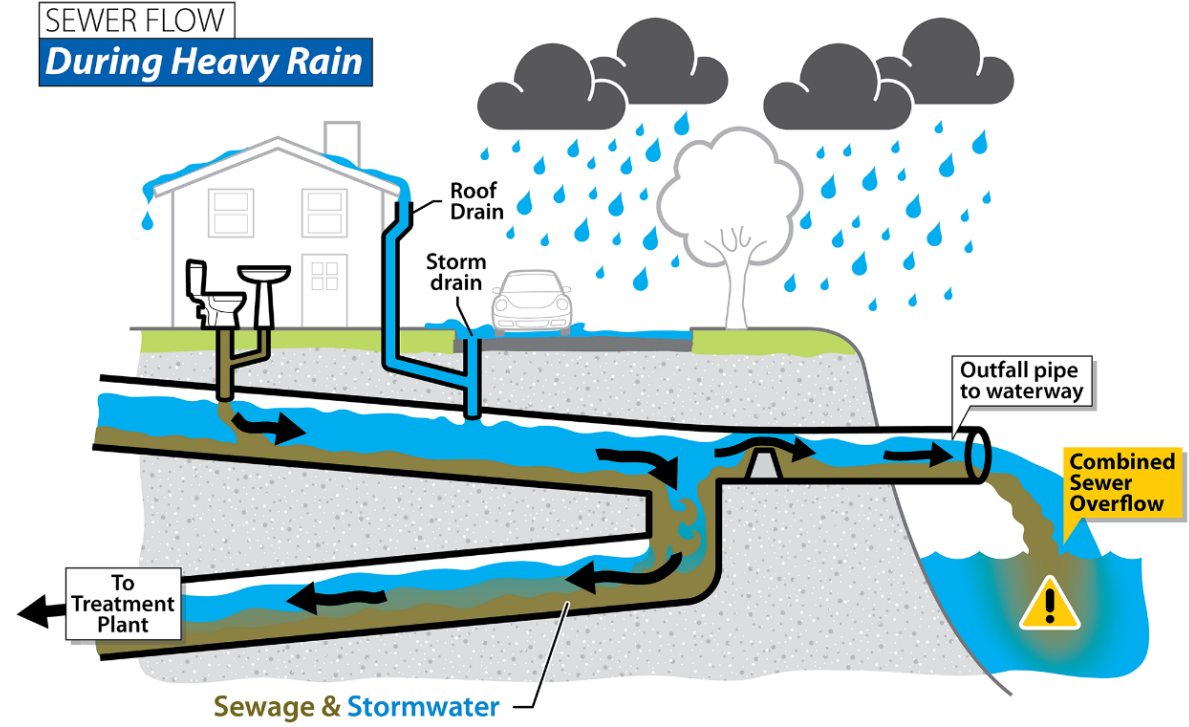
What is a combined sewer overflow (CSO)?

# Combined Sewer Overflow

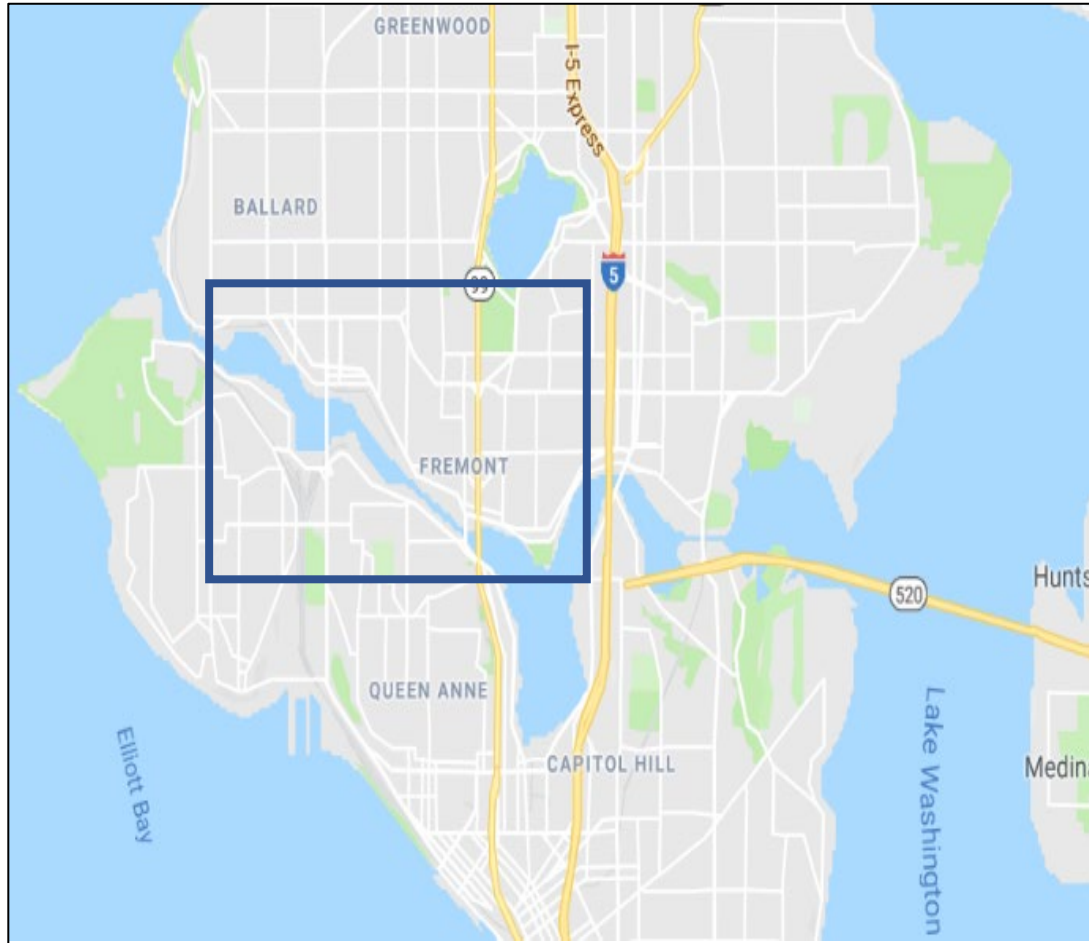
SEWER FLOW  
During Dry Weather



SEWER FLOW  
During Heavy Rain



# Ship Canal Water Quality Project



## Consent decree

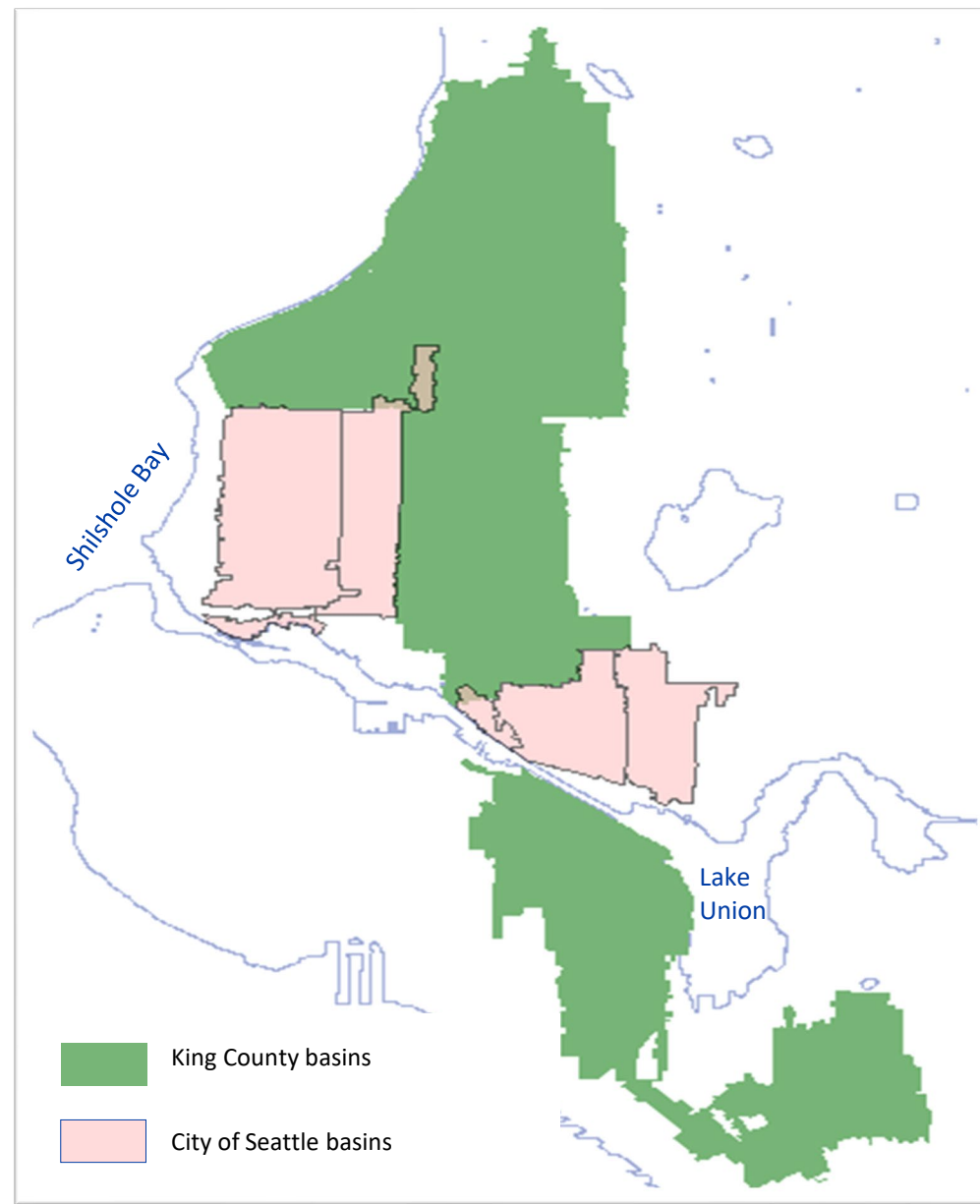
- With US Department of Justice, US Environmental Protection Agency, and WA Department of Ecology
- Less than 1 combined sewer overflow per outfall per year on a 20-year moving average
- King County and City of Seattle work together

## Joint Project: King County & City of Seattle

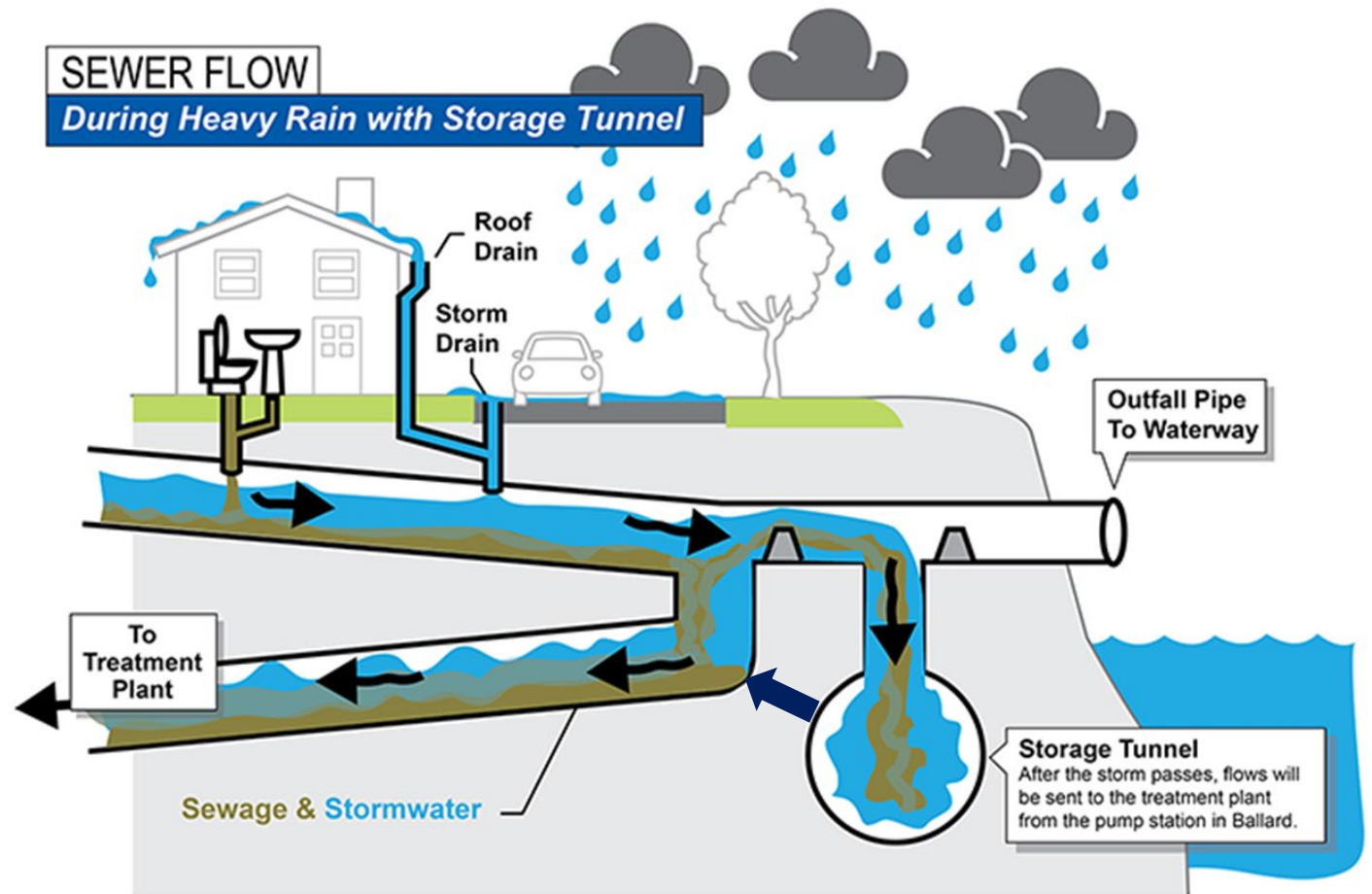
- 6 Outfalls: 2 KC, 4 Seattle

**SCWQP will improve water quality by reducing average number of combined sewer overflows to approximately 4.15 times per year for the 6 outfalls.**

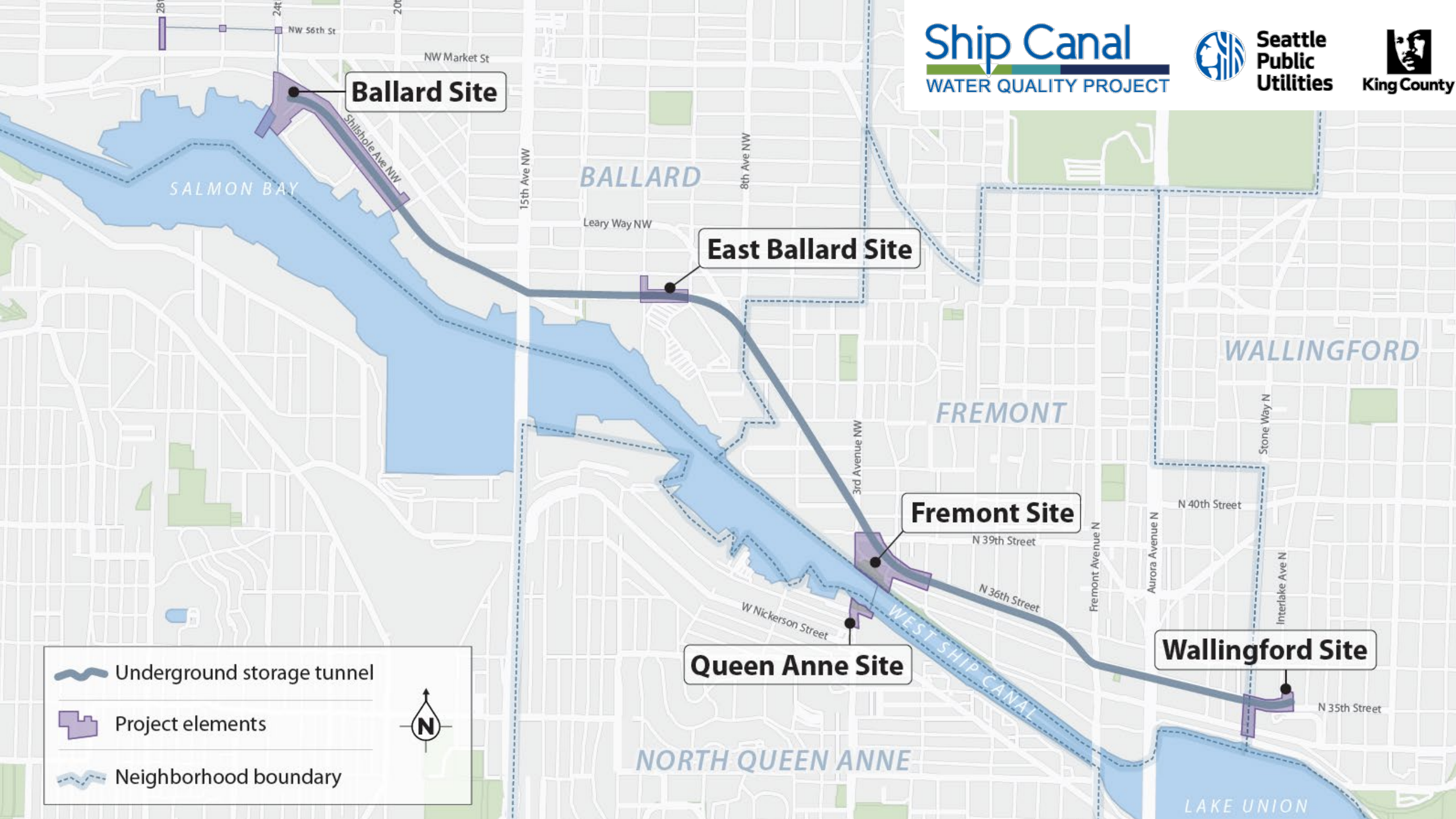
# SCWQP Combined Sewer Basins



# How can we address CSO for SCWQP?







**Ballard Site**

**East Ballard Site**

**Fremont Site**

**Queen Anne Site**

**Wallingford Site**

Underground storage tunnel

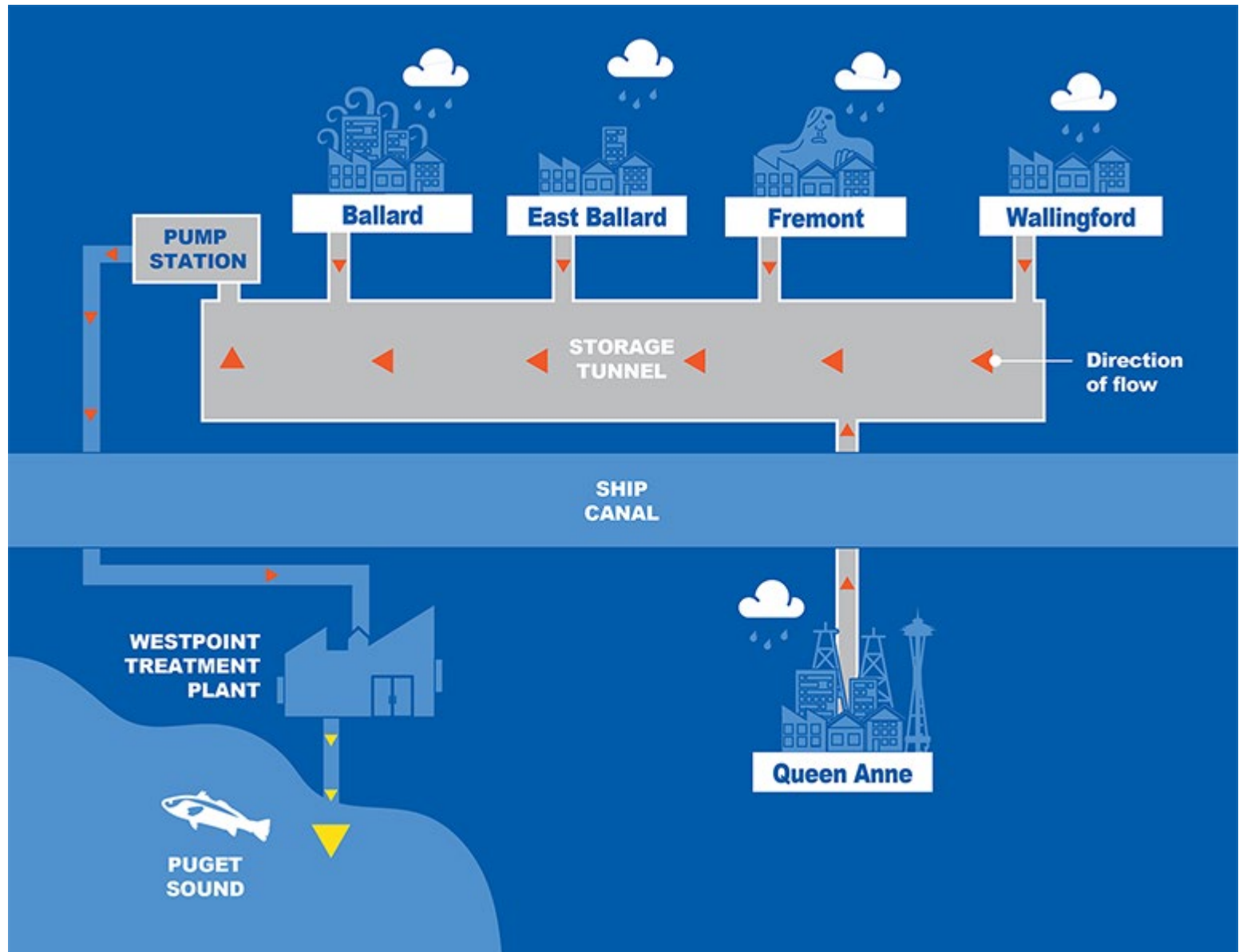
Project elements

Neighborhood boundary



# SCWQP Components

- Neighborhood Conveyances
- Drop Shafts
- Microtunnel
- Storage Tunnel
- Pump Station



# Early Challenges that Became Opportunities During Planning and Design

- SPU and KC working together in partnership to deliver project
- Invested in updating modeling tool to identify size of problem and assist in informing design solutions that incorporate future conditions
- Property Acquisition Early
- SPU establishing dedicated SCWQP Division
- Program creating project control tools to monitor progress and forecast trends

