

# M E M O

To: **Erika Kenzig, PE, ODOT District 12 Project Manager**

From: **Shelby Thomas, PE**

Date: **December 18, 2025**

Regarding: **CUY-480-16.56 Slide, PID 124096 – Drainage**

## Background

This project consists of the repair of a failed slope with benched excavation and embankment construction. The project is located approximately 500' east of the SR 17 (Granger Road) along the West Bound Outer Lanes Ramp (W.B.O.L.) on Interstate Route (IR) 480. The geotechnical recommendation for the reconstruction of the slope to between the culvert and the eastern end of the project conflicts with the existing conduit and ditch, resulting in an alternative scheme to maintain the existing drainage pattern.

## Existing Conditions

The existing drainage system consists of both ditches and a 24" conduit which outlets into West Creek at the northern and southern extents of IR 480.

An approximately 3.65 acre drainage area is captured by the catch basin at IR 480 STA. 902+36 which flows north in an 18-inch concrete conduit to a manhole at W.B.O.L. STA. 901+75. From the manhole the conduit increases in size to a 24" concrete conduit that flows west, outletting into West Creek. Based on the available survey information and record plans, the existing 24" conduit, which currently has limited cover, is depicted in the Cross Sections.

The impacted ditch is 2' wide and runs east to west along and down the slope and discharges into West Creek. The ditch captures approximately 1.17 acres of flow from the West Bound Outer Lanes and surrounding grading. Proposed grading which provides a 2.5:1 slope rather than the current 2:1 slope fills in the existing ditch.

## Proposed Conditions

To maintain the drainage pattern and provide an outlet for the water currently draining to the West Creek, a combination of improvements is proposed with the intent to provide a practical solution. Conduit that currently extends to the culvert headwall will be removed to STA. 899+88.55 where a half-height headwall will be constructed to intercept the existing 24" conduit and outlet into a proposed ditch at the toe of the slope.

Based on approximate areas and calculations in CDSS, the estimated flow of water coming from the 24" conduit at maximum capacity will be around 18.1 cfs so riprap and rock channel protection are proposed to dissipate the velocity of the water and prevent erosion of the ditch bottom. The riprap is 5' by 4' and the rock channel protection is 30" deep, 16' long with variable width consisting of 12" rock, Type B. The proposed ditch width is 2' with a foreslope of 2.5:1 and a backslope of 2:1. Due to the increase in flow from the proposed 24" conduit, a Type 1 Permanent Turf Mat is proposed within the ditch to prevent erosion from CDSS checks. Where the proposed ditch meets existing rock protecting the swale at West Creek, the Northeast Ohio Regional Sewer District requires a rock mixture of 40% Type B and 60% Type C with choking stones.

