Design for Safety: Incorporating Operational and Construction Safety into the LO-T WTP Expansion

Kari Duncan, City of Lake Oswego
Jude D Grounds, MWH

MAY 10, 2013

Agenda

- Project Overview
- Background
- LO-T WTP Design for Safety
  - Construction
  - Operations
  - Asset Management
- Conclusions
- Questions

Program Overview

Existing Plant

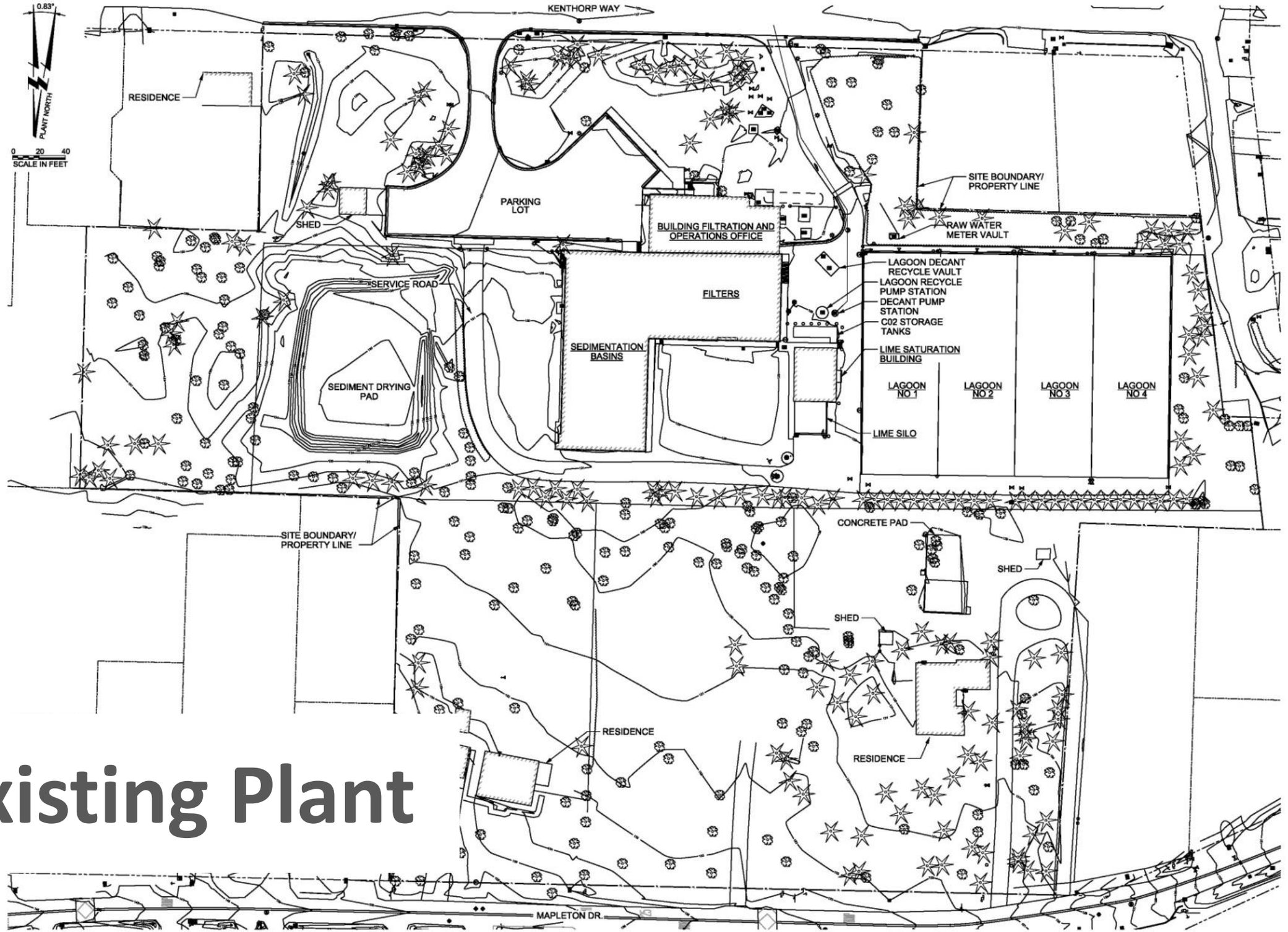
Process Overview

Site Layout

Project Overview

Intake
Pipelines
Treatment Plant
Reservoir
Pump Stations

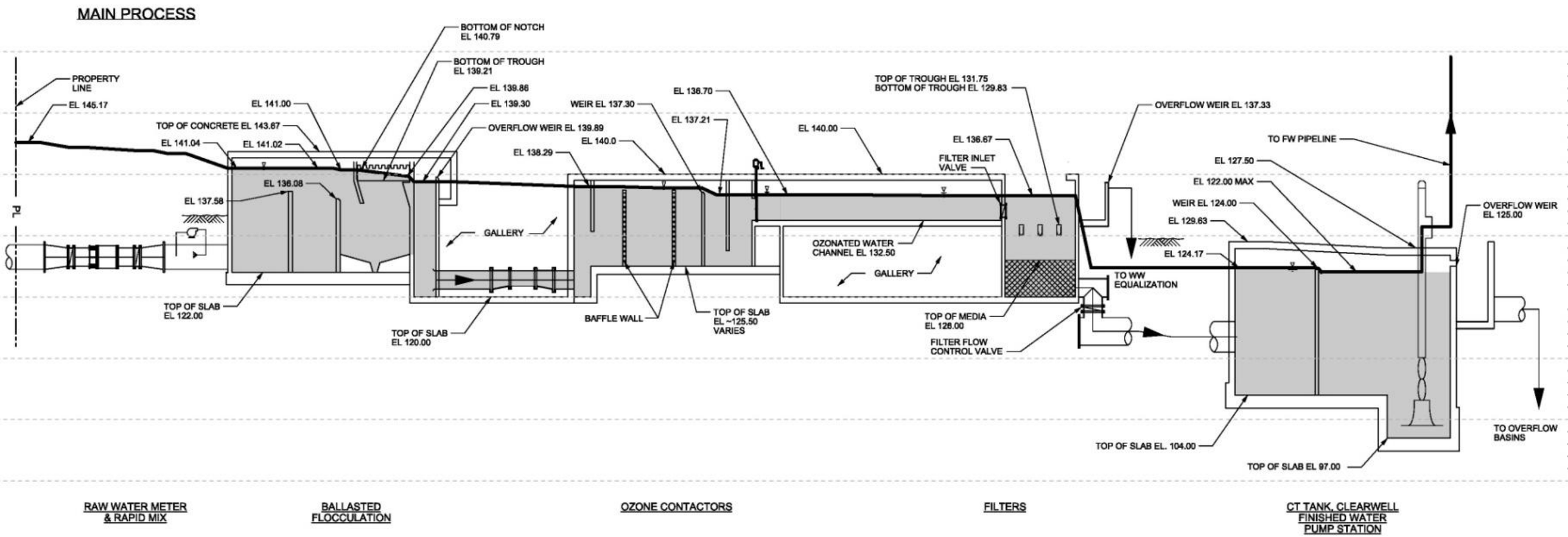
Existing Plant



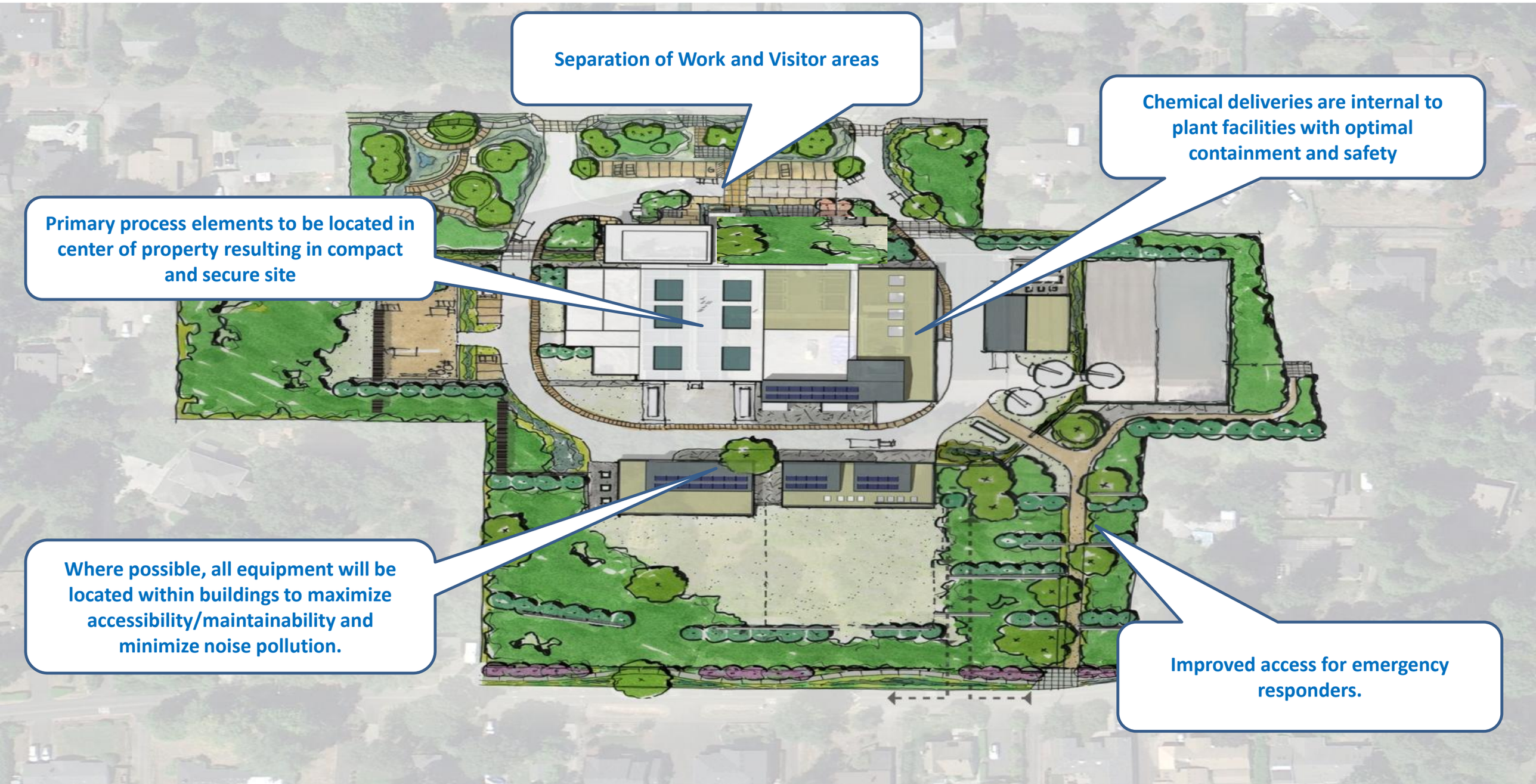
LO-T WTP Expansion

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

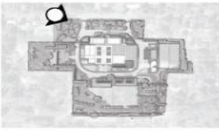
Process Overview



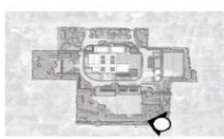
Expanded Plant



Kenthorpe Stormwater Area



Mapleton Trail/Emergency Access



Background[1]

Design for Safety Overview

Historical Data

Design Impacts

[1] ‘Design for Construction Safety’, Alliance – an OSHA Cooperative Program (April 2007)

What is Design for Safety?

