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Narrative

As discussed with ODOT, prior to the Preferred Alternative Verification Review (PAVR), culverts located under high fill¹ are to be increased in size. The increased size is the design size plus two additional sizes. This will allow a liner with a field paved invert to be inserted into it at a later date. Since a liner will be installed at the high fill locations, traffic on the roadway above the culvert can be maintained with minimal interruption when a new culvert is installed.

Currently there are no oversized storm sewers in this section of the project.

On June 23, 2005, the County Engineer requested that a copy of the LD-33 form be submitted to him at the Stage 1 Review. Therefore the LD-33 form has not yet been approved by the County Engineer. A copy of the form and calculations is attached in the Appendix.

For this Phase of the project the BMP's used are:
Exfiltration trenches and vegetative ditches as described in L&D Volume 2, section 1118. The BMP ditch calculations show required widths.

The SR 335 bridge over the Little Scioto River falls within FEMA flood zone A.

Hydraulic analysis for inlet spacing, storm sewers, culverts and ditches were done using ODOT CDSS Version 1.0.0.3.

The Report is organized as follows:

Appendix A contains all the LD-35 Drainage Criteria submitted to ODOT in July 2005

Appendix B contains all the Inlet Spacing Calculations

Appendix C contains the Storm Sewer Calculations

Appendix D contains Culverts Analysis

Appendix E contains Ditch Calculations

Appendix F contains the BMP Exfiltration Trench calculations and Ditch BMP calculations

Appendix G contains LD-33 Form

¹ (high is fill greater than or equal to 30')

APPENDIX A

LD-35, Drainage Criteria

GENERAL PROJECT INFORMATION

County	Route	Section
Scioto	SR 823	0.00

(Attach Typical Section)

<u>AFFECTED ROADWAYS:</u>	<u>Route</u>	<u>Average Daily Traffic</u>	<u>Rural / Urban</u>
INTERSTATE OR OTHER L/A FACILITIES	SCI 823	21,200 (2008)	Rural
ARTERIALS AND COLLECTORS	U.S. 52, U.S. 23, S.R. 140		
LOCALS	Shumway-Hollow Rd Stout Hollow Road		
CLEAR ZONE	30'		

All Units are English: Yes

PIPE POLICY:

The Pipe Policy of ODOT will be used for this project. (See Section 1002 for additional information)

If a policy other than ODOT's is being used, the following material types are permitted:

(Please attach a copy of the written pipe policy. In lieu of a written policy, documentation of locally funded construction practices may be provided)

PROJECT SPECIFIC INFORMATION AFFECTING DRAINAGE:

Section A. Roadway Culverts (Type A Conduits)

1. DESIGN STORM FREQUENCY (1004.2):
 - a. Mainline 50 Year
 - b. Crossroads 25 Year

2. BANKFULL DESIGN Yes No (Circle yes if at least one culvert has bankfull design) *attach a list of culverts with bankfull designs*

3. FLOOD PLAIN CULVERT(S) NEEDED? Yes No (Circle yes if at least one culvert has flood plain culverts) *attach a list of culverts with flood plain culverts*

4. DURABILITY SERVICE LIFE 75 Year *attach a list of culverts with their durability service life if multiple culverts have different frequencies.*

5. ABRASIVE SITE? Yes No (Circle yes if at least one culvert has an abrasive site) *attach a list of culverts with their abrasive site assumptions if multiple culverts are different*

6. MAXIMUM ALLOWABLE HEADWATER FOR DESIGN STORM (1006.2):
 - a. 2' below eop if drainage area >1000acres, 1' below eop if drainage area < 1000acres.
 - b. 2' above crown in flat terrain, 4' above crown in a ravine.
 - c.

7. METHOD USED TO ESTIMATE DESIGN DISCHARGE (Q) (1003):
 - a. U.S.G.S. Rural Equations for areas ≥ 6 acres.
 - b. Rational Method for areas < 6 acres.

8. SCALE OF TOPOGRAPHIC MAPPING USED TO DELINEATE DRAINAGE AREAS (1101.1):
 - a. 24,000:1
 - b.
 - c.

9. MANNING'S "n" USED FOR (1105.5.5):
 - a. Smooth pipe 0.012
 - b. Corrugated pipe:

2- ² / ₃ " x 1/2":	Full flow	<u>0.025</u>
3" x 1":	Full flow	<u>0.025</u>
6" x 2":	Full flow	<u>0.025</u>

Section A. Roadway Culverts - Continued

10. ENTRANCE LOSS COEFFICIENT (k_e) (1105.5.6, table 1105-1):
- a. Corrugated pipe: HW-4 Headwall 0.9 Full Headwall 0.25
 - b. Smooth Concrete pipe HW-4 Headwall 0.2 Full Headwall 0.25
 - d. Box Shape Full Headwall 0.2
11. MINIMUM COVER (top of pipe to subgrade) FOR (1008):
- a. Rigid pipe ODOT L&D Vol. 2 Sec. 1008.2.2
 - b. Flexible pipe ODOT L&D Vol. 2 Sec. 1008.1.4
12. MAXIMUM COVER FOR (1008):
- a. Rigid pipe ODOT L&D Vol. 2 Sec. 1008.1.4
 - b. Flexible pipe ODOT L&D Vol. 2 Sec. 1008.1.4
13. MAXIMUM ALLOWABLE CULVERT OUTLET VELOCITY (1002.2.2) :
- a. Bare earth channel 2fps
 - b. Rock channel protection 6-20fps
 - c. Use Energy Dissapators for velocities in excess of 20 f.p.s.
14. HEADWALL TYPE (1106.2):
- a. Hw-1.1
 - b. HW-2.1 or HW-2.2
15. CONTACT WILL BE MADE WITH COUNTY ENGINEER TO ESTABLISH:
- a. Floodplain Issues
 - b. Farm tiles
16. MINIMUM PIPE SIZE (1002.3.1, Figure 1002-1) :
- a. Freeway or limited access facility 15"
 - b. Other highways 12"

Section B. Storm Sewers (Type B & C Conduits)

1. DESIGN FREQUENCY (Just Full) 10 YEAR (1104.4.1)
2. HYDRAULIC GRADIENT SHALL NOT EXCEED (1104.4.2):
 - a. 12 inches below edge of pavement for 25 year frequency storm.
 - b. Pavement catch basin grate or lip of inlet for 25 year frequency storm.
 - c. A point in a depressed pavement sag that would result in an impassible highway for a 25 year frequency storm.
 - d. Other: See ODOT L&D Vol. 2 Sec. 1104.4.2

 - e. The above is based on:
 - i. A pipe roughness "n" = 0.015 for pipe sizes 60" and under and 0.013 for larger sizes.
 - ii. _____
3. METHOD USED TO ESTIMATE DESIGN DISCHARGE (Q) (1003):
 - a. Rational Method for areas under 6acres.
 - b. U.S.G.S. Rural Equations – Report 89-4126 for areas 6acres or greater.
4. COEFFICIENT OF RUNOFF "C" FOR (1101.2.3):
 - a. Pavement and paved shoulders 0.9
 - b. Berms and slopes (4:1 and flatter) 0.5
 - c. Berms and slopes (steeper than 4:1) 0.7
 - d. Contributing areas:
Residential 0.3-0.5 Woods 0.3-0.4 Cultivated 0.3-0.6
5. METHOD USED TO DETERMINE TIME TO FIRST CATCH BASIN OR PAVEMENT INLET (1101.2):
 - a. Overland flow plus time in ditch.
 - b.
6. MINIMUM TIME TO (1104.4.4):
 - a. Ditch catch basin 15 minutes
 - b. Pavement inlet or catch basin 10 minutes

Section B. Storm Sewers (Type B & C Conduits) - Continued

7. MINIMUM COVER OVER SEWERS (1104.2.1):

a. Rigid pipe:

- i. Type B conduit (under pavement or paved shoulder) 9" from top of pipe to bottom of the subgrade
- ii. Type C conduit (beyond pavement or paved shoulder) 18"

b. Flexible pipe:

- i. Type B conduit (under pavement or paved shoulder) 12"-24" from top of pipe to bottom of the subgrade
- ii. Type C conduit (beyond pavement or paved shoulder) 18"

8. DESIRABLE MINIMUM VELOCITY FOR DESIGN FLOW 3 f.p.s (1104.2.1).

9. MAXIMUM LENGTH BETWEEN MANHOLES OR SUITABLE CLEANOUT POINTS (1104.2.2):

- a. Under 36" diameter 300'
- b. 36" - 60" diameter 500'
- c. Over 60" diameter 750' to 1000'

10. MINIMUM PIPE SIZE UNDER PAVEMENT (1104.4.6):

- a. Freeway or limited access facility 15"
- b. Other highways 12"

11. PROCEDURE TO FOLLOW WHEN EXISTING PRIVATE DRAINS ARE CUT BY PROPOSED SEWERS OR DITCHES: See Section 1104.2.1 ODOT L&D Vol. 2

Section C. Roadway Ditches

1. METHOD USED TO ESTIMATE DESIGN DISCHARGE (Q) (1003):

- a. Rational Method with minimum Tc for areas under 6 acres.
- b. U.S.G.S. Rural Equations for areas ≥ 6 acres.

2. DESIGN FREQUENCY TO DETERMINE (1102.3.1 or 1102.4):

ADT >2000:

- a. Depth of flow determination 10 year
- b. Shear Stress determination (for protection and width of protection) 5 year

ADT <2000:

- c. Depth of flow determination 5 year
- d. Shear Stress determination (for protection and width of protection) 5 year

3. METHOD USED TO DETERMINE TIME OF FLOW TO DITCH (1101.2):

Overland Flow

3. ALLOWABLE SHEAR STRESS FOR DITCH LINING (1102.3):

Permanent Ditch Protection:

- a. Seed lining 0.40 psf.
- b. Sod or other temporary ditch protection 1.0 psf.
- c. Turf Reinforcing Mat (SS836), Type 1 2.00 psf.
- d. Turf Reinforcing Mat (SS836), Type 2 3.00 psf.
- e. Turf Reinforcing Mat (SS836), Type 3 5.00 psf.
- f. RCP, Type B 6 psf.
- g. RCP, Type C 4 psf.
- h. RCP, Type D 2 psf.

Temporary Ditch Protection (Item 670):

- a. Mat, Type A 1.25 psf.
- b. Mat, Type B 1.50 psf.
- c. Mat, Type C 2.0 psf.
- d. Mat, Type E 2.25 psf.
- e. Mat, Type F 0.45 psf.

f. Mat, Type G 1.75 psf.

4. MANNING'S "n" USED FOR (1102.3):

a. Seed lining 0.03

b. Sod, jute, or other temporary linings 0.04

c. Turf reinforcing mats 0.04

d. Tied Concrete Block Matting 0.021

e. Rock channel protection 0.04-0.06

5. DITCH CONFIGURATION (1102.2):

a. Cut section for roadway, with 18-3/4 inch minimum depth

b. Fill Section for toe of embankment, with 18 inch minimum depth

Section C. Roadway Ditches - Continued

7. TYPE OF DITCH CATCH BASIN (1102.3.4):
 - a. 2-2A, 2-2B, 2-3, 2-4, CB-4, CB-5, CB-8, CB-4A, CB-5A, CB-8A, CB-7
8. MINIMUM LONGITUDINAL SLOPE OF DITCHES IN CUT SECTIONS (1102.1):
 - a. 0.5% desirable minimum
 - b. 0.25% absolute minimum
9. METHOD USED TO LOCATE EXISTING FARM TILE CROSSED BY HIGHWAYS?
 - a. Contact with County Engineer
 - b.
 - c.
 - d.
10. MINIMUM WIDTH OF DITCH LININGS (1102.3.1):
 - a. Sod 7.5 ft.
 - b. Temporary linings 7.5 ft.
 - c. Turf reinforcing mats 7.5 ft.
11. DESIGN FREQUENCY DEPTH SHALL NOT EXCEED (1102.3.1):
 - a. 1' below eop for design discharge.
 - b. Toe of slope ditch not to overtop ditch bank for design year.
 - c.

Section D. Median Ditches

1. DITCH CONFIGURATIONS (1102.3):

- a. Depressed 60' Median
- b. Type of barrier Type A1

2. WIDTH BETWEEN PAVEMENT EDGES Varies 14'5-3/4" to 60' ft.

3. ALLOWABLE SHEAR STRESS FOR DITCH LINING (1102.3):

Permanent Ditch Protection:

- a. Seed lining 0.40 psf.
- i. Sod or other temporary ditch protection 1.0 psf.
- j. Turf Reinforcing Mat (SS836), Type 1 2.00 psf.
- k. Turf Reinforcing Mat (SS836), Type 2 3.00 psf.
- l. Turf Reinforcing Mat (SS836), Type 3 5.00 psf.
- m. RCP, Type B 6 psf.
- n. RCP, Type C 4 psf.
- o. RCP, Type D 2 psf.

Temporary Ditch Protection (Item 670):

- g. Mat, Type A 1.25 psf.
- h. Mat, Type B 1.50 psf.
- i. Mat, Type C 2.0 psf.
- j. Mat, Type E 2.25 psf.
- k. Mat, Type F 0.45 psf.
- l. Mat, Type G 1.75 psf.

4. METHOD USED TO ESTIMATE DESIGN DISCHARGE (Q) (1101.2):

- a. Rational Method for areas < 6 acres.
- b. U.S.G.S. Rural Equations for areas ≥ 6 acres.

5. CATCH BASIN SPACING WILL BE DETERMINED BY HYDRAULIC ANALYSIS USING (1102.3.4):

- a. 5 year frequency and "n" = 0.04 for velocity
- b. 10 year frequency and "n" = 0.04 for depth
- c. Controls:

i. Design frequency depth shall not exceed:

(1) 1' below eop design discharge.

(2)

d. Catch basin spacing, depressed median, fill section:

	Median Width	84'	60'	40'
i.	Desirable maximum	<u>1250'</u>	<u>1000'</u>	<u>800'</u>
ii.	Absolute maximum	<u>1500'</u>	<u>1250'</u>	<u>1000'</u>

5. TYPE OF MEDIAN CATCH BASIN OR INLET (1102.3.4):

a. CB- 4, Inlet No. 3, Single Slope Barrier A1, Inlet No. 3, Single Slope Barrier Type C1.

7. MINIMUM LONGITUDINAL SLOPE OF DEPRESSED EARTH MEDIAN:

0.5% preferred minimum, 0.25% absolute minimum.

Section E. Drainage for Curbed Pavements

1. CONTROLS FOR THE DETERMINATION OF INLET OR CATCH BASIN SPACING (1103):
 - a. Design storm frequency 10 year
 - b. Check storm frequency 50 year (for underpasses or depressed roadways where the storm sewer is the only outlet)
 - c. METHOD USED TO DETERMINE TIME TO FIRST CATCH BASIN OR PAVEMENT INLET:
 - i. Overland Flow
 - ii. 10 minute minimum.
 - d. Maximum spread of flow into traveled lane 0 ft. (table 1103-1)
Outside lane width greater than 12 feet 4 ft.
Total allowable spread on pavement 4 ft.
 - e. Maximum depth of flow at curb 5 in.
 - f. Manning's "n" for:
 - i. Reinforced concrete pavement .015
 - ii. Asphaltic concrete pavement .015
 - iii. Paved shoulders .015
2. TYPE OF INLET OR CATCH BASIN PROPOSED FOR (1103):
 - a. Continuous grades CB-3, CB-3A, CB-6, Inlet No.4 Type A, B, A1 and B1
 - b. Sags CB-3, CB-6, Inlet No.4 Type A, B, A1 and B1
4. INLET LIP OF CURB OPENING INLET WILL BE DEPRESSED _____ INCHES BELOW NORMAL GUTTER.
 - a. A local depression of 1/2 inches will be used to determine spacing of combination grate and curb opening catch basins for a curb pavement section.
 - b. A local depression of 0 inches will be used to determine spacing of combination grate and curb opening catch basins for a combination curb and gutter section.

Section F. Post Construction Storm Water Management

1. THRESHOLD LIMITS (1115):

- c. Impervious surface width drained in one direction 30 ft.
- d. Project is located within an MS4 area. Yes No (Circle answer)
- e. More than 80% of the drained area is discharged through a storm sewer.
Yes No (Circle answer)
- f. Storm water outfall is into a TMDL Regulated Stream.
Yes No (Circle answer)

APPENDIX B

Inlet Spacing Calculations



INLET SPACING DESIGN

PID : 77366 **Date :** 06/04/2007 **Project :** SCI-823-0.00 **Location :** PORTSMOUTH, SCIOTO COUNTY
Description : REACH # 1, FROM 58+85.96 & 61+00 TO 59+95.45; CB-3, SR823, 31.5' LT **Designer :** DL

Rainfall Area: D **Storm Frequency (yr.) :** 10 **Total Allow. Spread (ft.) :** 12.00 **Allowable Depth (ft.) :** 0.48

STATION	C.B. Type	GUTTER LENGTH (ft.)	RUNOFF COEF	AREA (acres)	CONC. TIME (min.)	GUTTER TIME (min.)	USED TIME (min.)	LONG. SLOPE (ft./ft.)	TIME (min.)	GUTT. SLOPE (ft./ft.)	PAVT. SLOPE (ft./ft.)	GUTT. WIDTH (ft.)	LOCAL DEPRESS. (ft.)	RAIN FALL (in./hrs.)	INTERCPTD FLOW (cfs.)	BYPASS FLOW (cfs.)	TOTAL FLOW (cfs.)	DEPTH FLOW (ft.)	PAVT. SPREAD (ft.)		
58+85	Begin																				
59+95	CB-3	109.49	0.00	0.00	0.00	0.00	0.00	0.00001	0.0400	0.0160	12.00	0.1670	0.00	0.00	*****	*****	0.29	0.272	6.80	Sag	
61+00	Begin																				
59+95	CB-3	104.55	0.00	0.00	0.00	0.00	0.00	0.00001	0.0400	0.0160	12.00	0.1670	0.00	0.00	*****	*****	0.28	0.268	6.71	Sag	



INLET SPACING DESIGN

PID : 77366 Date : 06/04/2007 Project : SCI-823-0.00

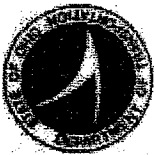
Location : PORTSMOUTH, SCIOTO COUNTY

Description : REACH # 1, FROM 63+08.83 TO 61+00; CB-3A, SR823, 31.5' LT

Designer : DL

Rainfall Area: D Storm Frequency (yr.) : 10 Total Allow. Spread (ft.) : 12.00 Allowable Depth (ft.) 0.48

STATION	C.B. Type	GUTTER LENGTH (ft.)	RUNOFF COEF	AREA (acres)	CONC. TIME (min.)	GUTTER TIME (min.)	USED TIME (min.)	LONG. SLOPE (ft./ft.)	GUTT. SLOPE (ft./ft.)	PAVT. SLOPE (ft./ft.)	GUTT. WIDTH (ft.)	LOCAL DEPRESS. (ft.)	RAIN FALL (in./hrs.)	INTERCPTD FLOW (cfs.)	BYPASS FLOW (cfs.)	TOTAL FLOW (cfs.)	DEPTH (ft.)	PAVT. FLOW (ft.)	SPREAD (ft.)	
63+08	Begin																			
61+00	CB-3A	208.83	0.00	0.00	0.00	0.00	0.00	0.0036	0.0160	0.0160	12.00	0.1670	0.00	0.44	0.14	0.58	0.128			7.99



INLET SPACING DESIGN

PID : 77366 **Date :** 06/14/2007 **Project :** SCI-823-0.00 **Location :** PORTSMOUTH, SCIOTO COUNTY
Description : REACH # 1, 37+40 (US52 RAMP A) TO 42+30 (HP), US 52 RAMP A, RHS **Designer :** MDC

Rainfall Area: D **Storm Frequency (yr.) :** 10 **Total Allow. Spread (ft.) :** 0.00 **Allowable Depth (ft.) :** 0.24

STATION	C.B. Type	GUTTER LENGTH (ft.)	COEFF	RUNOFF AREA (acres)	CONC. TIME (min.)	GUTTER TIME (min.)	USED TIME (min.)	LONG. SLOPE (ft./ft.)	GUTT. SLOPE (ft./ft.)	PAVT. SLOPE (ft./ft.)	GUTT. WIDTH (ft.)	LOCAL DEPRESS. (ft.)	RAIN FALL (in./hrs.)	INTERCPTD FLOW (cfs.)	BYPASS FLOW (cfs.)	TOTAL FLOW (cfs.)	DEPTH (ft.)	PAVT. FLOW (ft.)	SPREAD (ft.)	
42+30	Begin																			
37+40	I-3D	490.00	0.00	0.00	0.00	0.00	0.00	0.0460	0.0560	0.0000	8.00	0.1300	0.00	1.21	0.21	1.42	0.177			3.17



INLET SPACING DESIGN

PID : 77366 **Date :** 06/14/2007 **Project :** SCI-823-0.00 **Location :** PORTSMOUTH, SCIOTO COUNTY
Description : REACH # 1, 29+40 (US52 RAMP B) TO 44+60 (HP), US 52 RAMP B, LHS **Designer :** MDC

Rainfall Area: D **Storm Frequency (yr.) :** 10 **Total Allow. Spread (ft.) :** 0.00 **Allowable Depth (ft.) :** 0.24

STATION	C.B. Type	GUTTER LENGTH (ft.)	RUNOFF COEF	AREA (acres)	CONC. TIME (min.)	GUTTER TIME (min.)	USED TIME (min.)	LONG. SLOPE (ft./ft.)	GUTT. SLOPE (ft./ft.)	PAVT. SLOPE (ft./ft.)	GUTT. WIDTH (ft.)	LOCAL DEPRESS. (ft.)	RAIN FALL (in./hrs.)	INTERCPTD FLOW (cfs.)	BYPASS FLOW (cfs.)	TOTAL FLOW (cfs.)	DEPTH (ft.)	PAVT. FLOW (ft.)	SPREAD (ft.)	
44+60	Begin																			
29+40	I-3D	1520.00	0.00	0.00	0.00	0.00	0.00	0.0320	0.0400	0.0000	6.00	0.1300	0.00	0.91	0.07	0.98	0.146			3.64



INLET SPACING DESIGN

PID : 77366 **Date :** 06/14/2007 **Project :** SCI-823-0.00 **Location :** PORTSMOUTH, SCIOTO COUNTY
Description : REACH # 1, 32+40 (US52 RAMP B) TO 43+40 (HP), US 52 RAMP B, RHS **Designer :** MDC

Rainfall Area: D **Storm Frequency (yr.) :** 10 **Total Allow. Spread (ft.) :** 0.00 **Allowable Depth (ft.) :** 0.24

STATION	C.B. Type	GUTTER LENGTH (ft.)	RUNOFF COEF	AREA (acres)	CONC. TIME (min.)	GUTTER TIME USED (min.)	LONG. SLOPE (ft./ft.)	GUTT. PAVT. SLOPE (ft./ft.)	LOCAL FALL (in./hrs.)	INTERCPTD FLOW (cfs.)	BYPASS FLOW (cfs.)	TOTAL FLOW (cfs.)	DEPTH (ft.)	PAVT. SPREAD (ft.)			
43+40	Begin																
32+40	I-3D	1100.00	0.00	0.00	0.00	0.00	0.0320	0.0430	0.0000	6.00	0.1300	0.00	1.89	1.12	3.01	0.228	5.30



STORM SEWER SYSTEM

PID : 77366 **Date :** 02/01/2007 **Project :** SCI-823-0.00 **Location :** PORTSMOUTH, SCIOTO COUNTY
Description : STA. 56+00.00 SR 823, LHS **Designer :** DL

Rainfall Area: D **Just Full Capacity Frequency (yrs.):** 10 **Hydraulic Gradient Frequency (yrs.):** 25
Minimum Pipe Size : 15.00 **Tailwater Elevation (ft.):** 0.00

JUNCTION STATION		ΔAREA	ΔCA	BEGIN	RAINFALL	DISCHARGE	PIPE	F/I PIPE	MEAN	JUST FULL	FRICT	HYGREL.	COVER	COVER	COVER	INLET TYPE				
From	To	Σ (acres)	Σ (cfs.)	TIME (min.)	INTENSITY (10 yrs.)	(25 yrs.)	DIAM. (in.)	LENGTH (ft.)	SLOPE (ft./ft.)	IN / OUT	VEL (fps.)	CAPACITY (cfs.)	SLOPE (ft./ft.)	IN / OUT	HY GR	MINUS	MANNING'S 'n'			
0	1	0.21	0.19	10.00	5.39	6.65	1.0	1.2	15	40.5	0.0100	583.58	3.46	6.03	0.0005	584.04	588.28	4.24	3.45	1.3B
beg/h		0.21	0.19	0.19					583.18			584.02	586.43					0.015		



INLET SPACING DESIGN

PID : 77366 **Date :** 06/04/2007 **Project :** SCI-823-0.00 **Location :** PORTSMOUTH, SCIOTO COUNTY
Description : REACH # 2, FROM 112+26.36 TO 118+00; CB-3A, SR823, 43.5' LT **Designer :** DL

Rainfall Area: D **Storm Frequency (yr.) :** 10 **Total Allow. Spread (ft.) :** 12.00 **Allowable Depth (ft.) :** 0.48

STATION	C.B. Type	GUTTER LENGTH (ft.)	RUNOFF COEF	AREA (acres)	TIME (min.)	CONC. TIME (min.)	GUTTER TIME USED (min.)	LONG. SLOPE (ft./ft.)	GUTT. SLOPE (ft./ft.)	PAVT. SLOPE (ft./ft.)	GUTT. WIDTH (ft.)	LOCAL DEPRESS. (ft.)	RAIN FALL (in./hrs.)	FLOW (cfs.)	INTERCPTD FLOW (cfs.)	BYPASS FLOW (cfs.)	TOTAL FLOW (cfs.)	DEPTH (ft.)	PAVT. FLOW (ft.)	SPREAD (ft.)	
112+26	Begin																				
118+00	CB-3A	573.64	0.00	0.00	0.00	0.00	0.00	0.0410	0.0400	0.0160	12.00	0.1670	0.00	1.69	0.61	2.30	0.191			4.79	



INLET SPACING DESIGN

PID : 77366 **Date :** 06/04/2007 **Project :** SCI-823-0.00 **Location :** PORTSMOUTH, SCIOTO COUNTY
Description : REACH # 2, FROM 121+02.61 TO 126+00; CB-3A, SR823, 43.5' LT **Designer :** DL

Rainfall Area: D **Storm Frequency (yr.):** 10 **Total Allow. Spread (ft.):** 12.00 **Allowable Depth (ft.):** 0.48

STATION	C.B. Type	GUTTER LENGTH (ft.)	RUNOFF COEF	AREA (acres)	CONC. TIME (min.)	GUTTER TIME USED (min.)	LONG. SLOPE (ft./ft.)	GUTT. PAVT. SLOPE (ft./ft.)	LOCAL RAIN FALL (in./hrs.)	INTERCPTD BYPASS FLOW (cfs.)	TOTAL FLOW (cfs.)	DEPTH (ft.)	PAVT. FLOW SPREAD (ft.)				
121+02	Begin																
126+00	CB-3A	497.39	0.00	0.00	0.00	0.00	0.0223	0.0400	0.0160	12.00	0.1670	0.00	1.48	0.52	2.00	0.204	5.09



INLET SPACING DESIGN

PID : 77366 Date : 05/16/2007 Project : SCI-823-0.00 Location : PORTSMOUTH, SCIOTO COUNTY
Description : RH#2, FROM 112+00-120+00-128+50-129+50-140+00 TO 130+15.93; I3D, SR823, 41.7' RT Designer : DL

Rainfall Area: D Storm Frequency (yr.) : 10 Total Allow. Spread (ft.) : 12.00 Allowable Depth (ft.) 0.48

STATION	C.B. Type	GUTTER LENGTH (ft.)	RUNOFF COEF	AREA (acres)	CONC. TIME (min.)	GUTTER TIME (min.)	USED TIME (min.)	LONG. SLOPE (ft./ft.)	GUTT. SLOPE (ft./ft.)	PAVT. SLOPE (ft./ft.)	GUTT. WIDTH (ft.)	LOCAL DEPRESS. (ft.)	RAIN FALL (in./hrs.)	INTERCPTD FLOW (cfs.)	BYPASS FLOW (cfs.)	TOTAL FLOW (cfs.)	DEPTH (ft.)	PAVT. SPREAD (ft.)
110+00	Begin																	
112+00	I-3D	200.00	0.00	0.00	0.00	0.00	0.00	0.0410	0.0400	0.0160	12.00	0.0670	0.00	0.70	0.13	0.83	0.131	3.27
120+00	I-3D	800.00	0.00	0.00	0.00	0.00	0.00	0.0410	0.0400	0.0160	12.00	0.0670	0.00	1.71	1.64	3.34	0.220	5.51
128+50	I-3D	850.00	0.00	0.00	0.00	0.00	0.00	0.0089	0.0400	0.0297	12.00	0.0670	0.00	3.01	2.03	5.04	0.342	8.55
129+50	I-3D	100.00	0.00	0.00	0.00	0.00	0.00	0.0035	0.0400	0.0360	12.00	0.0670	0.00	2.14	0.33	2.47	0.312	7.80
130+15	I-3D	65.93	0.00	0.00	0.00	0.00	0.00	0.0010	0.0400	0.0360	12.00	0.0670	0.00	*****	*****	0.61	0.234	5.94 Sag
140+00	Begin																	
130+15	I-3D	984.07	0.00	0.00	0.00	0.00	0.00	0.0010	0.0400	0.0360	12.00	0.0670	0.00	*****	*****	4.16	0.480	11.99 Sag



INLET SPACING DESIGN

PID : 77366 **Date :** 05/23/2007 **Project :** SCI-823-0.00 **Location :** PORTSMOUTH, SCIOTO COUNTY
Description : STA. 16+76.64 TO 13+60; SR140, RHS **Designer :** DL

Rainfall Area: D **Storm Frequency (yr.):** 5 **Total Allow. Spread (ft.):** 4.00 **Allowable Depth (ft.):** 0.24

STATION	C.B. Type	GUTTER LENGTH (ft.)	COEF	RUNOFF AREA (acres)	CONC.	GUTTER TIME (min.)	USED TIME (min.)	LONG. SLOPE (ft./ft.)	GUTT. SLOPE (ft./ft.)	PAVT. SLOPE (ft./ft.)	GUTT. WIDTH (ft.)	LOCAL DEPRESS. (ft.)	RAIN FALL (in./hrs.)	INTERCPTD FLOW (cfs.)	BYPASS FLOW (cfs.)	TOTAL FLOW (cfs.)	DEPTH (ft.)	PAVT. SPREAD (ft.)
16+76	Begin																	
13+60	CB-3	316.64	0.00	0.00	0.00	0.00	0.00	0.0312	0.0833	0.0200	2.00	0.0417	0.00	0.63	0.00	0.63	0.163	1.96



INLET SPACING DESIGN

PID : 77366 **Date :** 12/10/2006 **Project :** SCI-823-0.00 **Location :** PORTSMOUTH, SCIOTO COUNTY
Description : REACH # 1, 47+50.94 (US52 RAMP B) TO 96+13.74 (HP), SR 823, LHS **Designer :** RN

Rainfall Area: D **Storm Frequency (yr.) :** 10 **Total Allow. Spread (ft.) :** 0.00 **Allowable Depth (ft.) :** 0.24

STATION	C.B. Type	GUTTER LENGTH (ft.)	RUNOFF COEF	AREA (acres)	CONC. TIME (min.)	GUTTER TIME (min.)	USED TIME (min.)	LONG. SLOPE (ft./ft.)	GUTT. SLOPE (ft./ft.)	PAVT. SLOPE (ft./ft.)	GUTT. WIDTH (ft.)	LOCAL DEPRESS. (ft.)	RAIN FALL (in./hrs.)	INTERCPTD FLOW (cfs.)	BYPASS FLOW (cfs.)	TOTAL FLOW (cfs.)	DEPTH (ft.)	PAVT. SPREAD (ft.)
47+50	Begin																	
52+00	I-3B	450.00	0.00	0.00	0.00	0.00	0.00	0.0087	0.0400	0.0000	6.00	0.0600	0.00	1.20	0.16	1.36	0.210	5.26
56+00	I-3B	400.00	0.00	0.00	0.00	0.00	0.00	0.0050	0.0400	0.0000	6.00	0.0600	0.00	0.86	0.00	0.86	0.196	4.90
59+00	I-3B	300.00	0.00	0.00	0.00	0.00	0.00	0.0033	0.0400	0.0000	6.00	0.0600	0.00	0.25	0.00	0.25	0.134	3.35
59+95	I-3B	95.00	0.00	0.00	0.00	0.00	0.00	0.0010	0.0400	0.0000	6.00	0.0600	0.00	*****	*****	0.09	0.114	2.85 Sag
96+13	Begin																	
86+00	I-3B	1013.00	0.00	0.00	0.00	0.00	0.00	0.0401	0.0400	0.0000	6.00	0.0600	0.00	0.70	0.15	0.85	0.132	3.31
76+00	I-3B	1000.00	0.00	0.00	0.00	0.00	0.00	0.0500	0.0400	0.0000	6.00	0.0600	0.00	0.75	0.24	0.99	0.134	3.36
71+00	I-3B	500.00	0.00	0.00	0.00	0.00	0.00	0.0380	0.0400	0.0000	6.00	0.0600	0.00	0.59	0.07	0.66	0.122	3.04
66+00	I-3B	500.00	0.00	0.00	0.00	0.00	0.00	0.0208	0.0400	0.0000	6.00	0.0600	0.00	0.49	0.00	0.49	0.122	3.05
63+50	I-3B	250.00	0.00	0.00	0.00	0.00	0.00	0.0122	0.0400	0.0000	6.00	0.0600	0.00	0.21	0.00	0.21	0.098	2.45
61+00	I-3B	250.00	0.00	0.00	0.00	0.00	0.00	0.0036	0.0400	0.0000	6.00	0.0600	0.00	0.21	0.00	0.21	0.123	3.08
59+95	I-3B	105.00	0.00	0.00	0.00	0.00	0.00	0.0010	0.0400	0.0000	6.00	0.0600	0.00	*****	*****	0.09	0.114	2.85 End

SUMP DATA

Total Flow (cfs) : 0.18 **Ponded Depth (ft.) :** 0.000 **Spread on Pavement (ft.) :** 0.00



INLET SPACING DESIGN

PID : 77366 **Date :** 12/10/2006 **Project :** SCI-823-0.00 **Location :** PORTSMOUTH, SCIOTO COUNTY
Description : REACH # 1, 44+14.11 (US52 RAMP A) TO 96+13.74 (HP), SR 823, RHS **Designer :** RN

Rainfall Area: D **Storm Frequency (yr.) :** 10 **Total Allow. Spread (ft.) :** 0.00 **Allowable Depth (ft.) :** 0.24

STATION	C.B. Type	GUTTER LENGTH (ft.)	RUNOFF COEF	AREA (acres)	CONC. TIME (min.)	GUTTER TIME (min.)	LONG. SLOPE (ft./ft.)	GUTT. SLOPE (ft./ft.)	PAVT. SLOPE (ft./ft.)	GUTT. WIDTH (ft.)	LOCAL DEPRESS. (ft.)	RAIN FALL (in./hrs.)	FLOW (cfs.)	INTERCPTD BYPASS FLOW (cfs.)	TOTAL FLOW (cfs.)	DEPTH (ft.)	PAVT. SPREAD (ft.)
44+14	Begin																
52+00	I-3B	786.00	0.00	0.00	0.00	0.00	0.0051	0.0400	0.0000	4.00	0.1670	0.00	0.48	0.00	0.48	0.157	3.93
56+00	I-3B	400.00	0.00	0.00	0.00	0.00	0.0050	0.0400	0.0000	6.00	0.0600	0.00	0.31	0.00	0.31	0.134	3.35
59+00	I-3B	300.00	0.00	0.00	0.00	0.00	0.0033	0.0400	0.0000	6.00	0.1670	0.00	0.25	0.00	0.25	0.134	3.35
59+95	I-3B	95.00	0.00	0.00	0.00	0.00	0.0010	0.0400	0.0000	6.00	0.1670	0.00	*****	*****	0.09	0.114	2.85 Sag
96+13	Begin																
86+00	I-3B	1013.00	0.00	0.00	0.00	0.00	0.0401	0.0400	0.0000	6.00	0.1670	0.00	0.85	0.00	0.85	0.132	3.31
76+00	I-3B	1000.00	0.00	0.00	0.00	0.00	0.0500	0.0400	0.0000	6.00	0.1670	0.00	0.84	0.00	0.84	0.126	3.16
71+00	I-3B	500.00	0.00	0.00	0.00	0.00	0.0380	0.0400	0.0000	6.00	0.1670	0.00	0.42	0.00	0.42	0.103	2.57
66+00	I-3B	500.00	0.00	0.00	0.00	0.00	0.0208	0.0400	0.0000	6.00	0.1670	0.00	0.42	0.00	0.42	0.115	2.87
63+50	I-3B	250.00	0.00	0.00	0.00	0.00	0.0122	0.0400	0.0000	6.00	0.1670	0.00	0.21	0.00	0.21	0.098	2.45
61+00	I-3B	250.00	0.00	0.00	0.00	0.00	0.0036	0.0400	0.0000	6.00	0.1670	0.00	0.21	0.00	0.21	0.123	3.08
59+95	I-3B	105.00	0.00	0.00	0.00	0.00	0.0010	0.0400	0.0000	6.00	0.1670	0.00	*****	*****	0.09	0.114	2.85 End

SUMP DATA

Total Flow (cfs) : 0.18 **Ponded Depth (ft.) :** 0.000 **Spread on Pavement (ft.) :** 0.00



INLET SPACING DESIGN

PID : 77366 **Date :** 12/05/2012 **Project :** SCI-823-0.00 **Location :** PORTSMOUTH, SCIOTO COUNTY
Description : REACH # 2, 96+13.74(HP) TO 130+15.93(LP) TO 167+27.78(HP), SR823, LHS **Designer :** KAG

Rainfall Area: D **Storm Frequency (yr.) :** 50 **Total Allow. Spread (ft.) :** 6.00 **Allowable Depth (ft.) :** 0.50

STATION	C.B. Type	GUTTER LENGTH (ft.)	RUNOFF COEF	AREA (acres)	CONC. TIME (min.)	GUTTER TIME (min.)	USED TIME (min.)	LONG. SLOPE (ft./ft.)	GUTT. SLOPE (ft./ft.)	PAVT. SLOPE (ft./ft.)	GUTT. WIDTH (ft.)	LOCAL DEPRESS. (ft.)	RAIN FALL (in./hrs.)	INTERCPTD FLOW (cfs.)	BYPASS FLOW (cfs.)	TOTAL FLOW (cfs.)	DEPTH FLOW (ft.)	PAVT. SPREAD (ft.)	
96+13	Begin																		
106+00	I-3B	987.00	0.90	0.17	2.00	5.22	10.00	0.0390	0.0400	0.0400	6.00	0.0416	7.20	0.81	0.30	1.10	0.147	3.67	
109+70	I-3B	370.00	0.90	0.06	2.58	2.15	10.00	0.0410	0.0400	0.0400	6.00	0.0416	7.20	0.57	0.11	0.68	0.121	3.04	
119+75	I-3B	1005.00	0.90	0.17	2.00	5.10	10.00	0.0410	0.0400	0.0400	6.00	0.0416	7.20	0.85	0.36	1.21	0.151	3.76	
126+00	I-3B	625.00	0.90	0.11	2.00	4.11	10.00	0.0223	0.0400	0.0400	6.00	0.0416	7.20	0.86	0.21	1.07	0.161	4.03	
128+50	I-3B	250.00	0.90	0.13	2.00	2.28	10.00	0.0089	0.0400	0.0400	6.00	0.0416	7.20	0.96	0.09	1.05	0.190	4.75	
129+50	I-3C	100.00	0.90	0.07	1.28	1.50	10.00	0.0035	0.0400	0.0400	6.00	0.0416	7.20	0.55	0.00	0.55	0.177	4.43	
130+16	I-3C	66.00	0.90	0.06	1.28	1.13	10.00	0.0030	0.0400	0.0400	6.00	0.0416	7.20	*****	*****	0.39	0.160	4.01	
167+27	Begin																		
161+00	I-3C	627.00	0.90	0.46	2.06	3.01	10.00	0.0246	0.0400	0.0390	6.00	0.0416	7.20	1.70	1.28	2.98	0.232	5.80	
155+00	I-3C	600.00	0.90	0.44	2.06	2.08	10.00	0.0480	0.0400	0.0350	6.00	0.0416	7.20	1.81	2.33	4.13	0.232	5.79	
150+00	I-3C	500.00	0.90	0.36	2.06	1.72	10.00	0.0500	0.0400	0.0350	6.00	0.0416	7.20	1.93	2.74	4.66	0.240	6.01	
146+00	I-3C	400.00	0.90	0.29	2.06	1.34	10.00	0.0500	0.0400	0.0350	6.00	0.0416	7.20	1.91	2.70	4.61	0.239	5.99	
142+00	I-3C	400.00	0.90	0.29	2.06	1.35	10.00	0.0500	0.0400	0.0350	6.00	0.0416	7.20	1.91	2.68	4.58	0.239	5.97	
141+50	I-3C	50.00	0.90	0.04	2.06	0.19	10.00	0.0500	0.0400	0.0500	6.00	0.0416	7.20	1.45	1.48	2.93	0.202	5.05	
141+00	I-3C	50.00	0.90	0.04	2.06	0.22	10.00	0.0500	0.0400	0.0350	6.00	0.0416	7.20	1.04	0.70	1.74	0.166	4.16	

Revised inlet location
 Stage 2 location comments not addressed



INLET SPACING DESIGN

STATION	C.B. Type	GUTTER LENGTH (ft.)	RUNOFF COEF	AREA (acres)	CONC. TIME (min.)	GUTTER TIME (min.)	USED TIME (min.)	LONG. SLOPE (ft./ft.)	GUTT. SLOPE (ft./ft.)	PAVT. SLOPE (ft./ft.)	GUTT. WIDTH (ft.)	LOCAL DEPRESS. (ft.)	RAIN FALL (in./hrs.)	INTERCPTD FLOW (cfs.)	BYPASS FLOW (cfs.)	TOTAL FLOW (cfs.)	DEPTH FLOW (ft.)	PAVT. SPREAD (ft.)	
130+16	I-3C	1084.00	0.90	0.79	2.06	10.49	12.54	0.0030	0.0400	0.0350	6.00	0.0416	6.64	*****	*****	5.42	0.428	11.38	End

SUMP DATA

Total Flow (cfs) : 5.81

Ponded Depth (ft.) : 0.328

Spread on Pavement (ft.) : 7.33



INLET SPACING DESIGN

PID : 77366 **Date :** 12/05/2012 **Project :** SCI-823-0.00

Location : PORTSMOUTH, SCIOTO COUNTY

Description : REACH # 2, 96+13.74(HP) TO 130+15.93(LP) TO 167+27.78(HP), SR823, RHS

Designer : KAG

Rainfall Area: D **Storm Frequency (yr.) :** 10

Total Allow. Spread (ft.) : 0.00

Allowable Depth (ft.) : 0.24

STATION	C.B. Type	GUTTER LENGTH (ft.)	RUNOFF COEF	AREA (acres)	CONC. TIME (min.)	GUTTER TIME (min.)	USED TIME (min.)	LONG. SLOPE (ft./ft.)	GUTT. SLOPE (ft./ft.)	PAVT. SLOPE (ft./ft.)	GUTT. WIDTH (ft.)	LOCAL DEPRESS. (ft.)	RAIN FALL (in./hrs.)	INTERCPTD FLOW (cfs.)	BYPASS FLOW (cfs.)	TOTAL FLOW (cfs.)	DEPTH (ft.)	PAVT. SPREAD (ft.)
96+13	Begin																	
106+00	I-3B	987.00	0.90	0.17	2.00	5.63	10.00	0.0390	0.0400	0.0000	6.00	0.0416	5.39	0.66	0.17	0.82	0.132	3.29
109+61	I-3B	361.00	0.90	0.60	2.00	1.40	10.00	0.0410	0.0400	0.0400	6.00	0.0416	5.39	1.56	1.52	3.08	0.213	5.34
119+75	I-3B	1014.00	0.90	0.17	2.00	4.41	10.00	0.0410	0.0400	0.0400	6.00	0.0416	5.39	1.31	1.03	2.34	0.193	4.82
126+00	I-3B	625.00	0.90	0.11	2.00	3.77	10.00	0.0223	0.0400	0.0400	6.00	0.0416	5.39	1.13	0.44	1.57	0.186	4.64
128+50	I-3B	150.00	0.90	0.04	1.28	1.59	10.00	0.0089	0.0400	0.0400	6.00	0.0416	5.39	0.63	0.01	0.63	0.157	3.93
129+50	I-3C	100.00	0.90	0.01	1.28	2.70	10.00	0.0035	0.0400	0.0400	6.00	0.0416	5.39	0.05	0.00	0.05	0.074	1.86
130+16	I-3C	66.00	0.90	0.01	1.11	1.90	10.00	0.0030	0.0400	0.0400	6.00	0.0416	5.39	*****	*****	0.05	0.074	1.84 Sag
167+27	Begin																	
161+00	I-3C	627.00	0.90	0.08	1.28	5.07	10.00	0.0246	0.0400	0.0400	4.00	0.0416	5.39	0.39	0.00	0.39	0.108	2.70
155+00	I-3C	600.00	0.90	0.08	1.28	3.72	10.00	0.0480	0.0400	0.0400	6.00	0.0416	5.39	0.37	0.02	0.39	0.095	2.38
150+00	I-3C	500.00	0.90	0.06	1.11	3.21	10.00	0.0500	0.0400	0.0400	6.00	0.0416	5.39	0.31	0.00	0.31	0.087	2.18
146+00	I-3C	400.00	0.90	0.05	1.11	2.71	10.00	0.0500	0.0400	0.0400	6.00	0.0416	5.39	0.24	0.00	0.24	0.080	1.99
142+00	I-3C	400.00	0.90	0.05	1.28	2.72	10.00	0.0500	0.0400	0.0400	6.00	0.0416	5.39	0.24	0.00	0.24	0.079	1.98
141+50	I-3C	50.00	0.90	0.01	1.28	0.49	10.00	0.0500	0.0400	0.0400	6.00	0.0416	5.39	0.05	0.00	0.05	0.043	1.08
141+00	I-3C	50.00	0.90	0.01	1.28	0.49	10.00	0.0500	0.0400	0.0400	6.00	0.0416	5.39	0.05	0.00	0.05	0.043	1.08



INLET SPACING DESIGN

STATION	C.B. Type	GUTTER LENGTH (ft.)	RUNOFF COEF	AREA (acres)	CONC. TIME (min.)	GUTTER TIME (min.)	USED TIME (min.)	LONG. SLOPE (ft./ft.)	GUTT. SLOPE (ft./ft.)	PAVT. SLOPE (ft./ft.)	GUTT. WIDTH (ft.)	LOCAL DEPRESS. (ft.)	RAIN FALL (in./hrs.)	INTERCPTD FLOW (cfs.)	BYPASS FLOW (cfs.)	TOTAL FLOW (cfs.)	DEPTH FLOW (ft.)	PAVT. SPREAD (ft.)
130+16	I-3C	1084.00	0.90	0.14	1.28	18.65	19.94	0.0030	0.0400	0.0400	6.00	0.0416	4.03	*****	*****	0.51	0.177	4.43

SUMP DATA

Total Flow (cfs) : 0.56

Ponded Depth (ft.) : 0.069

Spread on Pavement (ft.) : 1.46



INLET SPACING DESIGN

PID : 77366 **Date :** 02/06/2013 **Project :** SCI-823-0.00 **Location :** PORTSMOUTH, SCIOTO COUNTY
Description : REACH # 3, 167+27.78(HP) TO 186+32.39 TO 226+75(HP), SR823 **Designer :** KAG

Rainfall Area: D **Storm Frequency (yr.) :** 10 **Total Allow. Spread (ft.) :** 0.00 **Allowable Depth (ft.) :** 0.38

STATION	C.B. Type	GUTTER LENGTH (ft.)	RUNOFF COEF	AREA (acres)	CONC. TIME (min.)	GUTTER TIME (min.)	USED TIME (min.)	LONG. SLOPE (ft./ft.)	GUTT. SLOPE (ft./ft.)	PAVT. SLOPE (ft./ft.)	GUTT. WIDTH (ft.)	LOCAL DEPRESS. (ft.)	RAIN FALL (in./hrs.)	INTERCPTD FLOW (cfs.)	BYPASS FLOW (cfs.)	TOTAL FLOW (cfs.)	DEPTH FLOW (ft.)	PAVT. SPREAD (ft.)	
167+27	Begin																		
177+00	I-3C	973.00	0.90	0.22	1.28	5.19	10.00	0.0380	0.0400	0.0000	6.00	0.0417	5.39	0.79	0.27	1.07	0.146	3.64	
180+00	I-3C	300.00	0.90	0.07	1.28	1.89	10.00	0.0345	0.0400	0.0000	6.00	0.0417	5.39	0.54	0.07	0.61	0.121	3.01	
183+00	I-3C	300.00	0.90	0.07	1.28	2.63	10.00	0.0182	0.0400	0.0520	6.00	0.0417	5.39	0.41	0.00	0.41	0.117	2.93	
185+00	I-3C	200.00	0.90	0.04	1.28	2.98	10.00	0.0072	0.0400	0.0000	6.00	0.0417	5.39	0.19	0.00	0.19	0.105	2.62	
186+32	I-3B	132.00	0.90	0.03	1.28	4.50	10.00	0.0010	0.0400	0.0000	6.00	0.0417	5.39	*****	*****	0.15	0.136	3.41	
226+75	Begin																		
224+00	I-3B	275.00	0.90	0.07	1.52	3.17	10.00	0.0100	0.0400	0.0000	9.50	0.0417	5.39	0.34	0.00	0.34	0.122	3.04	
219+00	I-3B	500.00	0.90	0.13	1.52	3.23	10.00	0.0310	0.0400	0.0000	9.50	0.0417	5.39	0.56	0.07	0.63	0.124	3.10	
214+00	I-3B	500.00	0.90	0.13	1.52	3.16	10.00	0.0310	0.0400	0.0000	9.50	0.0417	5.39	0.61	0.10	0.70	0.129	3.23	
209+00	I-3B	500.00	0.90	0.13	1.52	3.13	10.00	0.0310	0.0400	0.0000	9.50	0.0417	5.39	0.62	0.10	0.73	0.131	3.27	
204+00	I-3B	500.00	0.90	0.13	1.49	3.12	10.00	0.0310	0.0400	0.0000	9.50	0.0417	5.39	0.63	0.11	0.74	0.132	3.29	
199+00	I-3B	500.00	0.90	0.13	1.66	3.12	10.00	0.0310	0.0400	0.0000	9.50	0.0417	5.39	0.63	0.11	0.74	0.132	3.29	
189+00	I-3B	1000.00	0.90	0.25	1.66	7.43	10.00	0.0146	0.0400	0.0000	9.50	0.0417	5.39	1.07	0.25	1.32	0.189	4.72	
187+00	I-3B	200.00	0.90	0.05	1.66	3.12	10.00	0.0037	0.0400	0.0000	9.50	0.0417	5.39	0.49	0.00	0.49	0.169	4.22	
186+32	I-3B	68.00	0.90	0.02	1.66	2.53	10.00	0.0010	0.0400	0.0000	6.00	0.0417	5.39	*****	*****	0.10	0.117	2.93	
																			End



INLET SPACING DESIGN

STATION	C.B. Type	GUTTER LENGTH (ft.)	COEFF AREA (acres)	CONC. TIME (min.)	GUTTER TIME (min.)	USED TIME (min.)	LONG. SLOPE (ft./ft.)	GUTT. SLOPE (ft./ft.)	PAVT. SLOPE (ft./ft.)	GUTT. WIDTH (ft.)	LOCAL DEPRESS. (ft.)	RAIN FALL (in./hrs.)	INTERCPTD FLOW (cfs.)	BYPASS FLOW (cfs.)	TOTAL FLOW (cfs.)	DEPTH FLOW (ft.)	PAVT. SPREAD (ft.)	

SUMP DATA

Total Flow (cfs) : 0.24

Ponded Depth (ft.) : 0.000

Spread on Pavement (ft.) : 0.00



INLET SPACING DESIGN

PID : 77366 **Date :** 02/06/2013 **Project :** SCI-823-0.00

Location : PORTSMOUTH, SCIOTO COUNTY

Description : REACH # 3, 167+27.78(HP) TO 186+32.39 TO 226+75(HP), SR823

Designer : KAG

Rainfall Area: D **Storm Frequency (yr.) :** 50 **Total Allow. Spread (ft.) :** 0.00 **Allowable Depth (ft.) :** 0.38

STATION	C.B. Type	GUTTER LENGTH (ft.)	RUNOFF COEF	AREA (acres)	CONC. TIME (min.)	GUTTER TIME (min.)	USED TIME (min.)	LONG. SLOPE (ft./ft.)	GUTT. SLOPE (ft./ft.)	PAVT. SLOPE (ft./ft.)	GUTT. WIDTH (ft.)	LOCAL DEPRESS. (ft.)	RAIN FALL (in./hrs.)	INTERCPTD FLOW (cfs.)	BYPASS FLOW (cfs.)	TOTAL FLOW (cfs.)	DEPTH (ft.)	PAVT. FLOW (ft.)	SPREAD (ft.)	
167+27	Begin																			
177+00	I-3C	973.00	0.90	0.22	1.28	4.82	10.00	0.0380	0.0400	0.0000	6.00	0.0417	7.20	0.96	0.46	1.43	0.162	0.140	4.06	
180+00	I-3C	300.00	0.90	0.07	1.28	1.72	10.00	0.0345	0.0400	0.0000	6.00	0.0417	7.20	0.72	0.19	0.92	0.140	0.140	3.50	
183+00	I-3C	300.00	0.90	0.07	1.28	2.37	10.00	0.0182	0.0400	0.0520	6.00	0.0417	7.20	0.60	0.04	0.65	0.138	0.138	3.46	
185+00	I-3C	200.00	0.90	0.04	1.28	2.69	10.00	0.0072	0.0400	0.0000	6.00	0.0417	7.20	0.30	0.00	0.30	0.124	0.124	3.09	
186+32	I-3B	132.00	0.90	0.03	1.28	4.18	10.00	0.0010	0.0400	0.0000	6.00	0.0417	7.20	*****	*****	0.19	0.152	0.152	3.80	
226+75	Begin																			
224+00	I-3B	275.00	0.90	0.07	1.52	2.94	10.00	0.0100	0.0400	0.0000	9.50	0.0417	7.20	0.45	0.00	0.45	0.136	0.136	3.39	
219+00	I-3B	500.00	0.90	0.13	1.52	3.00	10.00	0.0310	0.0400	0.0000	9.50	0.0417	7.20	0.69	0.15	0.84	0.138	0.138	3.46	
214+00	I-3B	500.00	0.90	0.13	1.52	2.90	10.00	0.0310	0.0400	0.0000	9.50	0.0417	7.20	0.78	0.21	0.99	0.147	0.147	3.68	
209+00	I-3B	500.00	0.90	0.13	1.52	2.86	10.00	0.0310	0.0400	0.0000	9.50	0.0417	7.20	0.81	0.24	1.06	0.151	0.151	3.77	
204+00	I-3B	500.00	0.90	0.13	1.49	2.84	10.00	0.0310	0.0400	0.0000	9.50	0.0417	7.20	0.83	0.26	1.09	0.152	0.152	3.81	
199+00	I-3B	500.00	0.90	0.13	1.66	2.84	10.00	0.0310	0.0400	0.0000	9.50	0.0417	7.20	0.84	0.26	1.10	0.153	0.153	3.82	
189+00	I-3B	1000.00	0.90	0.25	1.66	6.77	10.00	0.0146	0.0400	0.0000	9.50	0.0417	7.20	1.38	0.51	1.88	0.216	0.216	5.39	
187+00	I-3B	200.00	0.90	0.05	1.66	2.75	10.00	0.0037	0.0400	0.0000	9.50	0.0417	7.20	0.83	0.00	0.83	0.205	0.205	5.13	
186+32	I-3B	68.00	0.90	0.02	1.66	2.35	10.00	0.0010	0.0400	0.0000	6.00	0.0417	7.20	*****	*****	0.13	0.131	0.131	3.27	
																				End



INLET SPACING DESIGN

STATION	C.B. Type	GUTTER LENGTH (ft.)	COEFF AREA (acres)	RUNOFF TIME (min.)	CONC. TIME (min.)	GUTTER TIME (min.)	LONG. USED SLOPE (ft./ft.)	GUTT. SLOPE (ft./ft.)	PAVT. WIDTH (ft.)	LOCAL DEPRESS. (ft.)	RAIN FALL (in./hrs.)	INTERCPTD FLOW (cfs.)	BYPASS FLOW (cfs.)	TOTAL FLOW (cfs.)	DEPTH FLOW (ft.)	PAVT. SPREAD (ft.)
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SUMP DATA

Total Flow (cfs) : 0.32

Ponded Depth (ft.) : 0.000

Spread on Pavement (ft.) : 0.00



INLET SPACING DESIGN

PID : 77366 **Date :** 02/06/2013 **Project :** SCI-823-0.00 **Location :** PORTSMOUTH, SCIOTO COUNTY
Description : REACH # 3, 167+27.78(HP) TO 186+32.39 TO 226+75(HP), SR823, RHS **Designer :** KAG

Rainfall Area: D **Storm Frequency (yr.):** 10 **Total Allow. Spread (ft.):** 0.00 **Allowable Depth (ft.):** 0.38

STATION	C.B. Type	GUTTER LENGTH (ft.)	RUNOFF COEF	AREA (acres)	CONC. TIME (min.)	GUTTER TIME (min.)	USED TIME (min.)	LONG. SLOPE (ft./ft.)	GUTT. SLOPE (ft./ft.)	PAVT. SLOPE (ft./ft.)	GUTT. WIDTH (ft.)	LOCAL DEPRESS. (ft.)	RAIN FALL (in./hrs.)	INTERCPTD FLOW (cfs.)	BYPASS FLOW (cfs.)	TOTAL FLOW (cfs.)	DEPTH (ft.)	PAVT. SPREAD (ft.)
167+27	Begin																	
177+00	I-3C	973.00	0.90	0.66	2.46	3.55	10.00	0.0380	0.0600	0.0000	9.50	0.0417	5.39	1.92	1.29	3.20	0.256	4.27
180+00	I-3C	300.00	0.90	0.31	2.46	1.18	10.00	0.0345	0.0600	0.0000	9.50	0.0417	5.39	1.78	1.01	2.79	0.247	4.12
183+00	I-3C	300.00	0.90	0.29	2.42	1.58	10.00	0.0182	0.0560	0.0000	9.50	0.0417	5.39	1.77	0.64	2.41	0.257	4.60
185+00	I-3C	200.00	0.90	0.17	2.78	1.84	10.00	0.0072	0.0400	0.0000	9.50	0.0417	5.39	1.28	0.19	1.47	0.224	5.61
186+32	I-3C	132.00	0.90	0.11	2.97	3.05	10.00	0.0010	0.0400	0.0000	9.50	0.0417	5.39	*****	*****	0.73	0.249	6.23 Sag
226+75	Begin																	
224+00	I-3B	275.00	0.90	0.22	2.92	2.31	10.00	0.0110	0.0400	0.0000	9.50	0.0417	5.39	0.95	0.12	1.07	0.184	4.59
219+00	I-3B	500.00	0.90	0.40	2.83	2.42	10.00	0.0310	0.0400	0.0000	9.50	0.0417	5.39	1.28	0.78	2.06	0.194	4.84
214+00	I-3B	500.00	0.90	0.40	2.83	2.28	10.00	0.0310	0.0400	0.0000	9.50	0.0417	5.39	1.53	1.20	2.73	0.215	5.37
209+00	I-3B	500.00	0.90	0.40	2.83	2.21	10.00	0.0310	0.0400	0.0310	9.50	0.0417	5.39	1.67	1.46	3.14	0.227	5.67
204+00	I-3B	500.00	0.90	0.40	2.83	2.17	10.00	0.0310	0.0400	0.0000	9.50	0.0417	5.39	1.76	1.64	3.41	0.234	5.84
199+00	I-3B	500.00	0.90	0.15	1.66	2.39	10.00	0.0310	0.0400	0.0000	9.50	0.0417	5.39	1.40	0.97	2.37	0.204	5.10
189+00	I-3B	1000.00	0.90	0.25	1.66	6.54	10.00	0.0146	0.0400	0.0000	9.50	0.0417	5.39	1.53	0.66	2.19	0.228	5.70
187+00	I-3B	200.00	0.90	0.05	1.66	2.71	10.00	0.0037	0.0400	0.0000	9.50	0.0417	5.39	0.90	0.00	0.90	0.212	5.29
186+32	I-3B	68.00	0.90	0.02	1.66	2.51	10.00	0.0010	0.0400	0.0000	9.50	0.0417	5.39	*****	*****	0.10	0.119	2.96 End



INLET SPACING DESIGN

STATION	C.B. Type	GUTTER LENGTH (ft.)	RUNOFF COEF	AREA (acres)	CONC. TIME (min.)	GUTTER TIME USED (min.)	LONG. SLOPE (ft./ft.)	GUTT. PAVT. SLOPE (ft./ft.)	GUTT. WIDTH (ft.)	LOCAL DEPRESS. (ft.)	RAIN FALL (in./hrs.)	INTERCPTD FLOW (cfs.)	BYPASS FLOW (cfs.)	TOTAL FLOW (cfs.)	DEPTH FLOW (ft.)	PAVT. SPREAD (ft.)
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SUMP DATA

Total Flow (cfs) : 0.83

Ponded Depth (ft.) : 0.029

Spread on Pavement (ft.) : 2.84



INLET SPACING DESIGN

PID : 77366 **Date :** 02/06/2013 **Project :** SCI-823-0.00 **Location :** PORTSMOUTH, SCIOTO COUNTY
Description : REACH # 3, 167+27.78(HP) TO 186+32.39 TO 226+75(HP), SR823, RHS **Designer :** KAG

Rainfall Area: D **Storm Frequency (yr.) :** 50 **Total Allow. Spread (ft.) :** 0.00 **Allowable Depth (ft.) :** 0.38

STATION	C.B. Type	GUTTER LENGTH (ft.)	COEFF	RUNOFF AREA (acres)	CONC. TIME (min.)	GUTTER TIME (min.)	USED TIME (min.)	LONG. SLOPE (ft./ft.)	GUTT. SLOPE (ft./ft.)	PAVT. SLOPE (ft./ft.)	GUTT. WIDTH (ft.)	LOCAL DEPRESS. (ft.)	RAIN FALL (in./hrs.)	INTERCPTD FLOW (cfs.)	BYPASS FLOW (cfs.)	TOTAL FLOW (cfs.)	DEPTH (ft.)	PAVT. SPREAD (ft.)
167+27	Begin																	
177+00	I-3C	973.00	0.90	0.66	2.46	3.30	10.00	0.0380	0.0600	0.0000	9.50	0.0417	7.20	2.31	1.96	4.28	0.285	4.75
180+00	I-3C	300.00	0.90	0.31	2.46	1.08	10.00	0.0345	0.0600	0.0000	9.50	0.0417	7.20	2.25	1.72	3.97	0.283	4.71
183+00	I-3C	300.00	0.90	0.29	2.42	1.43	10.00	0.0182	0.0560	0.0000	9.50	0.0417	7.20	2.33	1.27	3.60	0.299	5.34
185+00	I-3C	200.00	0.90	0.17	2.78	1.64	10.00	0.0072	0.0400	0.0000	9.50	0.0417	7.20	1.82	0.55	2.38	0.268	6.71
186+32	I-3C	132.00	0.90	0.11	2.97	2.67	10.00	0.0010	0.0400	0.0000	9.50	0.0417	7.20	*****	*****	1.26	0.307	7.67 Sag
226+75	Begin																	
224+00	I-3B	275.00	0.90	0.22	2.92	2.15	10.00	0.0110	0.0400	0.0000	9.50	0.0417	7.20	1.18	0.25	1.43	0.205	5.12
219+00	I-3B	500.00	0.90	0.40	2.83	2.24	10.00	0.0310	0.0400	0.0000	9.50	0.0417	7.20	1.57	1.27	2.84	0.218	5.46
214+00	I-3B	500.00	0.90	0.40	2.83	2.09	10.00	0.0310	0.0400	0.0000	9.50	0.0417	7.20	1.91	1.96	3.86	0.245	6.12
209+00	I-3B	500.00	0.90	0.40	2.83	2.01	10.00	0.0310	0.0400	0.0310	9.50	0.0417	7.20	2.11	2.44	4.55	0.260	6.51
204+00	I-3B	500.00	0.90	0.40	2.83	1.97	10.00	0.0310	0.0400	0.0000	9.50	0.0417	7.20	2.25	2.78	5.03	0.271	6.76
199+00	I-3B	500.00	0.90	0.15	1.66	2.14	10.00	0.0310	0.0400	0.0000	9.50	0.0417	7.20	1.87	1.88	3.76	0.242	6.06
189+00	I-3B	1000.00	0.90	0.25	1.66	5.80	10.00	0.0146	0.0400	0.0000	9.50	0.0417	7.20	2.09	1.41	3.50	0.272	6.80
187+00	I-3B	200.00	0.90	0.05	1.66	2.31	10.00	0.0037	0.0400	0.0000	9.50	0.0417	7.20	1.57	0.16	1.73	0.270	6.76
186+32	I-3B	68.00	0.90	0.02	1.66	1.98	10.00	0.0010	0.0400	0.0000	9.50	0.0417	7.20	*****	*****	0.29	0.176	4.41 End



INLET SPACING DESIGN

STATION	C.B. Type	GUTTER LENGTH (ft.)	COEFF AREA (acres)	CONC. GUTTER TIME (min.)	USED TIME (min.)	TIME (min.)	LONG. SLOPE (ft./ft.)	GUTT. SLOPE (ft./ft.)	PAVT. SLOPE (ft./ft.)	GUTT. WIDTH (ft.)	LOCAL DEPRESS. (ft.)	RAIN FALL (in./hrs.)	INTERCPTD BYPASS FLOW (cfs.)	TOTAL FLOW (cfs.)	DEPTH FLOW (ft.)	PAVT. SPREAD (ft.)