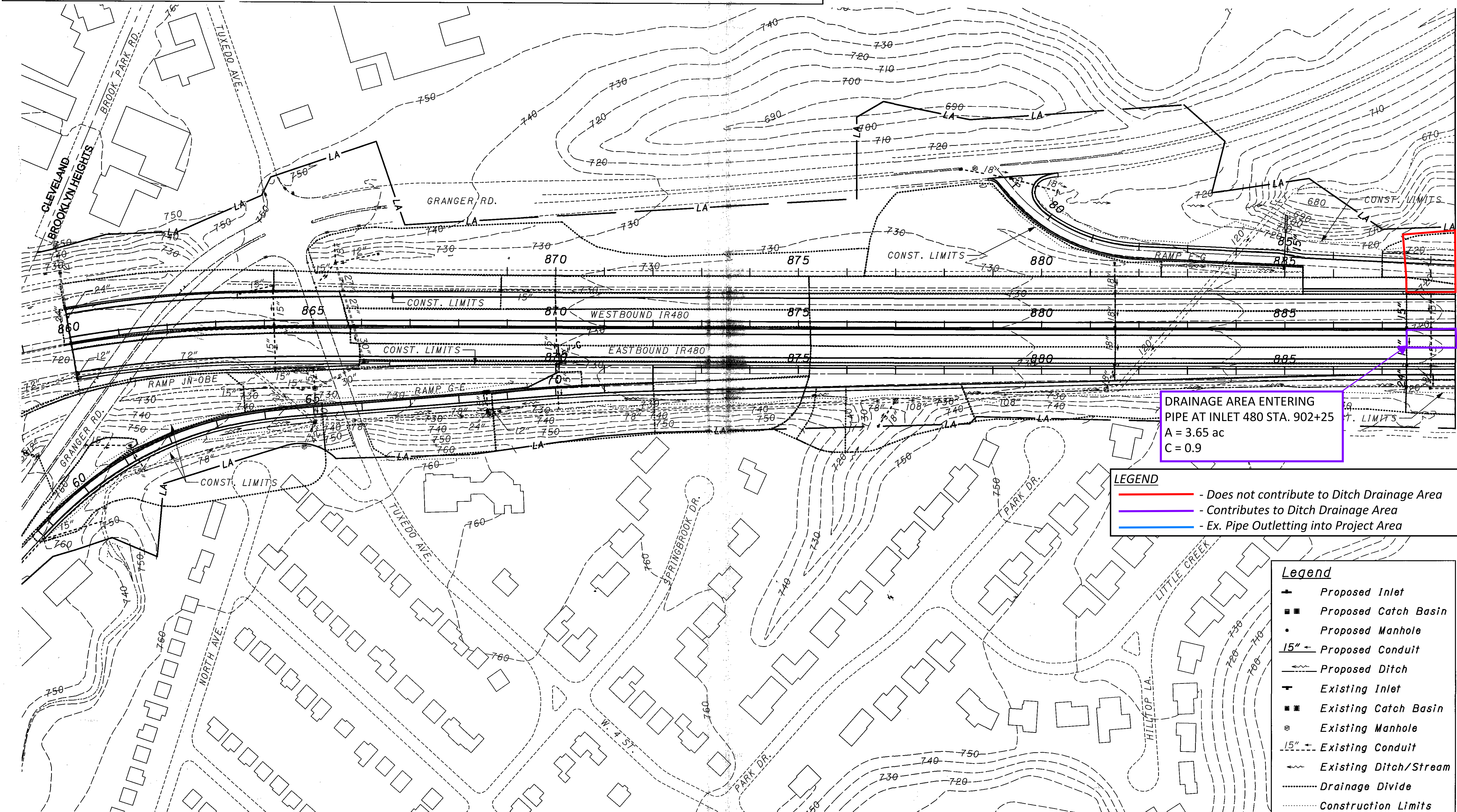
## Conclusion

The proposed closed and open drainage improvements resolve the conflicts created by the grading identified in the geotechnical recommendations and maintain drainage outletting. The realigned ditch with turf mat, riprap, and rock channel protection minimizes erosion.



Total Area (Right-of-Way)-----	235.2 Acres	Immediate Receiving Waters -----	West Creek
Project Earth Disturbed Area -----	115.3 Acres	Subsequent Receiving Waters -----	Cuyahoga River
Estimated Contractor Disturbed Area -----	1.0 Acres		Approved TMDL water body (Lower Cuyahoga River Watershed)
Notice of Intent Earth Disturbed Area -----	116.3 Acres		
Runoff Coefficient for Pre-Construction Site -----	0.63	Approximate Center of Project: Latitude N41°24'36"	Longitude W81°39'42"
Runoff Coefficient for Post-Construction Site -----	0.64	USGS Quadrant No. 41081-D6-TF-024 CLEVELAND SOUTH, OHIO	
Impervious (Paved) Area for Pre-Construction Site -----	78.7 Acres	Soil Survey of Cuyahoga County, Ohio [Digital Map]	
Impervious (Paved) Area for Post-Construction Site -----	80.5 Acres		

MAJOR ROAD REHABILITATION OF 2.58 MILES OF EXISTING MAINLINE IR-480 FROM JUST WEST OF THE TUXEDO AVENUE OVERPASS TO THE WESTERLY APPROACH OF THE VALLEY VIEW BRIDGE, INCLUDING INNER AND OUTER LANES AND 3.8 MILES OF I-77 AND GRANGER ROAD INTERCHANGE RAMPS. WORK ITEMS INCLUDE: PAVEMENT REPLACEMENT, STRUCTURE APPROACH UPGRADES, GUARDRAIL & FENCE REPLACEMENT, LIGHTING AND TRAFFIC CONTROL. THE PLANS & PROPOSAL HAVE BEEN PREPARED USING FULL DEPTH ASPHALT CONCRETE PAVEMENT WITH AN OPTIONAL BID USING FULL DEPTH PORTLAND CEMENT CONCRETE PAVEMENT.



