Reducing Overflows using a Baffling Solution

OWEA Collection Systems Workshop

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Columbus, Ohio

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URS

NEORSD Responsibility

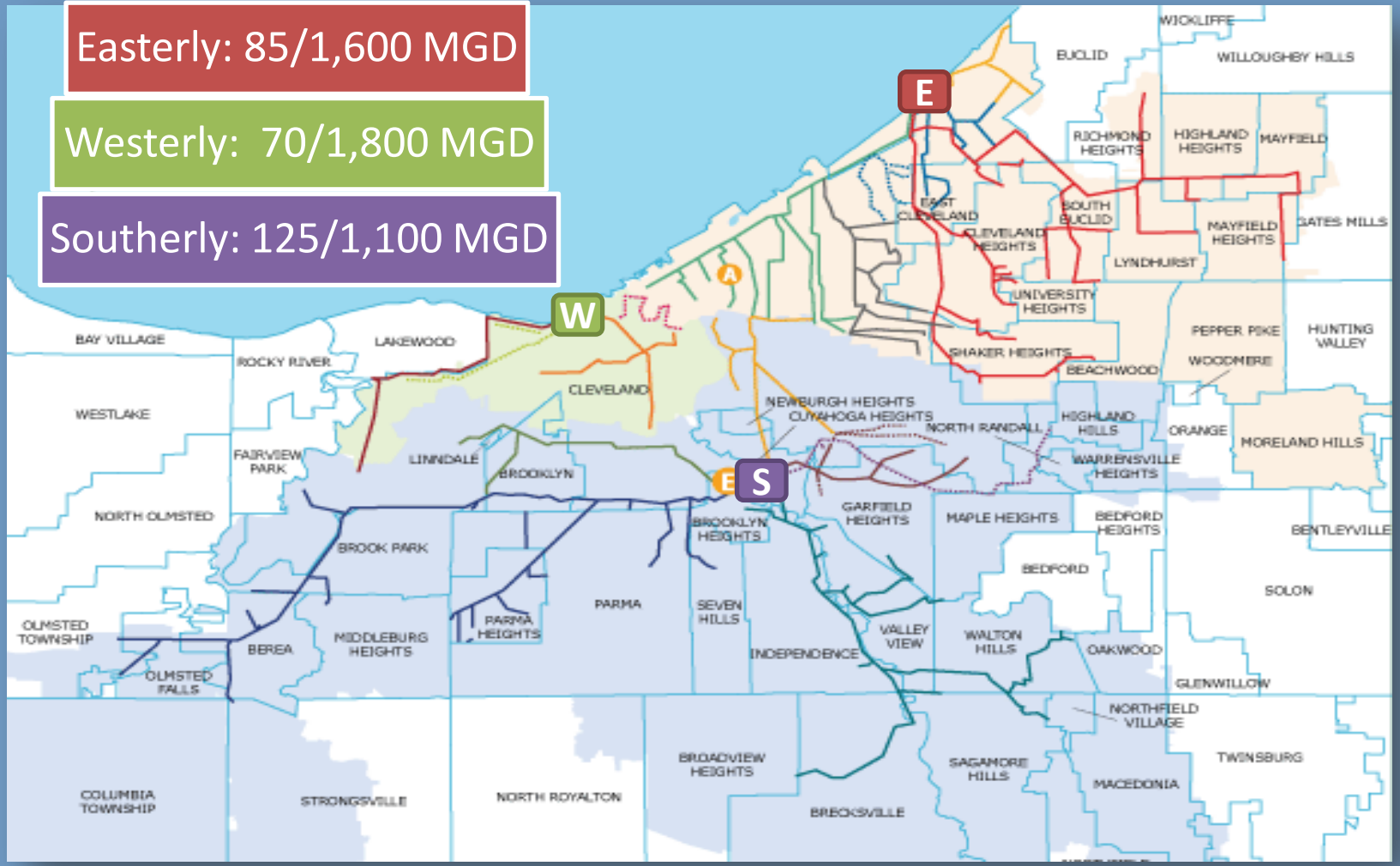
- Wastewater Collection and Treatment
  - Created in 1972 by court order
  - Governed by seven trustees
  - Serving all or part of 62 communities, 355 square miles, > 1 million customers
  - 3 wastewater plants, 280 MGD on average
  - 280 miles of large interceptor sewers
  - 25-year, $3 Billion CSO Control Program started in 2011 (Project Clean Lake)

