BURGESS & NIPLE
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Navigating Local Regulations for Effective Design

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2019 Ohio Stormwater Conference

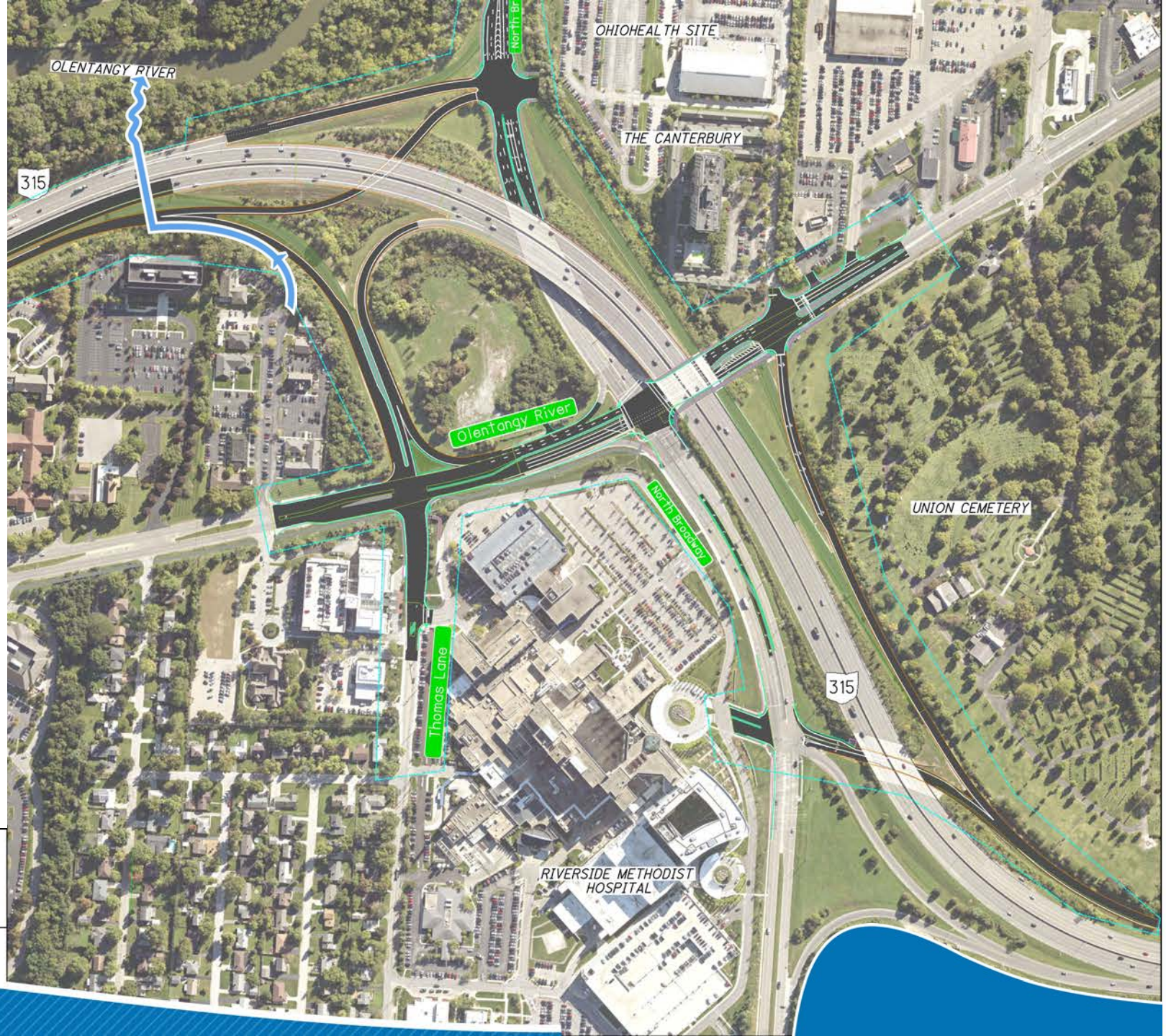
Thursday, May 9, 2019

Presentation Outline

- Project Overview
- Stream Impact Mitigation
- Stormwater BMP Design
- Design Challenges
  - Project Schedule
  - Layered Regulations
  - Location
  - Quantity v. Quality
  - Maintenance

Project Overview

- City of Columbus /Ohio Health partnership
- Accommodate new Ohio Health corporate center
- Major improvements to SR 315/Olentangy River Rd/N. Broadway interchange
- New SB exit ramp direct to N. Broadway
- Portions of project in ODOT LA/ROW
- Aggressive schedule