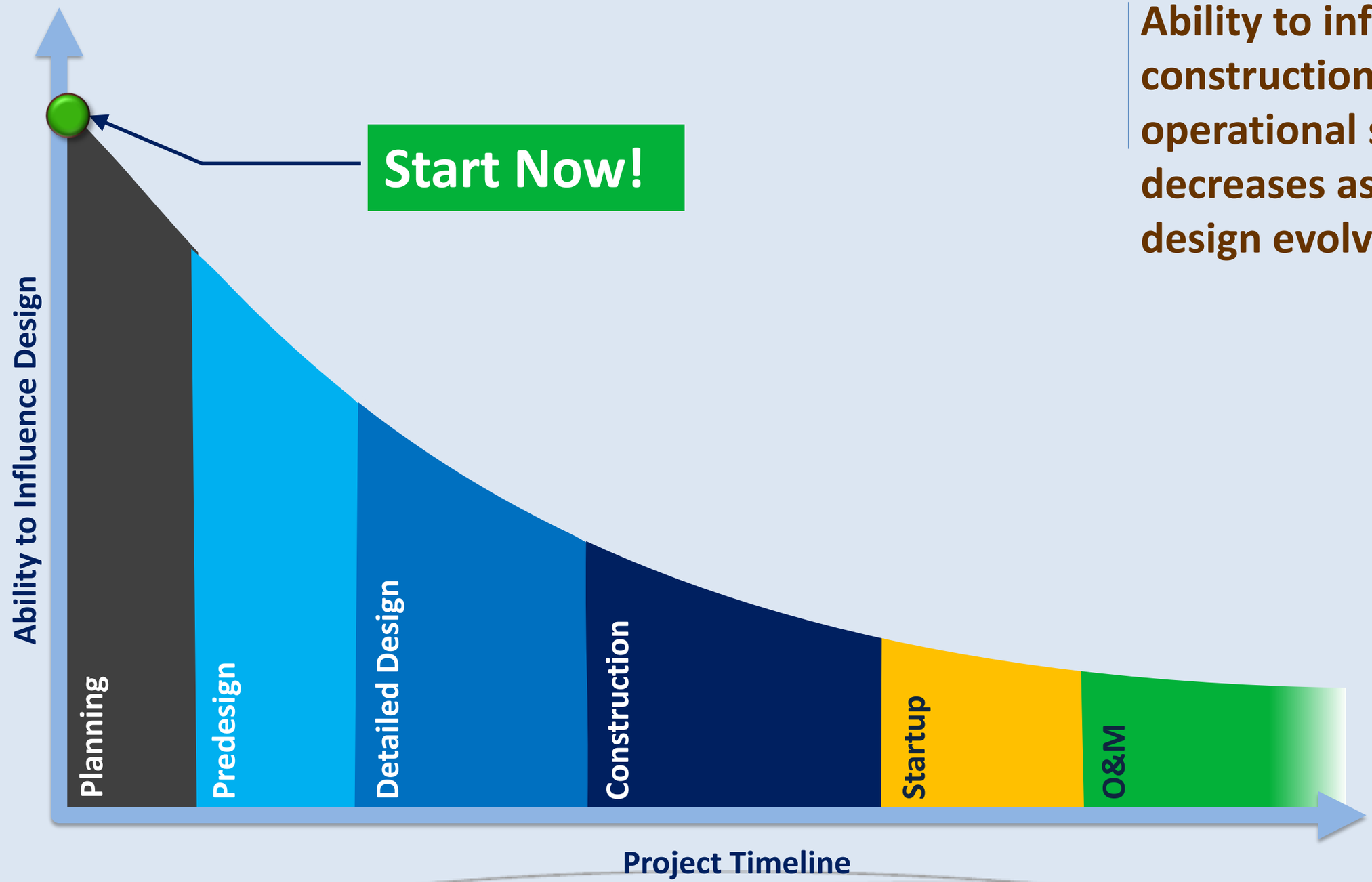
The process of addressing construction site health/safety while planning for future maintenance during the design phase of a project.

Construction Accidents[1]

- Nearly 200,000 serious injuries and 1,200 deaths each year
- 7% of workforce but 21% of fatalities
- Construction has the most fatalities of any industry sector

[1] Bureau of Labor Statistics-2005

Ability to influence construction and operational safety decreases as the design evolves



Design can Influence Construction and Operational Safety

- 22% of 226 injuries that occurred from 2000-2002 in Oregon, WA and CA linked to design[1]
- 42% of 224 fatalities in US between 1990-2003 linked to design[1]
- In Europe, a 1991 study concluded that 60% of fatal accidents resulted from decisions made before site work began[2]

[1] Behm, “Linking Construction Fatalities to the Design for Construction Safety Concept”, 2005

[2] European Foundation for the Improvement of Living and Working Conditions

Construction Considerations

Operational Considerations

Design for Safety:

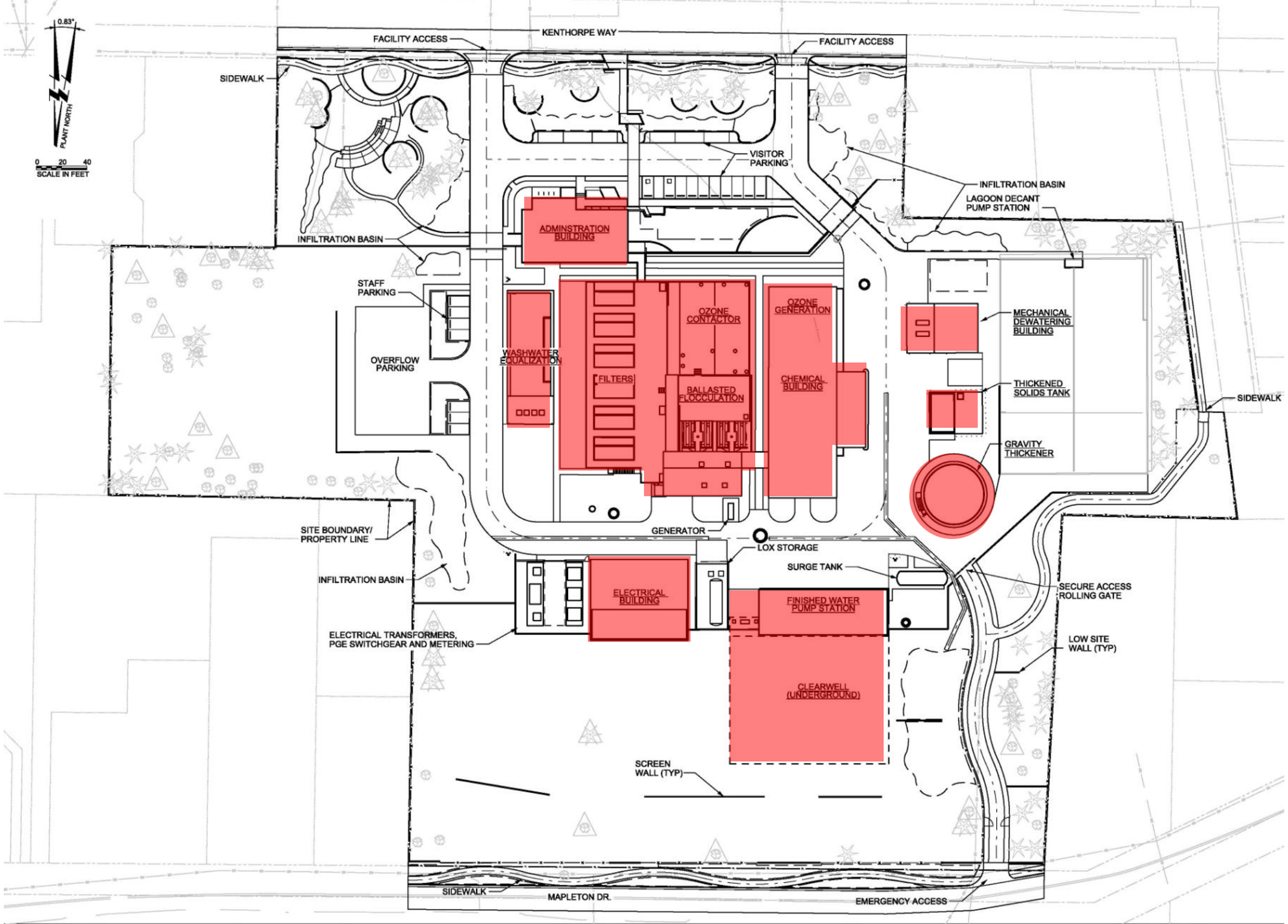
LO-T WTP Expansion

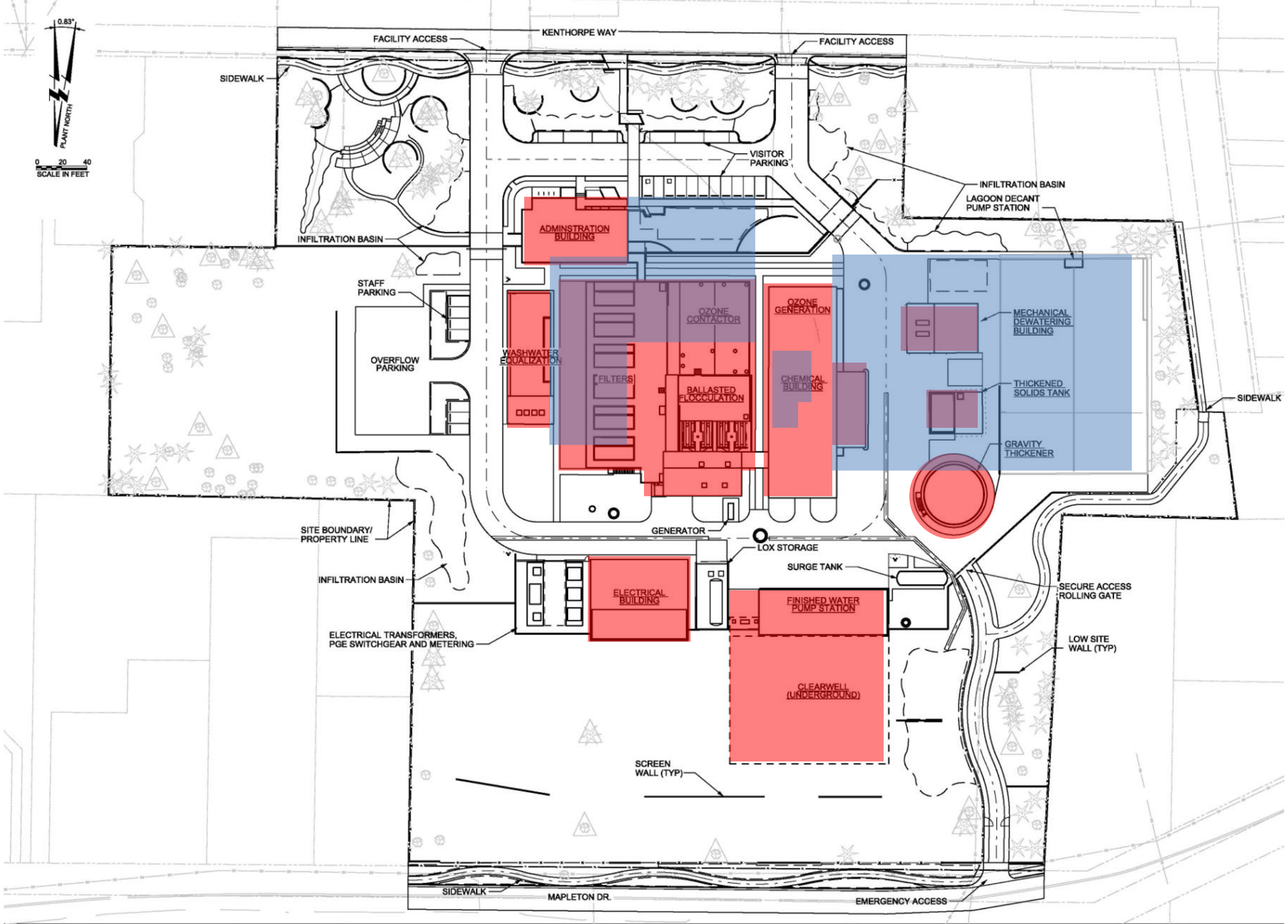
Construction Sequence Walkthrough

Other Constructability Considerations

Construction Considerations


0.83°
PLANT NORTH
0 20 40
SCALE IN FEET
KENTHORP WAY
RESIDENCE
SHED
PARKING LOT
BUILDING FILTRATION AND OPERATIONS OFFICE
FILTERS
SEDIMENTATION BASINS
SERVICE ROAD
SEDIMENT DRYING PAD
SITE BOUNDARY/ PROPERTY LINE
RAW WATER METER VAULT
LAGOON DECANT RECYCLE VAULT
LAGOON RECYCLE PUMP STATION
DECANT PUMP STATION
C02 STORAGE TANKS
LIME SATURATION BUILDING
LAGOON NO 1
LAGOON NO 2
LAGOON NO 3
LAGOON NO 4
LIME SILO
CONCRETE PAD
SHED
SHED
RESIDENCE
RESIDENCE
SITE BOUNDARY/ PROPERTY LINE
MAPLETON DR


0.83°
PLANT NORTH
0 20 40
SCALE IN FEET
FACILITY ACCESS
KENTHORPE WAY
FACILITY ACCESS
SIDEWALK
VISITOR PARKING
INFILTRATION BASIN
LAGOON DECANT PUMP STATION
ADMINSTRATION BUILDING
INFILTRATION BASIN
STAFF PARKING
OVERFLOW PARKING
WASHWATER EQUALIZATION
FILTERS
OZONE CONTACTOR
BALLASTED FLOCCULATION
OZONE GENERATION
CHEMICAL BUILDING
MECHANICAL DEWATERING BUILDING
THICKENED SOLIDS TANK
GRAVITY THICKENER
SIDEWALK
SITE BOUNDARY/ PROPERTY LINE
INFILTRATION BASIN
GENERATOR
LOX STORAGE
SURGE TANK
ELECTRICAL BUILDING
FINISHED WATER PUMP STATION
SECURE ACCESS ROLLING GATE
ELECTRICAL TRANSFORMERS, PGE SWITCHGEAR AND METERING
LOW SITE WALL (TYP)
CLEARWELL (UNDERGROUND)
SCREEN WALL (TYP)
SIDEWALK
MAPLETON DR.
EMERGENCY ACCESS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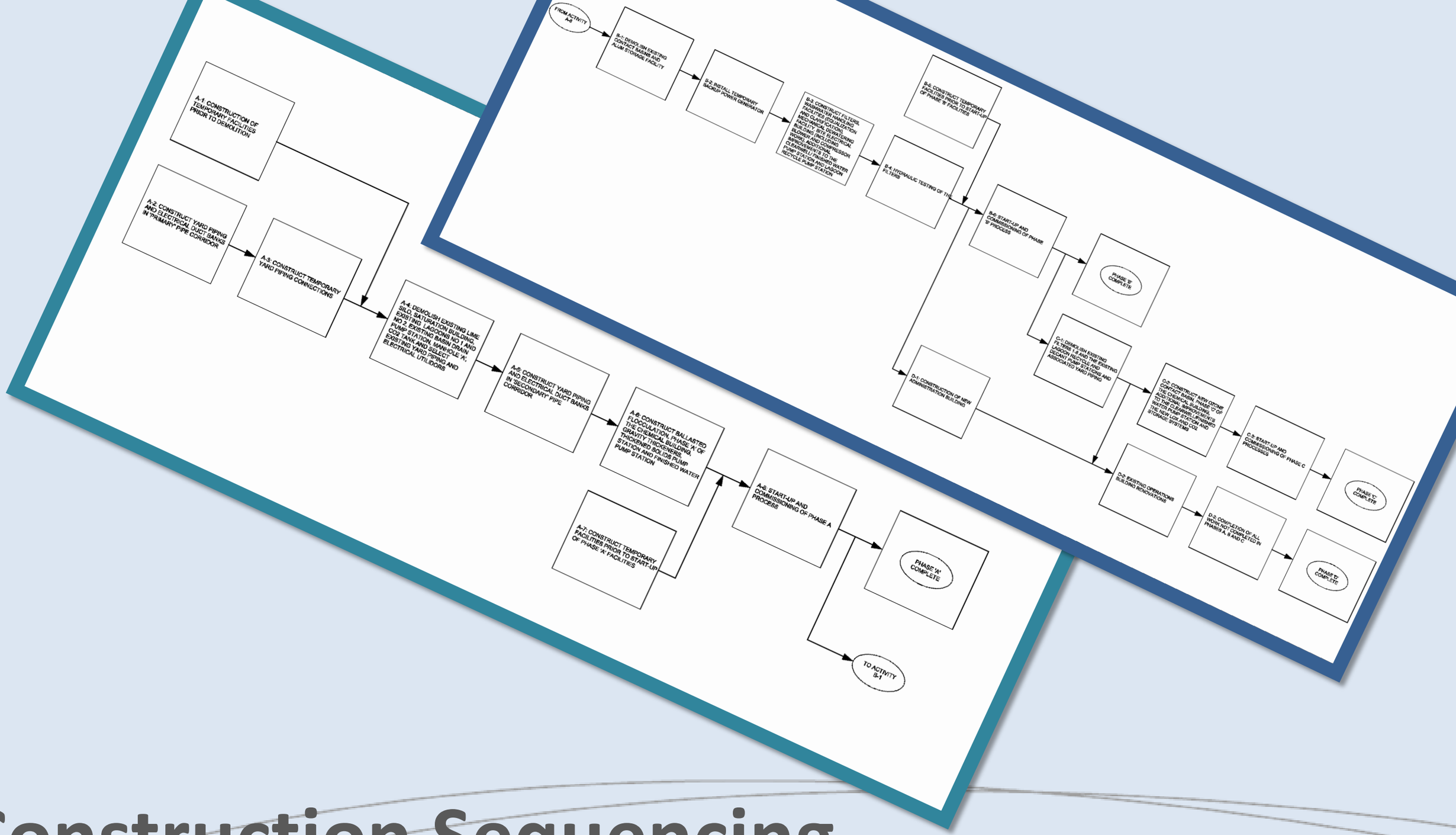
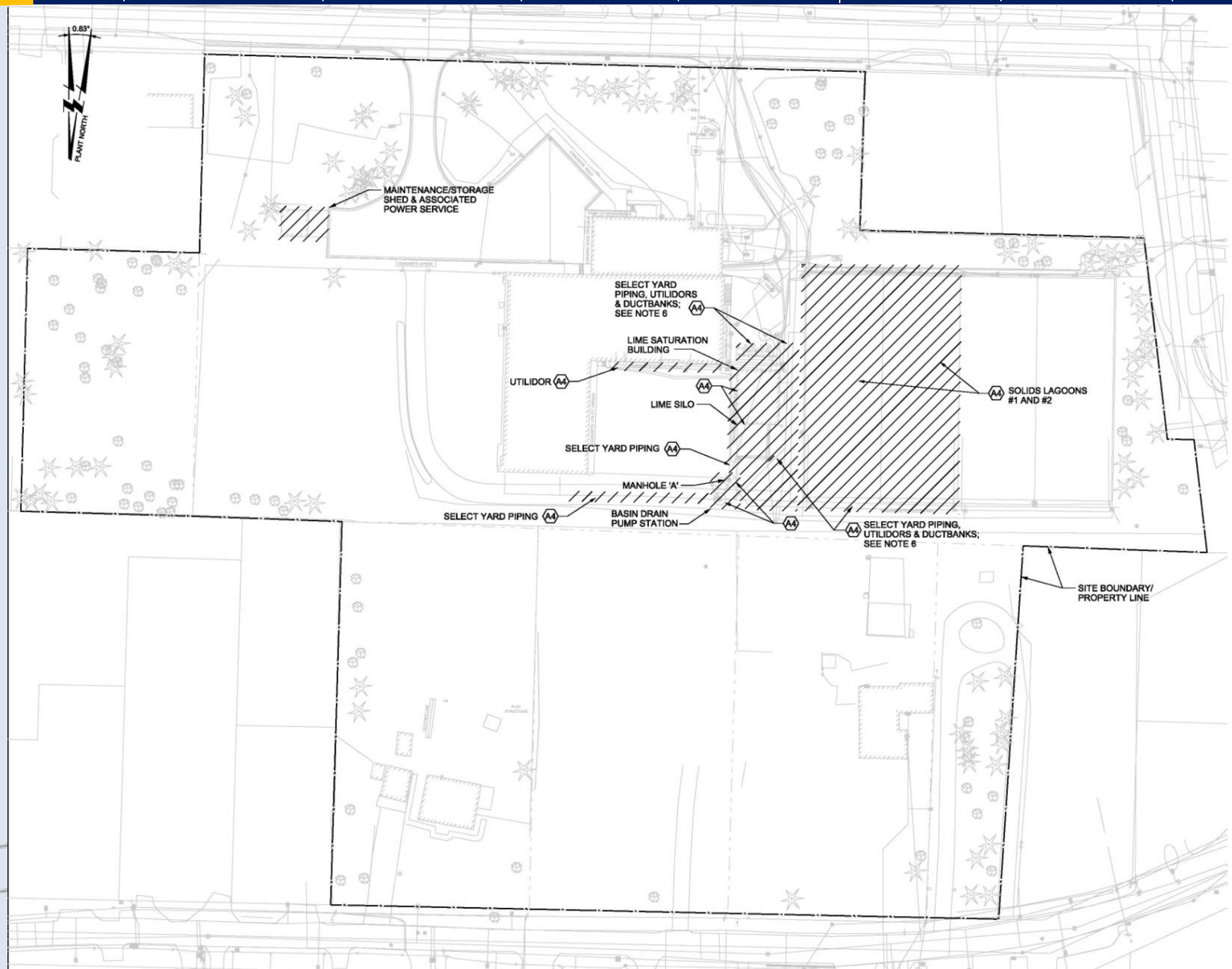