NEORSD Service Area and Plants

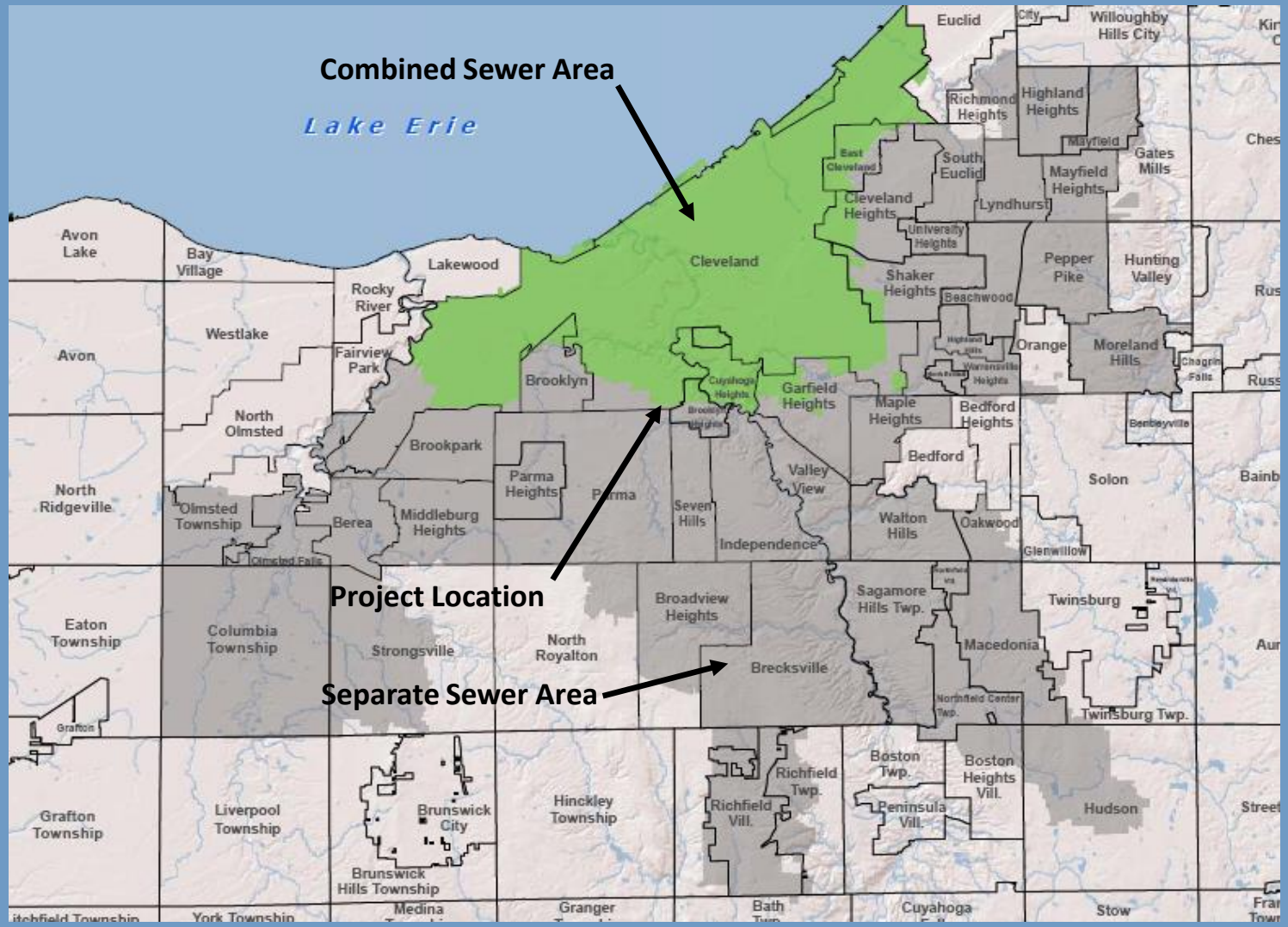
Easterly: 85/1,600 MGD

Westerly: 70/1,800 MGD

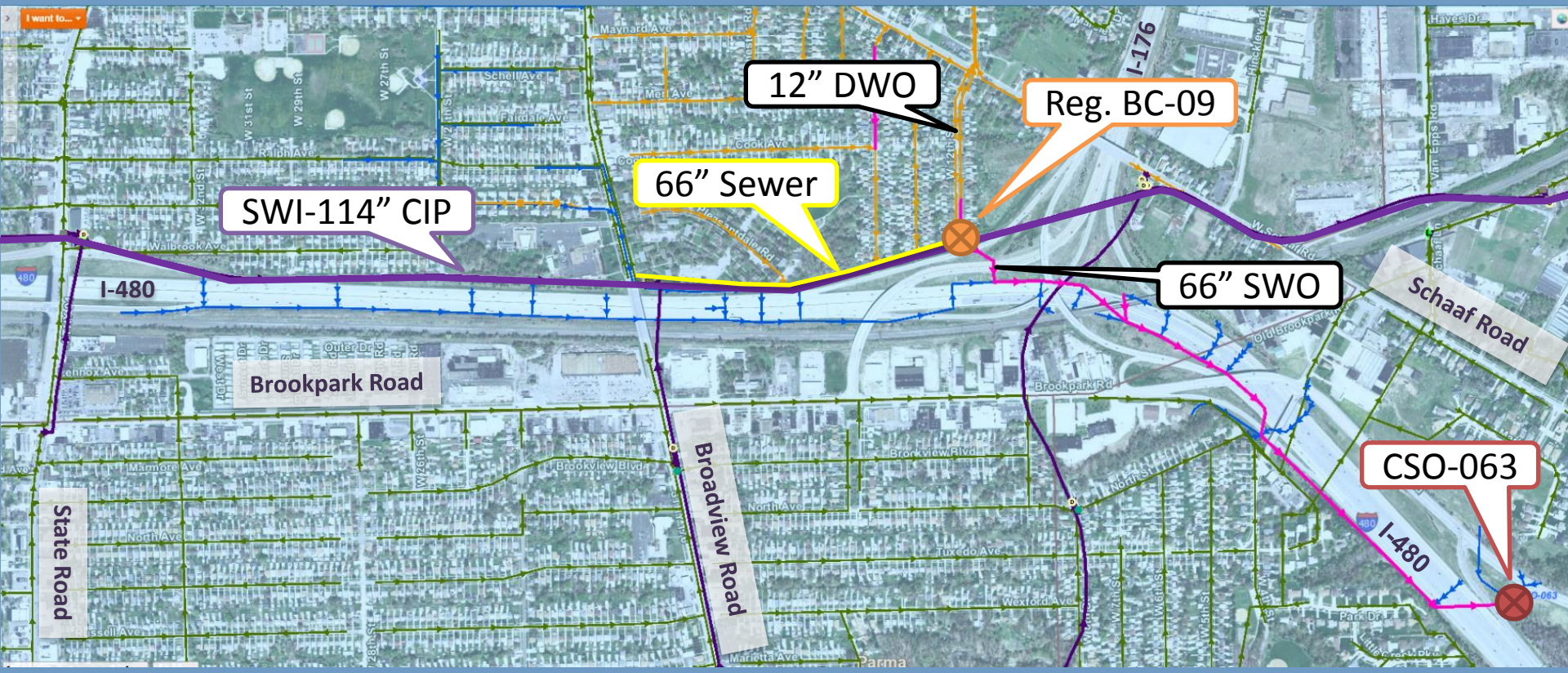
Southerly: 125/1,100 MGD



Combined and Separate Sewer Areas



Area Map


12” DWO
Reg. BC-09
66” Sewer
SWI-114” CIP
66” SWO
I-480
Brookpark Road
Broadview Road
State Road
Schaaf Road
CSO-063
I-480
I-176
1 Mile

Existing Conditions at CSO-063

- Serves a 72 acre sewershed
- Activates 76 times in a typical year
- Discharges a total of 29 million gallons of combined sewage in a typical year (not including storm water discharged from I-480 corridor)

CSO-063 R/CS Project Goal

- Reduce the numbers of overflows to one overflow or fewer in a typical year by diverting flow from the BC-09 regulator via drop shaft to SWI.

Identifying the Challenge

- Per consent decree “Interbasin diversion of combined flows to the Southwest Interceptor via 4’ diameter pipe and new SWI drop structure”
  - Local System: Combined sewer system
  - SWI: Sanitary only system
- Drop flows from combined system to sanitary system without negatively affecting the downstream conditions

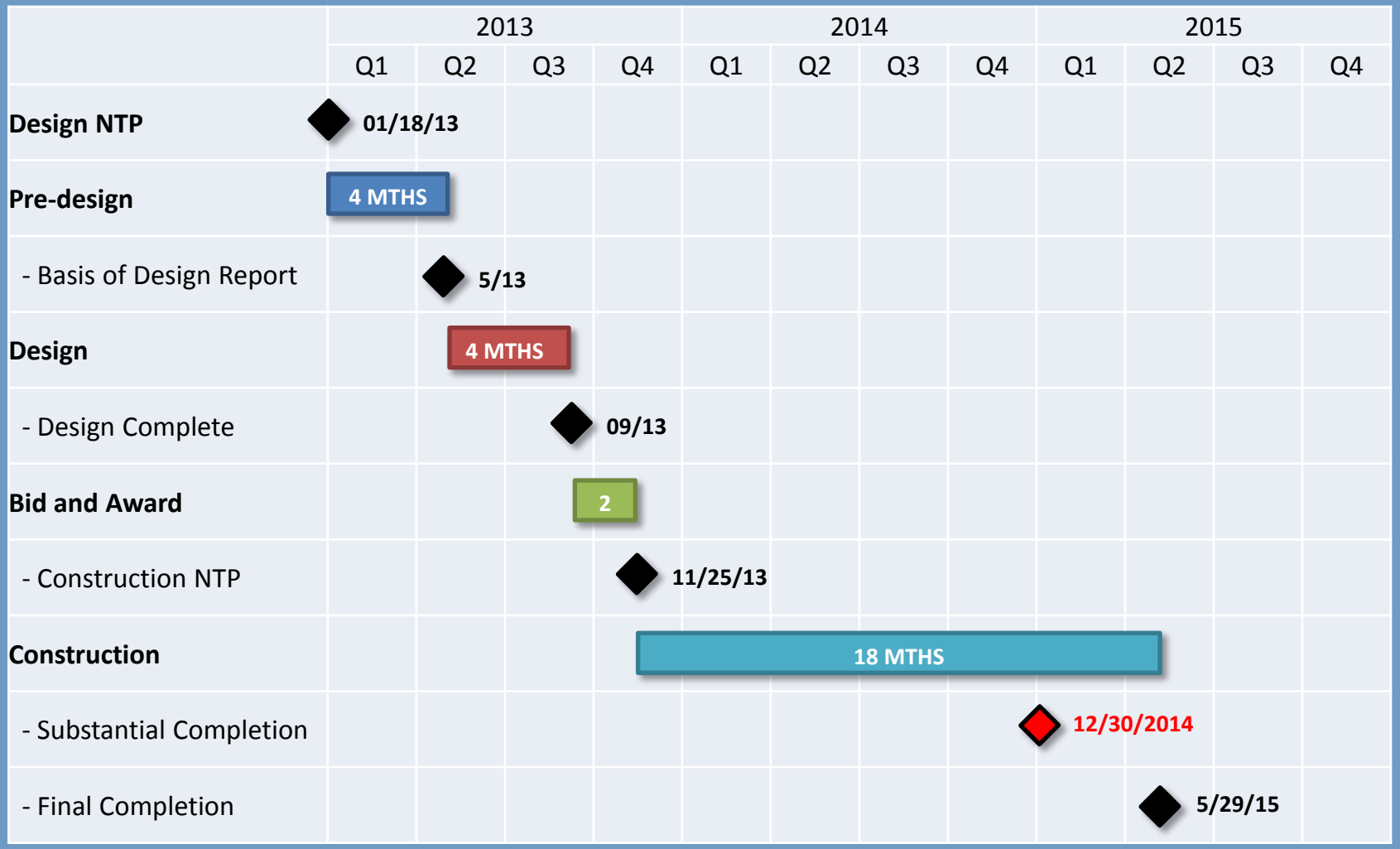
Consent Decree – Control Measure 24

- Consent Decree Milestones:
  - Construction NTP by end of 2013
  - Fully operational by end of 2014
- Control Measure 24 will be first of 28 control measures in consent decree to be operational
- Verify performance criteria is met through one year of post-construction monitoring of flow, level, and activation

Critical Project Issues

- Tight design/construction schedule
- Space limitations at BC-09 site
- Close proximity of residential properties
- Community impact during construction
- Connection to a live interceptor
- Constructing drop structure above unreinforced tunnel