SR 315 AND NORTH BROADWAY
INTERCHANGE IMPROVEMENTS
PROJECT AREA MAP

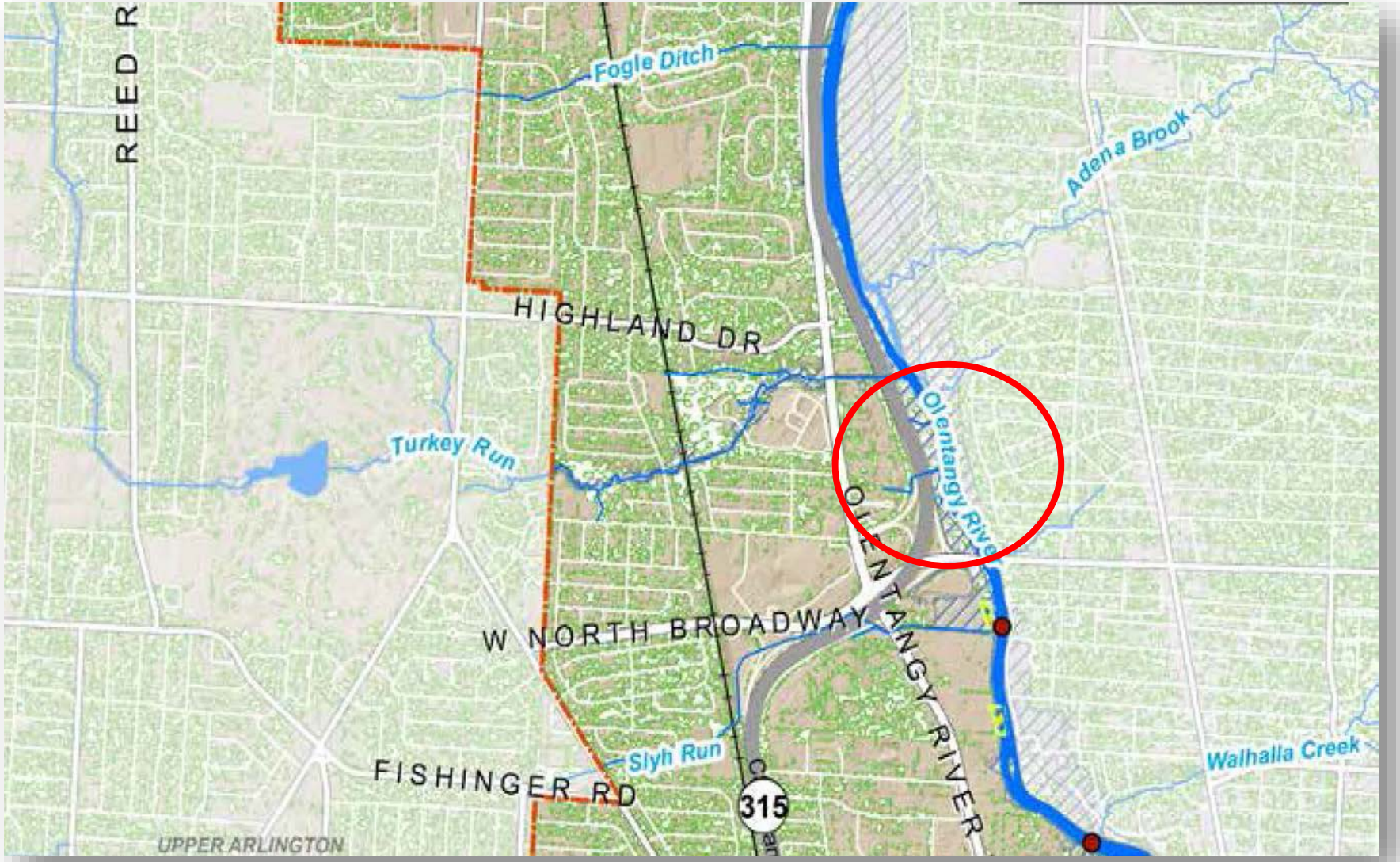
11/3/2017

THE CITY OF COLUMBUS

BURGESS & NIPLE

Stream Impact Mitigation

Unnamed Tributary to Olentangy River

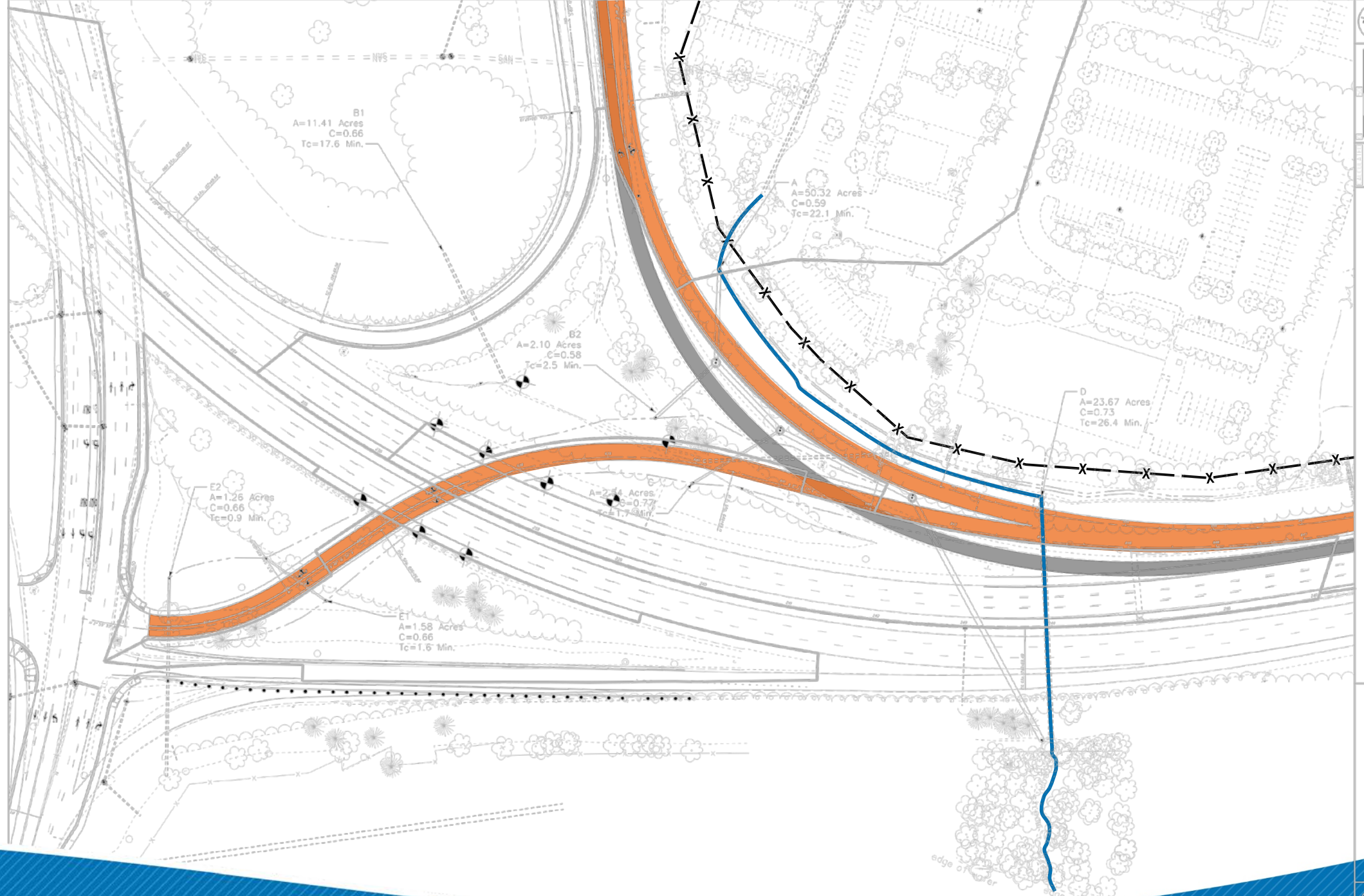


Unnamed Tributary to Olentangy River

- Drainage Area = 0.11 mi^2
- Affected Length = 425 lf
- HHEI = Modified Class II PHWH
- Intermittent Flow Regime
- Dense Bush Honeysuckle Corridor
- Culverted Upstream & Downstream

Proposed Impacts

- Proposed new SB exit ramp direct to N. Broadway
- Requires shifting existing SB ramp to Olentangy River Road slightly to west
- Now too close to stream!

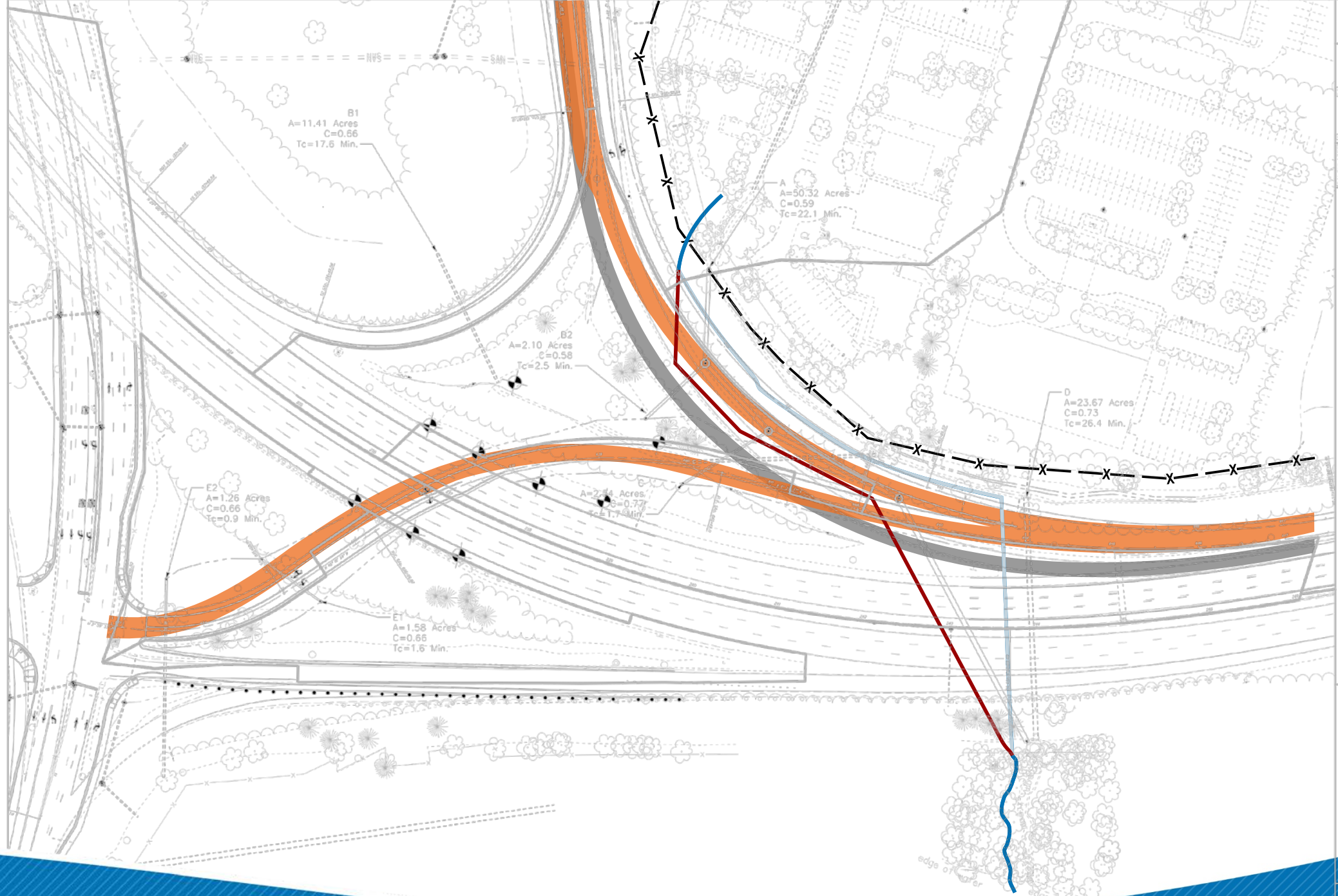


Regulatory Constraints

- Section 404 & 401 (Clean Water Act)
  - U.S. Army Corps of Engineers (404)
  - Ohio EPA (401)
- City of Columbus
  - Stream Corridor Protection Zone (SCPZ)
  - Type III Variance
- ODOT Requirements
  - Roadway Geometry
  - Stormwater Drainage

Alternative 1

- Intercept stream flow in new culvert



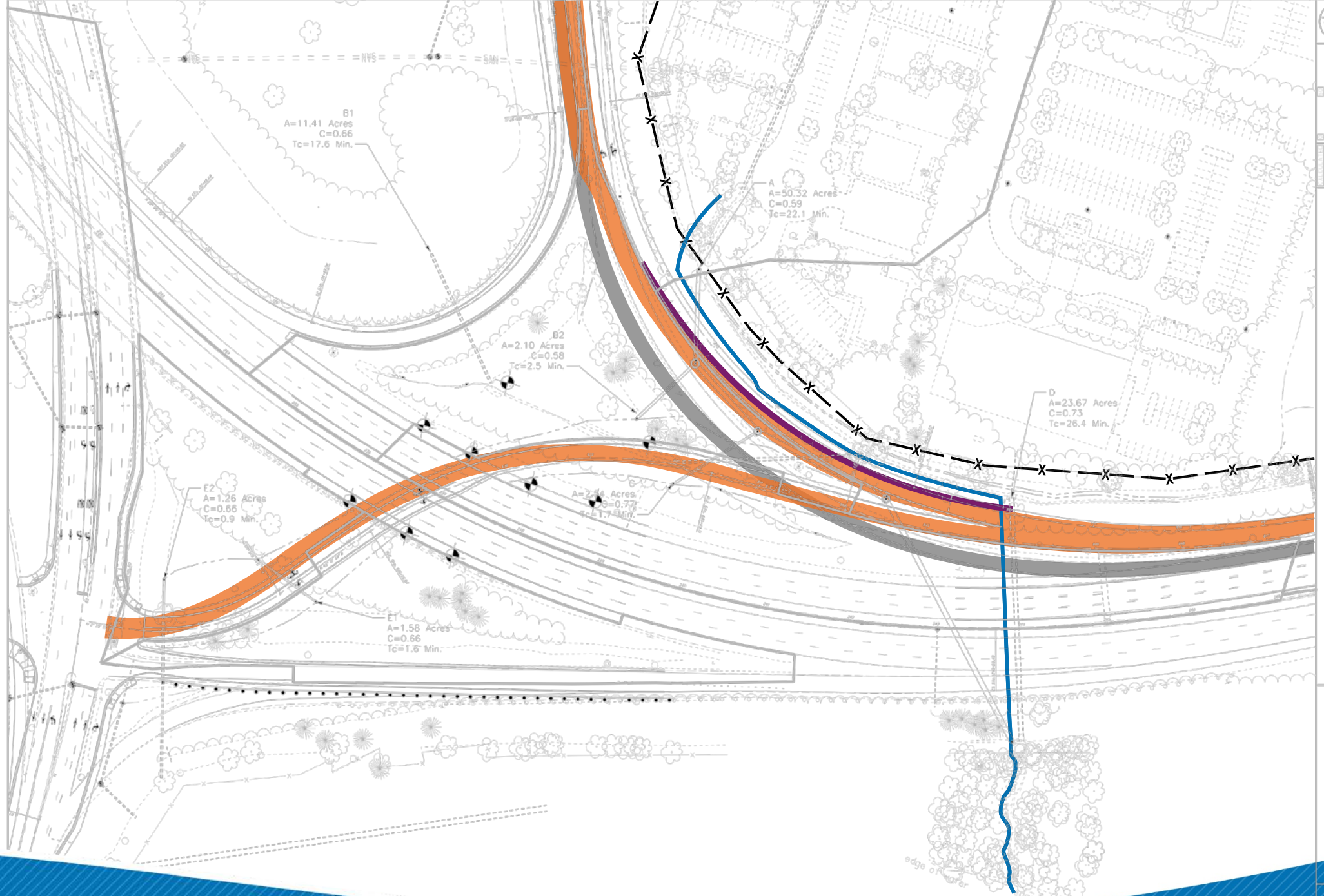
Alternative 1 – Culvert Stream

Why this won't work

- City of Columbus SCPZ requirements
  - Prohibit stream channel enclosures
  - Type III Variance unlikely to be granted for major stream enclosure
  - Mitigation? (no fee credit opportunity)
- Section 404/401 Permitting
  - Potential risk of project being elevated to Individual Section 404/401 review
- Project Schedule