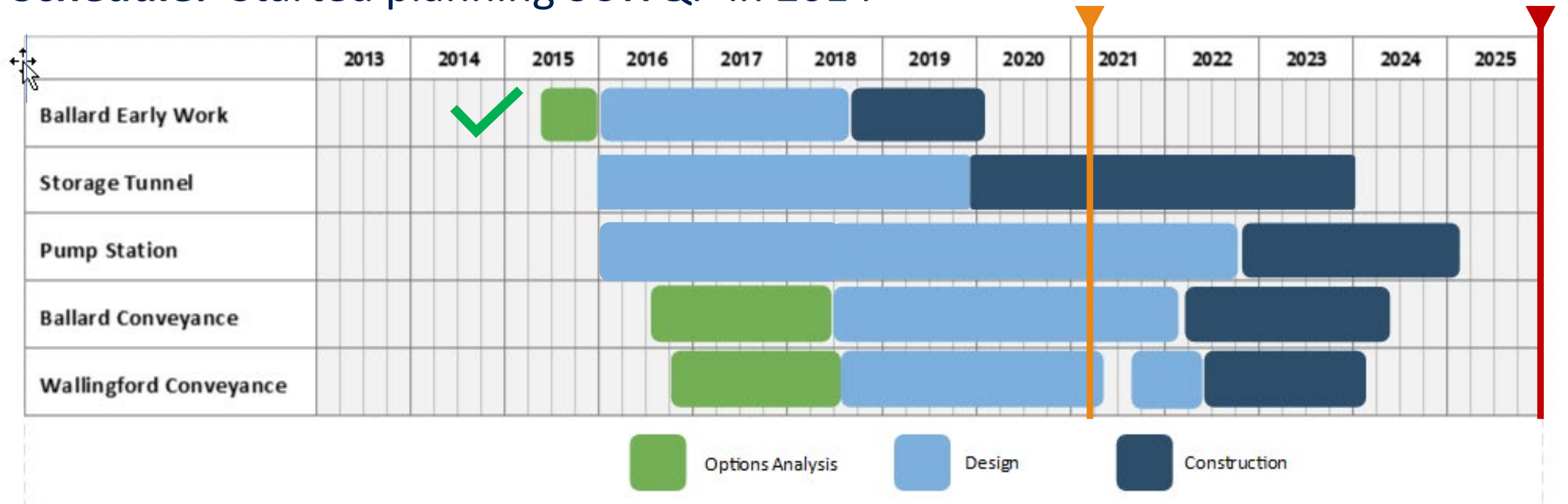
# Program Complexities

- Site constraints in urban environments
- Design for future operation including climate change
- Hydraulic design
- Permitting
- Program Duration

# Cost and Schedule Summary

**Overall Cost:** \$570M at a 65% confidence

**Schedule:** Started planning SCWQP in 2014





# Ballard Early Works Project - Construction Complete

## Site Preparation for Tunnel Launch Site

- Utilities: water, power, and sewer
- Pier
- Outfall
- Site Remediation





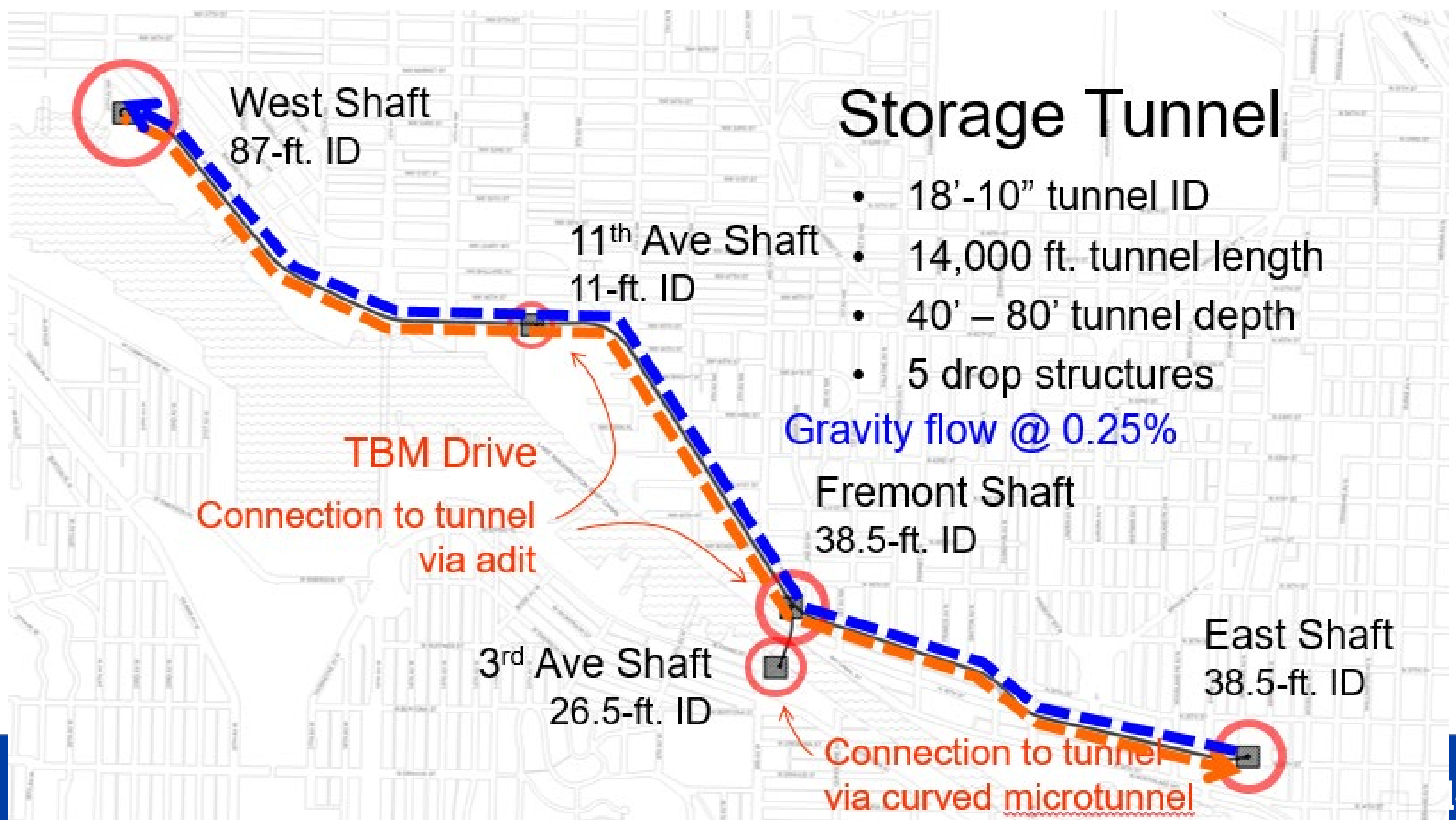






# Storage Tunnel Project - In Construction

- 18'10" Storage Tunnel
- 8' Microtunnel
- 4 Storage Tunnel Drop Shafts and 1 Microtunnel Drop Shaft
- Conveyance: Fremont, 11<sup>th</sup> Ave NW, and 3<sup>rd</sup> Ave W



# Storage Tunnel

- 18'-10" tunnel ID
- 14,000 ft. tunnel length
- 40' – 80' tunnel depth
- 5 drop structures