SUMP DATA

Total Flow (cfs) : 1.55

Ponded Depth (ft.) : 0.089

Spread on Pavement (ft.) : 3.67



INLET SPACING DESIGN

PID : 77366 **Date :** 02/06/2013 **Project :** SCI-823-0.00

Location : PORTSMOUTH, SCIOTO COUNTY

Description : REACH # 4, 226+75(HP) TO 237+50 TO 263+14(HP), SR823

Designer : KAG

Rainfall Area: D **Storm Frequency (yr.) :** 10

Total Allow. Spread (ft.) : 0.00

Allowable Depth (ft.) : 0.38

STATION	C.B. Type	GUTTER LENGTH (ft.)	RUNOFF COEF	AREA (acres)	CONC. TIME (min.)	GUTTER TIME (min.)	USED TIME (min.)	LONG. SLOPE (ft./ft.)	GUTT. SLOPE (ft./ft.)	PAVT. SLOPE (ft./ft.)	GUTT. WIDTH (ft.)	LOCAL DEPRESS. (ft.)	RAIN FALL (in./hrs.)	INTERCPTD FLOW (cfs.)	BYPASS FLOW (cfs.)	TOTAL FLOW (cfs.)	DEPTH (ft.)	PAVT. SPREAD (ft.)	
226+75	Begin																		
231+00	I-3B	425.00	0.90	0.11	1.52	5.82	10.00	0.0050	0.0400	0.0000	9.50	0.0417	5.39	0.53	0.00	0.53	0.164	4.11	
237+00	I-3B	600.00	0.90	0.15	1.52	10.25	11.78	0.0025	0.0400	0.0000	9.50	0.0417	5.08	0.69	0.00	0.69	0.205	5.14	
237+50	I-3B	50.00	0.90	0.01	1.52	2.20	10.00	0.0010	0.0400	0.0000	9.50	0.0417	5.39	*****	*****	0.05	0.090	2.26	Sag
263+14	Begin																		
256+50	I-3B	664.00	0.90	0.35	1.52	3.62	10.00	0.0254	0.0400	0.0000	9.50	0.0417	5.39	1.16	0.53	1.70	0.187	4.67	
246+50	I-3B	1000.00	0.90	0.25	1.52	4.91	10.00	0.0350	0.0400	0.0000	9.50	0.0417	5.39	1.12	0.63	1.75	0.178	4.45	
238+00	I-3B	850.00	0.90	0.21	1.52	11.87	13.39	0.0025	0.0400	0.0000	9.50	0.0417	4.83	1.48	0.06	1.54	0.278	6.96	
237+50	I-3B	50.00	0.90	0.01	1.66	1.85	10.00	0.0010	0.0400	0.0000	9.50	0.0417	5.39	*****	*****	0.11	0.122	3.06	End

SUMP DATA

Total Flow (cfs) : 0.16

Ponded Depth (ft.) : 0.000

Spread on Pavement (ft.) : 0.00



INLET SPACING DESIGN

PID : 77366 **Date :** 02/06/2013 **Project :** SCI-823-0.00

Location : PORTSMOUTH, SCIOTO COUNTY

Description : REACH # 4, 226+75(HP) TO 237+50 TO 263+14(HP), SR823

Designer : KAG

Rainfall Area: D **Storm Frequency (yr.) :** 50

Total Allow. Spread (ft.) : 0.00

Allowable Depth (ft.) : 0.38

STATION	C.B. Type	GUTTER LENGTH (ft.)	RUNOFF COEF	AREA (acres)	CONC. TIME (min.)	GUTTER TIME (min.)	USED TIME (min.)	LONG. SLOPE (ft./ft.)	GUTT. SLOPE (ft./ft.)	PAVT. SLOPE (ft./ft.)	GUTT. WIDTH (ft.)	LOCAL DEPRESS. (ft.)	RAIN FALL (in./hrs.)	INTERCPTD FLOW (cfs.)	BYPASS FLOW (cfs.)	TOTAL FLOW (cfs.)	DEPTH (ft.)	PAVT. SPREAD (ft.)	
226+75	Begin																		
231+00	I-3B	425.00	0.90	0.11	1.52	5.40	10.00	0.0050	0.0400	0.0000	9.50	0.0417	7.20	0.71	0.00	0.71	0.183	4.58	
237+00	I-3B	600.00	0.90	0.15	1.52	9.48	11.00	0.0025	0.0400	0.0000	9.50	0.0417	6.97	0.94	0.00	0.94	0.231	5.78	
237+50	I-3B	50.00	0.90	0.01	1.52	2.04	10.00	0.0010	0.0400	0.0000	9.50	0.0417	7.20	*****	*****	0.06	0.101	2.52	Sag
263+14	Begin																		
256+50	I-3B	664.00	0.90	0.35	1.52	3.37	10.00	0.0254	0.0400	0.0000	9.50	0.0417	7.20	1.41	0.86	2.27	0.208	5.21	
246+50	I-3B	1000.00	0.90	0.25	1.52	4.50	10.00	0.0350	0.0400	0.0000	9.50	0.0417	7.20	1.40	1.07	2.48	0.203	5.07	
238+00	I-3B	850.00	0.90	0.21	1.52	10.69	12.21	0.0025	0.0400	0.0000	9.50	0.0417	6.70	2.09	0.25	2.34	0.326	8.14	
237+50	I-3B	50.00	0.90	0.01	1.66	1.45	10.00	0.0010	0.0400	0.0000	9.50	0.0417	7.20	*****	*****	0.31	0.181	4.54	End

SUMP DATA

Total Flow (cfs) : 0.38

Ponded Depth (ft.) : 0.000

Spread on Pavement (ft.) : 0.00



INLET SPACING DESIGN

PID : 77366 **Date :** 02/06/2013 **Project :** SCI-823-0.00

Location : PORTSMOUTH, SCIOTO COUNTY

Description : REACH # 4, 226+75(HP) TO 237+50 TO 263+14(HP), SR823 RT

Designer : KAG

Rainfall Area: D **Storm Frequency (yr.) :** 10

Total Allow. Spread (ft.) : 0.00

Allowable Depth (ft.) : 0.38

STATION	C.B. Type	GUTTER LENGTH (ft.)	RUNOFF COEF	AREA (acres)	CONC. TIME (min.)	GUTTER TIME (min.)	USED TIME (min.)	LONG. SLOPE (ft./ft.)	GUTT. SLOPE (ft./ft.)	PAVT. SLOPE (ft./ft.)	GUTT. WIDTH (ft.)	LOCAL DEPRESS. (ft.)	RAIN FALL (in./hrs.)	INTERCPTD FLOW (cfs.)	BYPASS FLOW (cfs.)	TOTAL FLOW (cfs.)	DEPTH (ft.)	PAVT. FLOW (ft.)	SPREAD (ft.)	
226+75	Begin																			
231+00	I-3B	425.00	0.90	0.34	1.52	4.33	10.00	0.0050	0.0400	0.0190	9.50	0.0417	5.39	1.46	0.19	1.65	0.251	0.251	6.27	
237+00	I-3B	600.00	0.90	0.48	1.52	7.46	10.00	0.0024	0.0400	0.0190	9.50	0.0417	5.39	2.23	0.29	2.52	0.337	0.337	8.43	
237+50	I-3B	50.00	0.90	0.04	1.52	1.28	10.00	0.0010	0.0400	0.0190	9.50	0.0417	5.39	*****	*****	0.48	0.214	0.214	5.34	Sag
263+14	Begin																			
256+50	I-3B	664.00	0.90	0.16	1.52	4.44	10.00	0.0254	0.0400	0.0160	9.50	0.0417	5.39	0.67	0.11	0.78	0.139	0.139	3.48	
246+50	I-3B	1000.00	0.90	0.25	1.52	5.25	10.00	0.0350	0.0400	0.0160	9.50	0.0417	5.39	0.93	0.39	1.32	0.160	0.160	4.00	
238+00	I-3B	850.00	0.90	0.55	1.52	9.96	11.48	0.0026	0.0400	0.0190	9.50	0.0417	5.13	2.48	0.45	2.93	0.352	0.352	8.79	
237+50	I-3B	50.00	0.90	0.04	1.66	1.20	10.00	0.0010	0.0400	0.0190	9.50	0.0417	5.39	*****	*****	0.64	0.238	0.238	5.95	End

SUMP DATA

Total Flow (cfs) : 1.12

Ponded Depth (ft.) : 0.055

Spread on Pavement (ft.) : 3.16



INLET SPACING DESIGN

PID : 77366 **Date :** 02/06/2013 **Project :** SCI-823-0.00 **Location :** PORTSMOUTH, SCIOTO COUNTY
Description : REACH # 4, 226+75(HP) TO 237+50 TO 263+14(HP), SR823 RT **Designer :** KAG

Rainfall Area: D **Storm Frequency (yr.) :** 50 **Total Allow. Spread (ft.) :** 0.00 **Allowable Depth (ft.) :** 0.38

STATION	C.B. Type	GUTTER LENGTH (ft.)	RUNOFF COEF	AREA (acres)	CONC. TIME (min.)	GUTTER TIME (min.)	USED TIME (min.)	LONG. SLOPE (ft./ft.)	GUTT. SLOPE (ft./ft.)	PAVT. SLOPE (ft./ft.)	GUTT. WIDTH (ft.)	LOCAL DEPRESS. (ft.)	RAIN FALL (in./hrs.)	INTERCPTD FLOW (cfs.)	BYPASS FLOW (cfs.)	TOTAL FLOW (cfs.)	DEPTH (ft.)	PAVT. SPREAD (ft.)	
226+75	Begin																		
231+00	I-3B	425.00	0.90	0.34	1.52	4.02	10.00	0.0050	0.0400	0.0190	9.50	0.0417	7.20	1.83	0.38	2.20	0.279	6.99	
237+00	I-3B	600.00	0.90	0.48	1.52	6.94	10.00	0.0024	0.0400	0.0190	9.50	0.0417	7.20	2.87	0.62	3.49	0.381	9.55	
237+50	I-3B	50.00	0.90	0.04	1.52	1.11	10.00	0.0010	0.0400	0.0190	9.50	0.0417	7.20	*****	*****	0.88	0.268	6.70	Sag
263+14	Begin																		
256+50	I-3B	664.00	0.90	0.16	1.52	4.12	10.00	0.0254	0.0400	0.0160	9.50	0.0417	7.20	0.83	0.21	1.04	0.155	3.88	
246+50	I-3B	1000.00	0.90	0.25	1.52	4.83	10.00	0.0350	0.0400	0.0160	9.50	0.0417	7.20	1.15	0.68	1.83	0.181	4.52	
238+00	I-3B	850.00	0.90	0.55	1.52	9.15	10.67	0.0026	0.0400	0.0190	9.50	0.0417	7.04	3.23	0.94	4.16	0.401	10.60	
237+50	I-3B	50.00	0.90	0.04	1.66	1.03	10.00	0.0010	0.0400	0.0190	9.50	0.0417	7.20	*****	*****	1.19	0.300	7.51	End

SUMP DATA

Total Flow (cfs) : 2.08 **Ponded Depth (ft.) :** 0.124 **Spread on Pavement (ft.) :** 4.57



INLET SPACING DESIGN

PID : 19415 **Date :** 02/06/2013 **Project :** SCI-823
Description : Reach 5 - 263+14 HP to 350+60 LP to End

Location : Portsmouth

Designer : KAG

Rainfall Area: D **Storm Frequency (yr.) :** 10

Total Allow. Spread (ft.) : 9.50

Allowable Depth (ft.) : 0.50

STATION	C.B. Type	GUTTER LENGTH (ft.)	RUNOFF COEF	AREA (acres)	CONC. TIME (min.)	GUTTER TIME (min.)	USED TIME (min.)	LONG. SLOPE (ft./ft.)	GUTT. SLOPE (ft./ft.)	PAVT. SLOPE (ft./ft.)	GUTT. WIDTH (ft.)	LOCAL DEPRESS. (ft.)	RAIN FALL (in./hrs.)	INTERCPTD FLOW (cfs.)	BYPASS FLOW (cfs.)	TOTAL FLOW (cfs.)	DEPTH (ft.)	PAVT. SPREAD (ft.)
263+14	Begin																	
273+00	I-3C	986.00	0.90	0.79	2.41	4.08	10.00	0.0300	0.0440	0.0440	9.50	0.0417	5.39	1.99	1.84	3.83	0.255	5.79
283+00	I-3C	1000.00	0.90	0.81	2.41	3.71	10.00	0.0311	0.0440	0.0311	9.50	0.0417	5.39	2.55	3.23	5.77	0.295	6.71
293+00	I-3B	1000.00	0.90	0.62	2.46	3.59	10.00	0.0350	0.0400	0.0160	9.50	0.0417	5.39	2.49	3.74	6.23	0.287	7.16
303+00	I-3B	1000.00	0.90	0.25	1.61	6.17	10.00	0.0100	0.0400	0.0160	9.50	0.0417	5.39	2.83	2.12	4.96	0.333	8.31
313+00	I-3C	1000.00	0.90	0.25	1.52	6.81	10.00	0.0100	0.0400	0.0160	9.50	0.0417	5.39	2.18	1.16	3.33	0.287	7.17
323+00	I-3C	1000.00	0.90	0.25	1.52	7.42	10.00	0.0100	0.0400	0.0280	9.50	0.0417	5.39	1.72	0.64	2.37	0.252	6.30
333+50	I-3C	1050.00	0.90	0.26	1.52	5.34	10.00	0.0304	0.0400	0.0280	9.50	0.0417	5.39	1.22	0.69	1.91	0.189	4.72
336+00	I-3B	250.00	0.90	0.06	1.52	1.35	10.00	0.0386	0.0400	0.0280	9.50	0.0417	5.39	0.74	0.24	0.98	0.140	3.50
346+00	I-3C	1000.00	0.90	0.25	1.27	5.96	10.00	0.0238	0.0400	0.0280	9.50	0.0417	5.39	1.06	0.39	1.45	0.178	4.46
349+00	I-3C	300.00	0.90	0.08	1.52	3.08	10.00	0.0083	0.0400	0.0280	9.50	0.0417	5.39	0.76	0.03	0.78	0.172	4.31
350+00	I-3C	100.00	0.90	0.03	1.52	1.67	10.00	0.0057	0.0400	0.0280	9.50	0.0417	5.39	0.17	0.00	0.17	0.104	2.61
350+60	I-3C	60.00	0.90	0.02	1.52	5.44	10.00	0.0001	0.0400	0.0280	9.50	0.0417	5.39	*****	*****	0.10	0.180	4.51 Sag
419+83	Begin																	
416+50	I-3C	333.00	0.90	0.05	1.11	3.72	10.00	0.0136	0.0400	0.0650	4.00	0.0417	5.39	0.24	0.00	0.24	0.101	2.53
412+50	I-3A	350.00	0.90	0.05	2.85	3.05	10.00	0.0272	0.0400	0.0650	4.00	0.0417	5.39	0.24	0.00	0.24	0.089	2.22



INLET SPACING DESIGN

STATION	C.B. Type	GUTTER LENGTH (ft.)	RUNOFF COEF	AREA (acres)	CONC. TIME (min.)	GUTTER TIME (min.)	USED TIME (min.)	LONG. SLOPE (ft./ft.)	GUTT. SLOPE (ft./ft.)	PAVT. SLOPE (ft./ft.)	GUTT. WIDTH (ft.)	LOCAL DEPRESS. (ft.)	RAIN FALL (in./hrs.)	INTERCPTD FLOW (cfs.)	BYPASS FLOW (cfs.)	TOTAL FLOW (cfs.)	DEPTH FLOW (ft.)	PAVT. SPREAD (ft.)	
405+50	I-3C	750.00	0.90	0.09	1.11	5.55	10.00	0.0290	0.0400	0.0650	4.00	0.0417	5.39	0.42	0.01	0.44	0.110	2.74	
395+50	I-3B	1000.00	0.90	0.15	1.52	6.78	10.00	0.0269	0.0400	0.0160	9.50	0.0417	5.39	0.64	0.10	0.74	0.135	3.39	
386+50	I-3B	900.00	0.90	0.23	1.52	6.71	10.00	0.0150	0.0400	0.0160	9.50	0.0417	5.39	1.00	0.21	1.21	0.182	4.55	
382+00	I-3B	450.00	0.90	0.11	1.52	3.72	10.00	0.0150	0.0400	0.0160	9.50	0.0417	5.39	0.69	0.06	0.75	0.152	3.79	
375+00	I-3B	700.00	0.90	0.18	1.52	5.52	10.00	0.0150	0.0400	0.0160	9.50	0.0417	5.39	0.82	0.11	0.93	0.165	4.11	
365+00	I-3C	1000.00	0.90	0.25	1.52	7.34	10.00	0.0150	0.0400	0.0280	9.50	0.0417	5.39	1.07	0.26	1.32	0.188	4.70	
355+00	I-3C	1000.00	0.90	0.25	1.52	7.15	10.00	0.0150	0.0400	0.0280	9.50	0.0417	5.39	1.15	0.32	1.47	0.195	4.88	
351+50	I-3C	350.00	0.09	0.09	1.52	5.56	10.00	0.0046	0.0400	0.0280	9.50	0.0417	5.39	0.36	0.00	0.36	0.144	3.61	
350+60	I-3C	90.00	0.90	0.02	1.52	3.37	10.00	0.0010	0.0400	0.0280	9.50	0.0417	5.39	*****	*****	0.10	0.117	2.93	End

SUMP DATA

Total Flow (cfs) : 0.19

Ponded Depth (ft.) : 0.034

Spread on Pavement (ft.) : 0.77



INLET SPACING DESIGN

PID : 19415 **Date :** 02/06/2013 **Project :** SCI-823
Description : Reach 5 - 263+14 HP to 350+60 LP to End

Location : Portsmouth

Designer : KAG

Rainfall Area: D **Storm Frequency (yr.) :** 50 **Total Allow. Spread (ft.) :** 9.50 **Allowable Depth (ft.) :** 0.50

STATION	C.B. Type	GUTTER LENGTH (ft.)	RUNOFF COEF	AREA (acres)	CONC. TIME (min.)	GUTTER TIME (min.)	USED TIME (min.)	LONG. SLOPE (ft./ft.)	GUTT. SLOPE (ft./ft.)	PAVT. SLOPE (ft./ft.)	GUTT. WIDTH (ft.)	LOCAL DEPRESS. (ft.)	RAIN FALL (in./hrs.)	INTERCPTD FLOW (cfs.)	BYPASS FLOW (cfs.)	TOTAL FLOW (cfs.)	DEPTH (ft.)	PAVT. SPREAD (ft.)
263+14	Begin																	
273+00	I-3C	986.00	0.90	0.79	2.41	3.79	10.00	0.0300	0.0440	0.0440	9.50	0.0417	7.20	2.38	2.73	5.12	0.284	6.45
283+00	I-3C	1000.00	0.90	0.81	2.41	3.42	10.00	0.0311	0.0440	0.0311	9.50	0.0417	7.20	3.11	4.88	7.98	0.333	7.57
293+00	I-3B	1000.00	0.90	0.62	2.46	3.29	10.00	0.0350	0.0400	0.0160	9.50	0.0417	7.20	3.09	5.81	8.89	0.327	8.19
303+00	I-3B	1000.00	0.90	0.25	1.61	5.61	10.00	0.0100	0.0400	0.0160	9.50	0.0417	7.20	3.68	3.75	7.43	0.387	9.94
313+00	I-3C	1000.00	0.90	0.25	1.52	6.04	10.00	0.0100	0.0400	0.0160	9.50	0.0417	7.20	2.99	2.39	5.37	0.343	8.57
323+00	I-3C	1000.00	0.90	0.25	1.52	6.49	10.00	0.0100	0.0400	0.0280	9.50	0.0417	7.20	2.46	1.54	4.01	0.307	7.68
333+50	I-3C	1050.00	0.90	0.26	1.52	4.69	10.00	0.0304	0.0400	0.0280	9.50	0.0417	7.20	1.71	1.52	3.23	0.230	5.75
336+00	I-3B	250.00	0.90	0.06	1.52	1.16	10.00	0.0396	0.0400	0.0280	9.50	0.0417	7.20	1.16	0.75	1.91	0.180	4.49
346+00	I-3C	1000.00	0.90	0.25	1.27	5.27	10.00	0.0238	0.0400	0.0280	9.50	0.0417	7.20	1.47	0.90	2.37	0.214	5.36
349+00	I-3C	300.00	0.90	0.08	1.52	2.67	10.00	0.0083	0.0400	0.0280	9.50	0.0417	7.20	1.22	0.20	1.42	0.215	5.38
350+00	I-3C	100.00	0.90	0.03	1.52	1.39	10.00	0.0057	0.0400	0.0280	9.50	0.0417	7.20	0.39	0.00	0.39	0.143	3.57
350+60	I-3C	60.00	0.90	0.02	1.52	5.04	10.00	0.0001	0.0400	0.0280	9.50	0.0417	7.20	*****	*****	0.13	0.201	5.03 Sag
419+83	Begin																	
416+50	I-3C	333.00	0.90	0.05	1.11	3.46	10.00	0.0136	0.0400	0.0650	4.00	0.0417	7.20	0.32	0.00	0.32	0.113	2.82
412+50	I-3A	350.00	0.90	0.05	2.85	2.83	10.00	0.0272	0.0400	0.0650	4.00	0.0417	7.20	0.32	0.00	0.32	0.099	2.48



INLET SPACING DESIGN

STATION	C.B. Type	GUTTER LENGTH (ft.)	RUNOFF COEF	AREA (acres)	CONC. TIME (min.)	GUTTER TIME (min.)	TIME USED (min.)	LONG. SLOPE (ft./ft.)	GUTT. SLOPE (ft./ft.)	PAVT. SLOPE (ft./ft.)	GUTT. WIDTH (ft.)	LOCAL DEPRESS. (ft.)	RAIN FALL (in./hrs.)	INTERCPTD BYPASS FLOW (cfs.)	TOTAL FLOW (cfs.)	DEPTH FLOW (ft.)	PAVT. SPREAD (ft.)
405+50	I-3C	750.00	0.90	0.09	1.11	5.15	10.00	0.0290	0.0400	0.0650	4.00	0.0417	7.20	0.53	0.58	0.122	3.05
395+50	I-3B	1000.00	0.90	0.15	1.52	6.23	10.00	0.0269	0.0400	0.0160	9.50	0.0417	7.20	0.81	1.02	0.153	3.82
386+50	I-3B	900.00	0.90	0.23	1.52	6.15	10.00	0.0150	0.0400	0.0160	9.50	0.0417	7.20	1.28	1.70	0.206	5.16
382+00	I-3B	450.00	0.90	0.11	1.52	3.36	10.00	0.0150	0.0400	0.0160	9.50	0.0417	7.20	0.95	1.14	0.177	4.44
375+00	I-3B	700.00	0.90	0.18	1.52	5.02	10.00	0.0150	0.0400	0.0160	9.50	0.0417	7.20	1.08	1.35	0.189	4.73
365+00	I-3C	1000.00	0.90	0.25	1.52	6.69	10.00	0.0150	0.0400	0.0280	9.50	0.0417	7.20	1.37	1.89	0.215	5.37
355+00	I-3C	1000.00	0.90	0.25	1.52	6.49	10.00	0.0150	0.0400	0.0280	9.50	0.0417	7.20	1.49	2.13	0.225	5.62
351+50	I-3C	350.00	0.90	0.09	1.52	4.72	10.00	0.0046	0.0400	0.0280	9.50	0.0417	7.20	0.70	0.70	0.185	4.61
350+60	I-3C	90.00	0.90	0.02	1.52	3.13	10.00	0.0010	0.0400	0.0280	9.50	0.0417	7.20	*****	0.13	0.131	3.27 End

SUMP DATA

Total Flow (cfs) : 0.26

Ponded Depth (ft.) : 0.041

Spread on Pavement (ft.) : 0.93



INLET SPACING DESIGN

PID : 19415 **Date :** 02/06/2013 **Project :** SCI-823-PH3

Location : Portsmouth

Description : Sta 263+14 to PH3 project end Right Side

Designer : KAG

Rainfall Area: D **Storm Frequency (yr.) :** 10

Total Allow. Spread (ft.) : 0.00

Allowable Depth (ft.) : 0.50

STATION	C.B. Type	GUTTER LENGTH (ft.)	RUNOFF COEF	AREA (acres)	CONC. TIME (min.)	GUTTER TIME (min.)	USED TIME (min.)	LONG. SLOPE (ft./ft.)	GUTT. SLOPE (ft./ft.)	PAVT. SLOPE (ft./ft.)	GUTT. WIDTH (ft.)	LOCAL DEPRESS. (ft.)	RAIN FALL (in./hrs.)	INTERCPTD FLOW (cfs.)	BYPASS FLOW (cfs.)	TOTAL FLOW (cfs.)	DEPTH (ft.)	PAVT. SPREAD (ft.)
263+14	Begin																	
273+00	I-3C	986.00	0.90	0.19	1.30	5.86	10.00	0.0300	0.0440	0.0160	6.50	0.0417	5.39	0.76	0.16	0.92	0.149	3.39
283+00	I-3C	1000.00	0.90	0.19	1.30	5.65	10.00	0.0311	0.0440	0.0440	6.50	0.0417	5.39	0.85	0.23	1.08	0.157	3.58
293+00	I-3B	1000.00	0.90	0.23	1.49	5.23	10.00	0.0350	0.0400	0.0160	9.50	0.0417	5.39	0.94	0.41	1.35	0.161	4.03
303+00	I-3B	1000.00	0.90	0.25	1.49	8.18	10.00	0.0100	0.0400	0.0160	9.50	0.0417	5.39	1.31	0.31	1.62	0.219	5.46
313+00	I-3C	1000.00	0.90	0.25	1.57	8.33	10.00	0.0100	0.0400	0.0160	9.50	0.0417	5.39	1.25	0.27	1.52	0.213	5.34
323+00	I-3C	1000.00	0.90	0.70	2.56	6.64	10.00	0.0100	0.0400	0.0280	9.50	0.0417	5.39	2.32	1.34	3.66	0.297	7.42
333+50	I-3C	1050.00	0.90	0.85	2.60	4.09	10.00	0.0304	0.0400	0.0280	9.50	0.0417	5.39	2.37	3.09	5.47	0.280	7.00
336+00	I-3C	250.00	0.90	0.20	2.65	0.96	10.00	0.0396	0.0400	0.0280	9.50	0.0417	5.39	1.87	2.20	4.06	0.239	5.96
346+00	I-3C	1000.00	0.90	0.81	2.42	4.16	10.00	0.0238	0.0400	0.0280	9.50	0.0417	5.39	2.69	3.44	6.13	0.306	7.65
349+00	I-3C	300.00	0.90	0.24	2.42	2.00	10.00	0.0083	0.0400	0.0280	9.50	0.0417	5.39	2.80	1.80	4.60	0.335	8.38
350+00	I-3C	100.00	0.90	0.08	2.42	0.93	10.00	0.0057	0.0400	0.0280	9.50	0.0417	5.39	1.78	0.41	2.19	0.272	6.80
350+60	I-3C	60.00	0.90	0.05	2.42	1.43	10.00	0.0010	0.0400	0.0280	9.50	0.0417	5.39	*****	*****	0.65	0.239	5.97 Sag
425+25	Begin																	
416+00	I-3C	333.00	0.90	0.47	2.32	1.84	10.00	0.0141	0.0650	0.0650	9.50	0.0417	5.39	1.85	0.43	2.28	0.280	4.30
412+50	I-3A	350.00	0.90	0.43	2.34	1.49	10.00	0.0270	0.0650	0.0650	9.50	0.0417	5.39	1.79	0.72	2.51	0.257	3.95



INLET SPACING DESIGN

STATION	C.B. Type	GUTTER LENGTH (ft.)	COEFF	RUNOFF AREA (acres)	CONC. TIME (min.)	GUTTER TIME (min.)	TIME USED (min.)	LONG. SLOPE (ft./ft.)	GUTT. SLOPE (ft./ft.)	PAVT. SLOPE (ft./ft.)	GUTT. WIDTH (ft.)	LOCAL DEPRESS. (ft.)	RAIN FALL (in./hrs.)	INTERCEPTD BYPASS FLOW (cfs.)	TOTAL FLOW (cfs.)	DEPTH FLOW (ft.)	PAVT. SPREAD (ft.)
405+50	I-3C	750.00	0.90	0.90	7.78	2.75	10.54	0.0290	0.0650	0.0650	9.50	0.0417	5.29	2.80	5.01	0.328	5.06
395+50	I-3B	1000.00	0.90	1.14	1.52	3.70	10.00	0.0270	0.0400	0.0160	9.50	0.0417	5.39	3.02	7.74	0.326	8.16
386+50	I-3B	900.00	0.90	0.23	1.52	4.57	10.00	0.0150	0.0400	0.0160	9.50	0.0417	5.39	2.89	5.84	0.328	8.20
382+00	I-3B	450.00	0.90	0.11	1.52	2.59	10.00	0.0150	0.0400	0.0160	9.50	0.0417	5.39	2.07	3.49	0.270	6.75
375+00	I-3C	700.00	0.90	0.18	1.53	4.46	10.00	0.0150	0.0400	0.0104	9.50	0.0417	5.39	1.57	2.28	0.231	5.76
365+00	I-3C	1000.00	0.90	0.85	1.52	5.22	10.00	0.0150	0.0400	0.0280	9.50	0.0417	5.39	2.57	4.84	0.306	7.64
355+00	I-3C	1000.00	0.90	0.94	1.52	4.80	10.00	0.0150	0.0400	0.0280	9.50	0.0417	5.39	3.19	6.84	0.348	8.69
351+50	I-3C	350.00	0.90	0.28	2.42	2.87	10.00	0.0047	0.0400	0.0280	9.50	0.0417	5.39	3.31	5.00	0.385	9.66
350+60	I-3C	90.00	0.90	0.07	2.42	1.64	10.00	0.0010	0.0400	0.0280	9.50	0.0417	5.39	*****	2.03	0.367	9.17 End

SUMP DATA

Total Flow (cfs) : 2.68

Ponded Depth (ft.) : 0.196

Spread on Pavement (ft.) : 4.42



INLET SPACING DESIGN

PID : 19415 **Date :** 02/06/2013 **Project :** SCI-823-PH3

Location : Portsmouth

Description : Sta 263+14 to PH3 project end Right Side

Designer : KAG

Rainfall Area: D **Storm Frequency (yr.) :** 50 **Total Allow. Spread (ft.) :** 0.00 **Allowable Depth (ft.) :** 0.50

STATION	C.B. Type	GUTTER LENGTH (ft.)	RUNOFF COEF	AREA (acres)	CONC. TIME (min.)	GUTTER TIME (min.)	USED TIME (min.)	LONG. SLOPE (ft./ft.)	GUTT. SLOPE (ft./ft.)	PAVT. SLOPE (ft./ft.)	GUTT. WIDTH (ft.)	LOCAL DEPRESS. (ft.)	RAIN FALL (in./hrs.)	INTERCPTD FLOW (cfs.)	BYPASS FLOW (cfs.)	TOTAL FLOW (cfs.)	DEPTH (ft.)	PAVT. SPREAD (ft.)
263+14	Begin																	
273+00	I-3C	986.00	0.90	0.19	1.30	5.44	10.00	0.0300	0.0440	0.0160	6.50	0.0417	7.20	0.94	0.29	1.23	0.166	3.78
283+00	I-3C	1000.00	0.90	0.19	1.30	5.18	10.00	0.0311	0.0440	0.0440	6.50	0.0417	7.20	1.08	0.44	1.52	0.179	4.07
293+00	I-3B	1000.00	0.90	0.23	1.49	4.78	10.00	0.0350	0.0400	0.0160	9.50	0.0417	7.20	1.20	0.74	1.93	0.185	4.62
303+00	I-3B	1000.00	0.90	0.25	1.49	7.42	10.00	0.0100	0.0400	0.0160	9.50	0.0417	7.20	1.72	0.64	2.36	0.252	6.29
313+00	I-3C	1000.00	0.90	0.25	1.57	7.50	10.00	0.0100	0.0400	0.0160	9.50	0.0417	7.20	1.67	0.59	2.26	0.248	6.19
323+00	I-3C	1000.00	0.90	0.70	2.56	6.08	10.00	0.0100	0.0400	0.0280	9.50	0.0417	7.20	2.90	2.23	5.13	0.337	8.42
333+50	I-3C	1050.00	0.90	0.85	2.60	3.75	10.00	0.0304	0.0400	0.0280	9.50	0.0417	7.20	2.93	4.81	7.74	0.319	7.98
336+00	I-3C	250.00	0.90	0.20	2.65	0.87	10.00	0.0396	0.0400	0.0280	9.50	0.0417	7.20	2.39	3.71	6.10	0.278	6.94
346+00	I-3C	1000.00	0.90	0.81	2.42	3.78	10.00	0.0238	0.0400	0.0280	9.50	0.0417	7.20	3.39	5.57	8.96	0.353	8.82
349+00	I-3C	300.00	0.90	0.24	2.42	1.82	10.00	0.0083	0.0400	0.0280	9.50	0.0417	7.20	3.73	3.40	7.12	0.395	10.02
350+00	I-3C	100.00	0.90	0.08	2.42	0.80	10.00	0.0057	0.0400	0.0280	9.50	0.0417	7.20	2.70	1.22	3.92	0.338	8.46
350+60	I-3C	60.00	0.90	0.05	2.42	1.16	10.00	0.0010	0.0400	0.0280	9.50	0.0417	7.20	*****	*****	1.54	0.330	8.26 Sag
425+25	Begin																	
416+00	I-3C	333.00	0.90	0.47	2.32	1.72	10.00	0.0141	0.0650	0.0650	9.50	0.0417	7.20	2.29	0.76	3.05	0.312	4.80
412+50	I-3A	350.00	0.90	0.43	2.34	1.37	10.00	0.0270	0.0650	0.0650	9.50	0.0417	7.20	2.26	1.28	3.54	0.292	4.49



INLET SPACING DESIGN

STATION	C.B. Type	GUTTER LENGTH (ft.)	RUNOFF COEF	AREA (acres)	CONC. TIME (min.)	GUTTER TIME (min.)	USED TIME (min.)	LONG. SLOPE (ft./ft.)	GUTT. SLOPE (ft./ft.)	PAVT. SLOPE (ft./ft.)	GUTT. WIDTH (ft.)	LOCAL DEPRESS. (ft.)	RAIN FALL (in./hrs.)	INTERCPTD FLOW (cfs.)	BYPASS FLOW (cfs.)	TOTAL FLOW (cfs.)	DEPTH FLOW (ft.)	PAVT. SPREAD (ft.)
405+50	I-3C	750.00	0.90	0.90	7.78	2.53	10.31	0.0290	0.0650	0.0650	9.50	0.0417	7.13	3.49	3.57	7.05	0.373	5.74
395+50	I-3B	1000.00	0.90	1.14	1.52	3.39	10.00	0.0270	0.0400	0.0160	9.50	0.0417	7.20	3.72	7.24	10.96	0.372	9.29
386+50	I-3B	900.00	0.90	0.23	1.52	4.16	10.00	0.0150	0.0400	0.0160	9.50	0.0417	7.20	3.71	5.01	8.73	0.381	9.57
382+00	I-3B	450.00	0.90	0.11	1.52	2.29	10.00	0.0150	0.0400	0.0160	9.50	0.0417	7.20	2.86	2.87	5.73	0.325	8.14
375+00	I-3C	700.00	0.90	0.18	1.53	3.87	10.00	0.0150	0.0400	0.0104	9.50	0.0417	7.20	2.28	1.75	4.04	0.285	7.14
365+00	I-3C	1000.00	0.90	0.85	1.52	4.72	10.00	0.0150	0.0400	0.0280	9.50	0.0417	7.20	3.31	3.95	7.26	0.356	8.89
355+00	I-3C	1000.00	0.90	0.94	1.52	4.47	10.00	0.0150	0.0400	0.0280	9.50	0.0417	7.20	4.05	5.99	10.04	0.402	10.27
351+50	I-3C	350.00	0.90	0.28	2.42	2.59	10.00	0.0047	0.0400	0.0280	9.50	0.0417	7.20	4.45	3.36	7.81	0.454	12.14
350+60	I-3C	90.00	0.90	0.07	2.42	1.43	10.00	0.0010	0.0400	0.0280	9.50	0.0417	7.20	*****	*****	3.81	0.463	12.47 End

SUMP DATA

Total Flow (cfs) : 5.35

Ponded Depth (ft.) : 0.311

Spread on Pavement (ft.) : 7.00

APPENDIX C

Storm Sewer Calculations



STORM SEWER SYSTEM

PID : 77366 **Date :** 05/30/2007 **Project :** SCI-823-0.00 **Location :** PORTSMOUTH, SCIOTO COUNTY
Description : RH#1; FROM 59+00 & 61+00 TO 59+95.45 (I3-B); FROM 61+00 TO 59+95.45, CB-3A, CB-3, LHS **Designer :** DL

Rainfall Area: D **Just Full Capacity Frequency (yrs.):** 10 **Hydraulic Gradient Frequency (yrs.):** 25
Minimum Pipe Size : 15.00 **Tailwater Elevation (ft.):** 0.00

JUNCTION	STATION	Δ AREA	Δ CA	BEGIN TIME	RAINFALL INTENSITY	DISCHARGE	PIPE DIAM.	LENGTH	SLOPE	F/I PIPE	MEAN VEL	JUST FULL CAPACITY	FRICT SLOPE	HYGREL. IN / OUT	COVER IN / OUT	COVER MINUS HY GR	COVER MINUS CROWN	INLET TYPE	MANNING'S 'n'				
																				From To	Σ AREA (acres)	Σ CA (min.)	(10 yrs.) (25 yrs.)
0	1	59+00	0.10	0.09	10.00	5.39	6.60	0.5	0.6	15	95.5	0.0226	582.13	3.76	9.06	0.0001	582.36	586.83	4.47	3.45	13B	0.015	
		begin	0.10	0.09							579.97			580.75	586.67								
0	1	61+00	0.09	0.08	10.00	5.39	6.55	0.4	0.5	15	104.6	0.0104	581.06	2.71	6.15	0.0001	581.31	586.86	5.55	4.55	13B	0.015	
		begin	0.19	0.17							579.97			580.73	586.67								
1	2	59+95	0.07	0.06	10.64	5.27	6.52	1.2	1.5	15	28.8	0.0100	579.97	3.66	6.02	0.0007	580.57	586.67	6.10	5.45	13B	0.015	
		begin	0.26	0.23							579.68			580.55	586.14								
0	2	61+00	0.12	0.11	10.00	5.39	6.51	0.6	0.7	15	104.6	0.0253	582.33	4.09	9.58	0.0002	582.57	586.33	3.76	2.75	CB 3A	0.015	
		begin	0.38	0.34							579.68			580.54	586.14								
2	3	59+95	0.12	0.11	10.77	5.25	6.51	2.4	2.9	15	15.8	0.0100	579.68	4.37	6.02	0.0027	580.54	586.14	5.60	5.21	CB 3	0.015	
		final	0.50	0.45							579.52			580.49	582.77								





STORM SEWER SYSTEM

PID : 77366 Date : 02/28/2007 Project : SCI-823-0.00 Location : PORTSMOUTH, SCIOTO COUNTY Designer : DL
 Description : STA. 63+50.00 SR 823, LHS

Rainfall Area: D Just Full Capacity Frequency (yrs.): 10 Hydraulic Gradient Frequency (yrs.): 25
 Minimum Pipe Size : 15.00 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	INLET TYPE					
From	To	Σ AREA	Σ CA	TIME	INTENSITY	(cfs.)	DIAM.	IN / OUT	VEL	CAPACITY	SLOPE	IN / OUT	IN / OUT	MINUS	MANNING'S					
		(acres)		(min.)	(10 yrs.)	(25 yrs.)	(in.)	(ft.)	(fps.)	(cfs.)	(ft./ft.)	(ft.)	(ft.)	HY GR	'n'					
0	1	0.09	0.08	10.00	5.39	6.64	0.4	0.5	15	42.1	0.0100	583.03	2.67	6.02	0.0001	583.38	588.83	5.45	4.55	1 3B
	begin	0.09	0.08									582.61				583.37	585.86			0.015
1	2	0.00	0.00	10.26	5.34	6.60	0.4	0.5	15	87.2	0.3333	582.61	9.06	34.77	0.0001	582.72	858.86	276.14	275.00	MH 3
	63+50	0.09	0.08									553.55				554.31	556.80			0.015
2	3	0.00	0.00	10.42	5.31	6.59	0.4	0.5	15	11.4	0.0100	553.55	2.67	6.02	0.0001	554.20	556.80	2.60	2.00	MH 3
	final	0.09	0.08									553.43				554.20	556.68			0.015



STORM SEWER SYSTEM

PID : 77366 Date : 02/28/2007 Project : SCI-823-0.00 Location : PORTSMOUTH, SCIOTO COUNTY
 Description : STA. 66+00.00 SR 823, LHS

Designer : DL

Rainfall Area: D Just Full Capacity Frequency (yrs.) : 10 Hydraulic Gradient Frequency (yrs.) : 25
 Minimum Pipe Size : 15.00 Tailwater Elevation (ft.): 0.00

JUNCTION STATION		ΔAREA	ΔCA	BEGIN TIME	RAINFALL INTENSITY	DISCHARGE	PIPE DIAM.	LENGTH	SLOPE	F/L PIPE IN / OUT	MEAN VEL	FRICT SLOPE	HYGR EL.	COVER IN / OUT	COVER MINUS HY GR	COVER MINUS CROWN	INLET TYPE	MANNING'S 'n'					
From	To	Σ (acres)	Σ (cfs.)	(min.)	(10 yrs.)	(25 yrs.)	(in.)	(ft.)	(ft./ft.)	(ft.)	(fps.)	(ft./ft.)	(ft.)	(ft.)	(ft.)								
0	1	66+00	0.17	0.15	10.00	5.39	6.64	0.8	1.0	15	47.7	0.0100	587.15	3.27	6.02	0.0003	587.51	592.95	5.44	4.55	1.3B	0.015	
	begin	66+00	0.17	0.15							586.67		587.50		589.92								
1	2	66+00	0.00	0.00	10.24	5.35	6.61	0.8	1.0	15	81.9	0.2500	586.67	10.21	30.11	0.0003	586.84	589.92	3.09	2.00	MH 3	0.015	
	begin	66+00	0.17	0.15							566.20		567.02		569.45								
2	3	66+00	0.00	0.00	10.38	5.32	6.59	0.8	1.0	15	22.6	0.0100	566.20	3.26	6.01	0.0003	566.80	569.45	2.64	2.00	MH 3	0.015	
	final	66+00	0.17	0.15							565.97		566.79		569.22								



STORM SEWER SYSTEM

PID : 77366 **Date :** 02/28/2007 **Project :** SCI-823-0.00

Location : PORTSMOUTH, SCIOTO COUNTY

Description : STA. 71+00.00 SR 823, LHS

Designer : DL

Rainfall Area: D

Just Full Capacity Frequency (yrs.) : 10

Hydraulic Gradient Frequency (yrs.) : 25

Minimum Pipe Size : 15.00 **Tailwater Elevation (ft.):** 0.00

From	To	JUNCTION STATION	Δ AREA Σ AREA (acres)	Δ CA	BEGIN TIME (min.)	RAINFALL INTENSITY (10 yrs.) (25 yrs.) (10 yrs.) (25 yrs.)	DISCHARGE (cfs.)	PIPE DIAM. (in.)	LENGTH (ft.)	SLOPE (ft./ft.)	F/I L PIPE		MEAN VEL (fps.)	JUST FULL CAPACITY (cfs.)	FRICT SLOPE (ft./ft.)	HYGR EL. IN / OUT (ft.)	COVER IN / OUT (ft.)	COVER MINUS HY GR (ft.)	COVER MINUS CROWN (ft.)	INLET TYPE MANNING'S 'n'	
											IN	OUT									
0	1	71+00	0.17	0.15	10.00	5.39	6.65	0.8	1.0	15	97.8	0.0924	601.84	7.17	18.31	0.0003	602.05	607.64	5.59	4.55	1.3B
		begin	0.17	0.15								592.80				593.63	596.05				0.015



STORM SEWER SYSTEM

PID : 77366 Date : 05/16/2007 Project : SCI-823-0-00

Location : PORTSMOUTH, SCIOTO COUNTY

Description : STA. 76+00.00 SR 823, RHS

Designer : DL

Rainfall Area: D

Just Full Capacity Frequency (yrs.) : 10

Hydraulic Gradient Frequency (yrs.) : 25

Minimum Pipe Size : 15.00 Tailwater Elevation (ft.): 0.00

JUNCTION	STATION	Δ AREA	Δ CA	BEGIN TIME	RAINFALL INTENSITY	DISCHARGE	PIPE DIAM.	LENGTH	SLOPE	F/I PIPE	MEAN VEL	JUST FULL CAPACITY	FRICT	HYGR EL.	COVER IN / OUT	COVER MINUS HY GR	COVER MINUS CROWN	INLET TYPE
From	To	Σ (acres)	Σ CA	(min.)	(10 yrs.) (25 yrs.)	(10 yrs.) (25 yrs.)	(in.)	(ft.)	(ft./ft.)	(ft.)	(fps.)	(cfs.)	(ft./ft.)	(ft.)	(ft.)	(ft.)	(ft.)	'n'
0	1	0.34	0.31	10.00	5.39	6.65	1.7	2.1	15	57.7	0.0180	8.07	0.0014	626.28	630.53	4.25	3.45	1.3B
	begin	0.34	0.31							624.79				625.70	628.04			0.015



STORM SEWER SYSTEM

PID : 77366 Date : 01/31/2007 Project : SCI-823-0.00

Location : PORTSMOUTH, SCIOTO COUNTY

Description : STA. 86+00+00 SR 823, LHS

Designer : DL

Rainfall Area: D

Just Full Capacity Frequency (yrs.) : 10

Hydraulic Gradient Frequency (yrs.) : 25

Minimum Pipe Size : 15.00 Tailwater Elevation (ft.): 0.00

JUNCTION	STATION	ΔAREA	ΔCA	BEGIN	RAINFALL	DISCHARGE	PIPE	F/I PIPE	MEAN	JUST FULL	FRICT	HYGR EL.	COVER	COVER	INLET TYPE						
From	To	ΣAREA	ΣCA	TIME	INTENSITY	(cfs.)	DIAM.	LENGTH	SLOPE	IN / OUT	VEL	CAPACITY	SLOPE	IN / OUT	HY GR	MINUS	MINUS	CROWN	'n'		
		(acres)		(min.)	(10 yrs.)	(25 yrs.)	(10 yrs.)	(25 yrs.)	(ft./ft.)	(ft.)	(ft.)	(ft.)	(ft.)	(ft.)	(ft.)	(ft.)	(ft.)	(ft.)			
0	1	86+00	0.35	0.32	10.00	5.39	6.65	1.7	2.1	15	52.1	0.0100	674.60	3.99	6.02	0.0014	675.13	679.30	4.17	3.45	1 3B
	begin	86+00	0.35	0.32									674.08				674.99	677.33			0.015



STORM SEWER SYSTEM

PID : 77366 Date : 06/05/2007 Project : SCI-823-0.00 Location : PORTSMOUTH, SCIOTO COUNTY Designer : DL
 Description : 104+50 TO 105+00 TO 106+00 (MH3); 106+00 (13B) TO 106+00 (MH3) SR 823, RHS

Rainfall Area: D Just Full Capacity Frequency (yrs.) : 10 Hydraulic Gradient Frequency (yrs.) : 25
 Minimum Pipe Size : 15.00 Tailwater Elevation (ft.): 0.00

JUNCTION	STATION	ΔAREA	ΔCA	BEGIN	RAINFALL	DISCHARGE	PIPE	F/I	PIPE	MEAN	JUST FULL	FRICT	HYGR	EL.	COVER	COVER	INLET					
From	To	ΣAREA	ΣCA	TIME	INTENSITY	(cfs.)	DIAM.	LENGTH	SLOPE	IN / OUT	CAPACITY	SLOPE	IN / OUT	IN / OUT	IN / OUT	MINUS	MINUS					
		(acres)		(min.)	(10 yrs.)	(25 yrs.)	(in.)	(ft.)	(ft./ft.)	(ft.)	(cfs.)	(ft./ft.)	(ft.)	(ft.)	(ft.)	HYGR	CROWN					
				(10 yrs.)	(25 yrs.)	(10 yrs.)											'n'					
0	2	106+00	0.34	0.31	10.00	5.39	5.68	1.6	1.7	15	63.8	0.1169	674.58	9.53	20.59	0.0010	674.83	680.38	5.55	4.55	13B	0.015
		106+00	0.34	0.31									667.12				668.35	673.87				
0	1	104+50	2.58	1.94	15.00	4.60	5.71	8.9	11.1	15	50.0	0.0540	675.65	11.43	13.99	0.0390	676.54	679.65	3.11	2.75	CB 8	0.015
		105+00	2.92	2.24									672.95				674.18	677.95				
1	2	105+00	0.10	0.07	15.07	4.59	5.68	9.2	11.4	15	100.0	0.0583	672.95	11.86	14.54	0.0416	673.83	677.95	4.12	3.75	CB 8	0.015
		106+00	3.02	2.32									667.12				668.35	673.87				
2	3	106+00	0.00	0.00	15.21	4.58	5.68	10.6	13.2	15	6.8	0.0560	667.12	11.99	14.25	0.0553	668.35	673.87	5.52	5.50	MH 3	0.015
		106+00	3.02	2.32									666.74				667.98	670.39				
3	4	106+00	0.00	0.00	15.22	4.57	5.66	10.6	13.1	15	234.6	0.4000	666.74	25.19	38.09	0.0548	667.27	670.39	3.12	2.40	MH 3	0.015
		106+00	3.02	2.32									572.90				574.14	576.23				
4	5	106+00	0.00	0.00	15.38	4.55	5.65	10.6	13.1	15	12.6	0.0560	572.90	11.99	14.25	0.0547	574.12	576.23	2.11	2.08	MH 3	0.015
		106+00	3.02	2.32									572.19				573.43	575.72				



STORM SEWER SYSTEM

PID : 77366 Date : 02/07/2007 Project : SCI-823-0.00

Location : PORTSMOUTH, SCIOTO COUNTY

Description : FROM STA. 112+00 (I3B1) TO STA. 112+00 (I3D), SR 823, RHS

Designer : DL

Rainfall Area: D

Just Full Capacity Frequency (yrs.): 10

Hydraulic Gradient Frequency (yrs.): 25

Minimum Pipe Size : 15.00 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		Σ AREA (acres)	Σ CA	TIME (min.)	INTENSITY (10 yrs.)	(cfs.) (10 yrs.)	DIAM. (in.)	LENGTH (ft.)	SLOPE (ft./ft.)	CAPACITY (cfs.)	SLOPE (ft./ft.)	IN / OUT (ft.)	IN / OUT (ft.)	MINUS HYGR	MINUS COVER	MANNING'S 'n'							
0	1	0.21	0.19	10.00	5.39	6.66	1.0	1.2	15	39.0	0.0100	650.03	3.46	6.02	0.0005	650.50	655.83	5.33	4.55	I3B	0.015		
	begin	0.21	0.19									649.64				652.89							
1	2	0.17	0.15	10.19	5.36	6.64	1.8	2.2	15	13.5	0.0100	649.64	4.08	6.02	0.0016	650.45	655.23	4.78	4.34	I3D	0.015		
	112+00	0.38	0.34									649.51				650.43	652.76						
2	3	0.00	0.00	10.24	5.35	6.59	1.8	2.2	15	228.8	0.4000	649.51	15.12	38.09	0.0016	649.72	652.76	3.04	2.00	MH 3	0.015		
	112+00	0.38	0.34									557.99				558.91	561.24						
3	4	0.00	0.00	10.50	5.30	6.57	1.8	2.2	15	16.2	0.0100	557.99	4.06	6.02	0.0016	558.78	561.24	2.46	2.00	MH 3	0.015		
	112+00	0.38	0.34									557.83				558.75	561.08						



STORM SEWER SYSTEM

PID : 77366 Date : 03/11/2013 Project : SCI-823-0.00 Location : PORTSMOUTH, SCIOTO COUNTY
 Description : STA. 118+36.00 SR 823 Designer : KAG

Rainfall Area: D Just Full Capacity Frequency (yrs.): 10 Hydraulic Gradient Frequency (yrs.): 25
 Minimum Pipe Size : 15.00 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	INLET TYPE							
From	To	Σ AREA	Σ CA	TIME	INTENSITY	(cfs.)	DIAM.	LENGTH	SLOPE	CAPACITY	SLOPE	IN / OUT	IN / OUT	MINUS	MANNING'S							
		(acres)		(min.)	(10 yrs.)	(25 yrs.)	(in.)	(ft.)	(ft./ft.)	(cfs.)	(ft./ft.)	(ft.)	(ft.)	HY GR	'n'							
0	3	118+36	0.51	0.46	10.00	5.39	6.69	2.5	3.1	15	8.2	0.0100	625.07	4.42	6.02	0.0030	625.99	629.07	3.08	2.75	CB 3A	
		118+36	0.51	0.46								624.99	625.97	629.07								0.015



STORM SEWER SYSTEM

PID : 77366 Date : 11/14/2012 Project : SCI-823-0.00 Location : PORTSMOUTH, SCIOTO COUNTY Designer : KAG
 Description : FROM 119+75 TO 119+75 (CB) SR823 TO 15+80 PERS

Rainfall Area: D Just Full Capacity Frequency (yrs.): 10 Hydraulic Gradient Frequency (yrs.): 25
 Minimum Pipe Size : 12.00 Tailwater Elevation (ft.): 0.00

JUNCTION	STATION	ΔAREA	ΔCA	BEGIN	RAINFALL	DISCHARGE	PIPE	F/L PIPE	MEAN	JUST FULL	FRICT	HYGR EL.	COVER	COVER	INLET TYPE					
From	To	ΣAREA	ΣCA	TIME	INTENSITY	(cfs.)	DIAM. LENGTH	SLOPE	VEL	CAPACITY	SLOPE	IN / OUT	IN / OUT	MINUS	MANNING'S					
		(acres)		(min.)	(10 yrs.)	(25 yrs.)	(in.)	(ft./ft.)	(fps.)	(cfs.)	(ft./ft.)	(ft.)	(ft.)	HY GR	'n'					
				(10 yrs.)	(25 yrs.)	(10 yrs.)	(25 yrs.)													
19SR	19SM	0.90	0.81	10.00	5.39	6.65	4.4	5.4	15	44.5	0.0294	619.52	7.64	10.33	0.0092	620.19	623.52	3.33	2.75	1.3D
	begin	119+75	0.90	0.81								619.35	624.12							0.015
19SM	2	0.40	0.36	10.10	5.37	6.65	6.3	7.8	15	52.6	0.0200	618.21	7.15	8.52	0.0193	619.35	619.46	0.11	0.00	1.3B
	119+75	1.30	1.17									618.34	619.96							0.015
2	P3	0.00	0.00	10.22	5.35	6.62	6.3	7.7	15	165.4	0.4000	616.71	21.75	38.09	0.0191	617.10	619.96	2.85	2.00	CB 2-3
	119+75	1.30	1.17									550.55	553.57							0.015
P1	P2	2.30	0.69	15.00	4.60	5.70	3.2	3.9	12	55.0	0.0431	553.27	8.15	6.89	0.0162	553.84	554.94	1.10	0.67	CB 2-2A
	begin	15+00	3.60	1.86								550.90	553.30							0.015
P2	P3	1.95	1.47	15.11	4.59	5.65	9.9	12.2	24	82.0	0.0122	549.90	6.75	23.29	0.0039	551.22	553.30	2.08	1.40	CB 2-3
	119+75	5.55	3.33									550.90	552.43							0.015
P3	OUT	0.74	0.52	15.32	4.56	5.65	17.5	21.7	24	53.0	0.0100	548.90	7.06	21.09	0.0122	550.90	552.43	1.53	1.53	CB 2-3
	final	15+80	6.29	3.84								548.37	549.23							0.015



STORM SEWER SYSTEM

PID : 77366 **Date :** 05/31/2007 **Project :** SCI-823-0.00

Location : PORTSMOUTH, SCIOTO COUNTY

Description : STA. 126+00.00 SR 823, LHS

Designer : DL

Rainfall Area: D

Just Full Capacity Frequency (yrs.): 10

Hydraulic Gradient Frequency (yrs.): 25

Minimum Pipe Size : 15.00

Tailwater Elevation (ft.): 0.00

JUNCTION STATION		ΔAREA	ΔCA	BEGIN	RAINFALL	DISCHARGE	PIPE	F/L PIPE	MEAN	JUST FULL	FRICT	HYGR EL.	COVER	COVER	COVER	INLET TYPE				
From	To	Σ AREA (acres)	Σ CA (min.) (10 yrs.) (25 yrs.)	TIME (min.) (10 yrs.) (25 yrs.)	INTENSITY (cfs.)	(10 yrs.) (25 yrs.)	DIAM. LENGTH (in.) (ft.)	SLOPE (ft./ft.)	VEL (fps.)	CAPACITY (cfs.)	SLOPE (ft./ft.)	IN / OUT (ft.)	IN / OUT (ft.)	MINUS HY GR	MINUS CROWN	MANNING'S 'n'				
0	1	0.21	0.19	10.00	5.39	6.64	1.0	1.2	15	40.8	0.0100	595.91	3.46	6.02	0.0005	596.46	601.71	5.25	4.55	1.3B
	begin	0.21	0.19									595.50	596.44	598.75						0.015
1	2	0.41	0.37	10.20	5.36	6.64	3.0	3.7	15	12.7	0.0100	595.50	4.63	6.02	0.0043	596.44	600.91	4.47	4.16	CB 3A
	126+00	0.62	0.55									595.38	596.39	598.63						0.015
2	3	0.00	0.00	10.24	5.35	6.61	3.0	3.7	15	125.2	0.3333	595.38	16.42	34.77	0.0043	595.66	598.63	2.97	2.00	MH 3
	126+00	0.62	0.55									553.64	554.65	556.89						0.015
3	4	0.00	0.00	10.37	5.32	6.60	3.0	3.7	15	18.6	0.0100	553.64	4.62	6.02	0.0043	554.55	556.89	2.35	2.00	MH 3
	126+00	0.62	0.55									553.46	554.47	556.71						0.015
	final																			



STORM SEWER SYSTEM

PID : 77366 Date : 04/06/2007 Project : SCI-823-0.00

Location : PORTSMOUTH, SCIOTO COUNTY

Description : REACH # 2; FROM 128+50 TO 129+50 TO 130+15.93 (LP) (I3C1) TO 130+15.93 (I3D)

Designer : DL

Rainfall Area: D

Just Full Capacity Frequency (yrs.) : 10

Hydraulic Gradient Frequency (yrs.) : 25

Minimum Pipe Size : 15.00 Tailwater Elevation (ft.) : 0.00

JUNCTION From To	STATION	ΔAREA ΣAREA (acres)	ΔCA ΣCA (acres)	BEGIN TIME (min.)	RAINFALL INTENSITY (10 yrs.) (25 yrs.)	DISCHARGE (cfs.) (10 yrs.) (25 yrs.)	PIPE DIAM. (in.)	LENGTH (ft.)	SLOPE (ft./ft.)	F/L PIPE IN / OUT (ft.)	MEAN VEL (fps.)	JUST FULL CAPACITY (cfs.)	FRICT SLOPE (ft./ft.)	HYGREL.		COVER		INLET TYPE
														IN	OUT	IN	OUT	
1	2	128+50 begin	0.17 0.17	10.00 0.15	5.39 6.59	0.8 0.8	1.0 1.0	15 15	100.0 0.0112	593.12 592.00	3.41 3.41	6.37 6.37	0.0003 0.0003	593.47 592.82	597.82 597.20	4.35 4.35	3.45 3.45	1 3B 0.015
2	3	129+50 130+15	0.09 0.26	0.08 0.23	5.30 6.52	1.2 1.5	1.5 1.5	65.9 0.0109	592.00 591.28	3.78 3.78	6.29 6.29	0.0007 0.0007	592.44 592.15	597.20 597.08	4.76 4.76	3.95 3.95	1 3C 0.015	
3	4	130+15 130+15	0.20 0.45	0.18 0.41	5.25 6.48	2.2 2.7	1.5 1.5	40.7 0.0100	591.28 590.87	4.26 4.26	6.02 6.02	0.0022 0.0022	591.93 591.84	597.08 597.57	5.15 5.15	4.55 4.55	1 3C 0.015	
4	5	130+15 130+15	0.25 0.71	0.23 0.64	5.22 6.48	3.3 4.1	1.5 1.5	15.0 0.0100	590.87 590.72	4.76 4.76	6.02 6.02	0.0054 0.0054	591.84 591.76	597.57 593.97	5.73 5.73	5.45 5.45	CB 3 0.015	
5	6	130+15 130+15	0.00 0.71	0.00 0.64	5.21 6.46	3.3 4.1	1.5 1.5	116.4 0.4000	590.72 544.16	18.16 18.16	38.09 38.09	0.0054 0.0054	591.01 545.19	593.97 547.41	2.96 2.96	2.00 2.00	MH 3 0.015	
6	7	130+15 final	0.00 0.71	0.00 0.64	5.20 6.44	3.3 4.1	1.5 1.5	16.1 0.0100	544.16 543.99	4.75 4.75	6.02 6.02	0.0054 0.0054	545.12 545.03	547.41 547.24	2.29 2.29	2.00 2.00	MH 3 0.015	



STORM SEWER SYSTEM

PID : 77366 **Date :** 04/06/2007 **Project :** SCI-823-0.00

Location : PORTSMOUTH, SCIOTO COUNTY

Description : REACH # 2; FROM 128+50 TO 129+50 TO 130+15.93 (LP); SR823, 41.75' RT

Designer : DL

Rainfall Area: D

Just Full Capacity Frequency (yrs.) : 10

Hydraulic Gradient Frequency (yrs.) : 25

Minimum Pipe Size : 15.00 **Tailwater Elevation (ft.):** 0.00

JUNCTION	STATION	ΔAREA	ΔCA	BEGIN	RAINFALL	DISCHARGE	PIPE	F/L PIPE	MEAN	JUST FULL	FRICT	HYGR EL.	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.)	CAPACITY (cfs.)	SLOPE (ft./ft.)	IN / OUT (ft.)	IN / OUT (ft.)	MINUS HY GR	MINUS MANNING'S 'n'						
0	1	128+50	0.70	0.63	10.00	5.39	6.62	3.4	4.2	15	100.0	0.0100	592.64	4.79	6.02	0.0056	593.45	596.89	3.44	3.00	I 3D
		129+50	0.70	0.63									591.64				592.68	596.12			0.015
1	2	129+50	0.09	0.08	10.35	5.33	6.56	3.8	4.7	15	65.9	0.0100	591.64	4.90	6.03	0.0069	592.53	596.12	3.59	3.23	I 3D
		130+15	0.79	0.71									590.98				592.07	596.00			0.015
2	3	130+15	0.92	0.83	10.57	5.29	6.56	8.1	10.1	18	12.1	0.0140	590.73	6.70	11.61	0.0122	592.07	596.00	3.93	3.77	I 3D
		130+15	1.71	1.54									590.56				591.92	594.06			0.015
3	4	130+15	0.00	0.00	10.60	5.28	6.55	8.1	10.1	18	98.5	0.4000	590.56	23.04	61.94	0.0122	590.98	594.06	3.08	2.00	MH 3
		130+15	1.71	1.54									551.16				552.52	554.66			0.015
4	5	130+15	0.00	0.00	10.67	5.27	6.54	8.1	10.0	18	21.5	0.0140	551.16	6.69	11.59	0.0121	552.48	554.66	2.18	2.00	MH 3
		130+15	1.71	1.54									550.86				552.22	554.36			0.015



STORM SEWER SYSTEM

PID : 77366 Date : 12/28/2007 Project : SCI-823-0.00

Location : PORTSMOUTH, SCIOTO COUNTY

Description : FROM 141+50 TO 141+00; 139+50(CB) TO 141+00(CB) TO 141+00; SR 823, RHS

Designer : MDC

Rainfall Area: D

Just Full Capacity Frequency (yrs.) : 10

Hydraulic Gradient Frequency (yrs.) : 25

Minimum Pipe Size : 15.00 Tailwater Elevation (ft.): 0.00

JUNCTION	STATION	Δ AREA	Δ CA	BEGIN	RAINFALL	DISCHARGE	PIPE	DIAM.	LENGTH	SLOPE	PIPE	F/L PIPE	MEAN	JUST FULL	FRICT	HYGR EL.	COVER	COVER	INLET	TYPE	
From	To	Σ AREA	Σ CA	TIME	INTENSITY	(cfs.)	(in.)	(ft.)	(ft./ft.)	(ft./ft.)	(ft.)	IN / OUT	VEL	CAPACITY	SLOPE	IN / OUT	IN / OUT	MINUS	MINUS	MANNING'S	
		(acres)		(min.)	(10 yrs.)	(25 yrs.)	(10 yrs.)	(25 yrs.)			(cfs.)	(ft.)	(fps.)	(cfs.)	(ft./ft.)	(ft.)	(ft.)	HY GR	CROWN	'n'	
0	1	139+50	1.66	1.17	15.00	4.60	5.65	5.4	6.6	18	150.0	0.0120	611.55	5.75	10.73	0.0053	612.44	615.55	3.11	2.50	CB 8
		141+00	1.66	1.17									609.75				611.00	623.05			0.015
1	2	141+00	0.97	0.68	15.43	4.55	5.62	8.4	10.4	18	63.7	0.0207	609.75	7.87	14.08	0.0131	610.76	623.05	12.29	11.80	CB 8
		141+00	2.63	1.85									608.43				609.80	627.93			0.015
0	2	141+50	0.04	0.04	10.00	5.39	6.65	0.2	0.3	15	50.0	0.0500	625.73	3.79	13.47	0.0000	625.85	630.43	4.58	3.45	13C
		141+00	2.67	1.89									623.23				623.95	628.08			0.015
2	3	141+00	0.04	0.04	15.57	4.53	5.57	8.7	10.8	24	113.9	0.0100	607.93	6.07	21.14	0.0030	608.99	627.93	18.94	18.00	13C
		141+00	2.72	1.93									606.79				608.38	610.79			0.015



STORM SEWER SYSTEM

PID : 77366 **Date :** 02/07/2007 **Project :** SCI-823-0.00

Location : PORTSMOUTH, SCIOTO COUNTY

Description : FROM STA. 142+00 (55.7' LT) TO STA. 142+00, SR 823, RHS

Designer : DL

Rainfall Area: D

Just Full Capacity Frequency (yrs.): 10

Hydraulic Gradient Frequency (yrs.): 25

Minimum Pipe Size : 15.00 **Tailwater Elevation (ft.):** 0.00

JUNCTION STATION		Δ AREA	Δ CA	BEGIN TIME	RAINFALL INTENSITY	DISCHARGE	PIPE DIAM.	LENGTH	SLOPE	F/L PIPE IN / OUT	MEAN VEL	JUST FULL CAPACITY	FRICT SLOPE	HYGR EL. IN / OUT	COVER IN / OUT	COVER MINUS HY GR	COVER MINUS CROWN	INLET TYPE		
From	To	(acres)	(acres)	(min.)	(10 yrs.) (25 yrs.)	(10 yrs.) (25 yrs.)	(in.)	(ft.)	(ft./ft.)	(ft.)	(fps.)	(cfs.)	(ft./ft.)	(ft.)	(ft.)	(ft.)		'n'		
0	1	11.48	8.14	15.00	4.60	5.71	37.5	46.5	30	52.8	0.0500	628.05	15.96	85.51	0.0171	629.43	632.55	3.13	2.00	HW Half He
	begin	11.48	8.14							625.41		627.79		632.93					0.015	
1	2	0.36	0.33	15.06	4.60	5.70	38.9	48.2	30	70.8	0.0500	625.41	16.11	85.51	0.0184	626.82	632.93	6.11	5.02	I 3C
	final	11.84	8.47							621.87		624.26		626.38					0.015	



STORM SEWER SYSTEM

PID : 77366 Date : 02/07/2007 Project : SCI-823-0.00
 Description : STA. 146+00.00 SR 823, RHS

Location : PORTSMOUTH, SCIOTO COUNTY

Designer : DL

Rainfall Area: D

Just Full Capacity Frequency (yrs.) : 10

Hydraulic Gradient Frequency (yrs.) : 25

Minimum Pipe Size : 15.00 Tailwater Elevation (ft.) : 0.00

JUNCTION	STATION	Δ AREA	Δ CA	BEGIN	RAINFALL	DISCHARGE	PIPE	DIAM.	LENGTH	SLOPE	F/L PIPE	MEAN	JUST FULL	FRICT	HYGR EL.	COVER	COVER	COVER	INLET TYPE	
From	To	Σ AREA	Σ CA	TIME	INTENSITY	(cfs.)	(ft.)	(ft.)	(ft./ft.)	(ft.)	(ft.)	(fps.)	CAPACITY	SLOPE	IN / OUT	IN / OUT	MINUS	MINUS	MANNING'S	
		(acres)		(min.)	(10 yrs.)	(25 yrs.)	(10 yrs.)	(25 yrs.)					(cfs.)	(ft./ft.)	(ft.)	(ft.)	HY GR	CROWN	'n'	
0	1	0.36	0.32	10.00	5.39	6.64	1.7	2.2	15	58.0	0.0100	647.63	4.04	6.02	0.0015	648.17	652.93	4.76	4.05	1.3C
	begin	0.36	0.32									647.05				647.97	650.30			0.015



STORM SEWER SYSTEM

PID : 77366 Date : 02/07/2007 Project : SCI-823-0.00

Location : PORTSMOUTH, SCIOTO COUNTY

Description : STA. 150+00.00 SR 823, RHS

Designer : DL

Rainfall Area: D

Just Full Capacity Frequency (yrs.): 10

Hydraulic Gradient Frequency (yrs.): 25

Minimum Pipe Size : 15.00 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	INLET TYPE						
From	To	Σ AREA	Σ CA	TIME	INTENSITY	(cfs.)	DIAM. LENGTH	IN / OUT	VEL	CAPACITY	SLOPE	IN / OUT	IN / OUT	MINUS	MANNING'S						
	To	(acres)		(min.)	(10 yrs.) (25 yrs.)	(10 yrs.) (25 yrs.)	(in.) (ft.)	(ft.)	(fps.)	(cfs.)	(ft./ft.)	(ft.)	(ft.)	HY GR	'n'						
0	1	0.45	0.41	10.00	5.39	6.65	2.2	2.7	15	58.0	0.0100	667.63	4.29	6.02	0.0023	668.24	672.93	4.69	4.05	1.3C	
	begin	0.45	0.41									667.05				668.00	670.30				0.015



STORM SEWER SYSTEM

PID : 77366 Date : 02/07/2007 Project : SCI-823-0.00

Location : PORTSMOUTH, SCIOTO COUNTY

Description : STA. 155+00.00 SR 823, RHS

Designer : DL

Rainfall Area: D

Just Full Capacity Frequency (yrs.): 10

Hydraulic Gradient Frequency (yrs.): 25

Minimum Pipe Size : 15.00 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	INLET TYPE					
From	To	Σ AREA	Σ CA	TIME	INTENSITY	(cfs.)	DIAM. LENGTH	IN / OUT	VEL	CAPACITY	SLOPE	IN / OUT	IN / OUT	MINUS	MINUS					
		(acres)		(min.)	(10 yrs.)	(25 yrs.)	(in.)	(ft.)	(fps.)	(cfs.)	(ft./ft.)	(ft.)	(ft.)	(ft.)	HY GR	CROWN				
					(10 yrs.)	(25 yrs.)									'n'					
0	1	0.55	0.50	10.00	5.39	6.65	2.7	3.3	15	58.0	0.0100	692.58	4.51	6.03	0.0035	693.27	697.88	4.61	4.05	1.3C
	begin	0.55	0.50									692.00				692.99	695.25			0.015



STORM SEWER SYSTEM

PID : 77366 Date : 02/07/2007 Project : SCI-823-0.00
 Description : STA. 161+00.00 SR 823, RHS

Location : PORTSMOUTH, SCIOTO COUNTY

Designer : DL

Rainfall Area: D Just Full Capacity Frequency (yrs.): 10 Hydraulic Gradient Frequency (yrs.): 25
 Minimum Pipe Size : 15.00 Tailwater Elevation (ft.): 0.00

JUNCTION	STATION	ΔAREA	ΔCA	BEGIN	RAINFALL	DISCHARGE	PIPE	DIAM.	LENGTH	SLOPE	F/L PIPE	MEAN	JUST FULL	FRICT	HYGREL.	COVER	COVER	INLET	TYPE
From	To	Σ AREA	Σ CA	TIME	INTENSITY	(cfs.)	(ft.)	(in.)	(ft.)	(ft./ft.)	IN / OUT	VEL	CAPACITY	SLOPE	IN / OUT	IN / OUT	MINUS	MINUS	MANNING'S
		(acres)		(min.)	(10 yrs.)	(25 yrs.)	(10 yrs.)	(25 yrs.)	(ft.)	(ft./ft.)	(ft.)	(fps.)	(cfs.)	(ft./ft.)	(ft.)	(ft.)	HY GR	CROWN	'n'
0	1	0.58	0.52	10.00	5.39	6.65	2.8	3.4	15	58.0	0.0100	714.37	4.56	6.02	0.0038	715.08	719.67	4.05	1.3C
	begin	0.58	0.52									713.79				714.79	717.04		0.015



STORM SEWER SYSTEM

PID : 77366 Date : 03/01/2007 Project : SCI-823-0.00

Location : PORTSMOUTH, SCIOTO COUNTY

Description : STA. 177+00.00 SR 823, LHS

Designer : DL

Rainfall Area: D

Just Full Capacity Frequency (yrs.) : 10

Hydraulic Gradient Frequency (yrs.) : 25

Minimum Pipe Size : 15.00 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	Σ AREA	Σ CA	TIME	INTENSITY	(cfs.)	DIAM.	LENGTH	SLOPE	(ft.)	(ft.)	IN / OUT	(ft.)	IN / OUT	MINUS	MANNING'S							
		(acres)		(min.)	(10 yrs.)	(25 yrs.)	(in.)	(ft.)	(ft./ft.)	(cfs.)	(ft./ft.)	(ft.)	(ft.)	(ft.)	HY GR	'n'							
0	1	177+00	0.96	0.86	10.00	5.39	6.65	4.7	5.7	15	63.6	0.0110	702.31	5.31	6.32	0.0105	703.39	708.11	4.72	4.55	1.3C	0.015	
	begin	177+00	0.96	0.86									701.61		702.72		704.86						
1	2	177+00	0.00	0.00	10.20	5.35	6.64	4.6	5.7	15	53.9	0.3333	701.61	18.71	34.77	0.0105	701.97	704.86	2.89	2.00	MH 3	0.015	
	177+00		0.96	0.86									683.65		684.75		686.90						
2	3	177+00	0.00	0.00	10.25	5.35	6.63	4.6	5.7	15	18.0	0.0110	683.65	5.30	6.32	0.0105	684.74	686.90	2.15	2.00	MH 3	0.015	
	final	177+00	0.96	0.86									683.45		684.56		686.70						



STORM SEWER SYSTEM

PID : 77366 Date : 03/01/2007 Project : SCI-823-0.00

Location : PORTSMOUTH, SCIOTO COUNTY

Description : STA. 180+00.00 SR 823, LHS

Designer : DL

Rainfall Area: D

Just Full Capacity Frequency (yrs.): 10

Hydraulic Gradient Frequency (yrs.): 25

Minimum Pipe Size : 15.00 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	INLET TYPE						
From	To	Σ AREA	Σ CA	TIME	INTENSITY	(cfs.)	DIAM.	LENGTH	SLOPE	IN / OUT	VELOCITY	IN / OUT	IN / OUT	IN / OUT	MINUS						
		(acres)		(min.)	(10 yrs.)	(25 yrs.)	(in.)	(ft.)	(ft./ft.)	(cfs.)	(ft./ft.)	(ft.)	(ft.)	(ft.)	HY GR	MANNING'S					
					(10 yrs.)	(25 yrs.)									CROWN	'n'					
0	1	0.38	0.34	10.00	5.39	6.64	1.8	2.3	15	65.0	0.0100	690.63	4.09	6.02	0.0016	691.18	696.43	5.25	4.55	1.3C	
	begin	0.38	0.34									689.98				690.91	693.23				0.015



STORM SEWER SYSTEM

PID : 77366 Date : 03/01/2007 Project : SCI-823-0.00

Location : PORTSMOUTH, SCIOTO COUNTY

Description : STA. 183+00.00 SR 823, RHS

Designer : DL

Rainfall Area: D

Just Full Capacity Frequency (yrs.) : 10

Hydraulic Gradient Frequency (yrs.) : 25

Minimum Pipe Size : 15.00 Tailwater Elevation (ft.): 0.00

JUNCTION	STATION	ΔAREA	ΔCA	BEGIN	RAINFALL	DISCHARGE	PIPE	F/L PIPE	MEAN	JUST FULL	FRICT	HYGR EL.	COVER	COVER	COVER	INLET TYPE					
From	To	Σ AREA	Σ CA	TIME	INTENSITY	(cfs.)	DIAM.	LENGTH	SLOPE	(ft.)	(ft./ft.)	IN / OUT	IN / OUT	IN / OUT	MINUS	MINUS					
		(acres)		(min.)	(10 yrs.)	(25 yrs.)	(in.)	(ft.)	(ft./ft.)	(cfs.)	(ft./ft.)	(ft.)	(ft.)	(ft.)	HY GR	CROWN	'n'				
0	1	183+00	0.36	0.32	10.00	5.39	6.63	1.7	2.1	15	67.3	0.0100	682.97	4.04	6.02	0.0015	683.51	688.77	5.26	4.55	I 3C
		183+00	0.36	0.32									682.30				683.21	685.55			0.015
1	2	183+00	0.00	0.00	10.28	5.34	6.60	1.7	2.1	15	148.9	0.4000	682.30	15.00	38.09	0.0015	682.51	685.55	3.04	2.00	MH 3
		183+00	0.36	0.32									622.74				623.65	625.99			0.015
2	3	183+00	0.00	0.00	10.44	5.31	6.58	1.7	2.1	15	17.0	0.0100	622.74	4.02	6.02	0.0014	623.51	625.99	2.48	2.00	MH 3
		183+00	0.36	0.32									622.57				623.48	625.82			0.015



STORM SEWER SYSTEM

PID : 77366 Date : 04/06/2007 Project : SCI-823-0.00

Location : PORTSMOUTH, SCIOTO COUNTY

Description : REACH #3; FROM 185+00 TO 186+32.39; 187+00 TO 186+32.39 (LP); RHS

Designer : DL

Rainfall Area: D

Just Full Capacity Frequency (yrs.) : 10

Hydraulic Gradient Frequency (yrs.) : 25

Minimum Pipe Size : 15.00 Tailwater Elevation (ft.): 0.00

JUNCTION	STATION	Δ AREA	Σ CA	BEGIN	RAINFALL	DISCHARGE	PIPE	DIAM.	LENGTH	SLOPE	F/L PIPE	MEAN	JUST FULL	FRICT	HYGREL.	COVER	COVER	COVER	INLET TYPE		
From	To	(acres)	(min.)	(10 yrs.)	(25 yrs.)	(10 yrs.)	(25 yrs.)	(in.)	(ft.)	(ft./ft.)	IN / OUT	VEL	CAPACITY	SLOPE	IN / OUT	IN / OUT	MINUS	MINUS	MANNING'S		
			(min.)	(10 yrs.)	(25 yrs.)	(10 yrs.)	(25 yrs.)		(ft.)	(ft./ft.)	(ft.)	(fps.)	(cfs.)	(ft./ft.)	(ft.)	(ft.)	HY GR	CROWN	'n'		
0	1	185+00	0.22	0.20	10.00	5.39	6.56	1.1	1.3	15	132.4	0.0100	680.78	3.52	6.04	0.0005	681.19	686.58	5.39	4.55	1.3C
		186+32	0.22	0.20							679.45				680.30	686.15			0.015		
0	1	187+00	0.10	0.09	10.00	5.39	6.62	0.5	0.6	15	67.6	0.0151	680.47	3.26	7.40	0.0001	680.72	686.27	5.55	4.55	1.3B
		186+32	0.32	0.29							679.45				680.23	686.15			0.015		
1	2	186+32	0.17	0.15	10.63	5.28	6.51	2.3	2.9	15	100.5	0.0600	679.45	8.34	14.75	0.0026	679.84	686.15	6.31	5.45	1.3B
		186+32	0.49	0.44							673.42				674.39	676.67			0.015		



STORM SEWER SYSTEM

PID : 77366 Date : 04/13/2007 Project : SCI-823-0.00

Description : STA. 189+00.00 SR 823, LHS Location : PORTSMOUTH, SCIOTO COUNTY

Designer : DL

Rainfall Area: D

Just Full Capacity Frequency (yrs.) : 10

Hydraulic Gradient Frequency (yrs.) : 25

Minimum Pipe Size : 15.00 Tailwater Elevation (ft.): 0.00

JUNCTION	STATION	Δ AREA	Δ CA	BEGIN	RAINFALL	DISCHARGE	PIPE	DIAM.	LENGTH	SLOPE	F/I/L	PIPE	MEAN	JUST FULL	FRICT	HYGR	EL.	COVER	COVER	INLET	TYPE	
From	To	Σ AREA	Σ CA	TIME	INTENSITY	(cfs.)	(ft.)	(in.)	(ft.)	(ft./ft.)	IN / OUT	IN / OUT	VEL	CAPACITY	SLOPE	IN / OUT	IN / OUT	IN / OUT	MINUS	MINUS	CROWN	
		(acres)		(min.)	(10 yrs.)	(25 yrs.)	(10 yrs.)	(25 yrs.)			(ft.)	(ft.)	(fps.)	(cfs.)	(ft./ft.)	(ft.)	(ft.)	(ft.)	(ft.)	(ft.)	(ft.)	'n'
0	1	0.51	0.46	10.00	5.39	6.65	2.5	3.0	15	56.0	0.0100	683.40	4.41	6.02	0.0029	684.05	688.10	4.05	3.45	1	3B	
	begin	0.51	0.46									682.84				683.82	686.09					0.015



STORM SEWER SYSTEM

PID : 77366 Date : 02/01/2007 Project : SCI-823-0.00

Location : PORTSMOUTH, SCIOTO COUNTY

Description : STA. 199+00.00 SR 823, RHS

Designer : DL

Rainfall Area: D

Just Full Capacity Frequency (yrs.) : 10

Hydraulic Gradient Frequency (yrs.) : 25

Minimum Pipe Size : 15.00 Tailwater Elevation (ft.): 0.00

JUNCTION STATION		Δ AREA	Δ CA	BEGIN	RAINFALL	DISCHARGE	PIPE	F/L PIPE	MEAN	JUST FULL	FRICT	HYGREL.	COVER	COVER	COVER	INLET TYPE					
From	To	Σ AREA	Σ CA	TIME	INTENSITY	(cfs.)	DIAM. LENGTH	SLOPE	VEL	CAPACITY	SLOPE	IN / OUT	IN / OUT	IN / OUT	MINUS	MINUS					
		(acres)		(min.)	(10 yrs.)	(25 yrs.)	(in.)	(ft./ft.)	(fps.)	(cfs.)	(ft./ft.)	(ft.)	(ft.)	(ft.)	HY GR	CROWN	'n'				
0	1	0.28	0.25	10.00	5.39	6.64	1.4	1.7	15	56.0	0.0100	711.94	3.76	6.02	0.0009	712.41	716.64	4.23	3.45	1.38	
begin	199+00	0.28	0.25									711.38				712.26	714.63				0.015



STORM SEWER SYSTEM

PID : 77366 Date : 02/01/2007 Project : SCI-823-0.00

Description : STA. 204+00.00 SR 823, LHS Location : PORTSMOUTH, SCIOTO COUNTY

Designer : DL

Rainfall Area: D

Just Full Capacity Frequency (yrs.) : 10

Minimum Pipe Size : 15.00 Tailwater Elevation (ft.): 0.00 Hydraulic Gradient Frequency (yrs.) : 25

JUNCTION	From To	Δ AREA Σ AREA (acres)	Δ CA Σ CA	BEGIN TIME (min.)	RAINFALL INTENSITY (10 yrs.) (25 yrs.)	DISCHARGE (cfs.) (10 yrs.) (25 yrs.)	PIPE DIAM. (in.)	LENGTH (ft.)	SLOPE (ft./ft.)	F/L PIPE IN / OUT (ft.)	MEAN VEL (fps.)	JUST FULL CAPACITY (cfs.)	FRICT SLOPE (ft./ft.)	HYGR EL. IN / OUT (ft.)	COVER IN / OUT (ft.)	COVER MINUS HY GR	COVER MINUS CROWN	INLET TYPE MANNING'S 'n'		
0	1	0.53	0.48	10.00	5.39	6.65	2.6	3.2	15	61.5	0.0100	727.44	4.46	6.03	0.0032	728.11	732.14	4.03	3.45	1.3B
	begin	0.53	0.48									726.82		727.81	730.07					0.015



STORM SEWER SYSTEM

PID : 77366 Date : 03/02/2007 Project : SCI-823-0.00

Location : PORTSMOUTH, SCIOTO COUNTY

Description : STA. 209+00.00 SR 823, RHS

Designer : DL

Rainfall Area: D

Just Full Capacity Frequency (yrs.): 10

Hydraulic Gradient Frequency (yrs.): 25

Minimum Pipe Size : 15.00 Tailwater Elevation (ft.): 0.00

JUNCTION	STATION	Δ AREA	Δ CA	BEGIN	RAINFALL	DISCHARGE	PIPE	F/L PIPE	MEAN	JUST FULL	FRICT	HYGREL.	COVER	COVER	INLET	TYPE							
From	To	Σ AREA	Σ CA	TIME	INTENSITY	(cfs.)	DIAM.	LENGTH	SLOPE	IN / OUT	VELOCITY	IN / OUT	IN / OUT	IN / OUT	MINUS	MANNING'S							
		(acres)		(min.)	(10 yrs.)	(25 yrs.)	(in.)	(ft.)	(ft./ft.)	(ft.)	(fps.)	(ft.)	(ft.)	(ft.)	HY GR	CROWN							
0	1	209+00	0.53	0.48	10.00	5.39	6.65	2.6	3.2	15	57.1	0.0100	741.84	4.46	6.02	0.0032	742.51	747.64	5.13	4.55	1.3B	0.015	
	begin	209+00	0.53	0.48									741.27				742.25	744.52					
1	2	209+00	0.00	0.00	10.21	5.35	6.62	2.5	3.1	15	124.4	0.5000	741.27	18.17	42.58	0.0032	741.51	744.52	3.01	2.00	MH 3	0.015	
	209+00	0.53	0.48										679.07				680.05	682.32					
2	3	209+00	0.00	0.00	10.33	5.33	6.61	2.5	3.1	15	16.8	0.0100	679.07	4.44	6.02	0.0031	679.94	682.32	2.38	2.00	MH 3	0.015	
	209+00	0.53	0.48										678.90				679.88	682.15					



STORM SEWER SYSTEM

PID : 77366 Date : 02/01/2007 Project : SCI-823-0.00 Location : PORTSMOUTH, SCIOTO COUNTY

Description : STA. 214+00.00 SR 823, LHS

Designer : DL

Rainfall Area: D Just Full Capacity Frequency (yrs.): 10 Hydraulic Gradient Frequency (yrs.): 25
 Minimum Pipe Size : 15.00 Tailwater Elevation (ft.): 0.00