Construction Sequencing

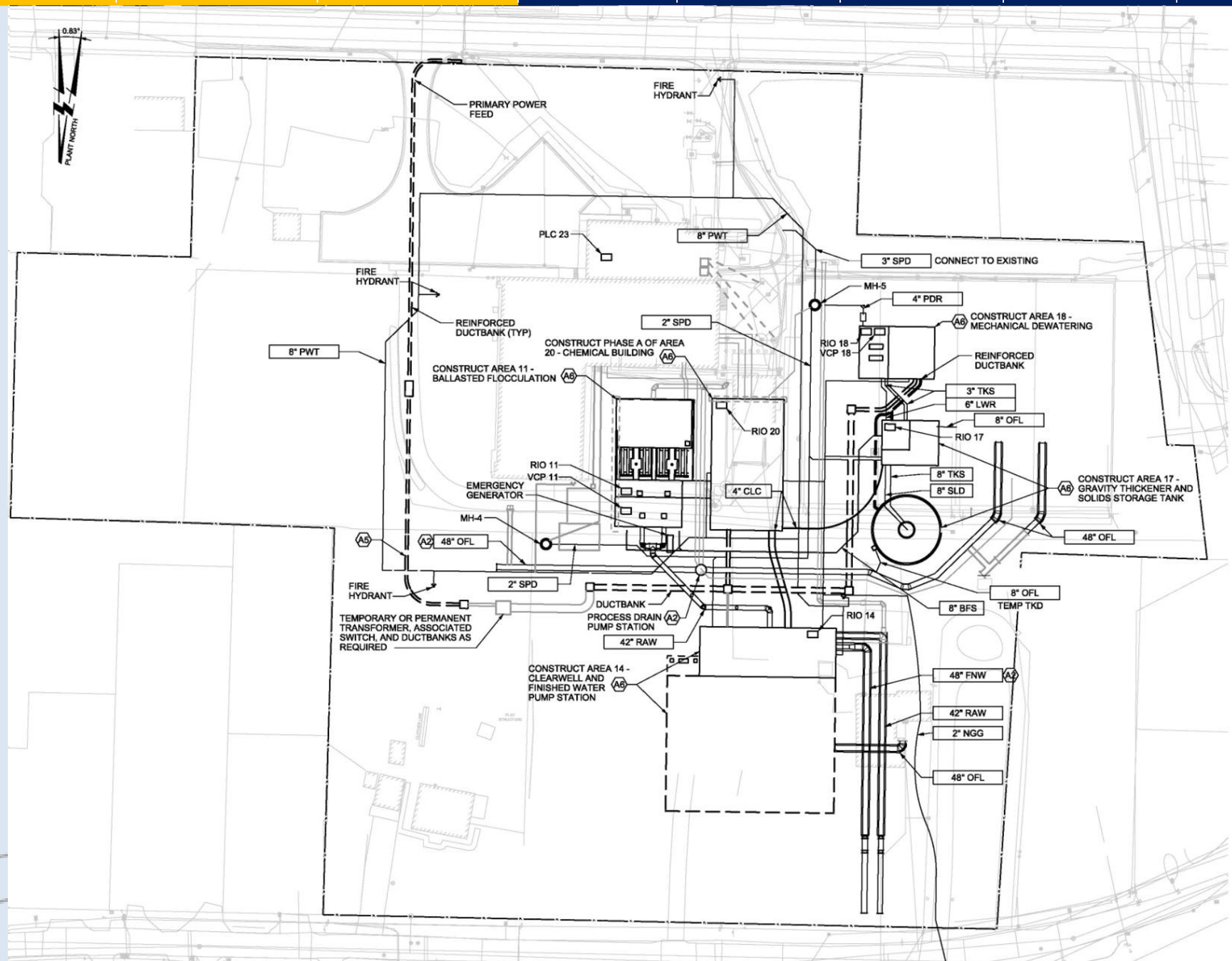
2013			2014				2015			
Q3		Q4	Q1		Q2	Q3	Q4	Q1	Q2	Q3	Q4

Demolition Phase A



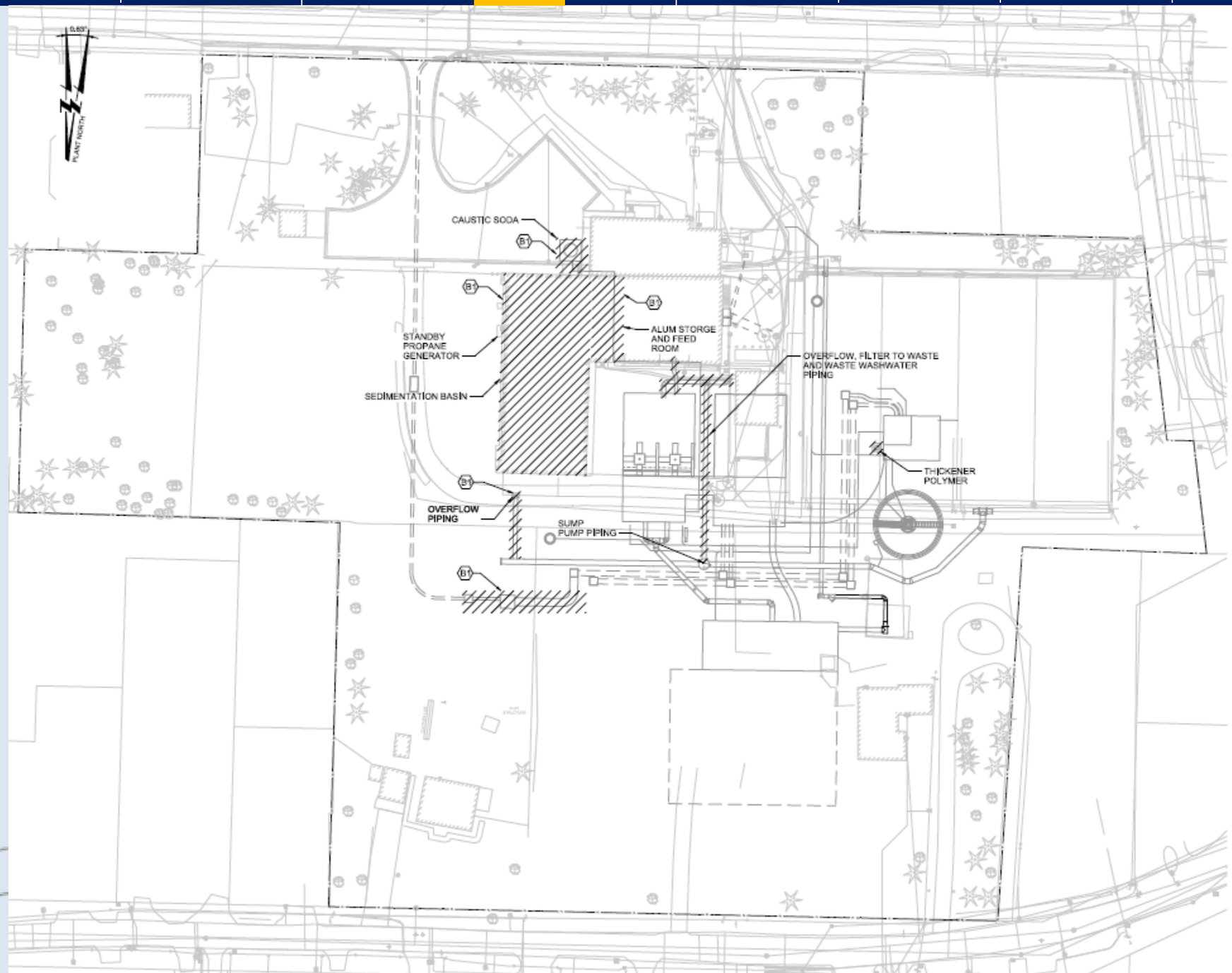
2013		2014				2015			
Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4