Alternative 2

- Retaining wall in lieu of standard embankment slope next to stream



Alternative 2 – Retaining Wall

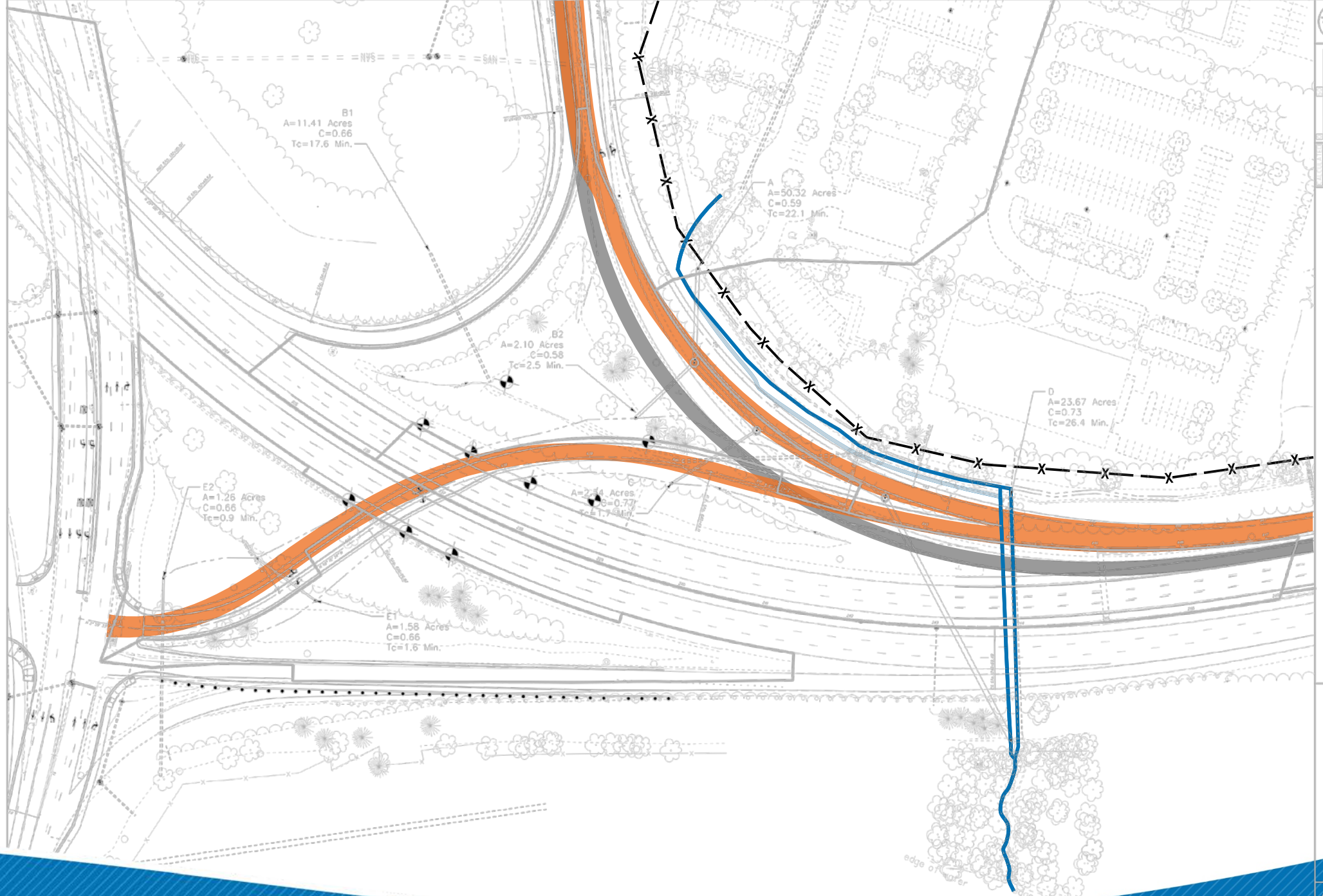
Why this won't work

- ODOT Design Standards
  - Retaining wall creates potential crash and ODOT horizontal stopping sight distance (HSSD) hazards

- Oh, and….$$$$$$$$

Alternative 3

- Relocate stream channel west
- Add new 60" culvert to improve storm flow routing



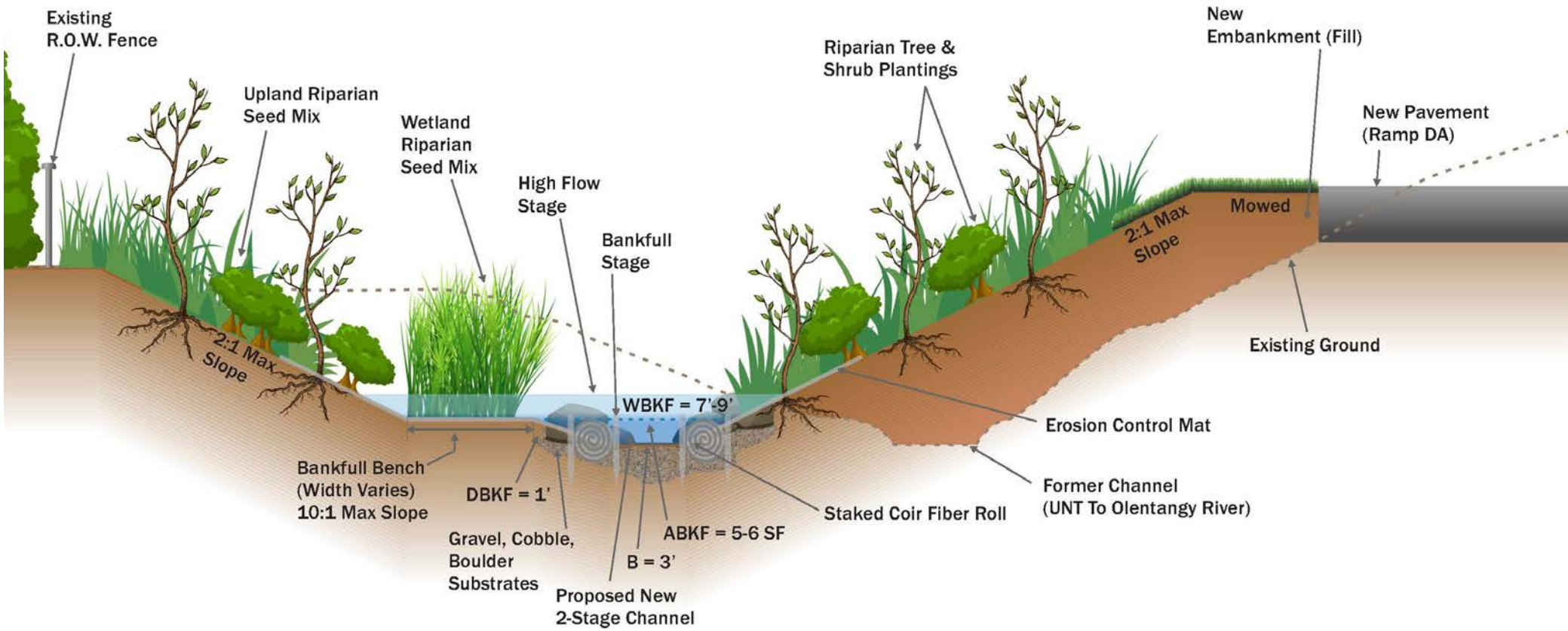
Alternative 3 – Relocate Stream + Additional 60 “ Culvert

This could work!

- Maintains open channel
- Enhanced new channel provides on-site mitigation
- Eligible for Nationwide Section 404/401 permitting
- No ODOT HSSD concerns
- New 60” culvert provides ODOT - compliant storm routing

Proposed Stream Mitigation Design

- 429 lf
- Average 8 ft. width
- Floodplain “benches” where feasible
- Remove invasive honeysuckle
- Native tree, shrub and herbaceous riparian plantings



FRA-315-06.37
Proposed SCPZ Stream Mitigation
Typical Section

Section 404/401 Permitting

- Eligible for Nationwide Permit (NWP) No. 14 *(Linear Transportation Projects)*
- No significant resource coordination issues (endangered bat habitat, cultural resources)
- On-site mitigation (429 lf > 425 lf)
- Project schedule accommodates NWP review
- Preconstruction Notification (PCN) submitted Feb. 5, 2018

Section 404/401 Permitting

Why this won't work

- Ohio Stream Valuation Metric (OSVM)
  - Released by USACE February 23, 2018
  - Based on West Virginia WSWVM metric in use for some years
  - Calculates stream impact "debits" and corresponding "credit" values for stream impacts and proposed stream mitigation projects
  - Developed by USACE-led Ohio Interagency Review Team (IRT) responsible for approving mitigation bank and in-lieu fee program proposals in Ohio
  - NOT linear foot based
  - NO regulated community representation on the IRT.
  - NO consultation with existing mitigation banks or in-lieu fee programs regarding new non-linear foot based pricing structure

Section 404/401 Permitting

- But… we submitted our application (PCN) before OSVM became effective!
- USACE determination to apply OSWM to all new and “in process” 404/401 permit applications involving stream impacts
- Looks like your project is going to be one of the first test cases!

Section 404/401 Permitting

- OSWM Issues:
  - Can generate positive net credit for proposed stream enhancement measures, but…
    - Cannot provide site protection (in ODOT LA/ROW)
    - 20-year temporal loss (replace wooded riparian corridor)
    - 20-year monitoring period required to generate overall net positive credits
  - Mitigation bank and in-lieu-fee sponsor concerns
    - IRT approval to sell new non-linear OSWM credits?
    - What are OSWM credits worth? (pricing structure concerns)
    - Prevents purchase of partial credits to address above OSVM deficiencies

Section 404/401 Permitting

- Two alternatives ultimately presented by USACE:

1. "Cash and Carry"
   - Purchase 100% of impacts in standard linear foot-based in lieu fee credits
   - NO credit for proposed stream mitigation measures
   - 425 lf x $230/lf = $97,750
   - No site protection or long-term monitoring required
2. "Monitor Forever"
   - Credit 25 years of site protection for SCPZ
   - No additional credit purchase required
   - Requires 20-year post-construction monitoring period

- City elects Alternative # 1

$$$$$$

Columbus SCPZ Requirements

- Type III Variance
  - Administered by Columbus DOSD
  - Unaffected by Section 404/401 mitigation outcomes
  - NO credit opportunity
  - "Adequate mitigation"
    - Channel Impacts:
      - Projected stream mitigation ≥ Baseline QHEI/HHEI score
    - SCPZ Riparian Impacts :
      - 1 : 1 acreage replacement on- site
      - 1 : 1.5 acreage replacement off-site
  - "Hardship" demonstration
  - Preferred, Minimal, No Impact Alternatives
- Submitted April 2018. Approved July 2018 !