JUNCTION	STATION	Δ AREA	Δ CA	BEGIN	RAINFALL	DISCHARGE	PIPE	F/L PIPE	MEAN	JUST FULL	FRICT	HYGREL.	COVER	COVER	INLET TYPE					
From	To	Σ AREA	Σ CA	TIME	INTENSITY	(cfs.)	DIAM.	LENGTH	SLOPE	IN / OUT	VEL	CAPACITY	SLOPE	IN / OUT	HY GR	MINUS	MINUS	MANNING'S		
		(acres)		(min.)	(10 yrs.)	(25 yrs.)	(10 yrs.)	(25 yrs.)	(ft./ft.)	(ft.)	(ft.)	(ft.)	(ft.)	(ft.)	(ft.)	(ft.)	(ft.)	(ft.)	'n'	
0	1	0.53	0.48	10.00	5.39	6.65	2.6	3.2	15	61.5	0.0100	758.44	4.46	6.02	0.0032	759.11	763.14	4.03	3.45	1.3B
	begin	0.53	0.48									757.83				758.81	761.08			0.015



STORM SEWER SYSTEM

PID : 77366 Date : 02/01/2007 Project : SCI-823-0.00

Location : PORTSMOUTH, SCIOTO COUNTY

Description : STA. 219+00.00 SR 823, LHS

Designer : DL

Rainfall Area: D Just Full Capacity Frequency (yrs.) : 10 Hydraulic Gradient Frequency (yrs.) : 25

Minimum Pipe Size : 15.00 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	INLET TYPE						
From	To	Σ AREA	Σ CA	TIME	INTENSITY	(cfs.)	DIAM.	LENGTH	SLOPE	IN / OUT	VEL	CAPACITY	SLOPE	IN / OUT	HY GR	MINUS	MINUS	MANNINGS			
		(acres)		(min.)	(10 yrs.)	(25 yrs.)	(in.)	(ft.)	(ft./ft.)	(ft.)	(fps.)	(cfs.)	(ft./ft.)	(ft.)	(ft.)			'n'			
0	1	219+00	0.53	0.48	10.00	5.39	6.65	2.6	3.2	15	61.5	0.0100	773.94	4.46	6.02	0.0032	774.61	778.64	4.03	3.45	1.3B
		begin	0.53	0.48									773.33				774.31	776.58			0.015



STORM SEWER SYSTEM

PID : 77366 **Date :** 02/01/2007 **Project :** SCI-823-0.00 **Location :** PORTSMOUTH, SCIOTO COUNTY
Description : STA. 224+00.00 SR 823, LHS **Designer :** DL

Rainfall Area: D **Just Full Capacity Frequency (yrs.) :** 10 **Hydraulic Gradient Frequency (yrs.) :** 25
Minimum Pipe Size : 15.00 **Tailwater Elevation (ft.):** 0.00

JUNCTION STATION		Δ AREA	Δ CA	BEGIN TIME	RAINFALL INTENSITY	DISCHARGE	PIPE DIAM.	LENGTH	SLOPE	F/I PIPE	MEAN VEL	JUST FULL CAPACITY	FRICT SLOPE	HYGR IN	EL. IN	OUT COVER	COVER MINUS	INLET TYPE			
From	To	Σ (acres)	Σ CA (acres)	(min.)	(10 yrs.) (25 yrs.)	(10 yrs.) (25 yrs.)	(in.)	(ft.)	(ft./ft.)	(ft.)	(fps.)	(cfs.)	(ft./ft.)	(ft.)	(ft.)	(ft.)	HY GR	MANNING'S 'n'			
0	1	224+00	0.53	0.48	10.00	5.39	6.65	2.6	3.2	15	61.5	0.0100	789.44	4.46	6.02	0.0032	790.11	794.14	4.03	3.45	13B
begin		224+00	0.53	0.48						788.83				789.81	792.08						0.015



STORM SEWER SYSTEM

PID : 77366 Date : 03/07/2013 Project : SCI-823-0.00 Location : PORTSMOUTH, SCIOTO COUNTY

Description : STA. 231+00, SR 823, RHS Designer : KAG

Rainfall Area: D Just Full Capacity Frequency (yrs.) : 10 Hydraulic Gradient Frequency (yrs.) : 25

Minimum Pipe Size : 15.00 Tailwater Elevation (ft.): 0.00

JUNCTION	STATION	Δ AREA	Δ CA	BEGIN TIME	RAINFALL INTENSITY	DISCHARGE	PIPE DIAM.	LENGTH	SLOPE	F/I/L PIPE	MEAN VEL	JUST FULL CAPACITY	FRICT	HYGR EL.	COVER IN / OUT	COVER MINUS HY GR	COVER MINUS CROWN	INLET TYPE		
From	To	Σ AREA (acres)	Σ CA	(min.) (10 yrs.) (25 yrs.)	(10 yrs.) (25 yrs.)	(cfs.) (10 yrs.) (25 yrs.)	(in.)	(ft.)	(ft./ft.)	(ft.)	(fps.)	(cfs.)	(ft./ft.)	(ft.)	(ft.)	(ft.)	'n'			
0	1	0.45	0.41	10.00	5.39	6.64	2.2	2.7	15	70.0	0.0119	783.73	4.56	6.56	0.0023	784.31	788.73	4.42	3.75	13C
	begin	0.45	0.41									782.90				783.85	788.73			0.015



STORM SEWER SYSTEM

PID : 77366 Date : 03/07/2013 Project : SCI-823-0.00

Location : PORTSMOUTH, SCIOTO COUNTY

Description : STA. 237+00 TO 238+00.00 SR 823

Designer : KAG

Rainfall Area: D

Just Full Capacity Frequency (yrs.): 10

Hydraulic Gradient Frequency (yrs.): 25

Minimum Pipe Size : 15.00 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	Σ AREA	Σ CA	TIME	INTENSITY	(cfs.)	DIAM. LENGTH	IN / OUT	VEL	CAPACITY	SLOPE	IN / OUT	IN / OUT	MINUS	MINUS	MANNING'S					
		(acres)		(min.)	(10 yrs.) (25 yrs.)	(10 yrs.) (25 yrs.)	(in.)	(ft.)	(fps.)	(cfs.)	(ft./ft.)	(ft.)	(ft.)	HY GR	CROWN	'n'					
0	1	237+00	0.63	0.57	10.00	5.39	6.66	3.1	3.8	15	50.0	0.0100	780.79	4.66	6.02	0.0045	781.54	785.79	4.25	3.75	13C
		237+50	0.63	0.57									780.29				781.31	785.73			0.015
1	2	237+50	0.08	0.07	10.18	5.36	6.62	3.4	4.2	15	50.0	0.0100	780.29	4.79	6.02	0.0057	781.12	785.73	4.61	4.19	13C
		238+00	0.71	0.64									779.79				780.83	785.79			0.015
2	3	238+00	0.76	0.68	10.35	5.33	6.58	7.0	8.7	18	60.0	0.0100	779.54	5.69	9.79	0.0091	780.81	785.79	4.98	4.75	13C
		238+00	1.47	1.32									778.94				780.26	785.70			0.015



STORM SEWER SYSTEM

PID : 77366 **Date :** 03/07/2013 **Project :** SCI-823-0.00 **Location :** PORTSMOUTH, SCIOTO COUNTY
Description : STA. 246+50.00 SR 823 **Designer :** KAG

Rainfall Area: D **Just Full Capacity Frequency (yrs.) :** 10 **Hydraulic Gradient Frequency (yrs.) :** 25
Minimum Pipe Size : 15.00 **Tailwater Elevation (ft.):** 0.00

JUNCTION	STATION	Δ AREA	Δ CA	BEGIN TIME	RAINFALL INTENSITY	DISCHARGE	PIPE DIAM.	LENGTH	SLOPE	F/I PIPE	MEAN VEL	JUST FULL CAPACITY	FRICT SLOPE	HYGR EL.	COVER IN / OUT	COVER MINUS HY GR	COVER MINUS CROWN	INLET TYPE	
From To		Σ (acres)	Σ CA	(min.)	(10 yrs.) (25 yrs.)	(10 yrs.) (25 yrs.)	(in.)	(ft.)	(ft./ft.)	(ft.)	(fps.)	(cfs.)	(ft./ft.)	(ft.)	(ft.)	(ft.)	'n'		
0	3	0.50	0.45	10.00	5.39	6.65	2.4	3.0	15	50.0	0.0100	799.97	4.40	6.02	0.0029	800.62	804.97	4.35	13B
	begin	0.50	0.45									799.47				800.44	804.97		0.015



STORM SEWER SYSTEM

PID : 77366 **Date :** 03/07/2013 **Project :** SCI-823-0.00 **Location :** PORTSMOUTH, SCIOTO COUNTY
Description : STA. 256+50.00 SR 823 **Designer :** KAG

Rainfall Area: D **Just Full Capacity Frequency (yrs.) :** 10 **Hydraulic Gradient Frequency (yrs.) :** 25
Minimum Pipe Size : 15.00 **Tailwater Elevation (ft.):** 0.00

JUNCTION STATION		Δ AREA	Δ CA	BEGIN TIME	RAINFALL INTENSITY	DISCHARGE	PIPE DIAM.	LENGTH	SLOPE	F/L PIPE IN / OUT	MEAN VEL	JUST FULL CAPACITY	FRICT SLOPE	HYGR EL. IN / OUT	COVER IN / OUT	COVER MINUS HY GR	COVER MINUS CROWN	INLET TYPE		
From	To	Σ (acres)	Σ CA (min.)	(10 yrs.)	(25 yrs.)	(10 yrs.)	(in.)	(ft.)	(ft./ft.)	(ft.)	(fps.)	(cfs.)	(ft./ft.)	(ft.)	(ft.)	(ft.)	'n'			
0	1	0.51	0.46	10.00	5.39	6.63	2.5	3.0	15	63.0	0.0057	833.76	3.58	4.55	0.0030	834.56	898.76	4.20	3.75	13B
	begin	0.51	0.46									833.40		834.38	898.76					0.015



STORM SEWER SYSTEM

PID : 77366 Date : 03/06/2013 Project : SCI-823-0.00 Location : PORTSMOUTH, SCIOTO COUNTY Designer : KAG
 Description : STA. 273+00.00 SR 823, RHS

Rainfall Area: D Just Full Capacity Frequency (yrs.): 10 Hydraulic Gradient Frequency (yrs.): 25
 Minimum Pipe Size : 15.00 Tailwater Elevation (ft.): 0.00

JUNCTION	STATION	Δ AREA	Δ CA	BEGIN TIME	RAINFALL INTENSITY	DISCHARGE	PIPE DIAM.	LENGTH	SLOPE	F/I/L PIPE	MEAN VEL	JUST FULL CAPACITY	FRICT SLOPE	HYGR EL.	COVER IN / OUT	COVER MINUS HY GR	COVER MINUS CROWN	INLET TYPE
From	To	Σ AREA (acres)	Σ CA	(min.)	(10 yrs.) (25 yrs.)	(cfs.) (10 yrs.) (25 yrs.)	(in.)	(ft.)	(ft./ft.)	(ft.)	(fps.)	(cfs.)	(ft./ft.)	(ft.)	(ft.)	(ft.)	'n'	
0	1	8.38	3.90	15.00	4.60	5.67	24	69.0	0.0100	821.90	7.08	21.09	0.0127	823.93	825.40	1.47	1.50	CB 8
	begin	8.38	3.90							821.21				823.05	829.36		0.015	
1	2	0.98	0.88	15.16	4.58	5.67	24	60.0	0.0200	821.20	9.79	29.83	0.0191	823.05	829.36	6.31	6.16	13C
	final	9.36	4.78							820.00				821.91	829.30		0.015	



STORM SEWER SYSTEM

PID : 77366 Date : 03/08/2013 Project : SCI-823-0.00 Location : PORTSMOUTH, SCIOTO COUNTY

Description : STA. 283+00.00 SR 823 Designer : KAG

Rainfall Area: D Just Full Capacity Frequency (yrs.) : 10 Hydraulic Gradient Frequency (yrs.) : 25

Minimum Pipe Size : 15.00 Tailwater Elevation (ft.): 0.00

JUNCTION	STATION	ΔAREA	ΔCA	BEGIN	RAINFALL	DISCHARGE	PIPE	F/L PIPE	MEAN JUST FULL	FRICT	HYGR EL.	COVER	COVER	COVER	INLET TYPE					
From	To	ΣAREA	ΣCA	TIME	INTENSITY	(cfs.)	DIAM. LENGTH	IN / OUT	VEL	CAPACITY	SLOPE	IN / OUT	IN / OUT	MINUS	MANNING'S					
	To	(acres)		(min.)	(10 yrs.)	(25 yrs.)	(in.)	(ft.)	(ft.)	(cfs.)	(ft./ft.)	(ft.)	(ft.)	HY GR	'n'					
0	1	1.00	0.90	10.00	5.39	6.66	4.9	6.0	15	64.0	0.0197	794.26	6.73	8.45	0.0115	795.08	799.26	4.18	3.75	13C
	begin	1.00	0.90									793.00				794.12	799.00			0.015



STORM SEWER SYSTEM

PID : 77366 **Date :** 03/07/2013 **Project :** SCI-823-0.00 **Location :** PORTSMOUTH, SCIOTO COUNTY
Description : FROM STA. 283+50 TO STA. 284+50, SR 823, LHS **Designer :** KAG

Rainfall Area: D **Just Full Capacity Frequency (yrs.):** 10 **Hydraulic Gradient Frequency (yrs.):** 25
Minimum Pipe Size : 15.00 **Tailwater Elevation (ft.):** 0.00

JUNCTION	STATION	ΔAREA	ΔCA	BEGIN	RAINFALL	DISCHARGE	PIPE	DIAM.	LENGTH	SLOPE	F/L PIPE	MEAN	JUST FULL	FRICT	HYGREL.	COVER	COVER	COVER	INLET TYPE	
From	To	ΣAREA	ΣCA	TIME	INTENSITY	(cfs.)	(ft.)	(in.)	(ft.)	(ft./ft.)	IN / OUT	VEL	CAPACITY	(cfs.)	(ft./ft.)	IN / OUT	IN / OUT	MINUS	MINUS	MANNING'S
		(acres)		(min.)	(10 yrs.)	(25 yrs.)	(10 yrs.)	(25 yrs.)	(ft.)	(ft./ft.)	(ft.)	(fps.)	(cfs.)	(ft./ft.)	(ft.)	(ft.)	HY GR	CROWN	'n'	
1	283+50	3.00	2.70	15.00	4.60	5.65	12.4	15.3	21	150.0	0.0230	790.45	9.05	22.40	0.0123	791.56	793.70	2.14	1.50	CB 8A
	begin		3.00	2.70							787.00					788.75	792.10			0.015
2	OUT	0.00	0.00	15.28	4.57	5.65	12.3	15.3	21	50.0	0.0100	787.00	6.46	14.77	0.0123	788.75	792.10	3.35	3.35	MH 3
	final	3.00	2.70								786.50					788.10	699.50			0.015



STORM SEWER SYSTEM

PID : 77366 Date : 03/07/2013 Project : SCI-823-0.00 Location : PORTSMOUTH, SCIOTO COUNTY

Description : STA. 293+00.00 SR 823, Designer : KAG

Rainfall Area: D Just Full Capacity Frequency (yrs.) : 10 Hydraulic Gradient Frequency (yrs.) : 25

Minimum Pipe Size : 15.00 Tailwater Elevation (ft.): 0.00

JUNCTION	STATION	Δ AREA	Δ CA	BEGIN TIME	RAINFALL INTENSITY	DISCHARGE	PIPE DIAM.	LENGTH	SLOPE	F/L PIPE IN / OUT	MEAN VEL	JUST FULL CAPACITY	FRICT SLOPE	HYGR EL. IN / OUT	COVER IN / OUT	COVER MINUS HY GR	COVER MINUS CROWN	INLET TYPE		
From To		Σ (acres)	Σ CA	(min.)	(10 yrs.) (25 yrs.)	(cfs.) (10 yrs.) (25 yrs.)	(in.)	(ft.)	(ft./ft.)	(ft.)	(fps.)	(cfs.)	(ft./ft.)	(ft.)	(ft.)			'n'		
0	1	0.85	0.77	10.00	5.39	6.66	4.1	5.1	15	50.0	0.0100	760.02	4.99	6.02	0.0083	761.02	765.02	4.00	3.75	13B
	begin	0.85	0.77								759.52			760.60	765.02					0.015



STORM SEWER SYSTEM

PID : 77366 **Date :** 03/08/2013 **Project :** SCI-823-0.00 **Location :** PORTSMOUTH, SCIOTO COUNTY
Description : STA. 303+00.00 SR 823, LHS **Designer :** KAG

Rainfall Area: D **Just Full Capacity Frequency (yrs.):** 10 **Hydraulic Gradient Frequency (yrs.):** 25
Minimum Pipe Size : 15.00 **Tailwater Elevation (ft.):** 0.00

JUNCTION	STATION	Δ AREA	Δ CA	BEGIN TIME	RAINFALL INTENSITY	DISCHARGE	PIPE DIAM.	LENGTH	SLOPE	F/L PIPE IN / OUT	MEAN VEL	JUST FULL CAPACITY	FRICT SLOPE	HYGR EL. IN / OUT	COVER IN / OUT	COVER MINUS HY GR	COVER MINUS CROWN	INLET TYPE MANNINGS 'n'		
From	To	(acres)	(acres)	(min.)	(10 yrs.) (25 yrs.)	(cfs.) (10 yrs.) (25 yrs.)	(in.)	(ft.)	(ft./ft.)	(ft.)	(fps.)	(cfs.)	(ft./ft.)	(ft.)	(ft.)	(ft.)	(ft.)			
0	3	0.50	0.45	10.00	5.39	6.65	2.4	3.0	15	50.0	0.0100	733.74	4.40	6.02	0.0029	734.39	738.74	4.35	3.75	13B
	begin	0.50	0.45								733.24			734.21	738.70					0.015



STORM SEWER SYSTEM

PID : 77366 **Date :** 03/08/2013 **Project :** SCI-823-0.00 **Location :** PORTSMOUTH, SCIOTO COUNTY
Description : STA. 313+00.00 SR 823, RHS **Designer :** KAG

Rainfall Area: D **Just Full Capacity Frequency (yrs.):** 10 **Hydraulic Gradient Frequency (yrs.):** 25
Minimum Pipe Size : 15.00 **Tailwater Elevation (ft.):** 0.00

JUNCTION	STATION	Δ AREA	Δ CA	BEGIN TIME	RAINFALL INTENSITY	DISCHARGE	PIPE DIAM.	LENGTH	SLOPE	PIPE VEL.	MEAN JUST FULL CAPACITY	FRICT HYGR EL.	COVER IN / OUT	COVER MINUS HY GR	COVER MINUS CROWN	INLET TYPE				
From To		Σ AREA (acres)	Σ CA	(min.)	(10 yrs.) (25 yrs.)	(10 yrs.) (25 yrs.)	(in.)	(ft.)	(ft./ft.)	(fps.)	(cfs.)	(ft.)	(ft.)	(ft.)	'n'					
0	1	0.50	0.45	10.00	5.39	6.65	2.4	3.0	15	50.0	0.0100	723.74	4.40	6.02	0.0029	724.39	728.74	4.35	3.75	1.3B
	begin	0.50	0.45									723.24				724.21	728.74			0.015



STORM SEWER SYSTEM

PID : 77366 **Date :** 03/08/2013 **Project :** SCI-823-0.00

Location : PORTSMOUTH, SCIOTO COUNTY

Description : STA. 323+00.00 SR 823, LHS

Designer : KAG

Rainfall Area: D

Just Full Capacity Frequency (yrs.): 10

Hydraulic Gradient Frequency (yrs.): 25

Minimum Pipe Size : 15.00

Tailwater Elevation (ft.): 0.00

JUNCTION	STATION	Δ AREA	Δ CA	BEGIN TIME	RAINFALL INTENSITY	DISCHARGE	PIPE DIAM.	LENGTH	SLOPE	F/I PIPE	MEAN VEL	JUST FULL CAPACITY	FRICT SLOPE	HYGREL.	COVER IN / OUT	COVER IN / OUT	COVER MINUS HY GR	COVER MINUS CROWN	INLET TYPE	
From	To	Σ AREA (acres)	Σ CA	(min.)	(10 yrs.) (25 yrs.)	(10 yrs.) (25 yrs.)	(in.)	(ft.)	(ft./ft.)	(ft.)	(fps.)	(cfs.)	(ft./ft.)	(ft.)	(ft.)	(ft.)	(ft.)	'n'		
0	1	0.95	0.86	10.00	5.39	6.66	4.6	5.7	15	71.0	0.0245	713.74	7.23	9.43	0.0103	714.47	718.74	4.27	3.75	13C
	begin	0.95	0.85								712.00				713.11	718.74			0.015	



STORM SEWER SYSTEM

PID : 77366 **Date :** 03/07/2013 **Project :** SCI-823-0.00 **Location :** Portsmouth, Scioto County **Designer :** KAG

Description : Sta 336+00 to 333+50

Rainfall Area: D **Just Full Capacity Frequency (yrs.) :** 10 **Hydraulic Gradient Frequency (yrs.) :** 25
Minimum Pipe Size : 15.00 **Tailwater Elevation (ft.):** 0.00

JUNCTION	STATION	ΔAREA	ΔCA	BEGIN	RAINFALL	DISCHARGE	PIPE	F/L PIPE	MEAN	JUST FULL	FRICT	HYGR EL.	COVER	COVER	INLET TYPE
From	To	Σ AREA	Σ CA	TIME	INTENSITY	(cfs.)	DIAM.	LENGTH	VEL	CAPACITY	SLOPE	IN / OUT	IN / OUT	MINUS	MANNING'S
		(acres)		(min.)	(10 yrs.)	(25 yrs.)	(in.)	(ft.)	(fps.)	(cfs.)	(ft./ft.)	(ft.)	(ft.)	HY GR	'n'
0	1	0.26	0.23	10.00	5.39	5.67	1.3	1.3	3.06	4.66	0.0006	690.47	693.90	3.43	1.3C
	begin	0.26	0.23					688.50				689.87	702.64		0.015
A	1	6.38	3.55	15.00	4.60	5.69	20.2	24	6.99	21.09	0.0106	695.35	696.70	1.35	CB 8
	begin	6.64	3.79					692.79				694.60	702.64		0.015
1	OUT	1.11	1.00	15.17	4.58	5.67	21.9	27.1	11.34	35.92	0.0191	689.87	702.64	12.77	1.3C
	final	7.75	4.79					685.60				687.50	687.00		0.015



STORM SEWER SYSTEM

PID : 77366 **Date :** 03/08/2013 **Project :** SCI-823-0.00 **Location :** PORTSMOUTH, SCIOTO COUNTY
Description : STA. 346+00.00 SR 823, LHS **Designer :** KAG

Rainfall Area: D **Just Full Capacity Frequency (yrs.):** 10 **Hydraulic Gradient Frequency (yrs.):** 25
Minimum Pipe Size : 15.00 **Tailwater Elevation (ft.):** 0.00

JUNCTION	STATION	Δ AREA	Δ CA	BEGIN TIME	RAINFALL INTENSITY	DISCHARGE	PIPE DIAM.	LENGTH	SLOPE	F/I PIPE	MEAN VEL	JUST FULL CAPACITY	FRICT	HYGREL.	COVER IN / OUT	COVER MINUS HYGR	COVER MINUS CROWN	COVER MINUS MANNING'S	INLET TYPE	
From To		Σ (acres)	Σ CA	(min.)	(10 yrs.) (25 yrs.) (10 yrs.) (25 yrs.)	(cfs.)	(in.)	(ft.)	(ft./ft.)	(ft.)	(fps.)	(cfs.)	(ft./ft.)	(ft.)	(ft.)	(ft.)	(ft.)	'n'		
0	1	1.06	0.95	10.00	5.39	6.66	5.1	6.4	15	50.0	0.0100	647.87	5.17	6.02	0.0129	649.15	652.87	3.72	3.75	13B
	begin	1.06	0.95									647.37				648.50	652.87			0.015



STORM SEWER SYSTEM

PID : 77366 **Date :** 03/08/2013 **Project :** SCI-823-0.00 **Location :** PORTSMOUTH, SCIOTO COUNTY
Description : FROM 351+50 TO 349+00 **Designer :** KAG

Rainfall Area: D **Just Full Capacity Frequency (yrs.):** 10 **Hydraulic Gradient Frequency (yrs.):** 25
Minimum Pipe Size : 15.00 **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	INLET TYPE						
From	To	Σ AREA	Σ CA	TIME	INTENSITY	(cfs.)	DIAM. LENGTH	IN / OUT	VEL	CAPACITY	SLOPE	IN / OUT	IN / OUT	MINUS	MANNING'S						
		(acres)		(min.)	(10 yrs.)	(25 yrs.)	(in.)	(ft.)	(fps.)	(cfs.)	(ft./ft.)	(ft.)	(ft.)	HY GR	'n'						
0	1	351+50	0.35	0.32	10.00	5.39	6.61	1.7	2.1	15	90.3	0.0101	642.62	4.01	6.04	0.0014	643.15	647.62	4.47	3.75	1.3B
		350+59	0.35	0.32									641.71				642.62	647.42			0.015
1	2	350+59	0.16	0.14	10.38	5.32	6.56	2.4	3.0	15	59.0	0.0100	641.71	4.40	6.02	0.0029	642.36	647.42	5.06	4.46	1.3B
		350+00	0.51	0.46									641.12				642.09	647.50			0.015
2	3	350+00	0.11	0.10	10.60	5.28	6.48	2.9	3.6	15	100.0	0.0100	641.12	4.63	6.02	0.0042	641.85	647.50	5.65	5.13	1.3B
		349+00	0.62	0.56									640.12				641.13	648.07			0.015
3	OUT	349+00	0.32	0.29	10.96	5.22	6.44	4.4	5.4	18	66.0	0.0086	639.87	4.84	9.10	0.0036	640.75	648.07	7.32	6.70	1.3C
		final	0.94	0.85									639.30				640.50	648.07			0.015



STORM SEWER SYSTEM

PID : 77366 Date : 05/29/2007 Project : SCI-823-0.00 Location : PORTSMOUTH, SCIOTO COUNTY Designer : MDC

Description : STA. 37+25.00 TO 29+61.40 US52 RAMP A, RHS

Rainfall Area: D Just Full Capacity Frequency (yrs.): 10 Hydraulic Gradient Frequency (yrs.): 25

Minimum Pipe Size : 15.00 Tailwater Elevation (ft.): 0.00

JUNCTION	STATION	ΔAREA	ΔCA	BEGIN	RAINFALL	DISCHARGE	PIPE	F/L PIPE	MEAN	JUST FULL	FRICT	HYGR EL.	COVER	COVER	INLET TYPE					
From	To	Σ AREA (acres)	Σ CA	TIME (min.)	INTENSITY (10 yrs.)	(25 yrs.) (10 yrs.)	DIAM. (in.)	LENGTH (ft.)	SLOPE (ft./ft.)	CAPACITY (cfs.)	VELOCITY (fps.)	IN / OUT (ft.)	IN / OUT (ft.)	MINUS HY GR	MINUS MANNING'S 'n'					
0	1	0.29	0.26	10.00	5.39	6.69	1.4	1.8	15	3.5	0.0100	571.96	3.80	6.02	0.0010	572.82	575.96	3.14	2.75	CB 3
	begin	0.29	0.26									571.92				572.81	574.17			0.015
1	2	0.00	0.00	10.02	5.39	6.69	1.4	1.8	15	37.6	0.5000	571.92	15.21	42.58	0.0010	572.10	574.17	2.07	1.00	MH 3
	begin	0.29	0.26									553.12				554.01	557.25			0.015
2	3	0.28	0.15	10.06	5.38	6.53	2.2	2.7	15	175.0	0.0093	553.12	4.18	5.80	0.0023	553.75	557.25	3.50	2.88	CB 2-2B
	begin	0.57	0.41									551.50				552.45	554.50			0.015
3	4	0.51	0.31	10.75	5.26	6.38	3.8	4.6	15	200.0	0.0100	551.50	4.91	6.02	0.0068	552.37	554.50	2.13	1.75	CB 2-2B
	begin	1.08	0.72									549.50				550.56	552.50			0.015
4	5	0.58	0.34	11.43	5.14	6.30	5.5	6.7	15	200.0	0.0350	549.50	8.62	11.27	0.0143	550.23	552.50	2.27	1.75	CB 2-2B
	begin	1.66	1.06									542.50				543.64	549.00			0.015
0	5	0.42	0.27	10.00	5.39	6.65	1.4	1.8	15	52.0	0.0115	543.10	4.03	6.47	0.0010	543.57	546.10	2.53	1.75	CB 2-2B
	begin	2.08	1.33									542.50				543.39	549.00			0.015
5	6	0.49	0.27	11.82	5.07	6.21	8.1	9.9	24	188.6	0.0139	541.75	6.70	24.86	0.0026	542.67	549.00	6.33	5.25	CB 2-3
	begin	2.57	1.60									539.13				540.69	546.71			0.015



STORM SEWER SYSTEM

PID : 77366 **Date :** 12/18/2007 **Project :** SCI-823-0.00 **Location :** PORTSMOUTH, SCIOTO COUNTY
Description : STA. 22+84 TO 24+50 US52 RAMP B, RHS **Designer :** DL

Rainfall Area: D **Just Full Capacity Frequency (yrs.):** 10 **Hydraulic Gradient Frequency (yrs.):** 25
Minimum Pipe Size : 15.00 **Tailwater Elevation (ft.):** 0.00

JUNCTION	STATION	ΔAREA	ΔCA	BEGIN	RAINFALL	DISCHARGE	PIPE	F/I/L	PIPE	MEAN	JUST FULL	FRICT	HYGR	EL.	COVER	COVER	COVER	INLET		
From	To	ΣAREA	ΣCA	TIME	INTENSITY	(cfs.)	DIAM.	LENGTH	SLOPE	IN / OUT	VEL	CAPACITY	SLOPE	IN / OUT	IN / OUT	IN / OUT	MINUS	MINUS	INLET	
		(acres)		(min.)	(10 yrs.)	(25 yrs.)	(in.)	(ft.)	(ft./ft.)	(ft.)	(fps.)	(cfs.)	(ft./ft.)	(ft.)	(ft.)	(ft.)	HY GR	MINUS	TYPE	
0	1	0.86	0.77	10.00	5.39	5.98	4.2	4.6	15	63.0	0.0357	537.25	8.12	11.38	0.0068	537.83	542.75	4.92	4.25	CB
	begin	0.86	0.77									535.00				536.21	537.90			0.015
1	2	0.72	0.65	13.00	4.89	5.98	7.0	8.5	18	154.4	0.0078	534.75	5.11	8.63	0.0087	536.21	537.90	1.69	1.65	CB 2-3
	24+50	1.58	1.42									533.55				534.86	537.10			0.015
2	3	0.93	0.84	13.50	4.81	5.93	10.9	13.4	24	82.5	0.0067	533.05	5.47	17.21	0.0047	534.54	537.10	2.56	2.05	CB 2-3
	final	2.51	2.26									532.50				534.16	535.00			0.015



STORM SEWER SYSTEM

PID : 77366 Date : 05/29/2007 Project : SCI-823-0.00

Location : PORTSMOUTH, SCIOTO COUNTY

Description : STA. 29+25.00, US52 RAMP B, LHS

Designer : MDC

Rainfall Area: D

Just Full Capacity Frequency (yrs.) : 10

Hydraulic Gradient Frequency (yrs.) : 25

Minimum Pipe Size : 15.00 Tailwater Elevation (ft.): 0.00

JUNCTION	STATION	Δ AREA	Δ CA	BEGIN	RAINFALL	DISCHARGE	PIPE	F/L PIPE	MEAN	JUST FULL	FRICT	HYGREL.	COVER	COVER	COVER	INLET TYPE				
From	To	Σ AREA	Σ CA	TIME	INTENSITY	(cfs.)	DIAM.	LENGTH	SLOPE	(in.)	(ft.)	(ft./ft.)	IN / OUT	IN / OUT	IN / OUT	MINUS	MANNING'S			
		(acres)		(min.)	(10 yrs.)	(25 yrs.)	(10 yrs.)	(25 yrs.)	(cfs.)	(ft.)	(ft./ft.)	(ft.)	(ft.)	(ft.)	(ft.)	HY GR	CROWN	'n'		
0	1	0.20	0.18	10.00	5.39	6.69	1.0	1.2	15	3.5	0.0100	550.03	3.42	6.02	0.0005	550.84	554.03	3.19	2.75	CB 3
	begin	0.20	0.18									550.00				550.84	552.25			0.015
1	2	0.00	0.00	10.02	5.39	6.68	1.0	1.2	15	38.0	0.5000	550.00	13.58	42.58	0.0005	550.14	552.25	2.10	1.00	MH 3
	begin	0.20	0.18									531.00				531.84	533.25			0.015
2	3	0.00	0.00	10.06	5.38	6.67	1.0	1.2	15	16.5	0.0100	531.00	3.41	6.02	0.0005	531.68	533.25	1.57	1.00	MH 3
	final	0.20	0.18									530.83				531.67	533.08			0.015



STORM SEWER SYSTEM

PID : 77366 Date : 05/29/2007 Project : SCI-823-0.00
 Description : STA. 34+70 TO 29+00 US52 RAMP B, RHS

Location : PORTSMOUTH, SCIOTO COUNTY

Designer : MDC

Rainfall Area: D Just Full Capacity Frequency (yrs.) : 10 Hydraulic Gradient Frequency (yrs.) : 25
 Minimum Pipe Size : 15.00 Tailwater Elevation (ft.): 0.00

JUNCTION	STATION	ΔAREA	ΔCA	BEGIN	RAINFALL	DISCHARGE	PIPE	DIAM.	LENGTH	SLOPE	PIPE	F/L	PIPE	MEAN	JUST FULL	FRICT	HYGR EL.	COVER	COVER	INLET	TYPE
From	To	Σ AREA	Σ CA	TIME	INTENSITY	(cfs.)	(in.)	(ft.)	(ft./ft.)	(ft.)	(ft.)	(ft.)	(ft.)	(fps.)	CAPACITY	SLOPE	IN / OUT	IN / OUT	MINUS	MINUS	MANNING'S
		(acres)	(min.)	(10 yrs.)	(25 yrs.)	(10 yrs.)	(25 yrs.)								(cfs.)	(ft./ft.)	(ft.)	(ft.)	HY GR	CROWN	'n'
0	1	1.00	0.88	10.00	5.39	6.54	4.7	5.8	15	245.0	0.0128	541.00	5.66	6.81	0.0105	541.93	544.50	2.57	2.25	CB 2-2B	0.015
	begin	1.00	0.88									537.87				538.98	541.45				
0	1	0.62	0.56	10.00	5.39	6.69	3.0	3.7	15	56.0	0.3768*	558.97	17.25	36.97	0.0044	559.25	562.97	3.72	2.75	CB 3	0.015
	begin	1.62	1.44									537.87				538.89	541.45				
1	2	0.35	0.25	10.72	5.26	6.43	8.9	10.8	24	175.0	0.0095	537.12	5.97	20.54	0.0030	538.20	541.45	3.25	2.33	CB 2-3	0.015
	30+50	1.97	1.68									535.46				537.05	538.70				
2	3	0.53	0.37	11.21	5.18	6.32	10.6	13.0	24	150.0	0.0242	535.46	8.83	32.81	0.0044	536.37	538.70	2.33	1.24	CB 2-3	0.015
	29+00	2.50	2.05									531.83				533.51	535.90				
3	4	4.00	3.40	11.49	5.13	6.32	28.0	34.5	36	125.5	0.0099	531.83	8.07	61.81	0.0035	533.51	535.90	2.39	1.07	CB 2-4	0.015
	29+00	6.50	5.45									530.59				533.04	535.90				

* SLOPE FROM CB TO CB (THE BEND IS NOT MODELED)



STORM SEWER SYSTEM

PID : 77366 Date : 06/04/2007 Project : SCI-823-0.00

Location : PORTSMOUTH, SCIOTO COUNTY

Description : 44+50 TO 43+10.93; US52 RAMP B, TO 21+65; CR503

Designer : DL

Rainfall Area: D

Just Full Capacity Frequency (yrs.) : 10

Hydraulic Gradient Frequency (yrs.) : 25

Minimum Pipe Size : 15.00

Tailwater Elevation (ft.): 0.00

JUNCTION	STATION	Δ AREA	Δ CA	BEGIN	RAINFALL	DISCHARGE	PIPE	F/I PIPE	MEAN	JUST FULL	FRICT	HYGREL.	COVER	COVER	INLET TYPE						
From	To	Σ AREA	Σ CA	TIME	INTENSITY	(cfs.)	DIAM.	LENGTH	VEL	CAPACITY	SLOPE	IN / OUT	IN / OUT	MINUS	MANNING'S						
		(acres)		(min.)	(10 yrs.)	(25 yrs.)	(in.)	(ft.)	(fps.)	(cfs.)	(ft./ft.)	(ft.)	(ft.)	HY GR	'n'						
0	1	44+50	0.13	0.09	15.00	4.60	5.65	0.4	0.5	15	68.4	0.0110	586.15	2.77	6.31	0.0001	586.40	590.15	3.75	2.75	CB 8
		44+50	0.13	0.09									585.40				586.16	589.45			0.015
1	2	44+50	0.27	0.22	15.41	4.55	5.57	1.4	1.7	15	137.7	0.0150	585.40	4.39	7.38	0.0009	585.83	589.45	3.62	2.80	CB 8
		43+10	0.40	0.31									583.33				584.22	587.35			0.015
2	3	43+10	0.04	0.03	15.93	4.48	5.56	1.5	1.9	15	57.8	0.5000	583.33	15.63	42.58	0.0012	583.52	587.35	3.83	2.77	CB 8
		42+53	0.43	0.34									554.41				555.31	557.66			0.015
3	4	42+53	0.00	0.00	16.00	4.47	5.51	1.5	1.9	15	63.2	0.0100	554.41	3.89	6.02	0.0011	554.91	557.66	2.75	2.00	MH 3
		24+00	0.43	0.34									553.78				554.68	557.90			0.015
4	5	24+00	0.13	0.09	16.27	4.44	5.51	1.9	2.4	15	6.0	0.0100	553.78	4.13	6.02	0.0018	554.67	557.90	3.23	2.87	CB 2-3
		24+00	0.56	0.43									553.72				554.65	559.04			0.015
0	7	26+50	4.12	2.15	10.00	5.39	6.63	11.6	14.2	24	123.0	0.0100	554.25	6.49	21.09	0.0053	555.51	557.25	1.74	1.00	CB 2-3
		25+27	4.68	2.58									553.02				554.70	558.10			0.015
7	8	25+27	0.18	0.12	10.32	5.33	6.62	12.1	15.0	24	7.8	0.0090	553.02	6.30	19.98	0.0058	554.69	558.10	3.41	3.08	CB 2-3
		25+27	4.86	2.70									552.95				554.65	558.88			0.015
8	5	25+27	0.01	0.01	10.34	5.33	6.55	12.1	14.9	24	127.0	0.0094	552.95	6.42	20.50	0.0058	554.28	558.88	4.60	3.93	CB 3A
		24+00	4.87	2.71									551.75				553.45	559.04			0.015



STORM SEWER SYSTEM

JUNCTION	STATION	From To	Δ AREA Σ AREA (acres)	Δ CA Σ CA (min.)	BEGIN TIME (10 yrs.)	RAINFALL INTENSITY (25 yrs.)	DISCHARGE (cfs.)	(10 yrs.)	(25 yrs.)	PIPE DIAM. (in.)	LENGTH (ft.)	SLOPE (ft./ft.)	F/L PIPE IN / OUT (ft.)	MEAN VEL (fps.)	JUST FULL CAPACITY (cfs.)	FULL SLOPE (ft./ft.)	FRICT HYGREL. IN / OUT (ft.)	COVER IN / OUT (ft.)	COVER MINUS HY GR 'n'	COVER MINUS MANNING'S 'n'	INLET TYPE	
																						5
			4.94	2.77									549.99				551.69	560.03		0.015		
9	10	21+65	0.11	0.10	16.96	4.36	5.40	12.5	15.5	24	23.0	0.0096	549.99	6.49	20.63	0.0062	551.62	560.03	8.41	8.04	CB 3	
		final	5.05	2.87									549.77				551.48	553.77		0.015		



STORM SEWER SYSTEM

PID : 77366 Date : 05/30/2007 Project : SCI-823-0.00
 Description : STA. 47+00; US52 RAMP B, RHS

Location : PORTSMOUTH, SCIOTO COUNTY

Designer : DL

Rainfall Area: D Just Full Capacity Frequency (yrs.) : 10 Hydraulic Gradient Frequency (yrs.) : 25
 Minimum Pipe Size : 15.00 Tailwater Elevation (ft.): 0.00

JUNCTION	STATION	Δ AREA	Δ CA	BEGIN	RAINFALL	DISCHARGE	PIPE	DIAM.	LENGTH	SLOPE	PIPE	F/I L	PIPE	MEAN	JUST FULL	FRICT	HYGREL.	COVER	COVER	INLET	TYPE
From	To	Σ AREA	Σ CA	TIME	INTENSITY	(cfs.)	(ft.)	(in.)	(ft.)	(ft./ft.)	(ft.)	IN / OUT	IN / OUT	VEL	CAPACITY	SLOPE	IN / OUT	IN / OUT	MINUS	MINUS	MANNING'S
		(acres)		(min.)	(10 yrs.)	(25 yrs.)	(10 yrs.)	(25 yrs.)	(ft.)	(ft./ft.)	(ft.)	(ft.)	(ft.)	(fps.)	(cfs.)	(ft./ft.)	(ft.)	(ft.)	HY GR	CROWN	'n'
0	1	0.08	0.07	10.00	5.39	6.63	0.4	0.5	15	46.2	0.0100	590.56	590.86	2.62	6.03	0.0001	590.86	594.40	3.54	2.59	CB 2-3
	begin	0.08	0.07									590.10	590.86				590.86	593.35			0.015



STORM SEWER SYSTEM

PID : 77366 **Date :** 06/19/2007 **Project :** SCI-823-0.00 **Location :** PORTSMOUTH, SCIOTO COUNTY
Description : STA. 8+50 to 11+36.71, SR 140, RHS **Designer :** MDC

Rainfall Area: D **Just Full Capacity Frequency (yrs.):** 10 **Hydraulic Gradient Frequency (yrs.):** 25
Minimum Pipe Size : 15.00 **Tailwater Elevation (ft.):** 1.00

JUNCTION STATION		ΔAREA	ΔCA	BEGIN	RAINFALL	DISCHARGE	PIPE	F/L PIPE	MEAN	JUST FULL	FRICT	HYGREL.	COVER	COVER	INLET TYPE					
From	To	Σ AREA (acres)	Σ CA (cfs.)	TIME (min.)	INTENSITY (10 yrs.) (25 yrs.) (10 yrs.) (25 yrs.)	(cfs.)	DIAM. (in.)	LENGTH (ft.)	SLOPE (ft./ft.)	VEL (fps.)	CAPACITY (cfs.)	SLOPE (ft./ft.)	IN / OUT (ft.)	OUT (ft.)	MINUS HY GR	MINUS CROWN	MANNINGS 'n'			
0	1	80.23	36.10	15.00	4.60	5.71	166.2	206.2	60	38.0	0.0076	551.62	13.47	265.14	0.0053	556.08	557.62	1.54	1.00	HW Half He
	begin	80.23	36.10							551.33		555.88		557.69						0.012
1	2	0.00	0.00	15.05	4.60	5.68	166.0	204.9	60	168.0	0.0075	551.33	13.38	262.84	0.0053	555.49	557.69	2.20	1.36	MH 3
	9+30	80.23	36.10							550.07		554.61		556.41						0.012
2	3	0.00	0.00	15.26	4.57	5.67	165.0	204.5	60	77.0	0.0429	550.07	25.58	628.32	0.0052	552.17	556.41	4.24	1.34	MH 3
	8+50	80.23	36.10							546.77		551.77		553.09						0.012
0	3	101.5	45.68	15.00	4.60	5.67	210.3	256.8	60	100.0	0.0053	547.30	11.91	220.96	0.0084	552.61	554.30	1.69	2.00	HW Half He
	begin	181.73	81.78							546.77		551.77		553.09						0.012
3	4	0.00	0.00	15.31	4.56	5.67	373.2	463.3	66	14.0	0.0114	546.27	18.64	418.35	0.0162	551.77	553.09	1.32	1.32	MH 3
	8+50	181.73	81.78							546.11		551.52		553.68						0.012
	final																			



STORM SEWER SYSTEM

PID : 77366 **Date :** 05/24/2007 **Project :** SCI-823-0.00 **Location :** PORTSMOUTH, SCIOTO COUNTY
Description : STA. 13+60.00, SR 140, RHS **Designer :** DL

Rainfall Area: D **Just Full Capacity Frequency (yrs.):** 10 **Hydraulic Gradient Frequency (yrs.):** 25
Minimum Pipe Size : 15.00 **Tailwater Elevation (ft.):** 0.00

JUNCTION STATION		Δ AREA	Δ CA	BEGIN TIME	RAINFALL INTENSITY	DISCHARGE	PIPE DIAM.	LENGTH	SLOPE	F/I PIPE IN / OUT	MEAN VEL	JUST FULL CAPACITY	FRICT SLOPE	HYGR EL. IN / OUT	COVER IN / OUT	COVER MINUS HY GR	INLET TYPE				
From	To	Σ (acres)	Σ (acres)	(min.)	(10 yrs.) (25 yrs.)	(cfs.) (10 yrs.) (25 yrs.)	(in.)	(ft.)	(ft./ft.)	(ft.)	(fps.)	(cfs.)	(ft./ft.)	(ft.)	(ft.)		'n'				
0	1	13+60	0.13	0.12	10.00	5.39	6.69	0.6	0.8	15	5.8	0.0100	560.18	3.01	6.02	0.0002	560.92	564.18	3.26	2.75	CB 3
		13+60	0.13	0.12						560.12				560.92	563.37						0.015
1	2	13+60	0.00	0.00	10.03	5.39	6.69	0.6	0.8	15	8.4	0.5000	560.12	11.83	42.58	0.0002	560.24	563.37	3.13	2.00	MH 3
		13+60	0.13	0.12						555.92				556.72	559.17						0.015
2	3	13+60	0.00	0.00	10.04	5.38	6.68	0.6	0.8	15	7.1	0.0100	555.92	3.03	6.02	0.0002	556.65	559.17	2.52	2.00	MH 3
		13+60	0.13	0.12						555.85				556.65	559.10						0.015



STORM SEWER SYSTEM

PID : 77366 Date : 03/11/2013 Project : SCI-823-0.00 Location : PORTSMOUTH, SCIOTO COUNTY
 Description : FROM 32+50 PERS North Designer : KAG

Rainfall Area: D Just Full Capacity Frequency (yrs.) : 10 Hydraulic Gradient Frequency (yrs.) : 25
 Minimum Pipe Size : 12.00 Tailwater Elevation (ft.) : 0.00

JUNCTION	STATION	ΔAREA	ΔCA	BEGIN	RAINFALL	DISCHARGE	PIPE	DIAM.	LENGTH	SLOPE	F/I	PIPE	MEAN	JUST	FULL	FRICT	HYGREL.	COVER	COVER	COVER	INLET	TYPE	
From	To	ΣAREA	ΣCA	TIME	INTENSITY	(cfs.)	(ft.)	(in.)	(ft.)	(ft./ft.)	IN	OUT	VEL	CAPACITY	SLOPE	(ft./ft.)	IN	OUT	IN	OUT	MINUS	MINUS	MANNING'S
		(acres)		(min.)	(10 yrs.)	(25 yrs.)	(10 yrs.)	(25 yrs.)	(ft.)	(ft./ft.)	(ft.)	(ft.)	(fps.)	(cfs.)	(ft./ft.)	(ft.)	(ft.)	(ft.)	HY GR	COVER	MINUS	MINUS	'n'
34	OUT	1.42	0.99	15.00	4.60	5.68	4.6	5.6	15	65.0	0.0108	546.44	5.24	6.25	0.0102	547.51	552.27	4.76	4.58	552.27	552.27	4.58	0.015
	begin	1.42	0.99									545.74				546.85							CB 2-2A



STORM SEWER SYSTEM

PID : 77366 **Date :** 03/11/2013 **Project :** SCI-823-0.00 **Location :** PORTSMOUTH, SCIOTO COUNTY
Description : FROM CSXT DITCH 113+00 TO 111+50 LT **Designer :** KAG

Rainfall Area: D **Just Full Capacity Frequency (yrs.):** 10 **Hydraulic Gradient Frequency (yrs.):** 25

Minimum Pipe Size : 12.00 **Tailwater Elevation (ft.):** 0.00

JUNCTION STATION		Δ AREA	Δ CA	BEGIN TIME	RAINFALL INTENSITY	DISCHARGE	PIPE DIAM.	LENGTH	SLOPE	F/I L PIPE	MEAN VEL	JUST FULL CAPACITY	FRICT SLOPE	HYGR EL.	COVER IN / OUT	COVER MINUS HY GR	COVER MINUS CROWN	COVER INLET TYPE			
From	To	Σ (acres)	Σ CA	(min.)	(10 yrs.) (25 yrs.) (10 yrs.) (25 yrs.)	(cfs.)	(in.)	(ft.)	(ft./ft.)	(ft.)	(fps.)	(cfs.)	(ft./ft.)	(ft.)	(ft.)	(ft.)	(ft.)				
1	OUT	0.10	0.07	15.00	4.60	5.69	0.3	0.4	12	65.0	0.1785	581.60	7.01	14.03	0.0002	581.72	570.63	584.60	2.88	2.00	CB 2-2A
	begin	0.10	0.10	0.07								570.00				578.00					0.015

APPENDIX D

Culvert Analysis

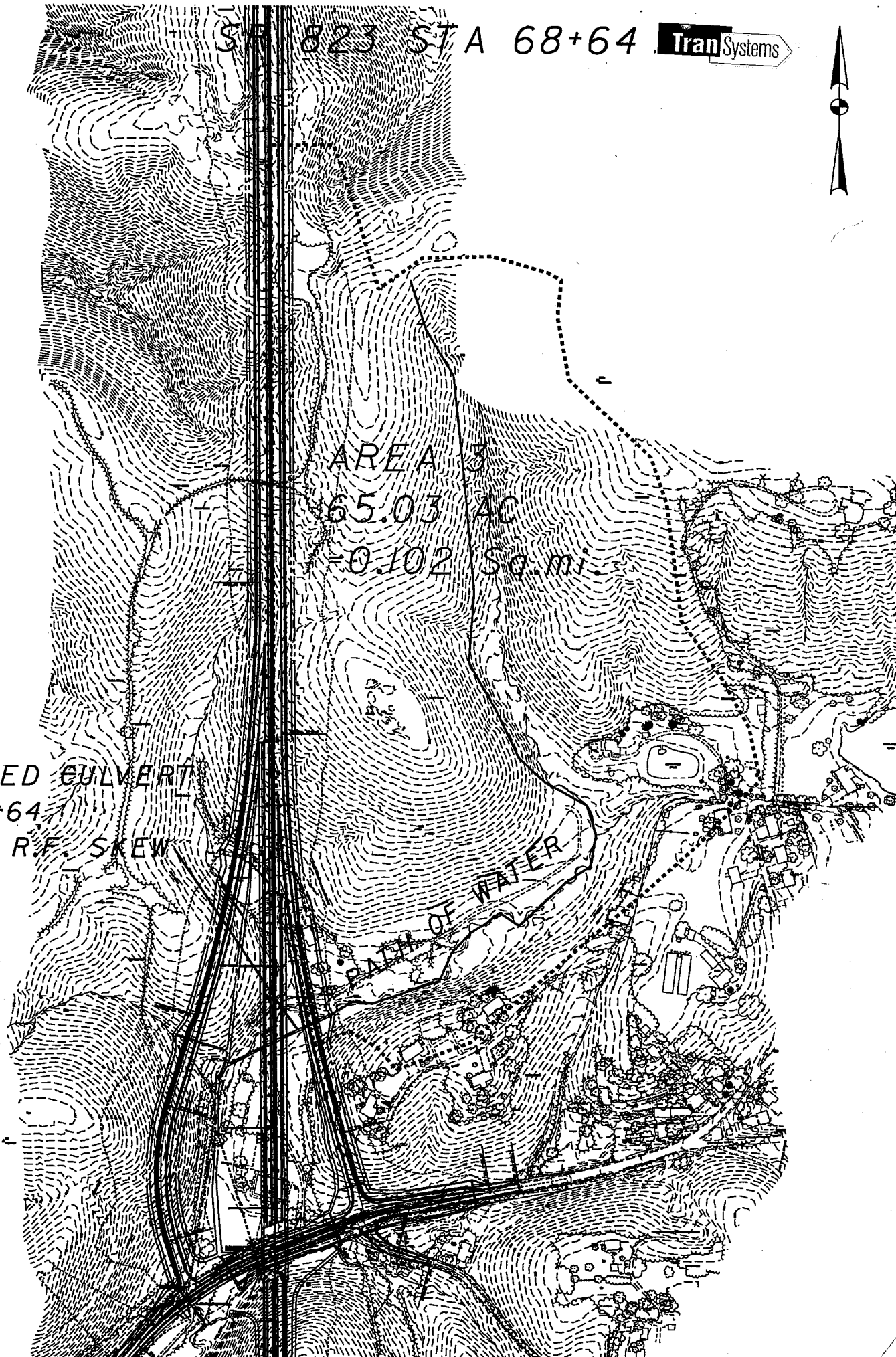


AREA 3
65.03 AC
= 0.102 SQ. MI.

PROPOSED CULVERT
STA 68+64
@ 26.0° R.F. SKEW

PAVE OF WATER

1"=400'



SR823 STA. 68+64.00
TECHNIQUES FOR ESTIMATING FLOOD-PEAK
DISCHARGES OF RURAL, UNREGULATED STREAMS IN OHIO AREA A
 U.S. GEOLOGICAL SURVEY Water Resources Investigations Report 89-4126

	Values	Units	Definitions
	2832542.00	SQ. FT.	
	0.102	SQ. MI.	CONTDA = Contributing Drainage Area
	0.00	SQ. FT.	
	0.00	%	STORAGE = Storage Area
	1378.00	FT.	TOTAL CHANNEL LENGTH
	137.80	FT.	L ₁₀ = 10% of the Distance along channel
	585	FT.	Elev ₁₀ = Elevation at point L ₁₀
	1171.30	FT.	L ₈₅ = 85% of the Distance along channel
	754	FT.	Elev ₈₅ = Elevation at point L ₈₅
	1033.50	FT.	Length = L ₈₅ - L ₁₀
	862.37	FT./MI.	SLOPE = (Elev ₁₀ -Elev ₈₅)/Length
		CFS	Q _# = Flood-Peak Discharge
			# = Frequency of Storm
Q ₂	30.01	CFS	= 56.1(CONTDA) ^{0.782} (SLOPE) ^{0.172} (STORAGE+1) ^{-0.297}
Q ₅	64.86	CFS	= 84.5(CONTDA) ^{0.769} (SLOPE) ^{0.221} (STORAGE+1) ^{-0.322}
Q ₁₀	94.32	CFS	= 104(CONTDA) ^{0.764} (SLOPE) ^{0.244} (STORAGE+1) ^{-0.335}
Q ₂₅	135.16	CFS	= 129(CONTDA) ^{0.760} (SLOPE) ^{0.264} (STORAGE+1) ^{-0.347}
Q ₅₀	169.33	CFS	= 148(CONTDA) ^{0.757} (SLOPE) ^{0.276} (STORAGE+1) ^{-0.355}
Q ₁₀₀	203.52	CFS	= 167(CONTDA) ^{0.756} (SLOPE) ^{0.285} (STORAGE+1) ^{-0.363}

Worksheet for SR 823 STA 68+64

Project Description

Friction Method Manning Formula
Solve For Normal Depth

Input Data

Roughness Coefficient	0.040	
Channel Slope	0.03400	ft/ft
Left Side Slope	2.00	ft/ft (H:V)
Right Side Slope	2.00	ft/ft (H:V)
Bottom Width	10.00	ft
Discharge	169.30	ft ³ /s

Results

Normal Depth	1.62	ft
Flow Area	21.40	ft ²
Wetted Perimeter	17.23	ft
Top Width	16.47	ft
Critical Depth	1.82	ft
Critical Slope	0.02203	ft/ft
Velocity	7.91	ft/s
Velocity Head	0.97	ft
Specific Energy	2.59	ft
Froude Number	1.22	
Flow Type	Supercritical	

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	1.62	ft
Critical Depth	1.82	ft
Channel Slope	0.03400	ft/ft
Critical Slope	0.02203	ft/ft



UNIVERSAL CULVERT DESIGN

PID : 77356 **Date :** 11/30/2011 **Project :** SR 823 Portsmouth Bypass **Location :** Portsmouth Ohio **Designer :** KAG

Description : Drainage area 3, Sta. 68+64

HEADWATER CONTROL CODES:

- INLET - Inlet Control.
- OUTLET - Outlet Control.
- OUTLET* - Outlet Control with backwater curve used to compute headwater. See Figure III - 7E in HDS 5 for type flow.
- OUTLET** - Outlet Control - See Figure III - 7D in HDS 5 for type flow.
- N/A - Flow is supercritical with low headwater and low tailwater. Control Section is at the inlet.

Inlet Invert Elevation (ft.) : 576.58 **Outlet Invert Elevation (ft.) :** 566.58 **Tailwater Elevation (ft.) :** 568.16 **Overflow Elevation (ft.) :** 593.41
Allowable Headwater Elevation (ft.) : 591.41 or Diameter + 2 ft. *(whichever is less)*
Pipe Length (ft.) : 330.00 **Culvert Slope (ft./ft.) :** 0.0303 **Design Manning 'n' :** 0.0120
Design Discharge (cfs) : 169.33 @ 50 yrs. **Flood Discharge (cfs) :** 203.52 @ 100 yrs.

FLOW (cfs.)	PIPE #	CULVERT SIZE	HWI (ft.)	HWO (ft.)	FLOW TYPE	VELOCITY (fps.)	DN (ft.)	DC (ft.)	MANNING N	HEADWATER CONTROL	OVERFLOW (cfs.)	DESIGN CODE	BURIAL DEPTH (ft.)
169.33	1	60 in.	582.39	N/A	1 - C	22.71	2.02	3.73	0.0120	INLET	0.00	D	0.00
169.33	1	54 in.	583.23	574.91	2 - E	22.79	2.13	3.79	0.0120	INLET	0.00	D - 1	0.00
169.33	1	48 in.	584.98	577.71	2 - E	22.74	2.29	3.72	0.0120	INLET	0.00	D - 2	0.00
169.33	1	66 in.	581.97	N/A	1 - C	22.57	1.94	3.64	0.0120	INLET	0.00	D + 1	0.00
203.52	1	60 in.	583.40	574.82	2 - E	23.85	2.24	4.07	0.0120	INLET	0.00	F	0.00
203.52	1	54 in.	584.78	576.91	2 - E	23.87	2.38	4.06	0.0120	INLET	0.00	F - 1	0.00
203.52	1	48 in.	587.43	581.01	2 - E	23.67	2.59	3.86	0.0120	INLET	0.00	F - 2	0.00
203.52	1	66 in.	582.71	N/A	1 - C	23.74	2.14	3.99	0.0120	INLET	0.00	F + 1	0.00

CULVERT TYPE : CIRCULAR SMOOTH **Entrance Type :** Half Headwall **Entrance Loss (Ke) :** 0.20

CULVERT TYPE : CIRCULAR CORRUGATED **Entrance Type :** Half Headwall **Entrance Loss (Ke) :** 0.90

Corrugated Metal Pipe (2 2/3 x 1/2 in. corrugations)

169.33	1	60 in.	583.37	577.56	2 - E	13.85	2.98	3.73	0.0232	INLET	0.00	D	0.00
--------	---	--------	--------	--------	-------	-------	------	------	--------	-------	------	---	------

H 7 1/2 up size

Main line culvert upsize
1 ft → 2 pipe sizes
60 + 12 = 72"



UNIVERSAL CULVERT DESIGN

FLOW PIPE #	CULVERT SIZE	HWI (ft.)	HWO (ft.)	FLOW TYPE	VELOCITY (fps.)	DN (ft.)	DC (ft.)	MANNING N	HEADWATER CONTROL	OVER FLOW (cfs.)	DESIGN CODE	BURIAL DEPTH (ft.)
169.33 1	54 in.	585.07	581.88	2 - E	13.56	3.30	3.79	0.0233	INLET	0.00	D - 1	0.00
169.33 1	48 in.	588.05	590.70	2 - F	13.89	4.00	3.72	0.0235	OUTLET**	0.00	D - 2	0.00
→ 169.33 1	66 in.	582.48	N/A	1 - C	13.95	2.80	3.64	0.0231	INLET	0.00	D + 1	0.00
203.52 1	60 in.	585.07	580.67	2 - E	14.38	3.39	4.07	0.0232	INLET	0.00	F	0.00
203.52 1	54 in.	587.58	586.98	2 - E	12.80	4.50	4.06	0.0233	INLET	0.00	F - 1	0.00
180.12 1	48 in.	591.59	599.77	2 - F	14.66	4.00	3.78	0.0235	OUTLET**	23.40	F - 2	0.00
→ 203.52 1	66 in.	583.62	577.30	2 - E	14.58	3.13	3.99	0.0231	INLET	0.00	F + 1	0.00
Corrugated Metal Pipe (3 x 1 in. corrugations)												
169.33 1	60 in.	583.37	579.17	2 - E	12.24	3.32	3.73	0.0271	INLET	0.00	D	0.00
169.33 1	54 in.	585.07	584.80	2 - E	11.64	3.87	3.79	0.0273	INLET	0.00	D - 1	0.00
159.93 1	48 in.	588.05	596.20	2 - F	13.25	4.00	3.67	0.0275	OUTLET**	9.40	D - 2	0.00
→ 169.33 1	66 in.	582.48	N/A	1 - C	12.42	3.07	3.64	0.0269	INLET	0.00	D + 1	0.00
203.52 1	60 in.	585.07	582.99	2 - E	12.59	3.84	4.07	0.0271	INLET	0.00	F	0.00
203.52 1	54 in.	587.58	591.19	2 - F	13.48	4.50	4.06	0.0273	OUTLET**	0.00	F - 1	0.00
159.92 1	48 in.	591.59	607.72	2 - F	13.25	4.00	3.67	0.0275	OUTLET**	43.60	F - 2	0.00
→ 203.52 1	66 in.	583.62	578.65	2 - E	12.94	3.46	3.99	0.0269	INLET	0.00	F + 1	0.00
Corrugated Metal Pipe (6 x 2 in. corrugations)												
169.33 1	66 in.	582.48	N/A	1 - C	10.60	3.51	3.64	0.0330	INLET	0.00	D	0.00
169.33 1	60 in.	583.37	583.61	2 - F	10.78	3.91	3.73	0.0332	OUTLET*	0.00	D - 1	0.00
169.33 1	72 in.	582.01	N/A	1 - C	10.74	3.27	3.54	0.0327	INLET	0.00	D + 1	0.00
203.52 1	66 in.	583.62	584.13	2 - F	11.01	4.02	3.99	0.0330	OUTLET*	0.00	F	0.00
203.52 1	60 in.	585.07	587.35	2 - F	11.90	5.00	4.07	0.0332	OUTLET**	0.00	F - 1	0.00
203.52 1	72 in.	582.83	N/A	1 - C	11.20	3.68	3.90	0.0327	INLET	0.00	F + 1	0.00
Corrugated Metal Pipe (6 x 2 in. corrugations, Field Paved Invert)												



UNIVERSAL CULVERT DESIGN

FLOW (cfs.)	PIPE #	CULVERT SIZE	HWI (ft.)	HWO (ft.)	FLOW TYPE	VELOCITY (fps.)	DN (ft.)	DC (ft.)	MANNING N	HEADWATER CONTROL	OVER FLOW (cfs.)	DESIGN CODE	BURIAL DEPTH (ft.)
169.33	1	60 in.	583.37	578.69	2 - E	12.66	3.22	3.73	0.0260	INLET	0.00	D	0.00
→ 169.33	1	66 in.	582.48	N/A	1 - C	12.75	3.00	3.64	0.0260	INLET	0.00	D + 1	0.00
203.52	1	60 in.	585.07	582.30	2 - E	13.06	3.70	4.07	0.0260	INLET	0.00	F	0.00
→ 203.52	1	66 in.	583.62	578.31	2 - E	13.29	3.38	3.99	0.0260	INLET	0.00	F + 1	0.00



CULVERT ANALYSIS

PID : 77356 **Date :** 12/02/2011 **Project :** SR 823, Portsmouth Bypass **Location :** Portsmouth, Ohio
Description : Drainage 3, Sta. 68+64

Designer : KAG

HEADWATER CONTROL CODES:

- INLET - Inlet Control.
- OUTLET - Outlet Control.
- OUTLET* - Outlet Control with backwater curve used to compute headwater. See Figure III - 7E in HDS 5 for type flow.
- OUTLET** - Outlet Control - See Figure III - 7D in HDS 5 for type flow.
- N/A - Flow is supercritical with low headwater and low tailwater. Control Section is at the inlet.

Pipe Number : 1 **Use HW :** 0 **Inlet Invert Elevation (ft.) :** 576.58 **Outlet Invert Elevation (ft.) :** 566.58
Pipe Quantity : 1

Culvert Type : Circular Corrugated **Pipe Length (ft.) :** 330.00 **Culvert Slope (ft./ft.) :** 0.0303
Corrugation Type : Corrugated Metal Pipe (6 x 2 in. corrugations, Field Paved Invert)
Pipe Size : 72 in.

Design Manning 'n' : (default)

Entrance Type : Half Headwall **Loss Coef. Ke :** 0.9000

FLOW LOSS (cfs.)	HEAD (ft.)	HWI (ft.)	HWO (ft.)	FLOW TYPE	VELOCITY (fps.)	DN (ft.)	DC (ft.)	MANNING N	HEADWATER CONTROL	BURIED DEPTH (ft.)	TAILWATER ELEVATION (ft.)
169.30	10.66	582.01	N/A	1 - C	12.76	2.86	3.54	0.0260	INLET	0.00	566.58
203.50	11.30	582.83	N/A	1 - C	13.36	3.18	3.90	0.0260	INLET	0.00	566.58

Culvert Material Selection as per ODOI

updated 04/11/2005

Input Variables for Round Conduit

pH ranges from 3 to 9.5 pH= 7.5 Required for all durability

Enter "a" for abrasive or "n" for non-abrasive Site Conditions= a

50 or 75 years Service Life= 75

Pipe Slope (%)= 3.10 Required for Concrete durability

Pipe Diameter (in)= 66

Maximum Height of Fill= 24.0 Required for Structural Design

Instructions for Use:

This spreadsheet will determine the available material options based upon ODOT durability tables and ODOT structural tables for round conduit.

Not all available options will apply to each situation and it is the users responsibility to verify each alternative is valid.

Notes:
 *** Concrete field paving shall be epoxy coated per 706.03 for pH < 5.0

** Externally coated per AASHTO M243

Sta 68+64

Metal Pipe Description	Material	Req. Gauge per Durability	Thickness per Durability (Inches)	Req. Gauge per Structural	Thickness per Structural (Inches)
Galvanized	707.01	n/a	n/a	10	0.138
Aluminized	707.01	10	0.138	10	0.138
Galvanized	707.02	n/a	n/a	16	0.064
Aluminized	707.02	10	0.138	16	0.064
Galvanized - W/CFPP	707.02 W/CFPP	16	0.064	16	0.064
Structural Plate	707.03	1	0.28	12	0.109
Structural Plate W/CFPP	707.03 W/CFPP	12	0.109	12	0.109
Polymer Coated	707.04 (0.5" corr.)	14	0.079	10	0.138
Polymer Coated	707.04 (1" corr.)	14	0.079	16	0.064
Polymer Coated- Asphalt Coated and Paved	707.04 (0.5" corr.)	16	0.064	10	0.138
Polymer Coated- Asphalt Coated and Paved	707.04 (1" corr.)	16	0.064	16	0.064
Aluminized- Asphalt Coated and Paved	707.05 ≤ 48"	14	0.079	10	0.138
Aluminized- Asphalt Coated and Paved	707.05 > 54"	12	0.109	10	0.138
Galvanized-Asphalt Coated and Paved	707.05 ≤ 48"	n/a	n/a	10	0.138
Galvanized-Asphalt Coated and Paved	707.05 > 54"	n/a	n/a	10	0.138
Aluminized- Asphalt Coated and Paved	707.07 ≤ 48"	14	0.079	10	0.138
Aluminized- Asphalt Coated and Paved	707.07 > 54"	12	0.109	10	0.138
Galvanized-Asphalt Coated and Paved	707.07 ≤ 48"	n/a	n/a	16	0.064
Galvanized-Asphalt Coated and Paved	707.07 > 54"	n/a	n/a	16	0.064
Aluminum Pipe	707.21 (0.5" corr.)	min W/CFPP	use min		0.164
Aluminum Pipe	707.22 (1.0" corr.)	min W/CFPP	use min		0.105
Structural Plate Aluminum Pipe	707.23	min W/CFPP	use min		0.100

no concrete height
 velocity

Concrete Pipe Material Options as per Durability Requirements			
Concrete Pipe Description	Material	Min pH	Epoxy Coated Required?
Concrete Conduit	706.02	4.1	No
D-Load Test Required for Concrete Pipe			
Concrete Pipe Description	Material	D-Load Required	Is Minimum D-Load Allowable?
Concrete Conduit	706.02	2000	No

AREA 5
17.3 AC
= 0.027 Sq.mi.



PROPOSED CULVERT
STA 110+02
6° L.F. SKEW

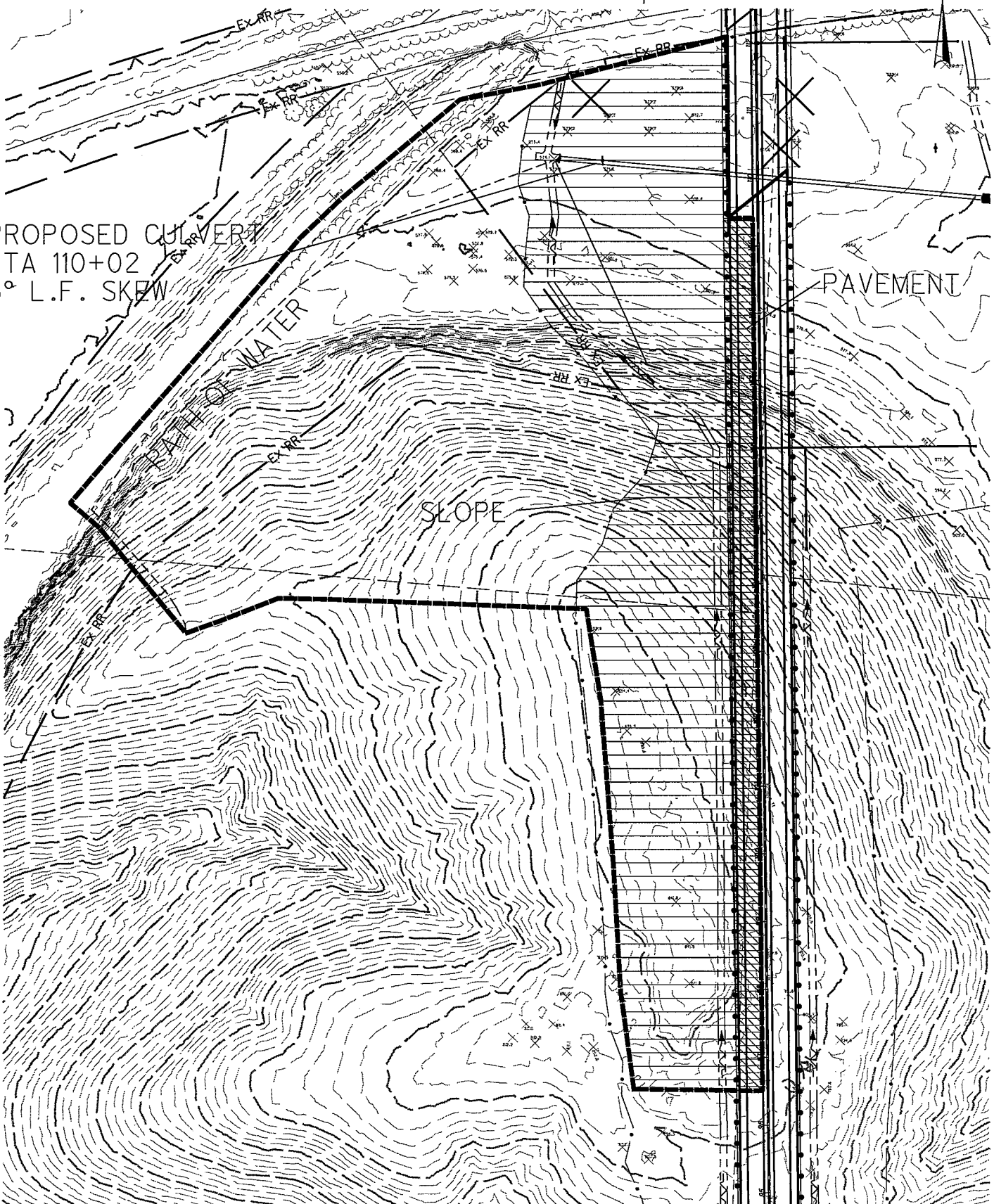
PAVEMENT

PAVED WATER

SLOPE

1"=200'

SR 823 STA 110+02



Project: SCI-823-PH3
 Subject: Hydrology - ROW submission
 Task: Area 5
 Job #: 71143



Originated: RCS-11/15/12
 Checked: KAG-11/30/12
 Changes Made:
 Corrections Verified:

Time of Concentration to Upstream Inlet

$$t_o \approx \frac{1.8(1.1-C)(L)^{(1/2)}}{(s)^{(1/3)}} \quad t_s \text{ or } t_d = \frac{L}{60V} \quad V = 3.281ks^{0.5}$$

Sheet Flow

Elev. UP (ft)	Elev. DN (ft)	Length (ft)	Slope (ft/ft)	To (min)
748	745	41	0.0732	5
				5

Shallow Concentrated Flow

Elev. UP (ft)	Elev. DN (ft)	Length (ft)	Slope (%)	k	V (ft/s)	Ts (min)
745	590	191	81.15	0.076	2.25	1
590	575	886	1.69	0.457	1.95	8
						9

Tc = To + Ts

Tc = 14 minutes

Drainage Area

	C	A	CA
Wooded	0.3	9.0	2.69
Impervious	0.9	1.2	1.08
Residential/Slope	0.4	7.2	2.89
Total		17.4	6.66

Wooded steep slopes

Rainfall Intensity

$i = a / (Tc + b)^c$

$i_2 = 3.36$ (in/hr)
 $i_{25} = 5.94$ (in/hr)
 $i_{50} = 6.40$ (in/hr)
 $i_{100} = 7.32$ (in/hr)

Q = CiA (cfs)
Q ₂ = 22
Q ₂₅ = 40
Q ₅₀ = 43
Q ₁₀₀ = 49

	a	b	c
2-Year	85.568	16.5	0.95
10-Year	198.92	19.3	1.004
50-Year	206.025	19.6	0.99
100-Year	355.551	23.199	1.076



UNIVERSAL CULVERT DESIGN

PID : 77366 **Date :** 12/19/2012 **Project :** SR 823 Portsmouth Bypass **Location :** Portsmouth Ohio **Designer :** KAG

Stage 1 Location

Description : Drainage area 5, Sta. 110+35
HEADWATER CONTROL CODES: INLET - Inlet Control.
 OUTLET - Outlet Control.
 OUTLET* - Outlet Control with backwater curve used to compute headwater. See Figure III - 7E in HDS 5 for type flow.
 OUTLET** - Outlet Control - See Figure III - 7D in HDS 5 for type flow.
 N/A - Flow is supercritical with low headwater and low tailwater. Control Section is at the inlet.

Inlet Invert Elevation (ft.) : 565.00 **Outlet Invert Elevation (ft.) :** 550.80 **Tailwater Elevation (ft.) :** 550.80 **Overflow Elevation (ft.) :** 568.60
Allowable Headwater Elevation (ft.) : 568.60 or Diameter + 2 ft. *(whichever is less)*
Pipe Length (ft.) : 632.00 **Culvert Slope (ft./ft.) :** 0.0225 **Design Manning 'n' :** 0.0120
Design Discharge (cfs) : 43.00 @ 50 yrs. **Flood Discharge (cfs) :** 49.00 @ 100 yrs.