Phase A Construction Plan



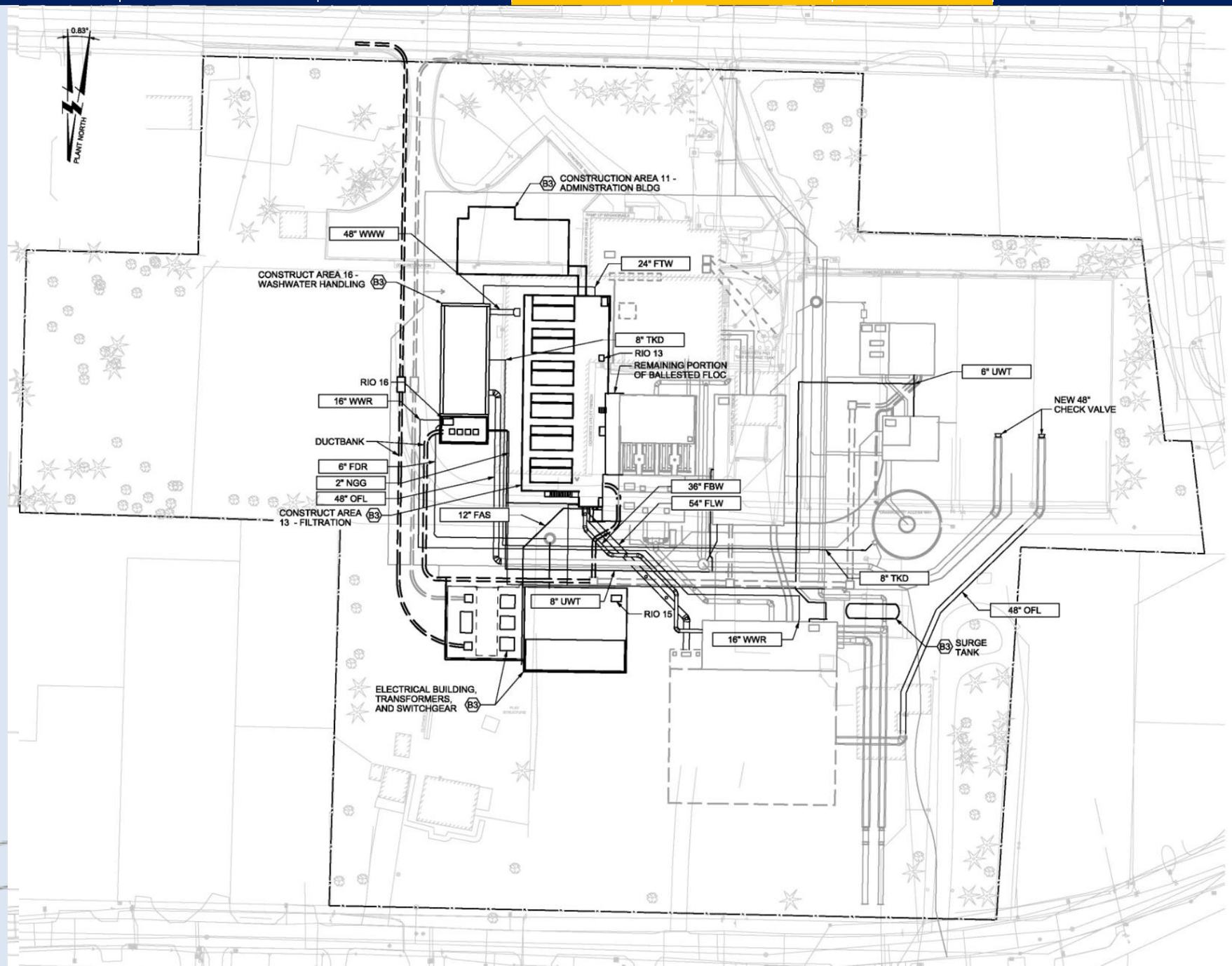
2013		2014				2015			
Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4

Demolition Phase B



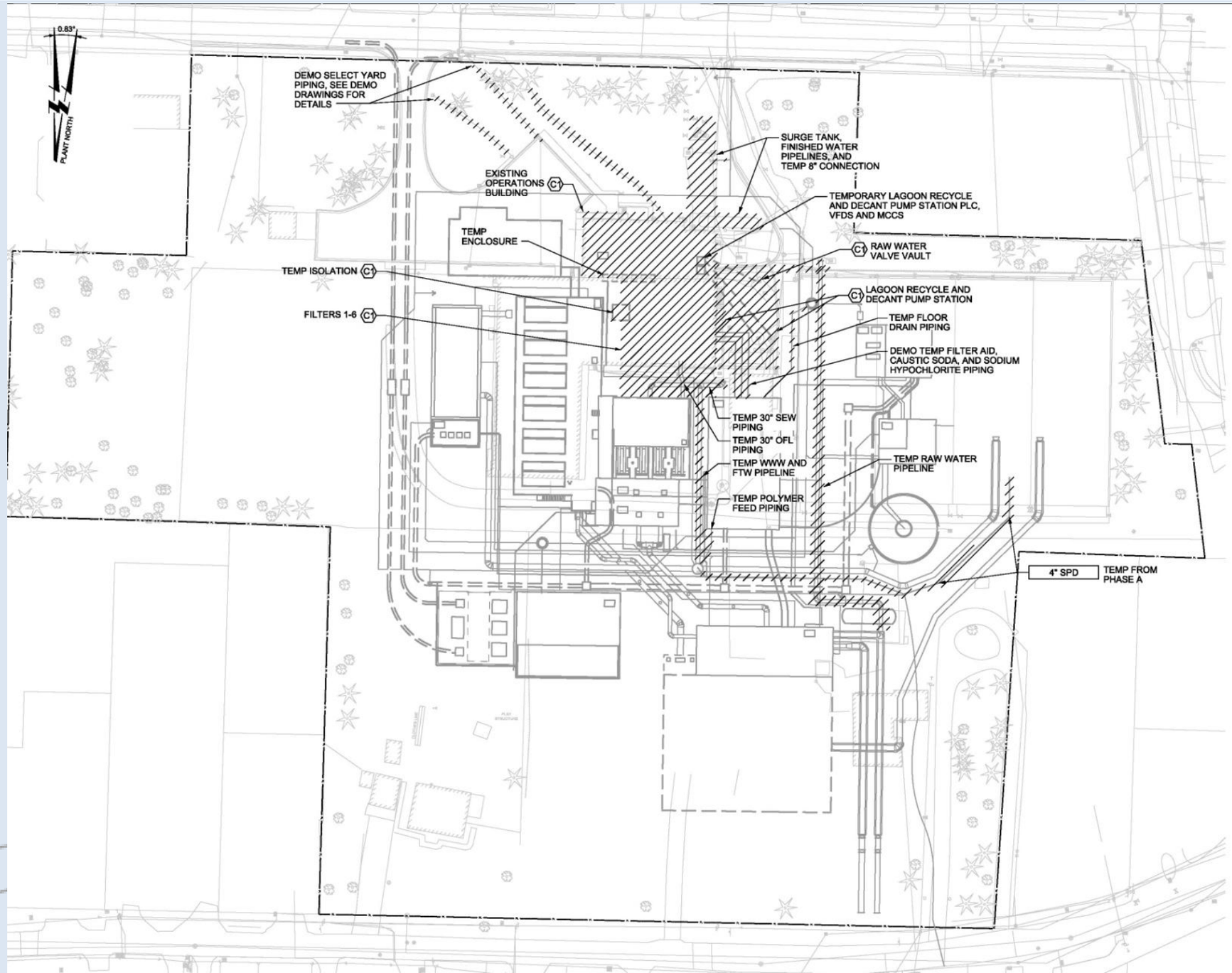
2013		2014				2015			
Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4

Construction Phase B



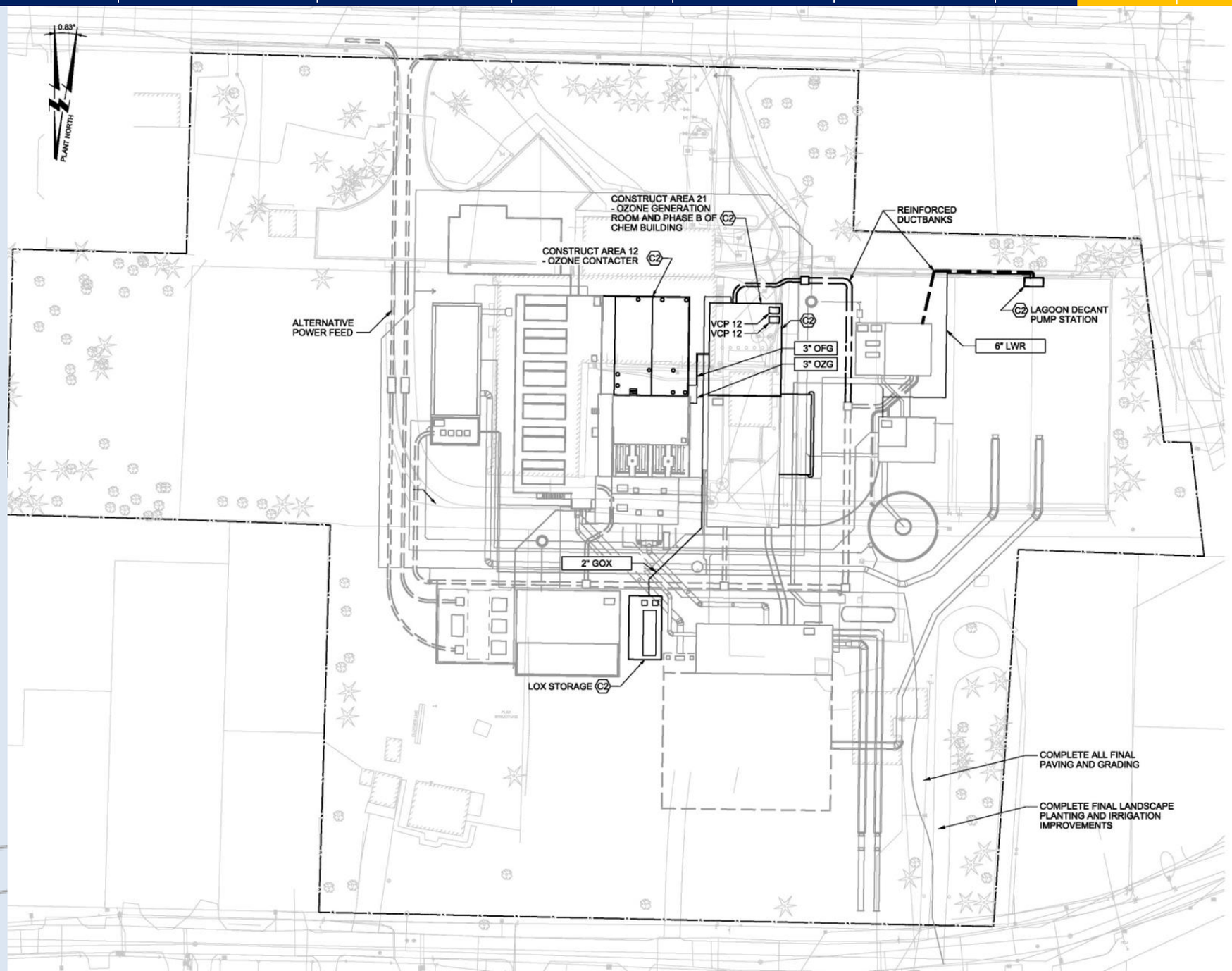
2013		2014				2015			
Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4