Gravity flow @ 0.25%

TBM Drive  
Connection to tunnel  
via adit

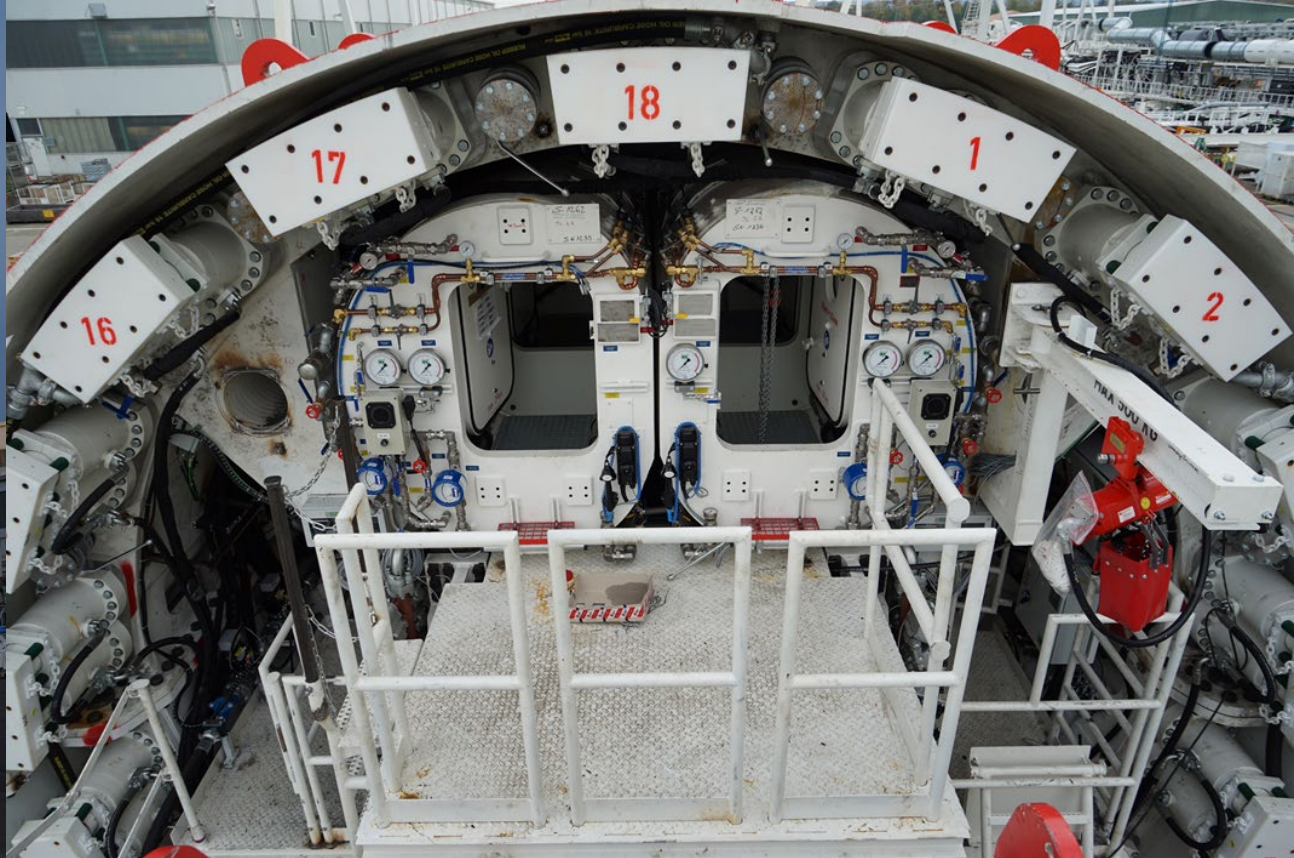
Fremont Shaft  
38.5-ft. ID

3<sup>rd</sup> Ave Shaft  
26.5-ft. ID

East Shaft  
38.5-ft. ID

Connection to tunnel  
via curved microtunnel

# Storage Tunnel - TBM



# Storage Tunnel - TBM



# Storage Tunnel - West Shaft Site



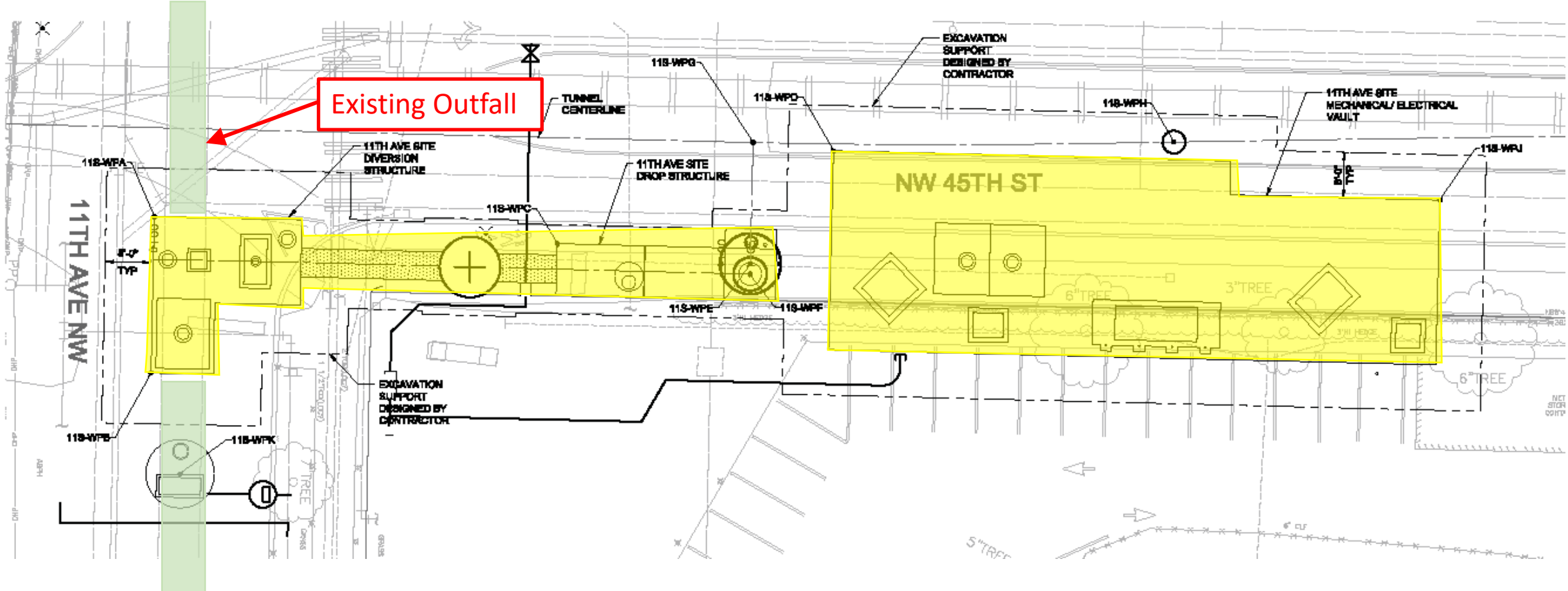
# 11<sup>th</sup> Ave NW Site



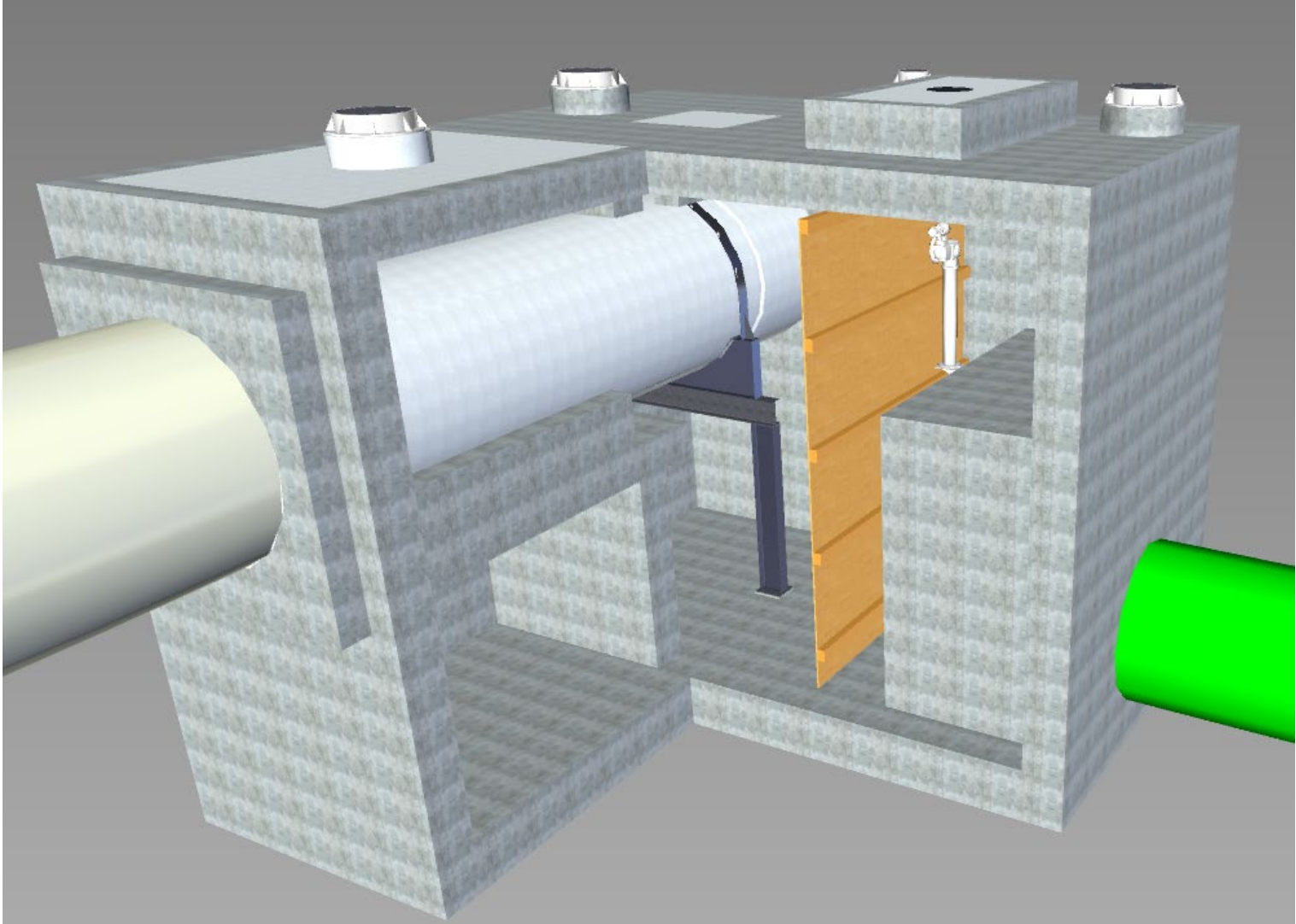
Google



# 11th Ave NW Site



# 11<sup>th</sup> Ave NW Site



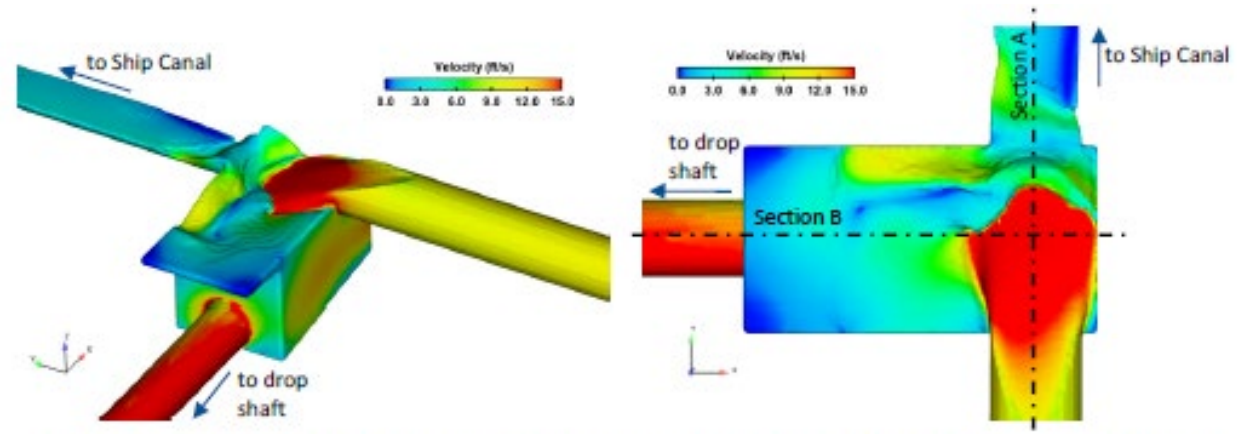
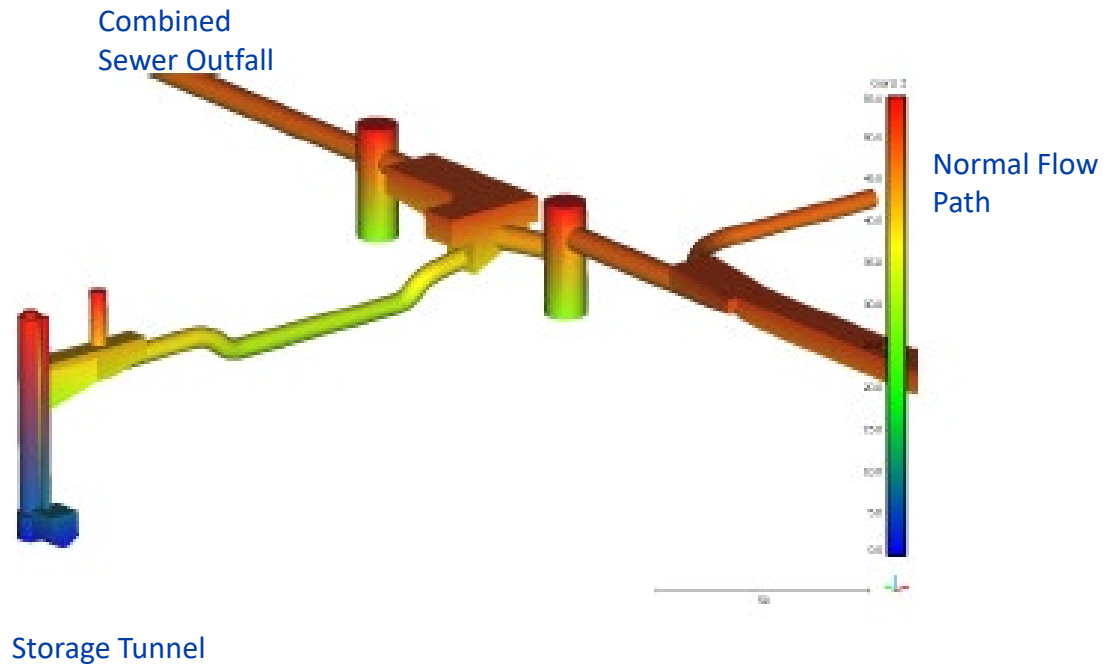
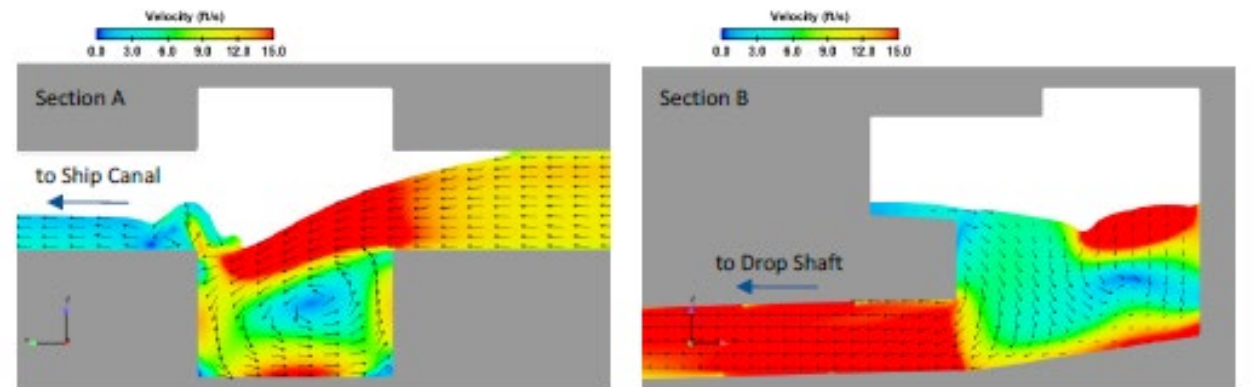
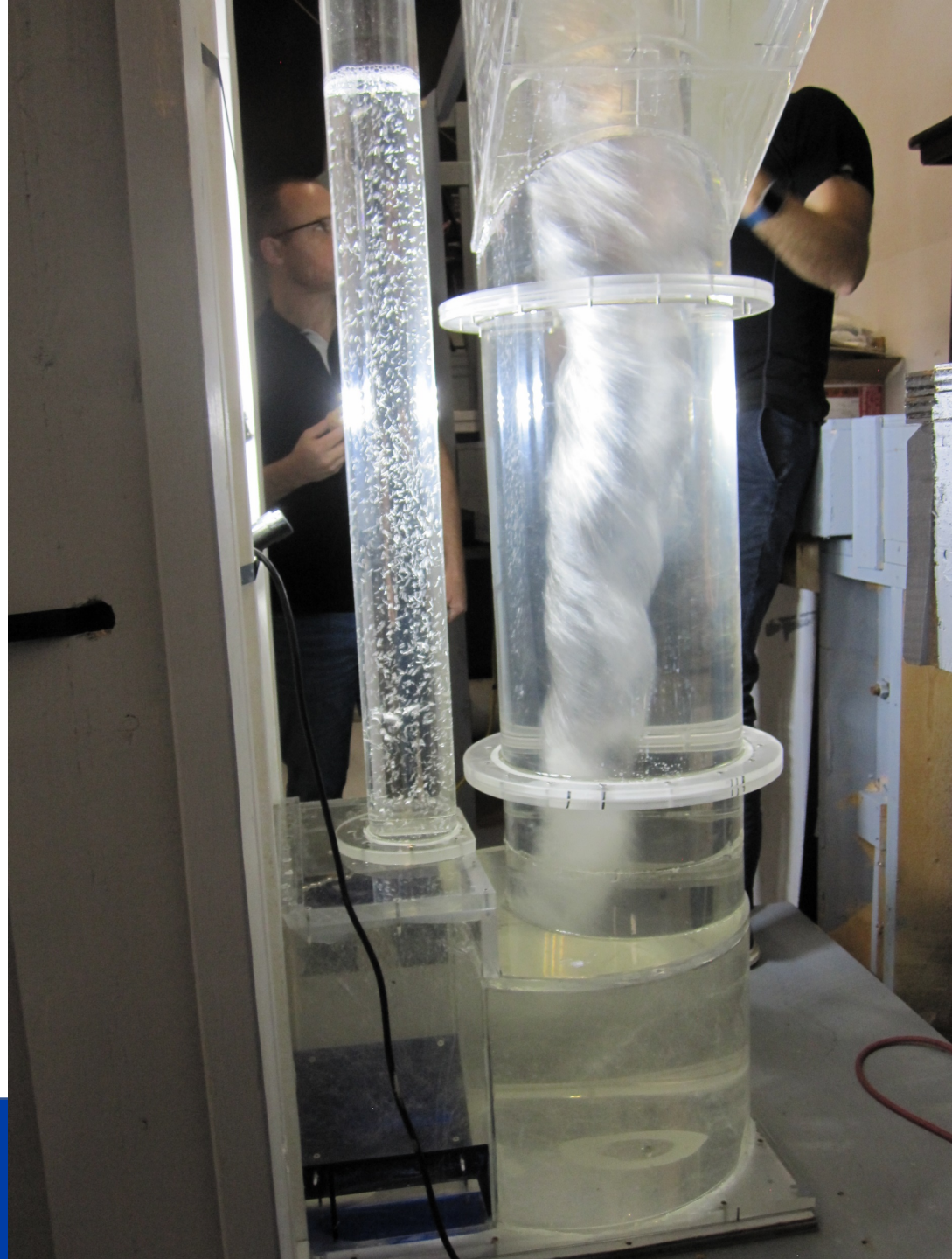
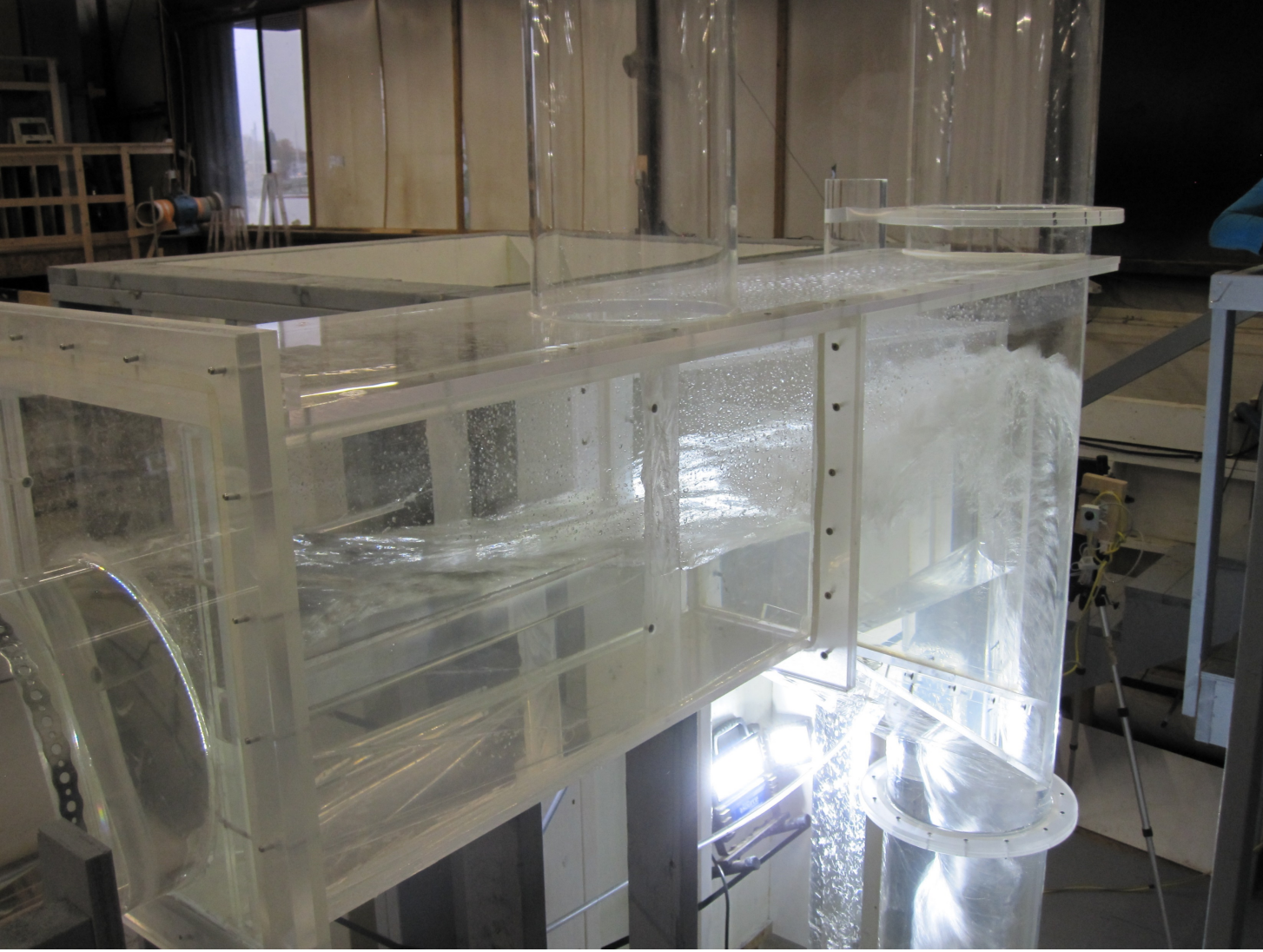


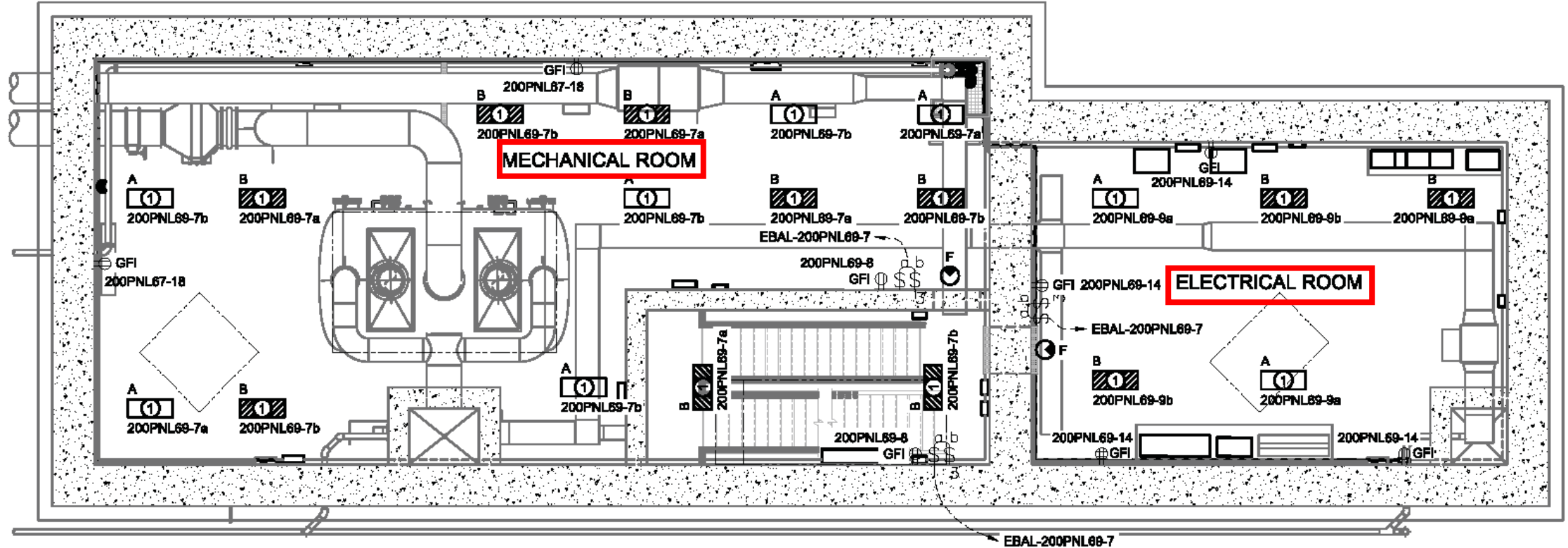
Figure 7. Oblique view (left) and top view (right) of the proposed facilities at 11<sup>th</sup> Ave NW operating at 170 mgd (Run 5, colored by flow velocity).



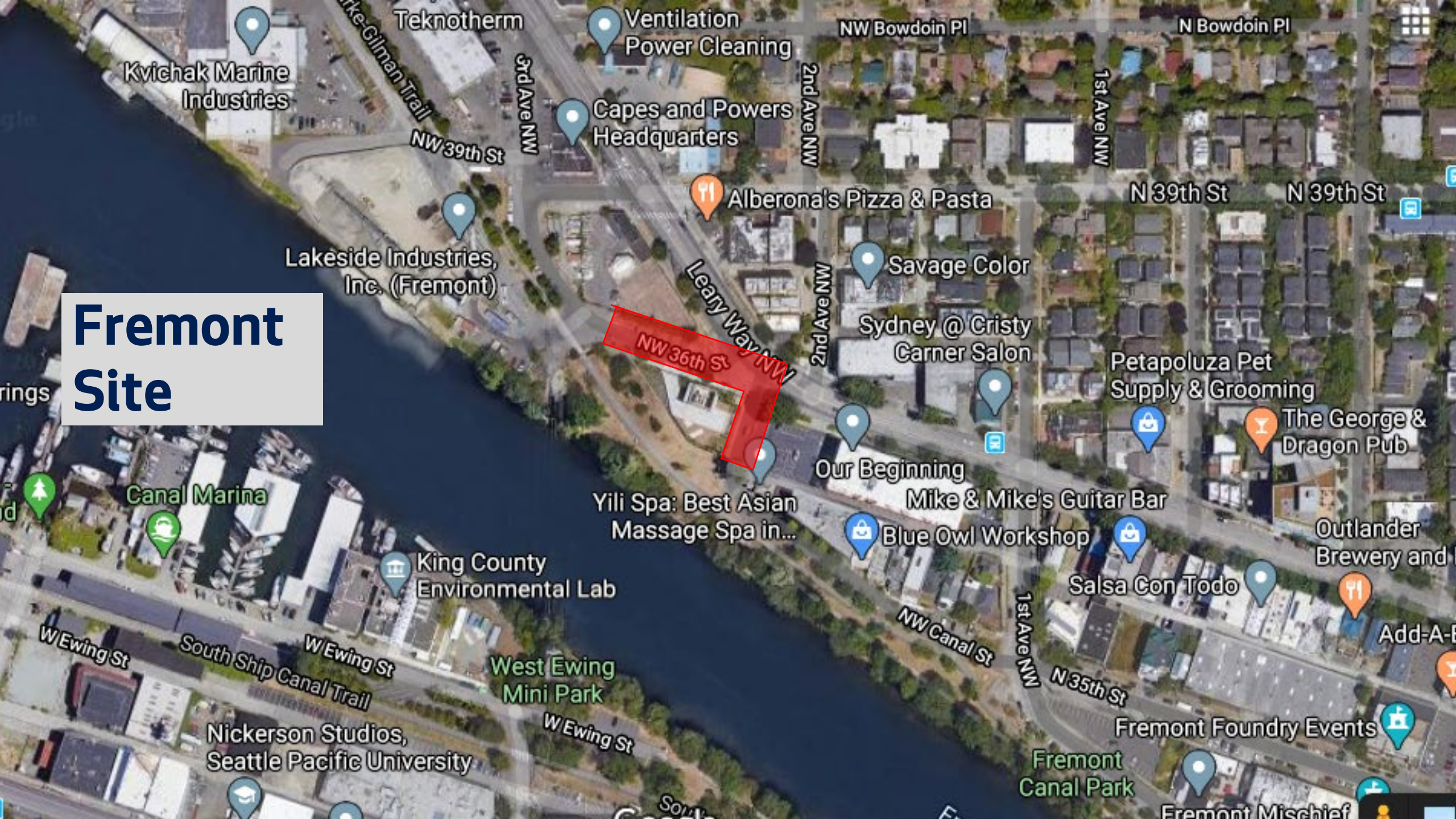




# 11<sup>th</sup> Ave NW Site



# Fremont Site



# Fremont Shaft Site

38.5-ft ID owner-designed  
secant pile shaft;  
adit connection

100-ft. excavation depth

Microtunnel launch shaft

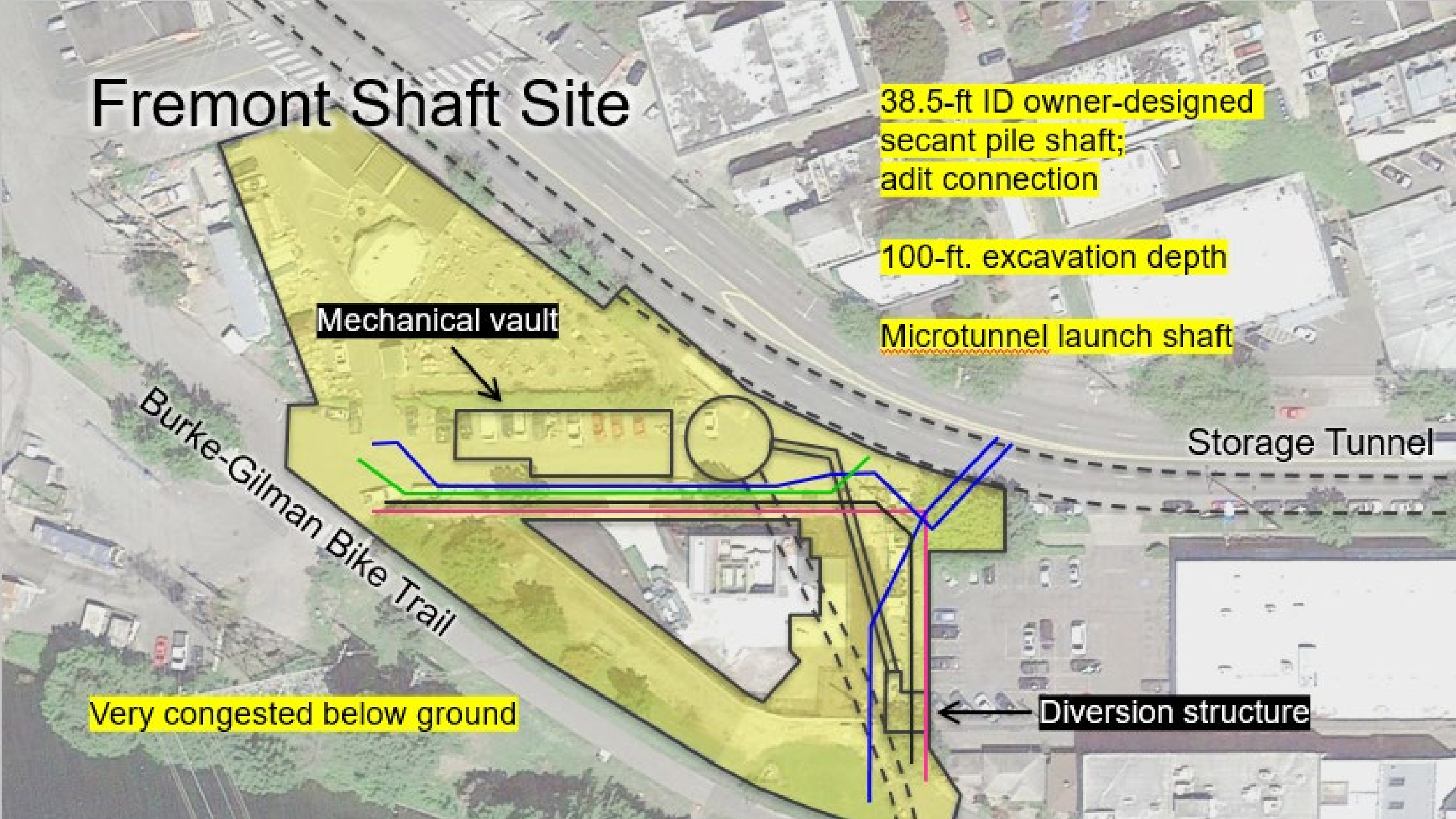
Mechanical vault

Storage Tunnel

Burke-Gilman Bike Trail

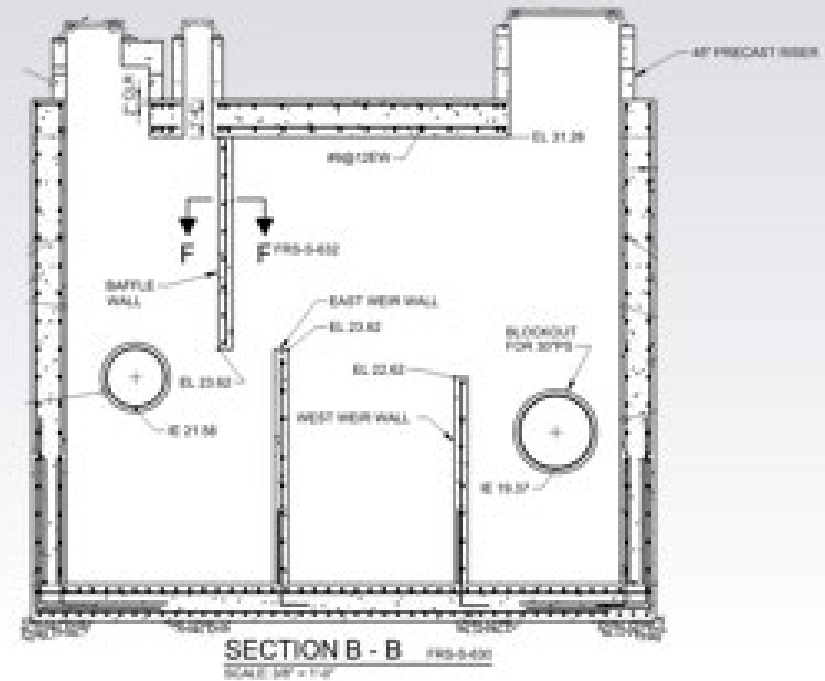
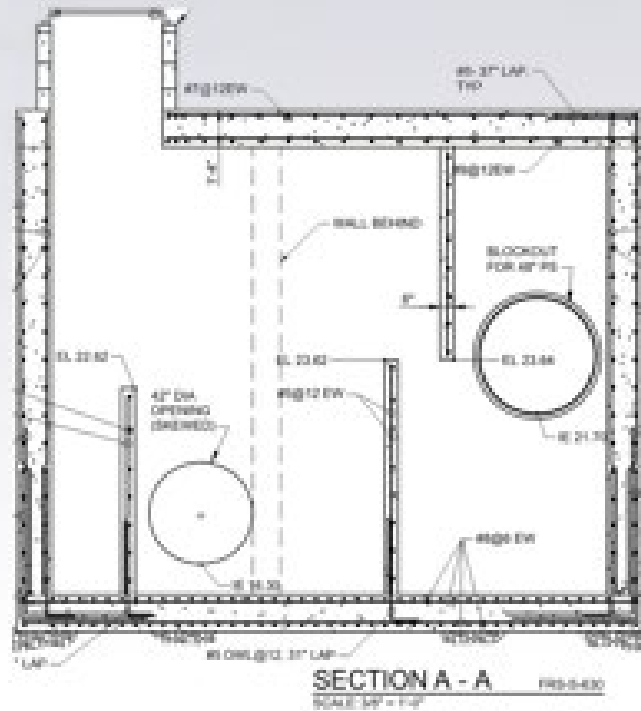
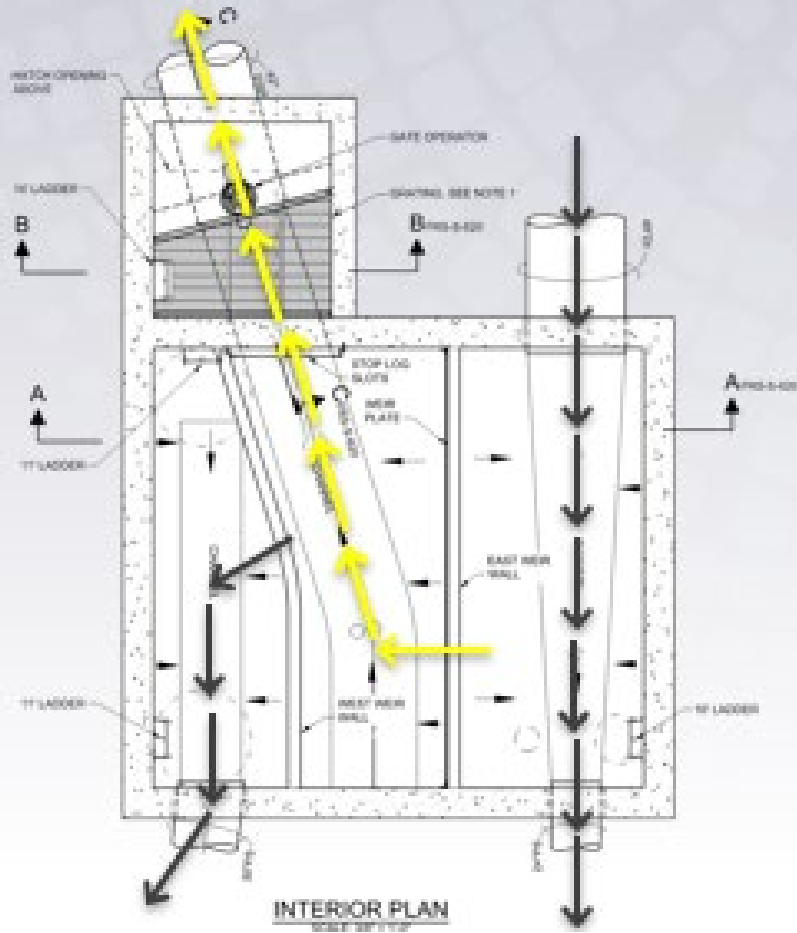
Very congested below ground