Final SCPZ Stream Mitigation Design

- Stream relocation and earthwork to be accomplished as part of roadway project
- Stream mitigation features to be constructed under separate contract
- Channel impacts and majority of riparian SCPZ impacts to be mitigated on-site
- Remaining riparian SCPZ impacts to be mitigated off-site along Olentangy Trail

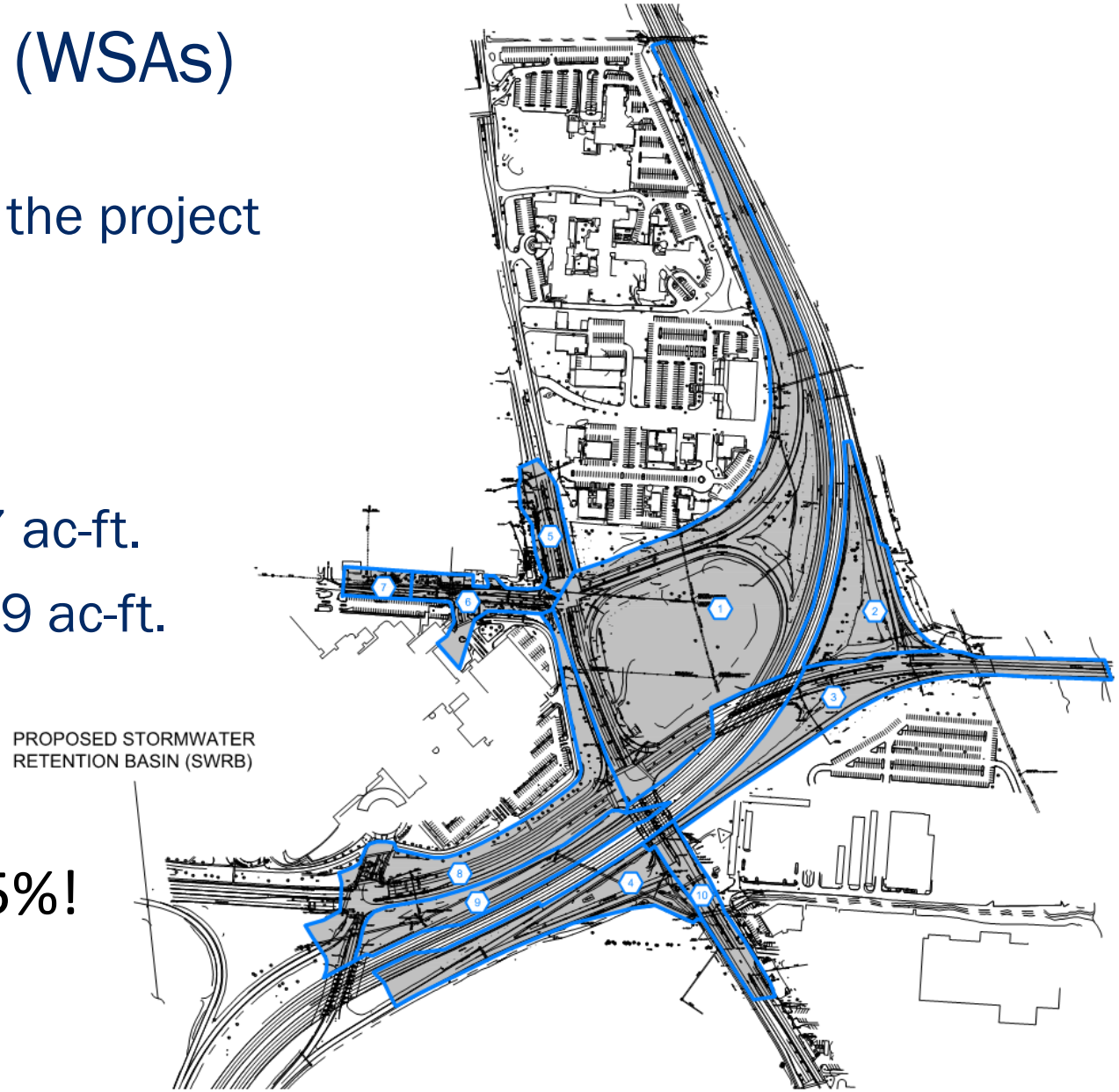
On - Site

Off - Site

Stormwater Best Management Practices (BMPs)

Overview of Watershed Areas (WSAs)

- 10 WSAs encompassing greater than the project extents
- Total Area = 45.21 ac.
- Impervious Area = 23.11 ac.
- Preconstruction runoff volume = 4.77 ac-ft.
- Postconstruction runoff volume = 4.79 ac-ft.



INCREASE IN RUN-OFF VOLUME < 0.5%!

State v. Local BMP Requirements

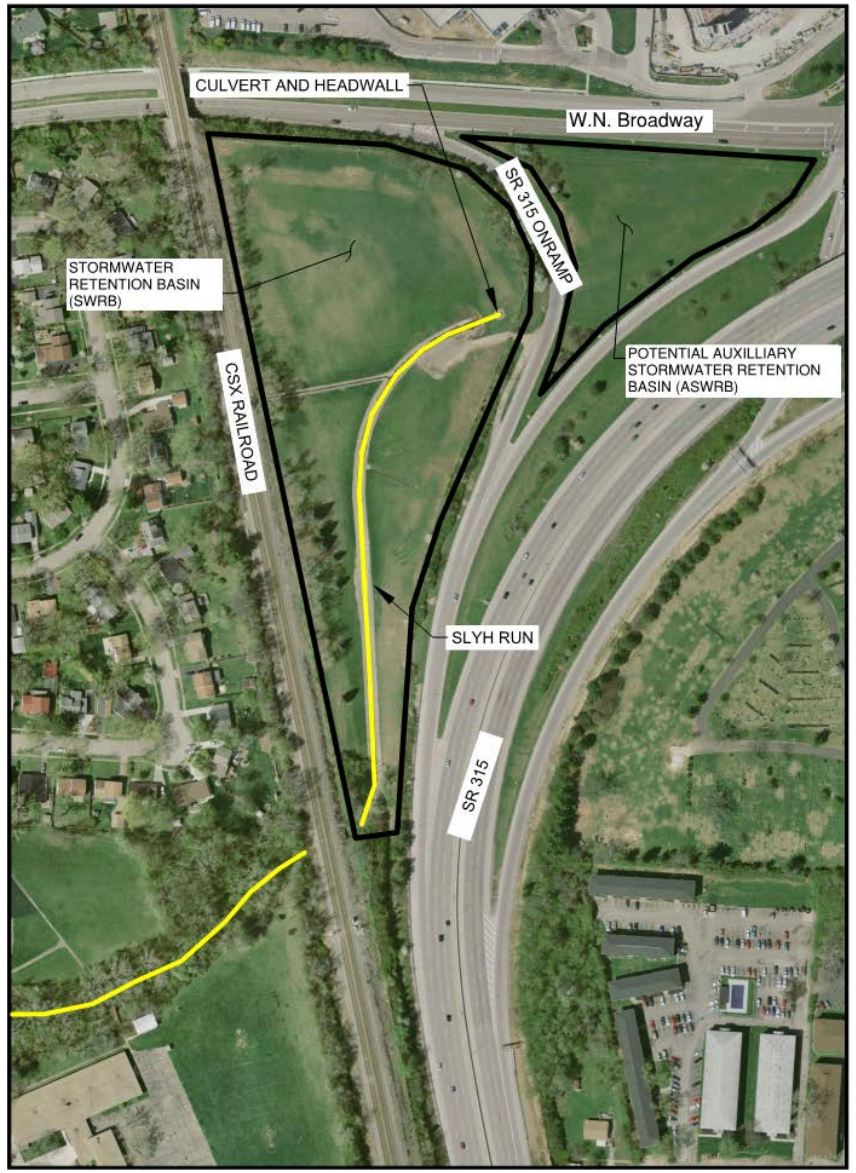
- Statewide General Stormwater Construction Permit
  - Critical Storm Method: 1-Year Storm
  - Design Response: BMPs in project area

- Local City Requirements
  - Require peak outflow of 100-year post-construction < 10-year pre-construction !!
  - Design Response: Compensatory BMPs outside project area required.

- ODOT Requirements
  - No BMPs allowed in LA ROW (including infields)
  - Design Response: Compensatory BMPs outside project area required.