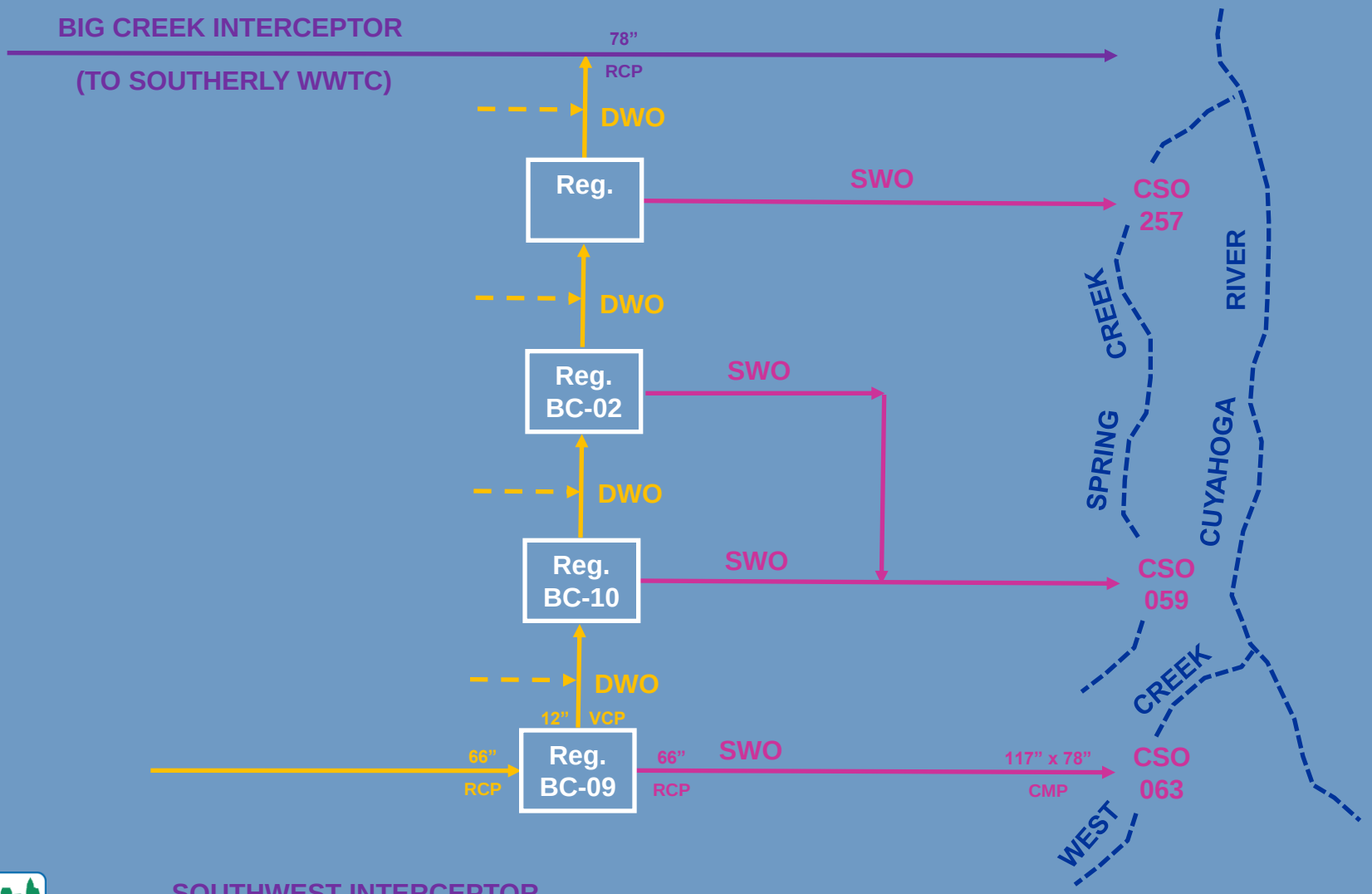
Project Schedule



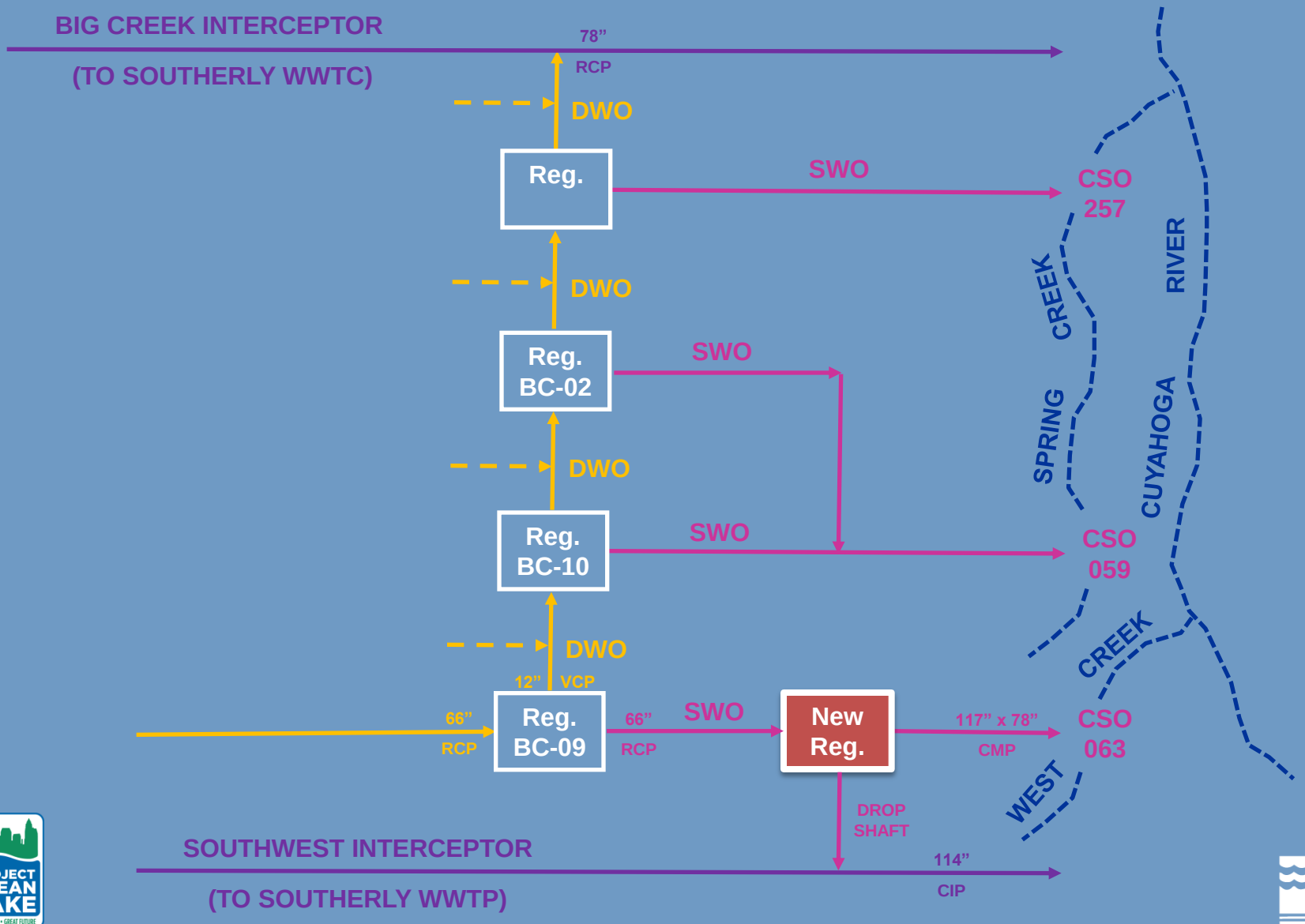
Project Assumptions at Issuance of RFP

- Peak flow rate for 5-year, 6-hour storm
  - 55 MGD to new regulating structure
  - 25 MGD to SWI via drop structure; 30 MGD to CSO-063
- Southwest Interceptor has capacity to accept flow
- Drop shaft excavation largely in Cleveland (black) and Chagrin (gray) shales