FLOW (cfs.)	PIPE #	CULVERT SIZE	HWI (ft.)	HWO (ft.)	FLOW TYPE	VELOCITY (fps.)	DN (ft.)	DC (ft.)	MANNING N	HEADWATER CONTROL	OVERFLOW (cfs.)	DESIGN CODE	BURIAL DEPTH (ft.)
43.00	1	33 in.	568.55	557.78	2 - E	14.47	1.38	2.18	0.0120	INLET	0.00	D	0.00
37.90	1	30 in.	569.12	560.46	2 - E	14.01	1.35	2.08	0.0120	INLET	5.10	D - 1	0.00
32.20	1	27 in.	570.18	N/A	2 - E	13.42	1.31	1.95	0.0120	INLET	10.80	D - 2	0.00
43.00	1	36 in.	568.25	N/A	1 - C	14.43	1.31	2.14	0.0120	INLET	0.00	D + 1	0.00
43.60	1	33 in.	569.03	N/A	2 - E	14.51	1.39	2.19	0.0120	INLET	5.40	F	0.00
37.90	1	30 in.	569.82	N/A	2 - E	14.01	1.35	2.08	0.0120	INLET	11.10	F - 1	0.00
32.20	1	27 in.	571.24	569.25	2 - E	13.42	1.31	1.95	0.0120	INLET	16.80	F - 2	0.00
49.00	1	36 in.	568.59	N/A	1 - C	14.93	1.42	2.28	0.0120	INLET	0.00	F + 1	0.00

CULVERT TYPE : CIRCULAR SMOOTH **Entrance Type :** Half Headwall **Entrance Loss (Ke) :** 0.20

CULVERT TYPE : CIRCULAR CORRUGATED **Entrance Type :** Half Headwall **Entrance Loss (Ke) :** 0.90

Corrugated Metal Pipe (2 2/3 x 1/2 in. corrugations)

43.00	1	42 in.	568.12	N/A	1 - C	8.68	1.79	2.04	0.0237	INLET	0.00	D	0.00
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UNIVERSAL CULVERT DESIGN

FLOW PIPE #	CULVERT SIZE	HWI (ft.)	HWO (ft.)	FLOW TYPE	VELOCITY (fps.)	DN (ft.)	DC (ft.)	MANNING N	HEADWATER CONTROL	OVER FLOW (cfs.)	DESIGN CODE	BURIAL DEPTH (ft.)
41.90	36 in.	568.69	N/A	2 - E	8.43	1.99	2.11	0.0241	INLET	1.10	D - 1	0.00
36.70	33 in.	569.33	N/A	2 - E	8.09	1.96	2.02	0.0241	INLET	6.30	D - 2	0.00
43.00	48 in.	567.89	N/A	1 - C	8.71	1.66	1.96	0.0235	INLET	0.00	D + 1	0.00
49.00	42 in.	568.43	N/A	1 - C	8.96	1.94	2.19	0.0237	INLET	0.00	F	0.00
41.90	36 in.	569.25	N/A	2 - E	8.43	1.99	2.11	0.0241	INLET	7.10	F - 1	0.00
36.70	33 in.	570.13	N/A	2 - E	7.86	1.96	2.02	0.0241	INLET	12.30	F - 2	0.00
49.00	48 in.	568.12	N/A	1 - C	9.01	1.79	2.10	0.0235	INLET	0.00	F + 1	0.00
Corrugated Metal Pipe (3 x 1 in. corrugations)												
43.00	42 in.	568.12	N/A	1 - C	7.69	1.97	2.04	0.0278	INLET	0.00	D	0.00
37.20	36 in.	568.69	568.92	2 - F	7.50	2.04	1.98	0.0281	OUTLET*	5.80	D - 1	0.00
43.00	48 in.	567.89	N/A	1 - C	7.75	1.82	1.96	0.0275	INLET	0.00	D + 1	0.00
49.00	42 in.	568.43	N/A	1 - C	7.92	2.15	2.19	0.0278	INLET	0.00	F	0.00
37.20	36 in.	569.25	N/A	2 - F	7.50	2.04	1.98	0.0281	OUTLET*	11.80	F - 1	0.00
49.00	48 in.	568.12	N/A	1 - C	8.02	1.96	2.10	0.0275	INLET	0.00	F + 1	0.00
Corrugated Metal Pipe (6 x 2 in. corrugations)												
43.00	60 in.	567.63	N/A	1 - C	6.68	1.81	1.83	0.0332	INLET	0.00	D	0.00
43.00	66 in.	567.52	N/A	1 - C	6.67	1.74	1.78	0.0330	INLET	0.00	D + 1	0.00
49.00	60 in.	567.84	N/A	1 - C	6.93	1.95	1.96	0.0332	INLET	0.00	F	0.00
49.00	66 in.	567.72	N/A	1 - C	6.91	1.86	1.91	0.0330	INLET	0.00	F + 1	0.00
21.50	60 in.	566.76	N/A	1 - C	5.50	1.27	1.28	0.0332	INLET	0.00	D	0.00
21.50	66 in.	566.69	N/A	1 - C	5.47	1.22	1.25	0.0330	INLET	0.00	D + 1	0.00
24.50	60 in.	566.90	N/A	1 - C	5.71	1.35	1.37	0.0332	INLET	0.00	F	0.00
24.50	66 in.	566.82	N/A	1 - C	5.67	1.31	1.33	0.0330	INLET	0.00	F + 1	0.00
Corrugated Metal Pipe (6 x 2 in. corrugations, Field Paved Invert)												



UNIVERSAL CULVERT DESIGN

FLOW PIPE #	PIPE #	CULVERT SIZE	HWI (ft.)	HWO (ft.)	FLOW TYPE	VELOCITY (fps.)	DN (ft.)	DC (ft.)	MANNING N	HEADWATER CONTROL	OVER FLOW (cfs.)	DESIGN CODE	BURIAL DEPTH (ft.)
43.00	1	60 in.	567.63	N/A	1 - C	7.97	1.59	1.83	0.0260	INLET	0.00	D	0.00
43.00	1	66 in.	567.52	N/A	1 - C	7.91	1.54	1.78	0.0260	INLET	0.00	D + 1	0.00
49.00	1	60 in.	567.84	N/A	1 - C	8.28	1.71	1.96	0.0260	INLET	0.00	F	0.00
49.00	1	66 in.	567.72	N/A	1 - C	8.20	1.65	1.91	0.0260	INLET	0.00	F + 1	0.00
21.50	2	60 in.	566.76	N/A	1 - C	6.54	1.12	1.28	0.0260	INLET	0.00	D	0.00
21.50	2	66 in.	566.69	N/A	1 - C	6.47	1.09	1.25	0.0260	INLET	0.00	D + 1	0.00
24.50	2	60 in.	566.90	N/A	1 - C	6.80	1.20	1.37	0.0260	INLET	0.00	F	0.00
24.50	2	66 in.	566.82	N/A	1 - C	6.72	1.16	1.33	0.0260	INLET	0.00	F + 1	0.00

Diameter exceeds 1.25 HWA

Diameter exceeds 1.25 HWA

Inlet Invert Elevation (ft.) : 565.00 **Outlet Invert Elevation (ft.) :** 555.23 **Tailwater Elevation (ft.) :** 555.23 **Overflow Elevation (ft.) :** 568.60
Allowable Headwater Elevation (ft.) : 568.60 or Diameter + 2 ft. *Larger Bridge Location*
Pipe Length (ft.) : 485.00 **Culvert Slope (ft./ft.) :** 0.0201 **Design Manning 'n' :** 0.0120
Design Discharge (cfs) : 43.00 @ 50 yrs. **Flood Discharge (cfs) :** 49.00 @ 100 yrs.

FLOW PIPE #	PIPE #	CULVERT SIZE	HWI (ft.)	HWO (ft.)	FLOW TYPE	VELOCITY (fps.)	DN (ft.)	DC (ft.)	MANNING N	HEADWATER CONTROL	OVER FLOW (cfs.)	DESIGN CODE	BURIAL DEPTH (ft.)
43.00	1	33 in.	568.55	561.39	2 - E	13.88	1.42	2.18	0.0120	INLET	0.00	D	0.00
37.90	1	30 in.	569.12	563.52	2 - E	13.43	1.40	2.08	0.0120	INLET	5.10	D - 1	0.00
32.20	1	27 in.	570.18	N/A	2 - E	12.86	1.36	1.95	0.0120	INLET	10.80	D - 2	0.00
43.00	1	36 in.	568.25	N/A	1 - C	13.86	1.36	2.14	0.0120	INLET	0.00	D + 1	0.00
43.60	1	33 in.	569.03	N/A	2 - E	13.93	1.43	2.19	0.0120	INLET	5.40	F	0.00
37.90	1	30 in.	569.82	N/A	2 - E	13.43	1.40	2.08	0.0120	INLET	11.10	F - 1	0.00

CULVERT TYPE : CIRCULAR SMOOTH **Entrance Type :** Half Headwall **Entrance Loss (Ke) :** 0.20



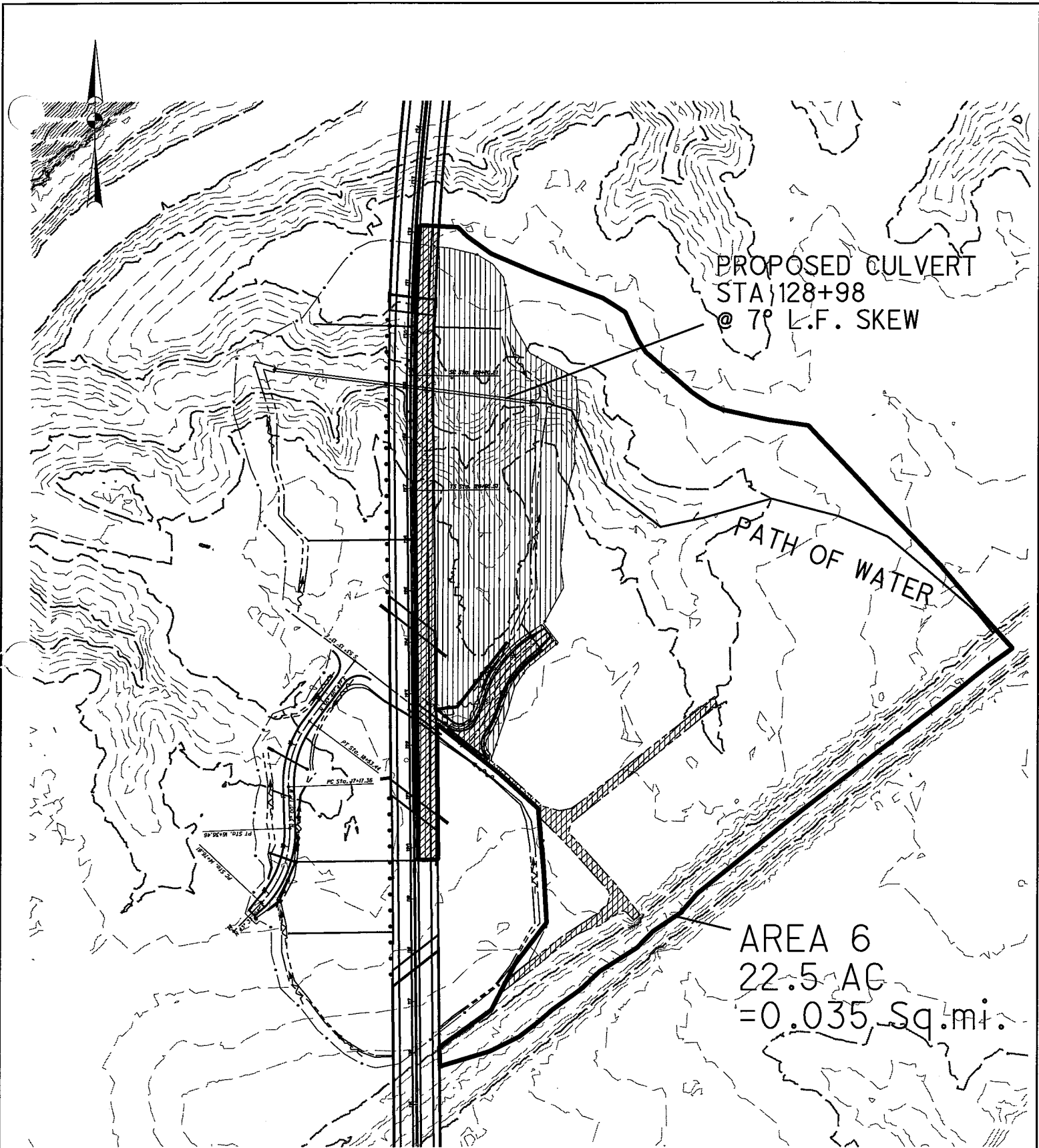
UNIVERSAL CULVERT DESIGN

FLOW PIPE #	CULVERT SIZE	HWI (ft.)	HWO (ft.)	FLOW TYPE	VELOCITY (fps.)	DN (ft.)	DC (ft.)	MANNING N	HEADWATER CONTROL	OVER FLOW (cfs.)	DESIGN CODE	BURIAL DEPTH (ft.)
32.20	1 27 in.	571.24	570.56	2 - E	12.86	1.36	1.95	0.0120	INLET	16.80	F - 2	0.00
49.00	1 36 in.	568.59	N/A	1 - C	14.34	1.46	2.28	0.0120	INLET	0.00	F + 1	0.00
Entrance Type : Half Headwall												
Entrance Loss (Ke) : 0.90												
CULVERT TYPE : CIRCULAR CORRUGATED												
Corrugated Metal Pipe (2 2/3 x 1/2 in. corrugations)												
43.00	1 42 in.	568.12	N/A	1 - C	8.33	1.85	2.04	0.0237	INLET	0.00	D	0.00
41.90	1 36 in.	568.69	N/A	2 - E	8.06	2.07	2.11	0.0241	INLET	1.10	D - 1	0.00
34.70	1 33 in.	569.33	N/A	2 - E	7.66	1.96	1.96	0.0241	INLET	8.30	D - 2	0.00
43.00	1 48 in.	567.89	N/A	1 - C	8.37	1.71	1.96	0.0235	INLET	0.00	D + 1	0.00
49.00	1 42 in.	568.43	N/A	1 - C	8.59	2.01	2.19	0.0237	INLET	0.00	F	0.00
41.90	1 36 in.	569.25	N/A	2 - E	7.89	2.07	2.11	0.0241	INLET	7.10	F - 1	0.00
34.70	1 33 in.	570.13	N/A	2 - E	7.66	1.96	1.96	0.0241	INLET	14.30	F - 2	0.00
49.00	1 48 in.	568.12	N/A	1 - C	8.67	1.84	2.10	0.0235	INLET	0.00	F + 1	0.00
Corrugated Metal Pipe (3 x 1 in. corrugations)												
43.00	1 48 in.	567.89	N/A	1 - C	7.45	1.87	1.96	0.0275	INLET	0.00	D	0.00
42.80	1 42 in.	568.12	N/A	1 - C	7.36	2.04	2.04	0.0278	INLET	0.20	D - 1	0.00
38.10	1 36 in.	568.69	568.87	2 - F	7.57	2.16	2.01	0.0281	OUTLET*	4.90	D - 2	0.00
43.00	1 54 in.	567.75	N/A	1 - C	7.46	1.76	1.89	0.0273	INLET	0.00	D + 1	0.00
49.00	1 48 in.	568.12	N/A	1 - C	7.70	2.02	2.10	0.0275	INLET	0.00	F	0.00
42.80	1 42 in.	568.43	N/A	1 - C	7.36	2.04	2.04	0.0278	INLET	6.20	F - 1	0.00
38.10	1 36 in.	569.25	571.45	2 - F	7.57	2.16	2.01	0.0281	OUTLET*	10.90	F - 2	0.00
49.00	1 54 in.	567.96	N/A	1 - C	7.72	1.89	2.02	0.0273	INLET	0.00	F + 1	0.00
Corrugated Metal Pipe (6 x 2 in. corrugations)												
43.00	1 60 in.	567.63	568.08	1 - A	6.60	1.87	1.83	0.0332	OUTLET*	0.00	D	0.00
Diameter exceeds 1.25 HWA												



UNIVERSAL CULVERT DESIGN

FLOW (cfs.)	PIPE #	CULVERT SIZE	HWI (ft.)	HWO (ft.)	FLOW TYPE	VELOCITY (fps.)	DN (ft.)	DC (ft.)	MANNING N	HEADWATER CONTROL	OVER FLOW (cfs.)	DESIGN CODE	BURIAL DEPTH (ft.)
43.00	1	66 in.	567.52	568.00	1 - A	6.45	1.79	1.78	0.0330	OUTLET*	0.00	D + 1	0.00
49.00	1	60 in.	567.84	568.31	1 - A	6.86	2.01	1.96	0.0332	OUTLET*	0.00	F	0.00
49.00	1	66 in.	567.72	568.22	1 - A	6.70	1.92	1.91	0.0330	OUTLET*	0.00	F + 1	0.00
21.50	2	60 in.	566.76	567.13	1 - A	5.41	1.30	1.28	0.0332	OUTLET*	0.00	D	0.00
21.50	2	66 in.	566.69	567.07	1 - A	5.32	1.26	1.25	0.0330	OUTLET*	0.00	D + 1	0.00
24.50	2	60 in.	566.90	567.28	1 - A	5.62	1.39	1.37	0.0332	OUTLET*	0.00	F	0.00
24.50	2	66 in.	566.82	567.22	1 - A	5.51	1.34	1.33	0.0330	OUTLET*	0.00	F + 1	0.00
Corrugated Metal Pipe (6 x 2 in. corrugations, Field Paved Invert)													
43.00	1	60 in.	567.63	N/A	1 - C	7.67	1.64	1.83	0.0260	INLET	0.00	D	0.00
43.00	1	66 in.	567.52	N/A	1 - C	7.60	1.58	1.78	0.0260	INLET	0.00	D + 1	0.00
49.00	1	60 in.	567.84	N/A	1 - C	7.96	1.76	1.96	0.0260	INLET	0.00	F	0.00
49.00	1	66 in.	567.72	N/A	1 - C	7.89	1.69	1.91	0.0260	INLET	0.00	F + 1	0.00
21.50	2	60 in.	566.76	N/A	1 - C	6.29	1.15	1.28	0.0260	INLET	0.00	D	0.00
21.50	2	66 in.	566.69	N/A	1 - C	6.22	1.12	1.25	0.0260	INLET	0.00	D + 1	0.00
24.50	2	60 in.	566.90	N/A	1 - C	6.53	1.23	1.37	0.0260	INLET	0.00	F	0.00
24.50	2	66 in.	566.82	N/A	1 - C	6.47	1.19	1.33	0.0260	INLET	0.00	F + 1	0.00
Diameter exceeds 1.25 HWA													



1"=250'

SR 823 STA 128+98

Project: SCI-823-PH3
 Subject: Hydrology - ROW submission
 Task: Area 6
 Job #: 71143



Originated: RCS-11/16/12
 Checked: 11/30/12
 Changes Made:
 Corrections Verified:

Time of Concentration to Upstream Inlet

$$t_o \approx \frac{1.8(1.1-C)(L)^{(1/2)}}{(s)^{(1/3)}} \quad t_s \text{ or } t_d = \frac{L}{60V} \quad V = 3.281ks^{0.5}$$

Sheet Flow

Elev. UP (ft)	Elev. DN (ft)	Length (ft)	Slope (ft/ft)	To (min)
575	570	52	0.0962	4
				4

Shallow Concentrated Flow

Elev. UP (ft)	Elev. DN (ft)	Length (ft)	Slope (%)	k	V (ft/s)	Ts (min)
570	550	600	3.33	0.305	1.83	5
550	540	104	9.62	0.152	1.55	1
540	531	375	2.40	0.152	0.77	8
						15

Tc = To + Ts

Tc = 19 minutes

Drainage Area

	C	A	CA	
Wooded/Residential	0.4	16.4	6.56	Wooded steep slopes
Impervious	0.9	1.8	1.62	
Slope	0.4	4.3	1.72	
Total		22.5	9.90	22.5

Rainfall Intensity

$i = a / (Tc + b)^c$

$i_2 = 2.88$ (in/hr)
 $i_{25} = 5.12$ (in/hr)
 $i_{50} = 5.54$ (in/hr)
 $i_{100} = 6.34$ (in/hr)

Q = CiA (cfs)		a	b	c
		29	85.568	16.5
51	10-Year	198.92	19.3	1.004
55	50-Year	206.025	19.6	0.99
63	100-Year	355.551	23.199	1.076



UNIVERSAL CULVERT DESIGN

PID : 77366 **Date :** 11/30/2012 **Project :** SR 823 Portsmouth Bypass **Location :** Portsmouth Ohio **Designer :** KAG

Description : Drainage area 6 , Sta. 128+98

HEADWATER CONTROL CODES:

INLET - Inlet Control.
 OUTLET - Outlet Control.

OUTLET* - Outlet Control with backwater curve used to compute headwater. See Figure III - 7E in HDS 5 for type flow.
 OUTLET** - Outlet Control - See Figure III - 7D in HDS 5 for type flow.

N/A - Flow is supercritical with low headwater and low tailwater. Control Section is at the inlet.

Inlet Invert Elevation (ft.) : 523.90 **Outlet Invert Elevation (ft.) :** 512.54 **Tailwater Elevation (ft.) :** 513.42 **Overflow Elevation (ft.) :** 596.97
Allowable Headwater Elevation (ft.) : 594.97 or Diameter + 2 ft. (*whichever is less*)
Pipe Length (ft.) : 506.00 **Culvert Slope (ft./ft.) :** 0.0225 **Design Manning 'n' :** 0.0120
Design Discharge (cfs) : 55.00 @ 50 yrs. **Flood Discharge (cfs) :** 63.00 @ 100 yrs.

FLOW #	PIPE	CULVERT SIZE	HWI (ft.)	HWO (ft.)	FLOW TYPE	VELOCITY (fps.)	DN (ft.)	DC (ft.)	MANNING N	HEADWATER CONTROL	OVERFLOW (cfs.)	DESIGN CODE	BURIAL DEPTH (ft.)
CULVERT TYPE : CIRCULAR CORRUGATED													
Corrugated Metal Pipe (2 2/3 x 1/2 in. corrugations)													
55.00	1	36 in.	528.79	528.79	2 - E	8.69	2.52	2.41	0.0241	INLET	0.00	D	0.00
55.00	1	33 in.	529.92	536.35	2 - F	9.95	2.75	2.41	0.0241	OUTLET**	0.00	D - 1	0.00
55.00	1	30 in.	531.61	550.54	2 - F	11.47	2.50	2.35	0.0244	OUTLET**	0.00	D - 2	0.00
55.00	1	42 in.	527.67	N/A	1 - C	9.20	2.09	2.32	0.0237	INLET	0.00	D + 1	0.00
63.00	1	36 in.	529.76	533.09	2 - F	9.83	3.00	2.55	0.0241	OUTLET**	0.00	F	0.00
63.00	1	33 in.	531.21	543.03	2 - F	11.03	2.75	2.53	0.0241	OUTLET**	0.00	F - 1	0.00
63.00	1	30 in.	533.31	561.67	2 - F	12.98	2.50	2.41	0.0244	OUTLET**	0.00	F - 2	0.00
63.00	1	42 in.	528.19	523.36	2 - E	9.47	2.29	2.49	0.0237	INLET	0.00	F + 1	0.00
Corrugated Metal Pipe (3 x 1 in. corrugations)													
55.00	1	42 in.	527.67	528.16	2 - F	8.12	2.33	2.32	0.0278	OUTLET*	0.00	D	0.00

Entrance Loss (Ke) : 0.90

Entrance Type : Half Headwall



UNIVERSAL CULVERT DESIGN

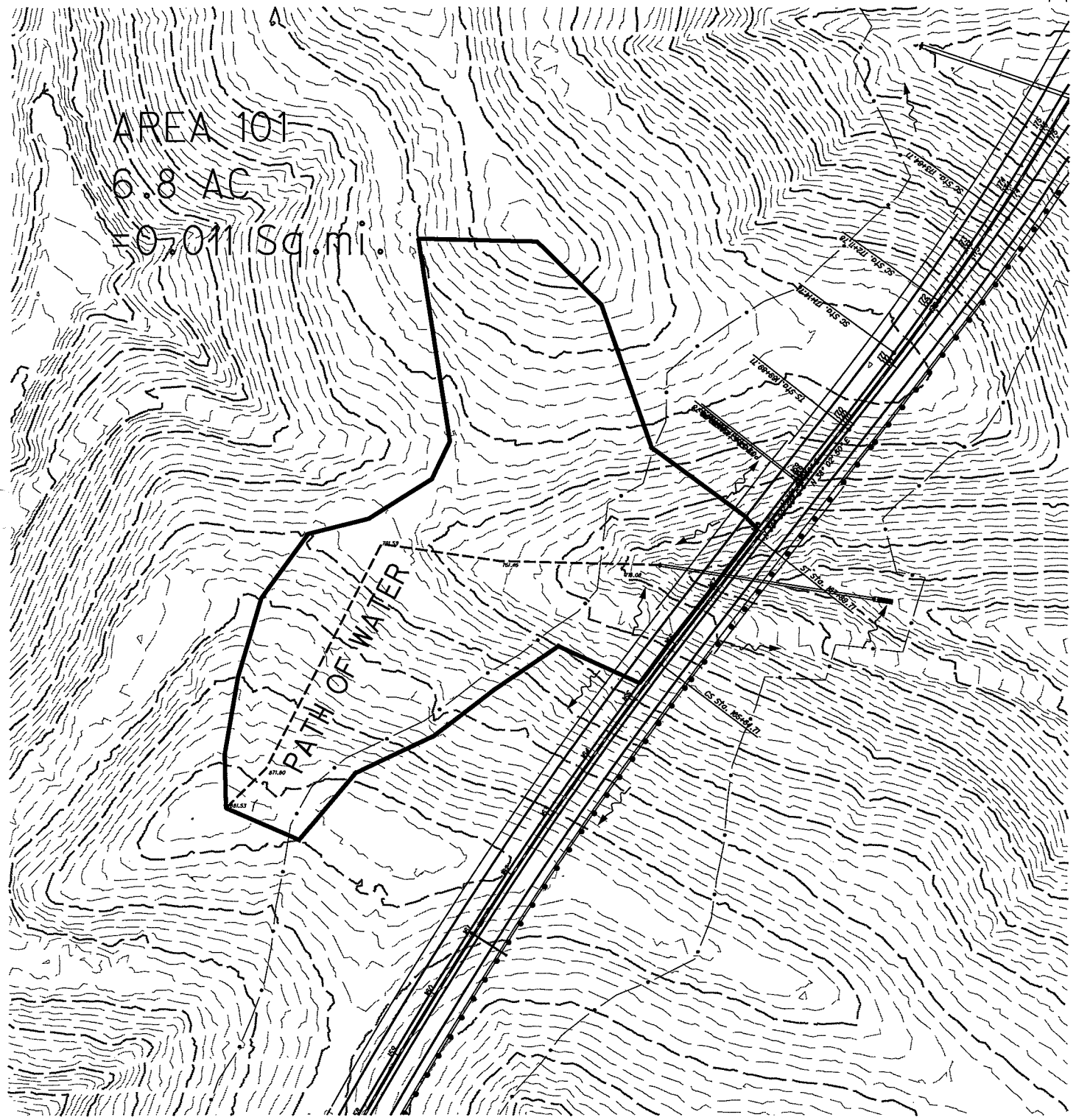
FLOW (cfs.)	PIPE #	CULVERT SIZE	HWI (ft.)	HWO (ft.)	FLOW TYPE	VELOCITY (fps.)	DN (ft.)	DC (ft.)	MANNING N	HEADWATER CONTROL	OVER FLOW (cfs.)	DESIGN CODE	BURIAL DEPTH (ft.)
55.00	1	36 in.	528.79	533.01	2 - F	9.05	3.00	2.41	0.0281	OUTLET**	0.00	D - 1	0.00
55.00	1	48 in.	527.26	N/A	1 - C	8.26	2.09	2.23	0.0275	INLET	0.00	D + 1	0.00
63.00	1	42 in.	528.19	528.50	2 - F	8.61	2.58	2.49	0.0278	OUTLET*	0.00	F	0.00
63.00	1	36 in.	529.76	538.63	2 - F	9.83	3.00	2.55	0.0281	OUTLET**	0.00	F - 1	0.00
63.00	1	48 in.	527.58	N/A	1 - C	8.52	2.28	2.39	0.0275	INLET	0.00	F + 1	0.00
Corrugated Metal Pipe (6 x 2 in. corrugations)													
55.00	1	60 in.	526.93	N/A	1 - C	7.15	2.07	2.08	0.0332	INLET	0.00	D	0.00
55.00	1	66 in.	526.81	N/A	1 - C	7.14	1.98	2.02	0.0330	INLET	0.00	D + 1	0.00
63.00	1	60 in.	527.17	527.76	1 - A	7.42	2.24	2.23	0.0332	OUTLET*	0.00	F	0.00
63.00	1	66 in.	527.05	N/A	1 - C	7.41	2.13	2.17	0.0330	INLET	0.00	F + 1	0.00
Corrugated Metal Pipe (6 x 2 in. corrugations, Field Paved Invert)													
55.00	1	60 in.	526.93	N/A	1 - C	8.54	1.82	2.08	0.0260	INLET	0.00	D	0.00
55.00	1	66 in.	526.81	N/A	1 - C	8.47	1.75	2.02	0.0260	INLET	0.00	D + 1	0.00
63.00	1	60 in.	527.17	N/A	1 - C	8.86	1.95	2.23	0.0260	INLET	0.00	F	0.00
63.00	1	66 in.	527.05	N/A	1 - C	8.80	1.88	2.17	0.0260	INLET	0.00	F + 1	0.00

HIGH FILL STRUCTURAL STEEL



AREA 101
6.8 AC
= 0.011 Sq. mi.

PATH OF WATER



1"=200'

SR 823 STA 167+22

Client: ODOT Sheet: of



Subject: Pipe Culvert Calculations
 @ STA 166+50
 Order No:
 Computed by: MDC Date: 7/24/2006
 Checked by: Date:

Rational Method

Coefficient of Runoff (1101.2.3)

	Area (Sft)	Area (Ac)	C
Pavement Area	18677	0.43	0.9
Non-paved Area	278728	6.40	0.45
Other			
Total Area		6.83 acres	Weighted "C" = 0.48

Overland Flow

Length	10
High Elevation	1
Low Elevation	0
Slope %	10

t_b 1.64 (1101.2.2)
 t_c 0.00 Compare with Fig 1101-1
 Negligible

Shallow Concentrated Flow

Length	630
High Elevation	876
Low Elevation	731
Slope %	23.01587
k	0.457 (Grassed waterways - Table 1101-1)
V	7.193432 (1101.2.2)
t_s	1.459665 (1101.2.2)

Since the time of concentration = $t_o + t_s$

t_c 10.00 min

For Intensity Zone D

Frequency	a	b	c	Ac	t_c	C	I	Q cu ft/s
2 Years	85.568	16.5	0.95	6.827479	10.00	0.48	3.80	12.42
5 Years	118.822	18.7	0.969	6.827479	10.00	0.48	4.59	15.00
10 Years	112.172	16.8	0.923	6.827479	10.00	0.48	5.39	17.61
25 Years	198.92	19.3	1.004	6.827479	10.00	0.48	6.70	21.87
50 Years	206.025	19.6	0.99	6.827479	10.00	0.48	7.20	23.51
100 Years	355.551	23.199	1.076	6.827479	10.00	0.48	8.21	26.80

Worksheet for SR 823 STA 166+50

Project Description

Friction Method Manning Formula
Solve For Normal Depth

Input Data

Roughness Coefficient	0.040
Channel Slope	0.10000 ft/ft
Left Side Slope	2.00 ft/ft (H:V)
Right Side Slope	2.00 ft/ft (H:V)
Bottom Width	10.00 ft
Discharge	23.50 ft ³ /s

Results

Normal Depth	0.38 ft
Flow Area	4.05 ft ²
Wetted Perimeter	11.69 ft
Top Width	11.51 ft
Critical Depth	0.54 ft
Critical Slope	0.03043 ft/ft
Velocity	5.80 ft/s
Velocity Head	0.52 ft
Specific Energy	0.90 ft
Froude Number	1.72
Flow Type	Supercritical

GVF Input Data

Downstream Depth	0.00 ft
Length	0.00 ft
Number Of Steps	0

GVF Output Data

Upstream Depth	0.00 ft
Profile Description	
Profile Headloss	0.00 ft
Downstream Velocity	Infinity ft/s
Upstream Velocity	Infinity ft/s
Normal Depth	0.38 ft
Critical Depth	0.54 ft
Channel Slope	0.10000 ft/ft
Critical Slope	0.03043 ft/ft



UNIVERSAL CULVERT DESIGN

PID : 77366 **Date :** 12/19/2012 **Project :** SR 823 Portsmouth Bypass **Location :** Portsmouth Ohio **Designer :** KAG
Description : Drainage area 101, Sta. 167+22

HEADWATER CONTROL CODES: INLET - Inlet Control.
 OUTLET - Outlet Control.
 OUTLET* - Outlet Control with backwater curve used to compute headwater. See Figure III - 7E in HDS 5 for type flow.
 OUTLET** - Outlet Control - See Figure III - 7D in HDS 5 for type flow.
 N/A - Flow is supercritical with low headwater and low tailwater. Control Section is at the inlet.

Inlet Invert Elevation (ft.) : 706.60 **Outlet Invert Elevation (ft.) :** 652.30 **Tailwater Elevation (ft.) :** 652.30 **Overflow Elevation (ft.) :** 727.00
Allowable Headwater Elevation (ft.) : 727.00 or Diameter + 2 ft. *(whichever is less)*
Pipe Length (ft.) : 367.00 **Culvert Slope (ft./ft.) :** 0.1480 **Design Manning 'n' :** 0.0120
Design Discharge (cfs) : 23.50 @ 50 yrs. **Flood Discharge (cfs) :** 26.80 @ 100 yrs.

FLOW PIPE #	CULVERT SIZE	HWI (ft.)	HWO (ft.)	FLOW TYPE	VELOCITY (fps.)	DN (ft.)	DC (ft.)	MANNING N	HEADWATER CONTROL	OVER FLOW (cfs.)	DESIGN CODE	BURIAL DEPTH (ft.)	
CULVERT TYPE : CIRCULAR CORRUGATED													
Entrance Type : Half Headwall													
Entrance Loss (Ke) : 0.90													
Corrugated Metal Pipe (2 2/3 x 1/2 in. corrugations)													
23.50	1	27 in.	709.73	662.77	2 - E	14.73	0.95	1.70	0.0245	INLET	0.00	D	0.00
23.50	1	24 in.	710.66	670.03	2 - E	14.69	1.01	1.72	0.0247	INLET	0.00	D - 1	0.00
23.50	1	21 in.	712.33	686.04	2 - E	14.53	1.12	1.66	0.0248	INLET	0.00	D - 2	0.00
23.50	1	30 in.	709.27	N/A	1 - C	14.68	0.90	1.65	0.0244	INLET	0.00	D + 1	0.00
26.80	1	27 in.	710.27	665.37	2 - E	15.25	1.02	1.81	0.0245	INLET	0.00	F	0.00
26.80	1	24 in.	711.49	674.84	2 - E	15.16	1.10	1.80	0.0247	INLET	0.00	F - 1	0.00
26.80	1	21 in.	713.57	695.68	2 - E	14.89	1.23	1.70	0.0248	INLET	0.00	F - 2	0.00
26.80	1	30 in.	709.62	660.80	2 - E	15.23	0.97	1.76	0.0244	INLET	0.00	F + 1	0.00
Corrugated Metal Pipe (3 x 1 in. corrugations)													
23.50	1	36 in.	708.92	N/A	1 - C	13.08	0.90	1.56	0.0281	INLET	0.00	D	0.00



UNIVERSAL CULVERT DESIGN

FLOW PIPE #	CULVERT SIZE	HWI (ft.)	HWO (ft.)	FLOW TYPE	VELOCITY (fps.)	DN (ft.)	DC (ft.)	MANNING N	HEADWATER CONTROL	OVER FLOW (cfs.)	DESIGN CODE	BURIAL DEPTH (ft.)
23.50 1	42 in.	708.77	N/A	1 - C	12.97	0.85	1.49	0.0278	INLET	0.00	D + 1	0.00
26.80 1	36 in.	709.12	N/A	1 - C	13.57	0.97	1.67	0.0281	INLET	0.00	F	0.00
26.80 1	42 in.	708.94	N/A	1 - C	13.48	0.91	1.60	0.0278	INLET	0.00	F + 1	0.00
Corrugated Metal Pipe (6 x 2 in. corrugations)												
23.50 1	60 in.	708.45	N/A	1 - C	10.98	0.83	1.34	0.0332	INLET	0.00	D	0.00
23.50 1	66 in.	708.38	N/A	1 - C	10.90	0.80	1.30	0.0330	INLET	0.00	D + 1	0.00
26.80 1	60 in.	708.60	N/A	1 - C	11.41	0.89	1.43	0.0332	INLET	0.00	F	0.00
26.80 1	66 in.	708.51	N/A	1 - C	11.34	0.86	1.40	0.0330	INLET	0.00	F + 1	0.00
Corrugated Metal Pipe (6 x 2 in. corrugations, Field Paved Invert)												
23.50 1	60 in.	708.45	N/A	1 - C	13.06	0.74	1.34	0.0260	INLET	0.00	D	0.00
23.50 1	66 in.	708.38	N/A	1 - C	12.88	0.72	1.30	0.0260	INLET	0.00	D + 1	0.00
26.80 1	60 in.	708.60	N/A	1 - C	13.57	0.79	1.43	0.0260	INLET	0.00	F	0.00
26.80 1	66 in.	708.51	N/A	1 - C	13.39	0.76	1.40	0.0260	INLET	0.00	F + 1	0.00



CULVERT ANALYSIS

PID : 77356 **Date :** 12/05/2012 **Project :** SR 823, Portsmouth Bypass **Location :** Portsmouth, Ohio **Designer :** KAG

Description : Drainage area 101, Sta. 167+21

HEADWATER CONTROL CODES: INLET - Inlet Control.
 OUTLET - Outlet Control.
 OUTLET* - Outlet Control with backwater curve used to compute headwater. See Figure III - 7E in HDS 5 for type flow.
 OUTLET** - Outlet Control - See Figure III - 7D in HDS 5 for type flow.
 N/A - Flow is supercritical with low headwater and low tailwater. Control Section is at the inlet.

Pipe Number : 1 **Use HW :** 0 **Inlet Invert Elevation (ft.) :** 706.60 **Outlet Invert Elevation (ft.) :** 652.30
Pipe Quantity : 1

Culvert Type : Circular Corrugated **Pipe Length (ft.) :** 367.00 **Culvert Slope (ft./ft.) :** 0.1480
Corrugation Type : Corrugated Metal Pipe (2 2/3 x 1/2 in. corrugations)
Pipe Size : 36 in.
Design Manning 'n' : (default)

Entrance Type : Half Headwall **Loss Coef. Ke :** 0.9000

FLOW LOSS (cfs.)	HEAD (ft.)	HWI (ft.)	HWO (ft.)	FLOW TYPE	VELOCITY (fps.)	DN (ft.)	DC (ft.)	MANNING N	HEADWATER CONTROL	BURIED DEPTH (ft.)	TAILWATER ELEVATION (ft.)
23.50	54.34	708.92	N/A	1 - C	14.61	0.84	1.56	0.0241	INLET	0.00	652.30
26.80	54.48	709.12	N/A	1 - C	15.16	0.89	1.67	0.0241	INLET	0.00	652.30

SR 823 STA 175+57

AREA 57
19.2 AC
= 0.030 Sq.mi.

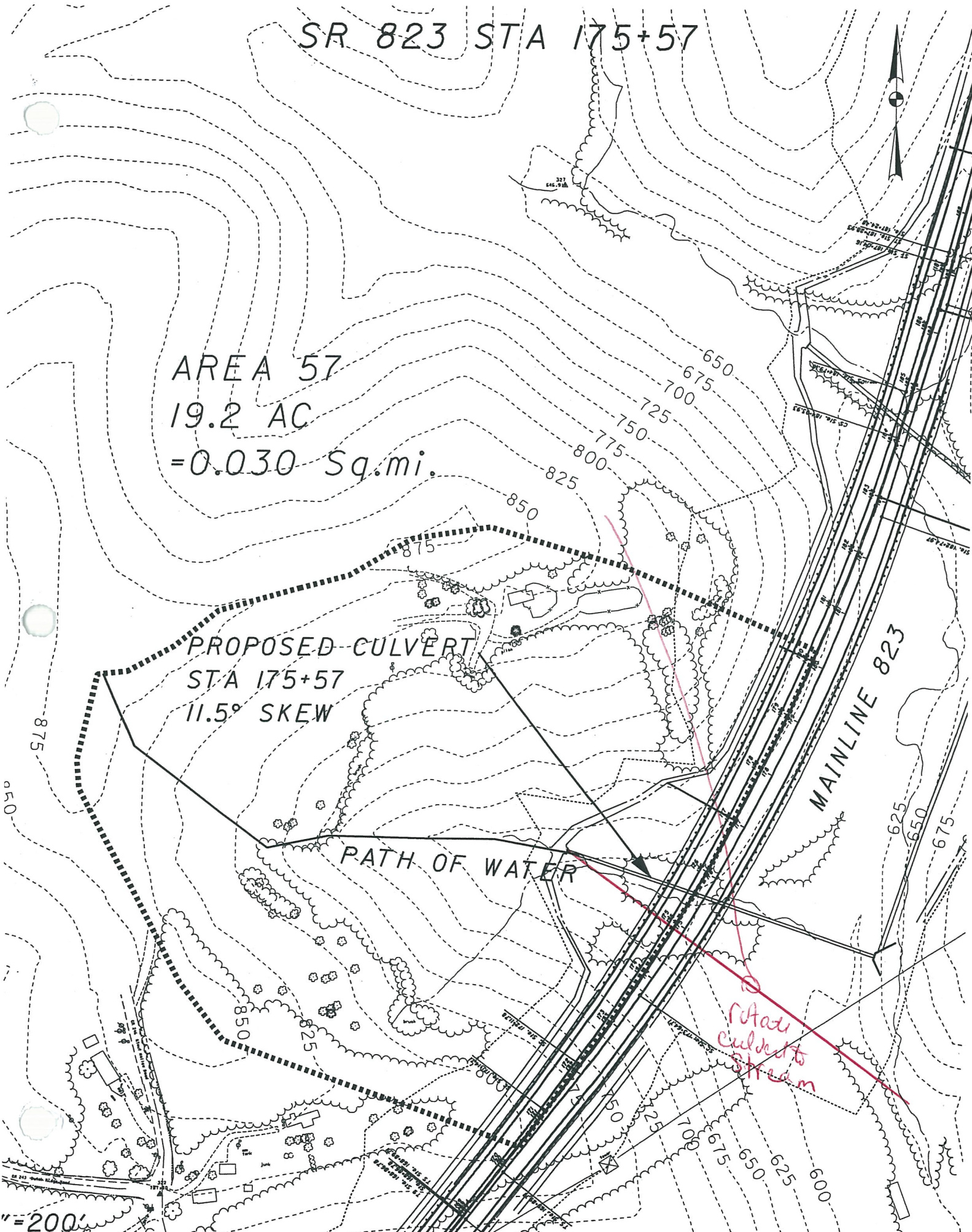
PROPOSED CULVERT
STA 175+57
11.5° SKEW

PATH OF WATER

MAINLINE 823

*Area
culvert to
stream*

"=200'



Time of Concentration to Upstream Inlet

$$t_o \approx \frac{1.8(1.1-C)(L)^{(1/2)}}{(s)^{(1/3)}} \quad t_s \text{ or } t_d = \frac{L}{60V} \quad V = 3.281ks^{0.5}$$

Sheet Flow

Elev. UP (ft)	Elev. DN (ft)	Length (ft)	Slope (ft/ft)	To (min)
889	885	34	0.1176	4
				4

Shallow Concentrated Flow

Elev. UP (ft)	Elev. DN (ft)	Length (ft)	Slope (%)	k	V (ft/s)	Ts (min)
885	805	387	20.67	0.076	1.13	6
805	770	93	37.63	0.076	1.53	1
770	680	220	40.91	0.076	1.59	2
680	649	233	13.30	0.457	5.47	1
						10

Tc = To + Ts

Tc = 13 minutes

Drainage Area

	C	A	CA
Wooded	0.3	18.0	5.40
Impervious	0.9	1.2	1.08
Residential/Slope	0.4	0.0	0.00
Total		19.2	6.48

Wooded steep slopes

Rainfall Intensity

$$i = a / (Tc + b)^c$$

$i_2 = \frac{3.39}{(in/hr)}$
 $i_{25} = \frac{6.00}{(in/hr)}$
 $i_{50} = \frac{6.46}{(in/hr)}$
 $i_{100} = \frac{7.39}{(in/hr)}$

Q = CiA
(cfs)

$Q_2 = 22$
 $Q_{25} = 39$
 $Q_{50} = 42$
 $Q_{100} = 48$

	a	b	c
2-Year	85.568	16.5	0.95
25-Year	198.92	19.3	1.004
50-Year	206.025	19.6	0.99
100-Year	355.551	23.199	1.076



UNIVERSAL CULVERT DESIGN

PID : 77366 **Date :** 11/16/2012 **Project :** SR 823 Portsmouth Bypass **Location :** Portsmouth Ohio **Designer :** RCS

Description : Drainage area 57 , Sta. 175+57

HEADWATER CONTROL CODES:

INLET - Inlet Control.
 OUTLET - Outlet Control.
 OUTLET* - Outlet Control with backwater curve used to compute headwater. See Figure III - 7E in HDS 5 for type flow.
 OUTLET** - Outlet Control - See Figure III - 7D in HDS 5 for type flow.
 N/A - Flow is supercritical with low headwater and low tailwater. Control Section is at the inlet.

Inlet Invert Elevation (ft.) : 649.20 **Outlet Invert Elevation (ft.) :** 602.79 **Tailwater Elevation (ft.) :** 603.74 **Overflow Elevation (ft.) :** 715.38

Allowable Headwater Elevation (ft.) : 711.21 or Diameter + 2 ft. *(whichever is less)*

Pipe Length (ft.) : 552.00 **Culvert Slope (ft./ft.) :** 0.0841 **Design Manning 'n' :** 0.0120

Design Discharge (cfs) : 42.00 @ 50 yrs. **Flood Discharge (cfs) :** 48.00 @ 100 yrs.

FLOW	PIPE #	CULVERT SIZE	HWI (ft.)	HWO (ft.)	FLOW TYPE	FLOW VELOCITY (fps.)	DN (ft.)	DC (ft.)	MANNING N	HEADWATER CONTROL	OVER FLOW (cfs.)	DESIGN CODE	BURIAL DEPTH (ft.)
CULVERT TYPE : CIRCULAR CORRUGATED													
Corrugated Metal Pipe (2 2/3 x 1/2 in. corrugations)													
42.00	1	33 in.	653.40	618.61	2 - E	13.98	1.39	2.15	0.0241	INLET	0.00	D	0.00
42.00	1	30 in.	654.44	627.56	2 - E	13.80	1.49	2.17	0.0244	INLET	0.00	D - 1	0.00
42.00	1	27 in.	656.08	644.12	2 - E	13.53	1.64	2.12	0.0245	INLET	0.00	D - 2	0.00
42.00	1	36 in.	652.80	613.87	2 - E	13.95	1.32	2.11	0.0241	INLET	0.00	D + 1	0.00
48.00	1	33 in.	654.19	622.77	2 - E	14.45	1.50	2.29	0.0241	INLET	0.00	F	0.00
48.00	1	30 in.	655.53	634.48	2 - E	14.20	1.63	2.27	0.0244	INLET	0.00	F - 1	0.00
48.00	1	27 in.	657.56	656.13	2 - E	13.66	1.86	2.17	0.0245	INLET	0.00	F - 2	0.00
48.00	1	36 in.	653.35	616.55	2 - E	14.45	1.43	2.26	0.0241	INLET	0.00	F + 1	0.00
Corrugated Metal Pipe (3 x 1 in. corrugations)													
42.00	1	36 in.	652.80	616.56	2 - E	12.46	1.45	2.11	0.0281	INLET	0.00	D	0.00

CULVERT TYPE : CIRCULAR CORRUGATED **Entrance Type :** Half Headwall **Entrance Loss (Ke) :** 0.90



UNIVERSAL CULVERT DESIGN

FLOW PIPE #	CULVERT SIZE	HWI (ft.)	HWO (ft.)	FLOW TYPE	VELOCITY (fps.)	DN (ft.)	DC (ft.)	MANNING N	HEADWATER CONTROL	OVER FLOW (cfs.)	DESIGN CODE	BURIAL DEPTH (ft.)
42.00 1	42 in.	652.27	N/A	1 - C	12.49	1.33	2.02	0.0278	INLET	0.00	D + 1	0.00
48.00 1	36 in.	653.35	620.06	2 - E	12.88	1.56	2.26	0.0281	INLET	0.00	F	0.00
48.00 1	42 in.	652.57	N/A	1 - C	12.95	1.43	2.16	0.0278	INLET	0.00	F + 1	0.00
Corrugated Metal Pipe (6 x 2 in. corrugations)												
42.00 1	60 in.	651.80	N/A	1 - C	10.67	1.27	1.81	0.0332	INLET	0.00	D	0.00
42.00 1	66 in.	651.69	N/A	1 - C	10.60	1.23	1.76	0.0330	INLET	0.00	D + 1	0.00
48.00 1	60 in.	652.01	N/A	1 - C	11.07	1.36	1.94	0.0332	INLET	0.00	F	0.00
48.00 1	66 in.	651.89	N/A	1 - C	11.02	1.31	1.88	0.0330	INLET	0.00	F + 1	0.00
Corrugated Metal Pipe (6 x 2 in. corrugations, Field Paved Invert)												
42.00 1	60 in.	651.80	N/A	1 - C	12.68	1.13	1.81	0.0260	INLET	0.00	D	0.00
42.00 1	66 in.	651.69	N/A	1 - C	12.54	1.09	1.76	0.0260	INLET	0.00	D + 1	0.00
48.00 1	60 in.	652.01	N/A	1 - C	13.18	1.20	1.94	0.0260	INLET	0.00	F	0.00
48.00 1	66 in.	651.89	N/A	1 - C	13.05	1.17	1.88	0.0260	INLET	0.00	F + 1	0.00

SR 823 STA 176+31.38
TO STA 181+91.80

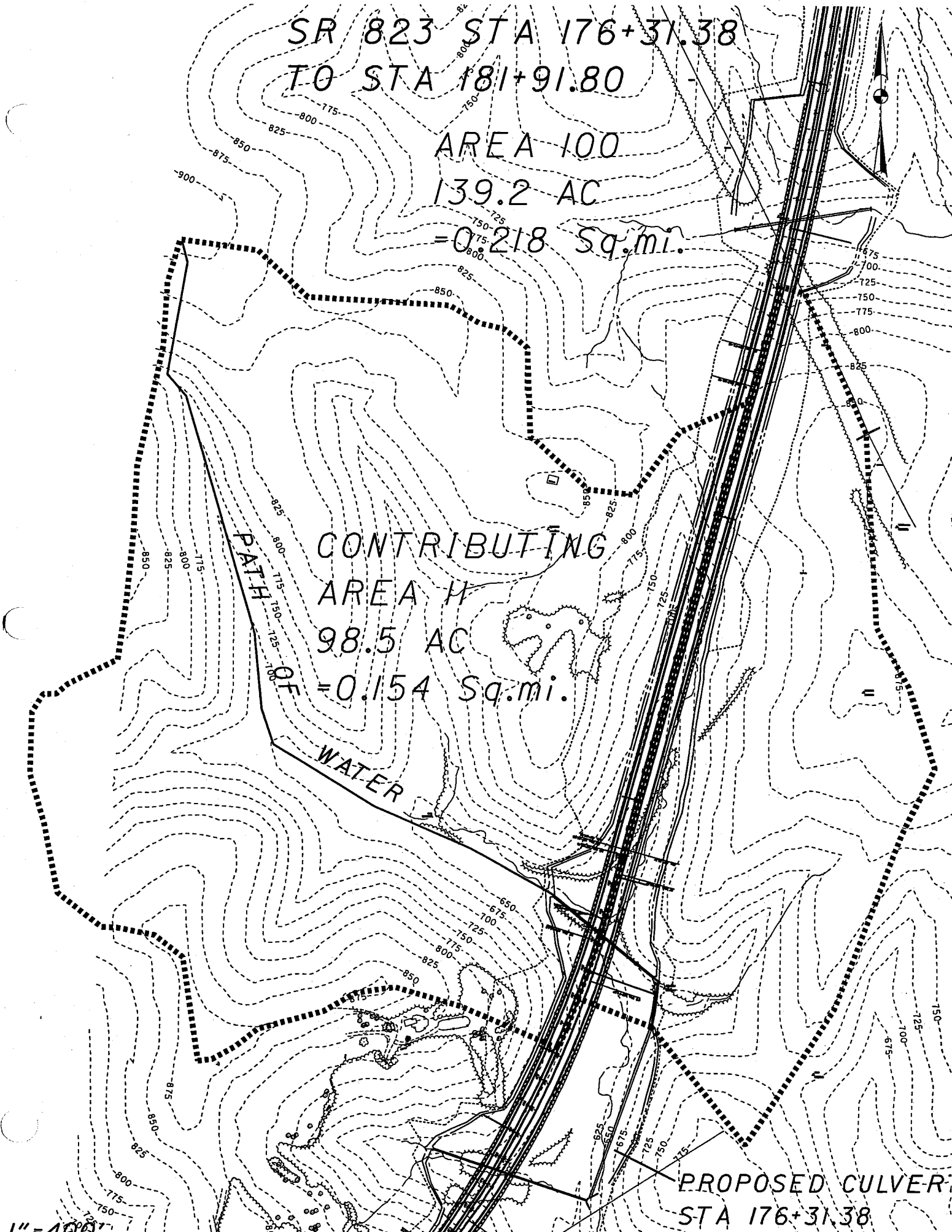
AREA 100
139.2 AC
= 0.218 Sq.mi.

CONTRIBUTING
AREA II
98.5 AC
= 0.154 Sq.mi.

PATH
OF
WATER

PROPOSED CULVER
STA 176+31.38

1" = 400'



SR 823 STA 176+31.38 to 181+91.80
TECHNIQUES FOR ESTIMATING FLOOD-PEAK
DISCHARGES OF RURAL, UNREGULATED STREAMS IN OHIO AREA A
 U.S. GEOLOGICAL SURVEY Water Resources Investigations Report 89-4126

	Values	Units	Definitions
	6065377.00	SQ. FT.	
	0.218	SQ. MI.	CONTDA = Contributing Drainage Area
	0.00	SQ. FT.	
	0.00	%	STORAGE = Storage Area
	3462.00	FT.	TOTAL CHANNEL LENGTH
	346.20	FT.	L ₁₀ = 10% of the Distance along channel
	626	FT.	Elev ₁₀ = Elevation at point L ₁₀
	2942.70	FT.	L ₈₅ = 85% of the Distance along channel
	780	FT.	Elev ₈₅ = Elevation at point L ₈₅
	2596.50	FT.	Length = L ₈₅ - L ₁₀
	313.16	FT./MI.	SLOPE = (Elev ₁₀ -Elev ₈₅)/Length
		CFS	Q _# = Flood-Peak Discharge
			# = Frequency of Storm
Q ₂	45.73	CFS	= 56.1(CONTDA) ^{0.782} (SLOPE) ^{0.172} (STORAGE+1) ^{-0.297}
Q ₅	93.12	CFS	= 84.5(CONTDA) ^{0.769} (SLOPE) ^{0.221} (STORAGE+1) ^{-0.322}
Q ₁₀	131.80	CFS	= 104(CONTDA) ^{0.764} (SLOPE) ^{0.244} (STORAGE+1) ^{-0.335}
Q ₂₅	184.52	CFS	= 129(CONTDA) ^{0.760} (SLOPE) ^{0.264} (STORAGE+1) ^{-0.347}
Q ₅₀	227.85	CFS	= 148(CONTDA) ^{0.757} (SLOPE) ^{0.276} (STORAGE+1) ^{-0.355}
Q ₁₀₀	271.16	CFS	= 167(CONTDA) ^{0.756} (SLOPE) ^{0.285} (STORAGE+1) ^{-0.363}

Worksheet for SR 823 STA 176+31 TO 181+91

Project Description

Friction Method Manning Formula
Solve For Normal Depth

Input Data

Roughness Coefficient	0.040
Channel Slope	0.03700 ft/ft
Left Side Slope	2.00 ft/ft (H:V)
Right Side Slope	2.00 ft/ft (H:V)
Bottom Width	10.00 ft
Discharge	227.90 ft ³ /s

Results

Normal Depth	1.86 ft
Flow Area	25.56 ft ²
Wetted Perimeter	18.33 ft
Top Width	17.45 ft
Critical Depth	2.17 ft
Critical Slope	0.02112 ft/ft
Velocity	8.92 ft/s
Velocity Head	1.24 ft
Specific Energy	3.10 ft
Froude Number	1.30
Flow Type	Supercritical

GVF Input Data

Downstream Depth	0.00 ft
Length	0.00 ft
Number Of Steps	0

GVF Output Data

Upstream Depth	0.00 ft
Profile Description	
Profile Headloss	0.00 ft
Downstream Velocity	Infinity ft/s
Upstream Velocity	Infinity ft/s
Normal Depth	1.86 ft
Critical Depth	2.17 ft
Channel Slope	0.03700 ft/ft
Critical Slope	0.02112 ft/ft



UNIVERSAL CULVERT DESIGN

PID : 77366 **Date :** 04/06/2007 **Project :** SR 823 Portsmouth Bypass **Location :** Portsmouth Ohio **Designer :** mdc

Description : Drainage area 100, Sta. 176+31.38 TO 181+91.80

HEADWATER CONTROL CODES: INLET - Inlet Control.
 OUTLET - Outlet Control.
 OUTLET* - Outlet Control with backwater curve used to compute headwater. See Figure III - 7E in HDS 5 for type flow.
 OUTLET** - Outlet Control - See Figure III - 7D in HDS 5 for type flow.
 N/A - Flow is supercritical with low headwater and low tailwater. Control Section is at the inlet.

Inlet Invert Elevation (ft.) : 618.75 **Outlet Invert Elevation (ft.) :** 601.28 **Tailwater Elevation (ft.) :** 603.14 **Overflow Elevation (ft.) :** 687.67

Allowable Headwater Elevation (ft.) : 685.00 or Diameter + 4 ft. *(whichever is less)*

Pipe Length (ft.) : 606.00 **Culvert Slope (ft./ft.) :** 0.0288 **Design Manning 'n' :** 0.0120

Design Discharge (cfs) : 227.90 @ 50 yrs. **Flood Discharge (cfs) :** 271.20 @ 100 yrs.

FLOW PIPE #	PIPE	CULVERT SIZE	HWI (ft.)	HWO (ft.)	FLOW TYPE	VELOCITY (fps.)	DN (ft.)	DC (ft.)	MANNING N	HEADWATER CONTROL	OVERFLOW (cfs.)	DESIGN CODE	BURIAL DEPTH (ft.)
227.90	1	60 in.	626.41	612.36	2 - E	24.09	2.43	4.27	0.0120	INLET	0.00	D	0.00
227.90	1	54 in.	628.23	616.35	2 - E	24.04	2.59	4.19	0.0120	INLET	0.00	D - 1	0.00
227.90	1	48 in.	631.59	624.29	2 - E	23.65	2.87	3.91	0.0120	INLET	0.00	D - 2	0.00
227.90	1	66 in.	625.46	610.22	2 - E	24.03	2.31	4.22	0.0120	INLET	0.00	D + 1	0.00
271.20	1	60 in.	628.13	615.17	2 - E	25.15	2.69	4.54	0.0120	INLET	0.00	F	0.00
271.20	1	54 in.	630.83	620.88	2 - E	24.95	2.91	4.33	0.0120	INLET	0.00	F - 1	0.00
271.20	1	48 in.	635.71	632.24	2 - E	23.93	3.38	3.95	0.0120	INLET	0.00	F - 2	0.00
271.20	1	66 in.	626.63	612.09	2 - E	25.15	2.55	4.57	0.0120	INLET	0.00	F + 1	0.00

CULVERT TYPE : CIRCULAR SMOOTH **Entrance Type :** Half Headwall **Entrance Loss (Ke) :** 0.20

CULVERT TYPE : CIRCULAR CORRUGATED **Entrance Type :** Half Headwall **Entrance Loss (Ke) :** 0.90

Corrugated Metal Pipe (2 2/3 x 1/2 in. corrugations)

F 7/16
 2 2/3 x 1/2
 5.24
 →



UNIVERSAL CULVERT DESIGN

FLOW PIPE # (cfs.)	CULVERT SIZE	HWI (ft.)	HWO (ft.)	FLOW TYPE	VELOCITY (fps.)	DN (ft.)	DC (ft.)	MANNING N	HEADWATER CONTROL	OVER FLOW (cfs.)	DESIGN CODE	BURIAL DEPTH (ft.)
227.90	1 60 in.	628.63	624.58	2 - E	14.32	3.78	4.27	0.0232	INLET	0.00	D - 1	0.00
227.90	1 54 in.	631.70	637.68	2 - F	14.77	4.50	4.19	0.0233	OUTLET**	0.00	D - 2	0.00
227.90	1 72 in.	625.67	N/A	1 - C	14.84	3.20	4.13	0.0229	INLET	0.00	D + 1	0.00
271.20	1 66 in.	628.71	622.57	2 - E	15.14	3.88	4.57	0.0231	INLET	0.00	F	0.00
271.20	1 60 in.	631.40	632.49	2 - F	14.47	5.00	4.54	0.0232	OUTLET**	0.00	F - 1	0.00
271.20	1 54 in.	635.45	651.09	2 - F	17.26	4.50	4.33	0.0233	OUTLET**	0.00	F - 2	0.00
271.20	1 72 in.	627.04	616.92	2 - E	15.45	3.57	4.51	0.0229	INLET	0.00	F + 1	0.00
Corrugated Metal Pipe (3 x 1 in. corrugations)												
227.90	1 66 in.	626.75	620.74	2 - E	12.96	3.81	4.22	0.0269	INLET	0.00	D	0.00
227.90	1 60 in.	628.63	629.94	2 - F	12.76	5.00	4.27	0.0271	OUTLET**	0.00	D - 1	0.00
227.90	1 54 in.	631.70	647.37	2 - F	14.77	4.50	4.19	0.0273	OUTLET**	0.00	D - 2	0.00
227.90	1 72 in.	625.67	N/A	1 - C	13.19	3.53	4.13	0.0267	INLET	0.00	D + 1	0.00
271.20	1 66 in.	628.71	626.99	2 - E	13.22	4.43	4.57	0.0269	INLET	0.00	F	0.00
271.20	1 60 in.	631.40	640.07	2 - F	14.47	5.00	4.54	0.0271	OUTLET**	0.00	F - 1	0.00
271.20	1 54 in.	635.45	664.82	2 - F	17.26	4.50	4.33	0.0273	OUTLET**	0.00	F - 2	0.00
271.20	1 72 in.	627.04	619.67	2 - E	13.68	3.97	4.51	0.0267	INLET	0.00	F + 1	0.00
Corrugated Metal Pipe (6 x 2 in. corrugations)												
227.90	1 66 in.	626.75	626.75	2 - F	11.64	4.58	4.22	0.0330	OUTLET*	0.00	D	0.00
227.90	1 60 in.	628.63	639.98	2 - F	12.76	5.00	4.27	0.0332	OUTLET**	0.00	D - 1	0.00
227.90	1 72 in.	625.67	N/A	1 - C	11.22	4.05	4.13	0.0327	INLET	0.00	D + 1	0.00
271.20	1 66 in.	628.71	635.49	2 - F	12.85	5.50	4.57	0.0330	OUTLET**	0.00	F	0.00
271.20	1 60 in.	631.40	654.30	2 - F	14.47	5.00	4.54	0.0332	OUTLET**	0.00	F - 1	0.00
271.20	1 72 in.	627.04	627.32	2 - F	11.90	4.66	4.51	0.0327	OUTLET*	0.00	F + 1	0.00
Corrugated Metal Pipe (6 x 2 in. corrugations, Field Paved Invert)												



UNIVERSAL CULVERT DESIGN

FLOW PIPE # (cfs.)	CULVERT SIZE	HWI (ft.)	HWO (ft.)	FLOW TYPE	VELOCITY (fps.)	DN (ft.)	DC (ft.)	MANNING N	HEADWATER CONTROL	OVER FLOW (cfs.)	DESIGN CODE	BURIAL DEPTH (ft.)
227.90	1 66 in.	626.75	619.96	2 - E	13.33	3.72	4.22	0.0260	INLET	0.00	D	0.00
227.90	1 60 in.	628.63	628.35	2 - E	12.81	4.25	4.27	0.0260	INLET	0.00	D - 1	0.00
227.90	1 72 in.	625.67	N/A	1 - C	13.46	3.47	4.13	0.0260	INLET	0.00	D + 1	0.00
271.20	1 66 in.	628.71	625.88	2 - E	13.66	4.28	4.57	0.0260	INLET	0.00	F	0.00
271.20	1 60 in.	631.40	637.82	2 - F	14.47	5.00	4.54	0.0260	OUTLET**	0.00	F - 1	0.00
271.20	1 72 in.	627.04	619.13	2 - E	13.97	3.89	4.51	0.0260	INLET	0.00	F + 1	0.00



CULVERT ANALYSIS

PID : 77366 **Date :** 12/01/2011 **Project :** SR 823 Portsmouth Bypass **Location :** Portsmouth, Ohio **Designer :** KAG

Description : Drainage Area 100, 176+31 to 181+91

HEADWATER CONTROL CODES: INLET - Inlet Control.
 OUTLET - Outlet Control.
 OUTLET* - Outlet Control with backwater curve used to compute headwater. See Figure III - 7E in HDS 5 for type flow.
 OUTLET** - Outlet Control - See Figure III - 7D in HDS 5 for type flow.
 N/A - Flow is supercritical with low headwater and low tailwater. Control Section is at the inlet.

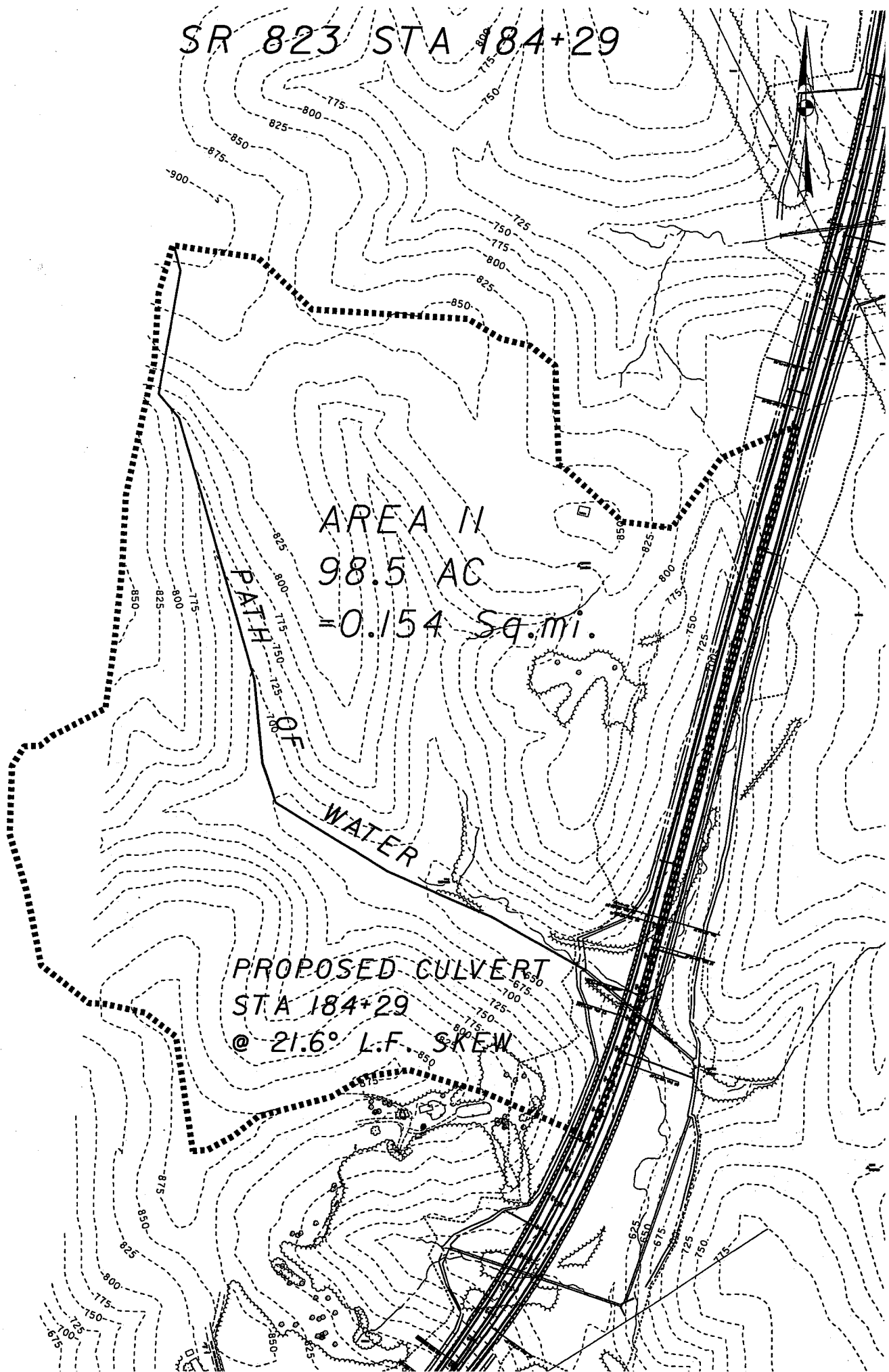
Pipe Number : 1 **Use HW :** 0 **Inlet Invert Elevation (ft.) :** 618.75 **Outlet Invert Elevation (ft.) :** 601.28
Pipe Quantity : 1

Culvert Type : Circular Corrugated **Pipe Length (ft.) :** 606.00 **Culvert Slope (ft./ft.) :** 0.0288
Corrugation Type : Corrugated Metal Pipe (6 x 2 in. corrugations)
Pipe Size : 78 in.
Design Manning 'n' : (default)

Entrance Type : Half Headwall **Loss Coef. Ke :** 0.9000

FLOW	HEAD LOSS	HWI	HWO	FLOW TYPE	VELOCITY	DN	DC	MANNING N	HEADWATER CONTROL	BURIED DEPTH	TAILWATER ELEVATION
(cfs.)	(ft.)	(ft.)	(ft.)		(fps.)	(ft.)	(ft.)			(ft.)	(ft.)
227.90	18.52	625.07	N/A	1 - C	11.39	3.78	4.04	0.0325	INLET	0.00	601.28
271.20	19.32	626.06	N/A	1 - C	11.81	4.25	4.42	0.0325	INLET	0.00	601.28

SR 823 STA 184+29



AREA II
98.5 AC
= 0.154 Sq. mi.

PATH OF
WATER

PROPOSED CULVERT
STA 184+29
@ 21.6° L.F. SKEW

1" = 400'

SR 823 STA 184+29.00
TECHNIQUES FOR ESTIMATING FLOOD-PEAK
DISCHARGES OF RURAL, UNREGULATED STREAMS IN OHIO AREA A
 U.S. GEOLOGICAL SURVEY Water Resources Investigations Report 89-4126

	Values	Units	Definitions
	4289215.00	SQ. FT.	
	0.154	SQ. MI.	CONTDA = Contributing Drainage Area
	0.00	SQ. FT.	
	0.00	%	STORAGE = Storage Area
	2980.00	FT.	TOTAL CHANNEL LENGTH
	298.00	FT.	L ₁₀ = 10% of the Distance along channel
	624	FT.	Elev ₁₀ = Elevation at point L ₁₀
	2533.00	FT.	L ₈₅ = 85% of the Distance along channel
	792	FT.	Elev ₈₅ = Elevation at point L ₈₅
	2235.00	FT.	Length = L ₈₅ - L ₁₀
	396.89	FT./MI.	SLOPE = (Elev ₁₀ -Elev ₈₅)/Length
		CFS	Q _# = Flood-Peak Discharge
			# = Frequency of Storm
Q ₂	36.33	CFS	= 56.1(CONTDA) ^{0.782} (SLOPE) ^{0.172} (STORAGE+1) ^{-0.297}
Q ₅	75.17	CFS	= 84.5(CONTDA) ^{0.769} (SLOPE) ^{0.221} (STORAGE+1) ^{-0.322}
Q ₁₀	107.17	CFS	= 104(CONTDA) ^{0.764} (SLOPE) ^{0.244} (STORAGE+1) ^{-0.335}
Q ₂₅	150.95	CFS	= 129(CONTDA) ^{0.760} (SLOPE) ^{0.264} (STORAGE+1) ^{-0.347}
Q ₅₀	187.13	CFS	= 148(CONTDA) ^{0.757} (SLOPE) ^{0.276} (STORAGE+1) ^{-0.355}
Q ₁₀₀	223.25	CFS	= 167(CONTDA) ^{0.756} (SLOPE) ^{0.285} (STORAGE+1) ^{-0.363}

Worksheet for SR 823 STA 184+29

Project Description

Friction Method Manning Formula
Solve For Normal Depth

Input Data

Roughness Coefficient	0.040
Channel Slope	0.02150 ft/ft
Left Side Slope	2.00 ft/ft (H:V)
Right Side Slope	2.00 ft/ft (H:V)
Bottom Width	6.00 ft
Discharge	187.10 ft ³ /s

Results

Normal Depth	2.39 ft
Flow Area	25.73 ft ²
Wetted Perimeter	16.68 ft
Top Width	15.55 ft
Critical Depth	2.38 ft
Critical Slope	0.02165 ft/ft
Velocity	7.27 ft/s
Velocity Head	0.82 ft
Specific Energy	3.21 ft
Froude Number	1.00
Flow Type	Subcritical

GVF Input Data

Downstream Depth	0.00 ft
Length	0.00 ft
Number Of Steps	0

GVF Output Data

Upstream Depth	0.00 ft
Profile Description	
Profile Headloss	0.00 ft
Downstream Velocity	Infinity ft/s
Upstream Velocity	Infinity ft/s
Normal Depth	2.39 ft
Critical Depth	2.38 ft
Channel Slope	0.02150 ft/ft
Critical Slope	0.02165 ft/ft



UNIVERSAL CULVERT DESIGN

PID : 77366 **Date :** 11/16/2012 **Project :** SR 823 Portsmouth Bypass **Location :** Portsmouth Ohio **Designer :** RCS

Description : Drainage area 11, Sta. 184+29

HEADWATER CONTROL CODES: INLET - Inlet Control.
 OUTLET - Outlet Control.
 OUTLET* - Outlet Control with backwater curve used to compute headwater. See Figure III - 7E in HDS 5 for type flow.
 OUTLET** - Outlet Control - See Figure III - 7D in HDS 5 for type flow.
 N/A - Flow is supercritical with low headwater and low tailwater. Control Section is at the inlet.

Inlet Invert Elevation (ft.) : 628.30 **Outlet Invert Elevation (ft.) :** 623.88 **Tailwater Elevation (ft.) :** 627.19 **Overflow Elevation (ft.) :** 687.67
Allowable Headwater Elevation (ft.) : 746.00 or Diameter + 4 ft. *(whichever is less)*
Pipe Length (ft.) : 442.00 **Culvert Slope (ft./ft.) :** 0.0100 **Design Manning 'n' :** 0.0120
Design Discharge (cfs) : 187.00 @ 50 yrs. **Flood Discharge (cfs) :** 223.00 @ 100 yrs.