**MATCH LINE SHEET 275**

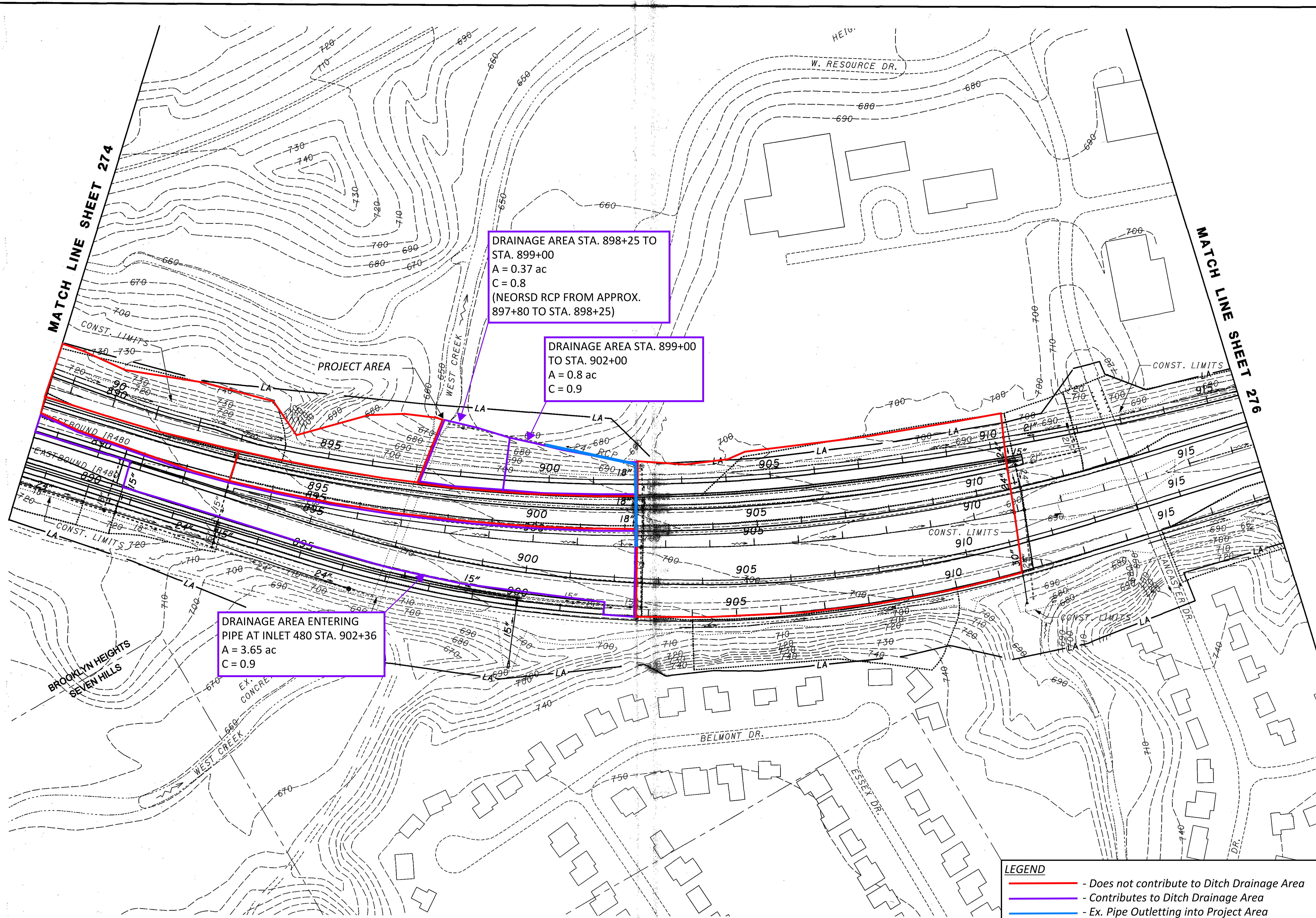
**PROJECT SITE PLAN**  
**I.R. 480 STA. 859+00 TO STA. 888+50**

**CUY-480-15.81**

$$\frac{274}{857}$$




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DRAINAGE AREA STA. 898+25 TO  
STA. 899+00  
A = 0.37 ac  
C = 0.8  
(NEORS RCP FROM APPROX.  
897+80 TO STA. 898+25)