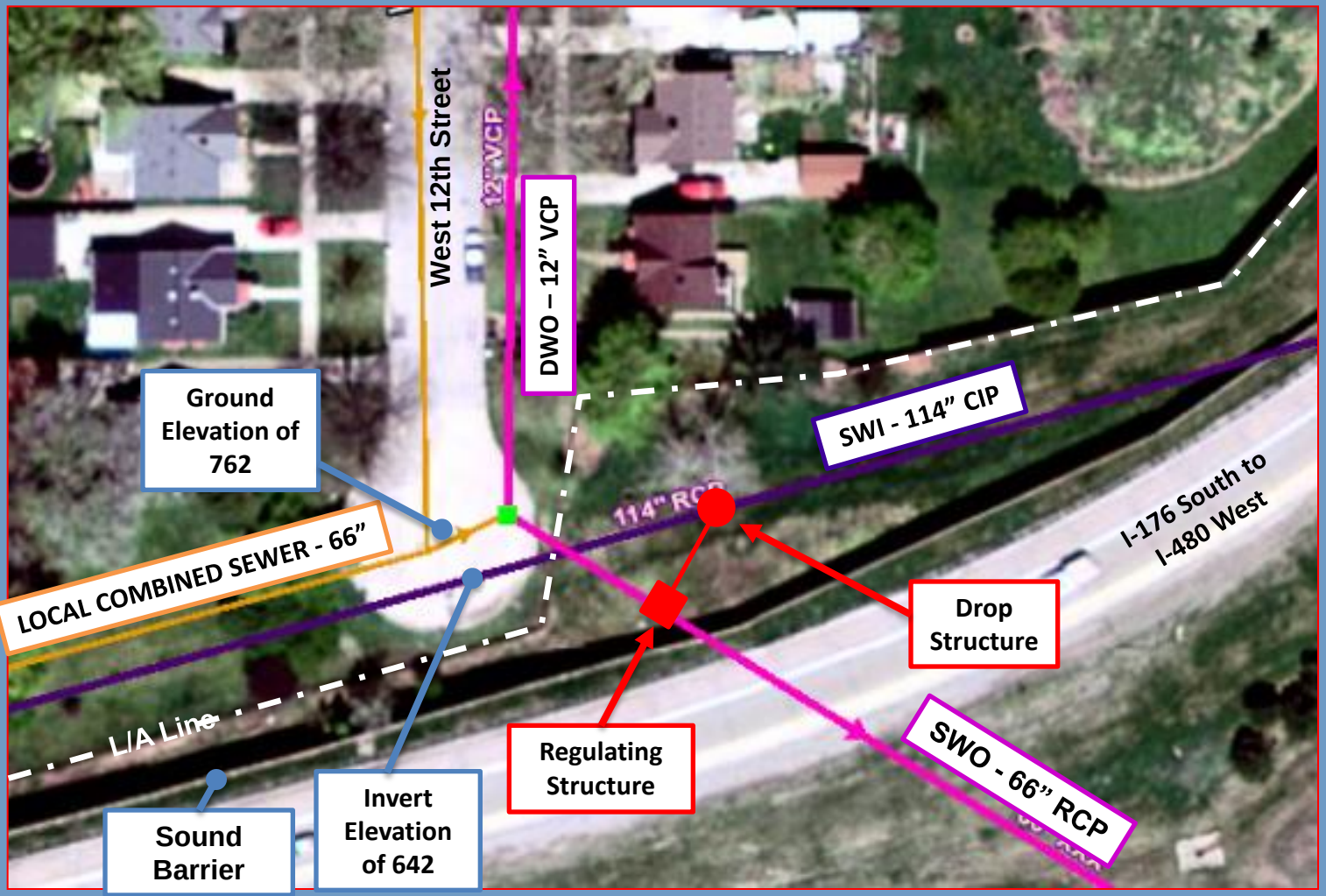
Schematic of Existing Sewer System



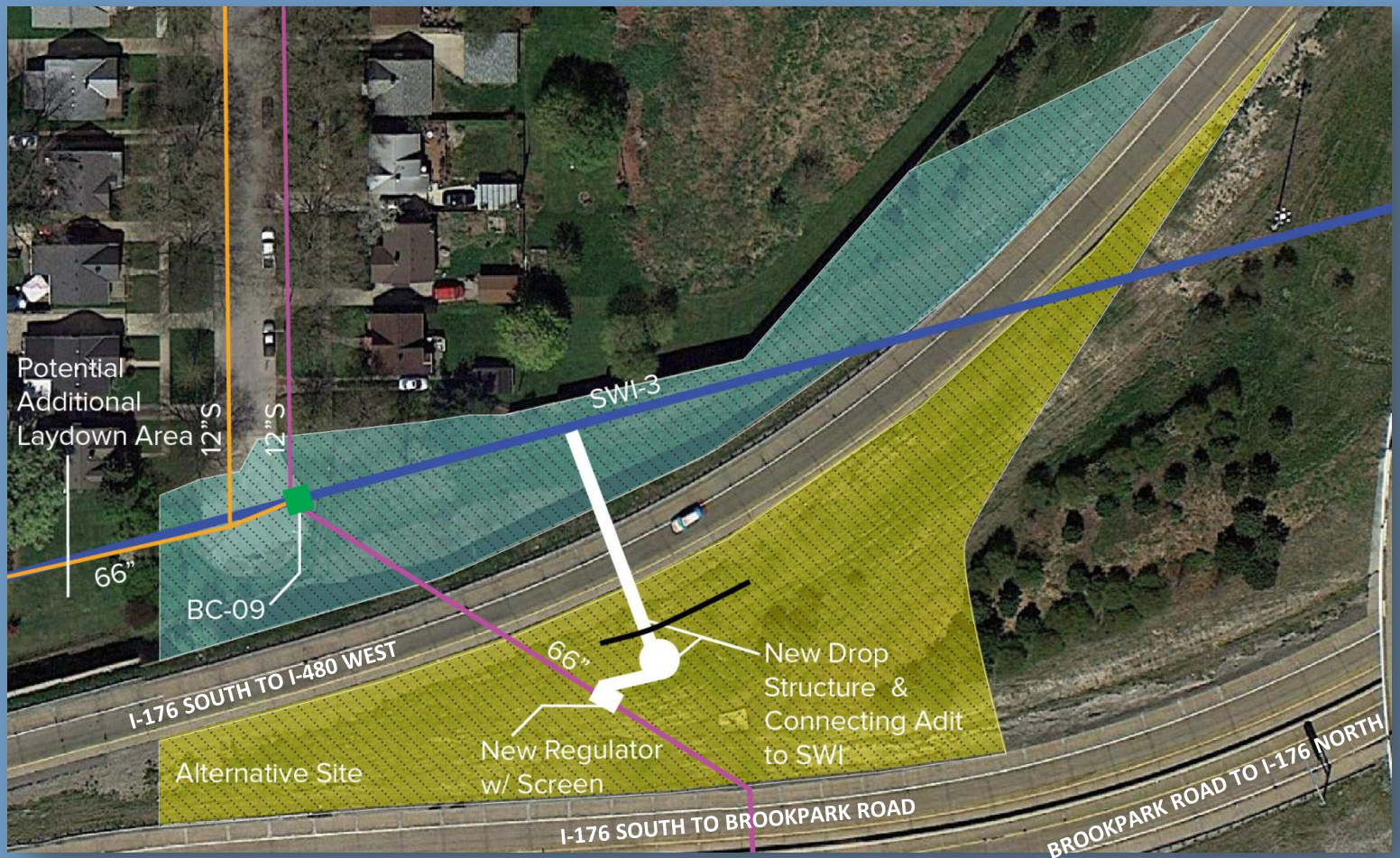
Schematic w/ Proposed Improvements



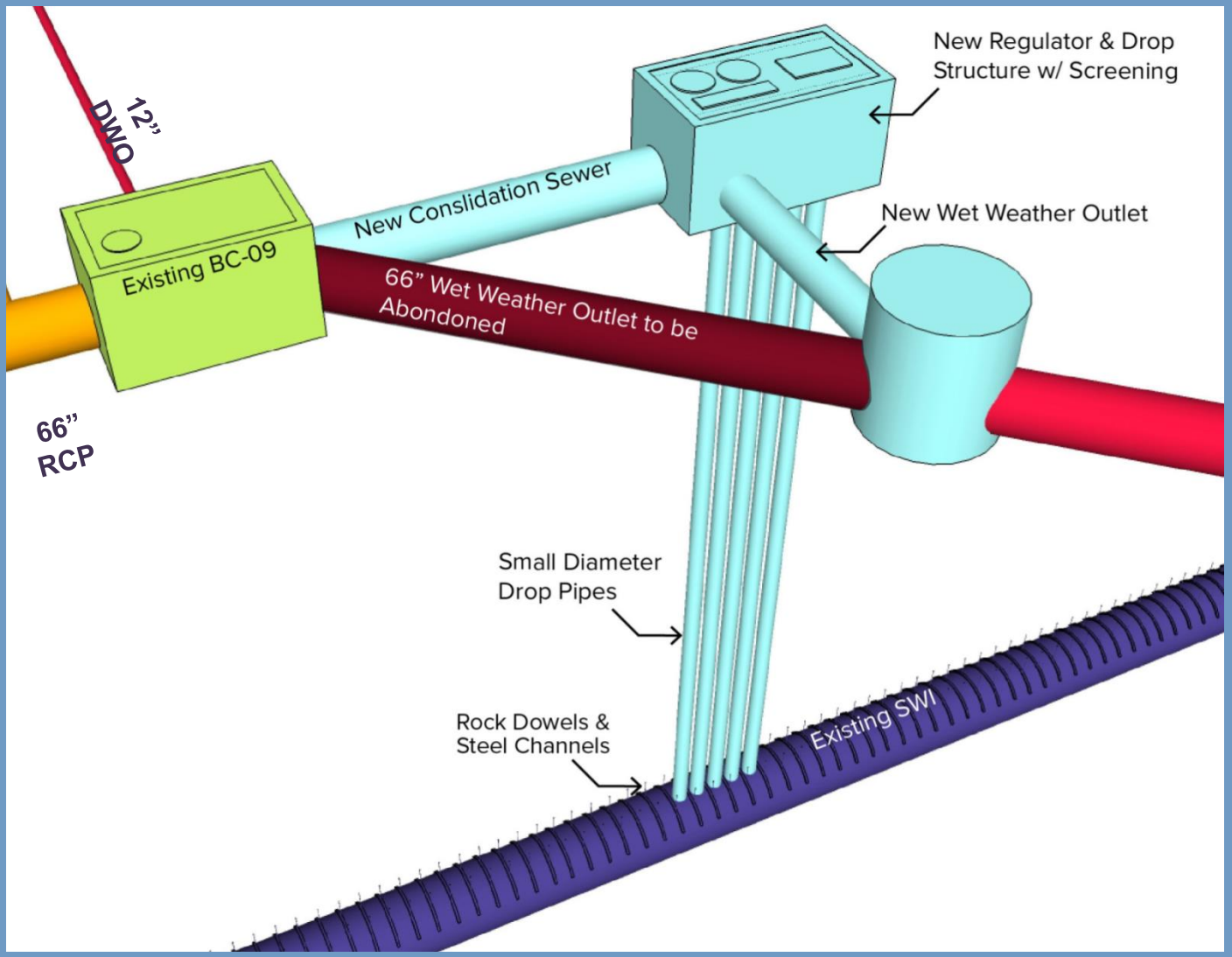
Plan w/ Proposed Improvements



Alt. Plan w/ Proposed Improvements



Alt. Plan w/ Proposed Improvements

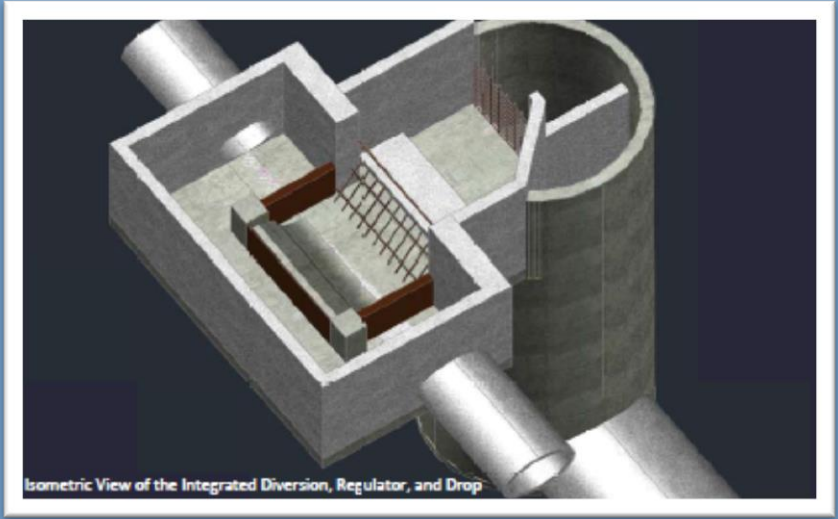


Disadvantages of Drill Drop Alternative

- Air entrainment
- No energy dissipation
- Maintenance issues
- Lack of access
- Precision of drill drop construction

Proposed Alternative/Configuration

- Key Decisions:
  - What type of drop structure is best suited for this project?

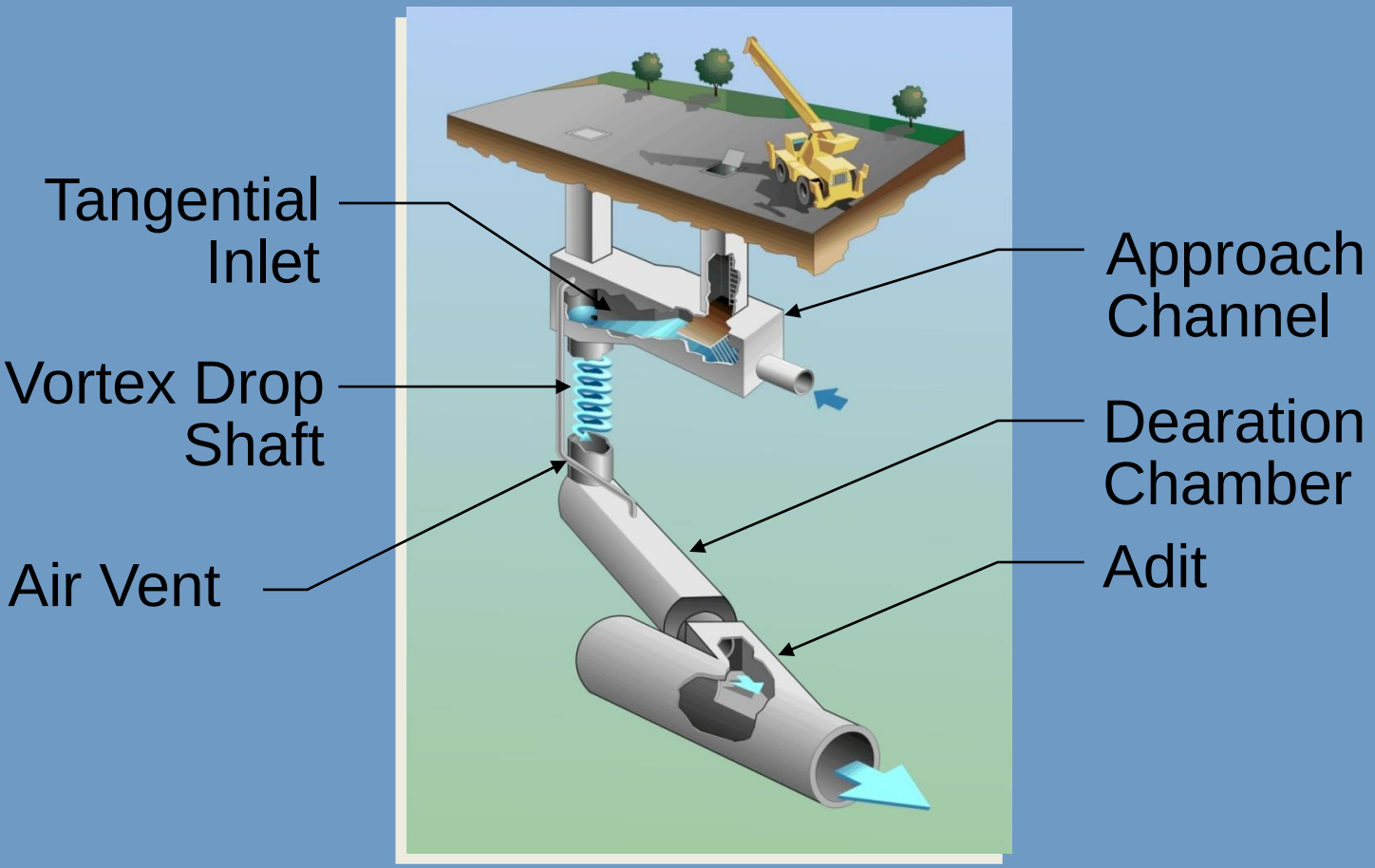


Types of Drops within NEORSD System

- Vortex Drops
- Baffle Drops
- Plunge Drops
- Special Drops