FLOW (cfs.)	PIPE #	CULVERT SIZE	HWI (ft.)	HWO (ft.)	FLOW TYPE	VELOCITY (fps.)	DN (ft.)	DC (ft.)	MANNING N	HEADWATER CONTROL	OVERFLOW (cfs.)	DESIGN CODE	BURIAL DEPTH (ft.)
CULVERT TYPE : CIRCULAR CORRUGATED													
Corrugated Metal Pipe (2 2/3 x 1/2 in. corrugations)													
187.00	1	66 in.	634.76	635.17	2 - F	10.59	4.46	3.83	0.0231	OUTLET*	0.00	D	0.00
187.00	1	60 in.	635.93	638.23	2 - F	11.34	5.00	3.91	0.0232	OUTLET**	0.00	D - 1	0.00
187.00	1	54 in.	638.05	644.95	2 - F	12.66	4.50	3.94	0.0233	OUTLET**	0.00	D - 2	0.00
187.00	1	72 in.	634.14	634.87	1 - A	10.12	3.98	3.73	0.0229	OUTLET*	0.00	D + 1	0.00
223.00	1	66 in.	636.09	637.44	2 - F	11.52	5.50	4.18	0.0231	OUTLET**	0.00	F	0.00
223.00	1	60 in.	637.89	642.56	2 - F	12.58	5.00	4.23	0.0232	OUTLET**	0.00	F - 1	0.00
223.00	1	54 in.	640.85	652.17	2 - F	14.50	4.50	4.17	0.0233	OUTLET**	0.00	F - 2	0.00
223.00	1	72 in.	635.08	635.61	2 - F	10.87	4.57	4.09	0.0229	OUTLET*	0.00	F + 1	0.00
Corrugated Metal Pipe (3 x 1 in. corrugations)													
187.00	1	66 in.	634.76	636.21	2 - F	10.59	5.50	3.83	0.0269	OUTLET**	0.00	D	0.00
Entrance Loss (Ke) : 0.90													



UNIVERSAL CULVERT DESIGN

FLOW PIPE #	CULVERT SIZE	HWI (ft.)	HWO (ft.)	FLOW TYPE	VELOCITY (fps.)	DN (ft.)	DC (ft.)	MANNING N	HEADWATER CONTROL	OVER FLOW (cfs.)	DESIGN CODE	BURIAL DEPTH (ft.)
187.00	1 60 in.	635.93	640.86	2 - F	11.34	5.00	3.91	0.0271	OUTLET**	0.00	D - 1	0.00
187.00	1 54 in.	638.05	649.71	2 - F	12.66	4.50	3.94	0.0273	OUTLET**	0.00	D - 2	0.00
187.00	1 72 in.	634.14	634.77	1 - A	10.12	4.48	3.73	0.0267	OUTLET*	0.00	D + 1	0.00
223.00	1 66 in.	636.09	639.62	2 - F	11.52	5.50	4.18	0.0269	OUTLET**	0.00	F	0.00
223.00	1 60 in.	637.89	646.30	2 - F	12.58	5.00	4.23	0.0271	OUTLET**	0.00	F - 1	0.00
223.00	1 54 in.	640.85	658.94	2 - F	14.50	4.50	4.17	0.0273	OUTLET**	0.00	F - 2	0.00
223.00	1 72 in.	635.08	635.71	2 - F	10.87	6.00	4.09	0.0267	OUTLET*	0.00	F + 1	0.00
Corrugated Metal Pipe (6 x 2 in. corrugations)												
187.00	1 72 in.	634.14	635.15	1 - A	10.12	5.48	3.73	0.0327	OUTLET*	0.00	D	0.00
187.00	1 66 in.	634.76	639.15	2 - F	10.59	5.50	3.83	0.0330	OUTLET**	0.00	D - 1	0.00
187.00	1 60 in.	635.93	645.79	2 - F	11.34	5.00	3.91	0.0332	OUTLET**	0.00	D - 2	0.00
187.00	1 78 in.	633.79	634.56	1 - A	9.77	4.78	3.64	0.0325	OUTLET*	0.00	D + 1	0.00
223.00	1 72 in.	635.08	638.47	2 - F	10.87	6.00	4.09	0.0327	OUTLET**	0.00	F	0.00
223.00	1 66 in.	636.09	643.81	2 - F	11.52	5.50	4.18	0.0330	OUTLET**	0.00	F - 1	0.00
223.00	1 60 in.	637.89	653.32	2 - F	12.58	5.00	4.23	0.0332	OUTLET**	0.00	F - 2	0.00
223.00	1 78 in.	634.51	635.48	1 - A	10.43	5.82	3.99	0.0325	OUTLET*	0.00	F + 1	0.00
Corrugated Metal Pipe (6 x 2 in. corrugations, Field Paved Invert)												
187.00	1 66 in.	634.76	635.82	2 - F	10.59	5.50	3.83	0.0260	OUTLET**	0.00	D	0.00
187.00	1 60 in.	635.93	640.08	2 - F	11.34	5.00	3.91	0.0260	OUTLET**	0.00	D - 1	0.00
187.00	1 72 in.	634.14	634.77	1 - A	10.12	4.38	3.73	0.0260	OUTLET*	0.00	D + 1	0.00
223.00	1 66 in.	636.09	639.07	2 - F	11.52	5.50	4.18	0.0260	OUTLET**	0.00	F	0.00
223.00	1 60 in.	637.89	645.19	2 - F	12.58	5.00	4.23	0.0260	OUTLET**	0.00	F - 1	0.00
223.00	1 72 in.	635.08	635.65	2 - F	10.87	5.27	4.09	0.0260	OUTLET*	0.00	F + 1	0.00

H > 16
40 PSI 3/4" Z Sizes
78"



CULVERT ANALYSIS

PID : 77366 **Date :** 01/04/2013 **Project :** SR 823 Portsmouth Bypass **Location :** Portsmouth, Ohio **Designer :** KAG

Description : Drainage Area 11, 184+29

HEADWATER CONTROL CODES: INLET - Inlet Control.
 OUTLET - Outlet Control.
 OUTLET* - Outlet Control with backwater curve used to compute headwater. See Figure III - 7E in HDS 5 for type flow.
 OUTLET** - Outlet Control - See Figure III - 7D in HDS 5 for type flow.
 N/A - Flow is supercritical with low headwater and low tailwater. Control Section is at the inlet.

Pipe Number : 2 **Use HW :** 0 **Inlet Invert Elevation (ft.) :** 628.30 **Outlet Invert Elevation (ft.) :** 623.88

Pipe Quantity : 1

Culvert Type : Circular Corrugated **Pipe Length (ft.) :** 442.00 **Culvert Slope (ft./ft.) :** 0.0100

Corrugation Type : Corrugated Metal Pipe (6 x 2 in. corrugations)

Pipe Size : 78 in.

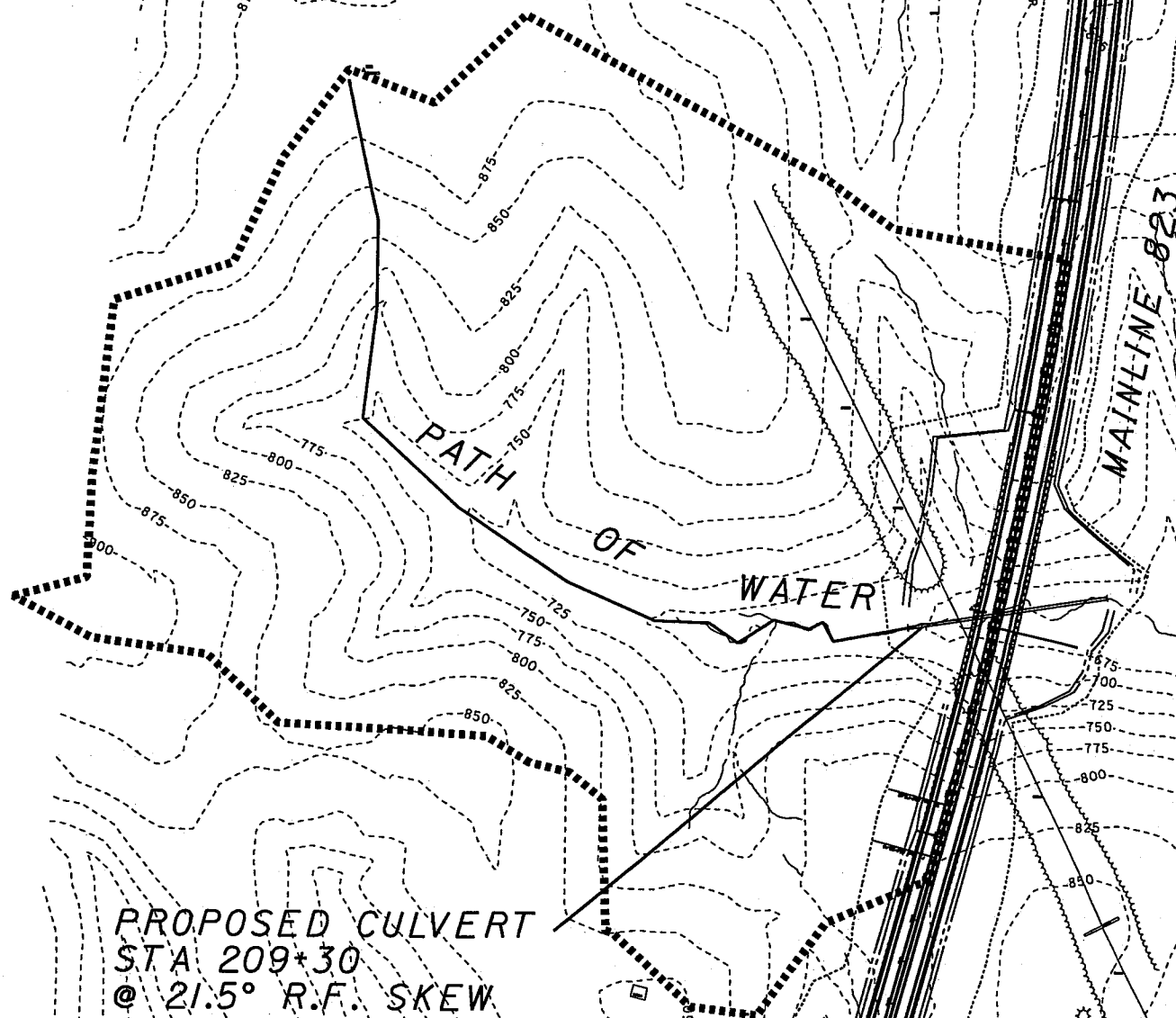
Design Manning 'n' : (default)

Entrance Type : Half Headwall **Loss Coef. Ke :** 0.9000

FLOW LOSS (cfs.)	HEAD LOSS (ft.)	HWI (ft.)	HWO (ft.)	FLOW TYPE	VELOCITY (fps.)	DN (ft.)	DC (ft.)	MANNING N	HEADWATER CONTROL	BURIED DEPTH (ft.)	TAILWATER ELEVATION (ft.)
187.00	7.04	633.79	634.56	1 - A	9.77	4.78	3.64	0.0325	OUTLET*	0.00	623.88
223.00	7.60	634.51	635.48	1 - A	10.43	5.82	3.99	0.0325	OUTLET*	0.00	623.88

SR 823 STA 209+30

AREA 12
73.9 AC
= 0.115 Sq.mi.



PROPOSED CULVERT
STA 209+30
@ 21.5° R.F. SKEW



1" = 400'

SR 823 209+30.00
TECHNIQUES FOR ESTIMATING FLOOD-PEAK
DISCHARGES OF RURAL, UNREGULATED STREAMS IN OHIO AREA A
 U.S. GEOLOGICAL SURVEY Water Resources Investigations Report 89-4126

	Values	Units	Definitions
	3218115.00	SQ. FT.	
	0.115	SQ. MI.	CONTDA = Contributing Drainage Area
	0.00	SQ. FT.	
	0.00	%	STORAGE = Storage Area
	2268.00	FT.	TOTAL CHANNEL LENGTH
	226.80	FT.	L ₁₀ = 10% of the Distance along channel
	717	FT.	Elev ₁₀ = Elevation at point L ₁₀
	1927.80	FT.	L ₈₅ = 85% of the Distance along channel
	832	FT.	Elev ₈₅ = Elevation at point L ₈₅
	1701.00	FT.	Length = L ₈₅ - L ₁₀
	356.97	FT./MI.	SLOPE = (Elev ₁₀ -Elev ₈₅)/Length
		CFS	Q _# = Flood-Peak Discharge
			# = Frequency of Storm
Q ₂	28.49	CFS	= 56.1(CONTDA) ^{0.782} (SLOPE) ^{0.172} (STORAGE+1) ^{-0.297}
Q ₅	58.87	CFS	= 84.5(CONTDA) ^{0.769} (SLOPE) ^{0.221} (STORAGE+1) ^{-0.322}
Q ₁₀	83.85	CFS	= 104(CONTDA) ^{0.764} (SLOPE) ^{0.244} (STORAGE+1) ^{-0.335}
Q ₂₅	117.99	CFS	= 129(CONTDA) ^{0.760} (SLOPE) ^{0.264} (STORAGE+1) ^{-0.347}
Q ₅₀	146.21	CFS	= 148(CONTDA) ^{0.757} (SLOPE) ^{0.276} (STORAGE+1) ^{-0.355}
Q ₁₀₀	174.32	CFS	= 167(CONTDA) ^{0.756} (SLOPE) ^{0.285} (STORAGE+1) ^{-0.363}

Worksheet for SR 823 STA 209+30

Project Description

Friction Method Manning Formula
Solve For Normal Depth

Input Data

Roughness Coefficient	0.040	
Channel Slope	0.03610	ft/ft
Left Side Slope	4.00	ft/ft (H:V)
Right Side Slope	4.00	ft/ft (H:V)
Bottom Width	5.50	ft
Discharge	146.20	ft ³ /s

Results

Normal Depth	1.66	ft
Flow Area	20.08	ft ²
Wetted Perimeter	19.16	ft
Top Width	18.75	ft
Critical Depth	1.85	ft
Critical Slope	0.02277	ft/ft
Velocity	7.28	ft/s
Velocity Head	0.82	ft
Specific Energy	2.48	ft
Froude Number	1.24	
Flow Type	Supercritical	

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	1.66	ft
Critical Depth	1.85	ft
Channel Slope	0.03610	ft/ft
Critical Slope	0.02277	ft/ft





UNIVERSAL CULVERT DESIGN

PID : 77366 **Date :** 11/16/2012 **Project :** SR 823 Portsmouth Bypass **Location :** Portsmouth Ohio
Description : Drainage area 12, Sta. 209+30

Designer : RCS

HEADWATER CONTROL CODES:

INLET - Inlet Control.
 OUTLET - Outlet Control.

OUTLET* - Outlet Control with backwater curve used to compute headwater. See Figure III - 7E in HDS 5 for type flow.
 OUTLET** - Outlet Control - See Figure III - 7D in HDS 5 for type flow.
 N/A - Flow is supercritical with low headwater and low tailwater. Control Section is at the inlet.

Inlet Invert Elevation (ft.) : 675.75 **Outlet Invert Elevation (ft.) :** 658.59 **Tailwater Elevation (ft.) :** 658.59 **Overflow Elevation (ft.) :** 748.00
Allowable Headwater Elevation (ft.) : 690.00 or Diameter + 4 ft.
Pipe Length (ft.) : 476.00 **Culvert Slope (ft./ft.) :** 0.0361 **Design Manning 'n' :** 0.0120
Design Discharge (cfs) : 146.00 @ 50 yrs. **Flood Discharge (cfs) :** 174.00 @ 100 yrs.

FLOW	PIPE #	CULVERT SIZE	HWI (ft.)	HWO (ft.)	FLOW TYPE	FLOW VELOCITY (fps.)	DN (ft.)	DC (ft.)	MANNING N	HEADWATER CONTROL	OVERFLOW (cfs.)	DESIGN CODE	BURIAL DEPTH (ft.)
CULVERT TYPE : CIRCULAR CORRUGATED													
Corrugated Metal Pipe (2 2/3 x 1/2 in. corrugations)													
146.00	1	54 in.	682.75	673.48	2 - E	14.17	2.78	3.55	0.0233	INLET	0.00	D	0.00
146.00	1	48 in.	685.01	682.33	2 - E	13.68	3.17	3.56	0.0235	INLET	0.00	D - 1	0.00
146.00	1	42 in.	688.91	701.95	2 - F	15.35	3.50	3.37	0.0237	OUTLET**	0.00	D - 2	0.00
146.00	1	60 in.	681.57	N/A	1 - C	14.30	2.58	3.46	0.0232	INLET	0.00	D + 1	0.00
174.00	1	54 in.	684.57	678.19	2 - E	14.66	3.14	3.83	0.0233	INLET	0.00	F	0.00
174.00	1	48 in.	687.68	690.82	2 - F	14.22	4.00	3.75	0.0235	OUTLET**	0.00	F - 1	0.00
174.00	1	42 in.	693.28	718.76	2 - F	18.16	3.50	3.44	0.0237	OUTLET**	0.00	F - 2	0.00
174.00	1	60 in.	682.76	672.03	2 - E	14.90	2.87	3.78	0.0232	INLET	0.00	F + 1	0.00
Corrugated Metal Pipe (3 x 1 in. corrugations)													
146.00	1	54 in.	682.75	676.61	2 - E	12.48	3.10	3.55	0.0273	INLET	0.00	D	0.00

Entrance Loss (Ke) : 0.90

Entrance Type : Half Headwall

no concrete High Velocity



UNIVERSAL CULVERT DESIGN

FLOW PIPE #	CULVERT SIZE	HWI (ft.)	HWO (ft.)	FLOW TYPE	VELOCITY (fps.)	DN (ft.)	DC (ft.)	MANNING N	HEADWATER CONTROL	OVER FLOW (cfs.)	DESIGN CODE	BURIAL DEPTH (ft.)
146.00	1 48 in.	685.01	688.24	2 - F	12.35	4.00	3.56	0.0275	OUTLET**	0.00	D - 1	0.00
146.00	1 42 in.	688.91	714.40	2 - F	15.35	3.50	3.37	0.0278	OUTLET**	0.00	D - 2	0.00
146.00	1 60 in.	681.57	N/A	1 - C	12.70	2.84	3.46	0.0271	INLET	0.00	D + 1	0.00
174.00	1 54 in.	684.57	682.63	2 - E	12.74	3.60	3.83	0.0273	INLET	0.00	F	0.00
174.00	1 48 in.	687.68	699.20	2 - F	14.22	4.00	3.75	0.0275	OUTLET**	0.00	F - 1	0.00
174.00	1 42 in.	693.28	736.45	2 - F	18.16	3.50	3.44	0.0278	OUTLET**	0.00	F - 2	0.00
174.00	1 60 in.	682.76	674.48	2 - E	13.20	3.18	3.78	0.0271	INLET	0.00	F + 1	0.00
Corrugated Metal Pipe (6 x 2 in. corrugations)												
146.00	1 60 in.	681.57	N/A	1 - C	10.83	3.24	3.46	0.0332	INLET	0.00	D	0.00
146.00	1 66 in.	680.98	N/A	1 - C	10.97	3.01	3.37	0.0330	INLET	0.00	D + 1	0.00
174.00	1 60 in.	682.76	679.08	2 - E	11.16	3.70	3.78	0.0332	INLET	0.00	F	0.00
174.00	1 66 in.	681.79	N/A	1 - C	11.41	3.37	3.69	0.0330	INLET	0.00	F + 1	0.00
Corrugated Metal Pipe (6 x 2 in. corrugations, Field Paved Invert)												
146.00	1 60 in.	681.57	N/A	1 - C	13.11	2.76	3.46	0.0260	INLET	0.00	D	0.00
146.00	1 66 in.	680.98	N/A	1 - C	13.13	2.61	3.37	0.0260	INLET	0.00	D + 1	0.00
174.00	1 60 in.	682.76	673.75	2 - E	13.64	3.09	3.78	0.0260	INLET	0.00	F	0.00
174.00	1 66 in.	681.79	N/A	1 - C	13.71	2.90	3.69	0.0260	INLET	0.00	F + 1	0.00

H > 30 upsizer
 2 pipe sizes
 60" → 66"
 54+12 ⇒ 66"

PROPOSED CULVERT
STA 233+87.39
@ 48.2° R.F. SKEW

PATH OF WATER

MAINLINE 823



AREA 13
39.2 AC
= 0.061 Sq.mi.

SR 823 STA 233+87.39

1"=400'

Time of Concentration to Upstream Inlet

$$t_o \approx \frac{1.8(1.1-C)(L)^{(1/2)}}{(s)^{(1/3)}} \quad t_s \text{ or } t_d = \frac{L}{60V} \quad V = 3.281ks^{0.5}$$

Sheet Flow

Elev. UP (ft)	Elev. DN (ft)	Length (ft)	Slope (ft/ft)	To (min)
896	895	58	0.0172	9
				9

Shallow Concentrated Flow

Elev. UP (ft)	Elev. DN (ft)	Length (ft)	Slope (%)	k	V (ft/s)	Ts (min)
895	820	320	23.44	0.076	1.21	4
820	725	390	24.36	0.076	1.23	5
725	690	533	6.57	0.457	3.84	2
						12

Tc = To + Ts

Tc = 21 minutes

Drainage Area

	C	A	CA	
Wooded	0.3	36.8	11.04	Wooded steep slopes
Impervious	0.9	2.4	2.16	
Residential/Slope	0.4	0.0	0.00	
Total		39.2	13.20	

Rainfall Intensity

$$i = a / (Tc + b)^c$$

$i_2 = 2.72$ (in/hr)
 $i_{25} = 4.84$ (in/hr)
 $i_{50} = 5.24$ (in/hr)
 $i_{100} = 6.01$ (in/hr)

Q = CiA (cfs)	a	b	c	
Q ₂ = 36	2-Year	85.568	16.5	0.95
Q ₂₅ = 64	25-Year	198.92	19.3	1.004
Q ₅₀ = 69	50-Year	206.025	19.6	0.99
Q ₁₀₀ = 79	100-Year	355.551	23.199	1.076

HY-8 Culvert Analysis Report

Crossing Discharge Data

Discharge Selection Method: Specify Minimum, Design, and Maximum Flow

Minimum Flow: 64 cfs

Design Flow: 69 cfs

Maximum Flow: 79 cfs

Table 1 - Summary of Culvert Flows at Crossing: Sta 233+87

Headwater Elevation (ft)	Total Discharge (cfs)	Culvert 1 Discharge (cfs)	Roadway Discharge (cfs)	Iterations
683.16	64.00	64.00	0.00	1
683.19	65.50	65.50	0.00	1
683.22	67.00	67.00	0.00	1
683.25	68.50	68.50	0.00	1
683.26	69.00	69.00	0.00	1
683.32	71.50	71.50	0.00	1
683.35	73.00	73.00	0.00	1
683.38	74.50	74.50	0.00	1
683.41	76.00	76.00	0.00	1
683.44	77.50	77.50	0.00	1
683.47	79.00	79.00	0.00	1
787.19	3038.98	3038.98	0.00	Overtopping

Table 2 - Culvert Summary Table: Culvert 1

Total Discharge (cfs)	Culvert Discharge (cfs)	Headwater Elevation (ft)	Inlet Control Depth (ft)	Outlet Control Depth (ft)	Flow Type	Normal Depth (ft)	Critical Depth (ft)	Outlet Depth (ft)	Tailwater Depth (ft)	Outlet Velocity (ft/s)	Tailwater Velocity (ft/s)
	64.00	64.00	683.16	2.059	0.0*	1-S2n	0.411	1.257	0.411	1.170	19.467
	65.50	65.50	683.19	2.091	0.0*	1-S2n	0.421	1.277	0.477	1.186	17.169
	67.00	67.00	683.22	2.122	0.0*	1-S2n	0.430	1.296	0.430	1.201	19.467
	68.50	68.50	683.25	2.154	0.0*	1-S2n	0.440	1.316	0.440	1.216	19.467
	69.00	69.00	683.26	2.165	0.0*	1-S2n	0.443	1.322	0.443	1.221	19.467
	71.50	71.50	683.32	2.216	0.0*	1-S2n	0.459	1.354	0.459	1.246	19.467
	73.00	73.00	683.35	2.247	0.0*	1-S2n	0.469	1.373	0.469	1.261	19.467
	74.50	74.50	683.38	2.278	0.0*	1-S2n	0.478	1.391	0.478	1.276	19.467
	76.00	76.00	683.41	2.309	0.0*	1-S2n	0.488	1.410	0.488	1.290	19.467
	77.50	77.50	683.44	2.339	0.0*	1-S2n	0.498	1.428	0.498	1.305	19.467
	79.00	79.00	683.47	2.369	0.0*	1-S2n	0.507	1.447	0.507	1.319	19.467

Straight Culvert
Inlet Elevation (invert): 681.10 ft, Outlet Elevation (invert): 640.19 ft
Culvert Length: 870.96 ft, Culvert Slope: 0.0470

Site Data - Culvert 1

Site Data Option: Culvert Invert Data
Inlet Station: 0.00 ft
Inlet Elevation: 681.10 ft
Outlet Station: 870.00 ft
Outlet Elevation: 640.19 ft
Number of Barrels: 1

Culvert Data Summary - Culvert 1

Barrel Shape: Concrete Box
Barrel Span: 8.00 ft
Barrel Rise: 8.00 ft
Barrel Material: Concrete
Embedment: 0.00 in
Barrel Manning's n: 0.0120
Culvert Type: Straight
Inlet Configuration: Square Edge (90°) Headwall
Inlet Depression: NONE

Tailwater Channel Data - Sta 233+87

Tailwater Channel Option: Trapezoidal Channel

Bottom Width: 10.00 ft

Side Slope (H:V): 2.00 (1:1)

Channel Slope: 0.0117

Channel Manning's n: 0.0350

Channel Invert Elevation: 640.19 ft

Roadway Data for Crossing: Sta 233+87

Roadway Profile Shape: Constant Roadway Elevation

Crest Length: 200.00 ft

Crest Elevation: 787.19 ft

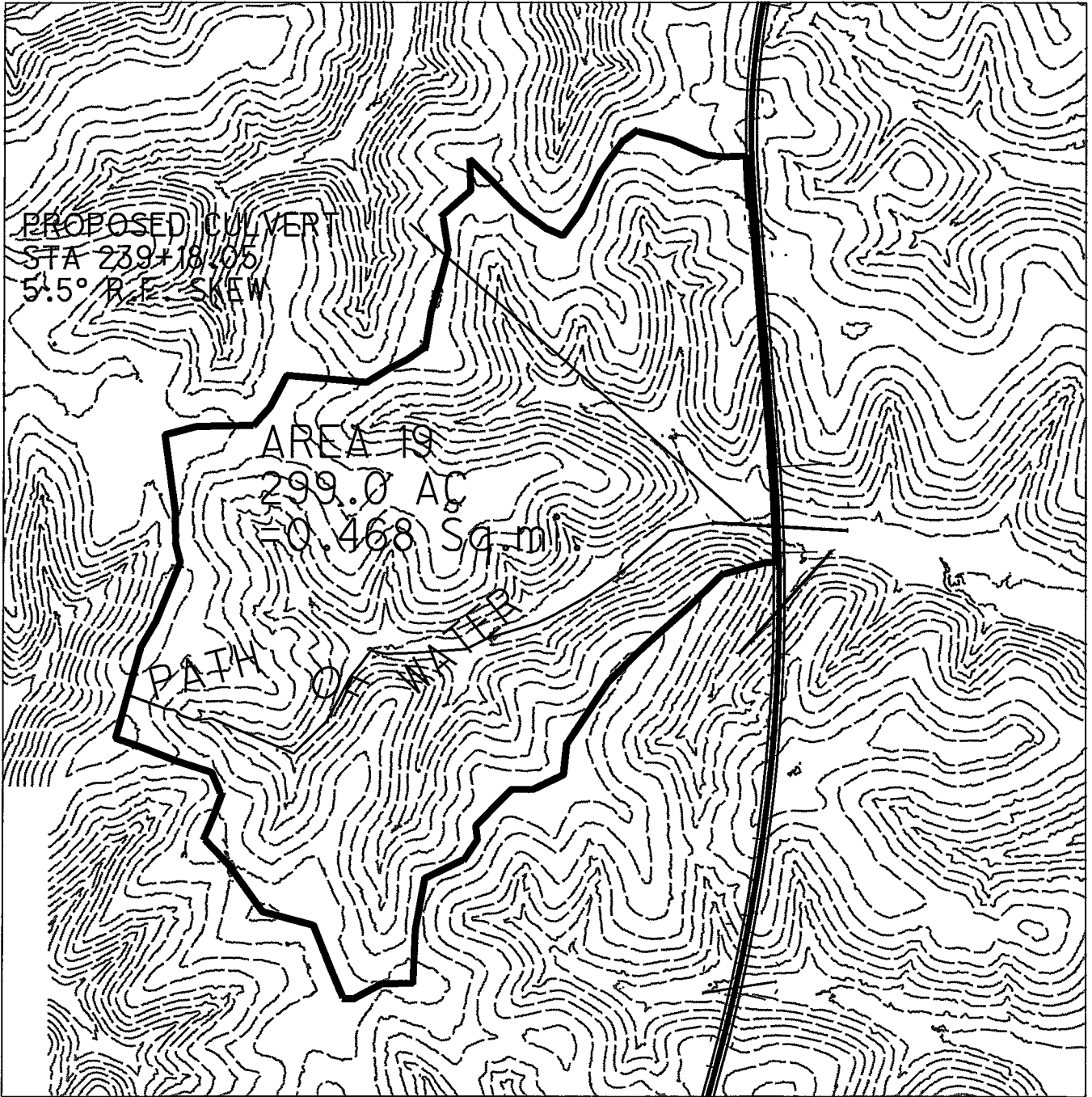
Roadway Surface: Paved

Roadway Top Width: 80.00 ft

HY-8 Energy Dissipation Report

External Energy Dissipator

Parameter	Value	Units
Select Culvert and Flow		
Crossing	Sta 233+87	
Culvert	Culvert 1	
Flow	79.00	cfs <i>Q = 100 cfs</i>
Culvert Data		
Culvert Width (including multiple barrels)	8.0	ft
Culvert Height	8.0	ft
Outlet Depth	0.51	ft
Outlet Velocity	19.47	ft/s
Froude Number	4.82	
Tailwater Depth	1.32	ft
Tailwater Velocity	4.74	ft/s
Tailwater Slope (SO)	0.0470	
External Dissipator Data		
External Dissipator Category	Streambed Level Structures	
External Dissipator Type	Contra Costa	
Restrictions		
Froude Number	<3	
TailWater	<.5D	
Input Data		
Baffle Block Height Ratio		
Note:	2.5 < Baffle Block Height Ratio < 7	
Note:	Optimum Baffle Block Height Ratio = 3.5	
Ratio of Baffle Block Height to Block Distance from the Culvert	3.500	
End Sill Height to Maximum Depth Ratio		
Note:	Maximum Depth in the Dissipator is 3.425 feet	
Note:	0.06 < End Sill Height to Max Depth Ratio < 0.1	
Note:	0.1 is Recommended for End Sill Height to Max Depth Ratio	
Ratio to Determine End Sill Height from Maximum Depth	0.100	
Basin Width		
Note:	Channel Width is 10.000 feet	ft
Note:	8.000 < Basin Width < 24.000	ft
Note:	Channel Width is Recommended for Basin Width	
Basin Width	10.000	ft
Results		
Basin Depth (Y2)	3.425	ft
Basin Length (LB)	15.273	ft
Basin Width (WB)	10.000	ft
Exit Width (W3)	10.000	ft
Exit Depth (YC)	1.196	ft



1"=1000'

SR 823 STA 239+18.05

SR 823 STA 239+18.05
TECHNIQUES FOR ESTIMATING FLOOD-PEAK
DISCHARGES OF RURAL, UNREGULATED STREAMS IN OHIO AREA A
 U.S. GEOLOGICAL SURVEY Water Resources Investigations Report 89-4126

	Values	Units	Definitions
	13033171.00	SQ. FT.	
	0.468	SQ. MI.	CONTDA = Contributing Drainage Area
	0.00	SQ. FT.	
	0.00	%	STORAGE = Storage Area
	4420.00	FT.	TOTAL CHANNEL LENGTH
	442.00	FT.	L₁₀ = 10% of the Distance along channel
	665	FT.	Elev₁₀ = Elevation at point L₁₀
	3757.00	FT.	L₈₅ = 85% of the Distance along channel
	800	FT.	Elev₈₅ = Elevation at point L₈₅
	3315.00	FT.	Length = L₈₅ - L₁₀
	215.02	FT./MI.	SLOPE = (Elev₁₀ - Elev₈₅)/ Length
		CFS	Q_# = Flood-Peak Discharge
			# = Frequency of Storm
Q₂	80	CFS	= 56.1(CONTDA)^{0.782}(SLOPE)^{0.172}(STORAGE+1)^{-0.297}
Q₅	150	CFS	= 84.5(CONTDA)^{0.769}(SLOPE)^{0.221}(STORAGE+1)^{-0.322}
Q₁₀	220	CFS	= 104(CONTDA)^{0.764}(SLOPE)^{0.244}(STORAGE+1)^{-0.335}
Q₂₅	300	CFS	= 129(CONTDA)^{0.760}(SLOPE)^{0.264}(STORAGE+1)^{-0.347}
Q₅₀	370	CFS	= 148(CONTDA)^{0.757}(SLOPE)^{0.276}(STORAGE+1)^{-0.355}
Q₁₀₀	430	CFS	= 167(CONTDA)^{0.756}(SLOPE)^{0.285}(STORAGE+1)^{-0.363}

HY-8 Culvert Analysis Report

Crossing Discharge Data

Discharge Selection Method: Specify Minimum, Design, and Maximum Flow

Minimum Flow: 370 cfs

Design Flow: 430 cfs

Maximum Flow: 430 cfs

Table 1 - Summary of Culvert Flows at Crossing: Sta 239+11

Headwater Elevation (ft)	Total Discharge (cfs)	Culvert 1 Discharge (cfs)	Roadway Discharge (cfs)	Iterations
656.98	370.00	370.00	0.00	1
657.05	376.00	376.00	0.00	1
657.13	382.00	382.00	0.00	1
657.20	388.00	388.00	0.00	1
657.27	394.00	394.00	0.00	1
657.35	400.00	400.00	0.00	1
657.42	406.00	406.00	0.00	1
657.49	412.00	412.00	0.00	1
657.56	418.00	418.00	0.00	1
657.64	424.00	424.00	0.00	1
657.71	430.00	430.00	0.00	1
836.62	4048.45	4048.45	0.00	Overtopping

Table 2 - Culvert Summary Table: Culvert 1

Total Discharge (cfs)	Culvert Discharge (cfs)	Headwater Elevation (ft)	Inlet Control Depth (ft)	Outlet Control Depth (ft)	Flow Type	Normal Depth (ft)	Critical Depth (ft)	Outlet Depth (ft)	Tailwater Depth (ft)	Outlet Velocity (ft/s)	Tailwater Velocity (ft/s)
	370.00	370.00	656.98	6.790	0.0*	1-S2n	2.312	4.050	2.350	3.015	19.681
	376.00	376.00	657.05	6.863	0.0*	1-S2n	2.337	4.094	2.385	3.042	19.704
	382.00	382.00	657.13	6.937	0.0*	1-S2n	2.363	4.137	2.412	3.068	19.795
	388.00	388.00	657.20	7.010	0.0*	1-S2n	2.389	4.180	2.434	3.094	19.928
	394.00	394.00	657.27	7.084	0.0*	1-S2n	2.414	4.223	2.467	3.120	19.966
	400.00	400.00	657.35	7.157	0.0*	1-S2n	2.440	4.266	2.495	3.146	20.041
	406.00	406.00	657.42	7.229	0.0*	1-S2n	2.466	4.309	2.518	3.171	20.154
	412.00	412.00	657.49	7.302	0.0*	1-S2n	2.492	4.351	2.547	3.197	20.220
	418.00	418.00	657.56	7.375	0.0*	1-S2n	2.517	4.393	2.577	3.222	20.278
	424.00	424.00	657.64	7.448	0.0*	1-S2n	2.543	4.435	2.602	3.247	20.372
	430.00	430.00	657.71	7.520	0.0*	1-S2n	2.569	4.477	2.626	3.272	20.471

* Full Flow Headwater elevation is below inlet invert.

Straight Culvert
Inlet Elevation (invert): 650.19 ft, Outlet Elevation (invert): 640.00 ft
Culvert Length: 656.08 ft, Culvert Slope: 0.0155

Site Data - Culvert 1

Site Data Option: Culvert Invert Data
Inlet Station: 0.00 ft
Inlet Elevation: 650.19 ft
Outlet Station: 656.00 ft
Outlet Elevation: 640.00 ft
Number of Barrels: 1

Culvert Data Summary - Culvert 1

Barrel Shape: Concrete Box
Barrel Span: 8.00 ft
Barrel Rise: 8.00 ft
Barrel Material: Concrete
Embedment: 0.00 in
Barrel Manning's n: 0.0120
Culvert Type: Straight
Inlet Configuration: Square Edge (90°) Headwall
Inlet Depression: NONE

Tailwater Channel Data - Sta 239+11

Tailwater Channel Option: Trapezoidal Channel

Bottom Width: 15.00 ft

Side Slope (H:V): 2.00 (1:1)

Channel Slope: 0.0065

Channel Manning's n: 0.0350

Channel Invert Elevation: 640.00 ft

Roadway Data for Crossing: Sta 239+11

Roadway Profile Shape: Constant Roadway Elevation

Crest Length: 200.00 ft

Crest Elevation: 836.62 ft

Roadway Surface: Paved

Roadway Top Width: 80.00 ft

HY-8 Energy Dissipation Report

External Energy Dissipator

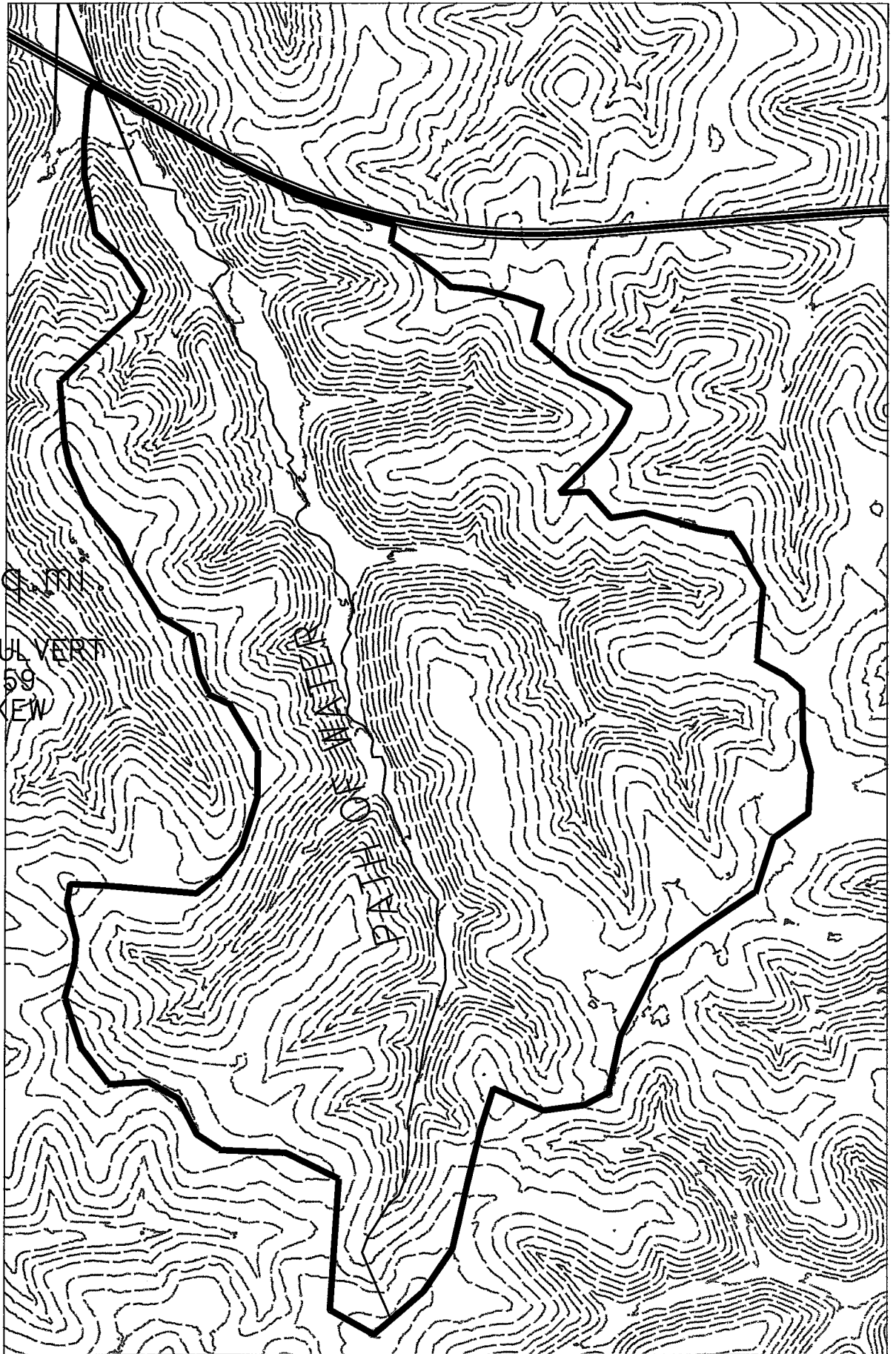
Parameter	Value	Units
Select Culvert and Flow		
Crossing	Sta 239+11	
Culvert	Culvert 1	
Flow	430.00	cfs
Culvert Data		
Culvert Width (including multiple barrels)	8.0	ft
Culvert Height	8.0	ft
Outlet Depth	2.63	ft
Outlet Velocity	20.47	ft/s
Froude Number	2.23	
Tailwater Depth	3.27	ft
Tailwater Velocity	6.10	ft/s
Tailwater Slope (SO)	0.0155	
External Dissipator Data		
External Dissipator Category	Streambed Level Structures	
External Dissipator Type	Riprap Basin	
Restrictions		
Froude Number	<3	
Input Data		
Condition to be used to Compute Basin Outlet Velocity	Envelope Curve	
D50 of the Riprap Mixture		
Note:	Minimum HS/D50 = 2 is Obtained if D50 = 1.037 ft	
D50 of the Riprap Mixture	1.000	ft
DMax of the Riprap Mixture	2.500	ft
Results		
Brink Depth	2.626	ft
Brink Velocity	20.471	ft/s
Depth (YE)	2.626	ft
Riprap Thickness	3.750	ft
Riprap Foreslope	5.0000	ft
Check HS/D50		
Note:	OK if HS/D50 > 2.0	
HS/D50	2.247	
HS/D50 Check	HS/D50 is OK	
Check HS/D50		
Note:	OK if 0.1 < D50/YE < 0.7	
Check D50/YE	0.381	
D50/YE Check	D50/YE is OK	
Basin Length (LB)	35.237	ft
Basin Width	31.491	ft
Apron Length	11.237	ft
Pool Length	24.000	ft
Pool Depth (HS)	2.247	ft
TW/YE	1.246	
Tailwater Depth (TW)	3.272	ft
Average Velocity with TW	3.455	ft/s

Critical Depth (Yc)	1.729	ft
Average Velocity with Yc	7.114	ft/s
Downstream Riprap for High TW		
Distance: 1 LB		
Velocity	16.028	ft/s
Size	1.674	ft
Distance: 2 LB		
Velocity	9.111	ft/s
Size	0.541	ft
Distance: 3 LB		
Velocity	6.056	ft/s
Size	0.239	ft
Distance: 4 LB		
Velocity	4.533	ft/s
Size	0.134	ft



AREA 21
588 AC
= 0.918 S.F.M.

PROPOSED CULVERT
TA 297+33.59
51.6° R.F. SKEW



SR 823 STA 297+33.59

1"=1000'

SR 823 STA 297+33.59
TECHNIQUES FOR ESTIMATING FLOOD-PEAK
DISCHARGES OF RURAL, UNREGULATED STREAMS IN OHIO AREA A
 U.S. GEOLOGICAL SURVEY Water Resources Investigations Report 89-4126

	Values	Units	Definitions
	25591080.00	SQ. FT.	
	0.918	SQ. MI.	CONTDA = Contributing Drainage Area
	587.49	ACRES	
	0.00	%	STORAGE = Storage Area
	9313.00	FT.	TOTAL CHANNEL LENGTH
	931.30	FT.	L₁₀ = 10% of the Distance along channel
	590	FT.	Elev₁₀ = Elevation at point L₁₀
	7916.05	FT.	L₈₅ = 85% of the Distance along channel
	800	FT.	Elev₈₅ = Elevation at point L₈₅
	6984.75	FT.	Length = L₈₅ - L₁₀
	158.75	FT./MI.	SLOPE = (Elev ₁₀ -Elev ₈₅)/Length
		CFS	Q_# = Flood-Peak Discharge
			# = Frequency of Storm
Q₂	100	CFS	= 56.1(CONTDA)^{0.782}(SLOPE)^{0.172}(STORAGE+1)^{-0.297}
Q₅	242	CFS	= 84.5(CONTDA)^{0.769}(SLOPE)^{0.221}(STORAGE+1)^{-0.322}
Q₁₀	335	CFS	= 104(CONTDA)^{0.764}(SLOPE)^{0.244}(STORAGE+1)^{-0.335}
Q₂₅	460	CFS	= 129(CONTDA)^{0.760}(SLOPE)^{0.264}(STORAGE+1)^{-0.347}
Q₅₀	600	CFS	= 148(CONTDA)^{0.757}(SLOPE)^{0.276}(STORAGE+1)^{-0.355}
Q₁₀₀	700	CFS	= 167(CONTDA)^{0.756}(SLOPE)^{0.285}(STORAGE+1)^{-0.363}

HY-8 Culvert Analysis Report

Crossing Discharge Data

Discharge Selection Method: Specify Minimum, Design, and Maximum Flow

Minimum Flow: 600 cfs

Design Flow: 700 cfs

Maximum Flow: 700 cfs

Table 1 - Summary of Culvert Flows at Crossing: Sta 297+45

Headwater Elevation (ft)	Total Discharge (cfs)	Culvert 1 Discharge (cfs)	Roadway Discharge (cfs)	Iterations
586.62	600.00	600.00	0.00	1
586.75	610.00	610.00	0.00	1
586.88	620.00	620.00	0.00	1
587.01	630.00	630.00	0.00	1
587.14	640.00	640.00	0.00	1
587.28	650.00	650.00	0.00	1
587.41	660.00	660.00	0.00	1
587.55	670.00	670.00	0.00	1
587.69	680.00	680.00	0.00	1
587.83	690.00	690.00	0.00	1
587.97	700.00	700.00	0.00	1
750.00	3667.38	3667.38	0.00	Overtopping

Table 2 - Culvert Summary Table: Culvert 1

Total Discharge (cfs)	Culvert Discharge (cfs)	Headwater Elevation (ft)	Inlet Control Depth (ft)	Outlet Control Depth (ft)	Flow Type	Normal Depth (ft)	Critical Depth (ft)	Outlet Depth (ft)	Tailwater Depth (ft)	Outlet Velocity (ft/s)	Tailwater Velocity (ft/s)
	600.00	600.00	586.62	9.616	0.0*	5-S2n	3.208	5.590	3.208	3.487	23.378
	610.00	610.00	586.75	9.746	0.0*	5-S2n	3.247	5.652	3.275	3.518	23.284
	620.00	620.00	586.88	9.877	0.0*	5-S2n	3.286	5.714	3.286	3.549	23.584
	630.00	630.00	587.01	10.009	0.0*	5-S2n	3.325	5.775	3.358	3.580	23.454
	640.00	640.00	587.14	10.142	0.0*	5-S2n	3.364	5.836	3.364	3.610	23.781
	650.00	650.00	587.28	10.276	0.0*	5-S2n	3.403	5.897	3.438	3.640	23.632
	660.00	660.00	587.41	10.411	0.0*	5-S2n	3.442	5.957	3.465	3.670	23.809
	670.00	670.00	587.55	10.548	0.0*	5-S2n	3.481	6.017	3.515	3.700	23.824
	680.00	680.00	587.69	10.686	0.0*	5-S2n	3.520	6.077	3.550	3.729	23.947
	690.00	690.00	587.83	10.826	0.0*	5-S2n	3.559	6.136	3.559	3.759	24.236
	700.00	700.00	587.97	10.967	0.0*	5-S2n	3.598	6.195	3.631	3.788	24.098

* Full Flow Headwater elevation is below inlet invert.

Straight Culvert
Inlet Elevation (invert): 577.00 ft, Outlet Elevation (invert): 555.90 ft
Culvert Length: 1288.17 ft, Culvert Slope: 0.0164

Site Data - Culvert 1

Site Data Option: Culvert Invert Data
Inlet Station: 0.00 ft
Inlet Elevation: 577.00 ft
Outlet Station: 1288.00 ft
Outlet Elevation: 555.90 ft
Number of Barrels: 1

Culvert Data Summary - Culvert 1

Barrel Shape: Concrete Box
Barrel Span: 8.00 ft
Barrel Rise: 8.00 ft
Barrel Material: Concrete
Embedment: 0.00 in
Barrel Manning's n: 0.0120
Culvert Type: Straight
Inlet Configuration: Square Edge (90°) Headwall
Inlet Depression: NONE

HY-8 Energy Dissipation Report

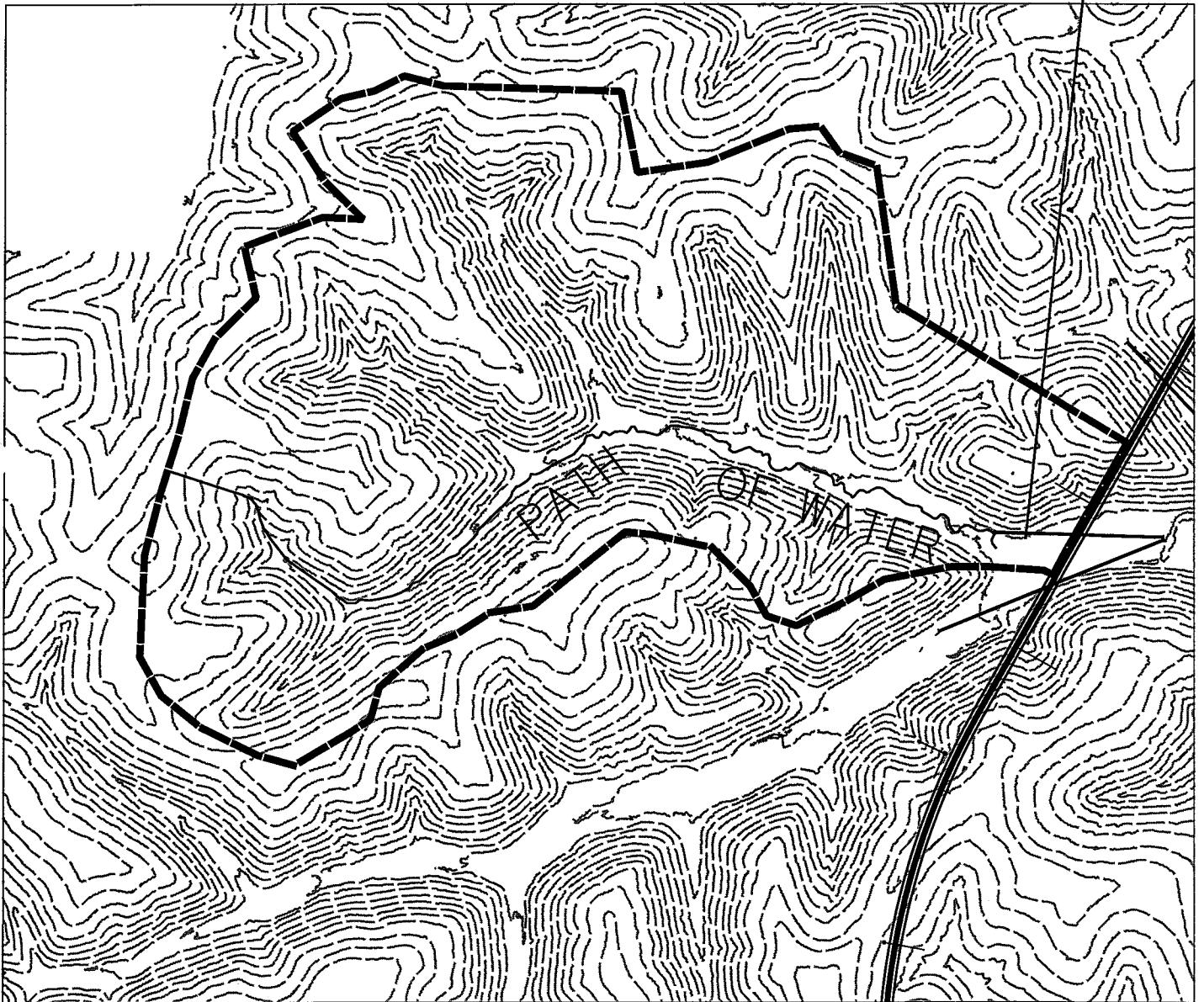
External Energy Dissipator

Parameter	Value	Units
Select Culvert and Flow		
Crossing	Sta 297+45	
Culvert	Culvert 1	
Flow	700.00	cfs
Culvert Data		
Culvert Width (including multiple barrels)	8.0	ft
Culvert Height	8.0	ft
Outlet Depth	3.63	ft
Outlet Velocity	24.10	ft/s
Froude Number	2.23	
Tailwater Depth	3.79	ft
Tailwater Velocity	8.19	ft/s
Tailwater Slope (SO)	0.0164	
External Dissipator Data		
External Dissipator Category	Streambed Level Structures	
External Dissipator Type	Riprap Basin	
Restrictions		
Froude Number	<3	
Input Data		
Condition to be used to Compute Basin Outlet Velocity	Envelope Curve	
D50 of the Riprap Mixture		
Note:	Minimum HS/D50 = 2 is Obtained if D50 = 1.436 ft	
D50 of the Riprap Mixture	0.797	ft
DMax of the Riprap Mixture	2.500	ft
Results		
Brink Depth	3.631	ft
Brink Velocity	24.098	ft/s
Depth (YE)	3.631	ft
Riprap Thickness	3.750	ft
Riprap Foreslope	5.0000	ft
Check HS/D50		
Note:	OK if HS/D50 > 2.0	
HS/D50	9.172	
HS/D50 Check	HS/D50 is OK	
Check HS/D50		
Note:	OK if $0.1 < D50/YE < 0.7$	
Check D50/YE	0.220	
D50/YE Check	D50/YE is OK	
Basin Length (LB)	109.650	ft
Basin Width	81.100	ft
Apron Length	36.550	ft
Pool Length	73.100	ft
Pool Depth (HS)	7.310	ft
TW/YE	1.043	
Tailwater Depth (TW)	3.788	ft
Average Velocity with TW	2.084	ft/s

Critical Depth (Yc)	1.308	ft
Average Velocity with Yc	6.390	ft/s
Downstream Riprap for High TW		
Distance: 1 LB		
Velocity	8.090	ft/s
Size	0.427	ft
Distance: 2 LB		
Velocity	4.025	ft/s
Size	0.106	ft
Distance: 3 LB		
Velocity	2.675	ft/s
Size	0.047	ft
Distance: 4 LB		
Velocity	2.002	ft/s
Size	0.026	ft

AREA 22
345 AC
=0.539 Sq.mi.

PROPOSED CULVERT
STA 300+32
32° R.F. SKEW



SR 823 STA 300+32

1"=1000'

SR 823 STA 300+32
TECHNIQUES FOR ESTIMATING FLOOD-PEAK
DISCHARGES OF RURAL, UNREGULATED STREAMS IN OHIO AREA A
 U.S. GEOLOGICAL SURVEY Water Resources Investigations Report 89-4126

	Values	Units	Definitions
	15014583.00	SQ. FT.	
	0.539	SQ. MI.	CONTDA = Contributing Drainage Area
	344.69	ACRES	
	0.00	%	STORAGE = Storage Area
	6593.00	FT.	TOTAL CHANNEL LENGTH
	659.30	FT.	L₁₀ = 10% of the Distance along channel
	575	FT.	Elev₁₀ = Elevation at point L₁₀
	5604.05	FT.	L₈₅ = 85% of the Distance along channel
	745	FT.	Elev₈₅ = Elevation at point L₈₅
	4944.75	FT.	Length = L₈₅ - L₁₀
	181.53	FT./MI.	SLOPE = (Elev ₁₀ -Elev ₈₅)/Length
		CFS	Q_# = Flood-Peak Discharge
			# = Frequency of Storm
Q₂	80	CFS	= 56.1(CONTDA)^{0.782}(SLOPE)^{0.172}(STORAGE+1)^{-0.297}
Q₅	170	CFS	= 84.5(CONTDA)^{0.769}(SLOPE)^{0.221}(STORAGE+1)^{-0.322}
Q₁₀	230	CFS	= 104(CONTDA)^{0.764}(SLOPE)^{0.244}(STORAGE+1)^{-0.335}
Q₂₅	320	CFS	= 129(CONTDA)^{0.760}(SLOPE)^{0.264}(STORAGE+1)^{-0.347}
Q₅₀	390	CFS	= 148(CONTDA)^{0.757}(SLOPE)^{0.276}(STORAGE+1)^{-0.355}
Q₁₀₀	460	CFS	= 167(CONTDA)^{0.756}(SLOPE)^{0.285}(STORAGE+1)^{-0.363}

HY-8 Culvert Analysis Report

Crossing Discharge Data

Discharge Selection Method: Specify Minimum, Design, and Maximum Flow

Minimum Flow: 390 cfs

Design Flow: 460 cfs

Maximum Flow: 460 cfs

Table 1 - Summary of Culvert Flows at Crossing: Sta 303+34

Headwater Elevation (ft)	Total Discharge (cfs)	Culvert 1 Discharge (cfs)	Roadway Discharge (cfs)	Iterations
573.05	390.00	390.00	0.00	1
573.13	397.00	397.00	0.00	1
573.22	404.00	404.00	0.00	1
573.30	411.00	411.00	0.00	1
573.39	418.00	418.00	0.00	1
573.47	425.00	425.00	0.00	1
573.56	432.00	432.00	0.00	1
573.64	439.00	439.00	0.00	1
573.73	446.00	446.00	0.00	1
573.81	453.00	453.00	0.00	1
573.90	460.00	460.00	0.00	1
741.80	3907.85	3907.85	0.00	Overtopping

Table 2 - Culvert Summary Table: Culvert 1

Total Discharge (cfs)	Culvert Discharge (cfs)	Headwater Elevation (ft)	Inlet Control Depth (ft)	Outlet Control Depth (ft)	Flow Type	Normal Depth (ft)	Critical Depth (ft)	Outlet Depth (ft)	Tailwater Depth (ft)	Outlet Velocity (ft/s)	Tailwater Velocity (ft/s)
	390.00	390.00	573.05	7.048	0.0*	1-S2n	2.615	4.195	2.615	2.634	18.642
	397.00	397.00	573.13	7.134	0.0*	1-S2n	2.649	4.245	2.683	2.660	18.499
	404.00	404.00	573.22	7.219	0.0*	1-S2n	2.683	4.294	2.704	2.686	18.679
	411.00	411.00	573.30	7.304	0.0*	1-S2n	2.717	4.344	2.717	2.711	18.910
	418.00	418.00	573.39	7.388	0.0*	1-S2n	2.751	4.393	2.784	2.737	18.765
	425.00	425.00	573.47	7.473	0.0*	1-S2n	2.785	4.442	2.809	2.762	18.914
	432.00	432.00	573.56	7.558	0.0*	1-S2n	2.818	4.491	2.818	2.787	19.159
	439.00	439.00	573.64	7.642	0.0*	1-S2n	2.852	4.539	2.885	2.812	19.023
	446.00	446.00	573.73	7.727	0.0*	1-S2n	2.886	4.587	2.913	2.836	19.138
	453.00	453.00	573.81	7.812	0.0*	1-S2n	2.919	4.635	2.919	2.861	19.396
	460.00	460.00	573.90	7.896	0.0*	1-S2n	2.951	4.683	2.982	2.885	19.281

Straight Culvert
Inlet Elevation (invert): 566.00 ft, Outlet Elevation (invert): 554.50 ft
Culvert Length: 946.07 ft, Culvert Slope: 0.0122

Site Data - Culvert 1

Site Data Option: Culvert Invert Data
Inlet Station: 0.00 ft
Inlet Elevation: 566.00 ft
Outlet Station: 946.00 ft
Outlet Elevation: 554.50 ft
Number of Barrels: 1

Culvert Data Summary - Culvert 1

Barrel Shape: Concrete Box
Barrel Span: 8.00 ft
Barrel Rise: 8.00 ft
Barrel Material: Concrete
Embedment: 0.00 in
Barrel Manning's n: 0.0120
Culvert Type: Straight
Inlet Configuration: Square Edge (90°) Headwall
Inlet Depression: NONE

Table 3 - Downstream Channel Rating Curve (Crossing: Sta 303+34)

Flow (cfs)	Water Surface Elev (ft)	Depth (ft)	Velocity (ft/s)	Shear (psf)	Froude Number
390.00	558.13	2.63	7.31	1.94	0.89
397.00	558.16	2.66	7.34	1.96	0.89
404.00	558.19	2.69	7.38	1.98	0.89
411.00	558.21	2.71	7.42	2.00	0.89
418.00	558.24	2.74	7.46	2.02	0.89
425.00	558.26	2.76	7.50	2.03	0.90
432.00	558.29	2.79	7.53	2.05	0.90
439.00	558.31	2.81	7.57	2.07	0.90
446.00	558.34	2.84	7.61	2.09	0.90
453.00	558.36	2.86	7.64	2.11	0.90
460.00	558.39	2.89	7.68	2.12	0.90

Tailwater Channel Data - Sta 303+34

Tailwater Channel Option: Trapezoidal Channel

Bottom Width: 15.00 ft

Side Slope (H:V): 2.00 (1:1)

Channel Slope: 0.0118

Channel Manning's n: 0.0350

Channel Invert Elevation: 555.50 ft

HY-8 Energy Dissipation Report

External Energy Dissipator

Parameter	Value	Units
Select Culvert and Flow		
Crossing	Sta 303+34	
Culvert	Culvert 1	
Flow	460.00	cfs
Culvert Data		
Culvert Width (including multiple barrels)	8.0	ft
Culvert Height	8.0	ft
Outlet Depth	2.98	ft
Outlet Velocity	19.28	ft/s
Froude Number	1.97	
Tailwater Depth	2.89	ft
Tailwater Velocity	7.68	ft/s
Tailwater Slope (SO)	0.0122	
External Dissipator Data		
External Dissipator Category	Streambed Level Structures	
External Dissipator Type	Riprap Basin	
Restrictions		
Froude Number	<3	
Input Data		
Condition to be used to Compute Basin Outlet Velocity	Best Fit Curve	
D50 of the Riprap Mixture		
Note:	Minimum HS/D50 = 2 is Obtained if D50 = 0.827 ft	
D50 of the Riprap Mixture	0.827	ft
DMax of the Riprap Mixture	2.500	ft
Results		
Brink Depth	2.982	ft
Brink Velocity	19.281	ft/s
Depth (YE)	2.982	ft
Riprap Thickness	3.750	ft
Riprap Foreslope	5.0000	ft
Check HS/D50		
Note:	OK if HS/D50 > 2.0	
HS/D50	2.007	
HS/D50 Check	HS/D50 is OK	
Check HS/D50		
Note:	OK if 0.1 < D50/YE < 0.7	
Check D50/YE	0.277	
D50/YE Check	D50/YE is OK	
Basin Length (LB)	32.298	ft
Basin Width	29.532	ft
Apron Length	8.298	ft
Pool Length	24.000	ft
Pool Depth (HS)	1.660	ft
TW/YE	0.967	
Tailwater Depth (TW)	2.885	ft
Average Velocity with TW	4.517	ft/s

Critical Depth (Yc)	1.876	ft
Average Velocity with Yc	7.366	ft/s
Downstream Riprap for High TW		
Distance: 1 LB		
Velocity	16.039	ft/s
Size	1.677	ft
Distance: 2 LB		
Velocity	9.989	ft/s
Size	0.650	ft
Distance: 3 LB		
Velocity	6.640	ft/s
Size	0.287	ft
Distance: 4 LB		
Velocity	4.969	ft/s
Size	0.161	ft

SR 823 STA 311+81

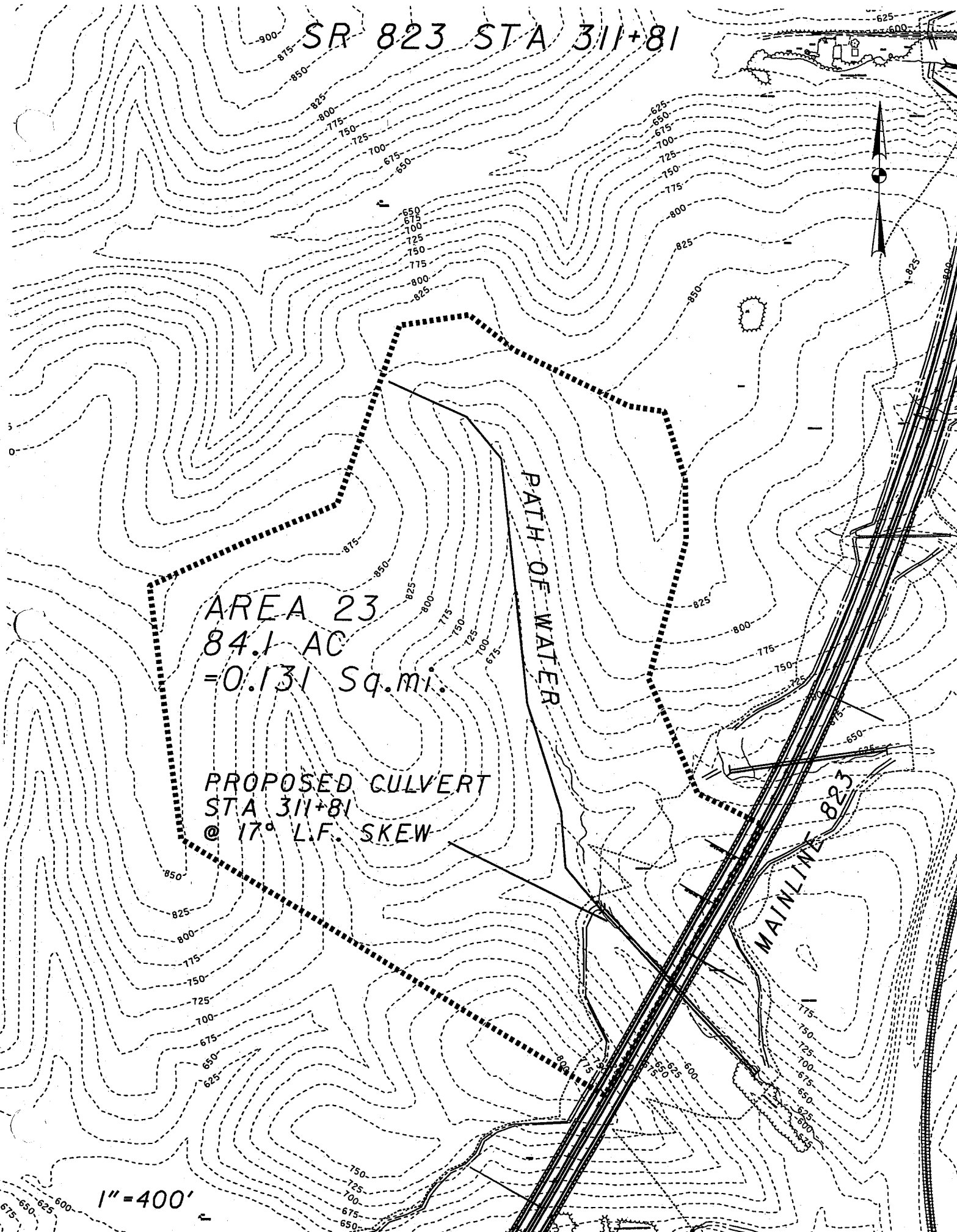
AREA 23
84.1 AC
= 0.131 Sq. mi.

PROPOSED CULVERT
STA 311+81
@ 17° L.F. SKEW

PATH OF WATER

MAINLINE 823

1" = 400'



SR 823 STA 311+81.00
TECHNIQUES FOR ESTIMATING FLOOD-PEAK
DISCHARGES OF RURAL, UNREGULATED STREAMS IN OHIO AREA A
 U.S. GEOLOGICAL SURVEY Water Resources Investigations Report 89-4126

	Values	Units	Definitions
	3662580.60	SQ. FT.	
	0.131	SQ. MI.	CONTDA = Contributing Drainage Area
	0.00	SQ. FT.	
	0.00	%	STORAGE = Storage Area
	2108.00	FT.	TOTAL CHANNEL LENGTH
	210.80	FT.	L ₁₀ = 10% of the Distance along channel
	625	FT.	Elev ₁₀ = Elevation at point L ₁₀
	1791.80	FT.	L ₈₅ = 85% of the Distance along channel
	749	FT.	Elev ₈₅ = Elevation at point L ₈₅
	1581.00	FT.	Length = L ₈₅ - L ₁₀
	414.12	FT./MI.	SLOPE = (Elev ₁₀ -Elev ₈₅)/Length
		CFS	Q _# = Flood-Peak Discharge
			# = Frequency of Storm
Q ₂	32.34	CFS	= 56.1(CONTDA) ^{0.782} (SLOPE) ^{0.172} (STORAGE+1) ^{-0.297}
Q ₅	67.20	CFS	= 84.5(CONTDA) ^{0.769} (SLOPE) ^{0.221} (STORAGE+1) ^{-0.322}
Q ₁₀	95.98	CFS	= 104(CONTDA) ^{0.764} (SLOPE) ^{0.244} (STORAGE+1) ^{-0.335}
Q ₂₅	135.39	CFS	= 129(CONTDA) ^{0.760} (SLOPE) ^{0.264} (STORAGE+1) ^{-0.347}
Q ₅₀	168.00	CFS	= 148(CONTDA) ^{0.757} (SLOPE) ^{0.276} (STORAGE+1) ^{-0.355}
Q ₁₀₀	200.54	CFS	= 167(CONTDA) ^{0.756} (SLOPE) ^{0.285} (STORAGE+1) ^{-0.363}

HY-8 Culvert Analysis Report

Crossing Discharge Data

Discharge Selection Method: Recurrence

Table 1 - Summary of Culvert Flows at Crossing: Sta 311+81

Headwater Elevation (ft)	Discharge Names	Total Discharge (cfs)	Culvert 1 Discharge (cfs)	Roadway Discharge (cfs)	Iterations
604.55	50 year	168.00	168.00	0.00	1
605.03	100 year	200.00	200.00	0.00	1
729.40	Overtopping	3357.38	3357.38	0.00	Overtopping

Table 2 - Culvert Summary Table: Culvert 1

Discharge Names	Total Discharge (cfs)	Culvert Discharge (cfs)	Headwater Elevation (ft)	Inlet Control Depth (ft)	Outlet Control Depth (ft)	Flow Type	Normal Depth (ft)	Critical Depth (ft)	Outlet Depth (ft)	Tailwater Depth (ft)	Outlet Velocity (ft/s)
50 year	168.00	168.00	604.55	3.946	0.0*	1-S2n	0.976	2.393	0.976	1.427	21.518
100 year	200.00	200.00	605.03	4.433	0.0*	1-S2n	1.085	2.687	1.137	1.574	21.997

Straight Culvert
Inlet Elevation (invert): 600.60 ft, Outlet Elevation (invert): 573.90 ft
Culvert Length: 671.53 ft, Culvert Slope: 0.0398

Site Data - Culvert 1

Site Data Option: Culvert Invert Data
Inlet Station: 0.00 ft
Inlet Elevation: 600.60 ft
Outlet Station: 671.00 ft
Outlet Elevation: 573.90 ft
Number of Barrels: 1

Culvert Data Summary - Culvert 1

Barrel Shape: Concrete Box
Barrel Span: 8.00 ft
Barrel Rise: 8.00 ft
Barrel Material: Concrete
Embedment: 0.00 in
Barrel Manning's n: 0.0120
Culvert Type: Straight
Inlet Configuration: Square Edge (90°) Headwall
Inlet Depression: NONE

HY-8 Energy Dissipation Report

External Energy Dissipator

Parameter	Value	Units
Select Culvert and Flow		
Crossing	Sta 311+81	
Culvert	Culvert 1	
Flow	200.00	cfs
Culvert Data		
Culvert Width (including multiple barrels)	8.0	ft
Culvert Height	8.0	ft
Outlet Depth	1.14	ft
Outlet Velocity	22.00	ft/s
Froude Number	3.64	
Tailwater Depth	1.57	ft
Tailwater Velocity	9.66	ft/s
Tailwater Slope (SO)	0.0398	
External Dissipator Data		
External Dissipator Category	Streambed Level Structures	
External Dissipator Type	Contra Costa	
Restrictions		
Froude Number	<3	
TailWater	<.5D	
Input Data		
Baffle Block Height Ratio		
Note:	2.5 < Baffle Block Height Ratio < 7	
Note:	Optimum Baffle Block Height Ratio = 3.5	
Ratio of Baffle Block Height to Block Distance from the Culvert	3.500	
End Sill Height to Maximum Depth Ratio		
Note:	Maximum Depth in the Dissipator is 5.646 feet	
Note:	0.06 < End Sill Height to Max Depth Ratio < 0.1	
Note:	0.1 is Recommended for End Sill Height to Max Depth Ratio	
Ratio to Determine End Sill Height from Maximum Depth	0.100	
Basin Width		
Note:	Channel Width is 10.000 feet	ft
Note:	8.000 < Basin Width < 24.000	ft
Note:	Channel Width is Recommended for Basin Width	
Basin Width	8.000	ft
Results		
Basin Depth (Y2)	5.646	ft
Basin Length (LB)	25.172	ft
Basin Width (WB)	8.000	ft
Exit Width (W3)	8.000	ft
Exit Depth (YC)	2.417	ft

Exit Velocity (VB=VC)	7.945	ft/s
First Baffle		
Height (H1)	1.383	ft
Width (WB)	8.000	ft
Space (L1)	4.841	ft
Second Baffle		
Height (H2)	2.766	ft
Width (WB)	8.000	ft
Space (L2)	9.682	ft
End Sill		
Height (H3)	0.565	ft
Top Width (W3)	8.000	ft
Location (L3)	15.489	ft

SR 823 STA 320+42.81

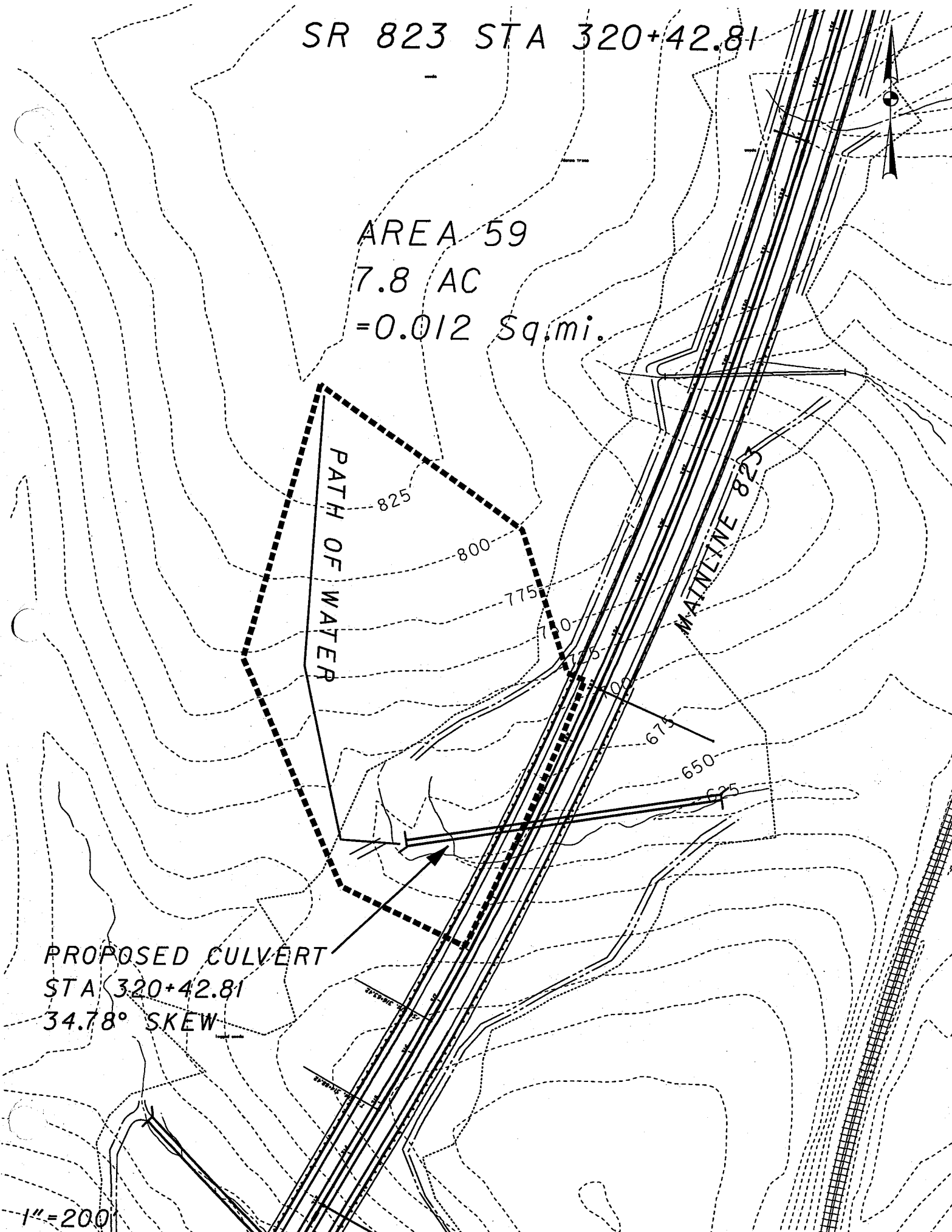
AREA 59
7.8 AC
= 0.012 Sq.mi.