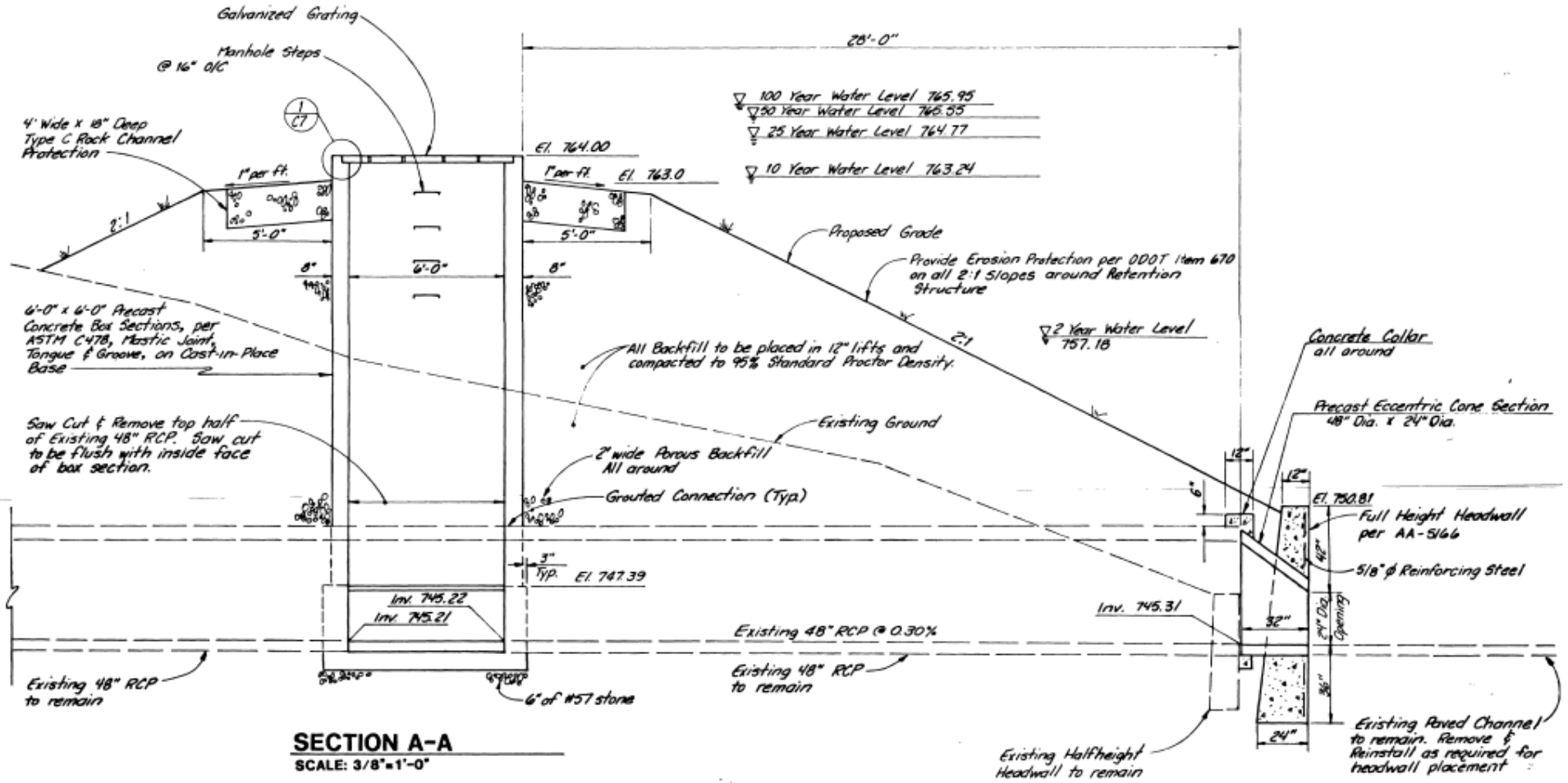
Overview of Stormwater Regional Basin

- One large and established basin (6.81 ac) with room for expansion east of the on-ramp
- Two main inlets draining approximately 450 acres
- Approximately 80 ac-ft. storage volume available
- Federal jurisdictional stream channel (Slyh Run)
  - USACE 404
  - Ohio EPA 401
  - Local Stream Corridor Protection Zone (SCPZ)
  - Schedule!
- Water quality and quantity control required (local and state)



Overview of Stormwater Regional Basin

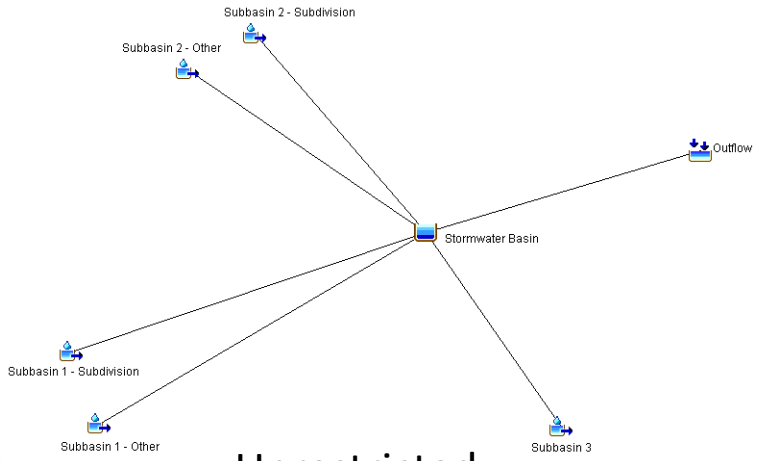
Overview of Stormwater Regional Basin – Quantity Control



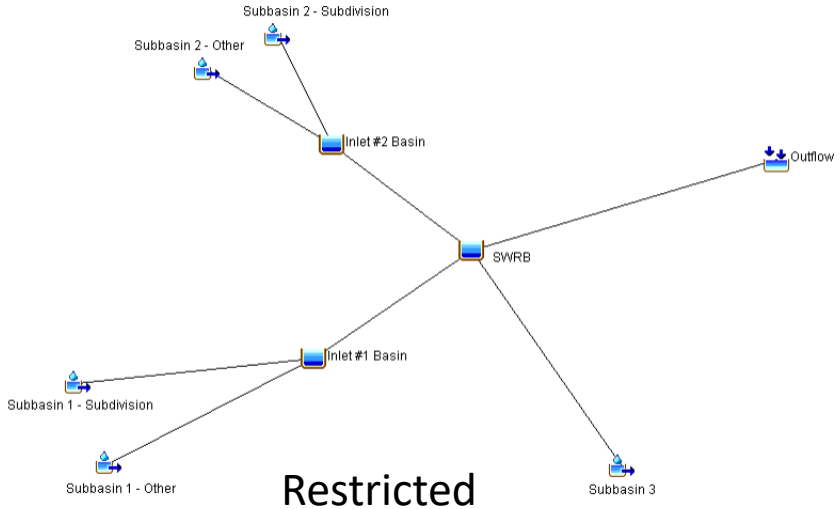
SECTION A-A
SCALE: 3/8"=1'-0"

Current Condition Modeling

- Restricted Inlet Model (based on mapped conditions)
  - Simulates storage upstream to corroborate field observations
  - Might not provide stormwater quantity control required
- Unrestricted Inlet Model (previous models)
  - Used to calibrate to existing models of the basin
  - Assumes unrestricted flow from the drainage areas to the basin