Diversion structure

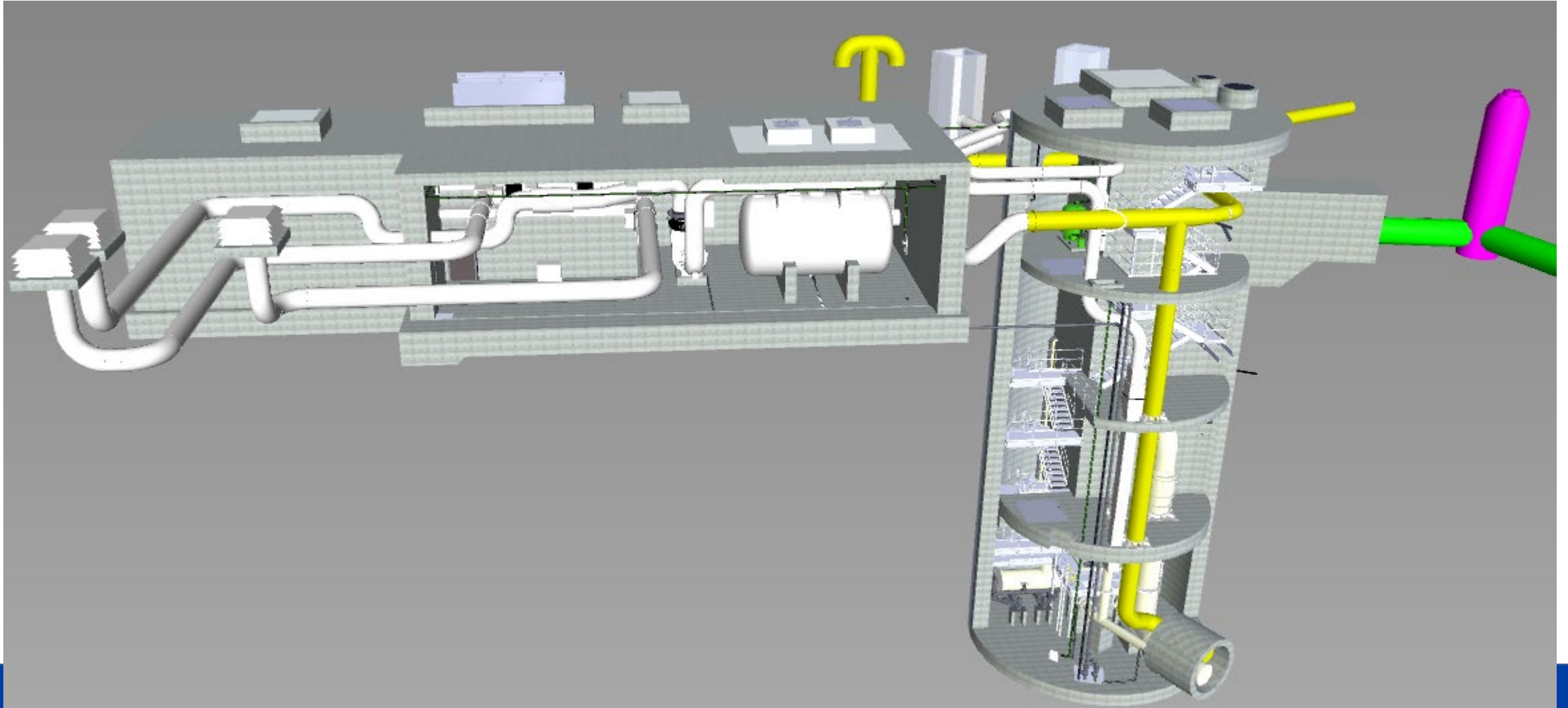




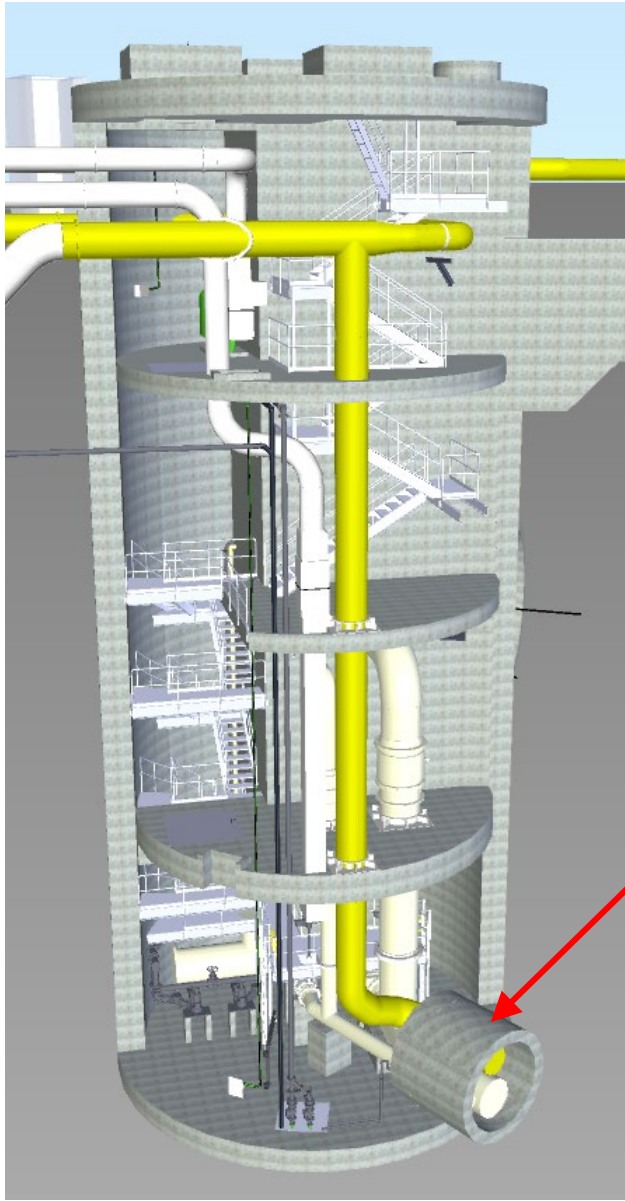
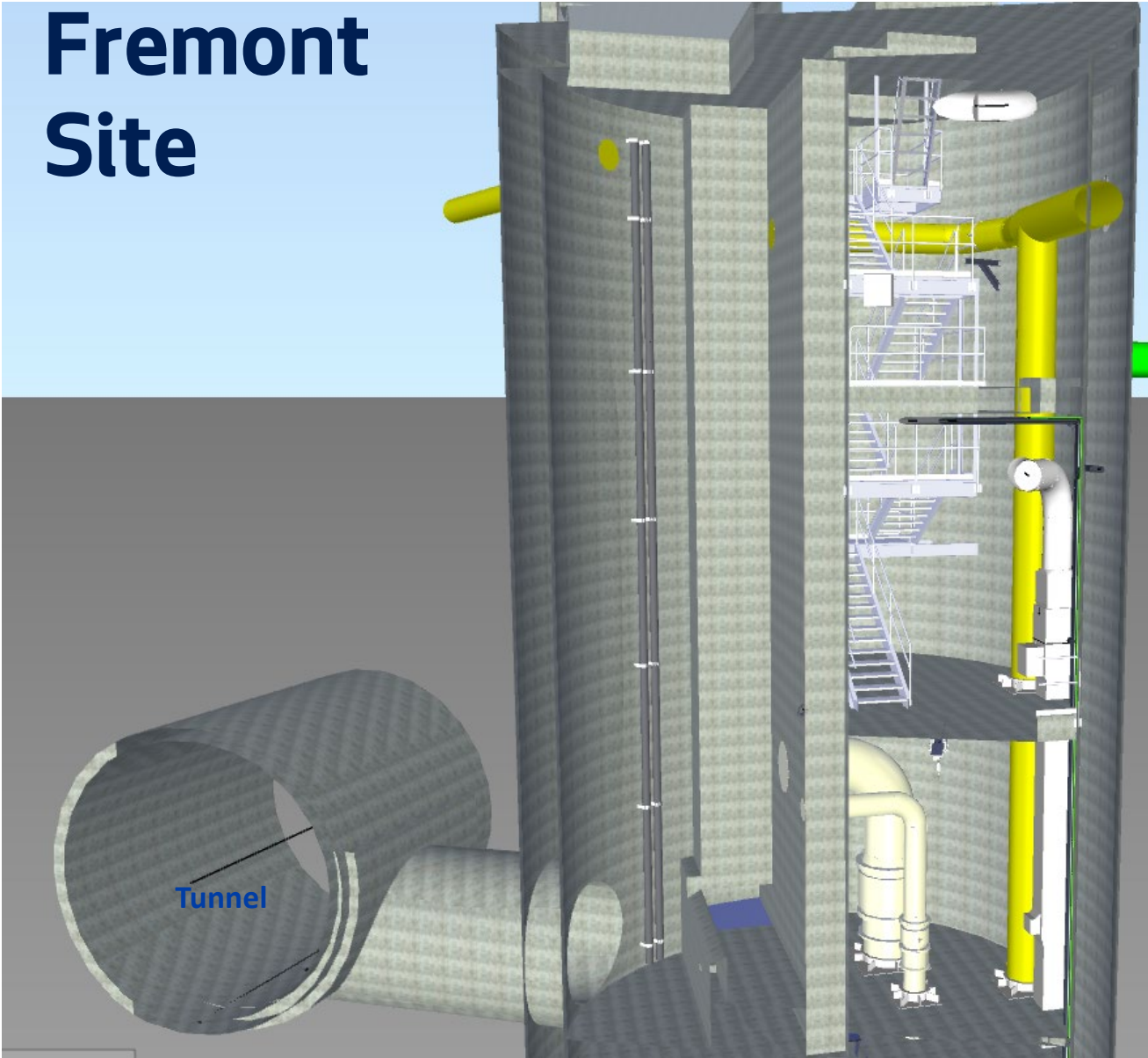
# Fremont Diversion Structure



# Fremont Site



# Fremont Site



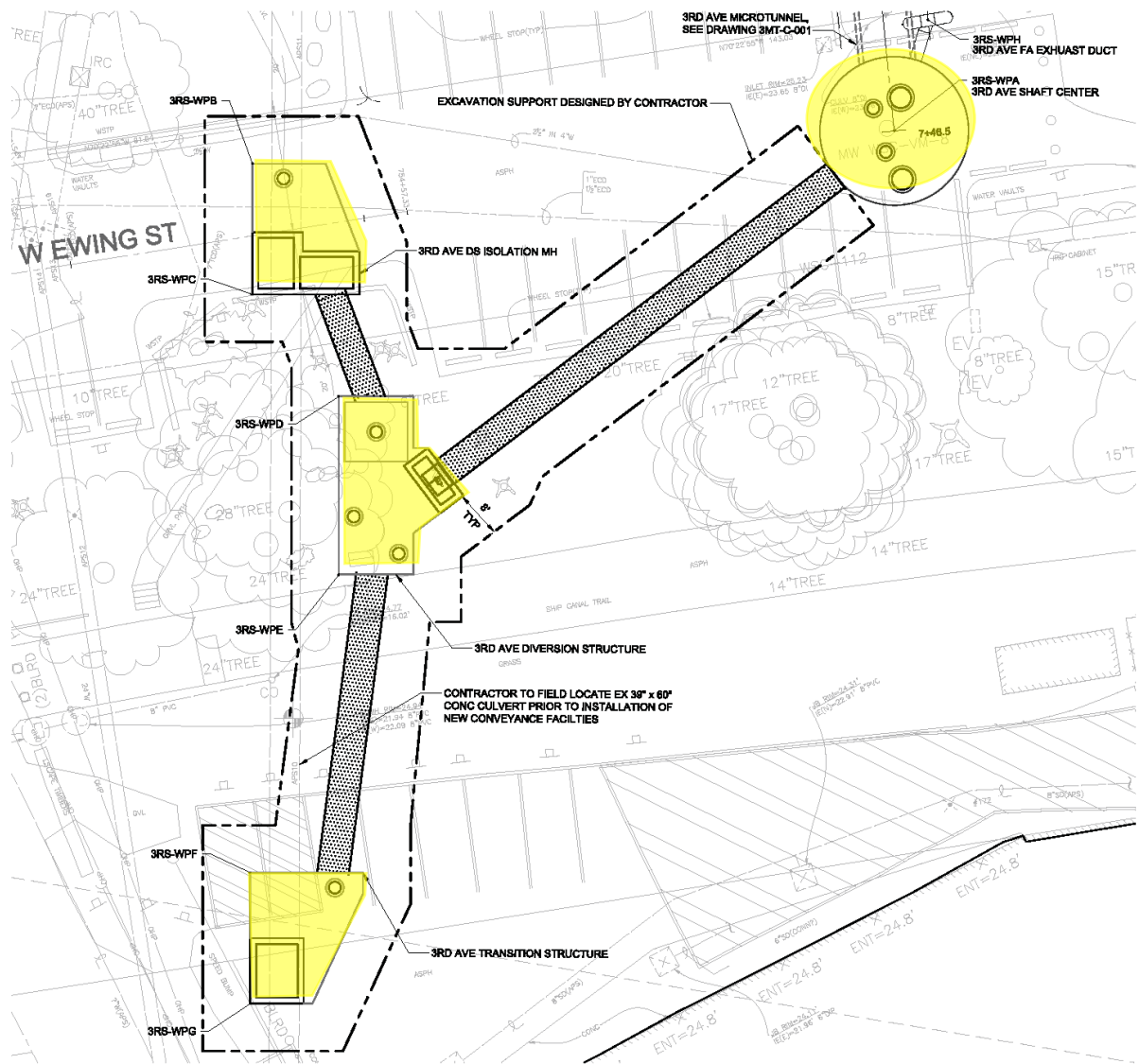
Microtunnel  
Connection



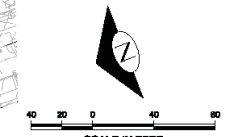
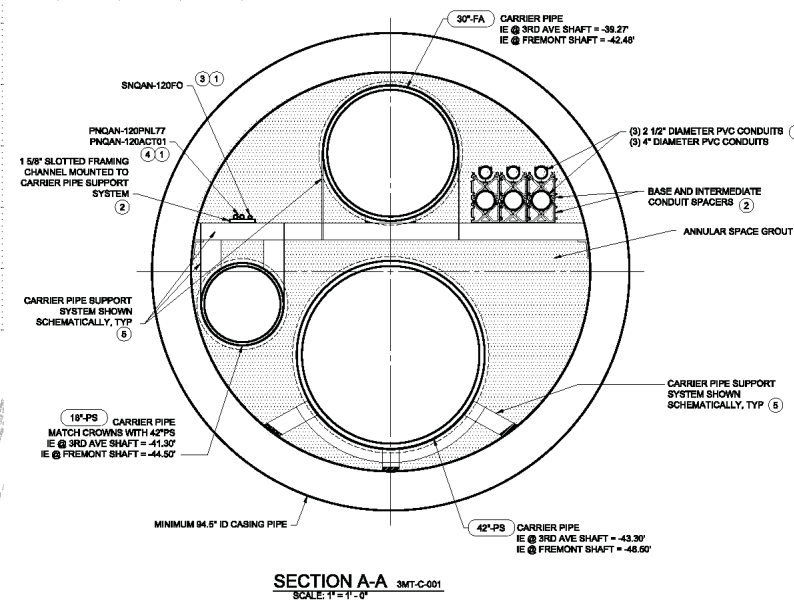
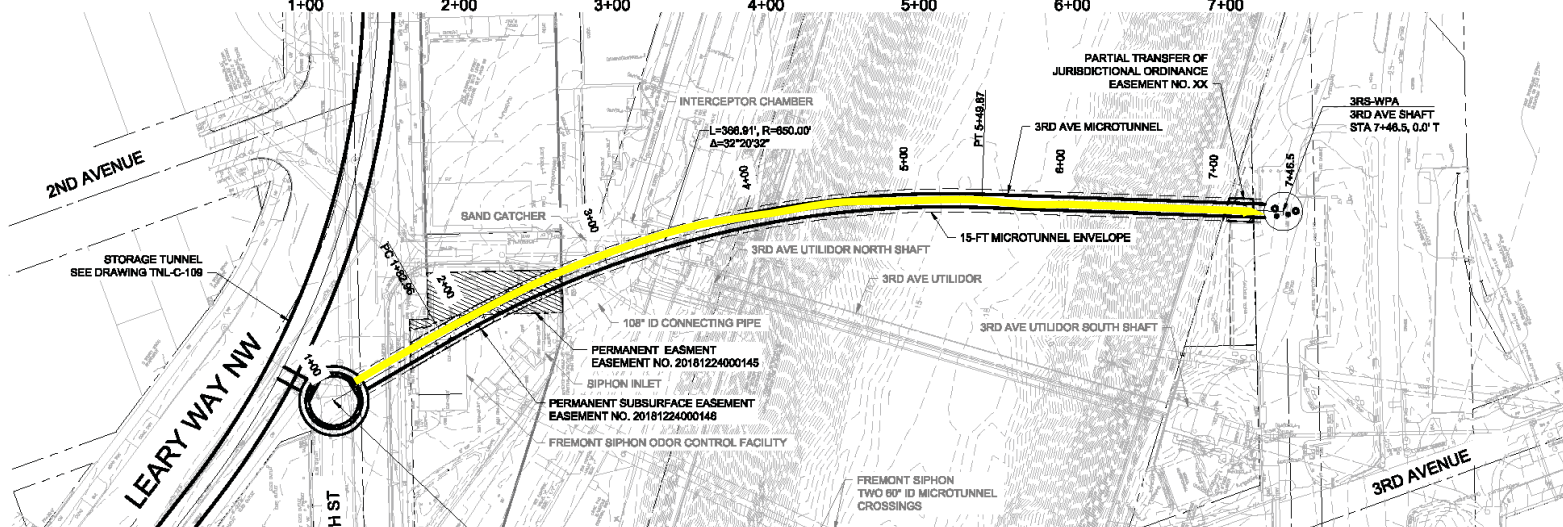
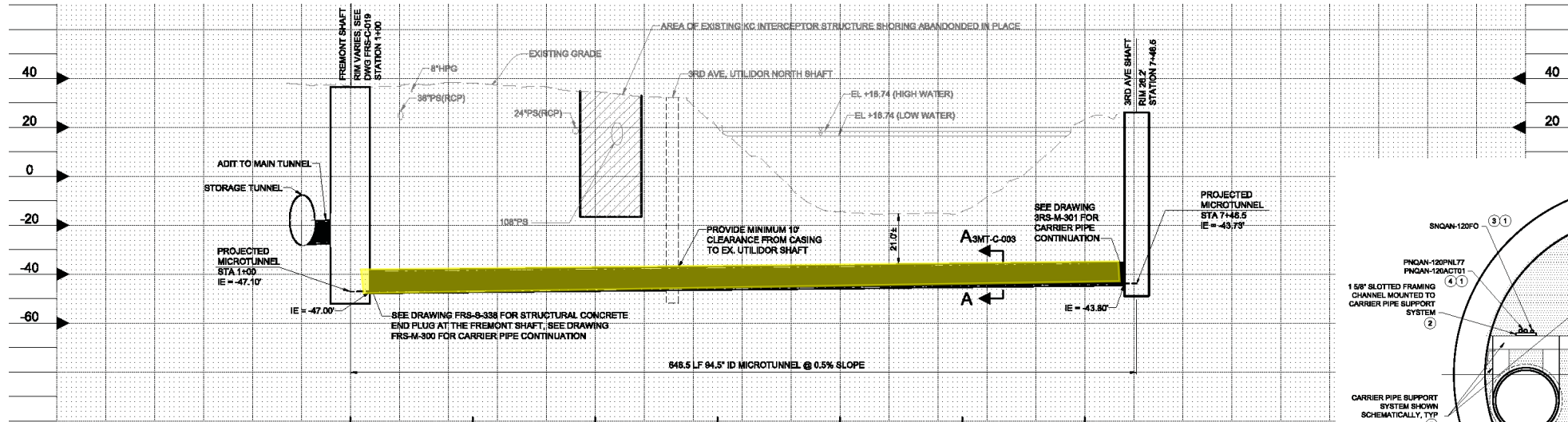
# 3rd Ave W Site