PATH OF WATER

MAINLINE 823

PROPOSED CULVERT
STA 320+42.81
34.78° SKEW

1" = 200'



Project: SCI-823-PH3
 Subject: Hydrology - ROW submission
 Task: Area 59
 Job #: 71143



Originated: RCS-11/16/12
 Checked: KAG-01/04/2013
 Changes Made:
 Corrections Verified:

Time of Concentration to Upstream Inlet

$$t_o \approx \frac{1.8(1.1-C)(L)^{(1/2)}}{(s)^{(1/3)}} \quad t_s \text{ or } t_d = \frac{L}{60V} \quad V = 3.281ks^{0.5}$$

Sheet Flow

Elev. UP (ft)	Elev. DN (ft)	Length (ft)	Slope (ft/ft)	To (min)
851	845	43	0.1395	3
				3

Shallow Concentrated Flow

Elev. UP (ft)	Elev. DN (ft)	Length (ft)	Slope (%)	k	V (ft/s)	Ts (min)
845	790	311	17.68	0.076	1.05	5
790	690	300	33.33	0.076	1.44	3
690	661	180	16.11	0.457	6.02	0
						9

Tc = To + Ts

Tc = 12 minutes

Drainage Area

	C	A	CA
Wooded	0.4	7.1	2.84
Impervious	0.9	0.6	0.54
Residential/Slope	0.4	0.0	0.00
Total		7.7	3.38

Wooded steep slopes

Rainfall Intensity

$$i = a / (Tc + b)^c$$

$i_2 = 3.51$ (in/hr)
 $i_{25} = 6.20$ (in/hr)
 $i_{50} = 6.67$ (in/hr)
 $i_{100} = 7.62$ (in/hr)

Q = CiA (cfs)	a			b			c		
	2-Year	25-Year	50-Year	100-Year	2-Year	25-Year	50-Year	100-Year	
Q ₂ = 12	85.568	198.92	206.025	355.551	16.5	19.3	19.6	23.199	
Q ₂₅ = 21	85.568	198.92	206.025	355.551	16.5	19.3	19.6	23.199	
Q ₅₀ = 23	85.568	198.92	206.025	355.551	16.5	19.3	19.6	23.199	
Q ₁₀₀ = 26	85.568	198.92	206.025	355.551	16.5	19.3	19.6	23.199	



UNIVERSAL CULVERT DESIGN

PID : 77366 **Date :** 01/04/2013 **Project :** SR 823 Portsmouth Bypass **Location :** Portsmouth, Ohio **Designer :** kag
Description : Drainage area 59, Sta. 320+42.81

HEADWATER CONTROL CODES: INLET - Inlet Control.
 OUTLET - Outlet Control.
 OUTLET* - Outlet Control with backwater curve used to compute headwater. See Figure III - 7E in HDS 5 for type flow.
 OUTLET** - Outlet Control - See Figure III - 7D in HDS 5 for type flow.
 N/A - Flow is supercritical with low headwater and low tailwater. Control Section is at the inlet.

Inlet Invert Elevation (ft.) : 659.10 **Outlet Invert Elevation (ft.) :** 619.20 **Tailwater Elevation (ft.) :** 619.70 **Overflow Elevation (ft.) :** 720.23
Allowable Headwater Elevation (ft.) : 720.23 or Diameter + 4 ft. *(whichever is less)*
Pipe Length (ft.) : 529.00 **Culvert Slope (ft./ft.) :** 0.0754 **Design Manning 'n' :** 0.0120
Design Discharge (cfs) : 23.00 @ 50 yrs. **Flood Discharge (cfs) :** 26.00 @ 100 yrs.

FLOW PIPE #	PIPE	CULVERT SIZE	HWI (ft.)	HWO (ft.)	FLOW TYPE	VELOCITY (fps.)	DN (ft.)	DC (ft.)	MANNING N	HEADWATER CONTROL	OVERFLOW (cfs.)	DESIGN CODE	BURIAL DEPTH (ft.)
CULVERT TYPE : CIRCULAR CORRUGATED													
Entrance Type : Half Headwall													
Entrance Loss (Ke) : 0.90													
Corrugated Metal Pipe (2 2/3 x 1/2 in. corrugations)													
23.00	1	21 in.	664.66	663.94	2 - E	10.80	1.45	1.66	0.0248	INLET	0.00	D	0.00
23.00	1	18 in.	668.28	718.21	2 - F	13.05	1.50	1.48	0.0249	OUTLET**	0.00	D - 1	0.00
14.30	1	15 in.	721.51	877.42	2 - F	11.68	1.25	1.23	0.0250	OUTLET**	8.70	D - 2	0.00
23.00	1	24 in.	663.04	642.26	2 - E	11.27	1.24	1.71	0.0247	INLET	0.00	D + 1	0.00
26.00	1	21 in.	665.75	675.91	2 - F	10.93	1.75	1.69	0.0248	OUTLET**	0.00	F	0.00
23.20	1	18 in.	672.29	745.31	2 - F	13.16	1.50	1.48	0.0249	OUTLET**	2.80	F - 1	0.00
14.30	1	15 in.	796.98	948.83	2 - F	11.68	1.25	1.23	0.0250	OUTLET**	11.70	F - 2	0.00
26.00	1	24 in.	663.78	648.20	2 - E	11.56	1.35	1.79	0.0247	INLET	0.00	F + 1	0.00
Corrugated Metal Pipe (3 x 1 in. corrugations)													
23.00	1	36 in.	661.39	N/A	1 - C	10.20	1.07	1.54	0.0281	INLET	0.00	D	0.00



UNIVERSAL CULVERT DESIGN

FLOW (cfs.)	PIPE #	CULVERT SIZE	HWI (ft.)	HWO (ft.)	FLOW TYPE	VELOCITY (fps.)	DN (ft.)	DC (ft.)	MANNING N	HEADWATER CONTROL	OVER FLOW (cfs.)	DESIGN CODE	BURIAL DEPTH (ft.)
23.00	1	42 in.	661.24	N/A	1 - C	10.16	1.00	1.47	0.0278	INLET	0.00	D + 1	0.00
26.00	1	36 in.	661.57	N/A	1 - C	10.54	1.14	1.65	0.0281	INLET	0.00	F	0.00
26.00	1	42 in.	661.40	N/A	1 - C	10.49	1.07	1.57	0.0278	INLET	0.00	F + 1	0.00
Corrugated Metal Pipe (6 x 2 in. corrugations)													
23.00	1	60 in.	660.93	N/A	1 - C	8.61	0.97	1.33	0.0332	INLET	0.00	D	0.00
23.00	1	66 in.	660.85	N/A	1 - C	8.55	0.94	1.29	0.0330	INLET	0.00	D + 1	0.00
26.00	1	60 in.	661.07	N/A	1 - C	8.92	1.03	1.41	0.0332	INLET	0.00	F	0.00
26.00	1	66 in.	660.98	N/A	1 - C	8.87	1.00	1.37	0.0330	INLET	0.00	F + 1	0.00
Corrugated Metal Pipe (6 x 2 in. corrugations, Field Paved Invert)													
23.00	1	60 in.	660.93	N/A	1 - C	10.24	0.86	1.33	0.0260	INLET	0.00	D	0.00
23.00	1	66 in.	660.85	N/A	1 - C	10.10	0.84	1.29	0.0260	INLET	0.00	D + 1	0.00
26.00	1	60 in.	661.07	N/A	1 - C	10.61	0.91	1.41	0.0260	INLET	0.00	F	0.00
26.00	1	66 in.	660.98	N/A	1 - C	10.48	0.89	1.37	0.0260	INLET	0.00	F + 1	0.00

*60 in
30 ft
N/A*

Fill over 16 wps, 3x 12" use 48"



CULVERT ANALYSIS

PID : 77366 **Date :** 01/04/2013 **Project :** SR 823 Portsmouth Bypass **Location :** Portsmouth, Ohio
Description : Drainage Area 59, 320+42

Designer : KAG

HEADWATER CONTROL CODES:

- INLET - Inlet Control.
- OUTLET - Outlet Control.
- OUTLET* - Outlet Control with backwater curve used to compute headwater. See Figure III - 7E in HDS 5 for type flow.
- OUTLET** - Outlet Control - See Figure III - 7D in HDS 5 for type flow.
- N/A - Flow is supercritical with low headwater and low tailwater. Control Section is at the inlet.

Pipe Number : 2 **Use HW :** 0 **Inlet Invert Elevation (ft.) :** 659.10 **Outlet Invert Elevation (ft.) :** 619.20
Pipe Quantity : 1

Culvert Type : Circular Corrugated **Pipe Length (ft.) :** 529.00 **Culvert Slope (ft./ft.) :** 0.0754
Corrugation Type : Corrugated Metal Pipe (3 x 1 in. corrugations)

Pipe Size : 48 in.

Design Manning 'n' : (default)

Entrance Type : Half Headwall

Loss Coef. Ke : 0.9000

FLOW LOSS (cfs.)	HEAD (ft.)	HWI (ft.)	HWO (ft.)	FLOW TYPE	VELOCITY (fps.)	DN (ft.)	DC (ft.)	MANNING N	HEADWATER CONTROL	BURIED DEPTH (ft.)	TAILWATER ELEVATION (ft.)
23.00	39.22	661.13	N/A	1 - C	10.09	0.95	1.42	0.0275	INLET	0.00	619.20
26.00	39.32	661.27	N/A	1 - C	10.45	1.01	1.51	0.0275	INLET	0.00	619.20



CULVERT ANALYSIS

FLOW LOSS (cfs.)	HEAD (ft.)	HWI (ft.)	HWO (ft.)	FLOW TYPE	VELOCITY (fps.)	DN (ft.)	DC (ft.)	MANNING N	HEADWATER CONTROL	BURIED DEPTH (ft.)	TAILWATER ELEVATION (ft.)
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Pipe Number : 3 **Use HW :** 0 **Inlet Invert Elevation (ft.) :** 659.10 **Outlet Invert Elevation (ft.) :** 619.20
Pipe Quantity : 1

Culvert Type : Circular Corrugated **Pipe Length (ft.) :** 529.00 **Culvert Slope (ft./ft.) :** 0.0754

Corrugation Type : Corrugated Metal Pipe (2 2/3 x 1/2 in. corrugations)

Pipe Size : 48 in.

Design Manning 'n' : (default)

Entrance Type : Half Headwall

Loss Coef. Ke : 0.9000

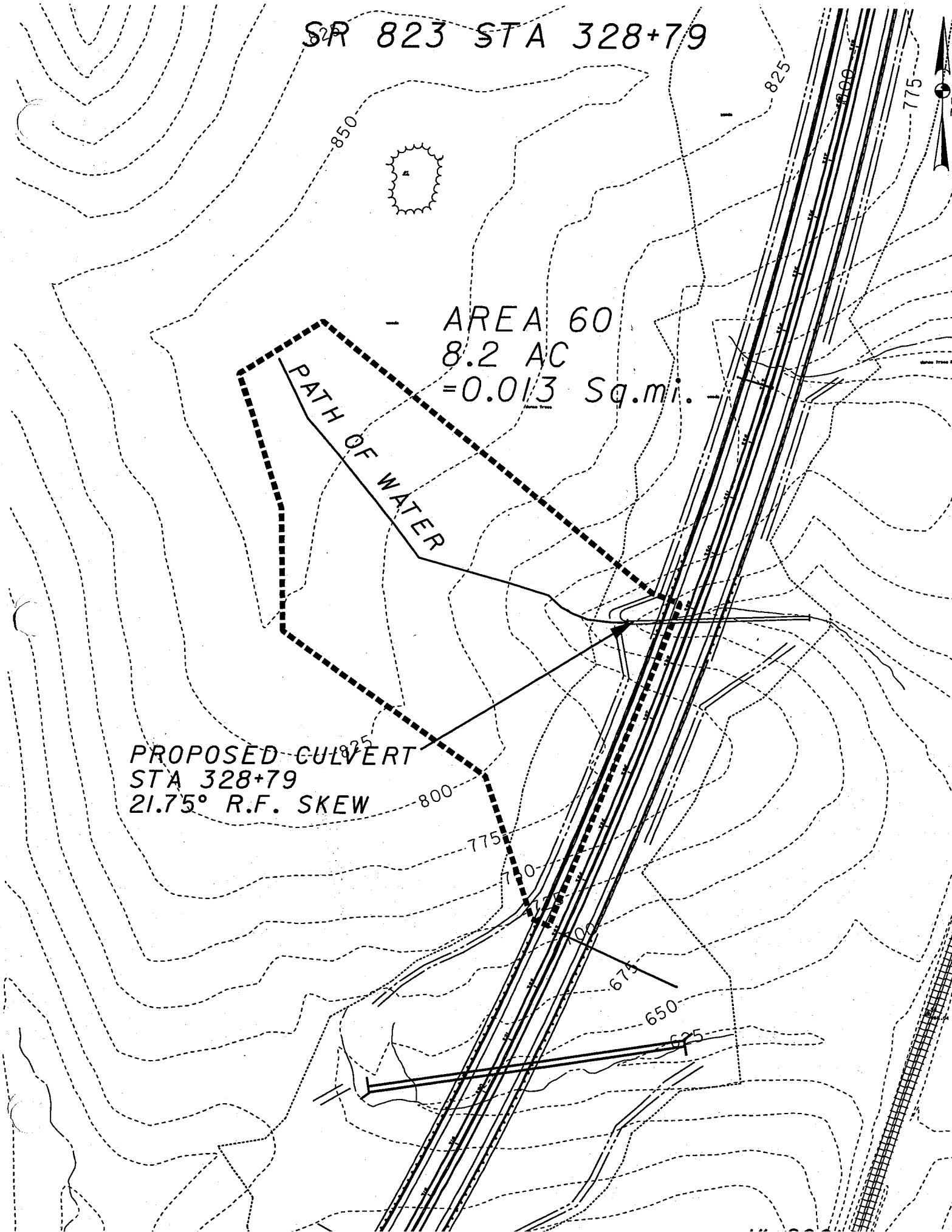
FLOW LOSS (cfs.)	HEAD (ft.)	HWI (ft.)	HWO (ft.)	FLOW TYPE	VELOCITY (fps.)	DN (ft.)	DC (ft.)	MANNING N	HEADWATER CONTROL	BURIED DEPTH (ft.)	TAILWATER ELEVATION (ft.)
23.00	39.22	661.13	N/A	1 - C	11.29	0.88	1.42	0.0235	INLET	0.00	619.20
26.00	39.32	661.27	N/A	1 - C	11.68	0.93	1.51	0.0235	INLET	0.00	619.20

SR 823 STA 328+79

- AREA 60
8.2 AC
= 0.013 Sq.mi.

PATH OF WATER

PROPOSED GULVERT
STA 328+79
21.75° R.F. SKEW



Project: SCI-823-PH3
 Subject: Hydrology - ROW submission
 Task: Area 60
 Job #: 71143



Originated: RCS-11/16/12
 Checked: KAG 01/04/13
 Changes Made:
 Corrections Verified:

Time of Concentration to Upstream Inlet

$$t_o \approx \frac{1.8(1.1-C)(L)^{(1/2)}}{(s)^{(1/3)}} \quad t_s \text{ or } t_d = \frac{L}{60V} \quad V = 3.281ks^{0.5}$$

Sheet Flow

Elev. UP (ft)	Elev. DN (ft)	Length (ft)	Slope (ft/ft)	To (min)
874	865	111	0.0811	7
				7

Shallow Concentrated Flow

Elev. UP (ft)	Elev. DN (ft)	Length (ft)	Slope (%)	k	V (ft/s)	Ts (min)
865	805	353	17.00	0.076	1.03	6
805	760	175	25.71	0.076	1.26	2
760	730	68	44.12	0.076	1.66	1
730	710	53	37.74	0.457	9.21	0
						9

Tc = To + Ts

Tc = 16 minutes

Drainage Area

	C	A	CA
Wooded	0.4	7.6	7.37
Impervious	0.9	0.6	0.79
Residential/Slope	0.4	0.0	0.00
Total		8.2	8.16

Wooded steep slopes

Rainfall Intensity

$$i = a / (Tc + b)^c$$

$i_2 = \frac{3.13}{(in/hr)}$
 $i_{25} = \frac{5.56}{(in/hr)}$
 $i_{50} = \frac{6.00}{(in/hr)}$
 $i_{100} = \frac{6.86}{(in/hr)}$

$Q = CiA$
 (cfs)
 $Q_2 = 26$
 $Q_{25} = 45$
 $Q_{50} = 49$
 $Q_{100} = 56$

	a	b	c
2-Year	85.568	16.5	0.95
25-Year	198.92	19.3	1.004
50-Year	206.025	19.6	0.99
100-Year	355.551	23.199	1.076



UNIVERSAL CULVERT DESIGN

FLOW PIPE # (cfs.)	CULVERT SIZE	HWI (ft.)	HWO (ft.)	FLOW TYPE	VELOCITY (fps.)	DN (ft.)	DC (ft.)	MANNING N	HEADWATER CONTROL	OVER FLOW (cfs.)	DESIGN CODE	BURIAL DEPTH (ft.)
49.00	1 42 in.	697.73	N/A	1 - C	15.82	1.25	2.19	0.0278	INLET	0.00	D + 1	0.00
56.00	1 36 in.	699.31	667.84	2 - E	16.36	1.46	2.43	0.0281	INLET	0.00	F	0.00
56.00	1 42 in.	698.13	N/A	1 - C	16.40	1.35	2.34	0.0278	INLET	0.00	F + 1	0.00
Corrugated Metal Pipe (6 x 2 in. corrugations)												
49.00	1 60 in.	697.14	N/A	1 - C	13.49	1.20	1.96	0.0332	INLET	0.00	D	0.00
49.00	1 66 in.	697.02	N/A	1 - C	13.39	1.16	1.91	0.0330	INLET	0.00	D + 1	0.00
56.00	1 60 in.	697.36	N/A	1 - C	14.02	1.29	2.10	0.0332	INLET	0.00	F	0.00
56.00	1 66 in.	697.24	N/A	1 - C	13.93	1.24	2.04	0.0330	INLET	0.00	F + 1	0.00
Corrugated Metal Pipe (6 x 2 in. corrugations, Field Paved Invert)												
49.00	1 60 in.	697.14	N/A	1 - C	16.04	1.06	1.96	0.0260	INLET	0.00	D	0.00
49.00	1 66 in.	697.02	N/A	1 - C	15.87	1.03	1.91	0.0260	INLET	0.00	D + 1	0.00
56.00	1 60 in.	697.36	N/A	1 - C	16.68	1.14	2.10	0.0260	INLET	0.00	F	0.00
56.00	1 66 in.	697.24	N/A	1 - C	16.49	1.10	2.04	0.0260	INLET	0.00	F + 1	0.00

12" up size
 H > 16
 up size 12" use 48"



CULVERT ANALYSIS

PID : 77366 **Date :** 01/04/2013 **Project :** SR 823 Portsmouth Bypass **Location :** Portsmouth, Ohio **Designer :** KAG

Description : Drainage Area 60, 328+79

HEADWATER CONTROL CODES: INLET - Inlet Control.
 OUTLET - Outlet Control.
 OUTLET* - Outlet Control with backwater curve used to compute headwater. See Figure III - 7E in HDS 5 for type flow.
 OUTLET** - Outlet Control - See Figure III - 7D in HDS 5 for type flow.
 N/A - Flow is supercritical with low headwater and low tailwater. Control Section is at the inlet.

Pipe Number : 2 **Use HW :** 0 **Inlet Invert Elevation (ft.) :** 694.30 **Outlet Invert Elevation (ft.) :** 654.10
Pipe Quantity : 1

Culvert Type : Circular Corrugated **Pipe Length (ft.) :** 280.00 **Culvert Slope (ft./ft.) :** 0.1436
Corrugation Type : Corrugated Metal Pipe (3 x 1 in. corrugations)
Pipe Size : 48 in.
Design Manning 'n' : (default)

Entrance Type : Half Headwall **Loss Coef. Ke :** 0.9000

FLOW (cfs.)	HEAD LOSS (ft.)	HWI (ft.)	HWO (ft.)	FLOW TYPE	VELOCITY (fps.)	DN (ft.)	DC (ft.)	MANNING N	HEADWATER CONTROL	BURIED DEPTH (ft.)	TAILWATER ELEVATION (ft.)
49.00	40.28	697.42	N/A	1 - C	15.77	1.18	2.10	0.0275	INLET	0.00	654.10
56.00	40.47	697.70	N/A	1 - C	16.36	1.27	2.25	0.0275	INLET	0.00	654.10



CULVERT ANALYSIS

FLOW	HEAD	HWI	HWO	FLOW	VELOCITY	DN	DC	MANNING	HEADWATER	BURIED	TAILWATER
(cfs.)	LOSS	(ft.)	(ft.)	TYPE	(fps.)	(ft.)	(ft.)	N	CONTROL	DEPTH	ELEVATION
	(ft.)									(ft.)	(ft.)

Pipe Number : 3 Use HW : 0 Inlet Invert Elevation (ft.) : 694.30 Outlet Invert Elevation (ft.) : 654.10
 Pipe Quantity : 1

Culvert Type : Circular Corrugated Pipe Length (ft.) : 280.00 Culvert Slope (ft./ft.) : 0.1436
 Corrugation Type : Corrugated Metal Pipe (2 2/3 x 1/2 in. corrugations)
 Pipe Size : 48 in.
 Design Manning 'n' : (default)

Entrance Type : Half Headwall Loss Coef. Ke : 0.9000

FLOW	HEAD	HWI	HWO	FLOW	VELOCITY	DN	DC	MANNING	HEADWATER	BURIED	TAILWATER
(cfs.)	LOSS	(ft.)	(ft.)	TYPE	(fps.)	(ft.)	(ft.)	N	CONTROL	DEPTH	ELEVATION
	(ft.)									(ft.)	(ft.)

49.00	40.28	697.42	N/A	1 - C	17.65	1.09	2.10	0.0235	INLET	0.00	654.10
56.00	40.47	697.70	N/A	1 - C	18.32	1.17	2.25	0.0235	INLET	0.00	654.10

SR 823 STA ~~344+82~~

45+15



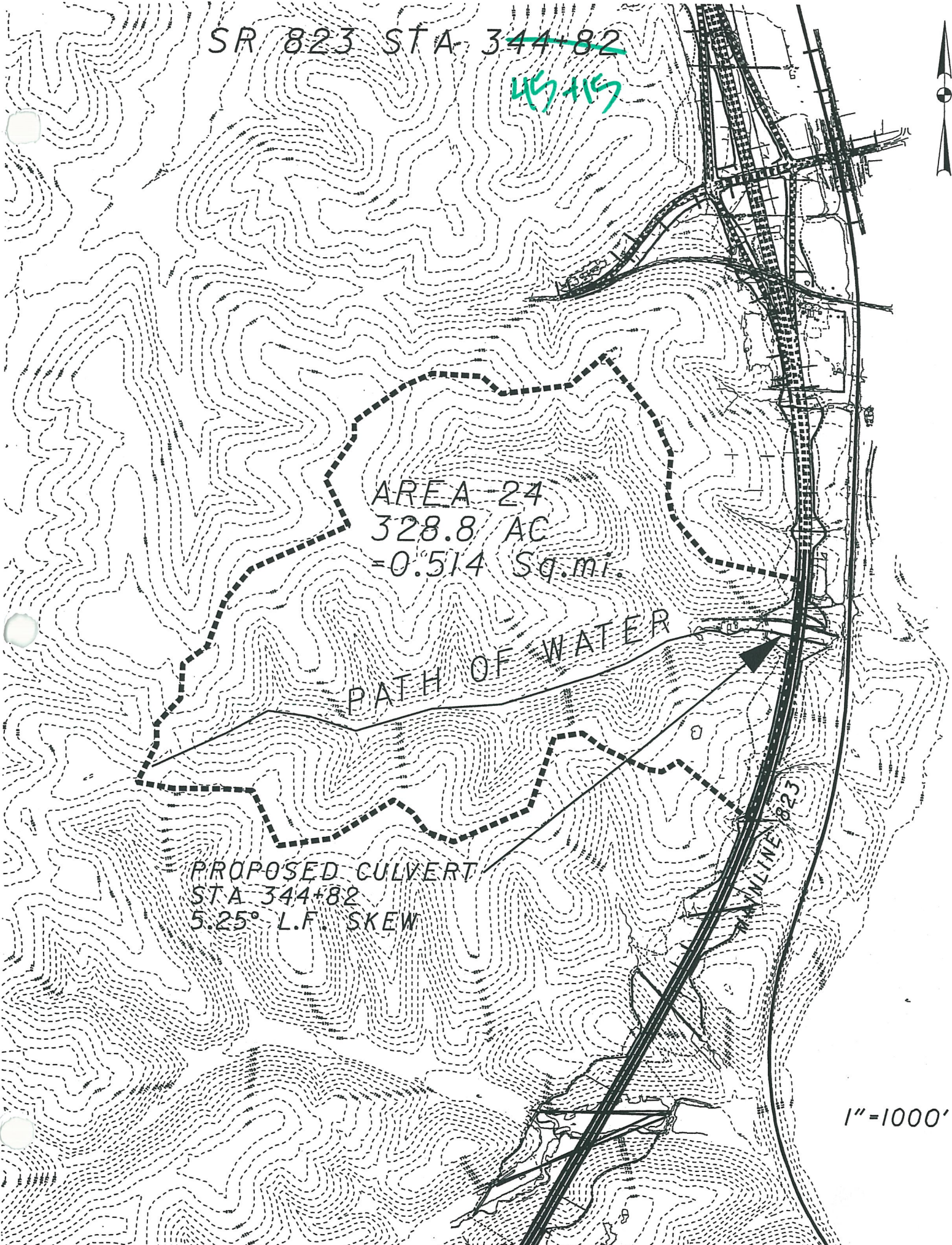
AREA 24
328.8 AC
= 0.514 Sq. mi.

PATH OF WATER

PROPOSED CULVERT
STA 344+82
5.25° L.F. SKEW

W/LINE 823

1" = 1000'



SR 823 STA 345+15.34
TECHNIQUES FOR ESTIMATING FLOOD-PEAK
DISCHARGES OF RURAL, UNREGULATED STREAMS IN OHIO AREA A
 U.S. GEOLOGICAL SURVEY Water Resources Investigations Report 89-4126

	Values	Units	Definitions
	14322402.00	SQ. FT.	
	0.514	SQ. MI.	CONTDA = Contributing Drainage Area
	0.00	SQ. FT.	
	0.00	%	STORAGE = Storage Area
	5536.00	FT.	TOTAL CHANNEL LENGTH
	553.60	FT.	L₁₀ = 10% of the Distance along channel
	586	FT.	Elev₁₀ = Elevation at point L₁₀
	4705.60	FT.	L₈₅ = 85% of the Distance along channel
	774	FT.	Elev₈₅ = Elevation at point L₈₅
	4152.00	FT.	Length = L₈₅ - L₁₀
	239.08	FT./MI.	SLOPE = (Elev₁₀ - Elev₈₅)/ Length
		CFS	Q_# = Flood-Peak Discharge
			# = Frequency of Storm
Q₂	90.00	CFS	= 56.1(CONTDA)^{0.782}(SLOPE)^{0.172}(STORAGE+1)^{-0.297}
Q₅	170.00	CFS	= 84.5(CONTDA)^{0.769}(SLOPE)^{0.221}(STORAGE+1)^{-0.322}
Q₁₀	240.00	CFS	= 104(CONTDA)^{0.764}(SLOPE)^{0.244}(STORAGE+1)^{-0.335}
Q₂₅	330.00	CFS	= 129(CONTDA)^{0.760}(SLOPE)^{0.264}(STORAGE+1)^{-0.347}
Q₅₀	410.00	CFS	= 148(CONTDA)^{0.757}(SLOPE)^{0.276}(STORAGE+1)^{-0.355}
Q₁₀₀	480.00	CFS	= 167(CONTDA)^{0.756}(SLOPE)^{0.285}(STORAGE+1)^{-0.363}

HY-8 Culvert Analysis Report

Crossing Discharge Data

Discharge Selection Method: Recurrence

Table 1 - Summary of Culvert Flows at Crossing: Sta 344+82

Headwater Elevation (ft)	Discharge Names	Total Discharge (cfs)	Culvert 1 Discharge (cfs)	Roadway Discharge (cfs)	Iterations
579.86	50 year	410.00	410.00	0.00	1
580.71	100 year	480.00	480.00	0.00	1
654.00	Overtopping	2638.35	2638.35	0.00	Overtopping

Table 2 - Culvert Summary Table: Culvert 1

Discharge Names	Total Discharge (cfs)	Culvert Discharge (cfs)	Headwater Elevation (ft)	Inlet Control Depth (ft)	Outlet Control Depth (ft)	Flow Type	Normal Depth (ft)	Critical Depth (ft)	Outlet Depth (ft)	Tailwater Depth (ft)	Outlet Velocity (ft/s)
50 year	410.00	410.00	579.86	7.259	0.0*	1-S2n	2.255	4.337	2.383	3.266	21.503
100 year	480.00	480.00	580.71	8.106	0.0*	5-S2n	2.529	4.817	2.689	3.534	22.310

* Full Flow Headwater elevation is below inlet invert.

Straight Culvert
Inlet Elevation (invert): 572.60 ft, Outlet Elevation (invert): 563.90 ft
Culvert Length: 430.09 ft, Culvert Slope: 0.0202

Site Data - Culvert 1

Site Data Option: Culvert Invert Data
Inlet Station: 0.00 ft
Inlet Elevation: 572.60 ft
Outlet Station: 430.00 ft
Outlet Elevation: 563.90 ft
Number of Barrels: 1

Culvert Data Summary - Culvert 1

Barrel Shape: Concrete Box
Barrel Span: 8.00 ft
Barrel Rise: 8.00 ft
Barrel Material: Concrete
Embedment: 0.00 in
Barrel Manning's n: 0.0120
Culvert Type: Straight
Inlet Configuration: Square Edge (90°) Headwall
Inlet Depression: NONE

Table 3 - Downstream Channel Rating Curve (Crossing: Sta 344+82)

Flow (cfs)	Water Surface Elev (ft)	Depth (ft)	Velocity (ft/s)	Shear (psf)	Froude Number
410.00	567.17	3.27	8.64	3.14	1.01
480.00	567.43	3.53	9.01	3.40	1.02

Tailwater Channel Data - Sta 344+82

Tailwater Channel Option: Trapezoidal Channel

Bottom Width: 8.00 ft

Side Slope (H:V): 2.00 (1:1)

Channel Slope: 0.0154

Channel Manning's n: 0.0350

Channel Invert Elevation: 563.90 ft

Roadway Data for Crossing: Sta 344+82

Roadway Profile Shape: Constant Roadway Elevation

Crest Length: 200.00 ft

Crest Elevation: 654.00 ft

Roadway Surface: Paved

Roadway Top Width: 80.00 ft

HY-8 Energy Dissipation Report

External Energy Dissipator

Parameter	Value	Units
Select Culvert and Flow		
Crossing	Sta 344+82	
Culvert	Culvert 1	
Flow	480.00	cfs
Culvert Data		
Culvert Width (including multiple barrels)	8.0	ft
Culvert Height	8.0	ft
Outlet Depth	2.69	ft
Outlet Velocity	22.31	ft/s
Froude Number	2.40	
Tailwater Depth	3.53	ft
Tailwater Velocity	9.01	ft/s
Tailwater Slope (SO)	0.0202	
External Dissipator Data		
External Dissipator Category	Streambed Level Structures	
External Dissipator Type	Riprap Basin	
Restrictions		
Froude Number	<3	
Input Data		
Condition to be used to Compute Basin Outlet Velocity	Best Fit Curve	
D50 of the Riprap Mixture		
Note:	Minimum HS/D50 = 2 is Obtained if D50 = 0.931 ft	
D50 of the Riprap Mixture	0.931	ft
DMax of the Riprap Mixture	2.500	ft
Results		
Brink Depth	2.689	ft
Brink Velocity	22.310	ft/s
Depth (YE)	2.689	ft
Riprap Thickness	3.750	ft
Riprap Foreslope	5.0000	ft
Check HS/D50		
Note:	OK if HS/D50 > 2.0	
HS/D50	2.008	
HS/D50 Check	HS/D50 is OK	
Check HS/D50		
Note:	OK if $0.1 < D50/YE < 0.7$	
Check D50/YE	0.346	
D50/YE Check	D50/YE is OK	
Basin Length (LB)	33.347	ft
Basin Width	30.231	ft
Apron Length	9.347	ft
Pool Length	24.000	ft
Pool Depth (HS)	1.869	ft
TW/YE	1.314	
Tailwater Depth (TW)	3.534	ft
Average Velocity with TW	3.641	ft/s

Critical Depth (Yc)	1.901	ft
Average Velocity with Yc	7.419	ft/s
Downstream Riprap for High TW		
Distance: 1 LB		
Velocity	17.987	ft/s
Size	2.109	ft
Distance: 2 LB		
Velocity	10.624	ft/s
Size	0.736	ft
Distance: 3 LB		
Velocity	7.062	ft/s
Size	0.325	ft
Distance: 4 LB		
Velocity	5.286	ft/s
Size	0.182	ft

SR 140 RAMP A STA 64+00



AREA 91
4.7 AC
0.007 Sq.M

PATH OF WATER

PROPOSED CULVERT.
STA 64+00
0.0° SKEW

-200

SR 140 RAMP A STA 64+00

Client: ODOT

Sheet: of



Subject: Pipe Culvert Calculations

Order No:

Computed by: MC

Date: 2/15/2007

Checked by:

Date:

Rational Method

Coefficient of Runoff (1101.2.3)

	Area (Sft)	Area (Ac)	C	
Pavement Area	25040	0.57	0.9	
Non-paved Area	177489	4.07	0.7	BERMS STEEPER THAN 4:1
Other				
Total Area	202529	4.65 acres		Weighted "C" = 0.72

Overland Flow

Length		
High Elevation		
Low Elevation		t_o #DIV/0! (1101.2.2)
Slope %	#DIV/0!	t_o 0.00 Compare with Fig 1101-1 negligible

Shallow Concentrated Flow

Length	681
High Elevation	665
Low Elevation	554
Slope %	16.29956
k	0.457 (Grassed waterways - Table 1101-1)
V	6.053553 (1101.2.2)
t_s	1.874932 (1101.2.2)

Since the time of concentration = $t_o + t_s$

t_c 10.00 min

For Intensity Zone D

Frequency	a	b	c	Ac	t_c	C	I	Q cu ft/s
2 Years	85.568	16.5	0.95	4.649426	10.00	0.72	3.80	12.82
5 Years	118.822	18.7	0.969	4.649426	10.00	0.72	4.59	15.48
10 Years	112.172	16.8	0.923	4.649426	10.00	0.72	5.39	18.17
25 Years	198.92	19.3	1.004	4.649426	10.00	0.72	6.70	22.57
50 Years	206.025	19.6	0.99	4.649426	10.00	0.72	7.20	24.26
100 Years	355.551	23.199	1.076	4.649426	10.00	0.72	8.21	27.65

Worksheet for SR 140 ramp A STA 64+00

Project Description

Friction Method Manning Formula
Solve For Normal Depth

Input Data

Roughness Coefficient	0.040	
Channel Slope	0.00400	ft/ft
Left Side Slope	2.00	ft/ft (H:V)
Right Side Slope	2.00	ft/ft (H:V)
Bottom Width	10.00	ft
Discharge	23.00	ft ³ /s

Results

Normal Depth	0.96	ft
Flow Area	11.38	ft ²
Wetted Perimeter	14.27	ft
Top Width	13.82	ft
Critical Depth	0.53	ft
Critical Slope	0.03055	ft/ft
Velocity	2.02	ft/s
Velocity Head	0.06	ft
Specific Energy	1.02	ft
Froude Number	0.39	
Flow Type	Subcritical	

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	0.96	ft
Critical Depth	0.53	ft
Channel Slope	0.00400	ft/ft
Critical Slope	0.03055	ft/ft



UNIVERSAL CULVERT DESIGN

PID : 77366 **Date :** 12/02/2011 **Project :** SR 823 Portsmouth Bypass **Location :** Portsmouth Ohio **Designer :** KAG

Description : Drainage area 91, SR 140 RAMP A Sta. 64+00

HEADWATER CONTROL CODES: INLET - Inlet Control.
 OUTLET - Outlet Control.
 OUTLET* - Outlet Control with backwater curve used to compute headwater. See Figure III - 7E in HDS 5 for type flow.
 OUTLET** - Outlet Control - See Figure III - 7D in HDS 5 for type flow.
 N/A - Flow is supercritical with low headwater and low tailwater. Control Section is at the inlet.

Inlet Invert Elevation (ft.) : 555.89 **Outlet Invert Elevation (ft.) :** 554.04 **Tailwater Elevation (ft.) :** 554.98 **Overflow Elevation (ft.) :** 561.30
Allowable Headwater Elevation (ft.) : 560.30 or Diameter + 2 ft. (*whichever is less*)
Pipe Length (ft.) : 77.00 **Culvert Slope (ft./ft.) :** 0.0240 **Design Manning 'n' :** 0.0120
Design Discharge (cfs) : 22.60 @ 25 yrs. **Flood Discharge (cfs) :** 27.60 @ 100 yrs.

FLOW (cfs.)	PIPE #	CULVERT SIZE	HWI (ft.)	HWO (ft.)	FLOW TYPE	VELOCITY (fps.)	DN (ft.)	DC (ft.)	MANNING N	HEADWATER CONTROL	OVERFLOW (cfs.)	DESIGN CODE	BURIAL DEPTH (ft.)
-------------	--------	--------------	-----------	-----------	-----------	-----------------	----------	----------	-----------	-------------------	-----------------	-------------	--------------------

CULVERT TYPE : CIRCULAR SMOOTH													
Entrance Type : Half Headwall													
22.60	1	24 in.	558.89	557.50	2 - E	12.62	1.11	1.69	0.0120	INLET	0.00	D	0.00
22.60	1	21 in.	559.84	558.71	2 - E	12.42	1.24	1.65	0.0120	INLET	0.00	D - 1	0.00
21.10	1	18 in.	561.91	561.60	2 - E	11.94	1.50	1.47	0.0120	INLET	1.50	D - 2	0.00
22.60	1	27 in.	558.47	N/A	1 - C	12.61	1.04	1.66	0.0120	INLET	0.00	D + 1	0.00
27.60	1	24 in.	559.67	558.36	2 - E	13.18	1.26	1.82	0.0120	INLET	0.00	F	0.00
27.60	1	21 in.	561.14	560.20	2 - E	12.57	1.50	1.70	0.0120	INLET	0.00	F - 1	0.00
21.10	1	18 in.	564.73	564.58	2 - E	11.94	1.50	1.47	0.0120	INLET	6.50	F - 2	0.00
27.60	1	27 in.	558.96	557.50	2 - E	13.28	1.17	1.83	0.0120	INLET	0.00	F + 1	0.00

CULVERT TYPE : CIRCULAR CORRUGATED													
Entrance Type : Half Headwall													
Corrugated Metal Pipe (2 2/3 x 1/2 in. corrugations)													
22.60	1	27 in.	558.89	558.40	2 - E	7.23	1.65	1.66	0.0245	INLET	0.00	D	0.00



UNIVERSAL CULVERT DESIGN

FLOW PIPE # (cfs.)	CULVERT SIZE	HWI (ft.)	HWO (ft.)	FLOW TYPE	VELOCITY (fps.)	DN (ft.)	DC (ft.)	MANNING N	HEADWATER CONTROL	OVER FLOW (cfs.)	DESIGN CODE	BURIAL DEPTH (ft.)
22.60	1 24 in.	559.73	560.17	2 - F	7.96	2.00	1.69	0.0247	OUTLET**	0.00	D - 1	0.00
18.50	1 21 in.	561.31	564.01	2 - F	8.17	1.75	1.56	0.0248	OUTLET**	4.10	D - 2	0.00
22.60	1 30 in.	558.48	N/A	1 - C	7.39	1.49	1.62	0.0244	INLET	0.00	D + 1	0.00
27.60	1 27 in.	559.70	559.66	2 - E	6.94	2.25	1.83	0.0245	INLET	0.00	F	0.00
25.30	1 24 in.	560.99	562.34	2 - F	8.61	2.00	1.77	0.0247	OUTLET**	2.30	F - 1	0.00
18.50	1 21 in.	563.18	568.10	2 - F	8.17	1.75	1.56	0.0248	OUTLET**	9.10	F - 2	0.00
27.60	1 30 in.	559.00	558.34	2 - E	7.69	1.71	1.79	0.0244	INLET	0.00	F + 1	0.00
Corrugated Metal Pipe (3 x 1 in. corrugations)												
22.60	1 36 in.	558.16	N/A	1 - C	6.67	1.45	1.53	0.0281	INLET	0.00	D	0.00
22.60	1 42 in.	558.01	N/A	1 - C	6.69	1.34	1.46	0.0278	INLET	0.00	D + 1	0.00
27.60	1 36 in.	558.46	N/A	1 - C	7.00	1.64	1.70	0.0281	INLET	0.00	F	0.00
27.60	1 42 in.	558.27	N/A	1 - C	7.05	1.49	1.62	0.0278	INLET	0.00	F + 1	0.00
Corrugated Metal Pipe (6 x 2 in. corrugations)												
22.60	1 60 in.	557.70	N/A	1 - C	5.71	1.28	1.31	0.0332	INLET	0.00	D	0.00
22.60	1 66 in.	557.63	N/A	1 - C	5.68	1.23	1.28	0.0330	INLET	0.00	D + 1	0.00
27.60	1 60 in.	557.93	N/A	1 - C	6.05	1.41	1.46	0.0332	INLET	0.00	F	0.00
27.60	1 66 in.	557.84	N/A	1 - C	6.02	1.36	1.42	0.0330	INLET	0.00	F + 1	0.00
Corrugated Metal Pipe (6 x 2 in. corrugations, Field Paved Invert)												
22.60	1 60 in.	557.70	N/A	1 - C	6.79	1.13	1.31	0.0260	INLET	0.00	D	0.00
22.60	1 66 in.	557.63	N/A	1 - C	6.72	1.10	1.28	0.0260	INLET	0.00	D + 1	0.00
27.60	1 60 in.	557.93	N/A	1 - C	7.19	1.25	1.46	0.0260	INLET	0.00	F	0.00
27.60	1 66 in.	557.84	N/A	1 - C	7.13	1.21	1.42	0.0260	INLET	0.00	F + 1	0.00

Culvert Material Selection as per ODOT

updated 04/11/2005

Input Variables for Round Conduit

pH ranges from 3 to 9.5 pH= 7.5 Required for all durability
 Enter "a" for abrasive or "n" for non-abrasive Site Conditions= n
 50 or 75 years Service Life= 75
 Pipe Slope (%)= 2.40 Required for Concrete durability
 Pipe Diameter (in)= 27
 Maximum Height of Fill= 4.0 Required for Structural Design

Instructions for Use:

This spreadsheet will determine the available material options based upon ODOT durability tables and ODOT structural tables for round conduit.

Not all available options will apply to each situation and it is the users responsibility to verify each alternative is valid.

Notes:
 *** Concrete field paving shall be epoxy coated per 706.03 for pH < 5.0

** Externally coated per AASHTO M243

Metal Pipe Description	Material	Req. Gauge per Durability	Thickness per Durability (Inches)	Req. Gauge per Structural	Thickness per Structural (Inches)
Galvanized	707.01	12	0.109	16	0.064
Aluminized	707.01	16	0.064	16	0.064
Galvanized	707.02	12	0.109	N/A	N/A
Aluminized	707.02	16	0.064	N/A	N/A
Galvanized-W/GFP	707.02-W/GFP	16	0.064	N/A	N/A
Structural Plate	707.03	12	0.109	N/A	N/A
Structural-Plate-W/GFP	707.03-W/GFP	n/a	n/a	N/A	N/A
Polymer Coated	707.04 (0.5" corr.)	16	0.064	16	0.064
Polymer-Coated	707.04 (1" corr.)	16	0.064	N/A	N/A
Polymer-Coated-Asphalt Coated and Paved	707.04 (0.5" corr.)	16	0.064	16	0.064
Polymer-Coated-Asphalt Coated and Paved	707.04 (1" corr.)	16	0.064	N/A	N/A
Aluminized-Asphalt Coated and Paved	707.05 ≤ 48"	16	0.064	16	0.064
Aluminized-Asphalt Coated and Paved	707.05 > 54"	16	0.064	16	0.064
Galvanized-Asphalt Coated and Paved	707.05 ≤ 48"	14	0.079	16	0.064
Galvanized-Asphalt Coated and Paved	707.05 > 54"	14	0.079	16	0.064
Aluminized-Asphalt Coated and Paved	707.07 ≤ 48"	16	0.064	16	0.064
Aluminized-Asphalt Coated and Paved	707.07 > 54"	16	0.064	16	0.064
Galvanized-Asphalt Coated and Paved	707.07 ≤ 48"	14	0.079	N/A	N/A
Galvanized-Asphalt Coated and Paved	707.07 > 54"	14	0.079	N/A	N/A
Aluminum Pipe	707.21 (0.5" corr.)	min	use min	N/A	0.075
Aluminum Pipe	707.22 (1.0" corr.)	min	use min	N/A	N/A
Structural Plate Aluminum Pipe	707.23	min	use min	N/A	N/A

Concrete Pipe Material Options as per Durability Requirements		
Concrete Pipe Description	Material	Epoxy Coated Required?
Concrete Conduit	706.02	No

D-Load Test Required for Concrete Pipe		
Concrete Pipe Description	Material	Is Minimum D-Load Required?
Concrete Conduit	706.02	1000

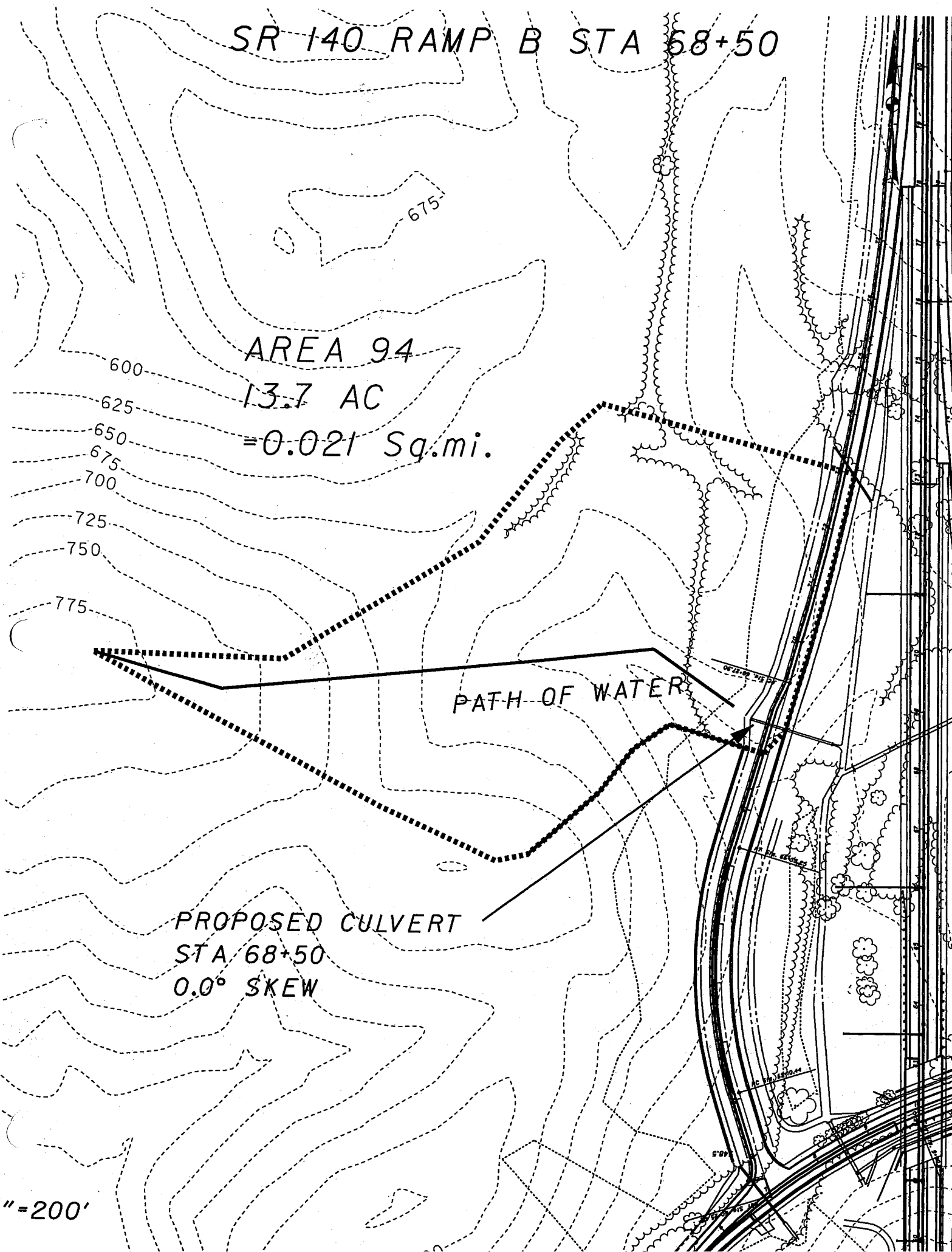
SR 140 RAMP B STA 68+50

AREA 94
13.7 AC
= 0.021 Sq.mi.

PATH OF WATER

PROPOSED CULVERT
STA 68+50
0.0° SKEW

" = 200'



SR 140 RAMP B STA 68+50

TECHNIQUES FOR ESTIMATING FLOOD-PEAK
DISCHARGES OF RURAL, UNREGULATED STREAMS IN OHIO AREA A
U.S. GEOLOGICAL SURVEY Water Resources Investigations Report 89-4126

	Values	Units	Definitions
	595342.00	SQ. FT.	
	0.021	SQ. MI.	CONTDA = Contributing Drainage Area
	0.00	SQ. FT.	
	0.00	%	STORAGE = Storage Area
	1135.00	FT.	TOTAL CHANNEL LENGTH
	113.50	FT.	L ₁₀ = 10% of the Distance along channel
	598	FT.	Elev ₁₀ = Elevation at point L ₁₀
	964.75	FT.	L ₈₅ = 85% of the Distance along channel
	775	FT.	Elev ₈₅ = Elevation at point L ₈₅
	851.25	FT.	Length = L ₈₅ - L ₁₀
	1097.87	FT./MI.	SLOPE = (Elev ₁₀ -Elev ₈₅)/Length
		CFS	Q _# = Flood-Peak Discharge
			# = Frequency of Storm
Q ₂	9.24	CFS	= 56.1(CONTDA) ^{0.782} (SLOPE) ^{0.172} (STORAGE+1) ^{-0.297}
Q ₅	20.62	CFS	= 84.5(CONTDA) ^{0.769} (SLOPE) ^{0.221} (STORAGE+1) ^{-0.322}
Q ₁₀	30.39	CFS	= 104(CONTDA) ^{0.764} (SLOPE) ^{0.244} (STORAGE+1) ^{-0.335}
Q ₂₅	44.03	CFS	= 129(CONTDA) ^{0.760} (SLOPE) ^{0.264} (STORAGE+1) ^{-0.347}
Q ₅₀	55.58	CFS	= 148(CONTDA) ^{0.757} (SLOPE) ^{0.276} (STORAGE+1) ^{-0.355}
Q ₁₀₀	67.05	CFS	= 167(CONTDA) ^{0.756} (SLOPE) ^{0.285} (STORAGE+1) ^{-0.363}

Rational Method

Worksheet for SR 140 ramp B STA 68+50

Project Description

Friction Method Manning Formula
Solve For Normal Depth

Input Data

Roughness Coefficient	0.040	
Channel Slope	0.06730	ft/ft
Left Side Slope	2.00	ft/ft (H:V)
Right Side Slope	2.00	ft/ft (H:V)
Bottom Width	10.00	ft
Discharge	44.00	ft ³ /s

Results

Normal Depth	0.61	ft
Flow Area	6.89	ft ²
Wetted Perimeter	12.74	ft
Top Width	12.45	ft
Critical Depth	0.80	ft
Critical Slope	0.02724	ft/ft
Velocity	6.39	ft/s
Velocity Head	0.63	ft
Specific Energy	1.25	ft
Froude Number	1.51	
Flow Type	Supercritical	

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	0.61	ft
Critical Depth	0.80	ft
Channel Slope	0.06730	ft/ft
Critical Slope	0.02724	ft/ft



UNIVERSAL CULVERT DESIGN

FLOW (cfs.)	PIPE #	CULVERT SIZE	HWI (ft.)	HWO (ft.)	FLOW VELOCITY (fps.)	DN (ft.)	DC (ft.)	MANNING N	HEADWATER CONTROL	OVER FLOW (cfs.)	DESIGN CODE	BURIAL DEPTH (ft.)
44.00	1	30 in.	578.44	580.61	9.59	2.50	2.21	0.0244	OUTLET**	0.00	D - 1	0.00
44.00	1	27 in.	580.21	586.21	11.28	2.25	2.14	0.0245	OUTLET**	0.00	D - 2	0.00
44.00	1	36 in.	576.63	576.92	8.07	2.17	2.16	0.0241	OUTLET*	0.00	D + 1	0.00
67.10	1	33 in.	580.86	584.46	11.63	2.75	2.57	0.0241	OUTLET**	0.00	F	0.00
59.80	1	30 in.	583.21	591.66	12.37	2.50	2.39	0.0244	OUTLET**	7.30	F - 1	0.00
46.20	1	27 in.	588.87	604.85	11.79	2.25	2.15	0.0245	OUTLET**	20.90	F - 2	0.00
67.10	1	36 in.	579.25	580.52	10.26	3.00	2.62	0.0241	OUTLET**	0.00	F + 1	0.00
Corrugated Metal Pipe (3 x 1 in. corrugations)												
44.00	1	36 in.	576.63	576.78	8.07	2.52	2.16	0.0281	OUTLET*	0.00	D	0.00
44.00	1	42 in.	576.02	576.53	7.44	2.09	2.07	0.0278	OUTLET*	0.00	D + 1	0.00
67.10	1	36 in.	579.25	582.33	10.26	3.00	2.62	0.0281	OUTLET**	0.00	F	0.00
67.10	1	42 in.	577.43	577.56	8.87	2.94	2.57	0.0278	OUTLET*	0.00	F + 1	0.00
Corrugated Metal Pipe (6 x 2 in. corrugations)												
44.00	1	60 in.	575.52	575.96	6.64	1.91	1.85	0.0332	OUTLET*	0.00	D	0.00
44.00	1	66 in.	575.41	575.88	6.50	1.83	1.80	0.0330	OUTLET*	0.00	D + 1	0.00
67.10	1	60 in.	576.24	576.77	7.57	2.41	2.31	0.0332	OUTLET*	0.00	F	0.00
67.10	1	66 in.	576.11	576.65	7.37	2.29	2.24	0.0330	OUTLET*	0.00	F + 1	0.00
Corrugated Metal Pipe (6 x 2 in. corrugations, Field Paved Invert)												
44.00	1	60 in.	575.52	N/A	7.63	1.67	1.85	0.0260	INLET	0.00	D	0.00
44.00	1	66 in.	575.41	N/A	7.57	1.61	1.80	0.0260	INLET	0.00	D + 1	0.00
67.10	1	60 in.	576.24	N/A	8.57	2.10	2.31	0.0260	INLET	0.00	F	0.00
67.10	1	66 in.	576.11	N/A	8.52	2.01	2.24	0.0260	INLET	0.00	F + 1	0.00

USE 36"

SR 140 RAMP BY STA 73+12.63



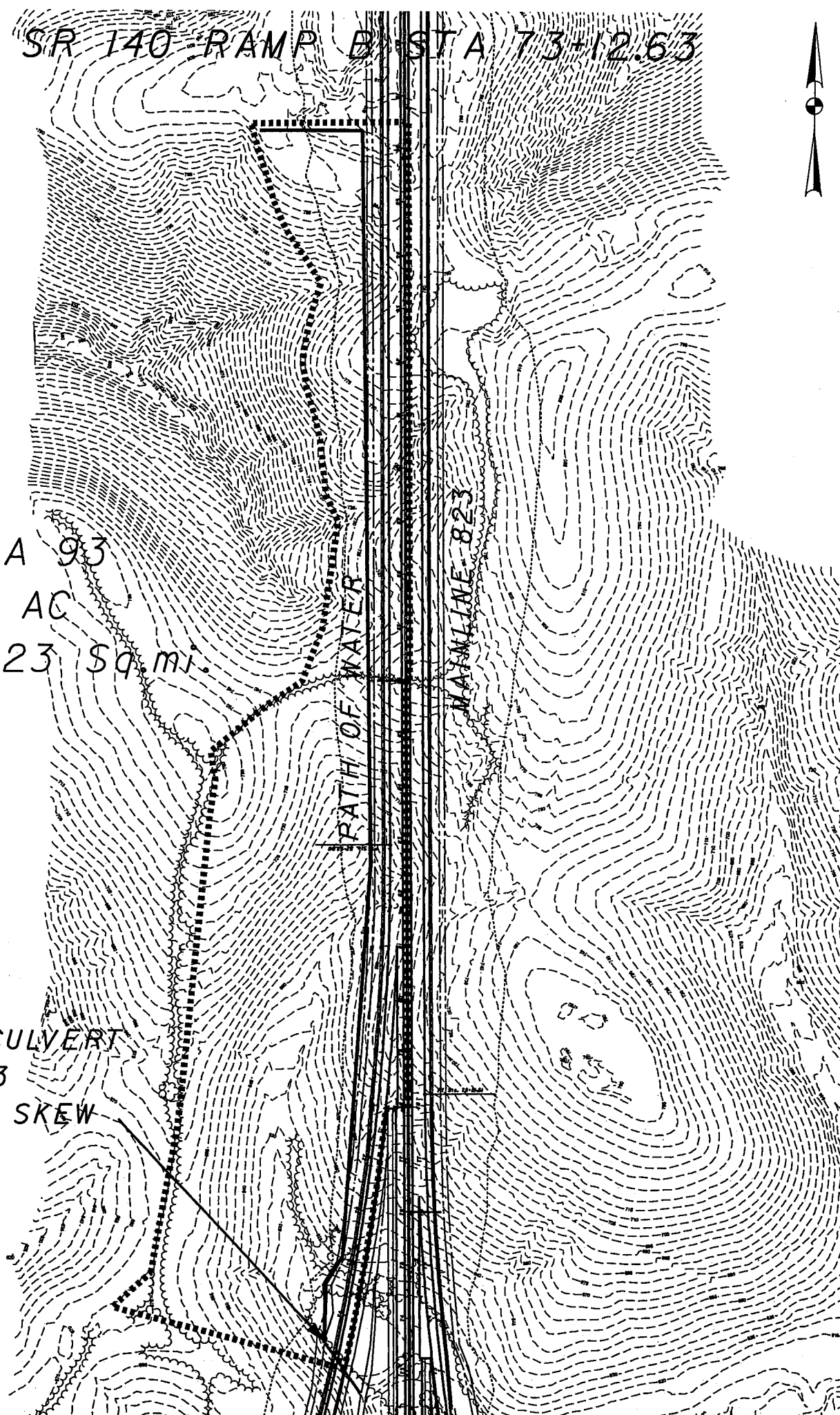
AREA 93
14.8 AC
= 0.023 Sq. mi.

PATH OF WATER

MAINLINE 823

PROPOSED CULVERT
STA 73+12.63
@ 43.5° L.F. SKEW

1" = 250'



SR 140 RAMP B STA 73+12.63

TECHNIQUES FOR ESTIMATING FLOOD-PEAK
DISCHARGES OF RURAL, UNREGULATED STREAMS IN OHIO AREA A
U.S. GEOLOGICAL SURVEY Water Resources Investigations Report 89-4126

	Values	Units	Definitions
	645439.00	SQ. FT.	
	0.023	SQ. MI.	CONTDA = Contributing Drainage Area
	0.00	SQ. FT.	
	0.00	%	STORAGE = Storage Area
	2392.00	FT.	TOTAL CHANNEL LENGTH
	239.20	FT.	L ₁₀ = 10% of the Distance along channel
	626	FT.	Elev ₁₀ = Elevation at point L ₁₀
	2033.20	FT.	L ₈₅ = 85% of the Distance along channel
	693	FT.	Elev ₈₅ = Elevation at point L ₈₅
	1794.00	FT.	Length = L ₈₅ - L ₁₀
	197.19	FT./MI.	SLOPE = (Elev ₁₀ -Elev ₈₅)/Length
		CFS	Q _# = Flood-Peak Discharge
			# = Frequency of Storm
Q ₂	7.32	CFS	= 56.1(CONTDA) ^{0.782} (SLOPE) ^{0.172} (STORAGE+1) ^{-0.297}
Q ₅	15.01	CFS	= 84.5(CONTDA) ^{0.769} (SLOPE) ^{0.221} (STORAGE+1) ^{-0.322}
Q ₁₀	21.26	CFS	= 104(CONTDA) ^{0.764} (SLOPE) ^{0.244} (STORAGE+1) ^{-0.335}
Q ₂₅	29.75	CFS	= 129(CONTDA) ^{0.760} (SLOPE) ^{0.264} (STORAGE+1) ^{-0.347}
Q ₅₀	36.78	CFS	= 148(CONTDA) ^{0.757} (SLOPE) ^{0.276} (STORAGE+1) ^{-0.355}
Q ₁₀₀	43.69	CFS	= 167(CONTDA) ^{0.756} (SLOPE) ^{0.285} (STORAGE+1) ^{-0.363}

*Rational
method*

Worksheet for SR 140 ramp B STA 73+12

Project Description

Friction Method Manning Formula
Solve For Normal Depth

Input Data

Roughness Coefficient	0.040	
Channel Slope	0.07520	ft/ft
Left Side Slope	2.00	ft/ft (H:V)
Right Side Slope	2.00	ft/ft (H:V)
Bottom Width	10.00	ft
Discharge	29.80	ft ³ /s

Results

Normal Depth	0.47	ft
Flow Area	5.16	ft ²
Wetted Perimeter	12.11	ft
Top Width	11.89	ft
Critical Depth	0.62	ft
Critical Slope	0.02916	ft/ft
Velocity	5.77	ft/s
Velocity Head	0.52	ft
Specific Energy	0.99	ft
Froude Number	1.54	
Flow Type	Supercritical	

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	0.47	ft
Critical Depth	0.62	ft
Channel Slope	0.07520	ft/ft
Critical Slope	0.02916	ft/ft



UNIVERSAL CULVERT DESIGN

PID : 77366 **Date :** 05/16/2007 **Project :** SR 823 Portsmouth Bypass **Location :** Portsmouth Ohio **Designer :** mdc

Description : Drainage area 93, SR 140 RAMP B Sta. 73+12.63

HEADWATER CONTROL CODES:
 INLET - Inlet Control.
 OUTLET - Outlet Control.
 OUTLET* - Outlet Control with backwater curve used to compute headwater. See Figure III - 7E in HDS 5 for type flow.
 OUTLET** - Outlet Control - See Figure III - 7D in HDS 5 for type flow.
 N/A - Flow is supercritical with low headwater and low tailwater. Control Section is at the inlet.

Inlet Invert Elevation (ft.) : 606.50 **Outlet Invert Elevation (ft.) :** 603.18 **Tailwater Elevation (ft.) :** 603.70 **Overflow Elevation (ft.) :** 612.55
Allowable Headwater Elevation (ft.) : 611.55 **or Diameter + 2 ft.** *(whichever is less)*

Pipe Length (ft.) : 110.00 **Culvert Slope (ft./ft.) :** 0.0302 **Design Manning 'n' :** 0.0120

Design Discharge (cfs) : 29.80 **@ 25 yrs.** **Flood Discharge (cfs) :** 43.70 **@ 100 yrs.**

FLOW #	PIPE #	CULVERT SIZE	HWI (ft.)	HWO (ft.)	FLOW TYPE	VELOCITY (fps.)	DN (ft.)	DC (ft.)	MANNING N	HEADWATER CONTROL	OVER FLOW (cfs.)	DESIGN CODE	BURIAL DEPTH (ft.)
CULVERT TYPE : CIRCULAR SMOOTH													
29.80	1	27 in.	609.81	607.16	2 - E	14.74	1.14	1.89	0.0120	INLET	0.00	D	0.00
29.80	1	24 in.	610.67	608.40	2 - E	14.66	1.23	1.86	0.0120	INLET	0.00	D - 1	0.00
29.80	1	21 in.	612.40	611.07	2 - E	14.14	1.43	1.71	0.0120	INLET	0.00	D - 2	0.00
29.80	1	30 in.	609.39	N/A	1 - C	14.70	1.08	1.86	0.0120	INLET	0.00	D + 1	0.00
43.70	1	27 in.	611.80	609.48	2 - E	16.09	1.45	2.13	0.0120	INLET	0.00	F	0.00
38.70	1	24 in.	613.78	612.25	2 - E	15.36	1.50	1.95	0.0120	INLET	5.00	F - 1	0.00
30.20	1	21 in.	618.96	618.17	2 - E	14.13	1.46	1.71	0.0120	INLET	13.50	F - 2	0.00
43.70	1	30 in.	610.69	608.07	2 - E	16.20	1.35	2.20	0.0120	INLET	0.00	F + 1	0.00
CULVERT TYPE : CIRCULAR CORRUGATED													
Entrance Type : Half Headwall													
Entrance Loss (Ke) : 0.20													
Entrance Type : Half Headwall													
Entrance Loss (Ke) : 0.90													
Corrugated Metal Pipe (2 2/3 x 1/2 in. corrugations)													
29.80	1	27 in.	610.72	610.50	2 - E	8.15	1.95	1.89	0.0245	INLET	0.00	D	0.00



UNIVERSAL CULVERT DESIGN

FLOW (cfs.)	PIPE #	CULVERT SIZE	HWI (ft.)	HWO (ft.)	FLOW TYPE	VELOCITY (fps.)	DN (ft.)	DC (ft.)	MANNING N	HEADWATER CONTROL	OVER FLOW (cfs.)	DESIGN CODE	BURIAL DEPTH (ft.)
26.40	1	24 in.	612.20	614.62	2 - F	8.88	2.00	1.80	0.0247	OUTLET**	3.40	D - 1	0.00
19.10	1	21 in.	614.78	N/A	2 - F	8.37	1.75	1.58	0.0248	OUTLET**	10.70	D - 2	0.00
29.80	1	30 in.	609.88	608.48	2 - E	8.56	1.67	1.86	0.0244	INLET	0.00	D + 1	0.00
34.90	1	27 in.	613.79	616.67	2 - F	9.31	2.25	2.01	0.0245	OUTLET**	8.80	F	0.00
26.40	1	24 in.	616.86	625.61	2 - F	8.88	2.00	1.80	0.0247	OUTLET**	17.30	F - 1	0.00
19.10	1	21 in.	633.93	644.94	2 - F	8.37	1.75	1.58	0.0248	OUTLET**	24.60	F - 2	0.00
43.70	1	30 in.	612.04	612.24	2 - F	9.54	2.50	2.20	0.0244	OUTLET**	0.00	F + 1	0.00
Corrugated Metal Pipe (3 x 1 in. corrugations)													
29.80	1	36 in.	609.21	N/A	1 - C	7.79	1.60	1.77	0.0281	INLET	0.00	D	0.00
29.80	1	42 in.	608.98	N/A	1 - C	7.83	1.46	1.69	0.0278	INLET	0.00	D + 1	0.00
43.70	1	36 in.	610.25	609.08	2 - E	8.45	2.06	2.15	0.0281	INLET	0.00	F	0.00
43.70	1	42 in.	609.65	N/A	1 - C	8.64	1.82	2.06	0.0278	INLET	0.00	F + 1	0.00
Corrugated Metal Pipe (6 x 2 in. corrugations)													
29.80	1	60 in.	608.63	N/A	1 - C	6.71	1.39	1.52	0.0332	INLET	0.00	D	0.00
29.80	1	66 in.	608.54	N/A	1 - C	6.67	1.34	1.47	0.0330	INLET	0.00	D + 1	0.00
43.70	1	60 in.	609.16	N/A	1 - C	7.48	1.69	1.85	0.0332	INLET	0.00	F	0.00
43.70	1	66 in.	609.05	N/A	1 - C	7.44	1.63	1.80	0.0330	INLET	0.00	F + 1	0.00
Corrugated Metal Pipe (6 x 2 in. corrugations, Field Paved Invert)													
29.80	1	60 in.	608.63	N/A	1 - C	7.98	1.23	1.52	0.0260	INLET	0.00	D	0.00
29.80	1	66 in.	608.54	N/A	1 - C	7.90	1.19	1.47	0.0260	INLET	0.00	D + 1	0.00
43.70	1	60 in.	609.16	N/A	1 - C	8.90	1.49	1.85	0.0260	INLET	0.00	F	0.00
43.70	1	66 in.	609.05	N/A	1 - C	8.83	1.44	1.80	0.0260	INLET	0.00	F + 1	0.00

CR 503 STA 21+50

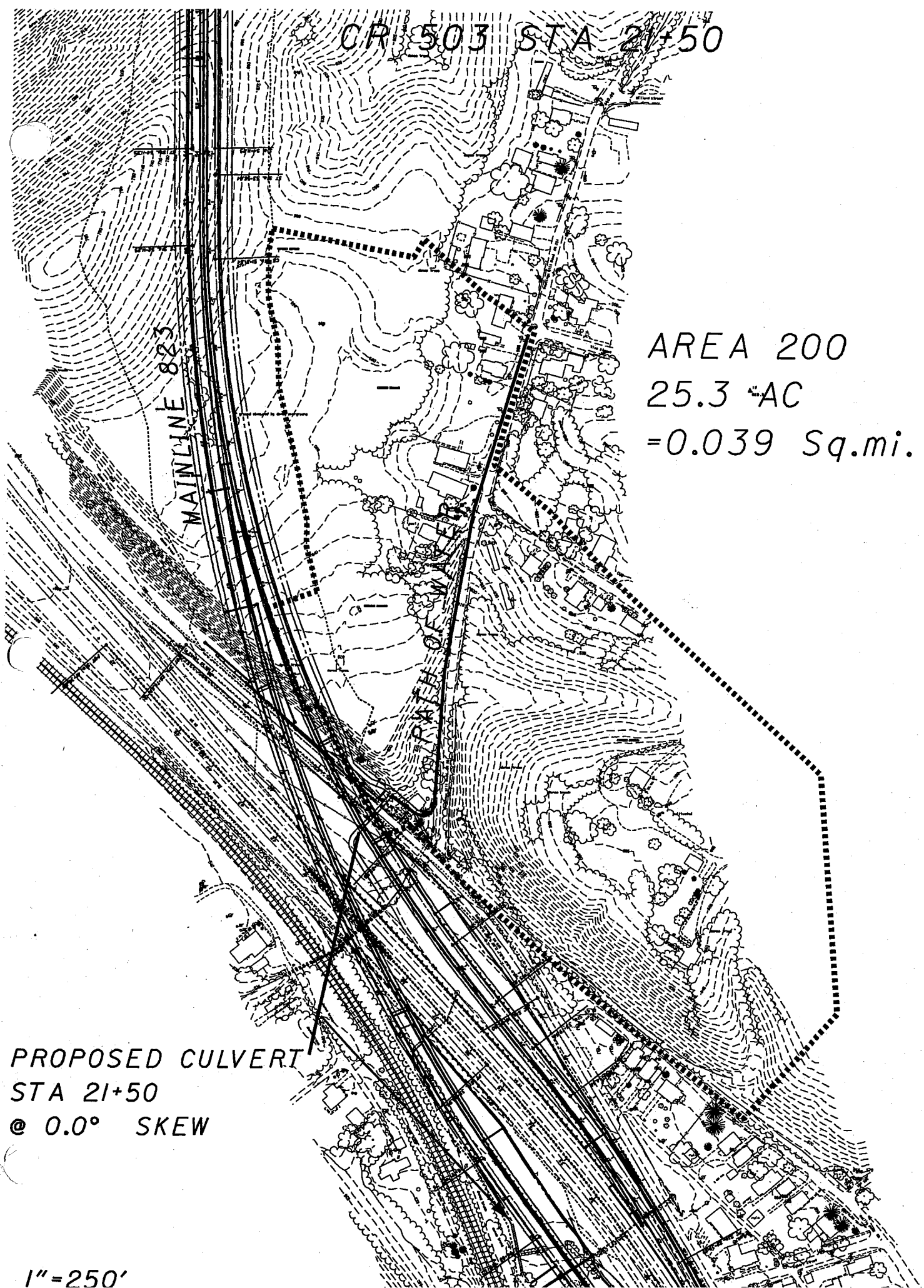


MAINLINE 823

AREA 200
25.3 AC
= 0.039 Sq.mi.

PROPOSED CULVERT
STA 21+50
@ 0.0° SKEW

1" = 250'



CR 503 STA 21+50.00
**TECHNIQUES FOR ESTIMATING FLOOD-PEAK
DISCHARGES OF RURAL, UNREGULATED STREAMS IN OHIO AREA A**
U.S. GEOLOGICAL SURVEY Water Resources Investigations Report 89-4126

	Values	Units	Definitions
	1100660.00	SQ. FT.	
	0.039	SQ. MI.	CONTDA = Contributing Drainage Area
	0.00	SQ. FT.	
	0.00	%	STORAGE = Storage Area
	1090.00	FT.	TOTAL CHANNEL LENGTH
	109.00	FT.	L ₁₀ = 10% of the Distance along channel
	559	FT.	Elev ₁₀ = Elevation at point L ₁₀
	926.50	FT.	L ₈₅ = 85% of the Distance along channel
	662	FT.	Elev ₈₅ = Elevation at point L ₈₅
	817.50	FT.	Length = L ₈₅ - L ₁₀
	663.96	FT./MI.	SLOPE = (Elev ₁₀ -Elev ₈₅)/Length
		CFS	Q _# = Flood-Peak Discharge
			# = Frequency of Storm
Q ₂	13.70	CFS	= 56.1(CONTDA) ^{0.782} (SLOPE) ^{0.172} (STORAGE+1) ^{-0.297}
Q ₅	29.59	CFS	= 84.5(CONTDA) ^{0.769} (SLOPE) ^{0.221} (STORAGE+1) ^{-0.322}
Q ₁₀	42.98	CFS	= 104(CONTDA) ^{0.764} (SLOPE) ^{0.244} (STORAGE+1) ^{-0.335}
Q ₂₅	61.50	CFS	= 129(CONTDA) ^{0.760} (SLOPE) ^{0.264} (STORAGE+1) ^{-0.347}
Q ₅₀	77.03	CFS	= 148(CONTDA) ^{0.757} (SLOPE) ^{0.276} (STORAGE+1) ^{-0.355}
Q ₁₀₀	92.45	CFS	= 167(CONTDA) ^{0.756} (SLOPE) ^{0.285} (STORAGE+1) ^{-0.363}

Rational
method

Worksheet for CR 503 STA 21+50

Project Description

Friction Method Manning Formula
Solve For Normal Depth

Input Data

Roughness Coefficient	0.040	
Channel Slope	0.03000	ft/ft
Left Side Slope	2.00	ft/ft (H:V)
Right Side Slope	2.00	ft/ft (H:V)
Bottom Width	10.00	ft
Discharge	61.50	ft ³ /s

Results

Normal Depth	0.94	ft
Flow Area	11.20	ft ²
Wetted Perimeter	14.21	ft
Top Width	13.77	ft
Critical Depth	0.98	ft
Critical Slope	0.02576	ft/ft
Velocity	5.49	ft/s
Velocity Head	0.47	ft
Specific Energy	1.41	ft
Froude Number	1.07	
Flow Type	Supercritical	

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	0.94	ft
Critical Depth	0.98	ft
Channel Slope	0.03000	ft/ft
Critical Slope	0.02576	ft/ft



UNIVERSAL CULVERT DESIGN

PID : 77366 **Date :** 06/07/2007 **Project :** SR 823 Portsmouth Bypass **Location :** Portsmouth Ohio **Designer :** mdc

Description : Drainage area 200, CR 503 Sta. 21+50.00

HEADWATER CONTROL CODES: INLET - Inlet Control.
 OUTLET - Outlet Control.
 OUTLET* - Outlet Control with backwater curve used to compute headwater. See Figure III - 7E in HDS 5 for type flow.
 OUTLET** - Outlet Control - See Figure III - 7D in HDS 5 for type flow.
 N/A - Flow is supercritical with low headwater and low tailwater. Control Section is at the inlet.

Inlet Invert Elevation (ft.) : 549.25 **Outlet Invert Elevation (ft.) :** 546.63 **Tailwater Elevation (ft.) :** 547.60 **Overflow Elevation (ft.) :** 560.00
Allowable Headwater Elevation (ft.) : 559.00 or Diameter + 2 ft. *(whichever is less)*
Pipe Length (ft.) : 88.00 **Culvert Slope (ft./ft.) :** 0.0298 **Design Manning 'n' :** 0.0120
Design Discharge (cfs) : 61.50 @ 25 yrs. **Flood Discharge (cfs) :** 92.50 @ 100 yrs.