Demolition Phase C

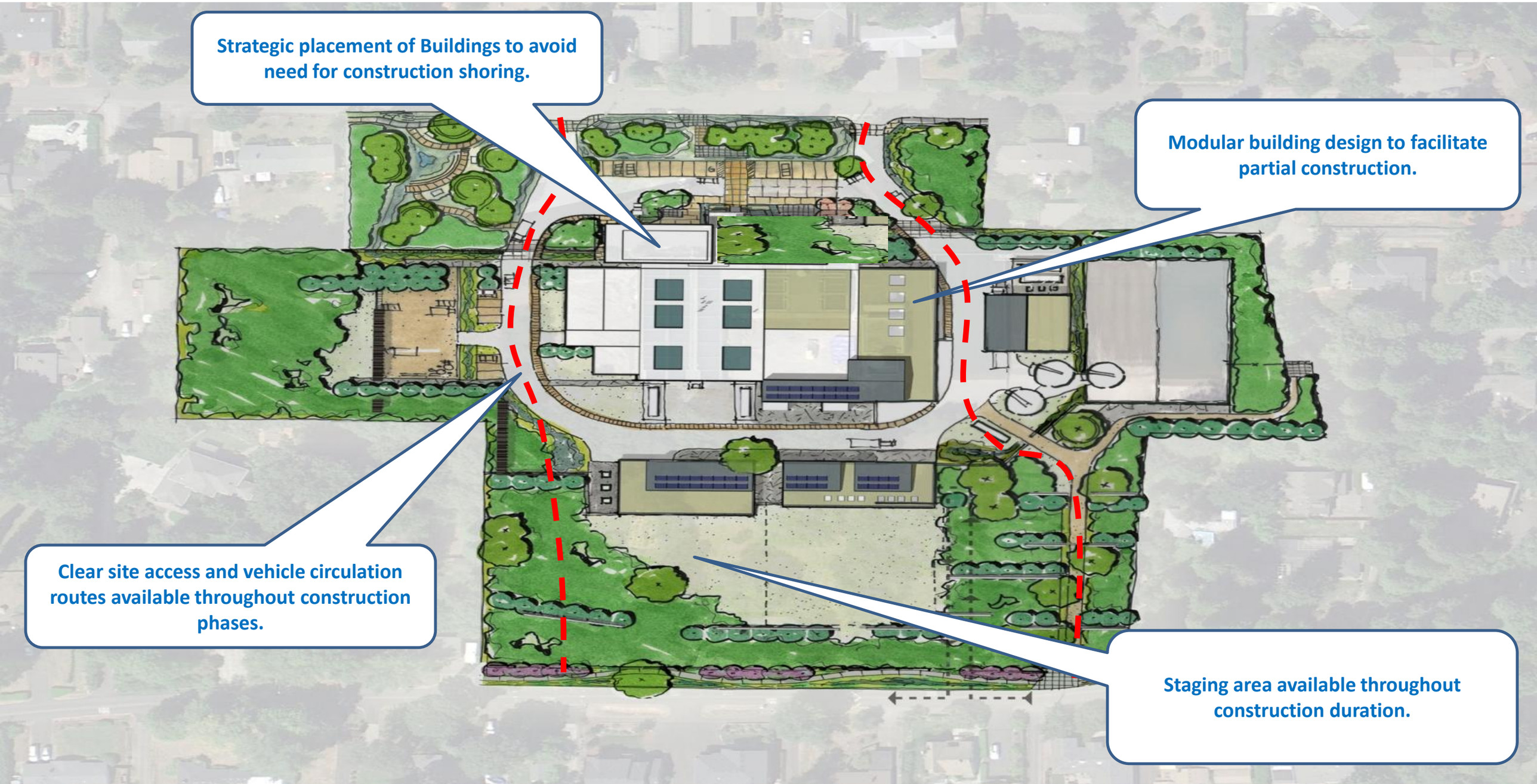


2013		2014				2015				
Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3		Q4

Construction Phase C



Additional Constructability Considerations



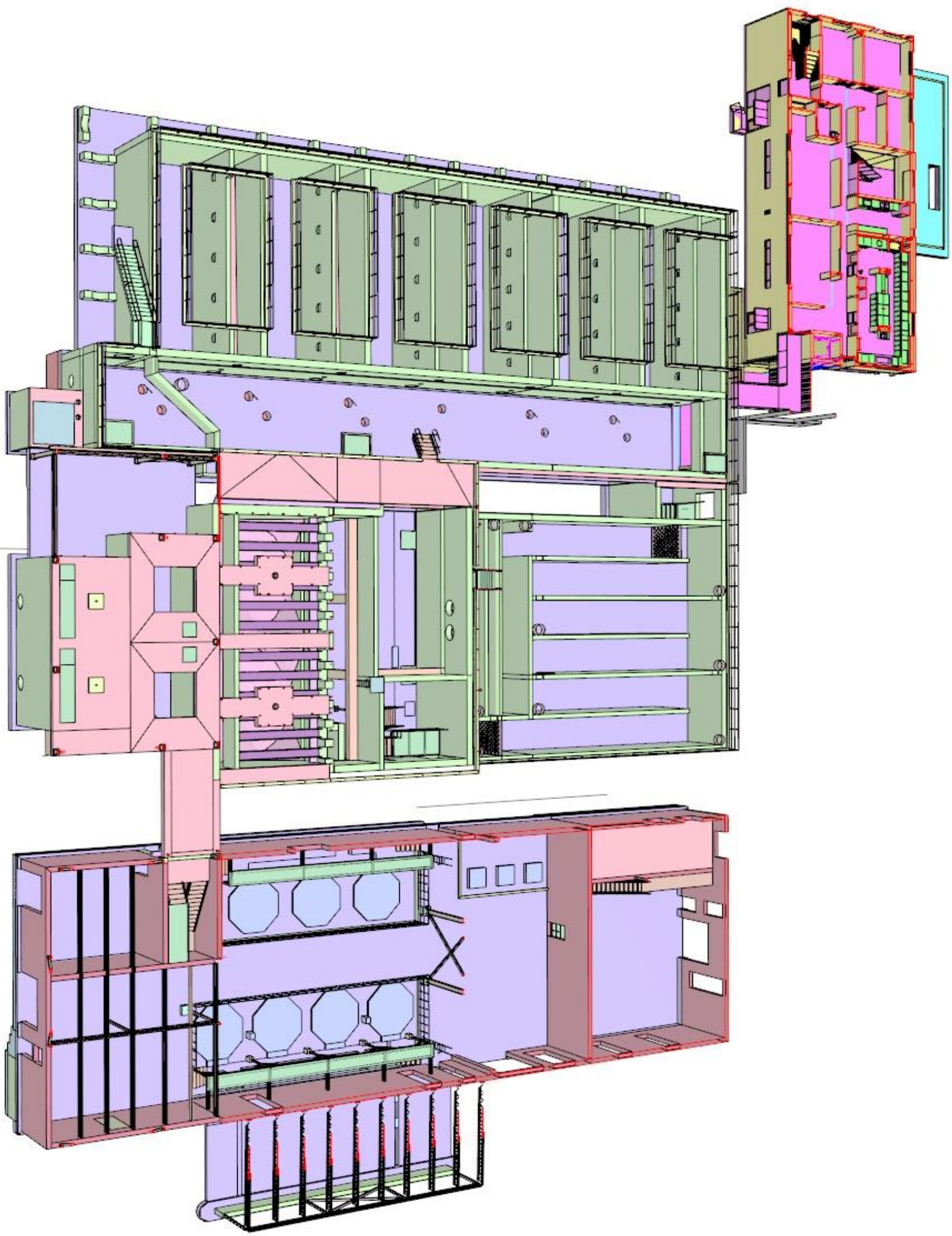
Operational Considerations

- Structural Integrity
- Accessibility
- Hazardous Materials Management
- Confined Space
- Site Security
- Asset Management