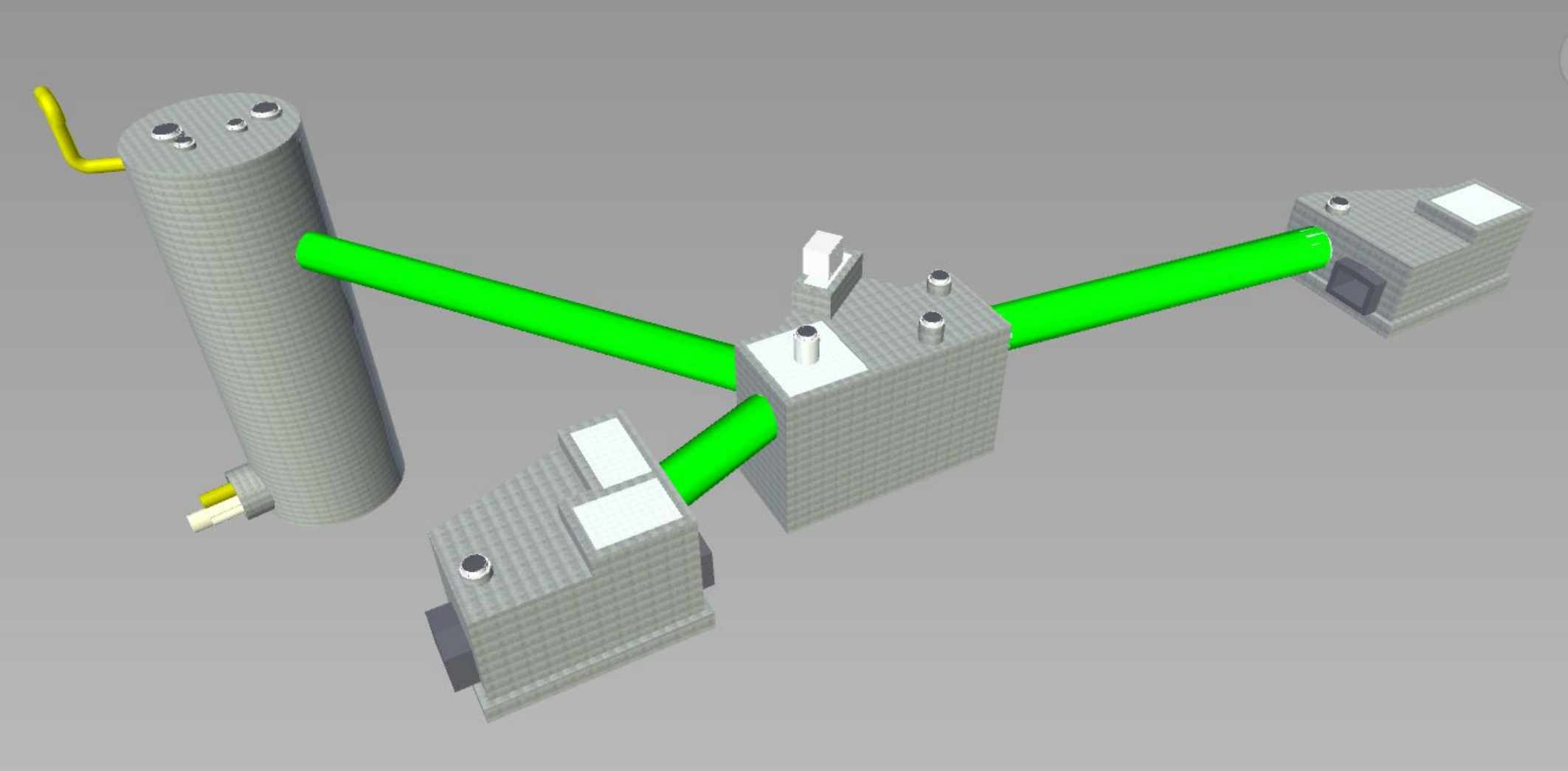
# 3rd Ave W Site



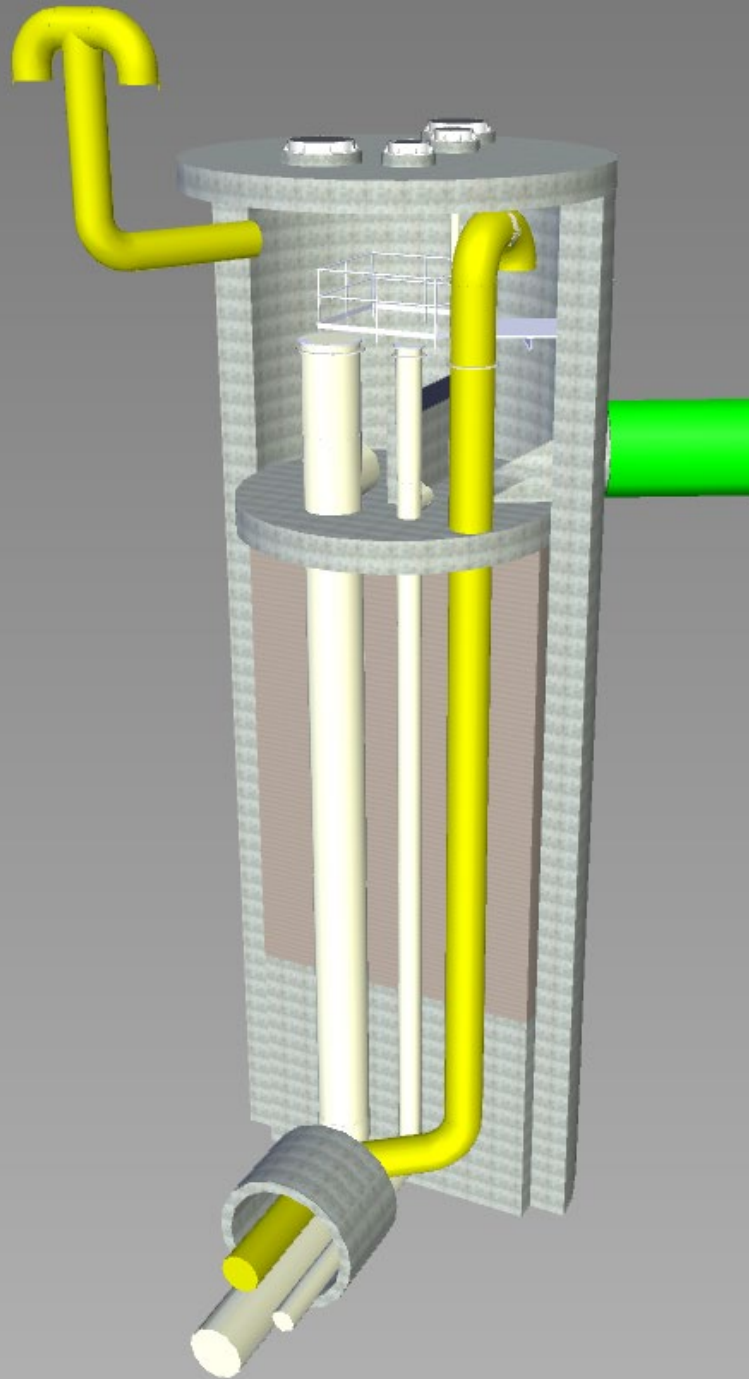
# Microtunnel From 3<sup>rd</sup> Ave W Shaft to Fremont Shaft



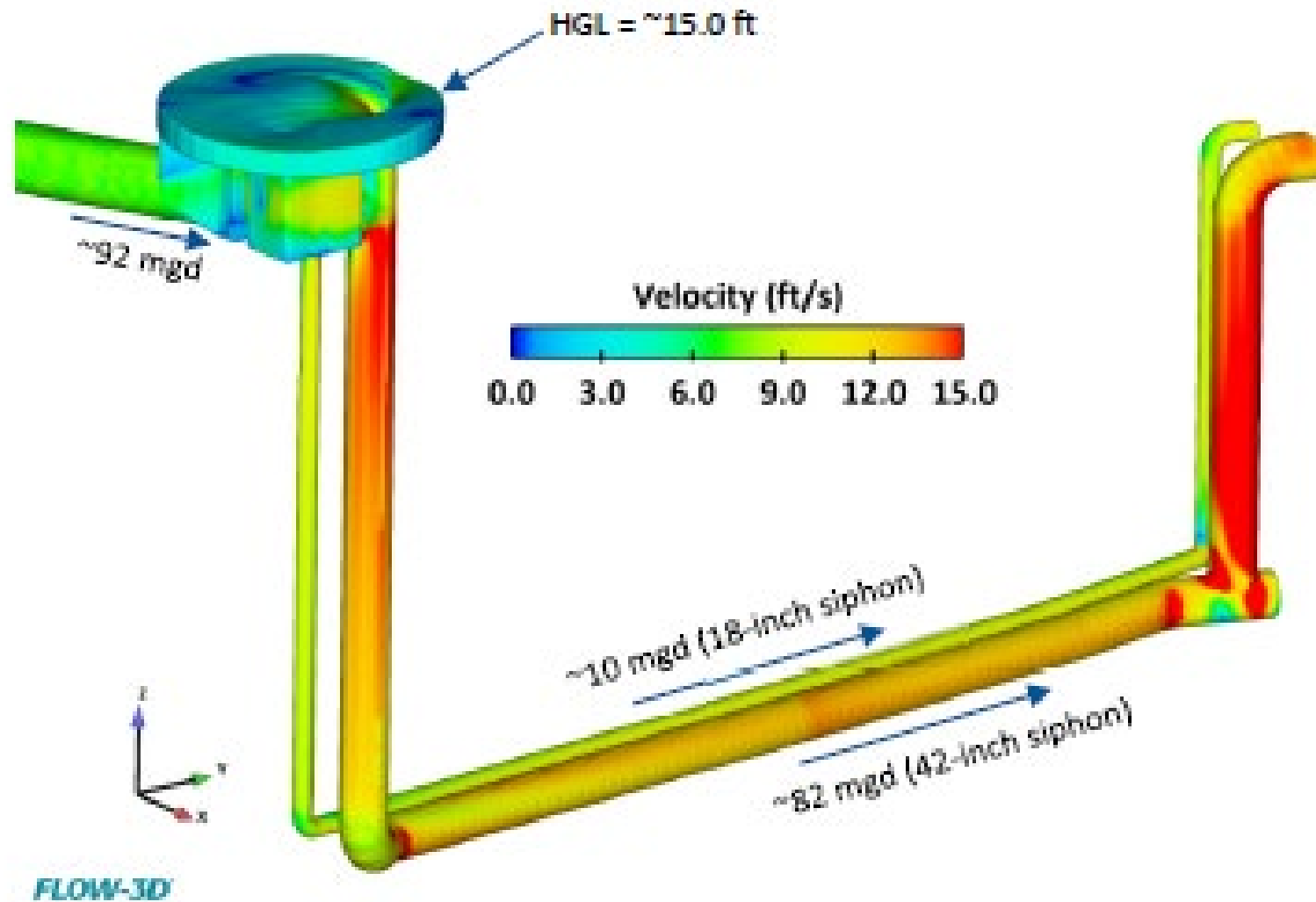
# 3<sup>rd</sup> Ave W Layout for CFD Modeling

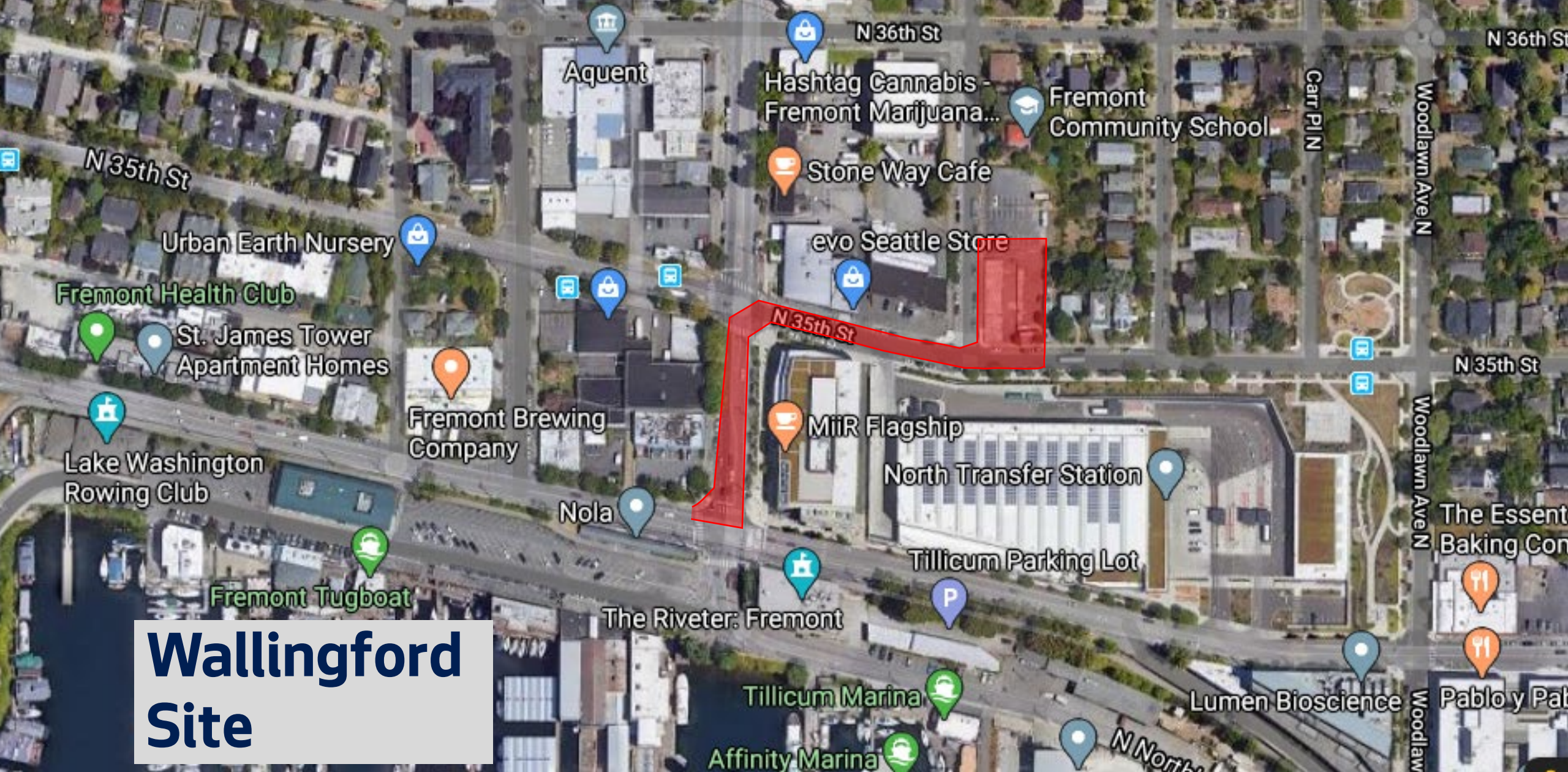


# 3<sup>rd</sup> Ave W Shaft



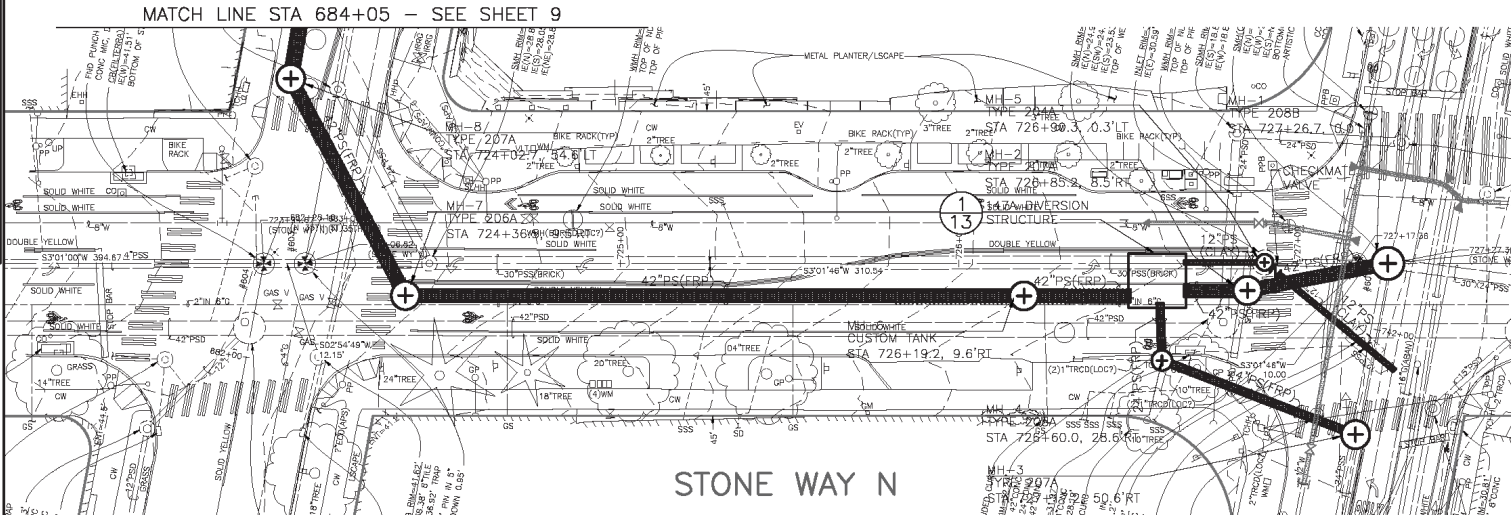
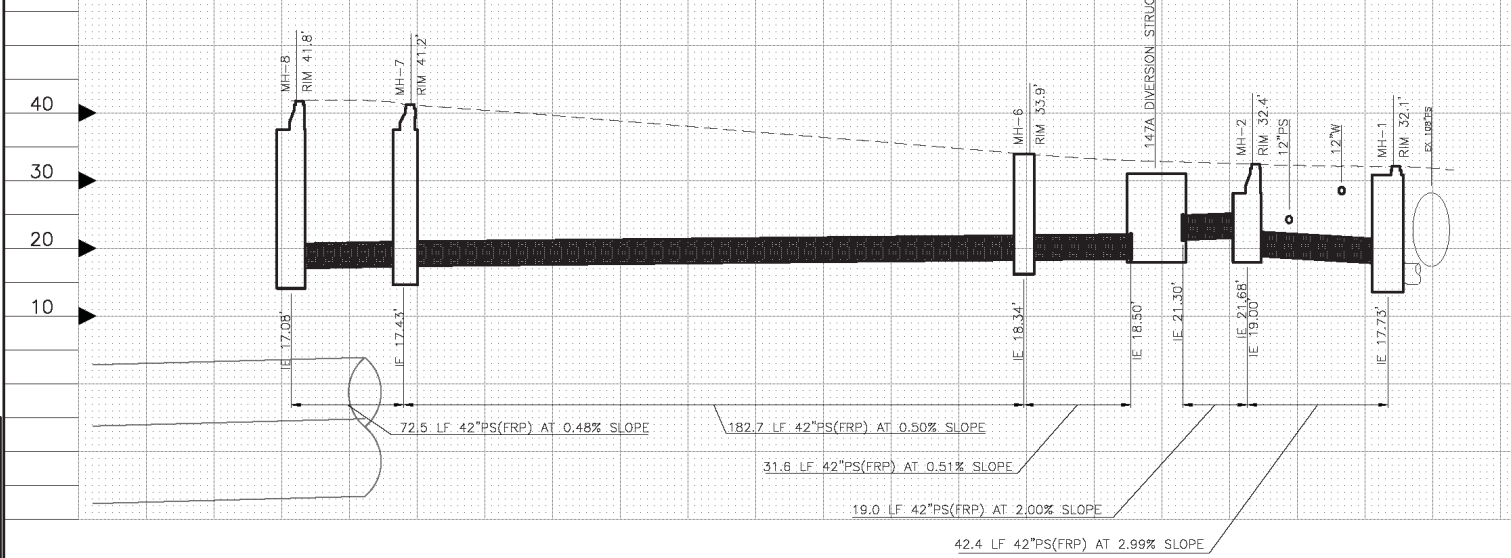