FLOW # (cfs.)	PIPE #	CULVERT SIZE	HWI (ft.)	HWO (ft.)	FLOW TYPE	VELOCITY (fps.)	DN (ft.)	DC (ft.)	MANNING N	HEADWATER CONTROL	OVER FLOW (cfs.)	DESIGN CODE	BURIAL DEPTH (ft.)
CULVERT TYPE : CIRCULAR SMOOTH													
Entrance Type : Half Headwall													
61.50	1	36 in.	553.69	551.44	2 - E	17.59	1.49	2.53	0.0120	INLET	0.00	D	0.00
61.50	1	33 in.	554.48	552.26	2 - E	17.55	1.57	2.51	0.0120	INLET	0.00	D - 1	0.00
61.50	1	30 in.	555.82	553.68	2 - E	17.36	1.69	2.40	0.0120	INLET	0.00	D - 2	0.00
61.50	1	42 in.	552.96	N/A	1 - C	17.50	1.38	2.46	0.0120	INLET	0.00	D + 1	0.00
92.50	1	36 in.	556.62	554.18	2 - E	19.31	1.92	2.86	0.0120	INLET	0.00	F	0.00
92.50	1	33 in.	558.56	556.15	2 - E	18.91	2.11	2.69	0.0120	INLET	0.00	F - 1	0.00
84.40	1	30 in.	561.99	559.53	2 - E	17.19	2.50	2.47	0.0120	INLET	8.10	F - 2	0.00
92.50	1	42 in.	554.55	552.22	2 - E	19.46	1.73	2.98	0.0120	INLET	0.00	F + 1	0.00
CULVERT TYPE : CIRCULAR CORRUGATED													
Entrance Type : Half Headwall													
Entrance Loss (Ke) : 0.20													
Entrance Loss (Ke) : 0.90													
Corrugated Metal Pipe (2 2/3 x 1/2 in. corrugations)													
61.50	1	42 in.	553.44	N/A	1 - C	10.52	2.05	2.46	0.0237	INLET	0.00	D	0.00



UNIVERSAL CULVERT DESIGN

FLOW (cfs.)	PIPE #	CULVERT SIZE	HWI (ft.)	HWO (ft.)	FLOW TYPE	VELOCITY (fps.)	DN (ft.)	DC (ft.)	MANNING N	HEADWATER CONTROL	OVER FLOW (cfs.)	DESIGN CODE	BURIAL DEPTH (ft.)
61.50	1	36 in.	554.92	554.18	2 - E	10.01	2.43	2.53	0.0241	INLET	0.00	D - 1	0.00
61.50	1	33 in.	556.31	556.49	2 - F	10.83	2.75	2.51	0.0241	OUTLET**	0.00	D - 2	0.00
61.50	1	48 in.	552.87	N/A	1 - C	10.61	1.88	2.36	0.0235	INLET	0.00	D + 1	0.00
92.50	1	42 in.	556.07	555.05	2 - E	11.28	2.78	2.98	0.0237	INLET	0.00	F	0.00
90.80	1	36 in.	559.41	560.40	2 - F	13.09	3.00	2.85	0.0241	OUTLET**	1.70	F - 1	0.00
74.70	1	33 in.	562.32	565.71	2 - F	12.79	2.75	2.62	0.0241	OUTLET**	17.80	F - 2	0.00
92.50	1	48 in.	554.41	552.87	2 - E	11.71	2.41	2.92	0.0235	INLET	0.00	F + 1	0.00
Corrugated Metal Pipe (3 x 1 in. corrugations)													
61.50	1	42 in.	553.44	N/A	1 - C	9.28	2.28	2.46	0.0278	INLET	0.00	D	0.00
61.50	1	36 in.	554.92	555.10	2 - F	9.68	3.00	2.53	0.0281	OUTLET**	0.00	D - 1	0.00
61.50	1	48 in.	552.87	N/A	1 - C	9.44	2.06	2.36	0.0275	INLET	0.00	D + 1	0.00
92.50	1	42 in.	556.07	555.98	2 - E	9.61	3.50	2.98	0.0278	INLET	0.00	F	0.00
83.20	1	36 in.	559.41	562.48	2 - F	12.12	3.00	2.80	0.0281	OUTLET**	9.30	F - 1	0.00
92.50	1	48 in.	554.41	553.31	2 - E	10.33	2.68	2.92	0.0275	INLET	0.00	F + 1	0.00
Corrugated Metal Pipe (6 x 2 in. corrugations)													
61.50	1	60 in.	552.48	N/A	1 - C	8.16	2.04	2.21	0.0332	INLET	0.00	D	0.00
61.50	1	66 in.	552.35	N/A	1 - C	8.15	1.95	2.14	0.0330	INLET	0.00	D + 1	0.00
92.50	1	60 in.	553.35	N/A	1 - C	9.08	2.58	2.73	0.0332	INLET	0.00	F	0.00
92.50	1	66 in.	553.16	N/A	1 - C	9.11	2.44	2.65	0.0330	INLET	0.00	F + 1	0.00
Corrugated Metal Pipe (6 x 2 in. corrugations, Field Paved Invert)													
61.50	1	60 in.	552.48	N/A	1 - C	9.75	1.79	2.21	0.0260	INLET	0.00	D	0.00
61.50	1	66 in.	552.35	N/A	1 - C	9.68	1.72	2.14	0.0260	INLET	0.00	D + 1	0.00
92.50	1	60 in.	553.35	N/A	1 - C	10.88	2.24	2.73	0.0260	INLET	0.00	F	0.00
92.50	1	66 in.	553.16	N/A	1 - C	10.85	2.14	2.65	0.0260	INLET	0.00	F + 1	0.00

MATCH EXISTING USE 7811



CULVERT ANALYSIS

PID : 19415 **Date :** 06/07/2007 **Project :** SR 823 Portsmouth Bypass **Location :** Portsmouth OH **Designer :** mdc
Description : Drainage area 200, CR 503 Sta. 21+50.00

HEADWATER CONTROL CODES:

- INLET - Inlet Control.
- OUTLET - Outlet Control.
- OUTLET* - Outlet Control with backwater curve used to compute headwater. See Figure III - 7E in HDS 5 for type flow.
- OUTLET** - Outlet Control - See Figure III - 7D in HDS 5 for type flow.
- N/A - Flow is supercritical with low headwater and low tailwater. Control Section is at the inlet.

Pipe Number : 1 **Use HW :** 0 **Inlet Invert Elevation (ft.) :** 549.25 **Outlet Invert Elevation (ft.) :** 546.63
Pipe Quantity : 1

Culvert Type : Circular Smooth **Pipe Length (ft.) :** 88.00 **Culvert Slope (ft./ft.) :** 0.0298
Corrugation Type :
Pipe Size : 78 in.
Design Manning 'n' : (default)

Entrance Type : Half Headwall **Loss Coef. Ke :** 0.2000

FLOW LOSS (cfs.) (ft.)	HEAD (ft.)	HWI (ft.)	HWO (ft.)	FLOW TYPE	VELOCITY (fps.)	DN (ft.)	DC (ft.)	MANNING N	HEADWATER CONTROL	BURIED DEPTH (ft.)	TAILWATER ELEVATION (ft.)
61.50	1.11	552.01	N/A	1 - C	16.47	1.10	2.04	0.0120	INLET	0.00	546.63
92.50	1.63	552.77	N/A	1 - C	18.56	1.35	2.52	0.0120	INLET	0.00	546.63

SRI40 STA. 6+89.33



AREA 104
0.5 AC
= 0.010 Sq.mi

PROPOSED CULVERT
STA 6+89.33
0.0° SKEW

1"=150'



Client: ODOT

Sheet: of



Subject: Pipe Culvert Calculations
@ STA 6+89.33 SR140

Order No:

Computed by: DL

Date: 5/10/2007

Checked by:



Rational Method

Coefficient of Runoff (1101.2.3)

	Area (Sft)	Area (Ac)	C
Pavement Area	12126	0.28	0.9
Non-paved Area	270704	6.21	0.45
Other			
Total Area		6.49 acres	Weighted "C" = 0.47

Overland Flow

Length	0
High Elevation	0
Low Elevation	0
Slope %	0

t_o 0.00 (1101.2.2)
 t_c 0.00 Compare with Fig 1101-1
 Negligible

Shallow Concentrated Flow

Length	1190
High Elevation	722.5
Low Elevation	548.4
Slope %	14.63025

k 0.457 (Grassed waterways - Table 1101-1)
 V 5.735197 (1101.2.2)
 t_s 3.458178 (1101.2.2)

Since the time of concentration = $t_o + t_s$

For Intensity Zone D	a	b	c	Ac	t_c	C	I	Q cu ft/s
2 Years	85.568	16.5	0.95	6.492886	10.00	0.47	3.80	11.59
5 Years	118.822	18.7	0.969	6.49	10.00	0.47	4.59	14.00
10 Years	112.172	16.8	0.923	6.492886	10.00	0.47	5.39	16.43
25 Years	198.92	19.3	1.004	6.492886	10.00	0.47	6.70	20.41
50 Years	206.025	19.6	0.99	6.492886	10.00	0.47	7.20	21.94
100 Years	355.551	23.199	1.076	6.492886	10.00	0.47	8.21	25.01



Worksheet for SR 140 STA 6+89.33

Project Description

Friction Method Manning Formula
Solve For Normal Depth

Input Data

Roughness Coefficient	0.040
Channel Slope	0.09200 ft/ft
Left Side Slope	2.00 ft/ft (H:V)
Right Side Slope	2.00 ft/ft (H:V)
Bottom Width	5.00 ft
Discharge	20.41 ft ³ /s

Results

Normal Depth	0.52 ft
Flow Area	3.17 ft ²
Wetted Perimeter	7.34 ft
Top Width	7.10 ft
Critical Depth	0.73 ft
Critical Slope	0.02938 ft/ft
Velocity	6.44 ft/s
Velocity Head	0.64 ft
Specific Energy	1.17 ft
Froude Number	1.70
Flow Type	Supercritical

GVF Input Data

Downstream Depth	0.00 ft
Length	0.00 ft
Number Of Steps	0

GVF Output Data

Upstream Depth	0.00 ft
Profile Description	
Profile Headloss	0.00 ft
Downstream Velocity	Infinity ft/s
Upstream Velocity	Infinity ft/s
Normal Depth	0.52 ft
Critical Depth	0.73 ft
Channel Slope	0.09200 ft/ft
Critical Slope	0.02938 ft/ft



UNIVERSAL CULVERT DESIGN

PID : 77366 **Date :** 05/09/2007 **Project :** SR 823 Portsmouth Bypass **Location :** Portsmouth Ohio **Designer :** DL

Description : Drainage area 104, Sta. 6+89.33, SR140

HEADWATER CONTROL CODES: INLET - Inlet Control.
 OUTLET - Outlet Control.
 OUTLET* - Outlet Control with backwater curve used to compute headwater. See Figure III - 7E in HDS 5 for type flow.
 OUTLET** - Outlet Control - See Figure III - 7D in HDS 5 for type flow.
 N/A - Flow is supercritical with low headwater and low tailwater. Control Section is at the inlet.

Inlet Invert Elevation (ft.) : 548.15 **Outlet Invert Elevation (ft.) :** 546.91 **Tailwater Elevation (ft.) :** 547.43 **Overflow Elevation (ft.) :** 554.47
Allowable Headwater Elevation (ft.) : 553.47 or Diameter + 2 ft. *(whichever is less)*
Pipe Length (ft.) : 125.00 **Culvert Slope (ft./ft.) :** 0.0099 **Design Manning 'n' :** 0.0120
Design Discharge (cfs) : 20.40 @ 25 yrs. **Flood Discharge (cfs) :** 25.00 @ 100 yrs.

FLOW PIPE #	PIPE CULVERT SIZE	HWI (ft.)	HWO (ft.)	FLOW TYPE	FLOW VELOCITY (fps.)	DN (ft.)	DC (ft.)	MANNING N	HEADWATER CONTROL	OVER FLOW (cfs.)	DESIGN CODE	BURIAL DEPTH (ft.)
→ 20.40	1	21 in.	551.59	551.68	2 - F	8.82	1.75	1.61	0.0120	0.00	D	0.00
19.70	1	18 in.	553.26	554.87	2 - F	11.21	1.50	1.47	0.0120	0.70	D - 1	0.00
12.90	1	15 in.	559.55	563.87	2 - F	10.56	1.25	1.22	0.0120	7.50	D - 2	0.00
20.40	1	24 in.	550.85	550.37	2 - E	8.70	1.40	1.62	0.0120	0.00	D + 1	0.00
→ 25.00	1	21 in.	552.70	553.27	2 - F	10.54	1.75	1.68	0.0120	0.00	F	0.00
19.70	1	18 in.	555.34	558.13	2 - F	11.21	1.50	1.47	0.0120	5.30	F - 1	0.00
12.90	1	15 in.	576.10	N/A	2 - F	10.51	1.25	1.22	0.0120	12.10	F - 2	0.00
25.00	1	24 in.	551.50	551.26	2 - E	8.84	1.69	1.76	0.0120	0.00	F + 1	0.00

CULVERT TYPE : CIRCULAR SMOOTH **Entrance Type :** Half Headwall **Entrance Loss (Ke) :** 0.20

Corrugated Metal Pipe (2 2/3 x 1/2 in. corrugations)

→ 20.40 1 27 in. 550.84 551.52 2 - F 6.84 2.25 1.58 0.0245 0.00 D 0.00

CULVERT TYPE : CIRCULAR CORRUGATED **Entrance Type :** Half Headwall **Entrance Loss (Ke) :** 0.90





UNIVERSAL CULVERT DESIGN

FLOW PIPE # (cfs.)	CULVERT SIZE	HWI (ft.)	HWO (ft.)	FLOW TYPE	VELOCITY (fps.)	DN (ft.)	DC (ft.)	MANNING N	HEADWATER CONTROL	OVER FLOW (cfs.)	DESIGN CODE	BURIAL DEPTH (ft.)
20.40	1 24 in.	551.50	553.61	2 - F	7.48	2.00	1.62	0.0247	OUTLET**	0.00	D - 1	0.00
16.00	1 21 in.	552.82	558.21	2 - F	7.39	1.75	1.48	0.0248	OUTLET**	4.40	D - 2	0.00
20.40	1 30 in.	550.53	550.80	1 - A	6.46	1.92	1.53	0.0244	OUTLET*	0.00	D + 1	0.00
→ 25.00	1 27 in.	551.52	552.95	2 - F	7.55	2.25	1.75	0.0245	OUTLET**	0.00	F	0.00
22.00	1 24 in.	552.58	556.14	2 - F	7.83	2.00	1.67	0.0247	OUTLET**	3.00	F - 1	0.00
16.00	1 21 in.	554.43	563.07	2 - F	7.39	1.75	1.48	0.0248	OUTLET**	9.00	F - 2	0.00
25.00	1 30 in.	550.98	551.40	2 - F	7.02	2.50	1.70	0.0244	OUTLET**	0.00	F + 1	0.00
Corrugated Metal Pipe (3 x 1 in. corrugations)												
20.40	1 36 in.	550.29	550.55	1 - A	6.03	1.79	1.45	0.0281	OUTLET*	0.00	D	0.00
20.40	1 42 in.	550.15	550.40	1 - A	5.77	1.62	1.38	0.0278	OUTLET*	0.00	D + 1	0.00
25.00	1 36 in.	550.56	550.87	1 - A	6.46	2.05	1.61	0.0281	OUTLET*	0.00	F	0.00
25.00	1 42 in.	550.40	550.68	1 - A	6.15	1.82	1.54	0.0278	OUTLET*	0.00	F + 1	0.00
Corrugated Metal Pipe (6 x 2 in. corrugations)												
20.40	1 60 in.	549.86	550.14	1 - A	5.33	1.52	1.25	0.0332	OUTLET*	0.00	D	0.00
20.40	1 66 in.	549.79	550.07	1 - A	5.24	1.46	1.21	0.0330	OUTLET*	0.00	D + 1	0.00
25.00	1 60 in.	550.07	550.36	1 - A	5.65	1.69	1.38	0.0332	OUTLET*	0.00	F	0.00
25.00	1 66 in.	549.99	550.30	1 - A	5.54	1.62	1.35	0.0330	OUTLET*	0.00	F + 1	0.00
Corrugated Metal Pipe (6 x 2 in. corrugations, Field Paved Invert)												
20.40	1 60 in.	549.86	550.17	1 - A	5.33	1.34	1.25	0.0260	OUTLET*	0.00	D	0.00
20.40	1 66 in.	549.79	550.11	1 - A	5.24	1.30	1.21	0.0260	OUTLET*	0.00	D + 1	0.00
25.00	1 60 in.	550.07	550.41	1 - A	5.65	1.49	1.38	0.0260	OUTLET*	0.00	F	0.00
25.00	1 66 in.	549.99	550.33	1 - A	5.54	1.44	1.35	0.0260	OUTLET*	0.00	F + 1	0.00



Culvert Material Selection as per ODOI

Updated 04/11/2005

Input Variables for Round Conduit

pH ranges from 3 to 9.5 pH = Required for all durability
 Enter "a" for abrasive or "n" for non-abrasive Site Conditions =
 50 or 75 years Service Life =
 Pipe Slope (%) = Required for Concrete durability
 Pipe Diameter (in) =
 Maximum Height of Fill = Required for Structural Design

Instructions for Use:
 This spreadsheet will determine the available material options based upon input durability tables and load structural tables for round conduit.
 Not all available options will apply to each situation and it is the user's responsibility to verify each alternative is valid.

Notes:
 *** Concrete field paving shall be epoxy coated per 706.03 for pH < 5.0
 ** Externally coated per AASHTO M243

Metal Pipe Description	Material	Req. Gauge per Durability	Thickness per Durability (Inches)	Req. Gauge per Structural	Thickness per Structural (Inches)
Galvanized	707.01	10	0.138	16	0.064
Aluminized	707.01	16	0.064	16	0.064
Galvanized	707.02	10	0.138	N/A	N/A
Aluminized	707.02	16	0.064	N/A	N/A
Galvanized - W/CFP	707.02 W/CFP	16	0.064	N/A	N/A
Structural Plate	707.03	12	0.109	N/A	N/A
Structural Plate W/CFP	707.03 W/CFP	n/a	n/a	N/A	N/A
Polymer Coated	707.04 (0.5" corr.)	16	0.064	16	0.064
Polymer Coated	707.04 (1" corr.)	16	0.064	N/A	N/A
Polymer Coated- Asphalt Coated and Paved	707.04 (0.5" corr.)	n/a	n/a	16	0.064
Polymer Coated- Asphalt Coated and Paved	707.04 (1" corr.)	n/a	n/a	N/A	N/A
Aluminized- Asphalt Coated and Paved	707.05 ≤ 48"	n/a	n/a	16	0.064
Aluminized- Asphalt Coated and Paved	707.05 > 54"	n/a	n/a	16	0.064
Galvanized-Asphalt Coated and Paved	707.06 ≤ 48"	16	0.064	16	0.064
Galvanized-Asphalt Coated and Paved	707.06 > 54"	12	0.109	16	0.064
Aluminized- Asphalt Coated and Paved	707.07 ≤ 48"	n/a	n/a	16	0.064
Aluminized- Asphalt Coated and Paved	707.07 > 54"	n/a	n/a	16	0.064
Galvanized-Asphalt Coated and Paved	707.07 ≤ 48"	16	0.064	N/A	N/A
Galvanized-Asphalt Coated and Paved	707.07 > 54"	12	0.109	N/A	N/A
Aluminum Pipe	707.21 (0.5" corr.)	min	use min	min	0.075
Aluminum Pipe	707.22 (1.0" corr.)	min	use min	min	N/A
Structural Plate Aluminum Pipe	707.23	min	use min	min	N/A

Concrete Pipe Material Options as per Durability Requirements	Material	Min pH	Epoxy Coated Required?
Concrete Conduit	706.02	3/2	No

D-Load Test Required for Concrete Pipe	Material	Is Minimum D-Load Allowable?
Concrete Conduit	706.02	Yes

SR 140 STA 8+50

AREA 96

8.0 AC

= 0.013 Sq. mi.

+ 0.023 AREA 93

+ 0.021 AREA 94

+ 0.102 AREA 3

= 0.159 Sq. mi.

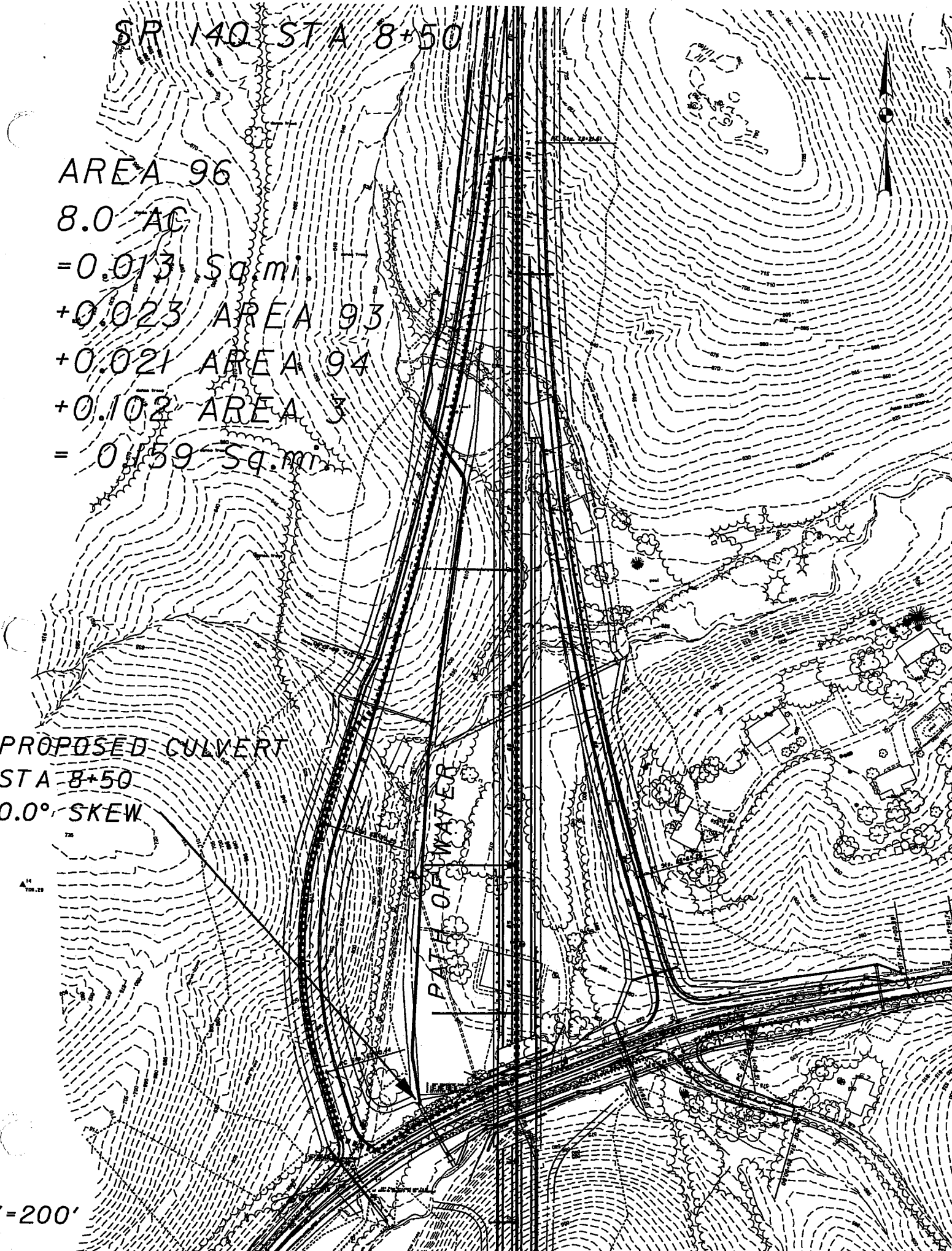
PROPOSED CULVERT

STA 8+50

0.0° SKEW

PATH OF WATER

"=200'



SR 140 STA 8+50

TECHNIQUES FOR ESTIMATING FLOOD-PEAK DISCHARGES OF RURAL, UNREGULATED STREAMS IN OHIO AREA A
 U.S. GEOLOGICAL SURVEY Water Resources Investigations Report 89-4126

	Values	Units	Definitions
	4420510.00	SQ. FT.	
	0.159	SQ. MI.	CONTDA = Contributing Drainage Area
	0.00	SQ. FT.	
	0.00	%	STORAGE = Storage Area
	3735.00	FT.	TOTAL CHANNEL LENGTH
	373.50	FT.	L ₁₀ = 10% of the Distance along channel
	559	FT.	Elev ₁₀ = Elevation at point L ₁₀
	3174.75	FT.	L ₈₅ = 85% of the Distance along channel
	691	FT.	Elev ₈₅ = Elevation at point L ₈₅
	2801.25	FT.	Length = L ₈₅ - L ₁₀
	248.80	FT./MI.	SLOPE = (Elev ₁₀ -Elev ₈₅)/Length
		CFS	Q _# = Flood-Peak Discharge
			# = Frequency of Storm
Q ₂	34.32	CFS	= 56.1(CONTDA) ^{0.782} (SLOPE) ^{0.172} (STORAGE+1) ^{-0.297}
Q ₅	69.39	CFS	= 84.5(CONTDA) ^{0.769} (SLOPE) ^{0.221} (STORAGE+1) ^{-0.322}
Q ₁₀	97.85	CFS	= 104(CONTDA) ^{0.764} (SLOPE) ^{0.244} (STORAGE+1) ^{-0.335}
Q ₂₅	136.54	CFS	= 129(CONTDA) ^{0.760} (SLOPE) ^{0.264} (STORAGE+1) ^{-0.347}
Q ₅₀	168.30	CFS	= 148(CONTDA) ^{0.757} (SLOPE) ^{0.276} (STORAGE+1) ^{-0.355}
Q ₁₀₀	199.94	CFS	= 167(CONTDA) ^{0.756} (SLOPE) ^{0.285} (STORAGE+1) ^{-0.363}

Use Rational Method



UNIVERSAL CULVERT DESIGN

PID : 77366 **Date :** 05/14/2007 **Project :** SR 823 Portsmouth Bypass **Location :** Portsmouth Ohio **Designer :** mdc

Description : Drainage area 96, SR 140 Sta. 8+50

HEADWATER CONTROL CODES: INLET - Inlet Control.
 OUTLET - Outlet Control.
 OUTLET - Outlet Control with backwater curve used to compute headwater. See Figure III - 7E in HDS 5 for type flow.
 OUTLET - Outlet Control - See Figure III - 7D in HDS 5 for type flow.
 N/A - Flow is supercritical with low headwater and low tailwater. Control Section is at the inlet.

Inlet Invert Elevation (ft.) : 547.30 **Outlet Invert Elevation (ft.) :** 546.77 **Tailwater Elevation (ft.) :** 548.75 **Overflow Elevation (ft.) :** 555.27

Allowable Headwater Elevation (ft.) : 554.27 or Diameter + 2 ft. (*whichever is less*)

Pipe Length (ft.) : 100.00 **Culvert Slope (ft./ft.) :** 0.0053 **Design Manning 'n' :** 0.0120

Design Discharge (cfs) : 136.50 @ 25 yrs. **Flood Discharge (cfs) :** 199.90 @ 100 yrs.

FLOW PIPE #	CULVERT SIZE	HWI (ft.)	HWO (ft.)	FLOW TYPE	VELOCITY (fps.)	DN (ft.)	DC (ft.)	MANNING N	HEADWATER CONTROL	OVERFLOW CODE	BURIAL DEPTH (ft.)	
CULVERT TYPE : CIRCULAR SMOOTH												
Entrance Type : Half Headwall Entrance Loss (Ke) : 0.20												
136.50	1	54 in.	552.74	552.52	2 - E	11.00	3.28	3.44	0.0120	INLET	0.00	D
136.50	1	48 in.	553.74	553.47	2 - E	10.86	4.00	3.48	0.0120	INLET	0.00	D - 1
128.70	1	42 in.	555.95	555.50	2 - E	13.38	3.50	3.30	0.0120	INLET	7.80	D - 2
136.50	1	60 in.	552.28	N/A	1 - C	11.19	2.98	3.35	0.0120	INLET	0.00	D + 1
198.80	1	54 in.	555.32	554.86	2 - E	12.50	4.50	4.03	0.0120	INLET	1.10	F
162.60	1	48 in.	557.88	557.05	2 - E	12.94	4.00	3.68	0.0120	INLET	37.30	F - 1
128.70	1	42 in.	562.91	561.64	2 - E	13.38	3.50	3.30	0.0120	INLET	71.20	F - 2
199.90	1	60 in.	554.01	553.72	2 - E	11.92	3.98	4.04	0.0120	INLET	0.00	F + 1

CULVERT TYPE : CIRCULAR CORRUGATED

Entrance Type : Half Headwall Entrance Loss (Ke) : 0.90

Corrugated Metal Pipe (2 2/3 x 1/2 in. corrugations)

136.50	1	60 in.	552.77	553.29	1 - A	9.78	4.57	3.35	0.0232	OUTLET*	0.00	D
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USE 60"



UNIVERSAL CULVERT DESIGN

FLOW PIPE #	CULVERT SIZE	HWI (ft.)	HWO (ft.)	FLOW TYPE	VELOCITY (fps.)	DN (ft.)	DC (ft.)	MANNING N	HEADWATER CONTROL	OVER FLOW (cfs.)	DESIGN CODE	BURIAL DEPTH (ft.)
136.50	1 54 in.	553.76	554.45	2 - F	10.48	4.50	3.44	0.0233	OUTLET**	0.00	D - 1	0.00
118.70	1 48 in.	555.72	556.92	2 - F	10.76	4.00	3.28	0.0235	OUTLET**	17.80	D - 2	0.00
136.50	1 66 in.	552.28	552.90	1 - A	9.33	4.47	3.25	0.0231	OUTLET*	0.00	D + 1	0.00
181.70	1 60 in.	555.60	556.21	2 - F	11.17	5.00	3.86	0.0232	OUTLET**	18.20	F	0.00
149.50	1 54 in.	558.02	559.00	2 - F	11.00	4.50	3.59	0.0233	OUTLET**	50.40	F - 1	0.00
118.70	1 48 in.	561.91	564.45	2 - F	10.76	4.00	3.28	0.0235	OUTLET**	81.20	F - 2	0.00
199.90	1 66 in.	554.21	554.70	2 - F	10.92	5.50	3.96	0.0231	OUTLET**	0.00	F + 1	0.00
Corrugated Metal Pipe (3 x 1 in. corrugations)												
136.50	1 60 in.	552.77	553.56	2 - F	9.78	5.00	3.35	0.0271	OUTLET**	0.00	D	0.00
136.50	1 54 in.	553.76	555.02	2 - F	10.48	4.50	3.44	0.0273	OUTLET**	0.00	D - 1	0.00
110.40	1 48 in.	555.72	558.01	2 - F	10.32	4.00	3.17	0.0275	OUTLET**	26.10	D - 2	0.00
136.50	1 66 in.	552.28	552.95	1 - A	9.33	5.02	3.25	0.0269	OUTLET*	0.00	D + 1	0.00
171.40	1 60 in.	555.60	556.89	2 - F	10.85	5.00	3.75	0.0271	OUTLET**	28.50	F	0.00
140.00	1 54 in.	558.02	560.23	2 - F	10.61	4.50	3.48	0.0273	OUTLET**	59.90	F - 1	0.00
110.40	1 48 in.	561.91	566.78	2 - F	10.32	4.00	3.17	0.0275	OUTLET**	89.50	F - 2	0.00
199.90	1 66 in.	554.21	555.10	2 - F	10.92	5.50	3.96	0.0269	OUTLET**	0.00	F + 1	0.00
Corrugated Metal Pipe (6 x 2 in. corrugations)												
136.50	1 60 in.	552.77	554.15	2 - F	9.78	5.00	3.35	0.0332	OUTLET**	0.00	D	0.00
136.50	1 66 in.	552.28	553.14	1 - A	9.33	5.02	3.25	0.0330	OUTLET*	0.00	D + 1	0.00
156.30	1 60 in.	555.60	558.17	2 - F	10.37	5.00	3.58	0.0332	OUTLET**	43.60	F	0.00
187.40	1 66 in.	554.21	555.86	2 - F	10.61	5.50	3.83	0.0330	OUTLET**	12.50	F + 1	0.00
Corrugated Metal Pipe (6 x 2 in. corrugations, Field Paved Invert)												
136.50	1 60 in.	552.77	553.40	2 - F	9.78	5.00	3.35	0.0260	OUTLET*	0.00	D	0.00
136.50	1 66 in.	552.28	552.94	1 - A	9.33	5.02	3.25	0.0260	OUTLET*	0.00	D + 1	0.00



UNIVERSAL CULVERT DESIGN

FLOW (cfs.)	PIPE #	CULVERT SIZE	HWI (ft.)	HWO (ft.)	FLOW TYPE	VELOCITY (fps.)	DN (ft.)	DC (ft.)	MANNING N	HEADWATER CONTROL	OVER FLOW (cfs.)	DESIGN CODE	BURIAL DEPTH (ft.)
174.30	1	60 in.	555.60	556.69	2 - F	10.93	5.00	3.78	0.0260	OUTLET**	25.60	F	0.00
199.90	1	66 in.	554.21	555.00	2 - F	10.92	5.50	3.96	0.0260	OUTLET**	0.00	F + 1	0.00

SP 140 STA 12+00



AREA 92

3.3 AC

= 0.005 Sq.mi.

= 0.007 Sq.mi.

AREA 91

= 0.012 Sq.mi.

PATH OF WATER

AREA 91'S

= 0.007

Sq.mi.

PROPOSED CULVERT

STA 12+00

0.0° SKEW

200'



SR 140 STA 12+00

Client: ODOT

Sheet: of



Subject: Pipe Culvert Calculations

Order No:

Computed by: DL

Date: 12/18/2007

Checked by:

Date:

Rational Method

Coefficient of Runoff (1101.2.3)

	Area (Sft)	Area (Ac)	C	
Pavement Area	82851	1.90	0.9	
Non-paved Area	262720	6.03	0.6	Wieghted "C" for non-paved area
Other				
Total Area	345571	7.93 acres		Weighted "C" = 0.70

Overland Flow

Length	
High Elevation	
Low Elevation	t_o #DIV/0! (1101.2.2)
Slope %	#DIV/0! t_o 0.00 Compare with Fig 1101-1 negligible

Shallow Concentrated Flow

Length	1000
High Elevation	611
Low Elevation	553
Slope %	5.8
k	0.457 (Grassed waterways - Table 1101-1)
V	3.611074 (1101.2.2)
t_s	4.615432 (1101.2.2)

Since the time of concentration = $t_o + t_s$

t_c 10.00 min

For Intensity Zone D

Frequency	a	b	c	Ac	t_c	C	I	Q cu ft/s
2 Years	85.568	16.5	0.95	7.933219	10.00	0.70	3.80	21.08
5 Years	118.822	18.7	0.969	7.933219	10.00	0.70	4.59	25.46
10 Years	112.172	16.8	0.923	7.933219	10.00	0.70	5.39	29.88
25 Years	198.92	19.3	1.004	7.933219	10.00	0.70	6.70	37.12
50 Years	206.025	19.6	0.99	7.933219	10.00	0.70	7.20	39.90
100 Years	355.551	23.199	1.076	7.933219	10.00	0.70	8.21	45.48



Worksheet for SR 140 STA 12+00

Project Description

Friction Method Manning Formula
Solve For Normal Depth

Input Data

Roughness Coefficient	0.040
Channel Slope	0.01000 ft/ft
Left Side Slope	2.00 ft/ft (H:V)
Right Side Slope	2.00 ft/ft (H:V)
Bottom Width	10.00 ft
Discharge	37.12 ft ³ /s

Results

Normal Depth	0.97 ft
Flow Area	11.54 ft ²
Wetted Perimeter	14.32 ft
Top Width	13.87 ft
Critical Depth	0.72 ft
Critical Slope	0.02805 ft/ft
Velocity	3.22 ft/s
Velocity Head	0.16 ft
Specific Energy	1.13 ft
Froude Number	0.62
Flow Type	Subcritical

GVF Input Data

Downstream Depth	0.00 ft
Length	0.00 ft
Number Of Steps	0

GVF Output Data

Upstream Depth	0.00 ft
Profile Description	
Profile Headloss	0.00 ft
Downstream Velocity	Infinity ft/s
Upstream Velocity	Infinity ft/s
Normal Depth	0.97 ft
Critical Depth	0.72 ft
Channel Slope	0.01000 ft/ft
Critical Slope	0.02805 ft/ft



UNIVERSAL CULVERT DESIGN

PID : 77366 **Date :** 12/18/2007 **Project :** SR 823 Portsmouth Bypass **Location :** Portsmouth Ohio **Designer :** DL

Description : Drainage area 92, SR 140 Sta. 12+00

HEADWATER CONTROL CODES: INLET - Inlet Control.

OUTLET - Outlet Control.

OUTLET* - Outlet Control with backwater curve used to compute headwater. See Figure III - 7E in HDS 5 for type flow.

OUTLET** - Outlet Control - See Figure III - 7D in HDS 5 for type flow.

N/A - Flow is supercritical with low headwater and low tailwater. Control Section is at the inlet.

Inlet Invert Elevation (ft.) : 553.72 **Outlet Invert Elevation (ft.) :** 552.80 **Tailwater Elevation (ft.) :** 553.77 **Overflow Elevation (ft.) :** 559.15

Allowable Headwater Elevation (ft.) : 558.15 or Diameter + 2 ft. *(whichever is less)*

Pipe Length (ft.) : 92.00 **Culvert Slope (ft./ft.) :** 0.0100 **Design Manning 'n' :** 0.0120

Design Discharge (cfs) : 37.10 @ 25 yrs. **Flood Discharge (cfs) :** 45.50 @ 100 yrs.

FLOW #	PIPE #	CULVERT SIZE	HWI (ft.)	HWO (ft.)	FLOW TYPE	VELOCITY (fps.)	DN (ft.)	DC (ft.)	MANNING N	HEADWATER CONTROL	OVER FLOW (cfs.)	DESIGN CODE	BURIAL DEPTH (ft.)	
CULVERT TYPE : CIRCULAR SMOOTH														
→	37.10	1	30 in.	557.24	556.78	2 - E	10.13	1.75	2.06	0.0120	INLET	0.00	D	0.00
	37.10	1	27 in.	557.98	557.69	2 - E	9.33	2.25	2.05	0.0120	INLET	0.00	D - 1	0.00
	35.80	1	24 in.	559.40	559.46	2 - F	11.53	2.00	1.93	0.0120	OUTLET**	1.30	D - 2	0.00
	37.10	1	33 in.	556.86	N/A	1 - C	10.26	1.61	2.03	0.0120	INLET	0.00	D + 1	0.00
→	45.50	1	30 in.	558.12	557.73	2 - E	10.30	2.11	2.23	0.0120	INLET	0.00	F	0.00
	44.40	1	27 in.	559.33	559.12	2 - E	11.17	2.25	2.14	0.0120	INLET	1.10	F - 1	0.00
	35.80	1	24 in.	561.49	561.85	2 - F	11.53	2.00	1.93	0.0120	OUTLET**	9.70	F - 2	0.00
	45.50	1	33 in.	557.46	556.96	2 - E	10.70	1.85	2.23	0.0120	INLET	0.00	F + 1	0.00
CULVERT TYPE : CIRCULAR CORRUGATED														
Corrugated Metal Pipe (2 2/3 x 1/2 in. corrugations)														
→	37.10	1	33 in.	557.36	557.89	2 - F	7.90	2.75	2.03	0.0241	OUTLET**	0.00	D	0.00



UNIVERSAL CULVERT DESIGN



FLOW (cfs.)	PIPE #	CULVERT SIZE	HWI (ft.)	HWO (ft.)	FLOW TYPE	VELOCITY (fps.)	DN (ft.)	DC (ft.)	MANNING N	HEADWATER CONTROL	OVER FLOW (cfs.)	DESIGN CODE	BURIAL DEPTH (ft.)
36.00	1	30 in.	558.14	559.40	2 - F	8.42	2.50	2.03	0.0244	OUTLET**	1.10	D - 1	0.00
28.50	1	27 in.	559.47	562.18	2 - F	8.12	2.25	1.86	0.0245	OUTLET**	8.60	D - 2	0.00
37.10	1	36 in.	556.93	557.23	1 - A	7.49	2.55	1.98	0.0241	OUTLET*	0.00	D + 1	0.00
44.40	1	33 in.	558.37	559.35	2 - F	8.68	2.75	2.21	0.0241	OUTLET**	1.10	F	0.00
36.00	1	30 in.	559.59	561.67	2 - F	8.42	2.50	2.03	0.0244	OUTLET**	9.50	F - 1	0.00
28.50	1	27 in.	561.45	565.88	2 - F	8.12	2.25	1.86	0.0245	OUTLET**	17.00	F - 2	0.00
45.50	1	36 in.	557.63	558.08	2 - F	8.20	3.00	2.20	0.0241	OUTLET**	0.00	F + 1	0.00
Corrugated Metal Pipe (3 x 1 in. corrugations)													
37.10	1	36 in.	556.93	557.33	2 - F	7.49	3.00	1.98	0.0281	OUTLET*	0.00	D	0.00
37.10	1	42 in.	556.55	556.91	1 - A	7.00	2.34	1.89	0.0278	OUTLET*	0.00	D + 1	0.00
45.50	1	36 in.	557.63	558.61	2 - F	8.20	3.00	2.20	0.0281	OUTLET**	0.00	F	0.00
45.50	1	42 in.	556.96	557.36	1 - A	7.53	2.77	2.10	0.0278	OUTLET*	0.00	F + 1	0.00
Corrugated Metal Pipe (6 x 2 in. corrugations)													
37.10	1	60 in.	556.14	556.46	1 - A	6.32	2.09	1.70	0.0332	OUTLET*	0.00	D	0.00
37.10	1	66 in.	556.04	556.36	1 - A	6.19	1.99	1.65	0.0330	OUTLET*	0.00	D + 1	0.00
45.50	1	60 in.	556.44	556.79	1 - A	6.71	2.34	1.89	0.0332	OUTLET*	0.00	F	0.00
45.50	1	66 in.	556.33	556.68	1 - A	6.56	2.22	1.83	0.0330	OUTLET*	0.00	F + 1	0.00
Corrugated Metal Pipe (6 x 2 in. corrugations, Field Paved Invert)													
37.10	1	60 in.	556.14	556.50	1 - A	6.32	1.83	1.70	0.0260	OUTLET*	0.00	D	0.00
37.10	1	66 in.	556.04	556.43	1 - A	6.19	1.76	1.65	0.0260	OUTLET*	0.00	D + 1	0.00
45.50	1	60 in.	556.44	556.83	1 - A	6.71	2.04	1.89	0.0260	OUTLET*	0.00	F	0.00
45.50	1	66 in.	556.33	556.74	1 - A	6.56	1.96	1.83	0.0260	OUTLET*	0.00	F + 1	0.00

Culvert Material Selection as per ODOI

updated 04/17/2005

Input Variables for Round Conduit

pH ranges from 3 to 9.5 pH=	6.5	Required for all durability
Enter "a" for abrasive or "n" for non-abrasive Site Conditions=	N	
50 or 75 years Service Life=	50	
Pipe Slope (%)=	1.00	Required for Concrete durability
Pipe Diameter (in)=	33	
Maximum Height of Fill=	4.0	Required for Structural Design

Instructions for Use:

This spreadsheet will determine the available material options based upon ODOI durability tables and ODOI structural variables for round conduit.

No all available options will apply to each situation and it is the user's responsibility to verify each alternative is valid.

Notes:

*** Concrete field paving shall be epoxy coated per 706.03 for pH <5.0

** Externally coated per AASHTO M243

Metal Pipe Description	Material	Req. Gauge per Durability	Thickness per Durability (Inches)	Req. Gauge per Structural	Thickness per Structural (Inches)
Galvanized	707.01	10	0.138	16	0.064
Aluminized	707.01	16	0.064	16	0.064
Galvanized	707.02	10	0.138	N/A	N/A
Aluminized	707.02	16	0.064	N/A	N/A
Galvanized - W/CFP	707.02 W/CFP	16	0.064	N/A	N/A
Structural Plate	707.03	12	0.109	N/A	N/A
Structural Plate W/CFP	707.03 W/CFP	n/a	n/a	N/A	N/A
Polymer Coated	707.04 (0.5" corr.)	16	0.064	16	0.064
Polymer Coated	707.04 (1" corr.)	16	0.064	N/A	N/A
Polymer Coated- Asphalt Coated and Paved	707.04 (0.5" corr.)	n/a	n/a	16	0.064
Polymer Coated- Asphalt Coated and Paved	707.04 (1" corr.)	n/a	n/a	N/A	N/A
Aluminized- Asphalt Coated and Paved	707.05 ≤ 48"	n/a	n/a	16	0.064
Aluminized- Asphalt Coated and Paved	707.05 > 54"	n/a	n/a	16	0.064
Galvanized-Asphalt Coated and Paved	707.05 ≤ 48"	16	0.064	16	0.064
Galvanized-Asphalt Coated and Paved	707.05 > 54"	12	0.109	16	0.064
Aluminized- Asphalt Coated and Paved	707.07 ≤ 48"	n/a	n/a	16	0.064
Aluminized- Asphalt Coated and Paved	707.07 > 54"	n/a	n/a	16	0.064
Galvanized-Asphalt Coated and Paved	707.07 ≤ 48"	16	0.064	N/A	N/A
Galvanized-Asphalt Coated and Paved	707.07 > 54"	12	0.109	N/A	N/A
Aluminum Pipe	707.21 (0.5" corr.)	min	use min		0.075
Aluminum Pipe	707.22 (1.0" corr.)	min	use min		N/A
Structural Plate Aluminum Pipe	707.23	min	use min		N/A

Concrete Pipe Material Options as per Durability Requirements		Epoxy Coated Required?	
Concrete Pipe Description	Material	Min pH	No.
Concrete Conduit	706.02	3-2	No.
D-Load Test Required for Concrete Pipe			
Concrete Pipe Description	Material	D-Load Required	Is Minimum D-Load Allowable?
Concrete Conduit	706.02	≥ 1000	Yes



SR 140 STA 150

AREA 95

28.1 AC

= 0.044 Sq. mi.

PATH OF WATER

PROPOSED CULVERT

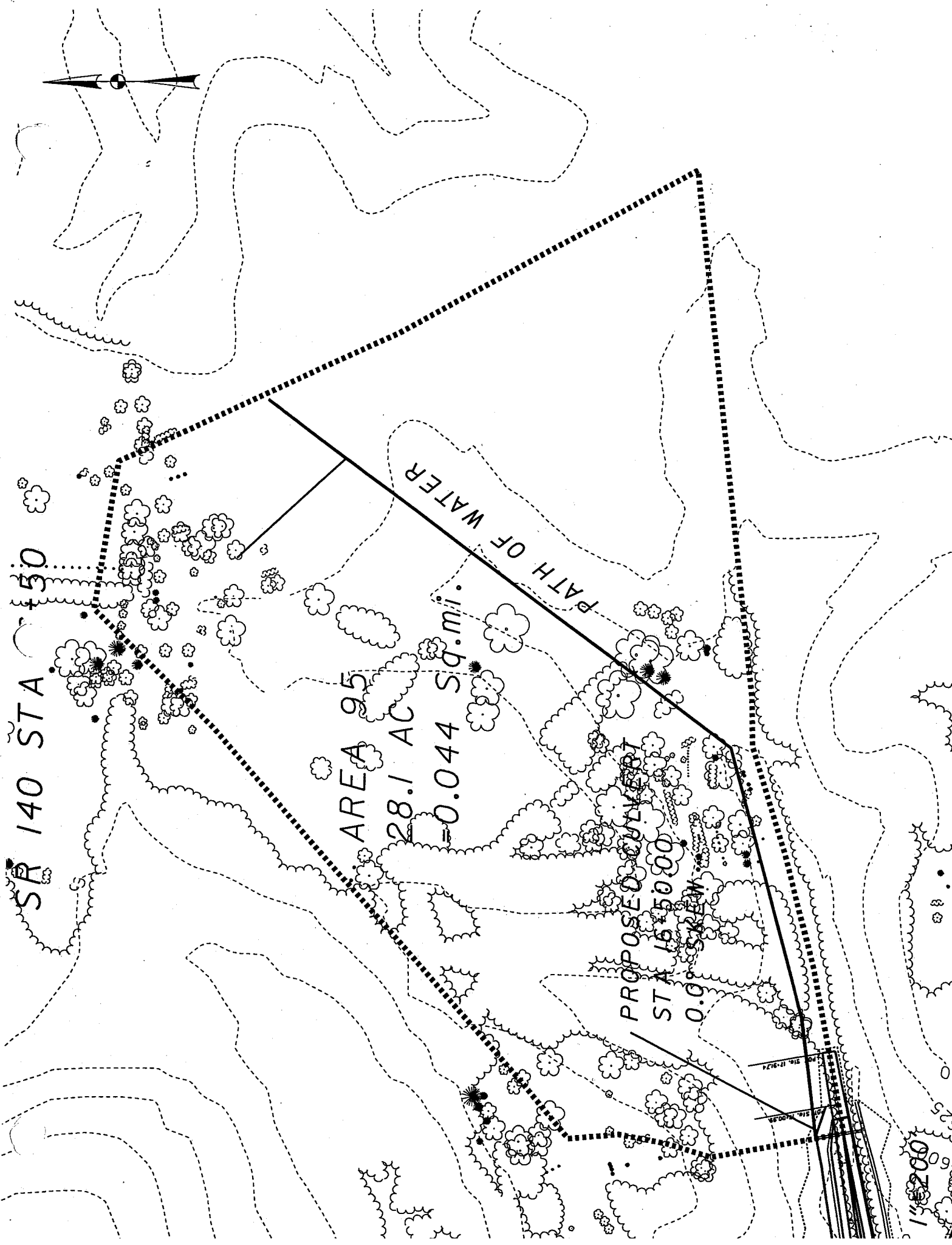
STA 16+50.00

0.0 SKEM

746.41 12+92.4

746.00 12+00.00

1452.00



SR 140 STA 16+50
TECHNIQUES FOR ESTIMATING FLOOD-PEAK
DISCHARGES OF RURAL, UNREGULATED STREAMS IN OHIO AREA A
 U.S. GEOLOGICAL SURVEY Water Resources Investigations Report 89-4126

	Values	Units	Definitions
	1225120.00	SQ. FT.	
	0.044	SQ. MI.	CONTDA = Contributing Drainage Area
	0.00	SQ. FT.	
	0.00	%	STORAGE = Storage Area
	1681.00	FT.	TOTAL CHANNEL LENGTH
	168.10	FT.	L₁₀ = 10% of the Distance along channel
	573	FT.	Elev₁₀ = Elevation at point L₁₀
	1428.85	FT.	L₈₅ = 85% of the Distance along channel
	652	FT.	Elev₈₅ = Elevation at point L₈₅
	1260.75	FT.	Length = L₈₅ - L₁₀
	330.85	FT./MI.	SLOPE = (Elev ₁₀ -Elev ₈₅)/Length
		CFS	Q_# = Flood-Peak Discharge # = Frequency of Storm
Q₂	13.22	CFS	= 56.1(CONTDA) ^{0.782} (SLOPE) ^{0.172} (STORAGE+1) ^{-0.297}
Q₅	27.55	CFS	= 84.5(CONTDA) ^{0.769} (SLOPE) ^{0.221} (STORAGE+1) ^{-0.322}
Q₁₀	39.36	CFS	= 104(CONTDA) ^{0.764} (SLOPE) ^{0.244} (STORAGE+1) ^{-0.335}
Q₂₅	55.51	CFS	= 129(CONTDA) ^{0.760} (SLOPE) ^{0.264} (STORAGE+1) ^{-0.347}
Q₅₀	68.92	CFS	= 148(CONTDA) ^{0.757} (SLOPE) ^{0.276} (STORAGE+1) ^{-0.355}
Q₁₀₀	82.20	CFS	= 167(CONTDA) ^{0.756} (SLOPE) ^{0.285} (STORAGE+1) ^{-0.363}

Revise with
Rational Equation

Worksheet for SR 140 STA 16+50

Project Description

Friction Method Manning Formula
Solve For Normal Depth

Input Data

Roughness Coefficient	0.040	
Channel Slope	0.04800	ft/ft
Left Side Slope	2.00	ft/ft (H:V)
Right Side Slope	2.00	ft/ft (H:V)
Bottom Width	10.00	ft
Discharge	55.50	ft ³ /s

Results

Normal Depth	0.78	ft
Flow Area	8.95	ft ²
Wetted Perimeter	13.47	ft
Top Width	13.10	ft
Critical Depth	0.92	ft
Critical Slope	0.02620	ft/ft
Velocity	6.20	ft/s
Velocity Head	0.60	ft
Specific Energy	1.37	ft
Froude Number	1.32	
Flow Type	Supercritical	

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	0.78	ft
Critical Depth	0.92	ft
Channel Slope	0.04800	ft/ft
Critical Slope	0.02620	ft/ft



UNIVERSAL CULVERT DESIGN

PID : 77366 **Date :** 05/13/2007 **Project :** SR 823 Portsmouth Bypass **Location :** Portsmouth Ohio **Designer :** mdc

Description : Drainage area 91A, SR 140 Sta. 16+50

HEADWATER CONTROL CODES: INLET - Inlet Control.
 OUTLET - Outlet Control.
 OUTLET* - Outlet Control with backwater curve used to compute headwater. See Figure III - 7E in HDS 5 for type flow.
 OUTLET** - Outlet Control - See Figure III - 7D in HDS 5 for type flow.
 N/A - Flow is supercritical with low headwater and low tailwater. Control Section is at the inlet.

Inlet Invert Elevation (ft.) : 566.94 **Outlet Invert Elevation (ft.) :** 566.16 **Tailwater Elevation (ft.) :** 566.94 **Overflow Elevation (ft.) :** 573.15
Allowable Headwater Elevation (ft.) : 572.15 or Diameter + 2 ft. *(whichever is less)*
Pipe Length (ft.) : 78.00 **Culvert Slope (ft./ft.) :** 0.0100 **Design Manning 'n' :** 0.0120
Design Discharge (cfs) : 55.50 @ 25 yrs. **Flood Discharge (cfs) :** 82.20 @ 100 yrs.

FLOW #	PIPE #	CULVERT SIZE	HWI (ft.)	HWO (ft.)	FLOW TYPE	VELOCITY (fps.)	DN (ft.)	DC (ft.)	MANNING N	HEADWATER CONTROL	OVERFLOW (cfs.)	DESIGN CODE	BURIAL DEPTH (ft.)
CULVERT TYPE : CIRCULAR SMOOTH													
Entrance Type : Half Headwall													
55.50	1	33 in.	571.56	571.10	2 - E	10.99	2.18	2.42	0.0120	INLET	0.00	D	0.00
55.50	1	30 in.	572.63	572.18	2 - E	11.31	2.50	2.36	0.0120	INLET	0.00	D - 1	0.00
48.80	1	27 in.	574.45	574.14	2 - E	12.27	2.25	2.17	0.0120	INLET	6.70	D - 2	0.00
55.50	1	36 in.	570.95	570.47	2 - E	11.27	1.97	2.42	0.0120	INLET	0.00	D + 1	0.00
70.00	1	33 in.	574.74	574.03	2 - E	11.79	2.75	2.59	0.0120	INLET	12.20	F	0.00
59.00	1	30 in.	577.21	576.52	2 - E	12.02	2.50	2.39	0.0120	INLET	23.20	F - 1	0.00
48.80	1	27 in.	583.11	581.02	2 - E	12.27	2.25	2.17	0.0120	INLET	33.40	F - 2	0.00
81.60	1	36 in.	573.21	572.58	2 - E	11.54	3.00	2.78	0.0120	INLET	0.60	F + 1	0.00
CULVERT TYPE : CIRCULAR CORRUGATED													
Entrance Type : Half Headwall													
Entrance Loss (Ke) : 0.20													
Entrance Loss (Ke) : 0.90													
Corrugated Metal Pipe (2 2/3 x 1/2 in. corrugations)													
55.50	1	42 in.	570.74	571.07	1 - A	8.15	2.89	2.33	0.0237	OUTLET*	0.00	D	0.00

USE 42" CONC. PIPE



UNIVERSAL CULVERT DESIGN

FLOW (cfs.)	PIPE #	CULVERT SIZE	HWI (ft.)	HWO (ft.)	FLOW TYPE	VELOCITY (fps.)	DN (ft.)	DC (ft.)	MANNING N	HEADWATER CONTROL	OVER FLOW (cfs.)	DESIGN CODE	BURIAL DEPTH (ft.)
55.50	1	36 in.	571.89	572.53	2 - F	9.10	3.00	2.42	0.0241	OUTLET**	0.00	D - 1	0.00
49.80	1	33 in.	573.04	574.26	2 - F	9.30	2.75	2.32	0.0241	OUTLET**	5.70	D - 2	0.00
55.50	1	48 in.	570.32	570.77	1 - A	7.66	2.46	2.24	0.0235	OUTLET*	0.00	D + 1	0.00
81.70	1	42 in.	572.77	573.20	2 - F	9.83	3.50	2.82	0.0237	OUTLET**	0.50	F	0.00
59.70	1	36 in.	575.50	577.09	2 - F	9.50	3.00	2.50	0.0241	OUTLET**	22.50	F - 1	0.00
49.80	1	33 in.	577.74	580.96	2 - F	9.30	2.75	2.32	0.0241	OUTLET**	32.40	F - 2	0.00
82.20	1	48 in.	571.53	571.85	2 - F	8.93	3.42	2.75	0.0235	OUTLET*	0.00	F + 1	0.00
Corrugated Metal Pipe (3 x 1 in. corrugations)													
55.50	1	42 in.	570.74	571.14	1 - A	8.15	3.20	2.33	0.0278	OUTLET*	0.00	D	0.00
55.20	1	36 in.	571.89	573.20	2 - F	9.07	3.00	2.41	0.0281	OUTLET**	0.30	D - 1	0.00
55.50	1	48 in.	570.32	570.75	1 - A	7.66	2.75	2.24	0.0275	OUTLET*	0.00	D + 1	0.00
76.00	1	42 in.	572.77	573.85	2 - F	9.44	3.50	2.73	0.0278	OUTLET**	6.20	F	0.00
55.20	1	36 in.	575.50	578.55	2 - F	9.07	3.00	2.41	0.0281	OUTLET**	27.00	F - 1	0.00
82.20	1	48 in.	571.53	571.91	2 - F	8.93	4.00	2.75	0.0275	OUTLET*	0.00	F + 1	0.00
Corrugated Metal Pipe (6 x 2 in. corrugations)													
55.50	1	60 in.	569.99	570.39	1 - A	7.13	2.63	2.09	0.0332	OUTLET*	0.00	D	0.00
55.50	1	66 in.	569.87	570.24	1 - A	6.96	2.48	2.03	0.0330	OUTLET*	0.00	D + 1	0.00
82.20	1	60 in.	570.75	571.27	1 - A	8.09	3.40	2.57	0.0332	OUTLET*	0.00	F	0.00
82.20	1	66 in.	570.59	571.08	1 - A	7.85	3.14	2.49	0.0330	OUTLET*	0.00	F + 1	0.00
Corrugated Metal Pipe (6 x 2 in. corrugations, Field Paved Invert)													
55.50	1	60 in.	569.99	570.41	1 - A	7.13	2.28	2.09	0.0260	OUTLET*	0.00	D	0.00
55.50	1	66 in.	569.87	570.29	1 - A	6.96	2.18	2.03	0.0260	OUTLET*	0.00	D + 1	0.00
82.20	1	60 in.	570.75	571.26	1 - A	8.09	2.88	2.57	0.0260	OUTLET*	0.00	F	0.00
82.20	1	66 in.	570.59	571.10	1 - A	7.85	2.72	2.49	0.0260	OUTLET*	0.00	F + 1	0.00



CULVERT ANALYSIS

PID : 77366 **Date :** 09/18/2007 **Project :** SR823 Portsmouth Bypass **Location :** Portsmouth, Ohio **Designer :** rn

Description : Drainage Area 91A, SR140 Sta. 16+50

HEADWATER CONTROL CODES:

- INLET - Inlet Control.
- OUTLET - Outlet Control.
- OUTLET* - Outlet Control with backwater curve used to compute headwater. See Figure III - 7E in HDS 5 for type flow.
- OUTLET** - Outlet Control - See Figure III - 7D in HDS 5 for type flow.
- N/A - Flow is supercritical with low headwater and low tailwater. Control Section is at the inlet.

Pipe Number : 1 **Use HW :** 0 **Inlet Invert Elevation (ft.) :** 566.94 **Outlet Invert Elevation (ft.) :** 566.16

Pipe Quantity : 1 **Pipe Length (ft.) :** 78.00 **Culvert Slope (ft./ft.) :** 0.0100

Culvert Type : Circular Smooth

Corrugation Type : Pipe Size : 42 in.

Design Manning 'n' : (default)

Entrance Type : Half Headwall **Loss Coef. Ke :** 0.2000

FLOW LOSS (cfs.)	HEAD (ft.)	HWI (ft.)	HWO (ft.)	FLOW TYPE	VELOCITY (fps.)	DN (ft.)	DC (ft.)	MANNING N	HEADWATER CONTROL	BURIED DEPTH (ft.)	TAILWATER ELEVATION (ft.)
55.50	1.33	570.40	N/A	1 - C	11.37	1.77	2.33	0.0120	INLET	0.00	566.94
82.20	2.32	571.65	571.13	2 - E	12.45	2.27	2.83	0.0120	INLET	0.00	566.94

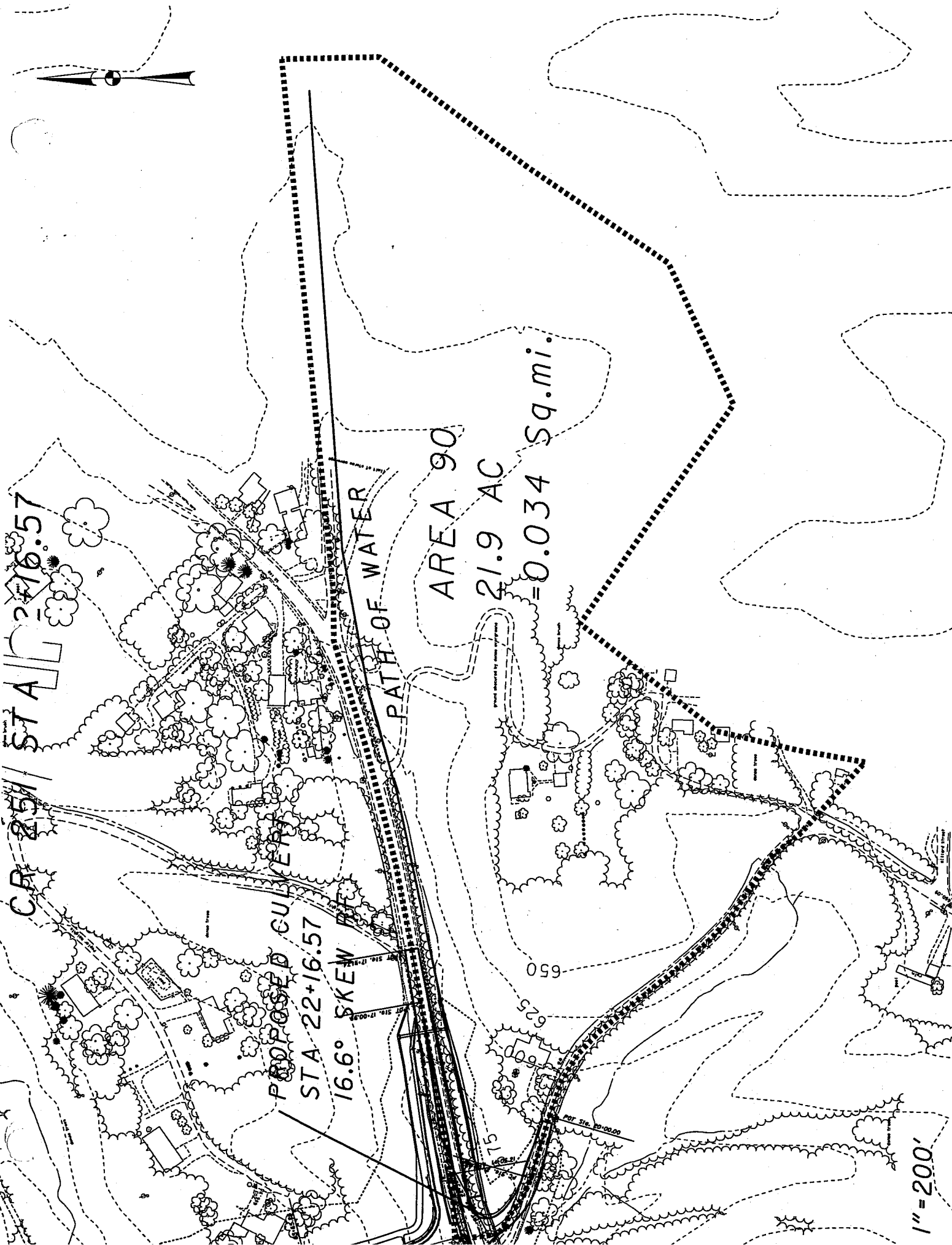
CR 2511 STA 2+16.57

PROPOSED CULVERT
STA 22+16.57
16.6° SKEW

PATH OF WATER

AREA 90
21.9 AC
= 0.034 Sq. mi.

1" = 200'



CR 251 STA 22+19.21

TECHNIQUES FOR ESTIMATING FLOOD-PEAK
DISCHARGES OF RURAL, UNREGULATED STREAMS IN OHIO AREA A
U.S. GEOLOGICAL SURVEY Water Resources Investigations Report 89-4126

	Values	Units	Definitions
	956129.00	SQ. FT.	
	0.034	SQ. MI.	CONTDA = Contributing Drainage Area
	0.00	SQ. FT.	
	0.00	%	STORAGE = Storage Area
	1943.00	FT.	TOTAL CHANNEL LENGTH
	194.30	FT.	L ₁₀ = 10% of the Distance along channel
	561	FT.	Elev ₁₀ = Elevation at point L ₁₀
	1651.55	FT.	L ₈₅ = 85% of the Distance along channel
	638	FT.	Elev ₈₅ = Elevation at point L ₈₅
	1457.25	FT.	Length = L ₈₅ - L ₁₀
	278.99	FT./MI.	SLOPE = (Elev ₁₀ -Elev ₈₅)/Length
		CFS	Q _# = Flood-Peak Discharge
			# = Frequency of Storm
Q ₂	10.57	CFS	= 56.1(CONTDA) ^{0.782} (SLOPE) ^{0.172} (STORAGE+1) ^{-0.297}
Q ₅	21.92	CFS	= 84.5(CONTDA) ^{0.769} (SLOPE) ^{0.221} (STORAGE+1) ^{-0.322}
Q ₁₀	31.24	CFS	= 104(CONTDA) ^{0.764} (SLOPE) ^{0.244} (STORAGE+1) ^{-0.335}
Q ₂₅	43.96	CFS	= 129(CONTDA) ^{0.760} (SLOPE) ^{0.264} (STORAGE+1) ^{-0.347}
Q ₅₀	54.50	CFS	= 148(CONTDA) ^{0.757} (SLOPE) ^{0.276} (STORAGE+1) ^{-0.355}
Q ₁₀₀	64.92	CFS	= 167(CONTDA) ^{0.756} (SLOPE) ^{0.285} (STORAGE+1) ^{-0.363}

*Revise
with Rational
Equation*



UNIVERSAL CULVERT DESIGN

PID : 77366 **Date :** 05/21/2007 **Project :** SR 823 Portsmouth Bypass **Location :** Portsmouth Ohio **Designer :** mdc

Description : Drainage area 90, CR 251 Sta. 22+16.57

HEADWATER CONTROL CODES: INLET - Inlet Control.
 OUTLET - Outlet Control.
 OUTLET* - Outlet Control with backwater curve used to compute headwater. See Figure III - 7E in HDS 5 for type flow.
 OUTLET** - Outlet Control - See Figure III - 7D in HDS 5 for type flow.
 N/A - Flow is supercritical with low headwater and low tailwater. Control Section is at the inlet.

Inlet Invert Elevation (ft.) : 555.24 ✓ **Outlet Invert Elevation (ft.) :** 553.50 ✓ **Tailwater Elevation (ft.) :** 556.02 **Overflow Elevation (ft.) :** 562.85 ✓
Allowable Headwater Elevation (ft.) : 561.85 or Diameter + 2 ft. *(whichever is less)*
Pipe Length (ft.) : 100.00 ✓ **Culvert Slope (ft./ft.) :** 0.0174 **Design Manning 'n' :** 0.0120
Design Discharge (cfs) : 44.00 ✓ @ 25 yrs. **Flood Discharge (cfs) :** 64.90 @ 100 yrs. ✓

FLOW #	PIPE #	CULVERT SIZE	HWI (ft.)	HWO (ft.)	FLOW TYPE	VELOCITY (fps.)	DN (ft.)	DC (ft.)	MANNING N	HEADWATER CONTROL	OVERFLOW (cfs.)	DESIGN CODE	BURIAL DEPTH (ft.)
CULVERT TYPE : CIRCULAR SMOOTH													
Entrance Type : Half Headwall													
44.00	1	30 in.	559.47	558.49	2 - H	13.10	1.62	2.21	0.0120	INLET	0.00	D	0.00
44.00	1	27 in.	560.59	560.01	2 - H	12.69	1.83	2.14	0.0120	INLET	0.00	D - 1	0.00
43.90	1	24 in.	562.60	562.88	2 - G	13.97	2.00	1.97	0.0120	OUTLET	0.10	D - 2	0.00
44.00	1	33 in.	558.86	557.63	2 - E	13.20	1.51	2.20	0.0120	INLET	0.00	D + 1	0.00
64.90	1	30 in.	562.35	561.40	2 - H	13.22	2.50	2.42	0.0120	INLET	0.00	F	0.00
55.90	1	27 in.	564.92	564.71	2 - H	14.06	2.25	2.20	0.0120	INLET	9.00	F - 1	0.00
43.90	1	24 in.	572.42	570.95	2 - G	13.97	2.00	1.97	0.0120	OUTLET	21.00	F - 2	0.00
64.90	1	33 in.	560.85	559.65	2 - E	14.30	1.96	2.55	0.0120	INLET	0.00	F + 1	0.00
CULVERT TYPE : CIRCULAR CORRUGATED													
Entrance Type : Half Headwall													
Entrance Loss (Ke) : 0.20													
Entrance Loss (Ke) : 0.90													
Corrugated Metal Pipe (2 2/3 x 1/2 in. corrugations)													
44.00	1	36 in.	559.02	559.25	2 - F	6.94	2.28	2.16	0.0241	OUTLET*	0.00	D	0.00



UNIVERSAL CULVERT DESIGN

FLOW (cfs.)	PIPE #	CULVERT SIZE	HWI (ft.)	HWO (ft.)	FLOW TYPE	VELOCITY (fps.)	DN (ft.)	DC (ft.)	MANNING N	HEADWATER CONTROL	OVER FLOW (cfs.)	DESIGN CODE	BURIAL DEPTH (ft.)
44.00	1	33 in.	559.69	560.00	2 - F	7.72	2.75	2.20	0.0241	OUTLET	0.00	D - 1	0.00
44.00	1	30 in.	560.83	562.42	2 - G	8.96	2.50	2.21	0.0244	OUTLET	0.00	D - 2	0.00
44.00	1	42 in.	558.41	N/A	1 - C	7.92	1.96	2.07	0.0237	INLET	0.00	D + 1	0.00
64.90	1	36 in.	561.34	562.01	2 - F	10.02	3.00	2.58	0.0241	OUTLET**	0.00	F	0.00
57.20	1	33 in.	562.88	564.82	2 - F	10.03	2.75	2.45	0.0241	OUTLET**	7.70	F - 1	0.00
45.40	1	30 in.	565.08	569.95	2 - G	9.25	2.50	2.23	0.0244	OUTLET	19.50	F - 2	0.00
64.90	1	42 in.	559.66	559.97	2 - F	8.73	2.58	2.53	0.0237	OUTLET*	0.00	F + 1	0.00
Corrugated Metal Pipe (3 x 1 in. corrugations)													
44.00	1	36 in.	559.02	559.21	2 - F	6.94	3.00	2.16	0.0281	OUTLET*	0.00	D	0.00
44.00	1	42 in.	558.41	558.87	1 - B	5.93	2.18	2.07	0.0278	OUTLET*	0.00	D + 1	0.00
63.30	1	36 in.	561.34	563.18	2 - F	9.86	3.00	2.56	0.0281	OUTLET**	1.60	F	0.00
64.90	1	42 in.	559.66	559.85	2 - F	8.73	3.04	2.53	0.0278	OUTLET*	0.00	F + 1	0.00
Corrugated Metal Pipe (6 x 2 in. corrugations)													
44.00	1	60 in.	557.91	558.32	1 - B	4.44	1.97	1.85	0.0332	OUTLET*	0.00	D	0.00
44.00	1	66 in.	557.80	558.23	1 - B	4.14	1.88	1.80	0.0330	OUTLET*	0.00	D + 1	0.00
64.90	1	60 in.	558.57	559.05	1 - B	6.54	2.45	2.27	0.0332	OUTLET*	0.00	F	0.00
64.90	1	66 in.	558.44	558.94	1 - B	6.11	2.32	2.21	0.0330	OUTLET*	0.00	F + 1	0.00
Corrugated Metal Pipe (6 x 2 in. corrugations, Field Paved Invert)													
44.00	1	60 in.	557.91	N/A	1 - C	7.32	1.73	1.85	0.0260	INLET	0.00	D	0.00
44.00	1	66 in.	557.80	N/A	1 - C	7.27	1.66	1.80	0.0260	INLET	0.00	D + 1	0.00
64.90	1	60 in.	558.57	N/A	1 - C	8.13	2.13	2.27	0.0260	INLET	0.00	F	0.00
64.90	1	66 in.	558.44	N/A	1 - C	8.10	2.04	2.21	0.0260	INLET	0.00	F + 1	0.00

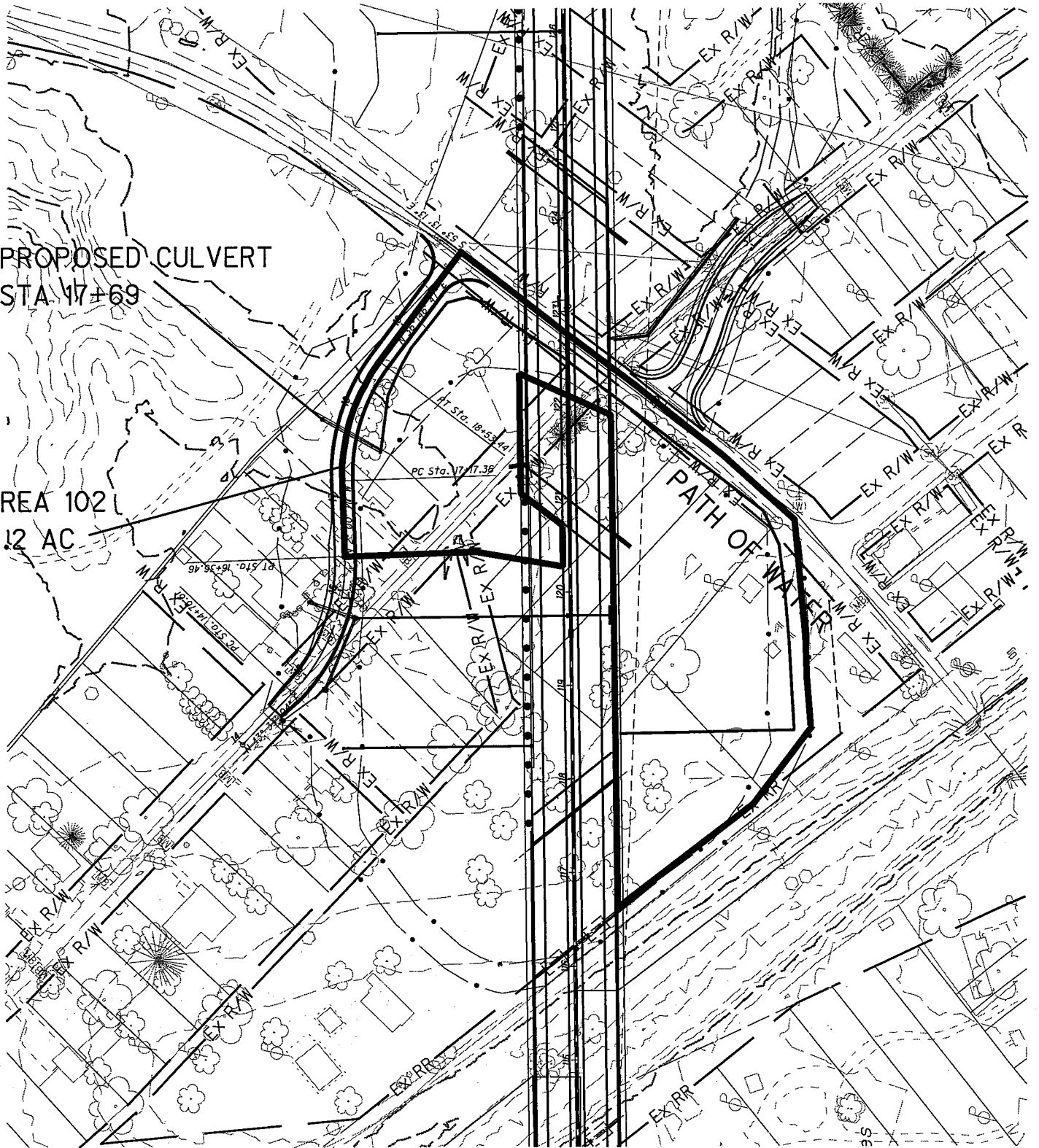
USE 36"

PERSHING AVENUE SOUTH STA. 17+69



PROPOSED CULVERT
STA. 17+69

AREA 102 L
3.12 AC



Project: SCI-823-PH3
 Subject: Hydrology - ROW submission
 Task: Area 102
 Job #: 71143



Originated: RCS-11/16/12
 Checked:
 Changes Made:
 Corrections Verified:

Time of Concentration to Upstream Inlet

$$t_o \approx \frac{1.8(1.1-C)(L)^{(1/2)}}{(s)^{(1/3)}} \quad t_s \text{ or } t_d = \frac{L}{60V} \quad V = 3.281ks^{0.5}$$

Sheet Flow

Elev. UP (ft)	Elev. DN (ft)	Length (ft)	Slope (ft/ft)	To (min)
628.62	562	186	0.3582	5
				5

Shallow Concentrated Flow

Elev. UP (ft)	Elev. DN (ft)	Length (ft)	Slope (%)	k	V (ft/s)	Ts (min)
562	552.8	832	1.11	0.457	1.58	9
						9

Tc = To + Ts

Tc = **14** minutes

Drainage Area

	C	A	CA
Paved	0.9	1.0	0.90
Residential/Slope	0.4	2.2	0.88
Total		3.2	1.78

Rainfall Intensity

$$i = a / (Tc + b)^c$$

$i_2 = \frac{3.33}{(in/hr)}$
 $i_{25} = \frac{5.89}{(in/hr)}$
 $i_{50} = \frac{6.35}{(in/hr)}$
 $i_{100} = \frac{7.26}{(in/hr)}$

Q = CiA (cfs)	a	b	c	
Q ₂ = 6	2-Year	85.568	16.5	0.95
Q₂₅ = 10	10-Year	198.92	19.3	1.004
Q ₅₀ = 11	50-Year	206.025	19.6	0.99
Q₁₀₀ = 13	100-Year	355.551	23.199	1.076



UNIVERSAL CULVERT DESIGN

PID : 77366 **Date :** 11/29/2012 **Project :** SR 823 Portsmouth Bypass **Location :** Portsmouth Ohio **Designer :** KAG

Description : Drainage area 102, Sta. 17+70, Pershing Avenue South

HEADWATER CONTROL CODES: INLET - Inlet Control.
 OUTLET - Outlet Control.
 OUTLET* - Outlet Control with backwater curve used to compute headwater. See Figure III - 7E in HDS 5 for type flow.
 OUTLET** - Outlet Control - See Figure III - 7D in HDS 5 for type flow.
 N/A - Flow is supercritical with low headwater and low tailwater. Control Section is at the inlet.