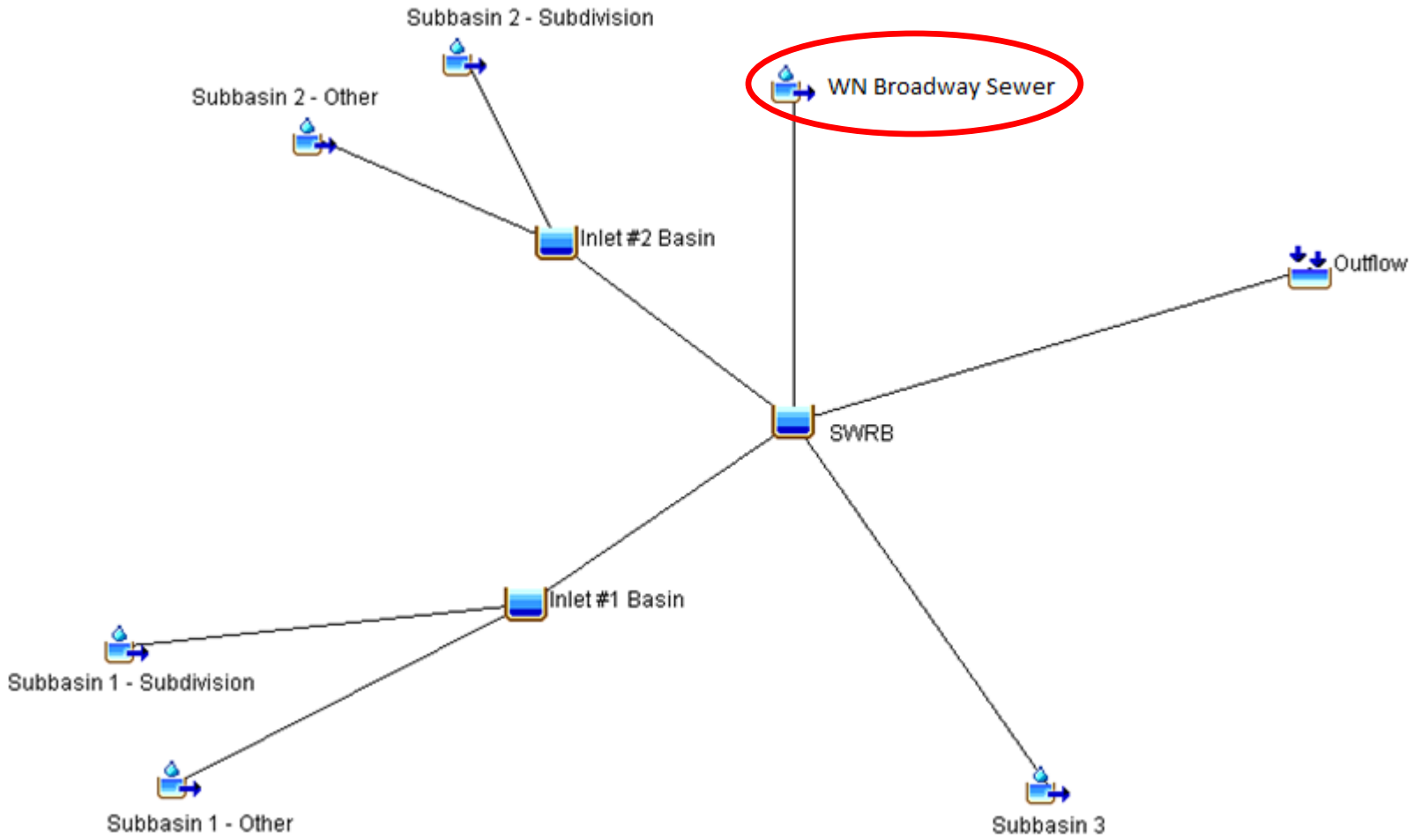


Unrestricted

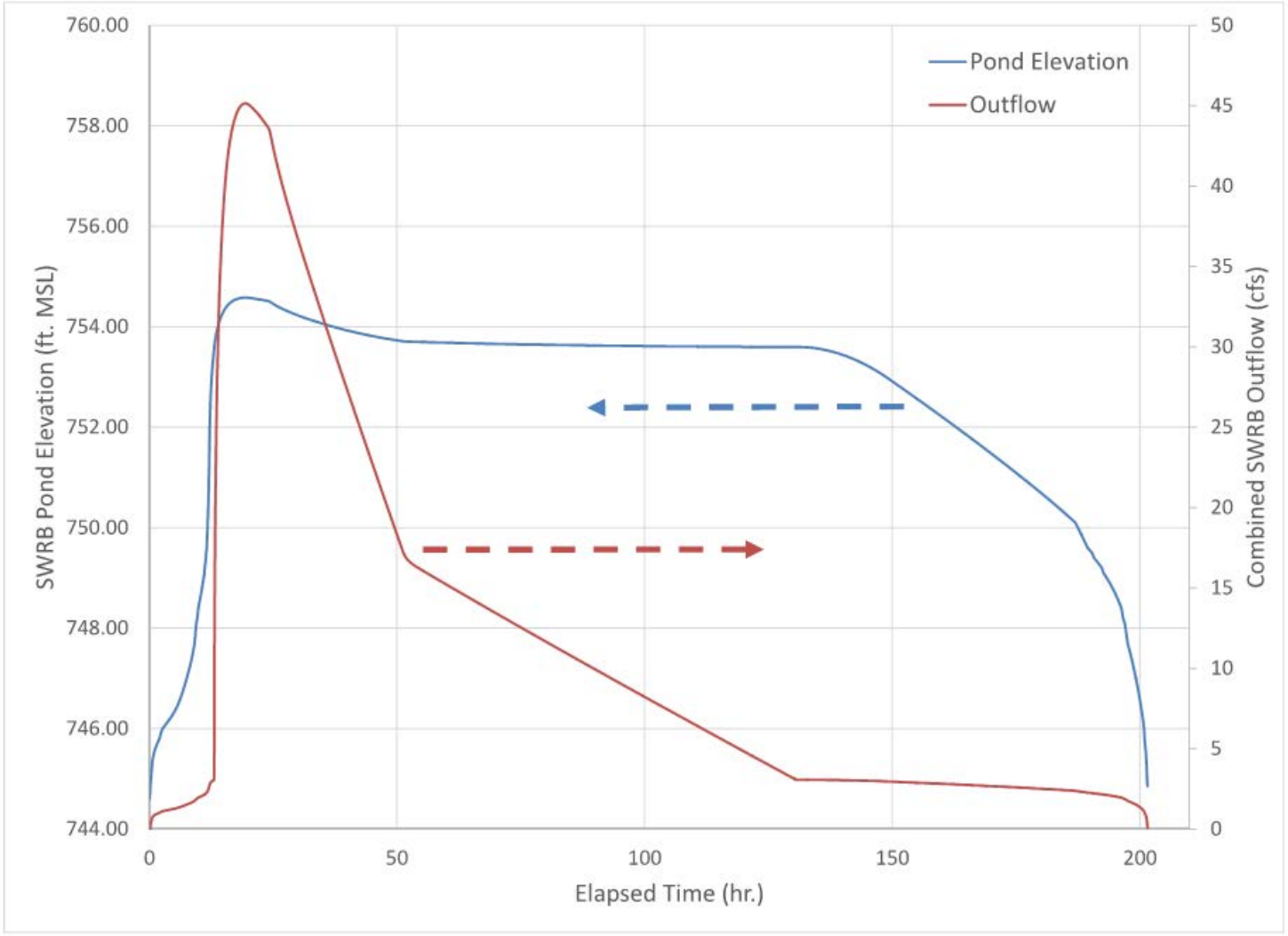


Restricted

Diversion of 42” Sewer for Quantity Control – The Paradox



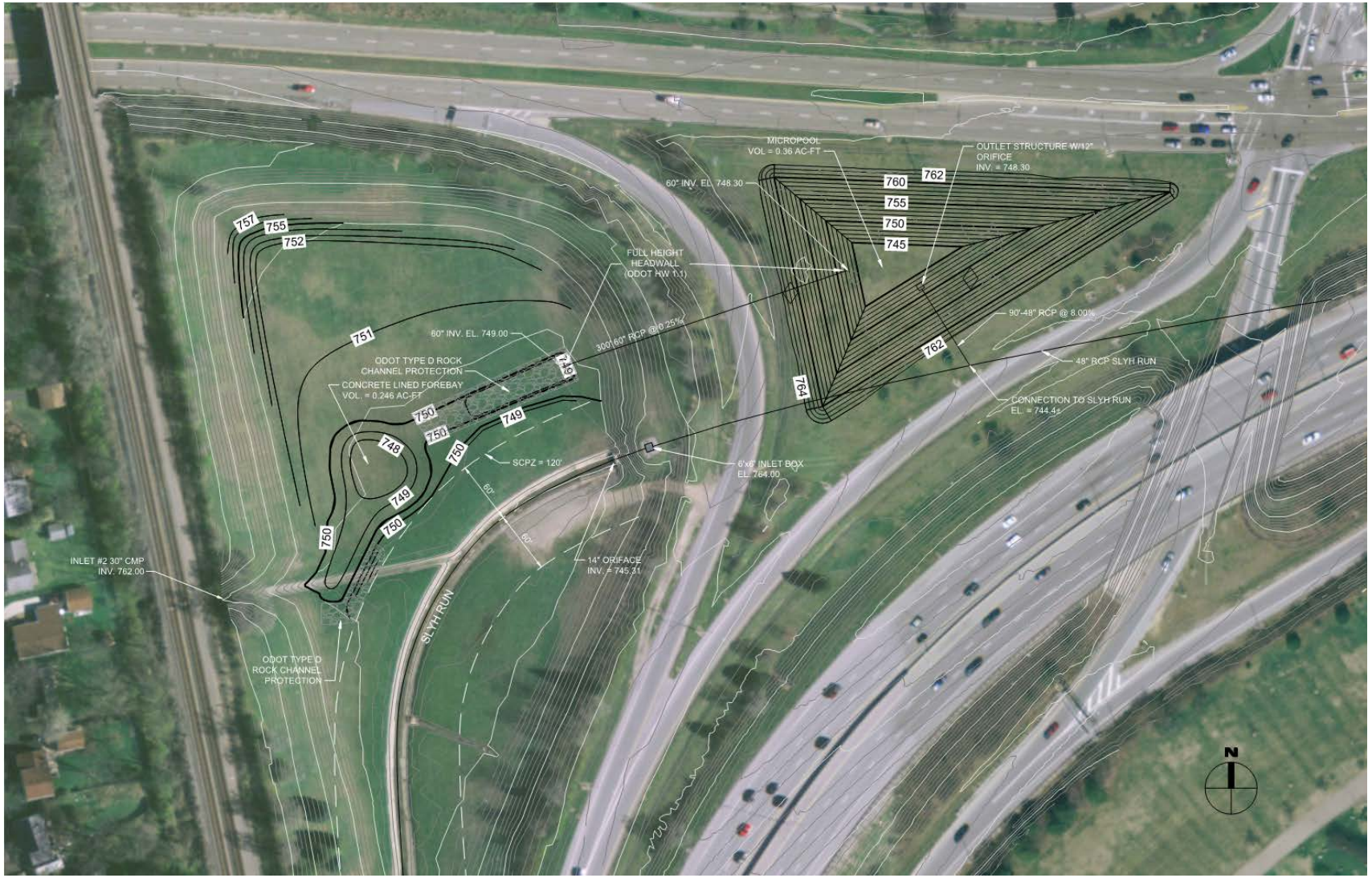
Diversion of 42” Sewer for Quantity Control



Environmental Site Visit

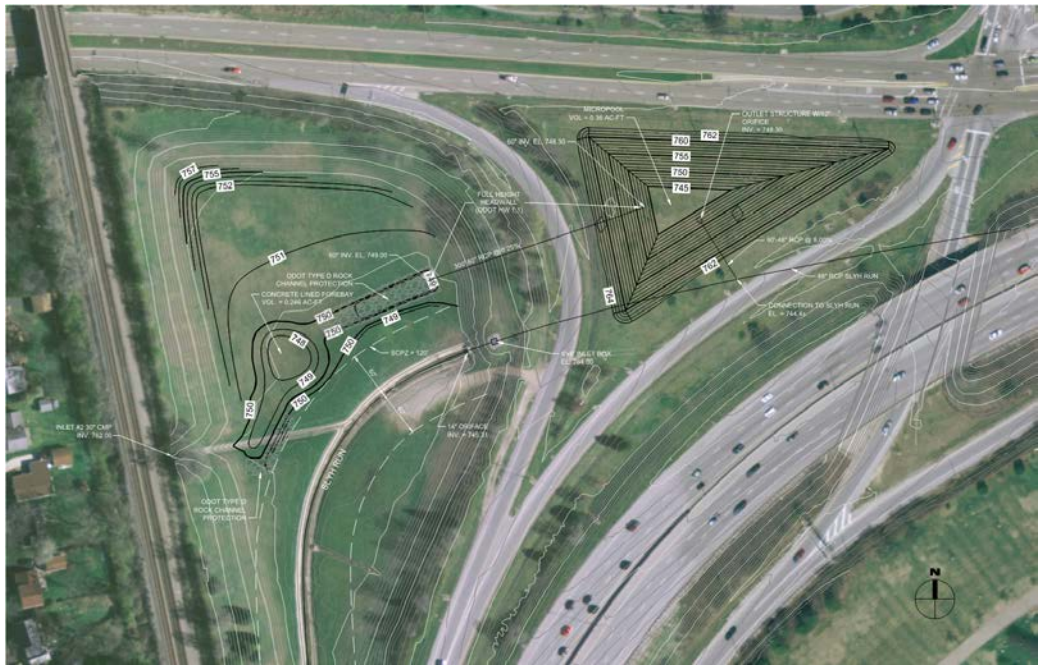
- The utility of an environmental site visit cannot be overstated!
- Atlas maps and even as-built drawings are not always accurate
- Discrepancies in the regional basin drawings
  - Number of Inlets
  - Location of Inlets
  - Size of Inlets
  - All impact modeling!

Water Quantity and Quality Control in the Regional Basin



Water Quantity and Quality Control in the Regional Basin

- Quantity Control
  - 1-year post-development storm outflows less than 1-year pre-development storm
  - 100-year post-development storm outflows less than 10-year pre-development storm
  - 1.5x requirement for compensatory quantity control
- Quality Control
  - Minimum drawdown time of 16-hours for *50%* water quality volume of all WSAs
  - Maximum drawdown time of 48-hours for *100%* water quality volume of all WSAs
  - 1.5x requirement for compensatory quality control