Proposed Alternative/Configuration

- Analyzed three types of drop structures
  - Vortex Drops



Proposed Alternative/Configuration

- Vortex Drops
  - Tangential Inlet forces the sewage to the wall of a vertical drop shaft
  - De-aeration chamber will remove excess air
  - Well suited for large flows
  - Typically more expensive than other types of drops

Proposed Alternative/Configuration

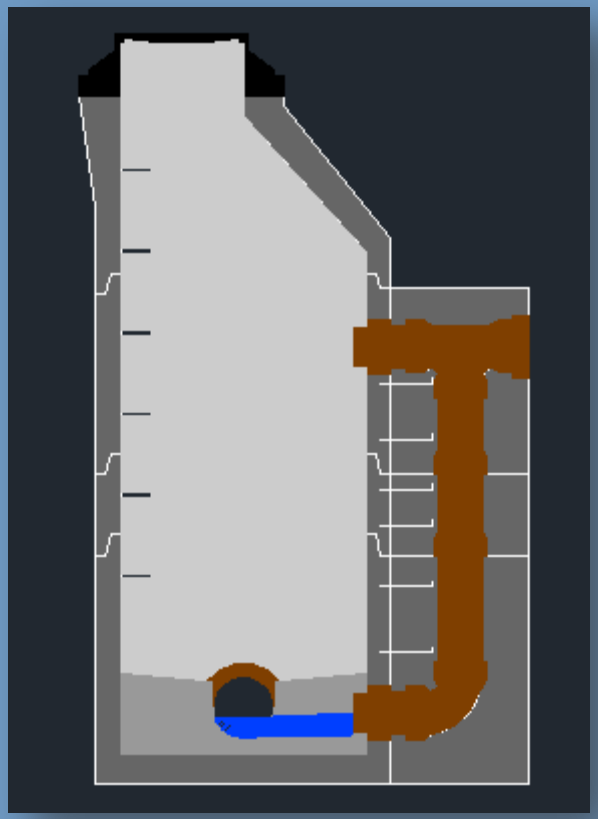
- Analyzed three types of drop structures
  - Baffle Drops

Proposed Alternative/Configuration

- Baffle Drop
  - Also known as a “Cascade Drop”
  - Flow cascades from baffle to baffle
  - Wet Side / Dry Side
  - Well suited for large flows
  - Typically less expensive than Vortex Drops
  - Typically shorter construction durations