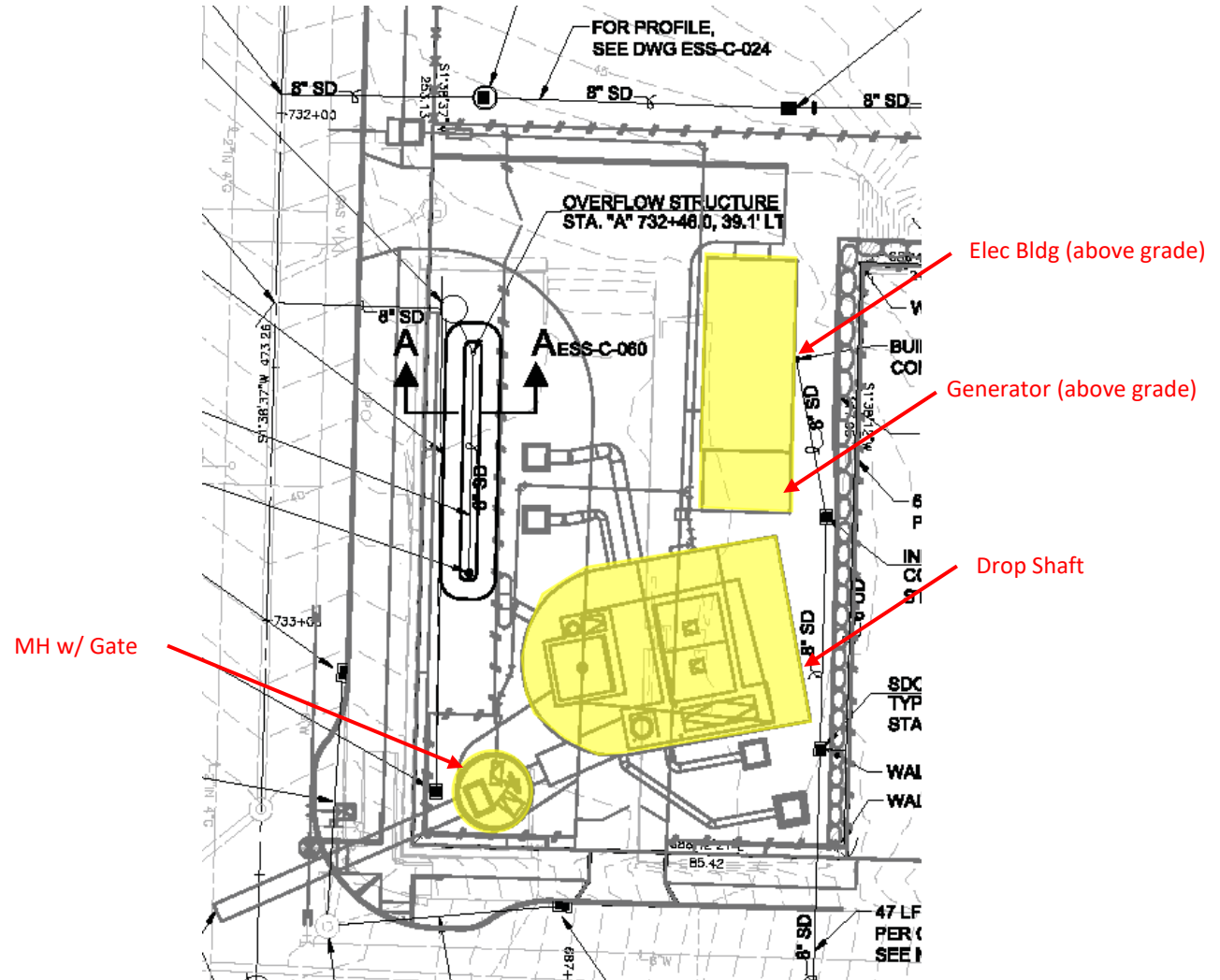


# Wallingford Site

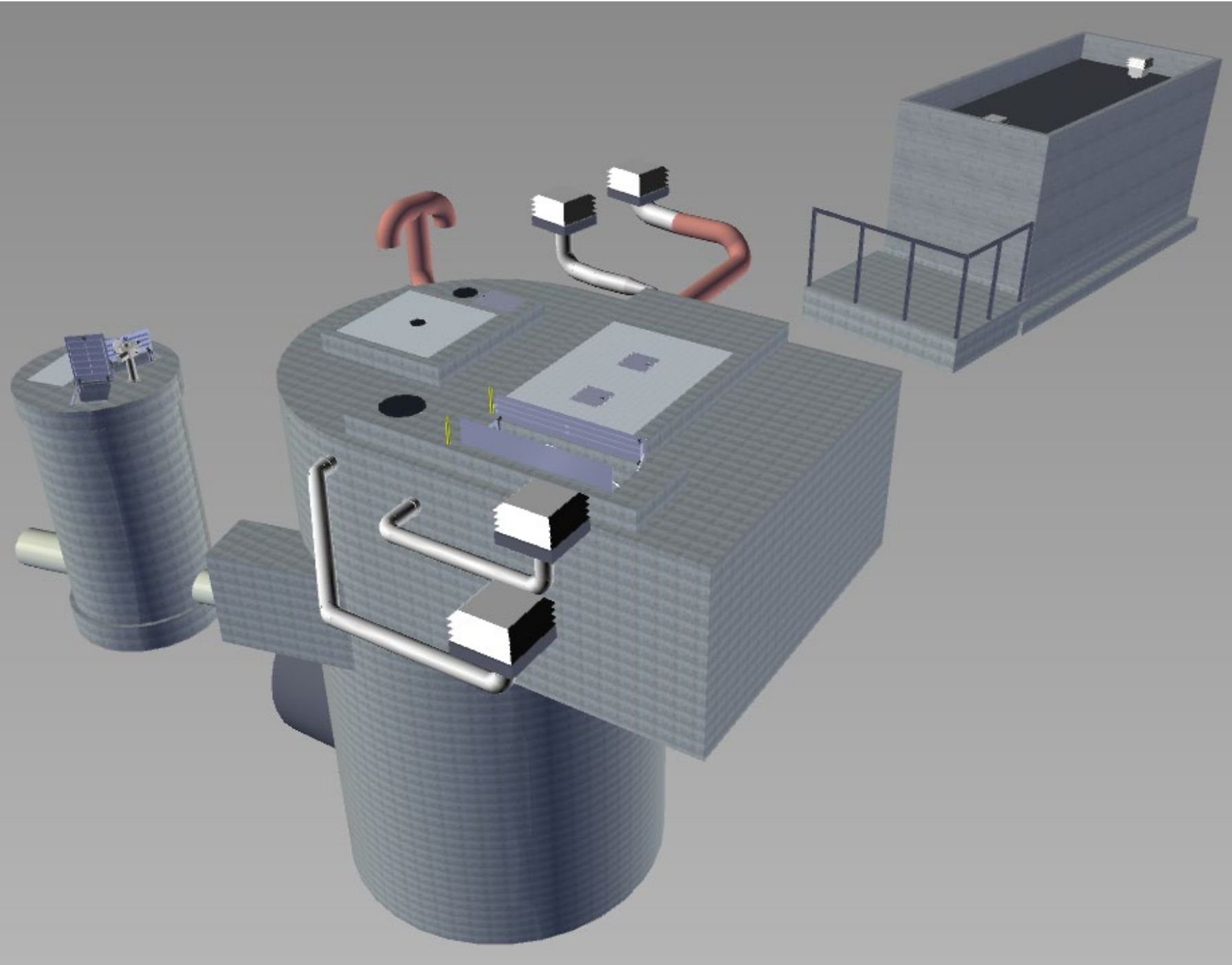
# Wallingford Conveyance



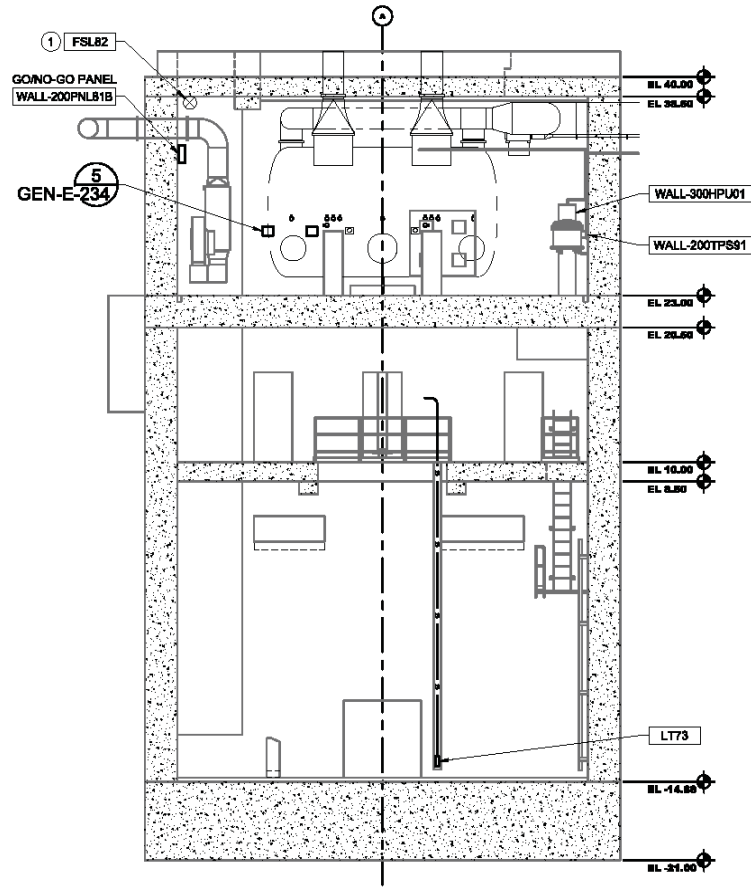
# Wallingford Site



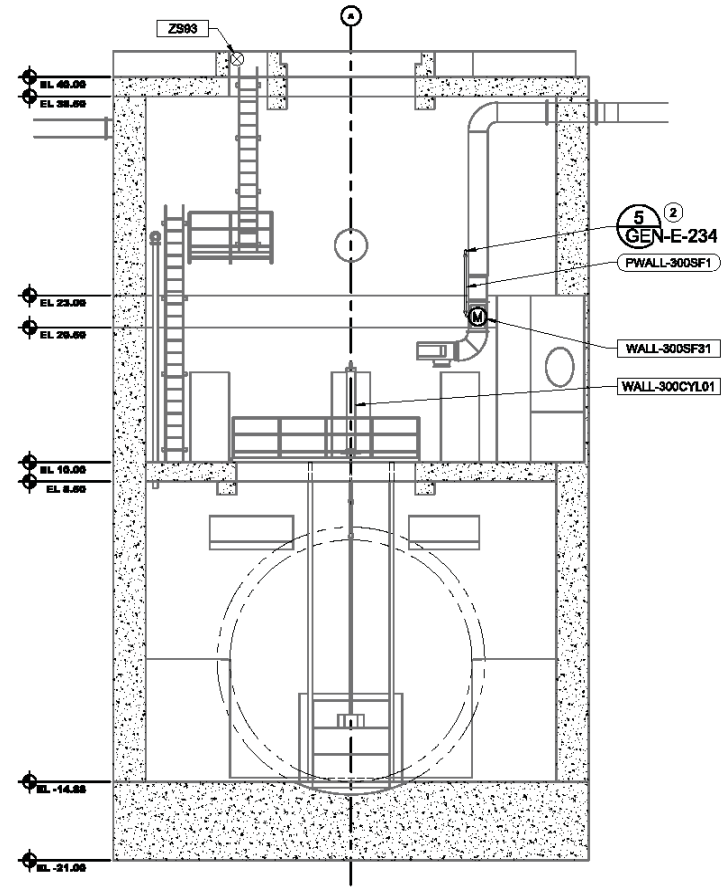
# Wallingford Site



# Wallingford Site

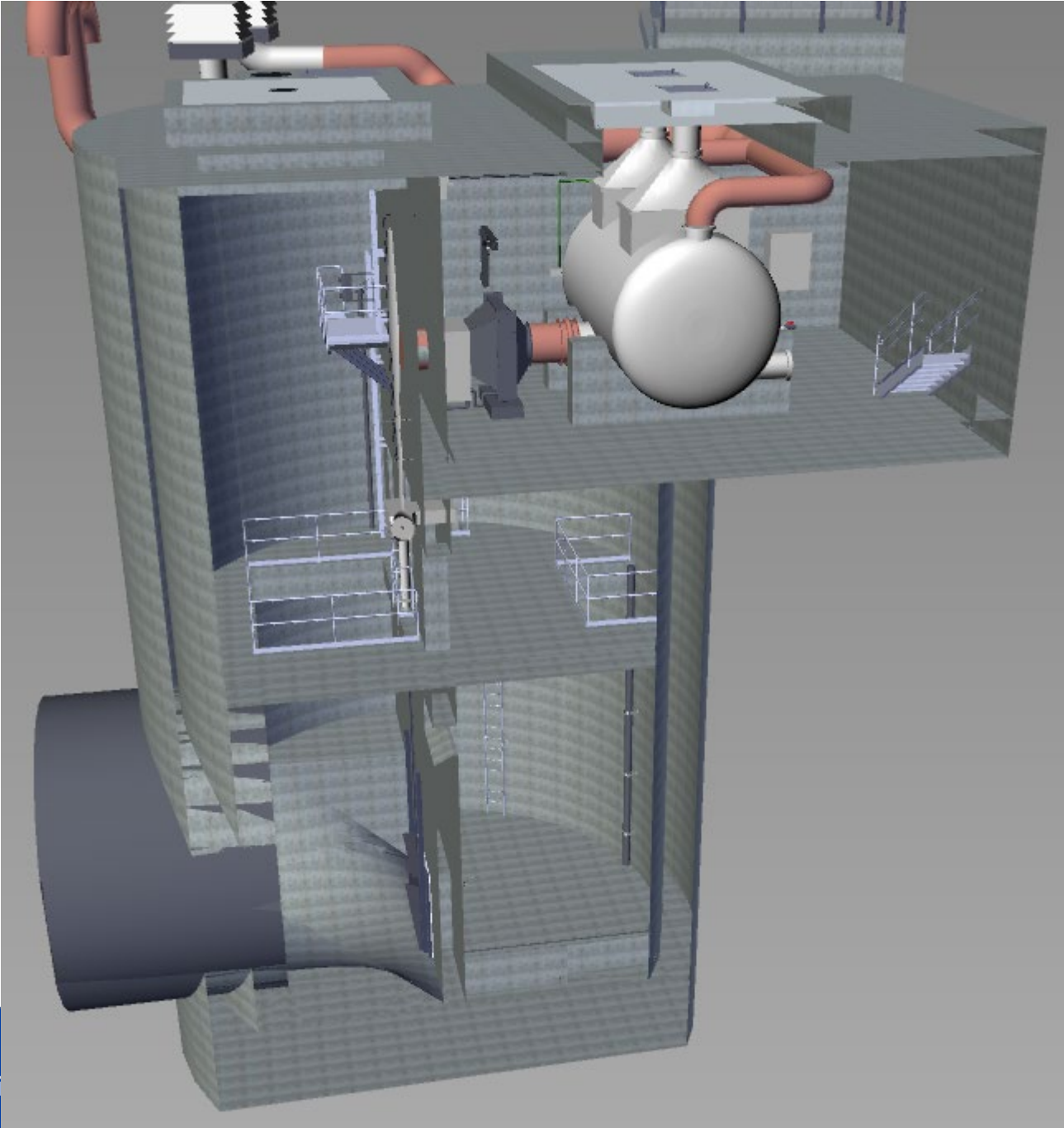


SECTION A - A  
SCALE: 3/16" = 1'-0" ESS-E-100



SECTION B - B  
SCALE: 3/16" = 1'-0" ESS-E-100

# Wallingford Site







2/2/2007 11:54 AM

24th Avenue and Street End

Pump Station

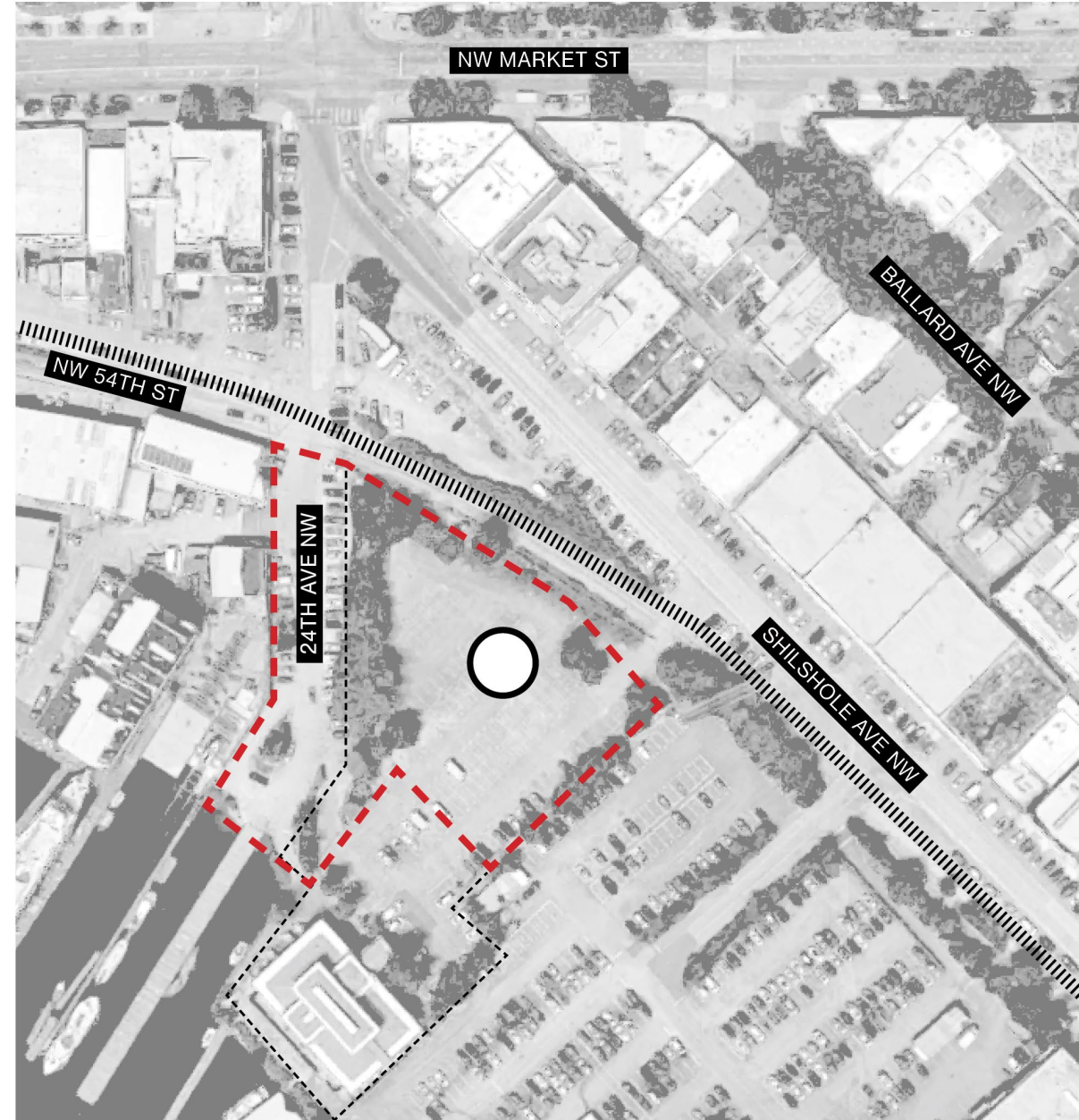
Ballard Site

**Ballard Site  
- Pump Station**

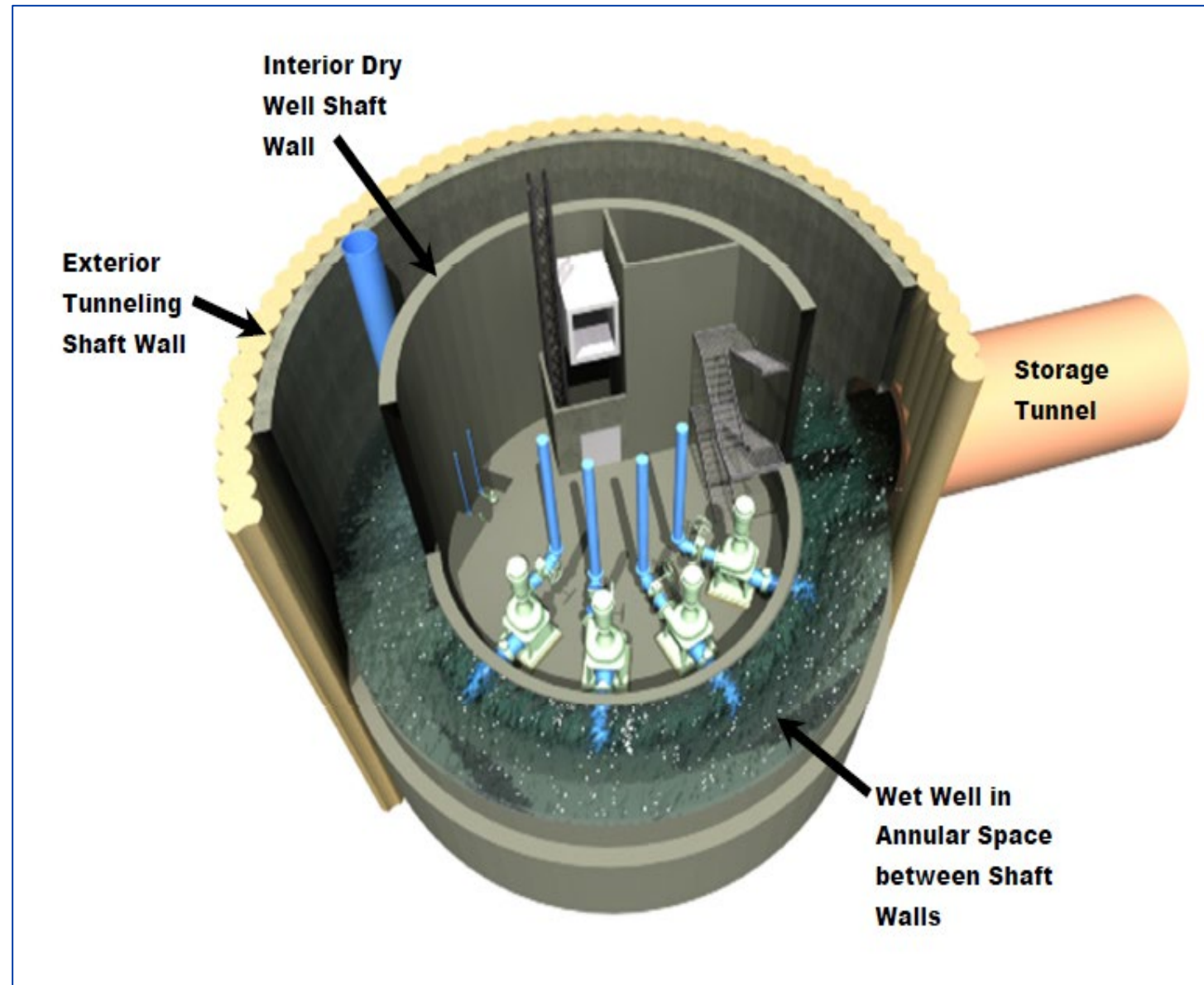


# Ballard Site - Design Goals

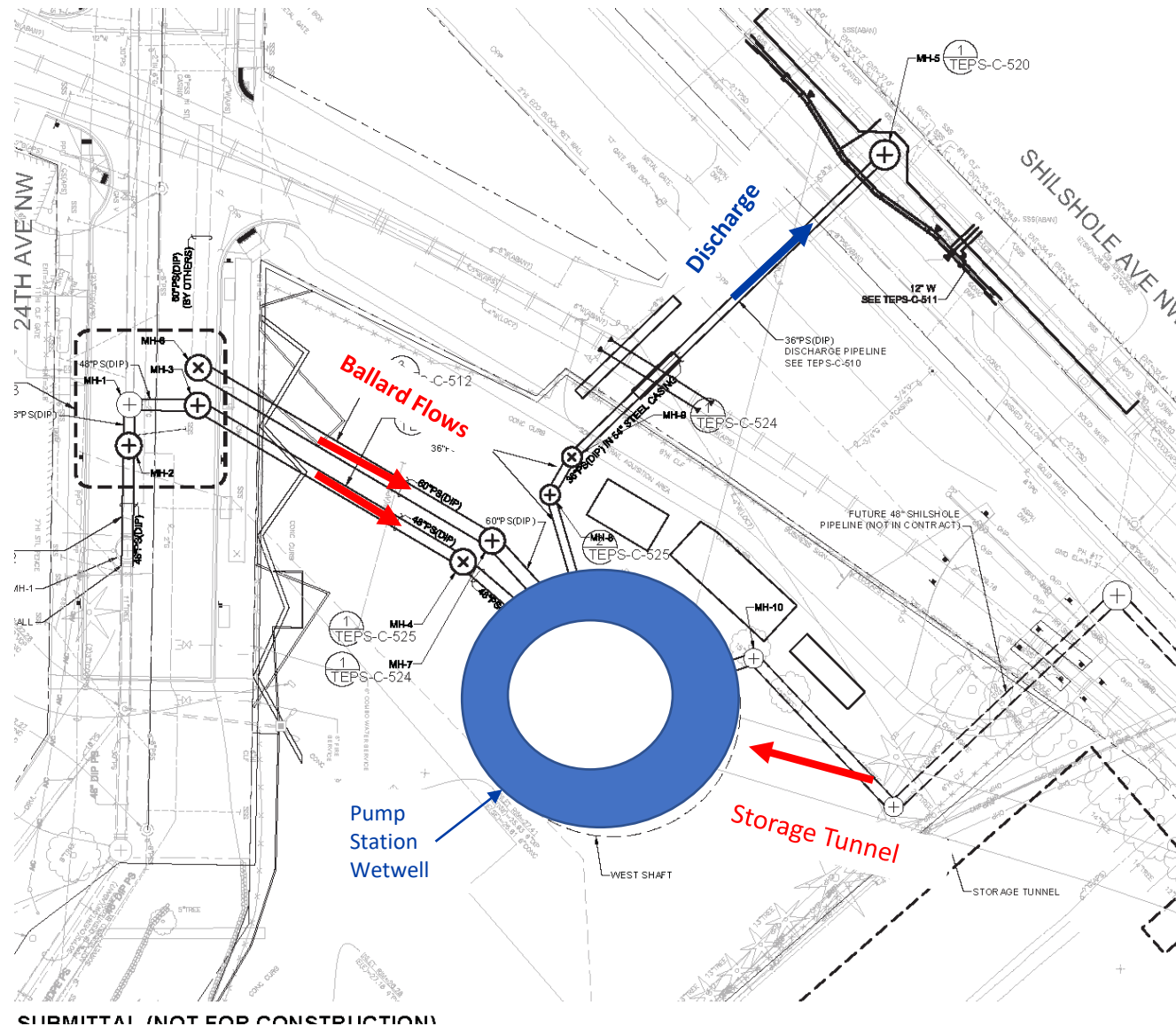
- Provide efficient Pump Station for discharging flows from Storage Tunnel
- Design the entire site
- Define and derive benefits for the Seattle community and SPU
- Contribute to and recognize the place and role of the waterfront in Ballard
- Connect the neighborhood to the waterfront