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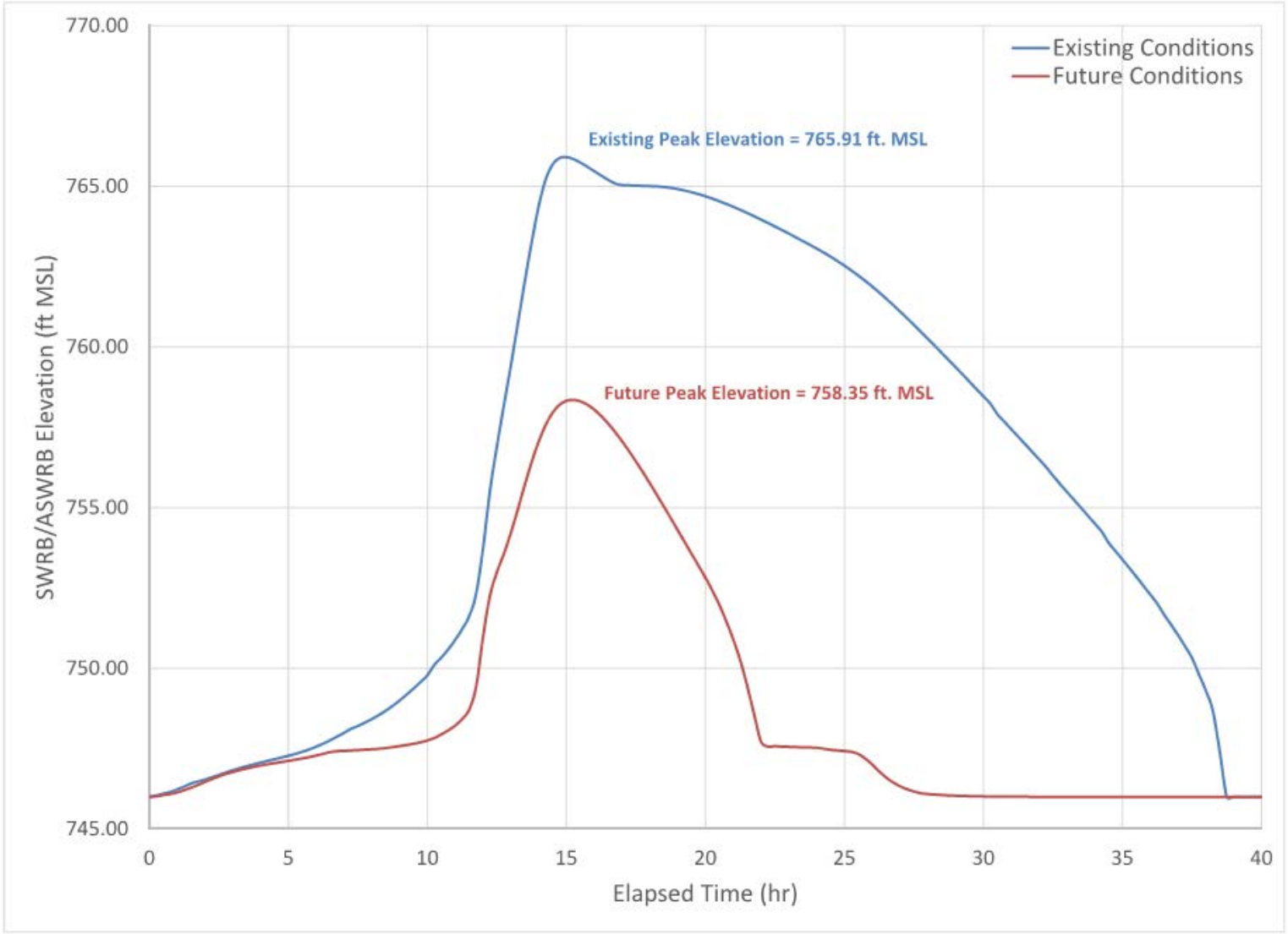
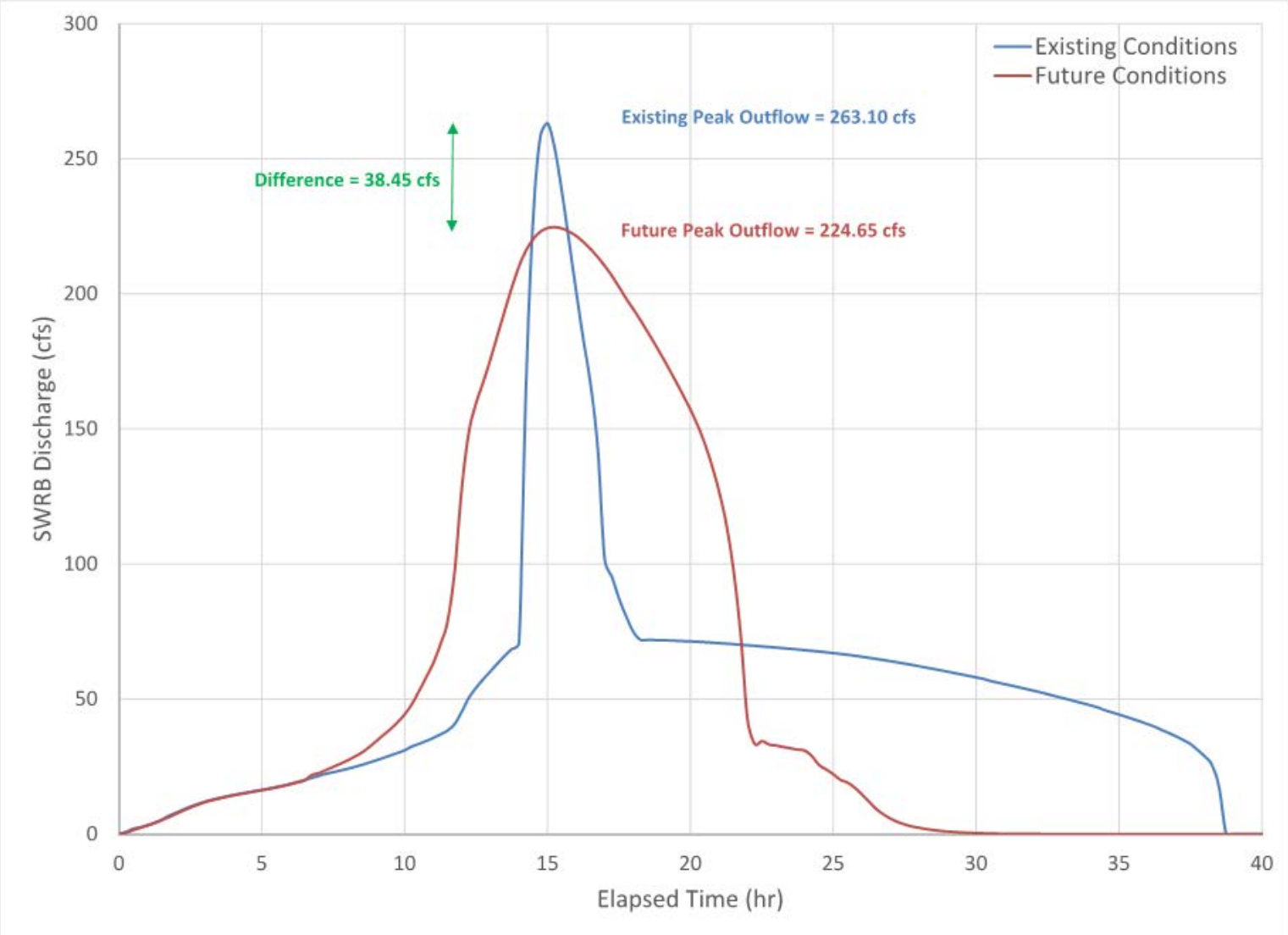


Water Quantity and Quality Control in the Regional Basin

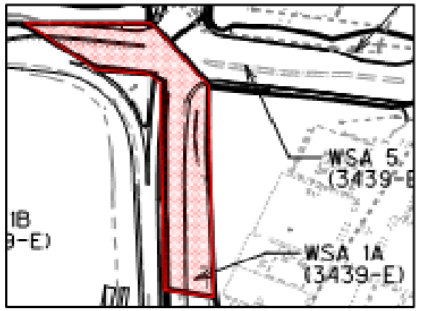


Why This Won't Work

- Standing water near the hospital is not ideal due to water fowl and other vector attraction
- City was interested in expanding the entirety of the regional basin
- Water quality control was not possible at 1.5x as required by the pending "new" Ohio EPA General Construction Permit
- City maintenance burden

Solution: On-site Quality Control with Off-Site Quantity Control

Time of Concentration		
Overland Flow - Pavement		
n	-	0.011
L	ft	75
P_2	in	2.63
s	ft/ft	0.029
t_t	min	0.92
Channelized Flow - Pavement		
s	-	0.01
V	ft/s	2.03
L	ft	235
t_t	min	1.93
Overland Flow - Grass		
n	-	0.15
L	ft	300
P_2	in	2.63
s	ft/ft	0.1
t_t	min	13.67
Channelized Flow - Grass		
s	-	0.038
V	ft/s	3.15
L	ft	100
t_t	min	0.53
Total t_c	min	17

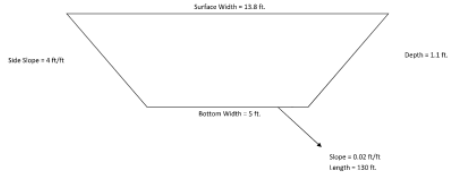


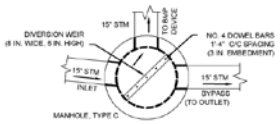
Water Quality Flow									
Total Area		Impervious Area			Runoff Coefficient for Water Quality	Water Quality Volume	Time of Concentration	Storm Intensity for Water Quality	Water Quality Flowrate
sf	ac	sf	ac	%	-	ac-ft	min	in/h	cfs
64645	1.48	33954	0.78	53	0.36	0.0330	17	1.2	0.63

Swale Design for WQ_v			Constraints		
Parameter	Unit	Value	Type	Unit	Value
Bottom Width	ft	5.00	Max	ft	10
Side Slope (H:V)	ft/ft	4	Max	ft/ft	4:1
Flow Depth	ft	0.25	Max	ft	0.25
Surface Width	ft	7.00			
Wet Perimeter	ft	7.06			
Flow Area	sf	1.50			
Hydraulic Radius	ft	0.21			
n	-	0.20	Exactly	-	0.20
Channel Slope	ft/ft	0.02	Range	ft/ft	0.02 - 0.06
Velocity	ft/s	0.38	Max	ft/s	2.5
Flowrate	cfs	0.65	Min	cfs	0.63
Length	ft	115	Min	ft	100
Residence Time	min	5.06	Min	min	5

10-Year Storm			
C	I	A	Peak Flow
-	in/h	ac	cfs
0.58	4.90	1.48	4.25

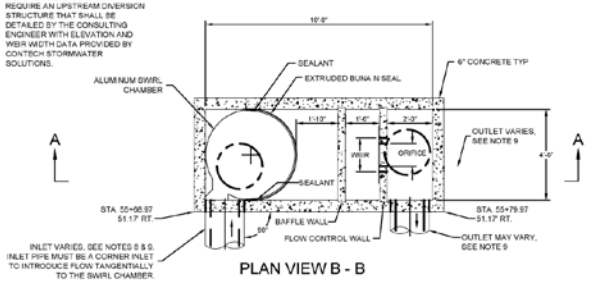
Velocity Check			Constraints		
			Type	Value	Unit
Bottom Width	ft	5.00	Max	10	ft
Side Slope (H:V)	ft/ft	4	Max	4:1	ft/ft
Flow Depth	ft	0.8			
Flow Surface Width	ft	11.40			
Wet Perimeter	ft	11.60			
Flow Area	sf	6.56			
Hydraulic Radius	ft	0.57			
n	-	0.20	Exactly	0.20	-
Channel Slope	ft/ft	0.02	Range	0.02 - 0.06	ft/ft
Velocity	ft/s	0.72	Max	2.5	ft/s
Flowrate	cfs	4.75	Min	cfs	4.25
Depth	ft	1.10	Min	1.05	ft
Tot. Surface Width	ft	13.80			



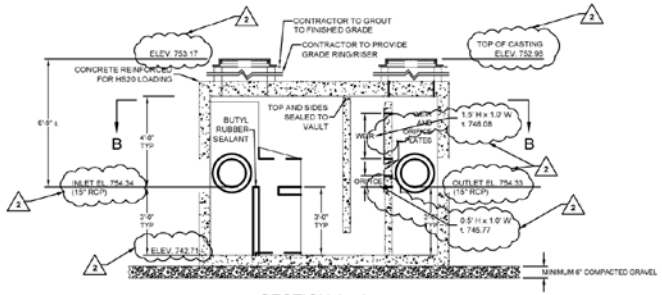


PLAN VIEW - MANHOLE D-21
(DIVERSION WEIR)

NOTE:
VORTECHS SYSTEMS INSTALLED IN A BYPASS CONFIGURATION REQUIRE AN UPSTREAM DIVERSION STRUCTURE THAT SHALL BE DETAILED BY THE CONSULTING ENGINEER WITH ELEVATION AND WEIR WIDTH DATA PROVIDED BY CONTECH STORMWATER SOLUTIONS.