Proposed Alternative/Configuration

- Analyzed three types of drop structures
  - Plunge Drops



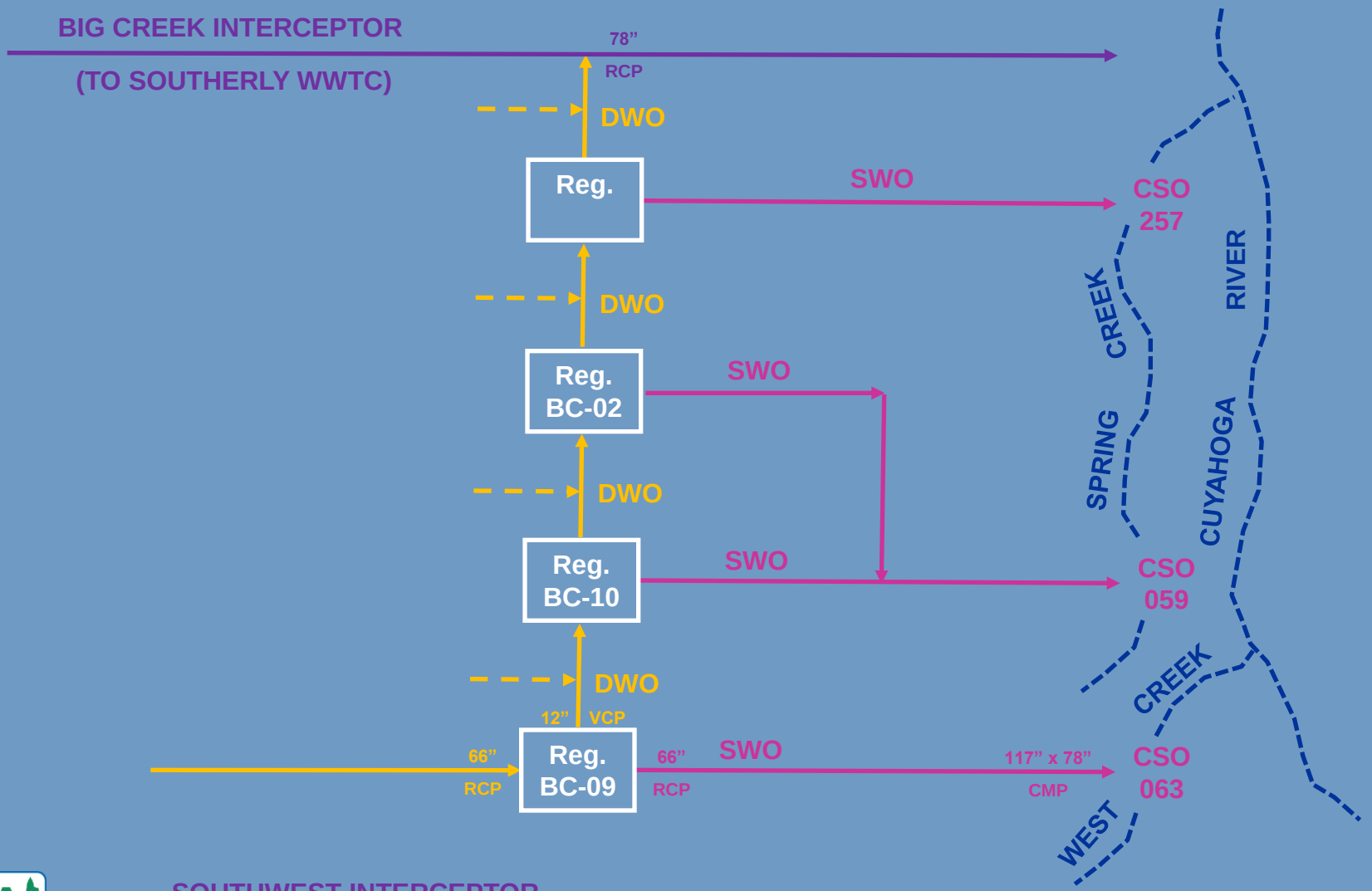
Proposed Alternative/Configuration

- Plunge Drop
  - Most common type of drop
  - Flow free falls, does not dissipate energy or limit air entrainment
  - Well suited for smaller flow rates and shorter drops
  - Least expensive to construct

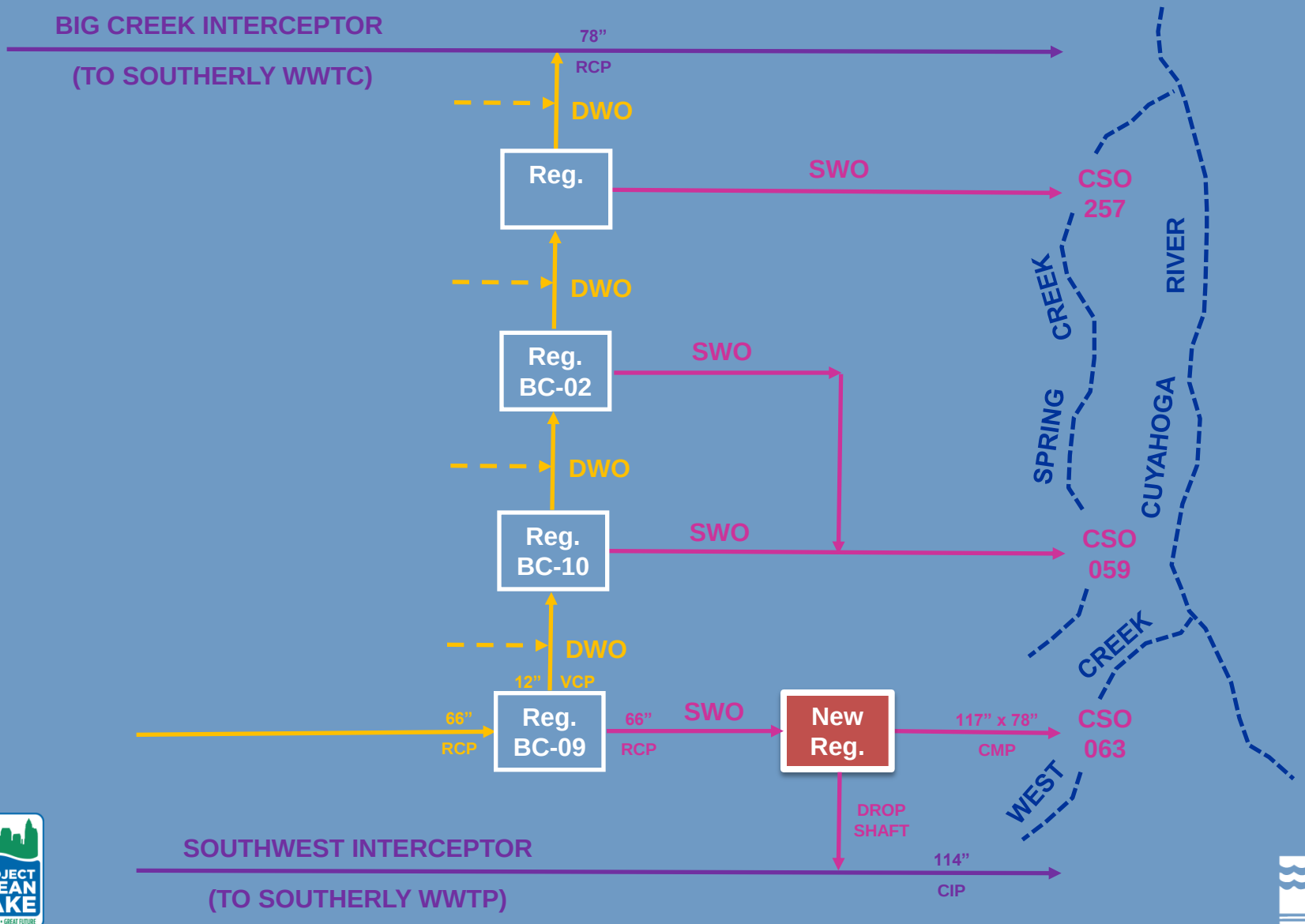
Drop Type Selection

- Baffle Drop Advantages
  - Less expensive than Vortex Drop
  - Limits air entrainment
  - Provides additional access point to SWI
  - Odor Control has not been an issue with these drops within the NEORSD system