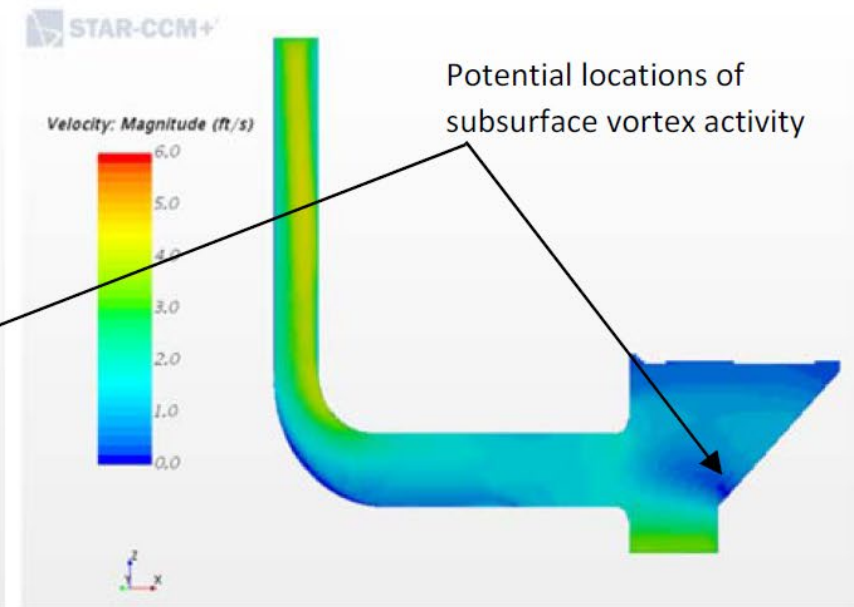
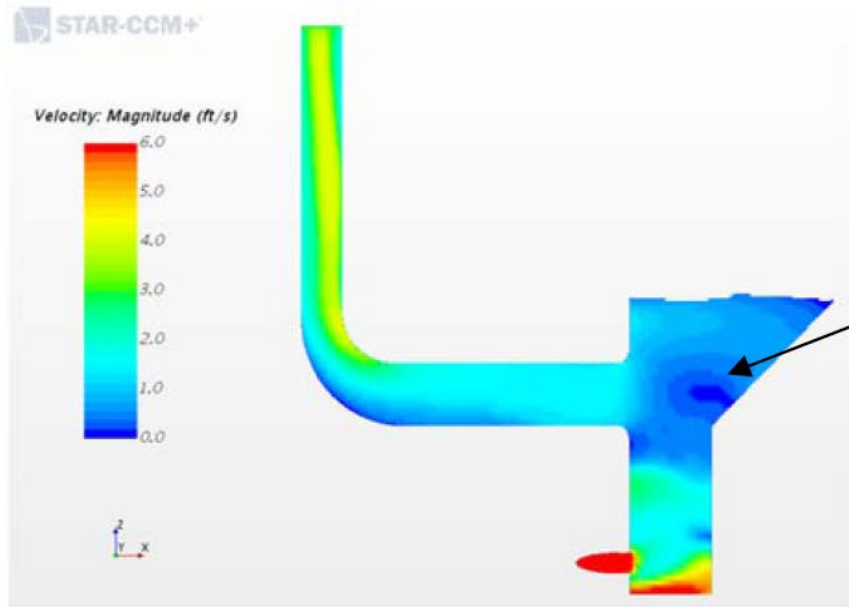
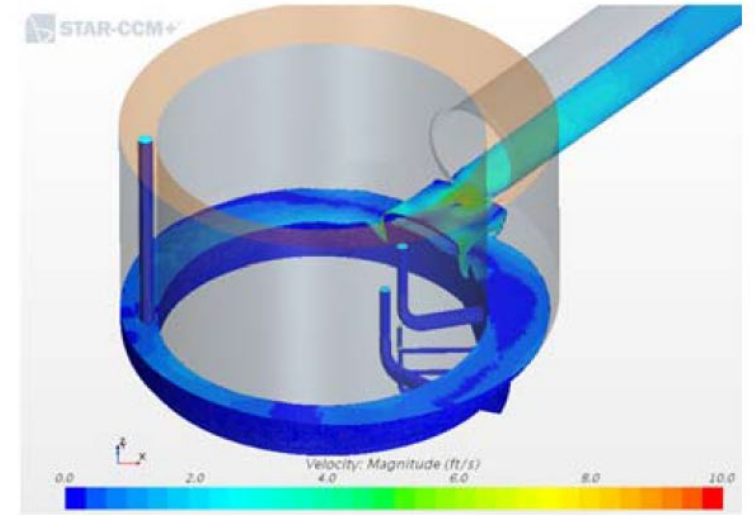
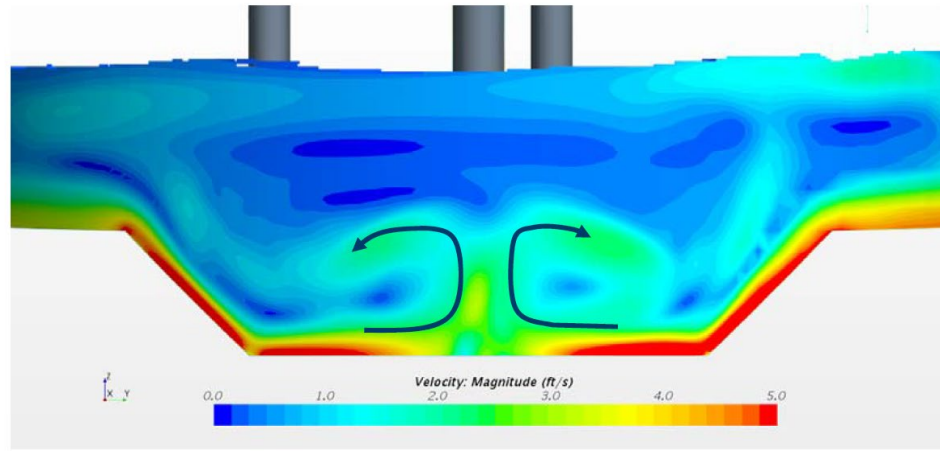
# Pump Station



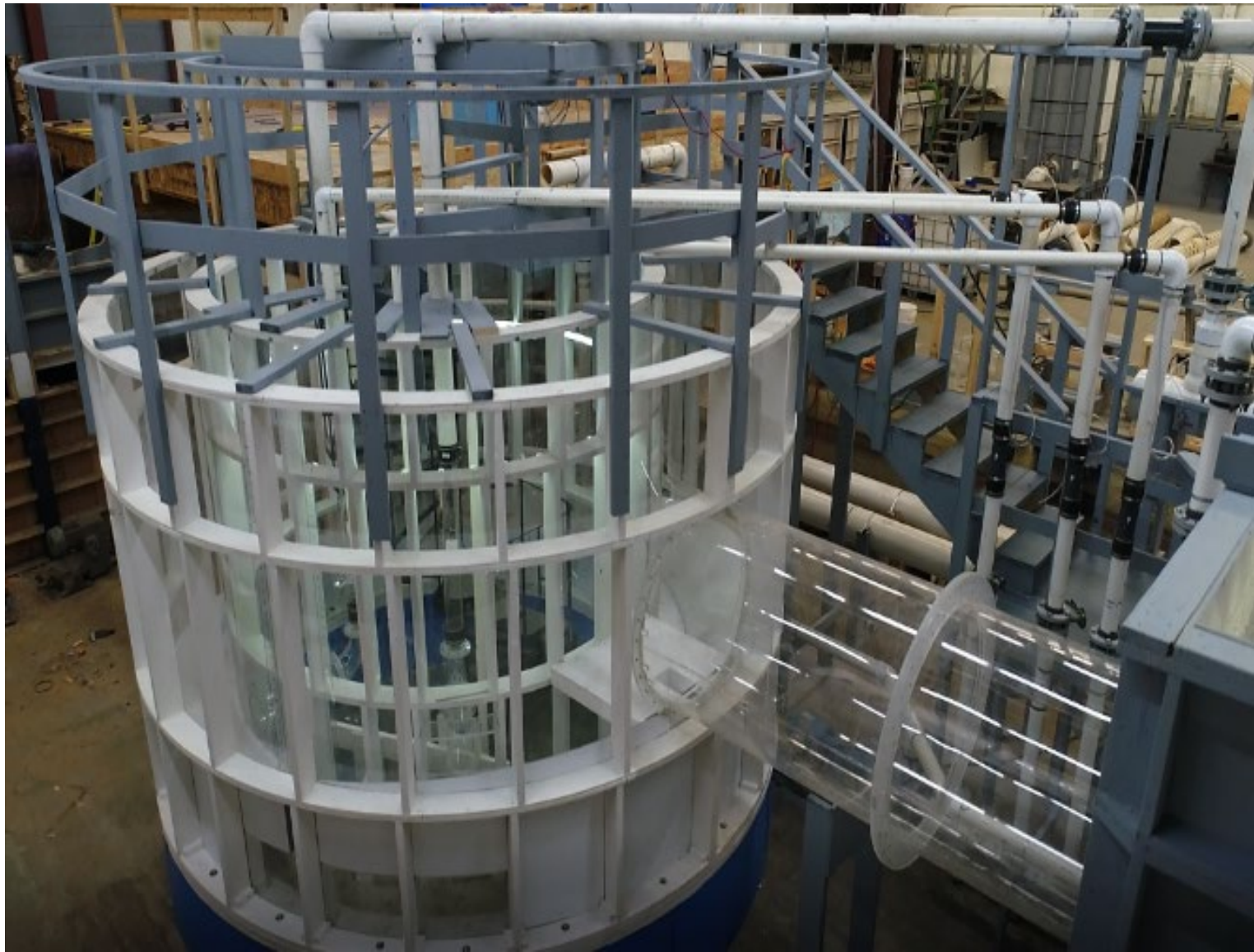
# Pump Station



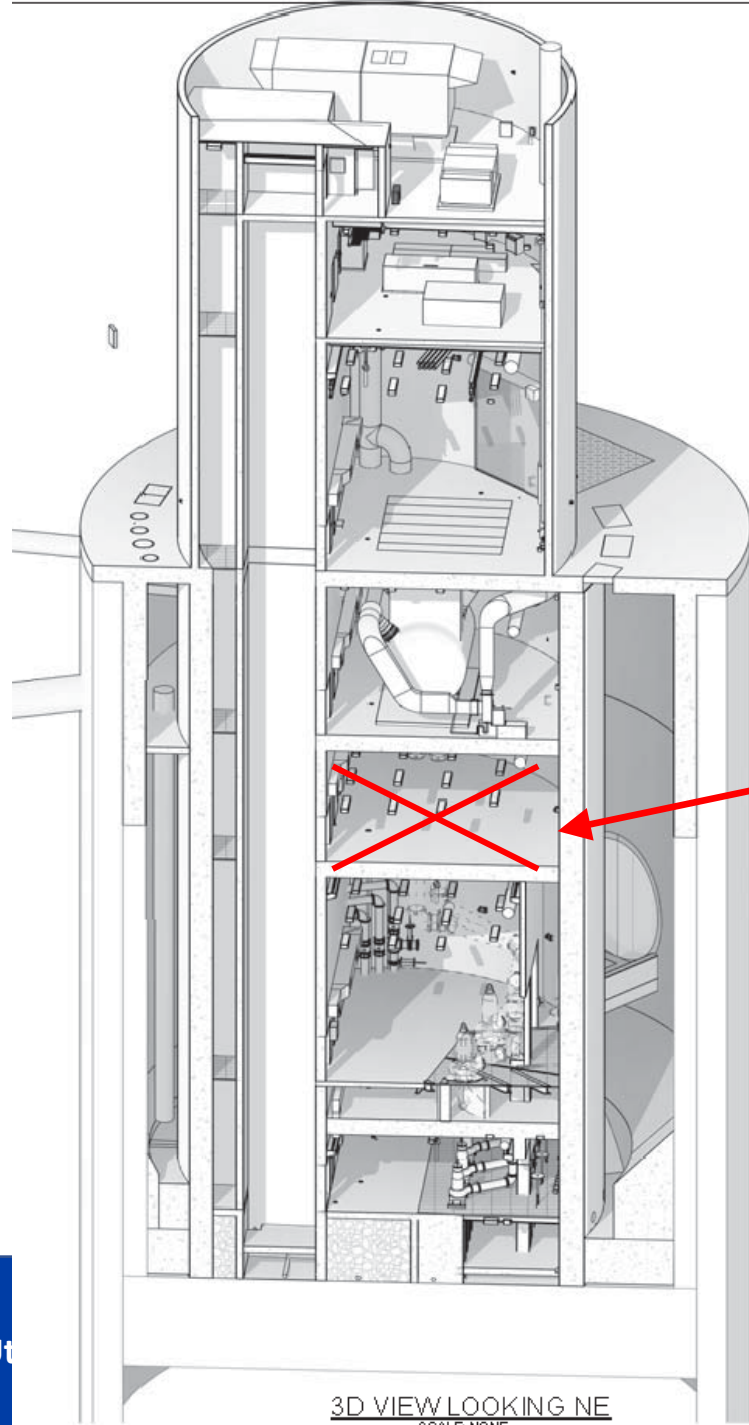
# CFD Modeling



Potential locations of subsurface vortex activity

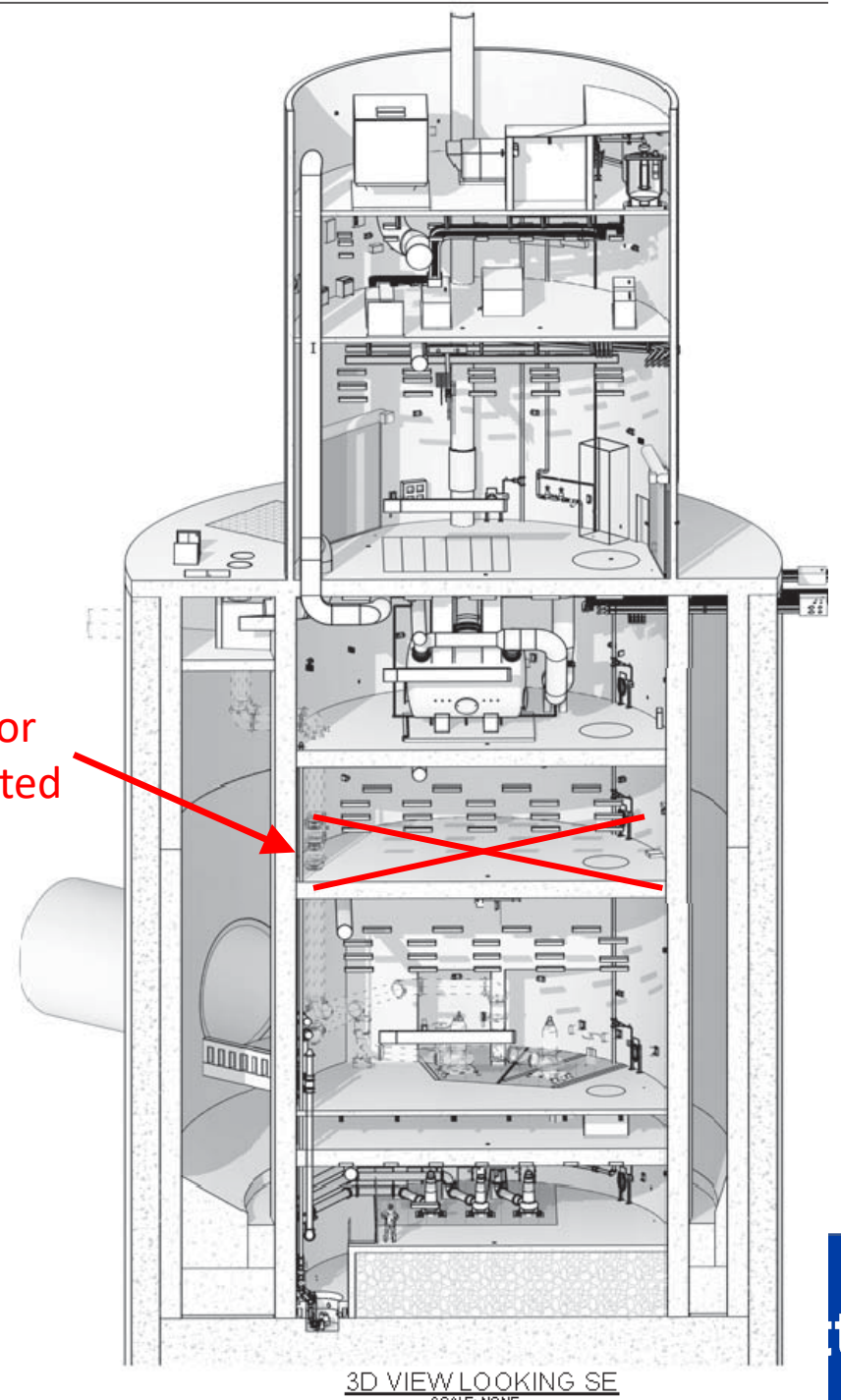


# Pump Station

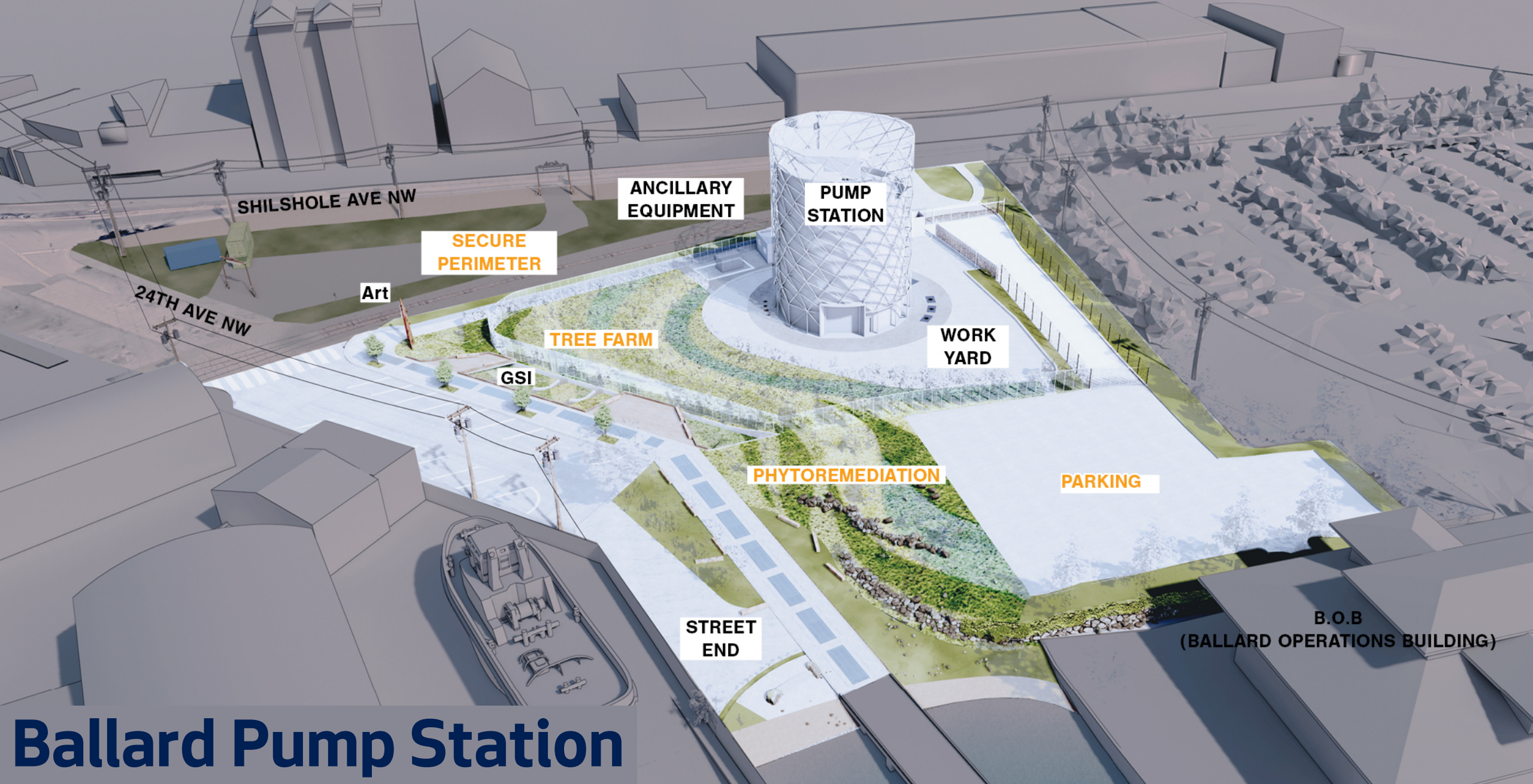


3D VIEW LOOKING NE  
SCALE: NONE

Floor Deleted



3D VIEW LOOKING SE  
SCALE: NONE



SHILSHOLE AVE NW

ANCILLARY EQUIPMENT

PUMP STATION

SECURE PERIMETER

Art

24TH AVE NW

TREE FARM

WORK YARD

GSI

PHYTOREMEDIATION

PARKING

STREET END

B.O.B  
(BALLARD OPERATIONS BUILDING)