PLAN VIEW B - B



SECTION A - A

NOTES:
1. STORMWATER TREATMENT SYSTEM (SWTS) SHALL HAVE:
PEAK TREATMENT CAPACITY: 3.34 CFS
SEDIMENT STORAGE: 1.2 CU YD
SEDIMENT CHAMBER DIA. 4' MIN
2. SWTS SHALL BE CONTAINED IN ONE RECTANGULAR STRUCTURE
3. SWTS REMOVAL EFFICIENCY SHALL BE DOCUMENTED BASED ON PARTICLE SIZE
4. SWTS SHALL RETAIN FLOATABLES AND TRAPPED SEDIMENT UP TO AND INCLUDING PEAK TREATMENT CAPACITY
5. SWTS INVERTS IN AND OUT ARE TYPICALLY AT THE SAME ELEVATION
6. SWTS SHALL NOT BE COMPROMISED BY EFFECTS OF DOWNSTREAM TAILWATER
7. SWTS SHALL HAVE NO INTERNAL COMPONENTS THAT OBSTRUCT MAINTENANCE ACCESS
8. INLET PIPE MUST BE PERPENDICULAR TO THE STRUCTURE
9. PIPE ORIENTATION MAY VARY. SEE SITE PLAN FOR SIZE AND LOCATION
10. PURCHASER SHALL NOT BE RESPONSIBLE FOR ASSEMBLY OF UNIT
11. MANHOLE FRAMES AND PERFORATED COVERS SUPPLIED WITH SYSTEM, NOT INSTALLED
12. PURCHASER TO PREPARE EXCAVATION AND PROVIDE CRANE FOR OFF-LOADING AND SETTING AT TIME OF DELIVERY
13. VORTECHS SYSTEMS BY CONTECH STORMWATER SOLUTIONS: PORTLAND, OR (800) 548-6867; SCARBOROUGH, ME (877) 907-8676; UNITHCUM, MD (866) 740-3318.

STANDARD DETAIL
STORMWATER TREATMENT SYSTEM
VORTECHS® MODEL 2000

On-site Quality Control with Off-Site Quantity Control

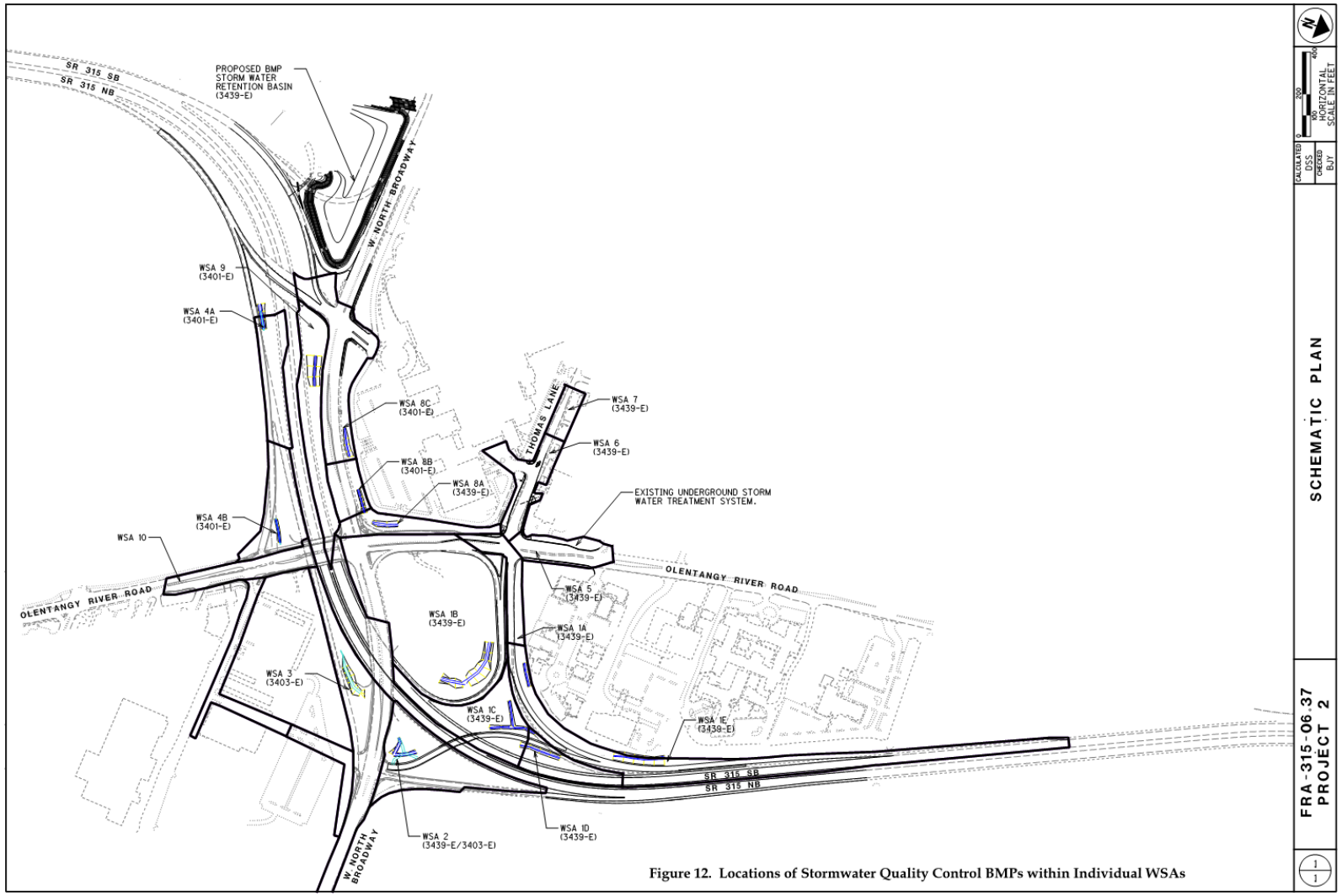
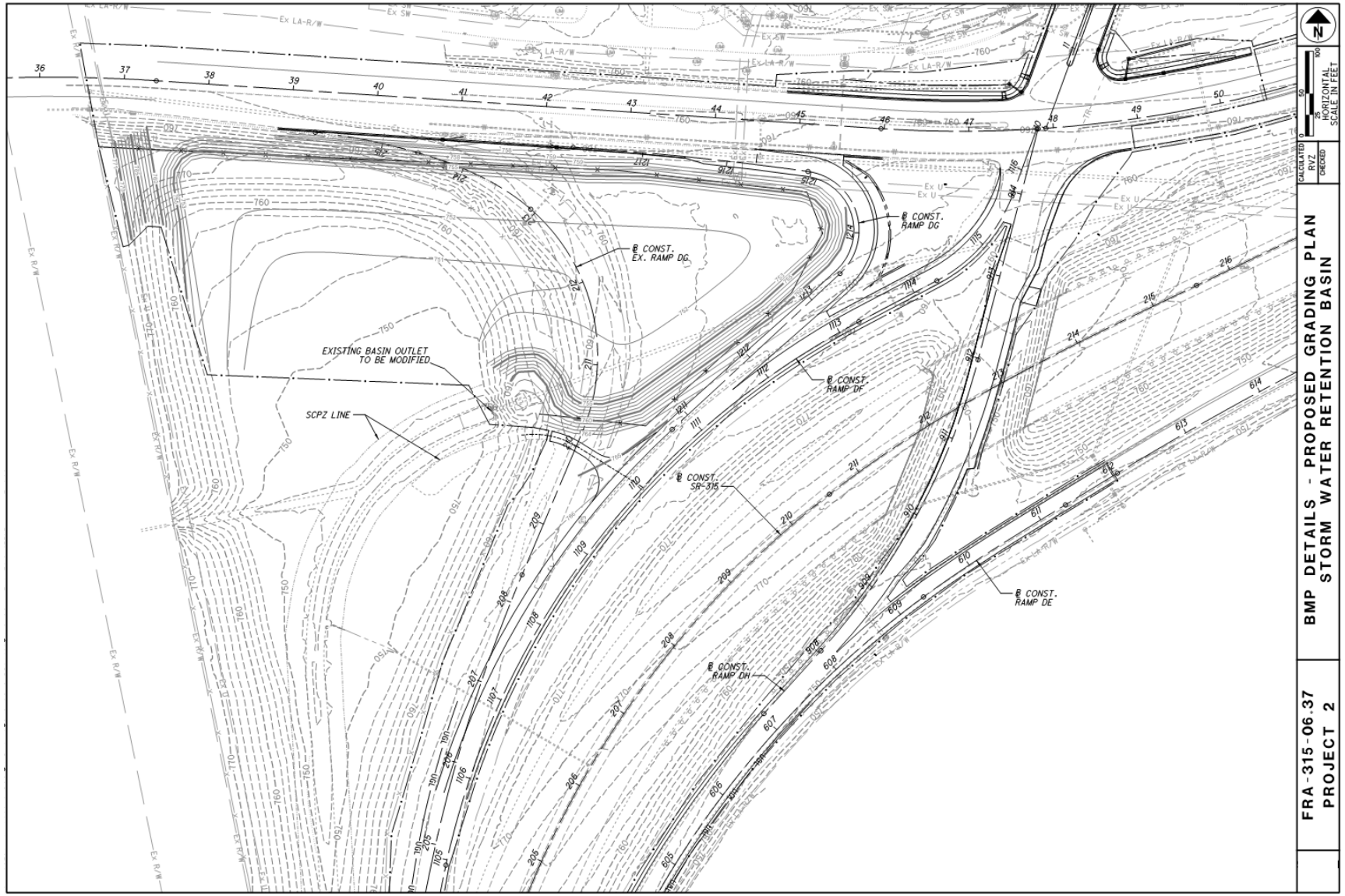


Figure 12. Locations of Stormwater Quality Control BMPs within Individual WSAs

Why this won’t work

- City maintenance burden. Period.

Solution: Phased Approach for Quality Control



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