Structural Integrity following Seismic Event

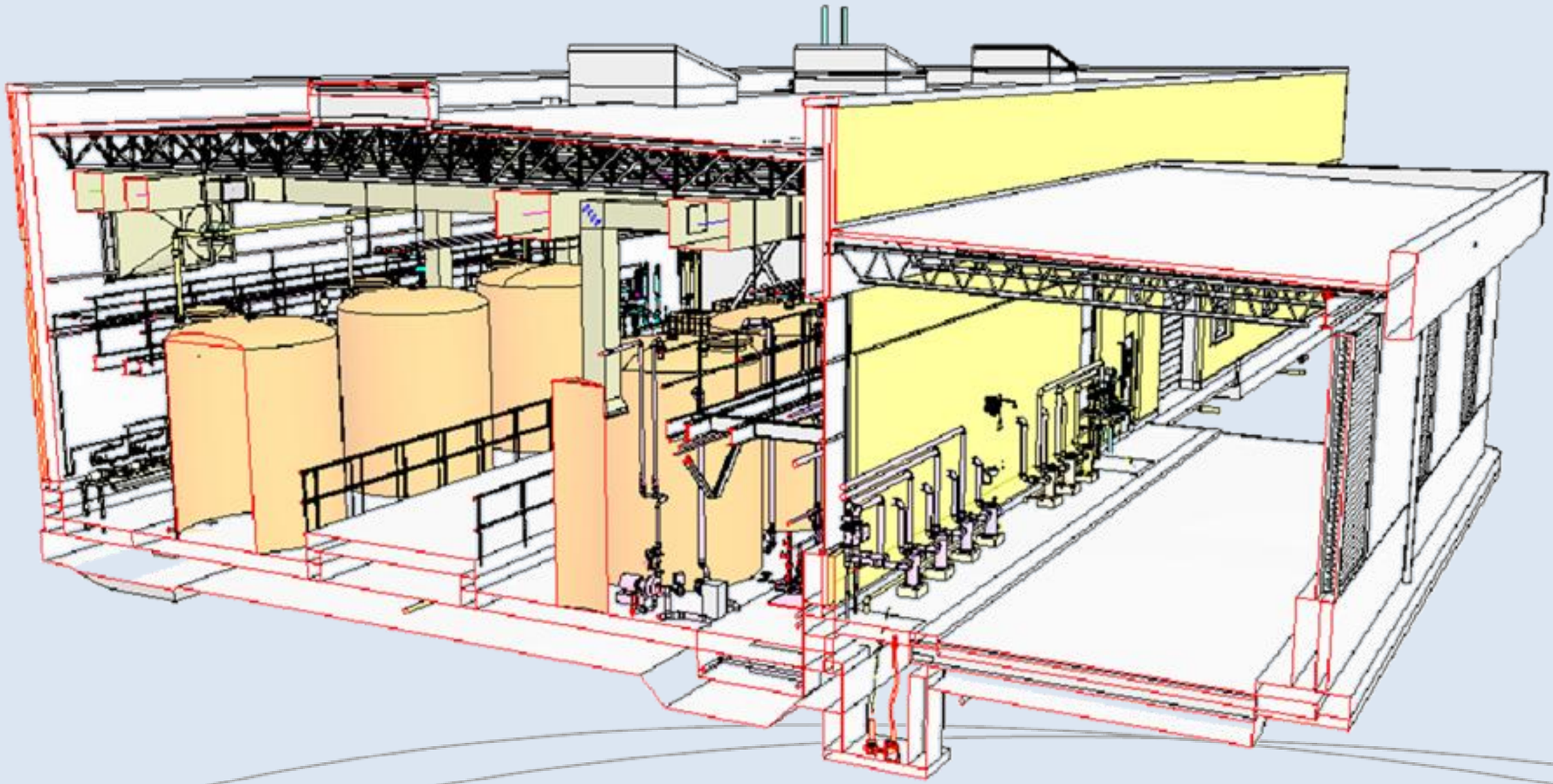
- Occupancy Category Drives Design Criteria
  - OC IV – Operable
  - OC III – Operable w/ Minor Repairs
- Most WTPs are designated OC III, but additional investments may be warranted/desired
  - Select Structures, Bracing and Anchorage
  - Select Equipment