DRAINAGE AREA STA. 899+00  
TO STA. 902+00  
A = 0.8 ac  
C = 0.9

DRAINAGE AREA ENTERING  
PIPE AT INLET 480 STA. 902+36  
A = 3.65 ac  
C = 0.9

**LEGEND**

- Does not contribute to Ditch Drainage Area
- Contributes to Ditch Drainage Area
- Ex. Pipe Outletting into Project Area





# STORM SEWER SYSTEM

**PID :** 124096      **Date :** 12/18/2025      **Project :** CUY-480-16.56 Slide

**Location :** STA. 899+00

**Description :** Pipe Flow Calculations Crossing IR 480

**Designer :** SHT

**Rainfall Area:** A

**Just Full Capacity Frequency (yrs.) :** 10

**Hydraulic Gradient Frequency (yrs.) :** 25

**Minimum Pipe Size :** 24.00

**Tailwater Elevation (ft.):** 0.00

JUNCTION		STATION		Δ AREA	Δ CA	BEGIN	RAINFALL		DISCHARGE		PIPE			F/L PIPE	MEAN	JUST FULL	FRICT	HYGR EL.	COVER	COVER	COVER	INLET TYPE
From	To	From	To	Σ AREA (acres)	Σ CA	TIME (min.)	INTENSITY (10 yrs.)	(25 yrs.)	(10 yrs.)	(25 yrs.)	DIAM. (in.)	LENGTH (ft.)	SLOPE (ft./ft.)	IN / OUT (ft.)	VEL (fps.)	CAPACITY (cfs.)	SLOPE (ft./ft.)	IN / OUT (ft.)	IN / OUT (ft.)	MINUS HY GR	MINUS CROWN	MANNING'S 'n'
1	2	897+75		3.65	3.29	10.00	4.94	5.52	16.2	18.1	24	445.6	0.0649	683.92	14.21	53.74	0.0085	684.75	693.56	8.80	7.64	MH 3
	begin	901+75		3.65	3.29									655.00				656.76	655.00			0.015



# DITCH ANALYSIS

**PID :** 124096      **Date :** 12/18/2025      **Project :** CUY-480-16.56 Slide

**Location :** STA. 897+80 to STA. 902+00

**Description :** Ditch Calculations to Check for Erosion/Capacity Needs

**Designer :** SHT

**Rainfall Area :** A

**Allowable Shears**

	<b>Seed:</b>	0.40	<b>Jute Mat:</b>	0.45	<b>Temporary Mat:</b>	1.00
<b>Permanent Mat</b>	<b>Type 1:</b>	3.00	<b>Type 2:</b>	4.00	<b>Type 3:</b>	5.00
<b>RCP</b>	<b>Type B:</b>	6.00				

(\*) Warning: Grade is steeper than allowable.

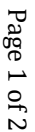
If value is parantheses, design parameters have been exceeded. - See user manual.

STATION BEGIN	STATION END	SIDE	LENGTH (ft.)	RADIUS WIDTH (ft.)	IN SLOPE (ft./ft.)	BACK SLOPE (ft./ft.)	GRADE (ft./ft.)	AREA (acres)	AREA SUM (acres)	RUNOFF COEFF.	CA (Sum)	PROTECT TYPE	RAIN INT. (in./hr.)	STORM FREQ. (yrs.)	MANN. COEFF.	TIME FLOW (min.)	VEL. FLOW (fps.)	SHEAR (lbs./ sq.ft.)	DESIGN FLOW (cfs.)	DEPTH FLOW (ft.)	WIDTH FLOW (ft.)
902+00	901+00	L	100.00	2.00	2.00	2.00	0.0679	0.26	0.26	0.80	0.21	Seed	4.31	5	0.030	10.54	3.04	0.55	0.90	0.13	2.52
												Jute Mat	4.29	5	0.040	10.65	2.53	0.65	0.89	0.15	2.61
												Temp. Mat	4.29	5	0.040	10.65	2.53	0.65	0.89	0.15	2.61
												Temp. Mat	4.82	10	0.040	10.63	2.63	0.69	1.00	0.16	2.66
901+00	900+00	L	100.00	2.00	2.00	2.00	0.1205 *	0.25	0.51	0.80	0.41	Seed	4.23	5	0.030	11.02	4.61	1.21	1.72	0.16	2.64
												Jute Mat	4.21	5	0.040	11.09	3.79	1.43	1.72	0.19	2.76
												Temp. Mat	4.21	5	0.040	11.09	3.79	1.43	1.72	0.19	2.76
												Perm, Type 1	4.21	5	0.040	11.09	3.79	1.43	1.72	0.19	2.76
												Perm, Type 1	4.74	10	0.040	11.05	3.94	1.53	1.94	0.20	2.82
900+00	899+00	L	100.00	4.00	2.00	2.00	0.0500	0.29	0.80	0.90	0.67	Seed	4.13	5	0.030	11.58	3.39	0.58	2.76	0.19	4.75
												Jute Mat	4.12	5	0.040	11.68	2.81	0.69	2.75	0.22	4.88
												Temp. Mat	4.12	5	0.040	11.68	2.81	0.69	2.75	0.22	4.88
												Temp. Mat	4.64	10	0.040	11.61	2.93	0.74	3.11	0.24	4.95