# Ballard Pump Station

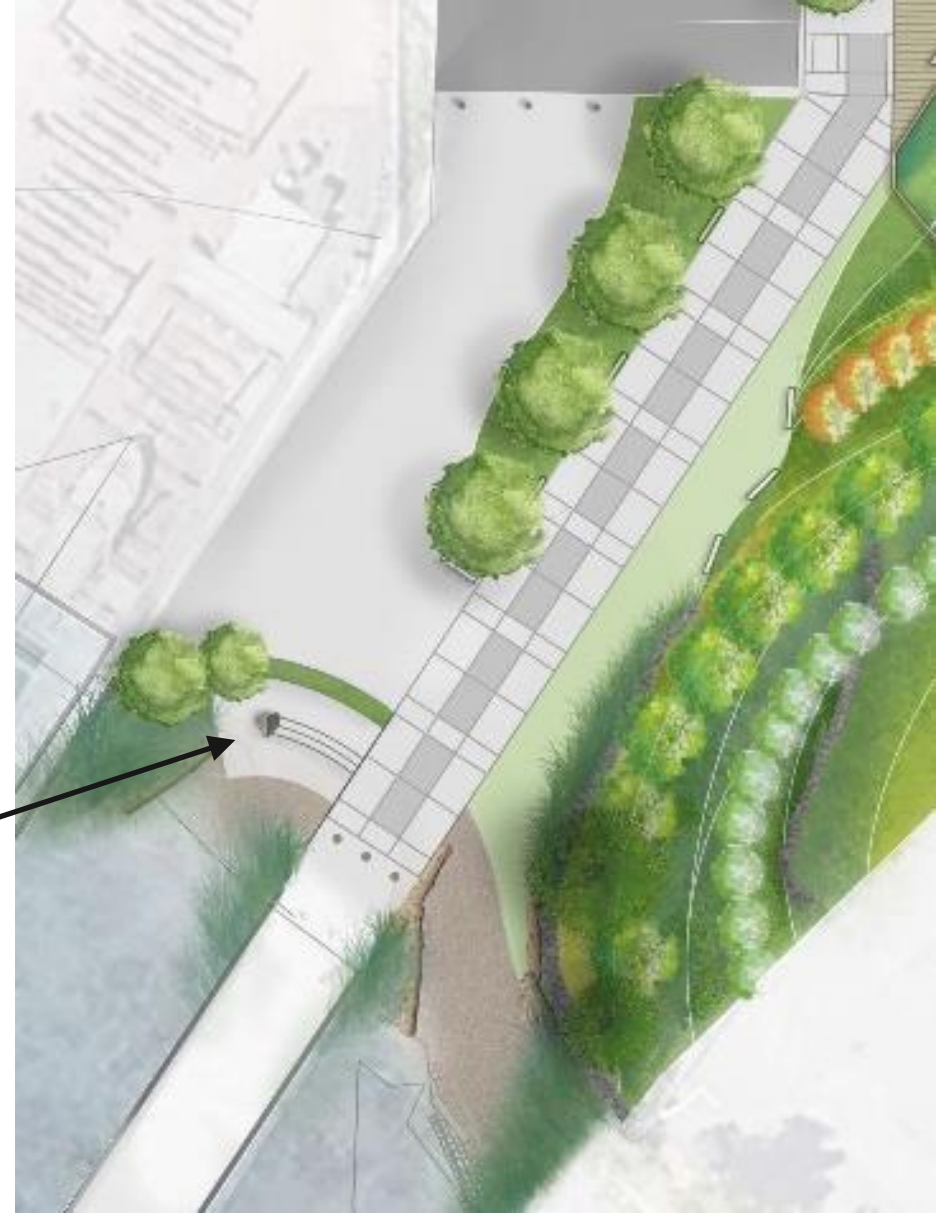
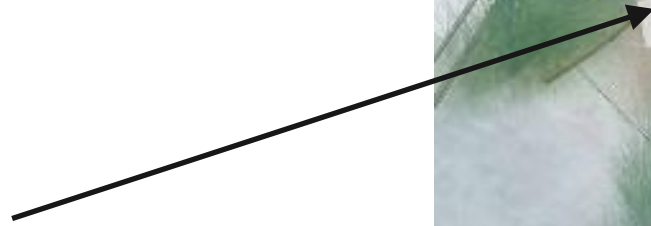
Seattle Public Utilities



City of Seattle



# 24<sup>th</sup> Avenue Right of Way



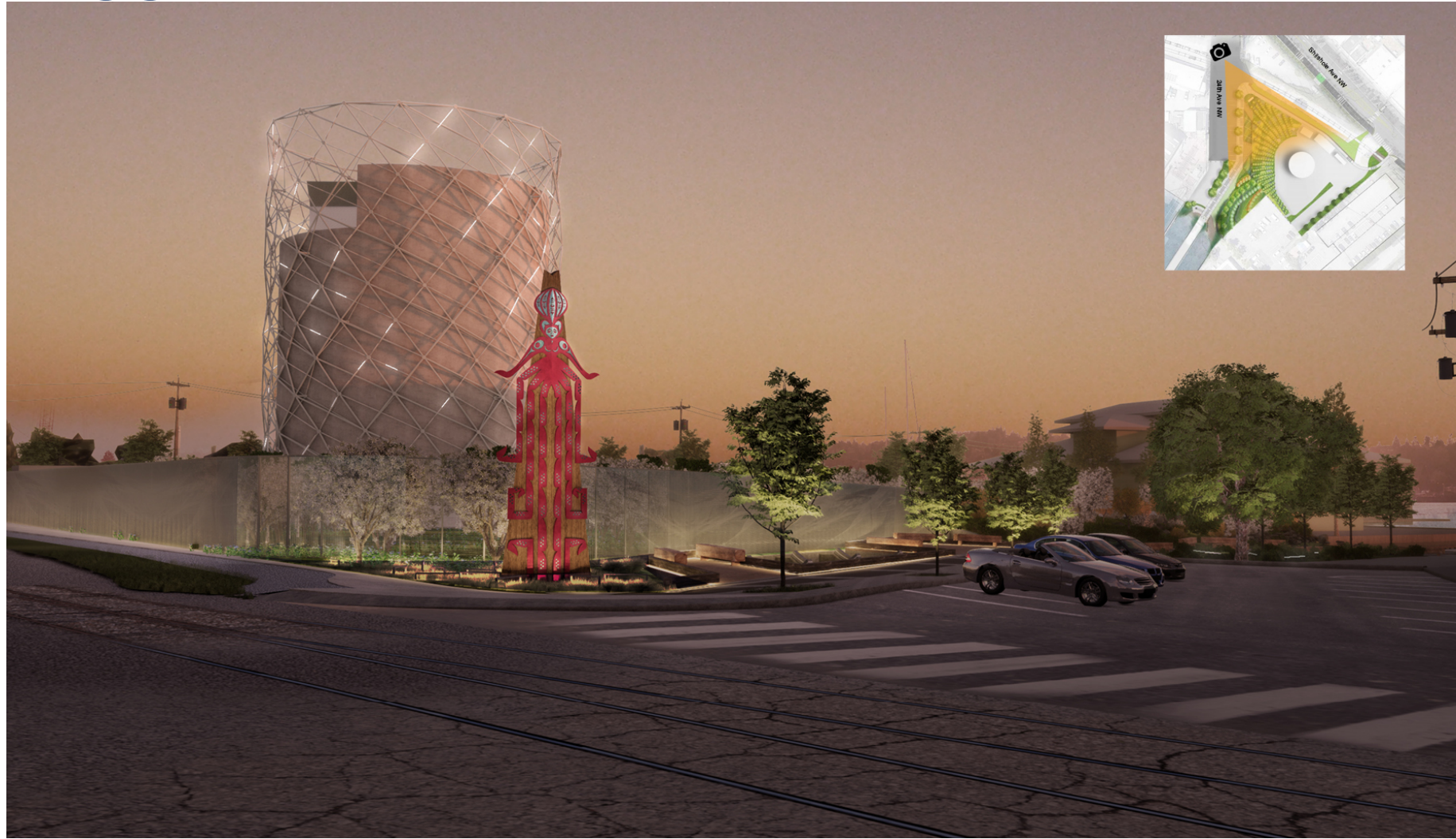
# 24<sup>th</sup> Avenue Right of Way

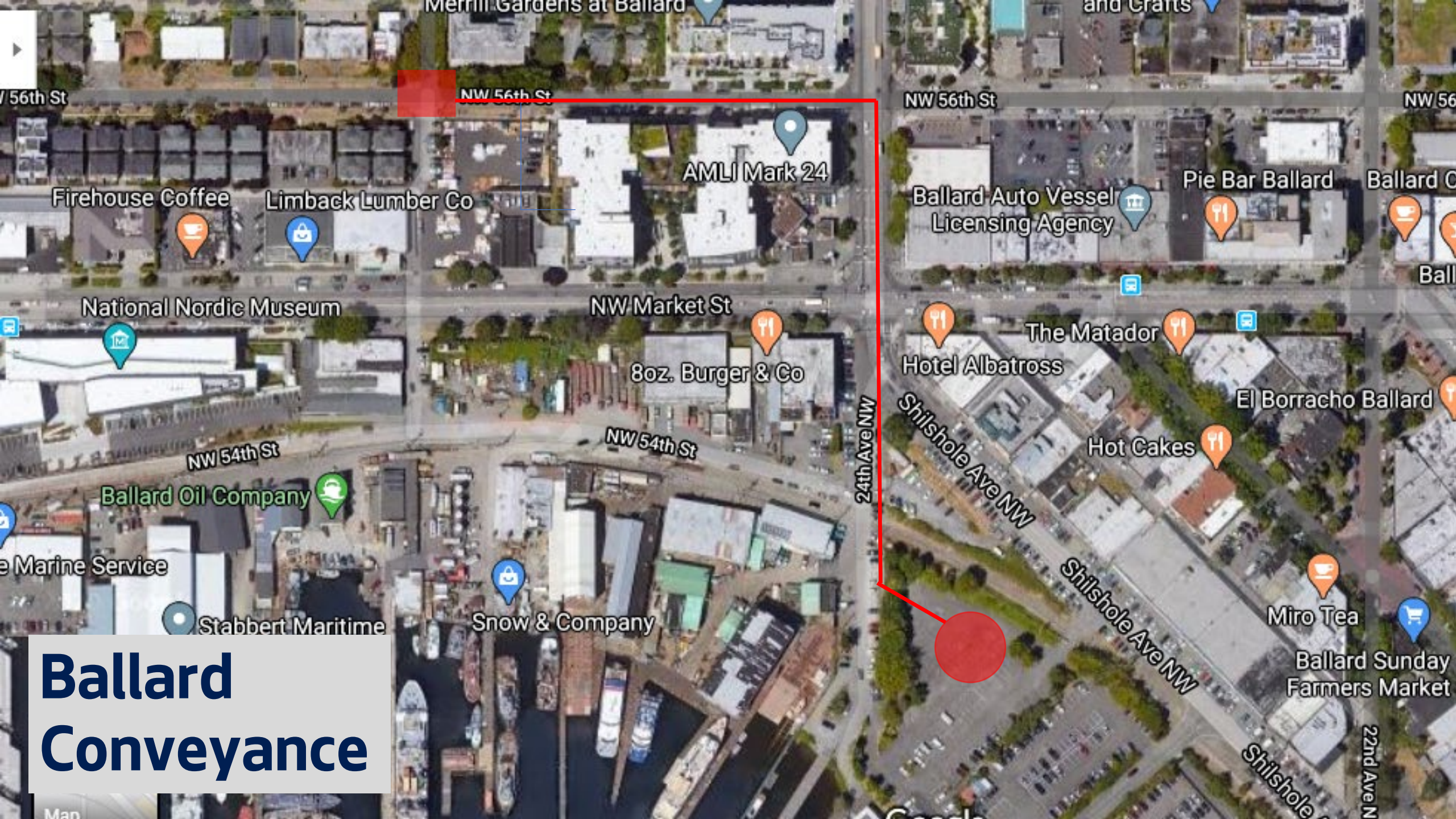


# Pump Station



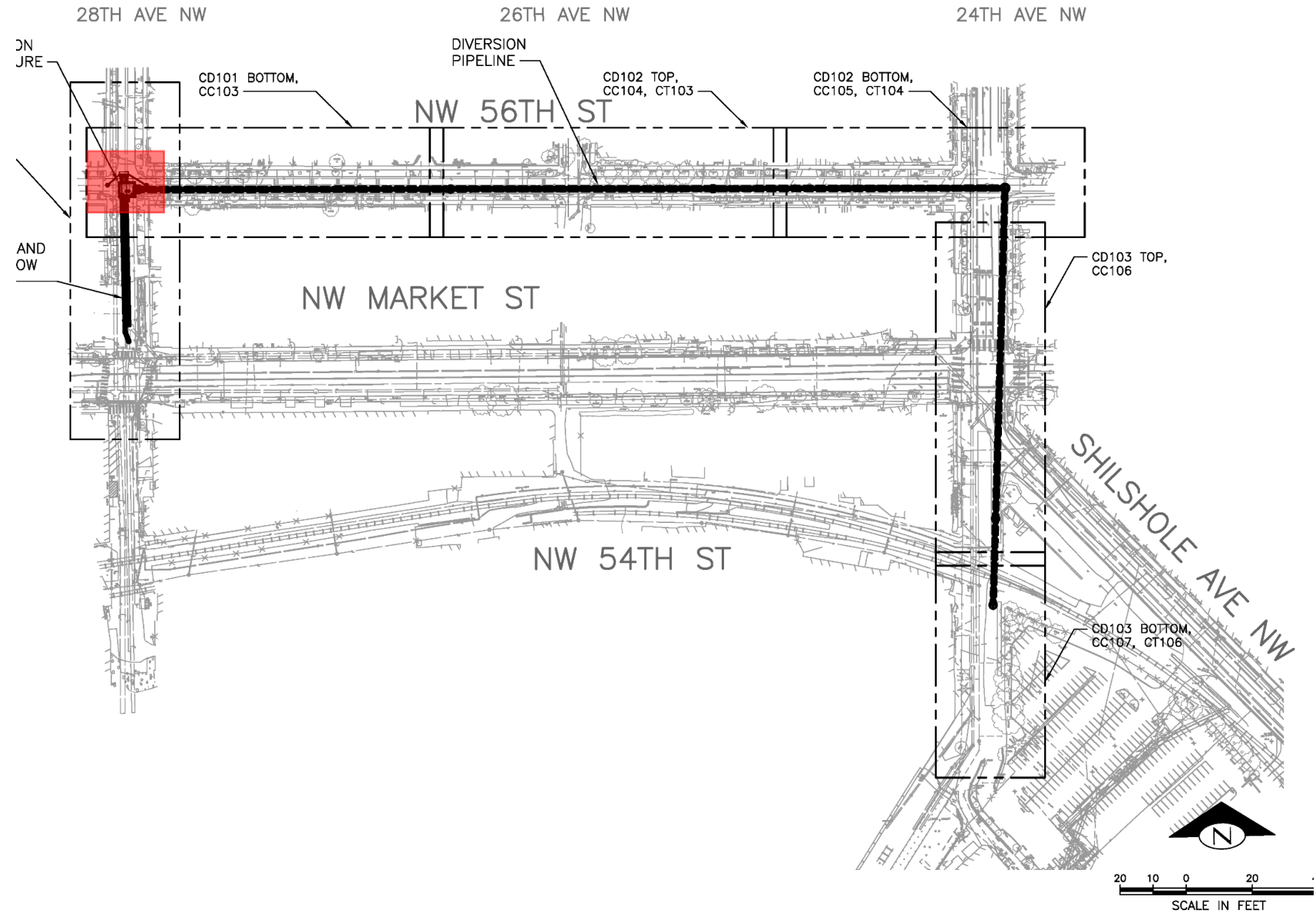
# Art - Jeffrey Veregge





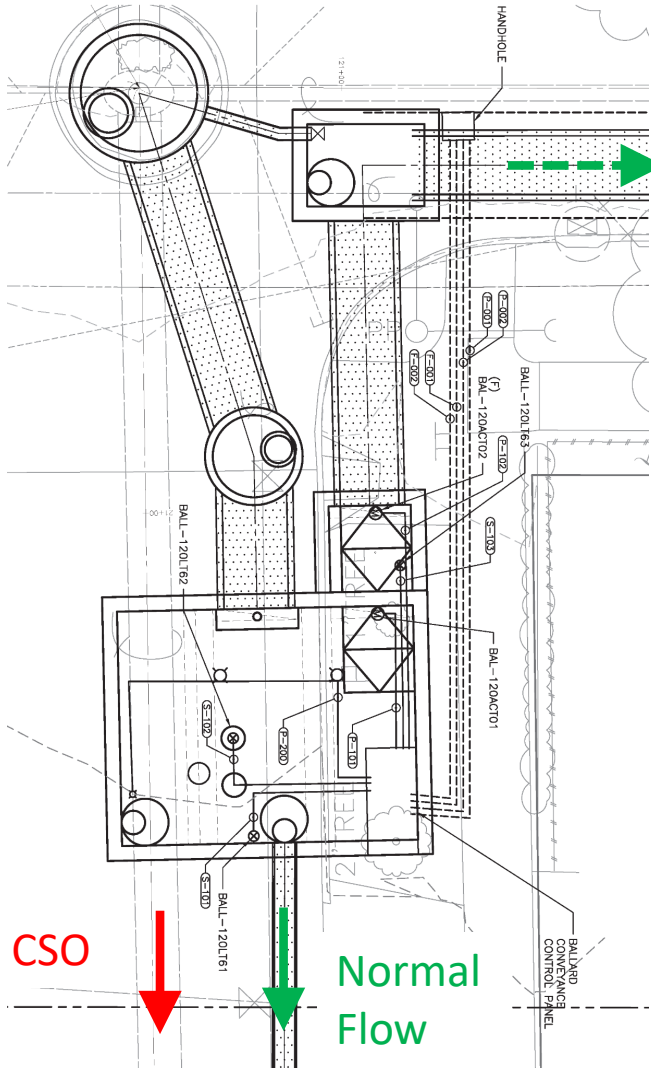
# Ballard Conveyance

# Ballard Conveyance

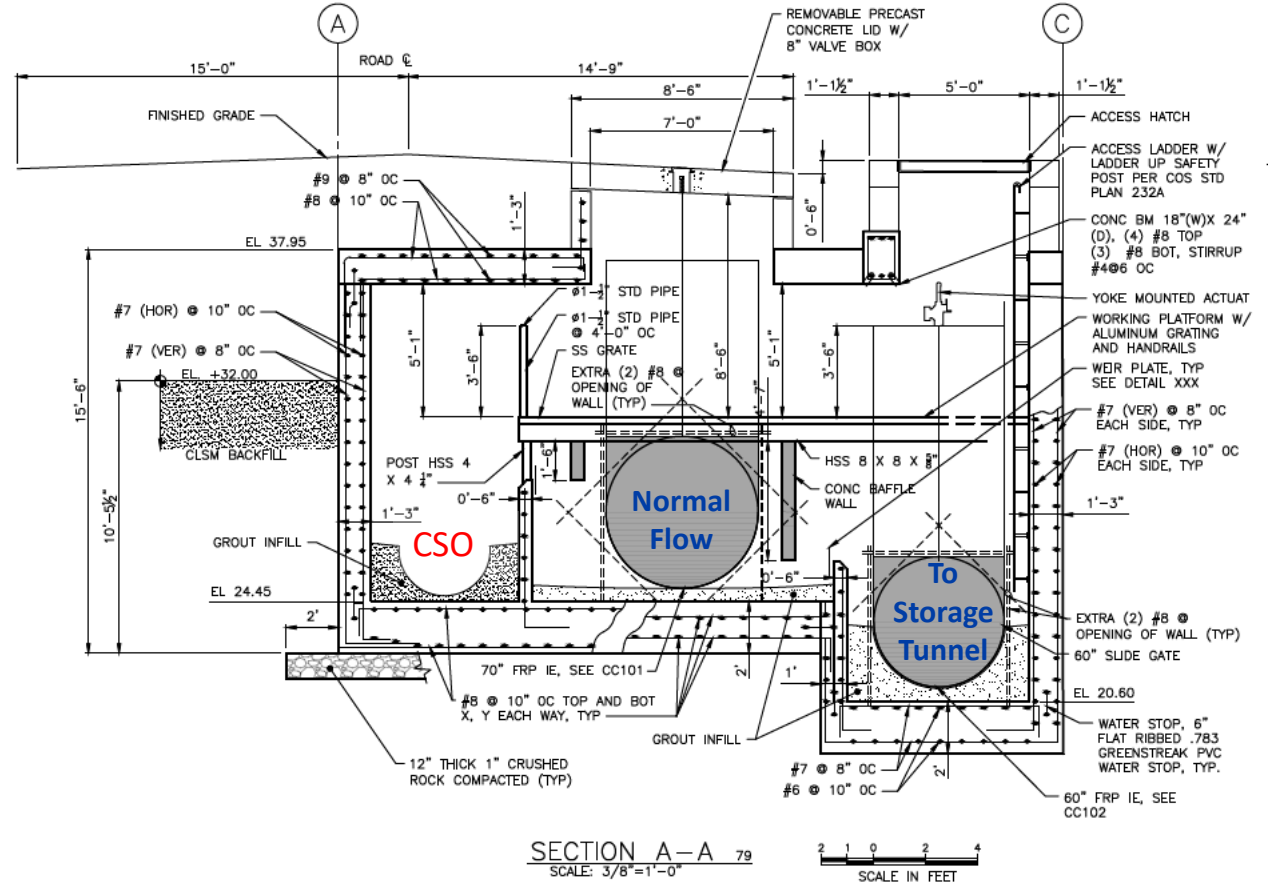


Connect to Existing  
Existing

# Ballard Conveyance - Diversion Structure



To Storage Tunnel



# Questions?

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