Maximize Operational Accessibility

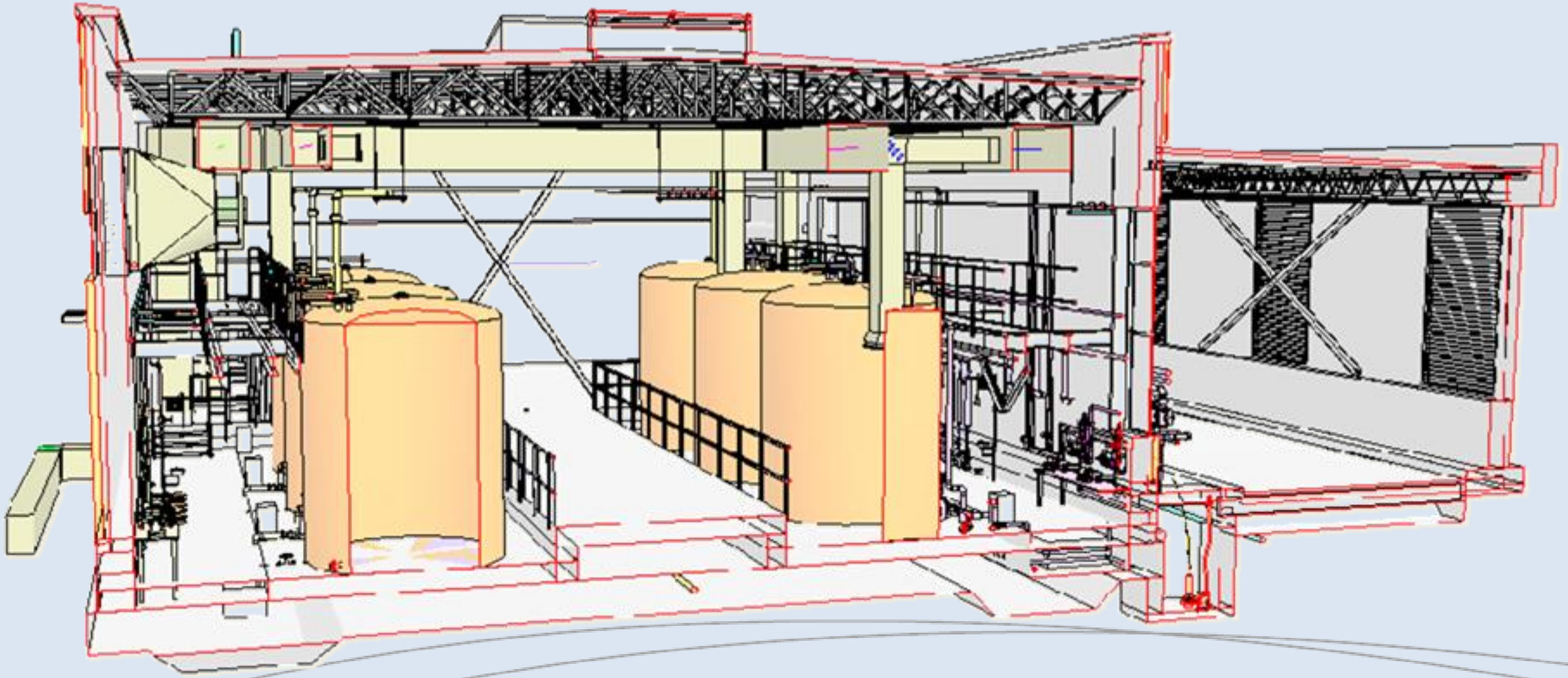


Maximize Operational Accessibility

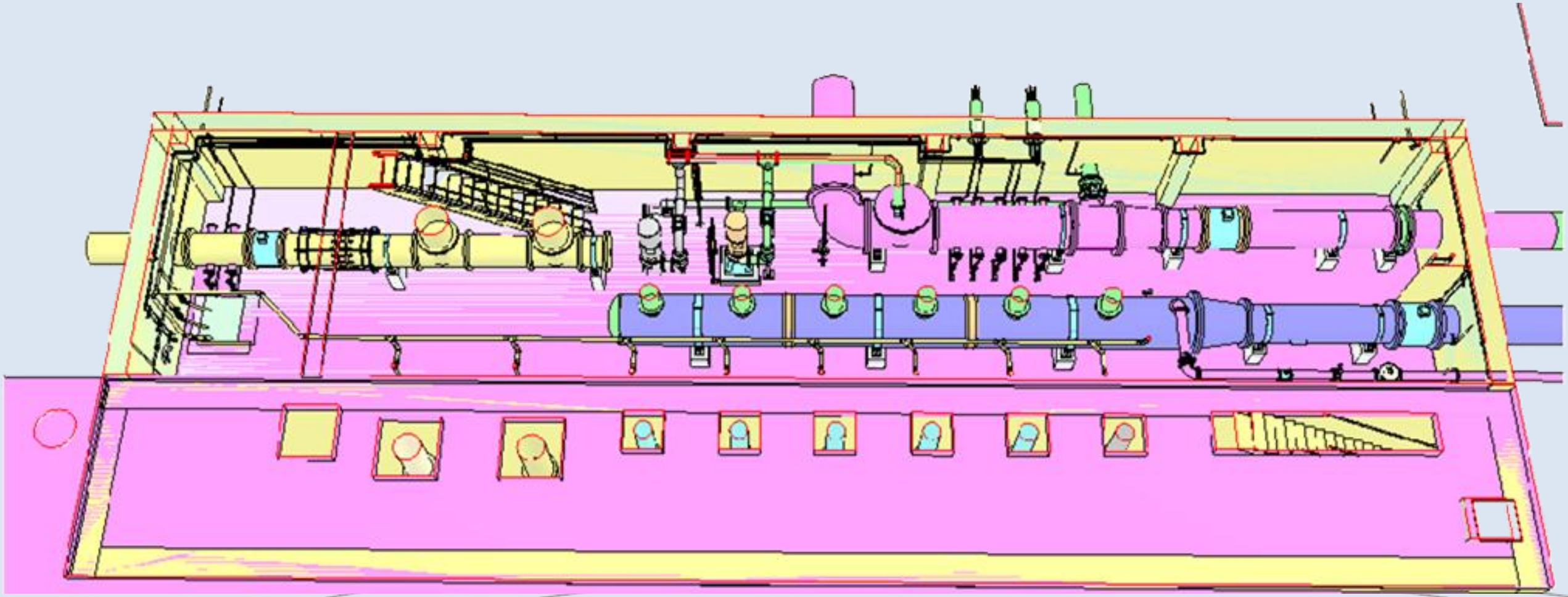
Hazardous Materials Management



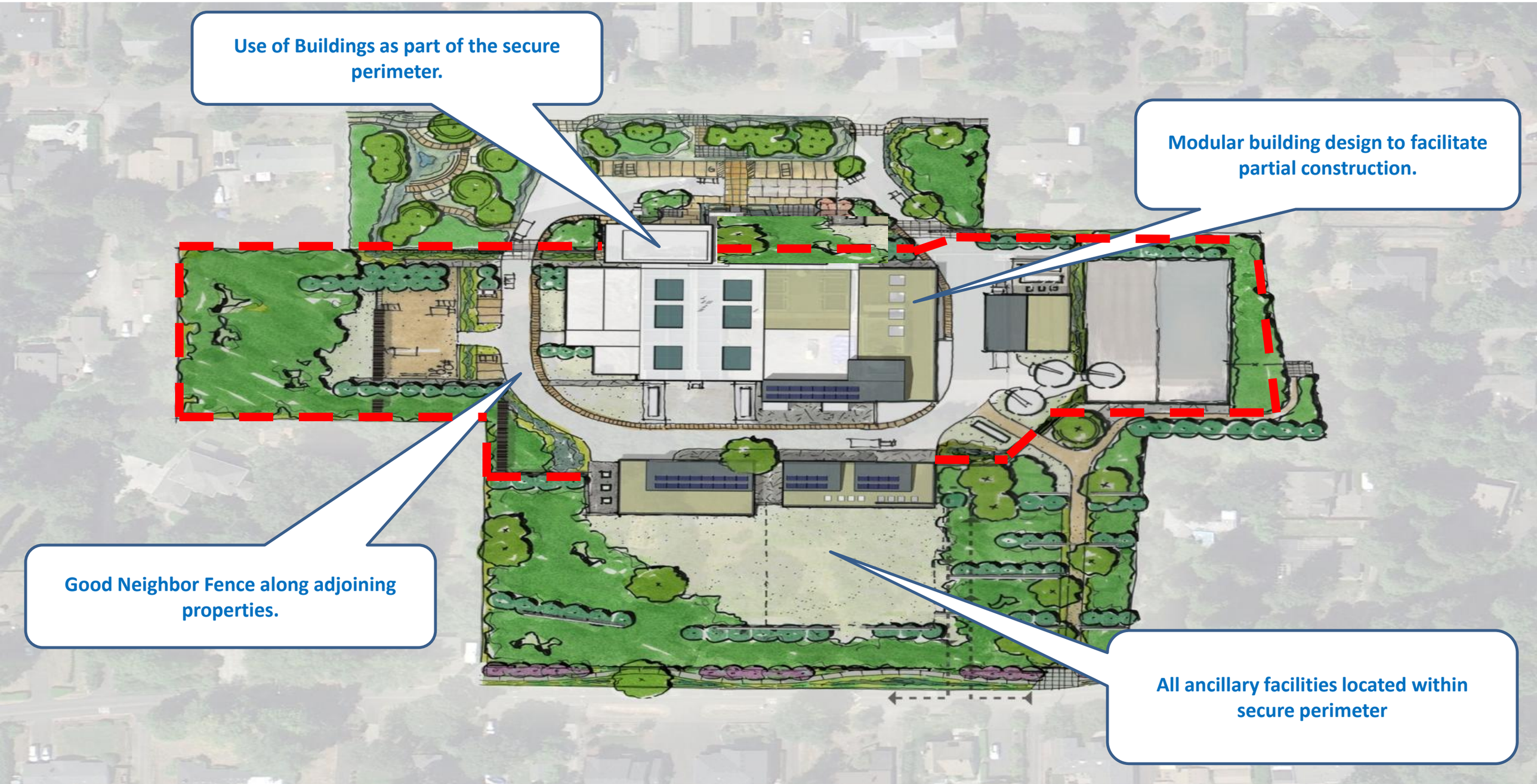
Hazardous Materials Management



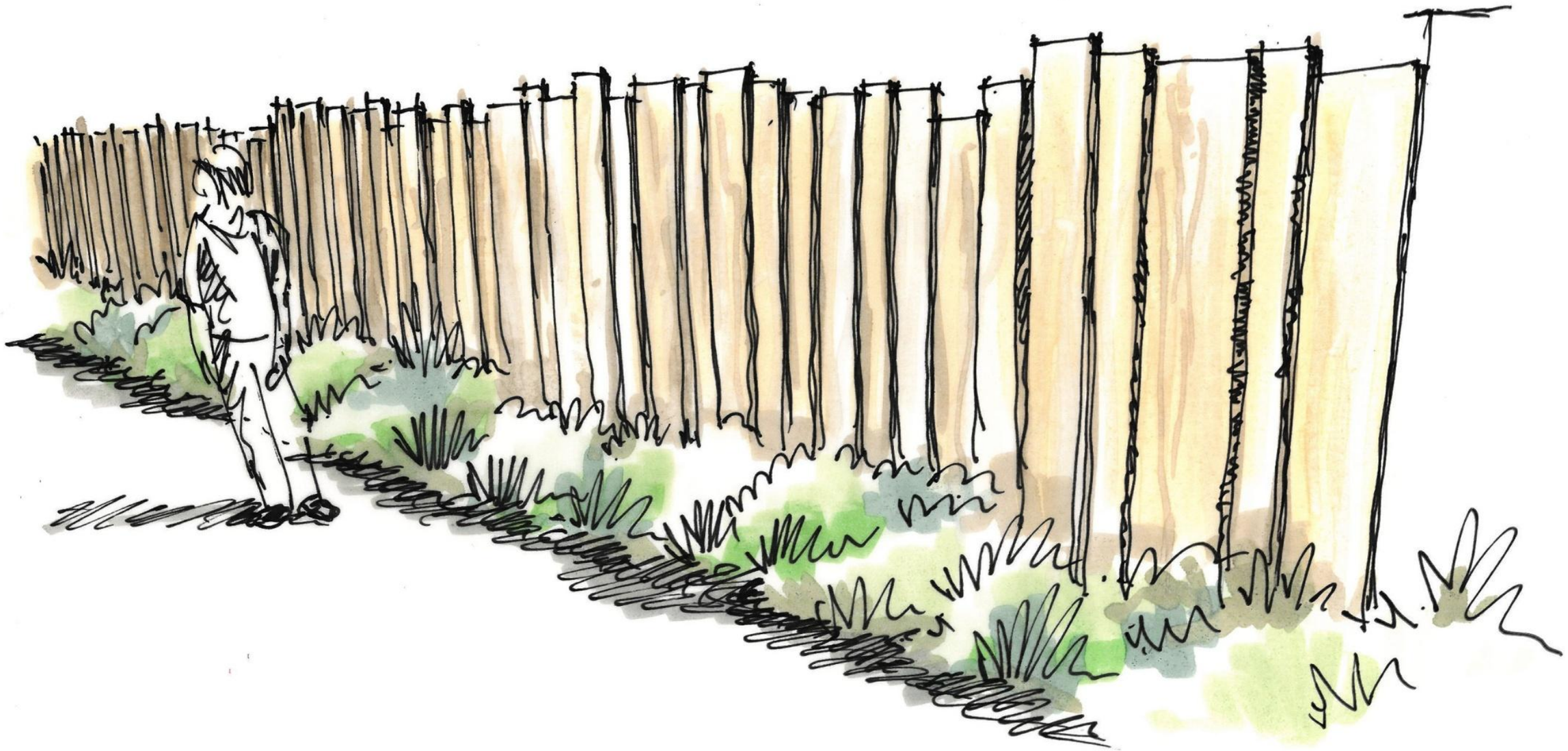
Minimize Confined Space



Site Security Considerations



Good Neighbor Fence



Asset Management

Equipment Number	Equipment Name	Drawing Number	Location	Pump Type	Fluid Service	Design Flow Capacity, gpm
SND 11 CTP 11	Ballasted Floc Basin no1 Sand Pump No.1	11I-2	BALLASTED FLOC GALLERY	CENTRIFUGAL NON-CLOG	SAND	215
SND 11 CTP 12	Ballasted Floc Basin no1 Sand Pump No.2	11I-2	BALLASTED FLOC GALLERY	CENTRIFUGAL NON-CLOG	SAND	215
SND 11 CTP 13	Ballasted Floc Basin no1 Sand Pump No.3	11I-2	BALLASTED FLOC GALLERY	CENTRIFUGAL NON-CLOG	SAND	215
SND 11 CTP 21	Ballasted Floc Basin No.2 Sand Pump No.1	11I-4	BALLASTED FLOC GALLERY	CENTRIFUGAL NON-CLOG	SAND	215
SND 11 CTP 22	Ballasted Floc Basin No.2 Sand Pump No.2	11I-4	BALLASTED FLOC GALLERY	CENTRIFUGAL NON-CLOG	SAND	215
SND 11 CTP 23	Ballasted Floc Basin No.2 Sand Pump No.3	11I-4	BALLASTED FLOC GALLERY	CENTRIFUGAL NON-CLOG	SAND	215
SEW 12 CTP 01	Sidestream Injection Pump No.1	12I-1	BALLASTED FLOC / OZONE CONTACTOR GALLERY	CENTRIFUGAL NON-CLOG	SAND	215
SEW 12 CTP 02	Sidestream Injection Pump No.2	12I-1	BALLASTED FLOC / OZONE CONTACTOR GALLERY	HORIZONTAL END SUCTION	SETTLED WATER	455
SEW 12 CTP 03	Sidestream Injection Pump No.3	12I-1	BALLASTED FLOC / OZONE CONTACTOR GALLERY	HORIZONTAL END SUCTION	SETTLED WATER	455
RAW 14 CTP 01	Rapid Mix Pump No.1	14I-2	FINISHED WATER PUMP STATION	VERTICAL NON-CLOG	RAW WATER	1,350
CWS 21 CTP 11	Cooling Water Pump No.1	21I-6	OZONE GENERATOR ROOM	CLOSE-COUPLED CENTRIFUGAL	COOLING WATER SUPPLY	60
CWS 21 CTP 21	Cooling Water Pump No.2	21I-7	OZONE GENERATOR ROOM	CLOSE-COUPLED CENTRIFUGAL	COOLING WATER SUPPLY	60

Closing Remarks

Questions

kduncan@ci.oswego.or.us

jude.d.grounds@mwhglobal.com