# DITCH ANALYSIS

STATION BEGIN	STATION END	SIDE	LENGTH (ft.)	RADIUS WIDTH (ft.)	IN SLOPE (ft./ft.)	BACK SLOPE (ft./ft.)	GRADE (ft./ft.)	AREA (acres)	AREA SUM (acres)	RUNOFF COEFF.	CA (Sum)	PROTECT TYPE	RAIN INT. (in./hr.)	STORM FREQ. (yrs.)	MANN. COEFF.	TIME FLOW (min.)	VEL. FLOW (fps.)	SHEAR (lbs./ sq.ft.)	DESIGN FLOW (cfs.)	DEPTH FLOW (ft.)	WIDTH FLOW (ft.)
899+00	899+00	L	100.00	2.00	1.00	1.00	0.0649	3.65	4.45	0.90	3.95	Seed	4.08	5	0.030	11.89	7.92	3.01	16.14	0.74	3.49
												Jute Mat	4.08	5	0.040	11.94	6.43	3.53	16.12	0.87	3.74
												Temp. Mat	4.08	5	0.040	11.94	6.43	3.53	16.12	0.87	3.74
												Perm, Type 1	4.08	5	0.040	11.94	6.43	3.53	16.12	0.87	3.74
												Perm, Type 2	4.08	5	0.040	11.94	6.43	3.53	16.12	0.87	3.74
												Perm, Type 2	4.60	10	0.040	11.86	6.65	3.78	18.19	0.93	3.87
899+00	898+25	L	75.00	2.00	2.50	2.00	0.0506	0.37	4.82	0.80	4.25	Seed	4.05	5	0.030	12.13	6.70	2.25	17.20	0.71	5.21
												Jute Mat	4.04	5	0.040	12.17	5.43	2.60	17.17	0.82	5.70
												Temp. Mat	4.04	5	0.040	12.17	5.43	2.60	17.17	0.82	5.70
												Perm, Type 1	4.04	5	0.040	12.17	5.43	2.60	17.17	0.82	5.70
												Perm, Type 1	4.56	10	0.040	12.09	5.60	2.76	19.40	0.87	5.93



ROCK CHANNEL PROTECTION AT CULVERT AND STORM SEWER OUTLETS	1002-4
	REFERENCE SECTION 1002.2.3

**Notes:**

Rock size (6", 12", 18") indicates the square opening on which 85% of the material by weight is retained.

Provide rock channel protection the width of the headwall with a minimum of 4'.

No rock channel protection is required where the natural stream bed will withstand the calculated velocity without erosion.

Equations for length of protection:

Rise	Length
120"	$L = 0.764996 * V + 21.17502$
108"	$L = 0.0203 * V^2 + 0.3004 * V + 20.765$
96"	$L = 0.0184 * V^2 + 0.3121 * V + 17.892$
84"	$L = 0.0261 * V^2 + 0.1234 * V + 15.970$
72"	$L = 0.0251 * V^2 + 0.0897 * V + 13.798$
60"	$L = 0.0139 * V^2 + 0.3683 * V + 9.4671$
48"	$L = 0.0151 * V^2 + 0.2661 * V + 8.0899$
36"	$L = 0.0262 * V^2 + 0.1341 * V + 8.4794$
24"	$L = 0.0182 * V^2 + 0.1404 * V + 6.983$
12"	$L = 0.0014 * V^2 + 0.0816 * V + 4.1255$

$$L = 12.65' = [0.0182 * (14.21^2)] + (0.1404 * 14.21) + 6.983$$

V=Velocity (f.p.s.)

L=Length of minimum Rock Channel Protection (ft.)