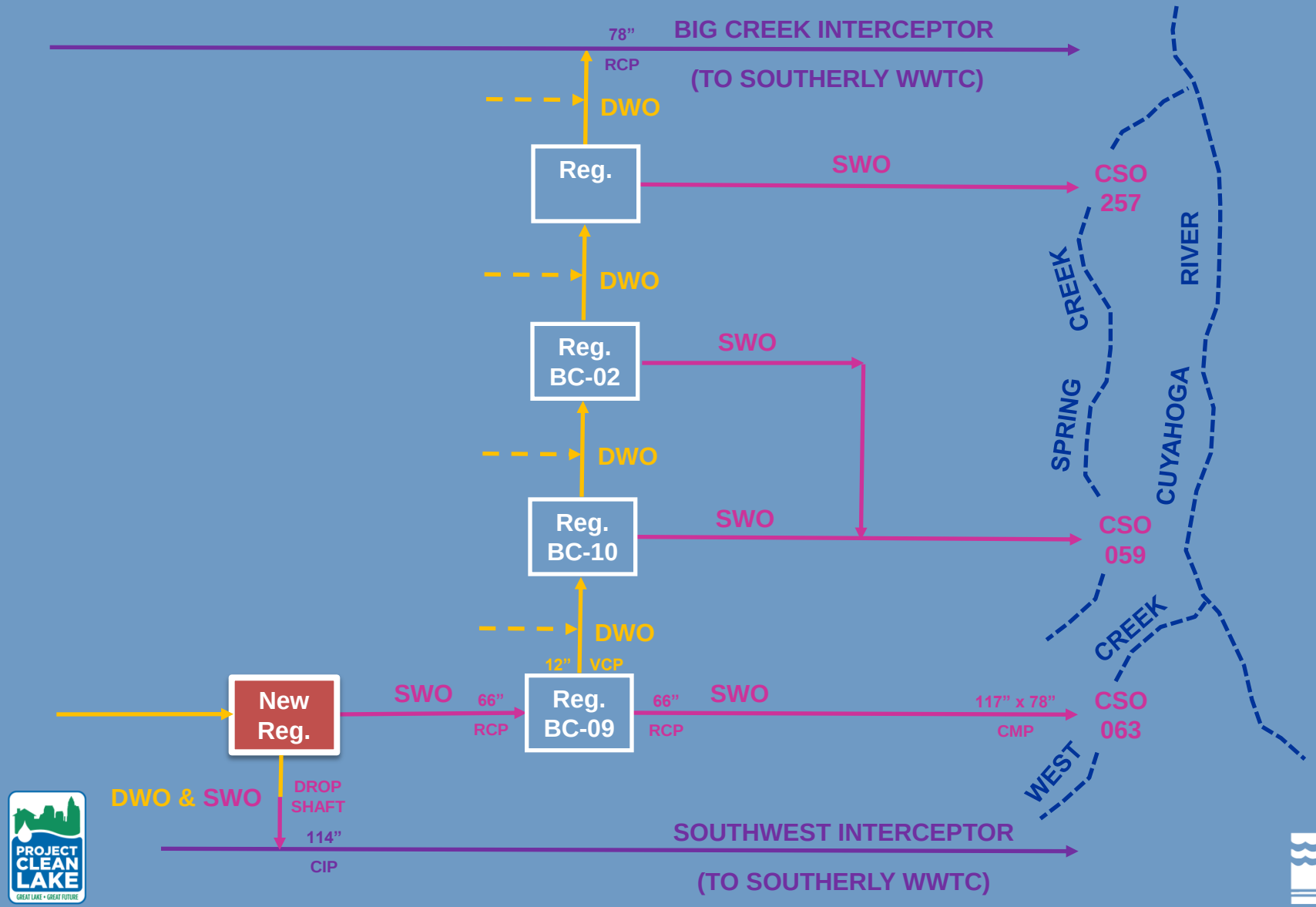
Schematic of Existing Sewer System



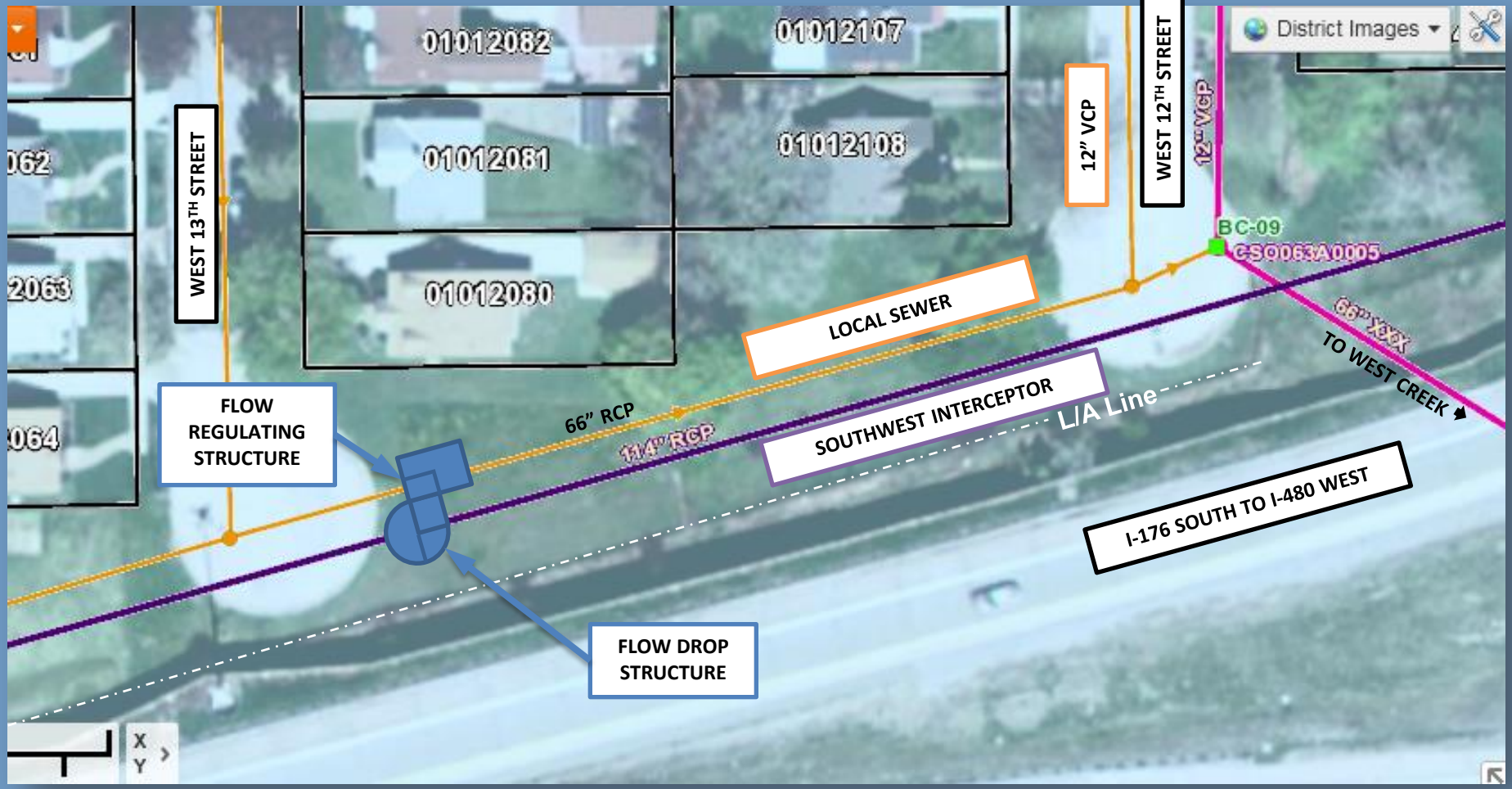
Schematic w/ Proposed Improvements



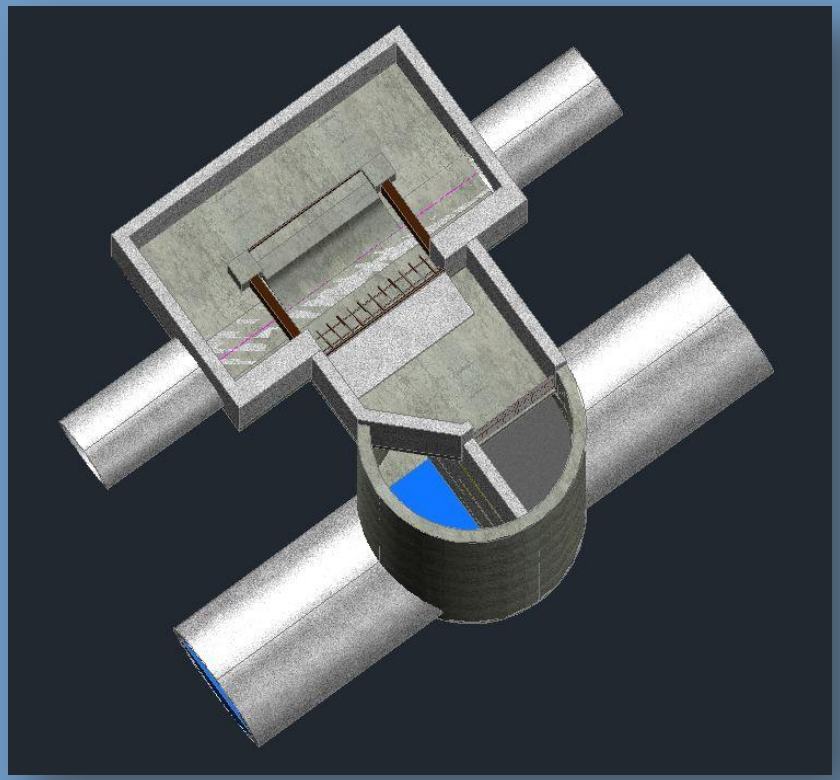
Schematic w/ Designed Improvements

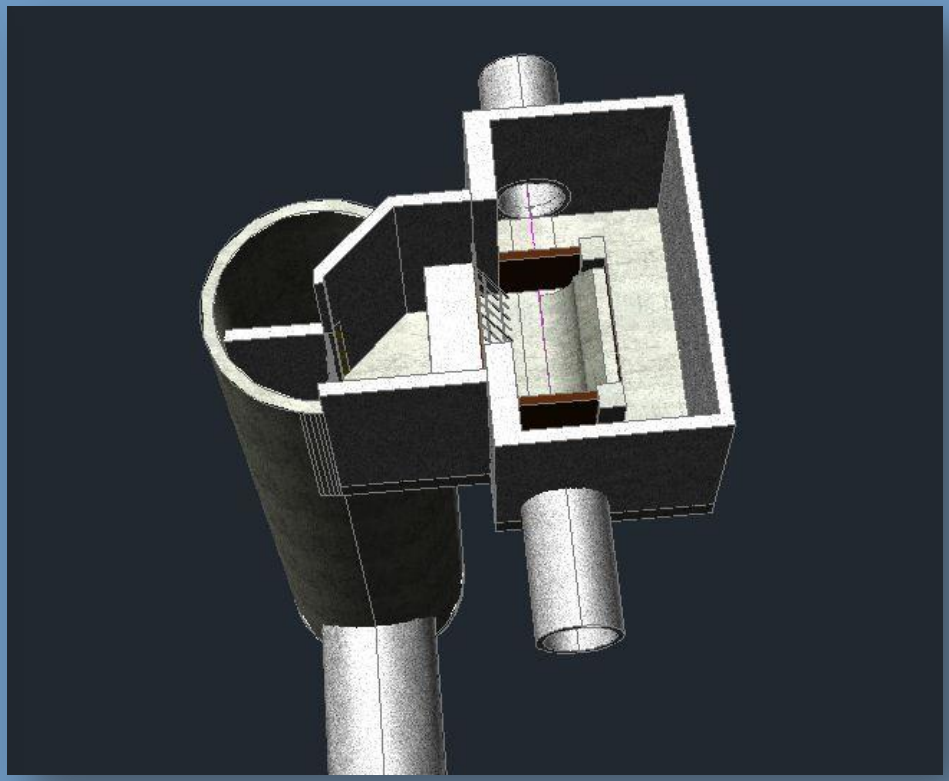


Plan w/ Designed Improvements

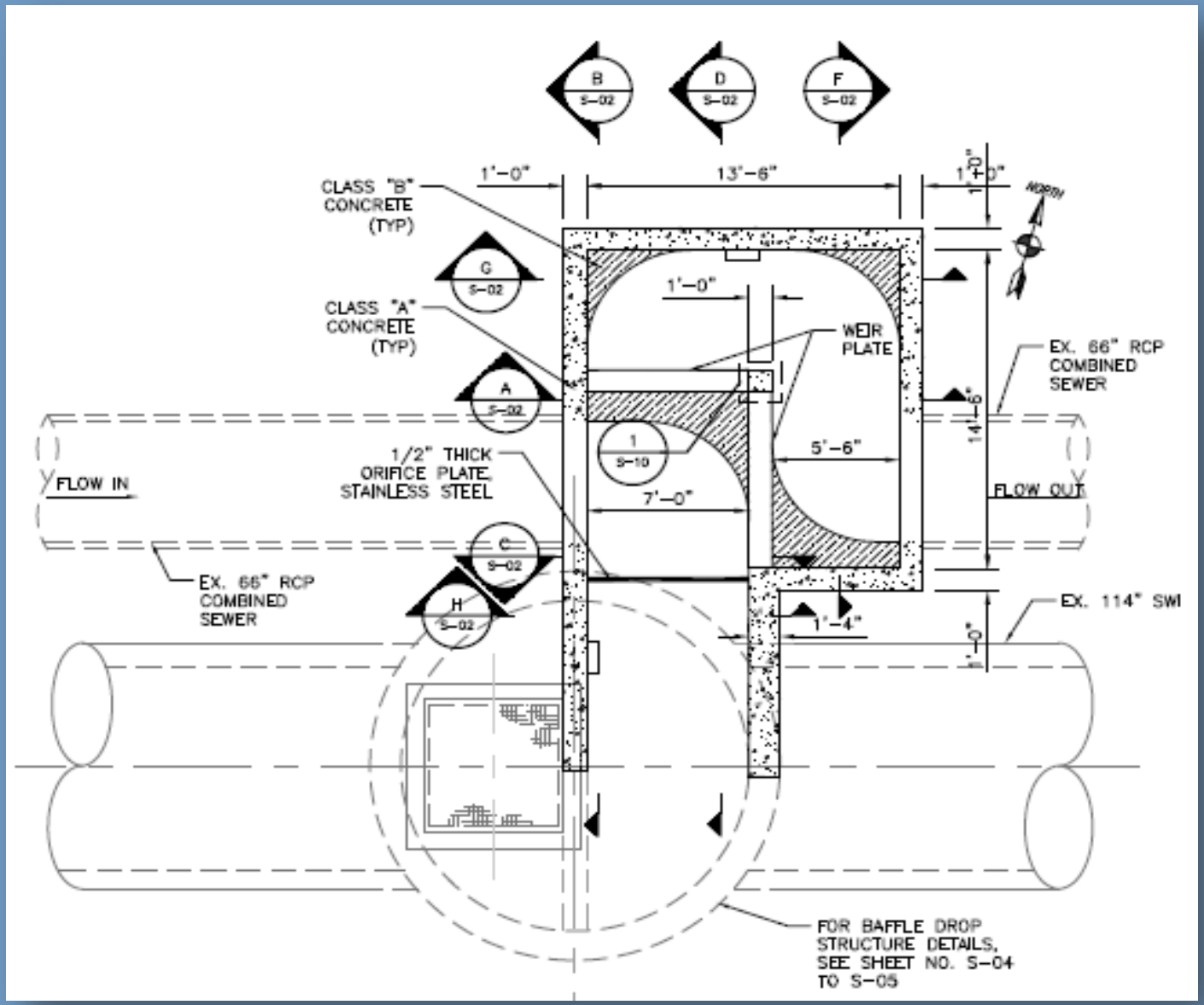


Baffle Drop Details

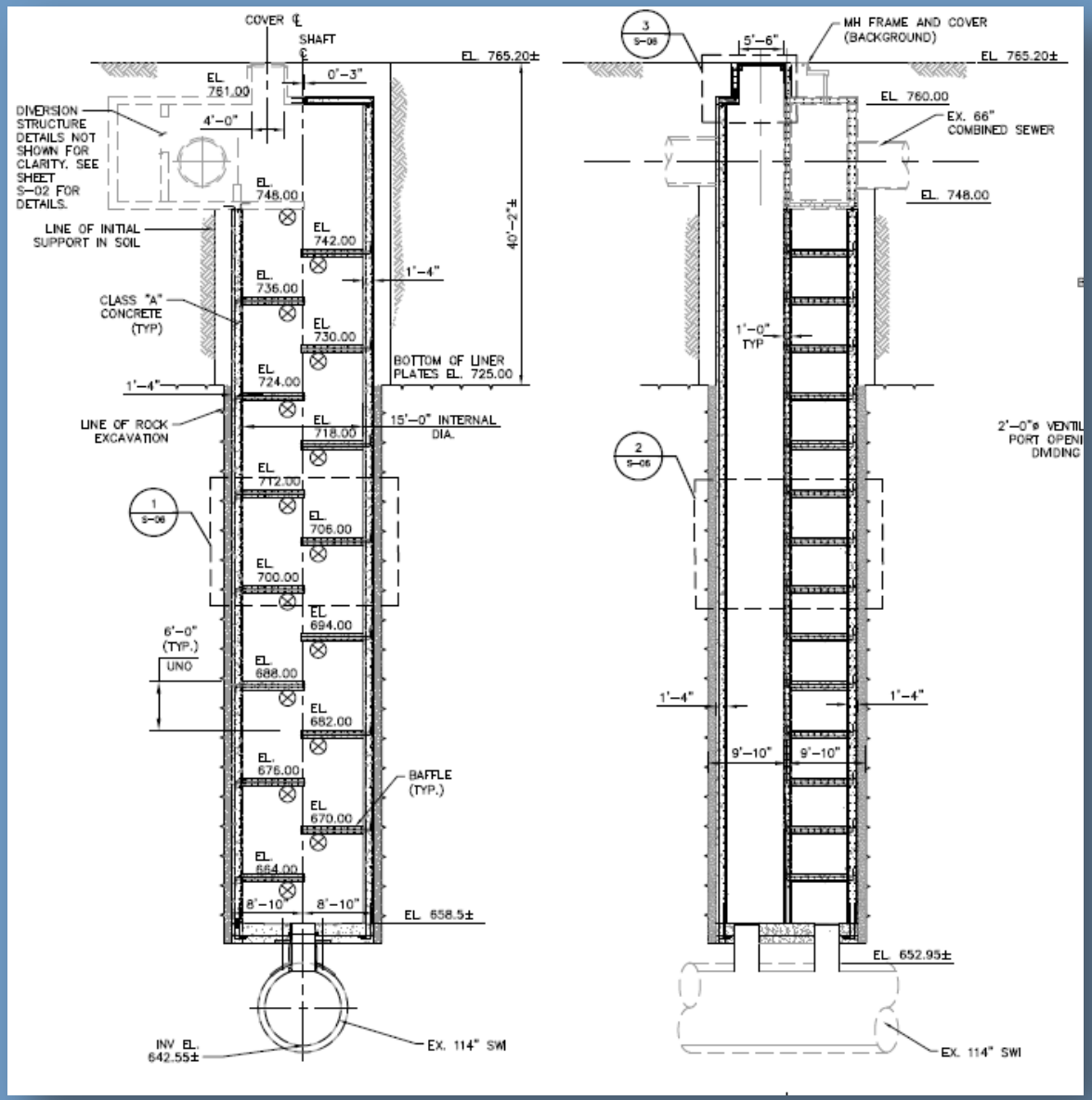




Diversion Structure Layout



Baffle Drop Sections



Baffle Drop in Action

- NEORSD ECT-4

Baffle Drop in Action

- Working installation – New Zealand

System Hydraulics

Storm Event	Peak Flow to:	Peak Flow in MGD
5-Year, 6-Hour Storm	SWI	39
	CSO-063	64
	DWO	1.9
Typical Storm 60*	SWI	36
	CSO-063	14
	DWO	1.7
Typical Storm 68	SWI	33
	CSO-063	0
	DWO	1.3
No Storm (Avg. Dry Weather Flow)	SWI	0.16
	CSO-063	0
	DWO	0

* Storm 60 is the only storm in the group of 121 synthetic storms representing a typical year where CSO-063 activates

* Storm 60 is a 1-year,1-hour storm producing 0.94 inches of rainfall

CSO-063 Site – Before Construction

CSO-063 Site – During Construction

Liner Plates & Ribs in Soft Ground

Rock Bolts & Shotcrete in Shale

Thank you!