Inlet Invert Elevation (ft.) : 545.57 **Outlet Invert Elevation (ft.) :** 543.11 **Tailwater Elevation (ft.) :** 543.11 **Overflow Elevation (ft.) :** 552.33

Allowable Headwater Elevation (ft.) : 550.33 or Diameter + 2 ft. *(whichever is less)*

Pipe Length (ft.) : 89.00 **Culvert Slope (ft./ft.) :** 0.0276 **Design Manning 'n' :** 0.0120

Design Discharge (cfs) : 10.00 @ 10 yrs. **Flood Discharge (cfs) :** 13.00 @ 25 yrs.

FLOW (cfs.)	PIPE #	CULVERT SIZE	HWI (ft.)	HWO (ft.)	FLOW TYPE	VELOCITY (fps.)	DN (ft.)	DC (ft.)	MANNING N	HEADWATER CONTROL	OVER FLOW (cfs.)	DESIGN CODE	BURIAL DEPTH (ft.)
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CULVERT TYPE : CIRCULAR SMOOTH													
Entrance Type : Half Headwall													
Entrance Loss (Ke) : 0.20													
10.00	1	15 in.	548.49	547.37	2 - E	10.66	0.89	1.18	0.0120	INLET	0.00	D	0.00
9.50	1	12 in.	551.44	553.07	2 - F	12.11	1.00	0.99	0.0120	OUTLET**	0.50	D - 1	0.00
10.00	1	18 in.	547.61	545.75	2 - E	10.85	0.78	1.22	0.0120	INLET	0.00	D + 1	0.00
13.00	1	15 in.	549.86	549.49	2 - E	10.59	1.25	1.22	0.0120	INLET	0.00	F	0.00
9.50	1	12 in.	559.53	N/A	2 - F	12.10	1.00	0.99	0.0120	OUTLET**	3.50	F - 1	0.00
13.00	1	18 in.	548.29	546.70	2 - E	11.54	0.91	1.35	0.0120	INLET	0.00	F + 1	0.00

CULVERT TYPE : CIRCULAR CORRUGATED													
Entrance Type : Half Headwall													
Entrance Loss (Ke) : 0.90													
Corrugated Metal Pipe (2 2/3 x 1/2 in. corrugations)													
10.00	1	18 in.	548.11	548.36	2 - F	6.50	1.50	1.22	0.0249	OUTLET**	0.00	D	0.00
9.00	1	15 in.	549.59	554.13	2 - F	7.60	1.25	1.16	0.0250	OUTLET**	1.00	D - 1	0.00
5.10	1	12 in.	556.60	574.88	2 - F	6.74	1.00	0.92	0.0251	OUTLET**	4.90	D - 2	0.00



UNIVERSAL CULVERT DESIGN

FLOW PIPE # (cfs.)	CULVERT SIZE	HWI (ft.)	HWO (ft.)	FLOW TYPE	VELOCITY (fps.)	DN (ft.)	DC (ft.)	MANNING N	HEADWATER CONTROL	OVER FLOW (cfs.)	DESIGN CODE	BURIAL DEPTH (ft.)	
10.00	1	21 in.	547.50	N/A	1-C	6.26	1.10	1.18	0.0248	INLET	0.00	D + 1	0.00
13.00	1	18 in.	549.21	551.11	2-F	7.75	1.50	1.35	0.0249	OUTLET**	0.00	F	0.00
9.00	1	15 in.	551.61	N/A	2-F	7.60	1.25	1.16	0.0250	OUTLET**	4.00	F - 1	0.00
5.10	1	12 in.	591.65	596.12	2-F	6.74	1.00	0.92	0.0251	OUTLET**	7.90	F - 2	0.00
13.00	1	21 in.	548.11	548.18	2-F	6.57	1.35	1.34	0.0248	OUTLET*	0.00	F + 1	0.00
Corrugated Metal Pipe (3 x 1 in. corrugations)													
10.00	1	36 in.	546.99	N/A	1-C	5.63	0.90	1.00	0.0281	INLET	0.00	D	0.00
10.00	1	42 in.	546.90	N/A	1-C	5.58	0.85	0.96	0.0278	INLET	0.00	D + 1	0.00
13.00	1	36 in.	547.23	N/A	1-C	6.06	1.03	1.15	0.0281	INLET	0.00	F	0.00
13.00	1	42 in.	547.12	N/A	1-C	6.03	0.96	1.09	0.0278	INLET	0.00	F + 1	0.00
Corrugated Metal Pipe (6 x 2 in. corrugations)													
10.00	1	60 in.	546.73	N/A	1-C	4.73	0.82	0.87	0.0332	INLET	0.00	D	0.00
10.00	1	66 in.	546.71	N/A	1-C	4.69	0.80	0.84	0.0330	INLET	0.00	D + 1	0.00
13.00	1	60 in.	546.90	N/A	1-C	5.11	0.94	0.99	0.0332	INLET	0.00	F	0.00
13.00	1	66 in.	546.86	N/A	1-C	5.07	0.91	0.96	0.0330	INLET	0.00	F + 1	0.00
Corrugated Metal Pipe (6 x 2 in. corrugations, Field Paved Invert)													
10.00	1	60 in.	546.73	N/A	1-C	5.61	0.73	0.87	0.0260	INLET	0.00	D	0.00
10.00	1	66 in.	546.71	N/A	1-C	5.54	0.71	0.84	0.0260	INLET	0.00	D + 1	0.00
13.00	1	60 in.	546.90	N/A	1-C	6.07	0.83	0.99	0.0260	INLET	0.00	F	0.00
13.00	1	66 in.	546.86	N/A	1-C	6.00	0.81	0.96	0.0260	INLET	0.00	F + 1	0.00

Culvert Material Selection as per ODOT

Updated 04/11/2005

Input Variables for Round Conduit

pH ranges from 3 to 9.5 pH=

Enter "a" for abrasive or "n" for non-abrasive Site Conditions=

50 or 75 years Service Life=

Pipe Slope (%)=

Pipe Diameter (in)=

Maximum Height of Fill=

6.5	Required for all durability
N	
50	
3.90	Required for Concrete Durability
21	
5.0	Required for Structural Design

Instructions for Use:

This spreadsheet will determine the available material options based upon ODOT Durability Tables and ODOT Structural Tables for round conduit.

Note: All available options will apply to each situation and it is the users' responsibility to verify each alternative is valid.

Notes:

*** Concrete field paving shall be epoxy coated per 706.03 for pH < 5.0

** Externally coated per AASHTO M243

Metal/Pipe Description	Material	Req. Gauge per Durability	Thickness per Durability (inches)	Req. Gauge per Structural	Thickness per Structural (inches)
Galvanized	707.01	10	0.138	16	0.064
Aluminized	707.01	16	0.064	16	0.064
Galvanized	707.02	10	0.138	N/A	N/A
Aluminized	707.02	16	0.064	N/A	N/A
Galvanized - W/CFRP	707.02 W/CFRP	16	0.064	N/A	N/A
Structural Plate	707.03	12	0.109	N/A	N/A
Structural Plate W/CFRP	707.03 W/CFRP	n/a	n/a	N/A	N/A
Polymer Coated	707.04 (0.5" corr.)	16	0.064	16	0.064
Polymer Coated	707.04 (1" corr.)	16	0.064	N/A	N/A
Polymer Coated- Asphalt Coated and Paved	707.04 (0.5" corr.)	n/a	n/a	16	0.064
Polymer Coated- Asphalt Coated and Paved	707.04 (1" corr.)	n/a	n/a	N/A	N/A
Aluminized- Asphalt Coated and Paved	707.05 ≤ 48"	n/a	n/a	16	0.064
Aluminized- Asphalt Coated and Paved	707.05 > 54"	n/a	n/a	16	0.064
Galvanized-Asphalt Coated and Paved	707.05 ≤ 48"	16	0.064	16	0.064
Galvanized-Asphalt Coated and Paved	707.05 > 54"	12	0.109	16	0.064
Aluminized- Asphalt Coated and Paved	707.07 ≤ 48"	n/a	n/a	16	0.064
Aluminized- Asphalt Coated and Paved	707.07 > 54"	n/a	n/a	16	0.064
Galvanized-Asphalt Coated and Paved	707.07 ≤ 48"	16	0.064	N/A	N/A
Galvanized-Asphalt Coated and Paved	707.07 > 54"	12	0.109	N/A	N/A
Aluminum Pipe	707.21 (0.5" corr.)	min	use min		0.06
Aluminum Pipe	707.22 (1.0" corr.)	min	use min		N/A
Structural Plate Aluminum Pipe	707.23	min	use min		N/A

Concrete Pipe Material Options as per Durability Requirements	Material	Min pH	Epoxy Coated Required?
Concrete Conduit	706.02	3.6	No

Concrete Pipe Description	D-Load Test Required for Concrete Pipe	Is Minimum D-Load Allowable?
Concrete Pipe Description	Material	D-Load Required
Concrete Conduit	706.02	1250
Concrete Conduit	706.02	Yes

DRIVEWAY AT PERSHING AVENUE SOUTH STA. 00+70

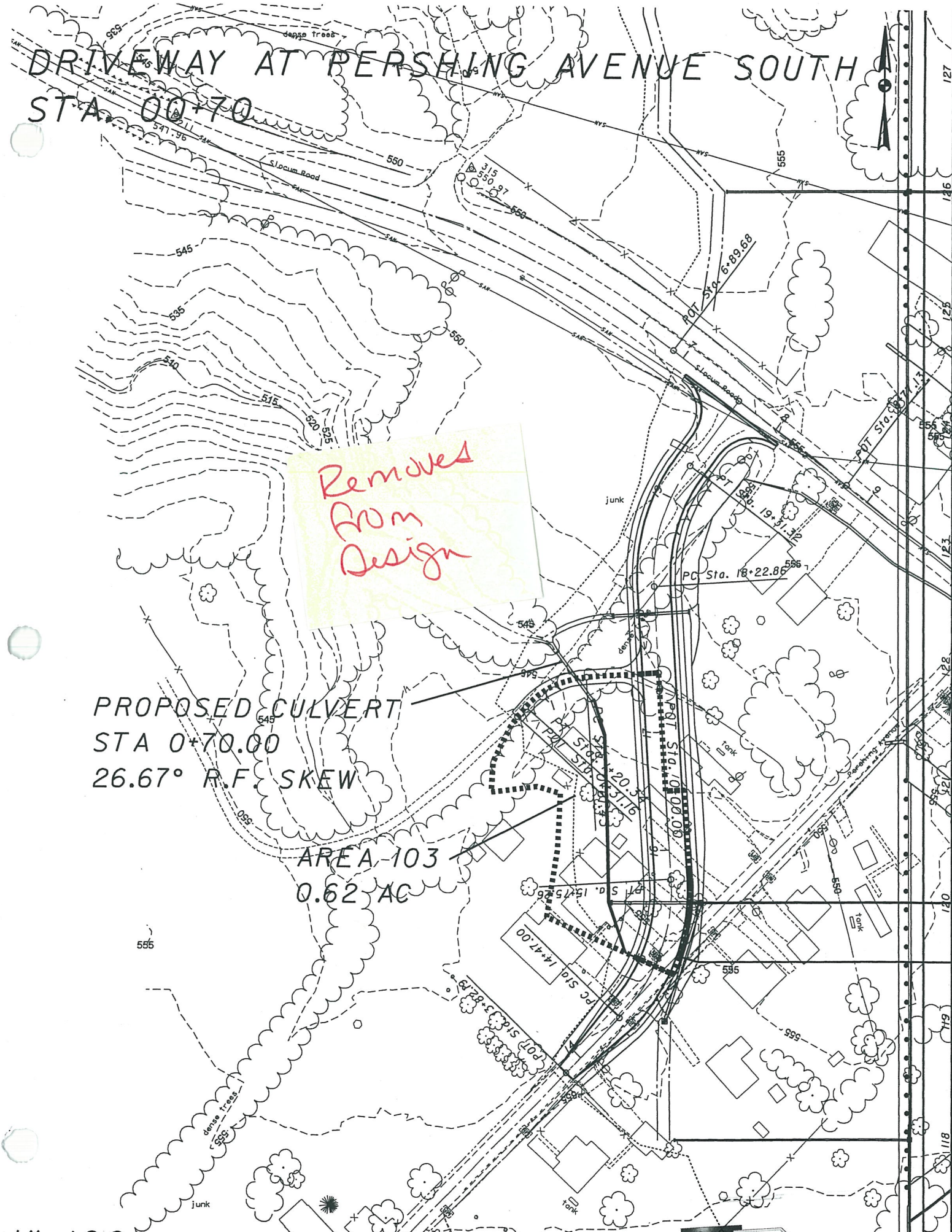
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From
Design

PROPOSED CULVERT
STA 0+70.00
26.67° R.F. SKEW

AREA 103
0.62 AC

1" = 100'

Customs



Client: ODOT Sheet: of



Subject: Pipe Culvert Calculations Order No:
 @ STA 0+75 DRIVEWAY AT PERSHING SOUTH
 Computed by: DL Date: 5/10/2007
 Checked by: Date:

Rational Method

Coefficient of Runoff (1101.2.3)

	Area (Sft)	Area (Ac)	C
Pavement Area	6907	0.16	0.9
Non-paved Area	20231	0.46	0.45
Other			
Total Area		0.62 acres	Weighted "C" = 0.56

Overland Flow

Length 0
 High Elevation 0
 Low Elevation 0
 Slope % #DIV/0!

t_b #DIV/0! (1101.2.2)
 t_o 0.00 Compare with Fig 1101-1
 Negligible

Shallow Concentrated Flow

Length 259
 High Elevation 554.97
 Low Elevation 543.5
 Slope % 4.428571
 k 0.457 (Grassed waterways - Table 1101-1)
 V 3.155399 (1101.2.2)
 t_s 1.368026 (1101.2.2)

Since the time of concentration = $t_o + t_s$ t_c 10.00 min

For Intensity Zone D

Frequency	a	b	c	Ac	t_c	C	I	Q cu ft/s
2 Years	85.568	16.5	0.95	0.623003	10.00	0.56	3.80	1.34
5 Years	118.822	18.7	0.969	0.62	10.00	0.56	4.59	1.62
10 Years	112.172	16.8	0.923	0.623003	10.00	0.56	5.39	1.90
25 Years	198.92	19.3	1.004	0.623003	10.00	0.56	6.70	2.36
50 Years	206.025	19.6	0.99	0.623003	10.00	0.56	7.20	2.53
100 Years	355.551	23.199	1.076	0.623003	10.00	0.56	8.21	2.89

Worksheet for DRIV PERSS STA 0+70

Project Description

Friction Method Manning Formula
Solve For Normal Depth

Input Data

Roughness Coefficient	0.040	
Channel Slope	0.25000	ft/ft
Left Side Slope	2.00	ft/ft (H:V)
Right Side Slope	2.00	ft/ft (H:V)
Bottom Width	2.00	ft
Discharge	1.90	ft ³ /s

Results

Normal Depth	0.16	ft
Flow Area	0.38	ft ²
Wetted Perimeter	2.73	ft
Top Width	2.65	ft
Critical Depth	0.28	ft
Critical Slope	0.04039	ft/ft
Velocity	4.99	ft/s
Velocity Head	0.39	ft
Specific Energy	0.55	ft
Froude Number	2.32	
Flow Type	Supercritical	

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	0.16	ft
Critical Depth	0.28	ft
Channel Slope	0.25000	ft/ft
Critical Slope	0.04039	ft/ft



UNIVERSAL CULVERT DESIGN

PID : 77366 **Date :** 05/10/2007 **Project :** SR 823 Portsmouth Bypass **Location :** Portsmouth Ohio **Designer :** DL

Description : Drainage area 103, Sta. 0+70, Driveway Pershing South.

HEADWATER CONTROL CODES: INLET - Inlet Control. OUTLET - Outlet Control.
 OUTLET* - Outlet Control with backwater curve used to compute headwater. See Figure III - 7E in HDS 5 for type flow.
 OUTLET** - Outlet Control - See Figure III - 7D in HDS 5 for type flow.
 N/A - Flow is supercritical with low headwater and low tailwater. Control Section is at the inlet.

Inlet Invert Elevation (ft.) : 543.46 ✓ **Outlet Invert Elevation (ft.) :** 540.86 ✓ **Tailwater Elevation (ft.) :** 541.00 ✓ **Overflow Elevation (ft.) :** 547.91
Allowable Headwater Elevation (ft.) : 546.91 ✓ or Diameter + 2 ft. *(whichever is less)* ✓
Pipe Length (ft.) : 52.00 **Culvert Slope (ft./ft.) :** 0.0500 **Design Manning 'n' :** 0.0120
Design Discharge (cfs) : 1.90 @ 10 yrs. **Flood Discharge (cfs) :** 2.36 @ 25 yrs.

FLOW PIPE # (cfs.)	PIPE #	CULVERT SIZE	HWI (ft.)	HWO (ft.)	FLOW TYPE	VELOCITY (fps.)	DN (ft.)	DC (ft.)	MANNING N	HEADWATER CONTROL	OVER FLOW (cfs.)	DESIGN CODE	BURIAL DEPTH (ft.)
1.90	1	12 in.	544.31	N/A	1 - C	8.79	0.32	0.59	0.0120	INLET	0.00	D	0.00
1.90	1	15 in.	544.24	N/A	1 - C	8.65	0.29	0.55	0.0120	INLET	0.00	D + 1	0.00
2.36	1	12 in.	544.43	N/A	1 - C	9.40	0.36	0.66	0.0120	INLET	0.00	F	0.00
2.36	1	15 in.	544.34	N/A	1 - C	9.20	0.33	0.61	0.0120	INLET	0.00	F + 1	0.00
Entrance Loss (Ke) : 0.20													
Entrance Type : Half Headwall													
Corrugated Metal Pipe (2 2/3 x 1/2 in. corrugations)													
1.90	1	12 in.	544.36	N/A	1 - C	5.16	0.48	0.59	0.0251	INLET	0.00	D	0.00
1.90	1	15 in.	544.26	N/A	1 - C	5.10	0.43	0.55	0.0250	INLET	0.00	D + 1	0.00
2.36	1	12 in.	544.52	N/A	1 - C	5.43	0.54	0.66	0.0251	INLET	0.00	F	0.00
2.36	1	15 in.	544.37	N/A	1 - C	5.41	0.48	0.61	0.0250	INLET	0.00	F + 1	0.00
Entrance Loss (Ke) : 0.90													
Entrance Type : Half Headwall													
Corrugated Metal Pipe (3 x 1 in. corrugations)													



age 2-A
Do Not Upsize use 15"



UNIVERSAL CULVERT DESIGN

FLOW (cfs.)	PIPE #	CULVERT SIZE	HWI (ft.)	HWO (ft.)	FLOW TYPE	VELOCITY (fps.)	DN (ft.)	DC (ft.)	MANNING N	HEADWATER CONTROL	OVER FLOW (cfs.)	DESIGN CODE	BURIAL DEPTH (ft.)
1.90	1	36 in.	544.04	N/A	1 - C	4.26	0.34	0.43	0.0281	INLET	0.00	D	0.00
1.90	1	42 in.	544.05	N/A	1 - C	4.19	0.33	0.41	0.0278	INLET	0.00	D + 1	0.00
2.36	1	36 in.	544.10	N/A	1 - C	4.54	0.38	0.48	0.0281	INLET	0.00	F	0.00
2.36	1	42 in.	544.10	N/A	1 - C	4.50	0.36	0.46	0.0278	INLET	0.00	F + 1	0.00
Corrugated Metal Pipe (6 x 2 in. corrugations)													
Diameter exceeds 1.25 HWA													
1.90	1	60 in.	544.12	N/A	1 - C	3.52	0.32	0.37	0.0332	INLET	0.00	D	0.00
1.90	1	66 in.	544.16	N/A	1 - C	3.50	0.31	0.36	0.0330	INLET	0.00	D + 1	0.00
2.36	1	60 in.	544.15	N/A	1 - C	3.77	0.36	0.42	0.0332	INLET	0.00	F	0.00
2.36	1	66 in.	544.19	N/A	1 - C	3.74	0.35	0.41	0.0330	INLET	0.00	F + 1	0.00
Diameter exceeds 1.25 HWA													
0.95	2	60 in.	544.06	N/A	1 - C	2.86	0.23	0.26	0.0332	INLET	0.00	D	0.00
0.95	2	66 in.	544.10	N/A	1 - C	2.83	0.23	0.26	0.0330	INLET	0.00	D + 1	0.00
1.18	2	60 in.	544.07	N/A	1 - C	3.04	0.26	0.29	0.0332	INLET	0.00	F	0.00
1.18	2	66 in.	544.12	N/A	1 - C	3.03	0.25	0.29	0.0330	INLET	0.00	F + 1	0.00
Corrugated Metal Pipe (6 x 2 in. corrugations, Field Paved Invert)													
Diameter exceeds 1.25 HWA													
1.90	1	60 in.	544.12	N/A	1 - C	4.18	0.29	0.37	0.0260	INLET	0.00	D	0.00
1.90	1	66 in.	544.16	N/A	1 - C	4.14	0.28	0.36	0.0260	INLET	0.00	D + 1	0.00
2.36	1	60 in.	544.15	N/A	1 - C	4.48	0.32	0.42	0.0260	INLET	0.00	F	0.00
2.36	1	66 in.	544.19	N/A	1 - C	4.40	0.31	0.41	0.0260	INLET	0.00	F + 1	0.00
Diameter exceeds 1.25 HWA													
0.95	2	60 in.	544.06	N/A	1 - C	3.40	0.21	0.26	0.0260	INLET	0.00	D	0.00
0.95	2	66 in.	544.10	N/A	1 - C	3.35	0.20	0.26	0.0260	INLET	0.00	D + 1	0.00
1.18	2	60 in.	544.07	N/A	1 - C	3.61	0.23	0.29	0.0260	INLET	0.00	F	0.00
1.18	2	66 in.	544.12	N/A	1 - C	3.58	0.22	0.29	0.0260	INLET	0.00	F + 1	0.00



CULVERT ANALYSIS

PID : 77366 **Date :** 05/10/2007 **Project :** SR 823, Portsmouth Bypass **Location :** Portsmouth, Ohio **Designer :** dl
Description : Drainage area 103, Sta. 0+70, Driveway at Pershing Avenue (Sta. 17+50' Lt.)

HEADWATER CONTROL CODES: INLET - Inlet Control.
 OUTLET - Outlet Control.
 OUTLET* - Outlet Control with backwater curve used to compute headwater. See Figure III - 7E in HDS 5 for type flow.
 OUTLET** - Outlet Control - See Figure III - 7D in HDS 5 for type flow.
 N/A - Flow is supercritical with low headwater and low tailwater. Control Section is at the inlet.

Pipe Number : 1 **Use HW :** 0 **Inlet Invert Elevation (ft.) :** 543.46 **Outlet Invert Elevation (ft.) :** 540.86
Pipe Quantity : 1

Culvert Type : Circular Corrugated **Pipe Length (ft.) :** 52.00 **Culvert Slope (ft./ft.) :** 0.0500
Corrugation Type : Corrugated Metal Pipe (2 2/3 x 1/2 in. corrugations)

Pipe Size : 24 in. ✓
Design Manning 'n' : (default)

Entrance Type : Half Headwall **Loss Coef. Ke :** 0.9000

FLOW LOSS (cfs.) (ft.)	HEAD (ft.)	HWI (ft.)	HWO (ft.)	FLOW TYPE	VELOCITY (fps.)	DN (ft.)	DC (ft.)	MANNING N	HEADWATER CONTROL	BURIED DEPTH (ft.)	TAILWATER ELEVATION (ft.)
1.90	2.01	544.11	N/A	1 - C	4.90	0.36	0.48	0.0247	INLET	0.00	540.86
2.36	2.07	544.20	N/A	1 - C	5.21	0.40	0.53	0.0247	INLET	0.00	540.86

Culvert Material Selection as per ODOI

Updated 04/11/2005

Input Variables for Round Conduit

6.5	Required for all durability
N	Required for all durability
50	Required for all durability
3.90	Required for Concrete durability
15	Required for Concrete durability
5.0	Required for Structural Design

pH ranges from 3 to 9.5 pH=
 Enter "a" for abrasive or "n" for non-abrasive Site Conditions=
 50 or 75 years Service Life=

Pipe Slope (%)=
 Pipe Diameter (in)=

Maximum Height of Fill=

Instructions for Use:
 This spreadsheet will determine the available material options based on pH, ODOI (durability, abras and ODOI), structural tables, pipe slope and pipe diameter.
 Not all available options will apply to each situation and it is the user's responsibility to verify each alternative is valid.

Notes:
 *** Concrete field paving shall be epoxy coated per 706.03 for pH <5.0

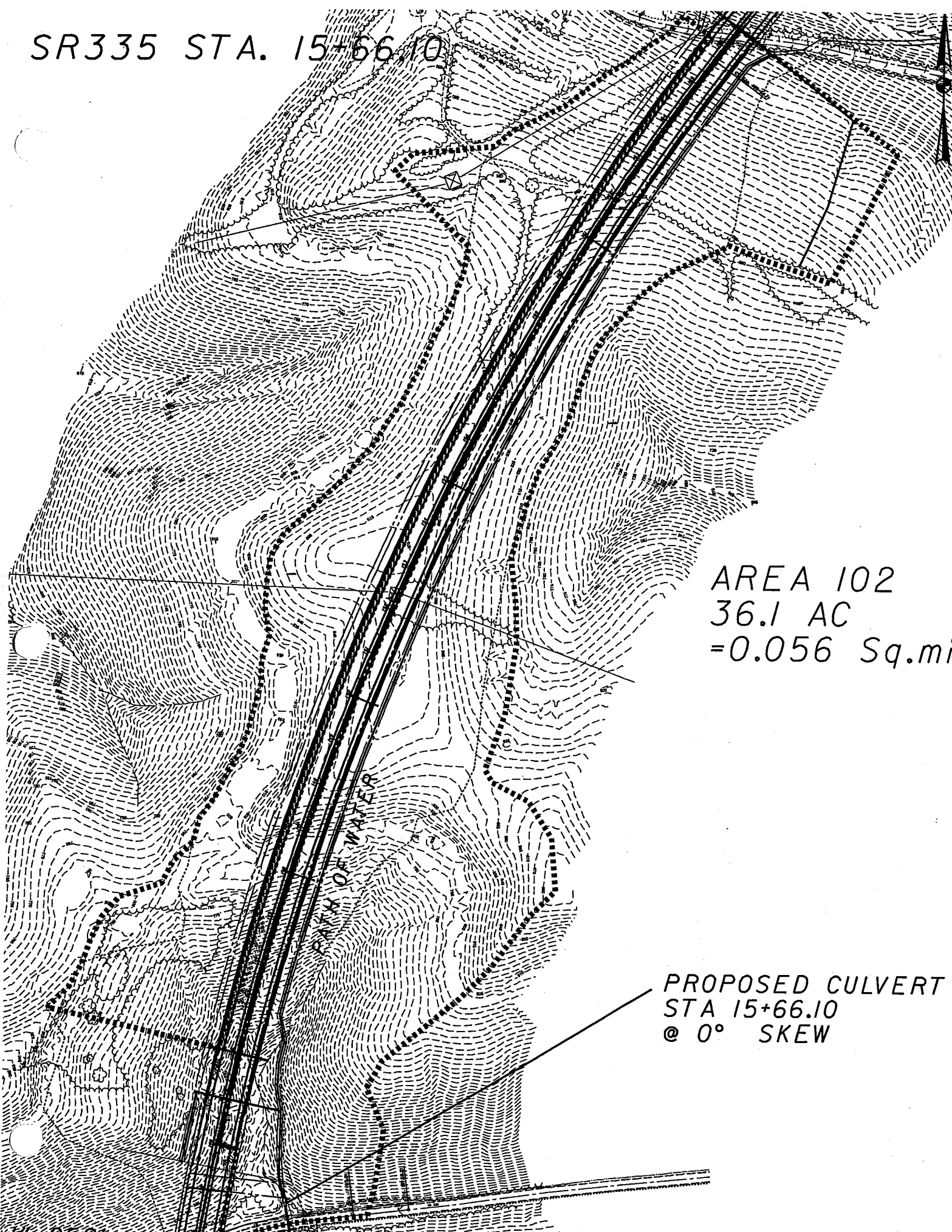
** Externally coated per AASHTO M243

Metal Pipe Description	Material	Req. Gauge per Durability	Thickness per Durability (Inches)	Req. Gauge per Structural	Thickness per Structural (Inches)
Galvanized	707.01	10	0.138	16	0.064
Aluminized	707.01	16	0.064	16	0.064
Galvanized	707.02	10	0.138	N/A	N/A
Aluminized	707.02	16	0.064	N/A	N/A
Galvanized - W/CFP	707.02 W/CFP	16	0.064	N/A	N/A
Structural Plate	707.03	12	0.109	N/A	N/A
Structural Plate W/CFP	707.03 W/CFP	n/a	n/a	N/A	N/A
Polymer Coated	707.04 (0.5" corr.)	16	0.064	16	0.064
Polymer Coated	707.04 (1" corr.)	16	0.064	N/A	N/A
Polymer Coated- Asphalt Coated and Paved	707.04 (0.5" corr.)	n/a	n/a	16	0.064
Polymer Coated- Asphalt Coated and Paved	707.04 (1" corr.)	n/a	n/a	N/A	N/A
Aluminized- Asphalt Coated and Paved	707.05 ≤ 48"	n/a	n/a	16	0.064
Aluminized- Asphalt Coated and Paved	707.05 > 54"	n/a	n/a	16	0.064
Galvanized-Asphalt Coated and Paved	707.05 ≤ 48"	16	0.064	16	0.064
Galvanized-Asphalt Coated and Paved	707.05 > 54"	12	0.109	16	0.064
Aluminized- Asphalt Coated and Paved	707.07 ≤ 48"	n/a	n/a	16	0.064
Aluminized- Asphalt Coated and Paved	707.07 > 54"	n/a	n/a	16	0.064
Galvanized-Asphalt Coated and Paved	707.07 ≤ 48"	16	0.064	N/A	N/A
Galvanized-Asphalt Coated and Paved	707.07 > 54"	12	0.109	N/A	N/A
Aluminum Pipe	707.21 (0.5" corr.)	min	use min		0.06
Aluminum Pipe	707.22 (1.0" corr.)	min	use min		N/A
Structural Plate Aluminum Pipe	707.23	min	use min		N/A

Concrete Pipe Description	Material	Min pH	Epoxy Coated Required?
Concrete Conduit	706.02	3.6	No

Concrete Pipe Description	Material	D-Load Required	Is Minimum D-Load Allowable?
Concrete Conduit	706.02	2000	Yes

SR335 STA. 15+66.10



AREA 102
36.1 AC
=0.056 Sq.mi

PROPOSED CULVERT
STA 15+66.10
@ 0° SKEW

FOOTWATER

STA. 15+66.10, SR 335
TECHNIQUES FOR ESTIMATING FLOOD-PEAK
DISCHARGES OF RURAL, UNREGULATED STREAMS IN OHIO AREA A
 U.S. GEOLOGICAL SURVEY Water Resources Investigations Report 89-4126

	Values	Units	Definitions
	1571049.50	SQ. FT.	
	0.056	SQ. MI.	CONTDA = Contributing Drainage Area
	0.00	SQ. FT.	
	0.00	%	STORAGE = Storage Area
	3285.00	FT.	TOTAL CHANNEL LENGTH
	328.50	FT.	L ₁₀ = 10% of the Distance along channel
	626	FT.	Elev ₁₀ = Elevation at point L ₁₀
	2792.25	FT.	L ₈₅ = 85% of the Distance along channel
	736	FT.	Elev ₈₅ = Elevation at point L ₈₅
	2463.75	FT.	Length = L ₈₅ - L ₁₀
	234.91	FT./MI.	SLOPE = (Elev ₁₀ -Elev ₈₅)/Length
		CFS	Q _# = Flood-Peak Discharge
			# = Frequency of Storm
Q ₂	15.13	CFS	= 56.1(CONTDA) ^{0.782} (SLOPE) ^{0.172} (STORAGE+1) ^{-0.297}
Q ₅	30.92	CFS	= 84.5(CONTDA) ^{0.769} (SLOPE) ^{0.221} (STORAGE+1) ^{-0.322}
Q ₁₀	43.78	CFS	= 104(CONTDA) ^{0.764} (SLOPE) ^{0.244} (STORAGE+1) ^{-0.335}
Q ₂₅	61.26	CFS	= 129(CONTDA) ^{0.760} (SLOPE) ^{0.264} (STORAGE+1) ^{-0.347}
Q ₅₀	75.70	CFS	= 148(CONTDA) ^{0.757} (SLOPE) ^{0.276} (STORAGE+1) ^{-0.355}
Q ₁₀₀	89.97	CFS	= 167(CONTDA) ^{0.756} (SLOPE) ^{0.285} (STORAGE+1) ^{-0.363}

Revise with Rational Method

Worksheet for SR335_15+66.10

Project Description

Friction Method Manning Formula
Solve For Normal Depth

Input Data

Roughness Coefficient	0.040
Channel Slope	0.35000 ft/ft
Left Side Slope	2.00 ft/ft (H:V)
Right Side Slope	2.00 ft/ft (H:V)
Bottom Width	5.00 ft
Discharge	61.26 ft ³ /s

Results

Normal Depth	0.67 ft
Flow Area	4.25 ft ²
Wetted Perimeter	8.00 ft
Top Width	7.68 ft
Critical Depth	1.38 ft
Critical Slope	0.02511 ft/ft
Velocity	14.41 ft/s
Velocity Head	3.23 ft
Specific Energy	3.90 ft
Froude Number	3.42
Flow Type	Supercritical

GVF Input Data

Downstream Depth	0.00 ft
Length	0.00 ft
Number Of Steps	0

GVF Output Data

Upstream Depth	0.00 ft
Profile Description	
Profile Headloss	0.00 ft
Downstream Velocity	Infinity ft/s
Upstream Velocity	Infinity ft/s
Normal Depth	0.67 ft
Critical Depth	1.38 ft
Channel Slope	0.35000 ft/ft
Critical Slope	0.02511 ft/ft



UNIVERSAL CULVERT DESIGN

PID : 77366 **Date :** 06/14/2007 **Project :** SR 823 Portsmouth Bypass **Location :** Portsmouth Ohio **Designer :** DL

Description : Drainage area 102, 15+66.10, SR335

HEADWATER CONTROL CODES: INLET - Inlet Control.
 OUTLET - Outlet Control.
 OUTLET* - Outlet Control with backwater curve used to compute headwater. See Figure III - 7E in HDS 5 for type flow.
 OUTLET** - Outlet Control - See Figure III - 7D in HDS 5 for type flow.
 N/A - Flow is supercritical with low headwater and low tailwater. Control Section is at the inlet.

Inlet Invert Elevation (ft.) : 528.22 **Outlet Invert Elevation (ft.) :** 527.56 **Tailwater Elevation (ft.) :** 528.23 **Overflow Elevation (ft.) :** 535.39
Allowable Headwater Elevation (ft.) : 534.39 or Diameter + 2 ft. *(whichever is less)*
Pipe Length (ft.) : 66.50 **Culvert Slope (ft./ft.) :** 0.0100 **Design Manning 'n' :** 0.0120
Design Discharge (cfs) : 61.26 @ 25 yrs. **Flood Discharge (cfs) :** 90.00 @ 50 yrs.

FLOW PIPE # (cfs.)	PIPE	CULVERT SIZE	HWI (ft.)	HWO (ft.)	FLOW TYPE	VELOCITY (fps.)	DN (ft.)	DC (ft.)	MANNING N	HEADWATER CONTROL	OVER FLOW (cfs.)	DESIGN CODE	BURIAL DEPTH (ft.)
CULVERT TYPE : CIRCULAR SMOOTH													
Entrance Type : Half Headwall													
61.26	1	36 in.	532.64	532.19	2 - E	11.46	2.12	2.52	0.0120	INLET	0.00	D	0.00
61.26	1	33 in.	533.43	532.92	2 - E	10.31	2.75	2.50	0.0120	INLET	0.00	D - 1	0.00
61.26	1	30 in.	534.76	534.17	2 - E	12.48	2.50	2.40	0.0120	INLET	0.00	D - 2	0.00
61.26	1	42 in.	531.92	N/A	1 - C	11.66	1.88	2.45	0.0120	INLET	0.00	D + 1	0.00
90.00	1	36 in.	535.31	534.53	2 - E	12.73	3.00	2.85	0.0120	INLET	0.00	F	0.00
77.50	1	33 in.	537.15	536.18	2 - E	13.05	2.75	2.64	0.0120	INLET	12.50	F - 1	0.00
65.20	1	30 in.	540.29	539.02	2 - E	13.28	2.50	2.42	0.0120	INLET	24.80	F - 2	0.00
90.00	1	42 in.	533.37	532.86	2 - E	12.65	2.43	2.94	0.0120	INLET	0.00	F + 1	0.00
CULVERT TYPE : CIRCULAR CORRUGATED													
Entrance Type : Half Headwall													
Entrance Loss (Ke) : 0.20													
Entrance Loss (Ke) : 0.90													

CULVERT TYPE : CIRCULAR CORRUGATED

Corrugated Metal Pipe (2 2/3 x 1/2 in. corrugations)

61.26	1	42 in.	532.39	532.64	2 - F	8.50	3.50	2.45	0.0237	OUTLET*	0.00	D	0.00
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UNIVERSAL CULVERT DESIGN

FLOW (cfs.)	PIPE #	CULVERT SIZE	HWI (ft.)	HWO (ft.)	FLOW TYPE	VELOCITY (fps.)	DN (ft.)	DC (ft.)	MANNING N	HEADWATER CONTROL	OVER FLOW (cfs.)	DESIGN CODE	BURIAL DEPTH (ft.)
61.26	1	36 in.	533.86	534.45	2 - F	9.65	3.00	2.52	0.0241	OUTLET**	0.00	D - 1	0.00
56.36	1	33 in.	535.24	536.37	2 - F	10.13	2.75	2.44	0.0241	OUTLET**	4.90	D - 2	0.00
61.26	1	48 in.	531.83	532.28	1 - A	7.95	2.64	2.36	0.0235	OUTLET*	0.00	D + 1	0.00
90.00	1	42 in.	534.79	535.12	2 - F	10.42	3.50	2.94	0.0237	OUTLET**	0.00	F	0.00
67.50	1	36 in.	537.98	539.40	2 - F	10.30	3.00	2.62	0.0241	OUTLET**	22.50	F - 1	0.00
56.30	1	33 in.	540.69	543.63	2 - F	10.12	2.75	2.44	0.0241	OUTLET**	33.70	F - 2	0.00
90.00	1	48 in.	533.24	533.46	2 - F	9.31	4.00	2.88	0.0235	OUTLET*	0.00	F + 1	0.00
Corrugated Metal Pipe (3 x 1 in. corrugations)													
61.26	1	42 in.	532.39	532.85	2 - F	8.50	3.50	2.45	0.0278	OUTLET**	0.00	D	0.00
61.26	1	36 in.	533.86	535.14	2 - F	9.65	3.00	2.52	0.0281	OUTLET**	0.00	D - 1	0.00
61.26	1	48 in.	531.83	532.27	1 - A	7.95	2.97	2.36	0.0275	OUTLET*	0.00	D + 1	0.00
86.60	1	42 in.	534.79	535.78	2 - F	10.17	3.50	2.90	0.0278	OUTLET**	3.40	F	0.00
62.70	1	36 in.	537.98	540.89	2 - F	9.80	3.00	2.55	0.0281	OUTLET**	27.30	F - 1	0.00
90.00	1	48 in.	533.24	533.67	2 - F	9.31	4.00	2.88	0.0275	OUTLET**	0.00	F + 1	0.00
Corrugated Metal Pipe (6 x 2 in. corrugations)													
61.26	1	60 in.	531.44	531.87	1 - A	7.35	2.79	2.20	0.0332	OUTLET*	0.00	D	0.00
61.26	1	66 in.	531.32	531.71	1 - A	7.16	2.63	2.14	0.0330	OUTLET*	0.00	D + 1	0.00
90.00	1	60 in.	532.25	532.80	1 - A	8.35	3.65	2.69	0.0332	OUTLET*	0.00	F	0.00
90.00	1	66 in.	532.07	532.58	1 - A	8.08	3.33	2.62	0.0330	OUTLET*	0.00	F + 1	0.00
Corrugated Metal Pipe (6 x 2 in. corrugations, Field Paved Invert)													
61.26	1	60 in.	531.44	531.88	1 - A	7.35	2.41	2.20	0.0260	OUTLET*	0.00	D	0.00
61.26	1	66 in.	531.32	531.76	1 - A	7.16	2.30	2.14	0.0260	OUTLET*	0.00	D + 1	0.00
90.00	1	60 in.	532.25	532.77	1 - A	8.35	3.06	2.69	0.0260	OUTLET*	0.00	F	0.00
90.00	1	66 in.	532.07	532.60	1 - A	8.08	2.87	2.62	0.0260	OUTLET*	0.00	F + 1	0.00

APPENDIX E

Ditch Calculations

DITCH CALCS NOT REVISED



DITCH ANALYSIS

PID : 77366 Date : 07/02/2007 Project : SCI-823-0.00
 Description : US52 A, STA. 44+50 TO STA. 44+00, RHS

Location : PORTSMOUTH, SCIOTO COUNTY
 Designer : MDC

Rainfall Area : D

Seed: 0.40
 Permanent Mat Type 1: 2.00
 RCP Type B: 6.00

Allowable Shears
 Jute Mat: 0.45
 Type 2: 3.00

Temporary Mat: 1.00
 Type 3: 5.00

(*) Warning: Grade is steeper than allowable. If value is parantheses, design parameters have been exceeded. - See user manual.

STATION	BEGIN	END	SIDE LENGTH (ft.)	RADIUS (ft.)	IN SLOPE (ft./ft.)	BACK SLOPE (ft./ft.)	GRADE (ft./ft.)	AREA (acres)	AREA SUM (acres)	RUNOFF COEFF. (Sum)	CA TYPE	PROTECT TYPE	RAIN INT. (in./hr.)	FREQ. (yrs.)	STORM MANN. COEFF.	TIME (min.)	VEL. FLOW (fps.)	SHEAR (lbs./sq.ft.)	DESIGN FLOW (cfs.)	DEPTH (ft.)	WIDTH FLOW (ft.)
44+50	40+00	R	450.00	10.00	3.00	1.00	0.0899	1.11	1.11	0.72	0.80	Seed	3.68	5	0.030	17.40	3.04	0.53	2.94	0.10	10.38
												Jute Mat	3.63	5	0.040	17.87	2.54	0.63	2.91	0.11	10.45
												Temp. Mat	3.63	5	0.040	17.87	2.54	0.63	2.91	0.11	10.45
												Temp. Mat	4.27	10	0.040	17.69	2.70	0.69	3.42	0.12	10.49



DITCH ANALYSIS

PID : 77366 **Date :** 07/02/2007 **Project :** SCI-823-0.00
Description : US52 A, STA. 44+50 TO STA. 62+50, RHS

Location : PORTSMOUTH, SCIOTO COUNTY

Designer : MDC

Rainfall Area : D

Allowable Shears
Jute Mat: 0.45 **Temporary Mat:** 1.00
Type 2: 3.00 **Type 3:** 5.00

Seed: 0.40
Permanent Mat Type 1: 2.00
RCP Type B: 6.00

(*) Warning: Grade is steeper than allowable. If value is parantheses, design parameters have been exceeded. - See user manual.

STATION	BEGIN	END	SIDE LENGTH (ft.)	RADIUS (ft.)	IN SLOPE (ft./ft.)	BACK SLOPE (ft./ft.)	GRADE (ft./ft.)	AREA (acres)	AREA SUM (acres)	RUNOFF COEFF. (Sum)	CA TYPE	PROTECT TYPE	RAIN INT. (in./hr.)	FREQ. (yrs.)	COEFF. (min.)	FLOW (cfs.)	VEL. (fps.)	SHEAR (sq.ft.)	DESIGN FLOW (cfs.)	DEPTH (ft.)	WIDTH (ft.)
44+50	61+00	R	1650.0	10.00	3.00	0.50	0.0078	6.81	6.81	0.73	4.97	Seed	3.09	5	0.030	24.54	2.65	0.26	15.36	0.53	11.86
61+00	62+50	R	150.00	10.00	3.00	0.50	0.1587*	0.34	7.16	0.71	5.22	Seed	3.51	10	0.040	25.90	2.30	0.33	17.45	0.68	12.38
												Seed	3.06	5	0.030	24.90	6.96	2.19	15.99	0.22	10.77
												Jute Mat	3.06	5	0.040	24.97	5.82	2.60	15.96	0.26	10.92
												Temp. Mat	3.06	5	0.040	24.97	5.82	2.60	15.96	0.26	10.92
												Perm, Type 1	3.06	5	0.040	24.97	5.82	2.60	15.96	0.26	10.92
												Perm, Type 2	3.06	5	0.040	24.97	5.82	2.60	15.96	0.26	10.92
												Perm, Type 2	3.48	10	0.040	26.31	6.10	2.80	18.14	0.28	10.99



DITCH ANALYSIS

PID : 77366 **Date :** 07/02/2007 **Project :** SCI-823-0.00
Description : SR140 A, STA. 68+50 TO STA. 64+00, RHS

Location : PORTSMOUTH, SCIOTO COUNTY
Designer : MDC

Rainfall Area : D

Allowable Shears

Seed:	0.40	Temporary Mat:	1.00
Permanent Mat	Type 1: 2.00	Type 2:	3.00
RCP	Type B: 6.00	Type 3:	5.00

(*) Warning: Grade is steeper than allowable. If value is parentheses, design parameters have been exceeded. - See user manual.

STATION	BEGIN	END	SIDE LENGTH (ft.)	RADIUS (ft.)	IN SLOPE (ft./ft.)	BACK SLOPE (ft./ft.)	GRADE (ft./ft.)	AREA (acres)	AREA SUM (acres)	RUNOFF COEFF. (Sum)	CA TYPE	PROTECT INT. (in./hr.)	RAIN FREQ. (yrs.)	STORM FLOW (cfs.)	MANN. COEFF. (min.)	TIME FLOW (min.)	VEL. FLOW (fps.)	SHEAR FLOW (sq.ft.)	DESIGN FLOW (cfs.)	DEPTH FLOW (ft.)	WIDTH FLOW (ft.)
68+50	64+00	R	400.00	10.00	3.00	0.50	0.0618	1.58	1.58	0.73	1.15	Seed	3.71	5	0.030	17.08	3.14	0.51	4.27	0.13	10.47
												Jute Mat	3.67	5	0.040	17.48	2.62	0.61	4.22	0.16	10.55
												Temp. Mat	3.67	5	0.040	17.48	2.62	0.61	4.22	0.16	10.55
												Temp. Mat	4.31	10	0.040	17.34	2.79	0.67	4.96	0.17	10.61



DITCH ANALYSIS

PID : 77366 Date : 07/02/2007 Project : SCI-823-0.00
 Description : SR140 A, STA. 68+50 TO STA. 69+00, RHS

Location : PORTSMOUTH, SCIOTO COUNTY

Designer : MDC

Rainfall Area : D

Seed: 0.40
 Permanent Mat Type 1: 2.00
 RCP Type B: 6.00
 Allowable Shears
 Jute Mat: 0.45
 Type 2: 3.00
 Temporary Mat: 1.00
 Type 3: 5.00

(*) Warning: Grade is steeper than allowable. If value is parantheses, design parameters have been exceeded. - See user manual.

STATION	SIDE	LENGTH	RADIUS	IN	BACK	GRADE	AREA	AREA	AREA	RUNOFF	CA	PROTECT	RAIN	STORM	MANN.	TIME	VEL.	SHEAR	DESIGN	DEPTH	WIDTH	
BEGIN	END	(ft.)	(ft.)	SLOPE	SLOPE	(ft./ft.)	(acres)	SUM	COEFF.	(Sum)	TYPE	INT.	FREQ.	COEFF.	FLOW	FLOW	(lbs./	FLOW	FLOW	FLOW	FLOW	
		(ft./ft.)	(ft./ft.)	(ft./ft.)	(ft./ft.)	(ft./ft.)	(acres)	(acres)	(in./hr.)	(yrs.)	(min.)	(min.)	(min.)	(min.)	(min.)	(min.)	(min.)	(min.)	(min.)	(min.)	(min.)	(min.)
68+50	69+00	R	50.00	10.00	2.00	2.00	0.0340	0.12	0.12	0.74	0.09	Seed	3.84	5	0.030	15.86	0.99	0.07	0.35	0.03	10.14	
												Seed	4.48	10	0.040	15.95	0.88	0.10	0.40	0.05	10.18	



DITCH ANALYSIS

PID : 77366 **Date :** 07/02/2007 **Project :** SCI-823-0.00
Description : SR823, STA. 96+00 TO STA. 69+50, RHS

Location : PORTSMOUTH, SCIOTO COUNTY

Designer : MDC

Rainfall Area : D

Seed: 0.40	Temporary Mat: 1.00	Allowable Shears
Permanent Mat Type 1: 2.00	Type 3: 5.00	Jute Mat: 0.45
RCP Type B: 6.00		Type 2: 3.00

(*) Warning: Grade is steeper than allowable.

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

STATION	SIDE LENGTH	RADIUS	IN	BACK	GRADE	AREA	AREA	RUNOFF	CA	PROTECT	RAIN	STORM	MANN.	TIME	VEL.	SHEAR	DESIGN	DEPTH	WIDTH		
BEGIN	END	(ft.)	WIDTH	SLOPE	SLOPE	(ft./ft.)	(acres)	SUM	COEFF.	(Sum)	TYPE	INT.	FREQ.	COEFF.	FLOW	FLOW	(lbs./	FLOW	FLOW		
		(ft./ft.)	(ft./ft.)	(ft./ft.)	(ft./ft.)	(acres)		(acres)			(in./hr.)	(yrs.)	(min.)	(min.)	(fps.)	sq.ft.)	(cfs.)	(ft.)	(ft.)		
96+00	76+00	R	2000.0	10.00	3.00	0.50	0.0348	11.34	11.34	0.73	8.28	Seed	3.36	5	0.030	20.94	5.30	1.05	27.80	0.48	11.69
												Jute Mat	3.26	5	0.040	22.16	4.36	1.22	27.00	0.56	11.97
												Temp. Mat	3.26	5	0.040	22.16	4.36	1.22	27.00	0.56	11.97
												Perm, Type 1	3.26	5	0.040	22.16	4.36	1.22	27.00	0.56	11.97
												Perm, Type 1	3.85	10	0.040	21.78	4.62	1.35	31.88	0.62	12.18
												Seed	3.15	5	0.030	23.62	7.34	2.05	35.99	0.45	11.80
												Jute Mat	3.13	5	0.040	23.91	6.09	2.42	35.75	0.53	12.12
												Temp. Mat	3.13	5	0.040	23.91	6.09	2.42	35.75	0.53	12.12
												Perm, Type 1	3.13	5	0.040	23.91	6.09	2.42	35.75	0.53	12.12
												Perm, Type 2	3.13	5	0.040	23.91	6.09	2.42	35.75	0.53	12.12
												Perm, Type 2	3.71	10	0.040	23.43	6.46	2.67	42.29	0.59	12.34



DITCH ANALYSIS

PID : 77366 Date : 07/02/2007 Project : SCI-823-0-00
 Description : SR823, STA. 96+00 TO STA. 105+00, RHS

Location : PORTSMOUTH, SCIOTO COUNTY

Designer : MDC

Rainfall Area : D

Allowable Shears

Seed: 0.40 Temporary Mat: 1.00
 Permanent Mat Type 1: 2.00 Type 3: 5.00
 RCP Type B: 6.00
 Jute Mat: 0.45
 Type 2: 3.00

(*) Warning: Grade is steeper than allowable.

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

STATION	SIDE LENGTH	RADIUS	IN	BACK	GRADE	AREA	AREA	RUNOFF	CA	PROTECT	RAIN	STORM	MANN.	TIME	VEL.	SHEAR	DESIGN	DEPTH	WIDTH		
BEGIN	END	(ft.)	SLOPE	SLOPE	(ft./ft.)	(acres)	SUM	COEFF.	(Sum)	TYPE	INT.	FREQ.	COEFF.	FLOW	FLOW	(lbs./	FLOW	DEPTH	WIDTH		
		(ft./ft.)	(ft./ft.)	(ft./ft.)	(ft./ft.)	(acres)				(in./hr.)	(in./hr.)	(yrs.)	(min.)	(min.)	(fps.)	sq.ft.)	(cfs.)	(ft.)	FLOW	FLOW	
96+00	105+00	R	900.00	10.00	3.00	0.50	0.0172	2.72	2.72	0.75	2.04	Seed	3.39	5	0.030	20.58	2.54	0.28	6.91	0.26	10.91
												Seed	3.90	10	0.040	21.31	2.24	0.36	7.94	0.34	11.17



DITCH ANALYSIS

PID : 77366 Date : 07/02/2007 Project : SCI-823-0.00
 Description : SR823, STA. 105+50 TO STA. 107+00, RHS

Location : PORTSMOUTH, SCIOTO COUNTY

Designer : MDC

Rainfall Area : D

Allowable Shears

Seed: 0.40
 Permanent Mat Type 1: 2.00
 RCP Type B: 6.00
 Jute Mat: 0.45
 Type 2: 3.00
 Temporary Mat: 1.00
 Type 3: 5.00

(*) Warning: Grade is steeper than allowable. If value is parentheses, design parameters have been exceeded. - See user manual.

STATION	SIDE	LENGTH	RADIUS	IN	BACK	GRADE	AREA	AREA	AREA	RUNOFF	CA	PROTECT	RAIN	STORM	MANN.	TIME	VEL.	SHEAR	DESIGN	DEPTH	WIDTH	
BEGIN	END	(ft.)	WIDTH	SLOPE	SLOPE	(ft./ft.)	(acres)	SUM	COEFF.	(Sum)	TYPE	INT.	FREQ.	COEFF.	FLOW	FLOW	(lbs./	FLOW	DESIGN	DEPTH	WIDTH	
		(ft./ft.)	(ft./ft.)	(ft./ft.)	(ft./ft.)	(ft./ft.)	(acres)	(acres)				(in./hr.)	(yrs.)		(min.)	(fps.)	sq.ft.)	(cfs.)		(ft.)	(ft.)	(ft.)
105+50	106+00	R	50.00	10.00	4.00	4.00	0.0740	15.87	15.87	0.73	11.59	Seed	3.92	5	0.030	15.11	7.60	2.30	45.41	0.50	13.99	
												Jute Mat	3.92	5	0.040	15.13	6.27	2.71	45.38	0.59	14.69	
												Temp. Mat	3.92	5	0.040	15.13	6.27	2.71	45.38	0.59	14.69	
												Perm, Type 1	3.92	5	0.040	15.13	6.27	2.71	45.38	0.59	14.69	
												Perm, Type 2	3.92	5	0.040	15.13	6.27	2.71	45.38	0.59	14.69	
												Perm, Type 2	4.59	10	0.040	15.13	6.59	2.96	53.14	0.64	15.13	
106+00	107+00	R	100.00	10.00	4.00	4.00	0.0800	0.99	16.86	0.72	12.30	Seed	3.89	5	0.030	15.34	7.94	2.51	47.88	0.50	14.02	
												Jute Mat	3.89	5	0.040	15.39	6.54	2.95	47.82	0.59	14.73	
												Temp. Mat	3.89	5	0.040	15.39	6.54	2.95	47.82	0.59	14.73	
												Perm, Type 1	3.89	5	0.040	15.39	6.54	2.95	47.82	0.59	14.73	
												Perm, Type 2	3.89	5	0.040	15.39	6.54	2.95	47.82	0.59	14.73	
												Perm, Type 2	4.56	10	0.040	15.37	6.89	3.23	56.01	0.65	15.17	



DITCH ANALYSIS

PID : 77366 **Date :** 07/02/2007 **Project :** SCI-823-0.00 **Location :** PORTSMOUTH, SCIOTO COUNTY
Description : SR823, STA. 118+50 TO STA. 120+50, RHS **Designer :** MDC

Rainfall Area : D

Allowable Shears
Jute Mat: 0.45 **Temporary Mat:** 1.00
Type 2: 3.00 **Type 3:** 5.00
Seed: 0.40
Permanent Mat Type 1: 2.00
RCP Type B: 6.00

(*) Warning: Grade is steeper than allowable. If value is parantheses, design parameters have been exceeded. - See user manual.

STATION	SIDE LENGTH	RADIUS	IN	BACK	GRADE	AREA	AREA	SUM	CA	PROTECT	RAIN	STORM	MANN.	TIME	VEL.	SHEAR	DESIGN	DEPTH	WIDTH		
BEGIN	END	(ft.)	WIDTH	SLOPE	SLOPE	(ft./ft.)	(acres)	(acres)	COEFF.	(Sum)	TYPE	INT.	FREQ.	COEFF.	FLOW	FLOW	(lbs./	FLOW	FLOW		
		(ft./ft.)	(ft./ft.)	(ft./ft.)	(ft./ft.)	(ft./ft.)	(acres)	(acres)			(in./hr.)	(yrs.)	(min.)	(min.)	(fps.)	sq.ft.)	(cfs.)	(ft.)	(ft.)		
118+50	120+50	R	200.00	10.00	4.00	4.00	0.0150	0.93	0.93	0.70	0.65	Seed	3.71	5	0.030	17.04	1.60	0.13	2.42	0.14	11.14
												Seed	4.32	10	0.040	17.31	1.41	0.17	2.81	0.19	11.48



DITCH ANALYSIS

PID : 77366 Date : 07/02/2007 Project : SCI-823-0.00
 Description : SR823, STA. 124+50 TO STA. 128+50, RHS

Location : PORTSMOUTH, SCIOTO COUNTY

Designer : MDC

Rainfall Area : D

Allowable Shears

Seed: 0.40
 Permanent Mat Type 1: 2.00
 RCP Type B: 6.00
 Jute Mat: 0.45
 Type 2: 3.00
 Temporary Mat: 1.00
 Type 3: 5.00

(*) Warning: Grade is steeper than allowable.

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

STATION	BEGIN	END	SIDE LENGTH (ft.)	RADIUS (ft.)	IN SLOPE (ft./ft.)	BACK SLOPE (ft./ft.)	AREA (acres)	GRADE (ft./ft.)	AREA (acres)	CA SUM (acres)	RUNOFF COEFF. (Sum)	PROTECT TYPE	RAIN INT. (in./hr.)	STORM FREQ. (yrs.)	MANN. COEFF.	TIME (min.)	VEL. FLOW (fps.)	SHEAR (lbs./sq.ft.)	DESIGN FLOW (cfs.)	DEPTH (ft.)	WIDTH FLOW (ft.)
124+50	128+50	R	400.00	12.00	3.00	3.00	0.0538	2.27	2.27	0.70	1.59	Seed	3.71	5	0.030	17.07	3.16	0.50	5.90	0.15	12.90
												Jute Mat	3.67	5	0.040	17.47	2.63	0.59	5.83	0.18	13.06
												Temp. Mat	3.67	5	0.040	17.47	2.63	0.59	5.83	0.18	13.06
												Temp. Mat	4.31	10	0.040	17.33	2.80	0.65	6.85	0.19	13.17



DITCH ANALYSIS

PID : 77366 Date : 07/02/2007 Project : SCI-823-0.00 Location : PORTSMOUTH, SCIOTO COUNTY Designer : MDC
 Description : SR823, STA. 131+50 TO STA. 129+00, RHS

Rainfall Area : D

Allowable Shears

Seed: 0.40 Temporary Mat: 1.00

Permanent Mat Type 1: 2.00 Type 2: 3.00 Type 3: 5.00

RCP Type B: 6.00

(*) Warning: Grade is steeper than allowable. If value is parantheses, design parameters have been exceeded. - See user manual.

STATION	SIDE LENGTH	RADIUS	IN	BACK	GRADE	AREA	AREA	RUNOFF	CA	PROTECT	RAIN	STORM	MANN.	TIME	VEL.	SHEAR	DESIGN	DEPTH	WIDTH		
BEGIN	END	(ft.)	WIDTH	SLOPE	SLOPE	(ft./ft.)	(acres)	SUM	COEFF.	(Sum)	TYPE	INT.	FREQ.	COEFF.	FLOW	FLOW	(lbs./	FLOW	FLOW		
		(ft.)	(ft./ft.)	(ft./ft.)	(ft./ft.)	(ft./ft.)	(acres)	(acres)			(in./hr.)	(yrs.)	(min.)	(min.)	(fps.)	sq.ft.)	(cfs.)	(ft.)	(ft.)		
131+50	130+00	R	150.00	10.00	4.00	4.00	0.0167	0.63	0.63	0.70	0.44	Seed	3.75	5	0.030	16.72	1.43	0.12	1.65	0.11	10.89
130+00	129+50	R	50.00	10.00	4.00	4.00	0.0900	2.02	2.65	0.87	2.20	Seed	4.36	10	0.040	16.94	1.27	0.15	1.92	0.14	11.15
												Seed	3.73	5	0.030	16.91	4.42	0.97	8.19	0.17	11.39
												Jute Mat	3.72	5	0.040	16.95	3.68	1.15	8.18	0.21	11.64
												Temp. Mat	3.72	5	0.040	16.95	3.68	1.15	8.18	0.21	11.64
												Perm, Type 1	3.72	5	0.040	16.95	3.68	1.15	8.18	0.21	11.64
												Perm, Type 1	4.33	10	0.040	17.15	3.89	1.26	9.52	0.22	11.80
129+50	129+00	R	75.00	15.00	4.00	4.00	0.2933*	0.95	3.60	0.70	2.86	Seed	3.70	5	0.030	17.15	6.12	2.05	10.59	0.11	15.90
												Jute Mat	3.70	5	0.040	17.19	5.12	2.44	10.58	0.13	16.06
												Temp. Mat	3.70	5	0.040	17.19	5.12	2.44	10.58	0.13	16.06
												Perm, Type 1	3.70	5	0.040	17.19	5.12	2.44	10.58	0.13	16.06
												Perm, Type 2	3.70	5	0.040	17.19	5.12	2.44	10.58	0.13	16.06
												Perm, Type 2	4.31	10	0.040	17.38	5.43	2.67	12.32	0.15	16.17



DITCH ANALYSIS

PID : 77366 **Date :** 07/02/2007 **Project :** SCI-823-0.00 **Location :** PORTSMOUTH, SCIOTO COUNTY
Description : SR823, STA. 166+00 TO STA. 140+00, RHS **Designer :** MDC

Rainfall Area : D

Allowable Shears

Permanent Mat	Seed:	Temporary Mat:
RCP	Type 1:	Type 3:
	Type B:	

(*) Warning: Grade is steeper than allowable. If value is in parentheses, design parameters have been exceeded. - See user manual.

STATION	BEGIN	END	SIDE LENGTH (ft.)	RADIUS (ft.)	IN SLOPE (ft./ft.)	BACK SLOPE (ft./ft.)	GRADE (ft./ft.)	AREA (acres)	CA RUNOFF COEFF. (Sum)	PROTECT TYPE	RAIN INT. (in./hr.)	STORM FREQ. (yrs.)	MANN. COEFF. (min.)	TIME FLOW (min.)	VEL. FLOW (fps.)	SHEAR (lbs./sq.ft.)	DESIGN FLOW (cfs.)	DEPTH FLOW (ft.)	WIDTH FLOW (ft.)
166+00	161+00	R	500.00	10.00	3.00	0.50	0.0150	2.14	0.74	1.58	Seed	5	0.030	18.56	2.26	0.22	5.64	0.24	10.84
161+00	155+00	R	600.00	10.00	3.00	0.50	0.0363	2.62	0.78	3.63	Seed	10	0.040	19.02	1.99	0.29	6.52	0.31	11.09
155+00	150+00	R	500.00	10.00	3.00	0.50	0.0498	3.01	0.76	5.91	Seed	5	0.030	21.02	3.97	0.66	12.16	0.29	11.02
											Jute Mat	5	0.040	21.51	3.30	0.78	12.02	0.34	11.20
											Temp. Mat	5	0.040	21.51	3.30	0.78	12.02	0.34	11.20
											Temp. Mat	10	0.040	21.82	3.48	0.85	13.96	0.38	11.32
											Seed	5	0.030	23.11	5.16	1.07	18.86	0.34	11.21
											Jute Mat	5	0.040	23.42	4.29	1.27	18.73	0.41	11.43
											Temp. Mat	5	0.040	23.42	4.29	1.27	18.73	0.41	11.43
											Perm, Type 1	5	0.040	23.42	4.29	1.27	18.73	0.41	11.43
											Perm, Type 1	10	0.040	23.63	4.53	1.39	21.81	0.45	11.56
150+00	146+00	R	400.00	10.00	3.00	0.50	0.0500	2.54	0.76	7.84	Seed	5	0.030	24.59	5.66	1.25	24.20	0.40	11.40
											Jute Mat	5	0.040	24.83	4.70	1.48	24.07	0.47	11.65



DITCH ANALYSIS

STATION BEGIN END	SIDE LENGTH (ft.)	RADIUS (ft.)	IN SLOPE (ft./ft.)	BACK GRADE (ft./ft.)	AREA SUM (acres)	AREA SUM (acres)	RUNOFF COEFF. (Sum)	CA	PROTECT TYPE	RAIN INT. (in./hr.)	STORM FREQ. (yrs.)	MANN. FLOW COEFF. (min.)	VEL. FLOW (fps.)	SHEAR (lbs./ sq.ft.)	DESIGN FLOW (cfs.)	DEPTH FLOW (ft.)	WIDTH FLOW (ft.)	
143+00	300.00	10.00	3.00	0.50	0.0500	1.17	11.48	0.80	8.78	3.01	5	0.030	25.68	5.84	1.31	26.45	0.42	11.48
										3.07	5	0.040	24.83	4.70	1.48	24.07	0.47	11.65
										3.07	5	0.040	24.83	4.70	1.48	24.07	0.47	11.65
										3.58	10	0.040	24.96	4.97	1.62	28.09	0.52	11.81
										3.01	5	0.030	25.68	5.84	1.31	26.45	0.42	11.48
										3.00	5	0.040	25.85	4.86	1.56	26.35	0.50	11.75
										3.00	5	0.040	25.85	4.86	1.56	26.35	0.50	11.75
										3.00	5	0.040	25.85	4.86	1.56	26.35	0.50	11.75
										3.00	5	0.040	25.85	4.86	1.56	26.35	0.50	11.75
										3.51	10	0.040	25.92	5.13	1.71	30.79	0.55	11.92
										2.99	5	0.030	26.08	7.21	2.06	35.33	0.43	12.60
										2.98	5	0.040	26.13	5.97	2.43	35.30	0.51	13.07
										2.98	5	0.040	26.13	5.97	2.43	35.30	0.51	13.07
										2.98	5	0.040	26.13	5.97	2.43	35.30	0.51	13.07
										2.98	5	0.040	26.13	5.97	2.43	35.30	0.51	13.07
										3.49	10	0.040	26.19	6.30	2.66	41.25	0.56	13.36
										2.97	5	0.030	26.28	10.69	4.41	67.89	0.39	17.36
										2.97	5	0.040	26.31	8.90	5.22	67.85	0.46	17.79
										2.97	5	0.040	26.31	8.90	5.22	67.85	0.46	17.79
										2.97	5	0.040	26.31	8.90	5.22	67.85	0.46	17.79
										2.97	5	0.040	26.31	8.90	5.22	67.85	0.46	17.79
										2.97	5	0.040	26.31	8.90	5.22	67.85	0.46	17.79
										2.97	5	0.040	26.31	8.90	5.22	67.85	0.46	17.79



DITCH ANALYSIS

STATION	SIDE LENGTH	RADIUS	IN	BACK	GRADE	AREA	AREA	RUNOFF	CA	PROTECT	RAIN	STORM	MANN.	TIME	VEL.	SHEAR	DESIGN	DEPTH	WIDTH		
BEGIN	END	(ft.)	SLOPE	SLOPE	(ft./ft.)	(acres)	SUM	COEFF.	(Sum)	TYPE	INT.	FREQ.	COEFF.	(min.)	(fps.)	(lbs./sq.ft.)	FLOW	FLOW	FLOW		
		(ft.)	(ft./ft.)	(ft./ft.)		(acres)					(in./hr.)	(yrs.)					(cfs.)	(ft.)	(ft.)	(ft.)	
							2.97	5	0.060	26.37	6.86	67.77	0.59	18.54							



DITCH ANALYSIS

PID : 77366 Date : 07/02/2007 Project : SCI-823-0-00
 Description : SR823, STA. 166+00 TO STA. 168+50, RHS

Location : PORTSMOUTH, SCIOTO COUNTY
 Designer : MDC

Rainfall Area : D

Allowable Shears
 Jute Mat: 0.45 Temporary Mat: 1.00
 Type 2: 3.00 Type 3: 5.00
 Seed: 0.40
 Permanent Mat Type 1: 2.00
 RCP Type B: 6.00

(*) Warning: Grade is steeper than allowable. If value is parantheses, design parameters have been exceeded. - See user manual.

STATION	BEGIN	END	SIDE	LENGTH	RADIUS	IN	BACK	GRADE	AREA	AREA	RUNOFF	CA	PROTECT	RAIN	STORM	MANN.	TIME	VEL.	SHEAR	DESIGN	DEPTH	WIDTH
	(ft.)	(ft.)		(ft.)	(ft.)	(ft./ft.)	(ft./ft.)	(ft./ft.)	(acres)	SUM	COEFF.	(Sum)	TYPE	INT.	FREQ.	COEFF.	FLOW	FLOW	(lbs./	FLOW	DEPTH	FLOW
	(ft.)	(ft.)		(ft./ft.)	(ft./ft.)	(ft./ft.)	(ft./ft.)	(acres)		(acres)				(in./hr.)	(yrs.)		(min.)	(fps.)	sq.ft.)	(cfs.)	(ft.)	(ft.)
166+00	166+50	R		50.00	10.00	3.00	0.50	0.2240*	0.29	0.29	0.73	0.21	Seed	3.89	5	0.030	15.34	2.40	0.47	0.81	0.03	10.12
													Jute Mat	3.89	5	0.040	15.41	2.03	0.55	0.81	0.04	10.14
													Temp. Mat	3.89	5	0.040	15.41	2.03	0.55	0.81	0.04	10.14
													Temp. Mat	4.55	10	0.040	15.38	2.15	0.61	0.95	0.04	10.15
166+50	168+50	R		300.00	10.00	2.00	4.00	0.2020*	8.07	8.36	0.87	7.23	Seed	3.83	5	0.030	15.96	9.05	3.55	27.67	0.28	11.69
													Jute Mat	3.82	5	0.040	16.07	7.52	4.20	27.58	0.33	12.00
													Temp. Mat	3.82	5	0.040	16.07	7.52	4.20	27.58	0.33	12.00
													Perm, Type 1	3.82	5	0.040	16.07	7.52	4.20	27.58	0.33	12.00
													Perm, Type 2	3.82	5	0.040	16.07	7.52	4.20	27.58	0.33	12.00
													Perm, Type 3	3.82	5	0.040	16.07	7.52	4.20	27.58	0.33	12.00
													Perm, Type 3	4.47	10	0.040	16.01	7.96	4.61	32.34	0.37	12.20



DITCH ANALYSIS

PID : 77366 **Date :** 07/02/2007 **Project :** SCI-823-0.00 **Location :** PORTSMOUTH, SCIOTO COUNTY
Description : SR823, STA. 169+50 TO STA. 173+00, RHS **Designer :** MDC

Rainfall Area : D

Allowable Shears
Jute Mat: 0.45 **Temporary Mat:** 1.00
Type 2: 3.00 **Type 3:** 5.00

Seed: 0.40
Permanent Mat Type 1: 2.00
RCP Type B: 6.00

(*) Warning: Grade is steeper than allowable. If value is parantheses, design parameters have been exceeded. - See user manual.

STATION	BEGIN	END	SIDE LENGTH (ft.)	RADIUS (ft.)	IN SLOPE (ft./ft.)	BACK SLOPE (ft./ft.)	GRADE (ft./ft.)	AREA (acres)	AREA SUM (acres)	RUNOFF COEFF. (Sum)	CA TYPE	PROTECT TYPE	RAIN INT. (in./hr.)	STORM FREQ. (yrs.)	MANN. COEFF. (min.)	TIME FLOW (fps.)	VEL. FLOW (cfs.)	SHEAR DESIGN (sq.ft.)	DEPTH FLOW (ft.)	WIDTH FLOW (ft.)	
169+50	173+00	R	350.00	10.00	3.00	0.50	0.0114	0.78	0.78	0.74	0.58	Seed	3.53	5	0.030	18.98	1.41	0.10	2.03	0.14	10.49
												Seed	4.08	10	0.040	19.48	1.25	0.13	2.35	0.18	10.64

APPENDIX E

Ditch Calculations



DITCH ANALYSIS

PID : 77366 **Date :** 07/02/2007 **Project :** SCI-823-0.00 **Location :** PORTSMOUTH, SCIOTO COUNTY
Description : US52 A, STA. 44+50 TO STA. 44+00, RHS **Designer :** MDC

Rainfall Area : D **Allowable Shears**
Seed: 0.40 **Jute Mat:** 0.45 **Temporary Mat:** 1.00
Permanent Mat Type 1: 2.00 **Type 2:** 3.00 **Type 3:** 5.00
RCP Type B: 6.00

(* Warning: Grade is steeper than allowable. If value is parantheses, design parameters have been exceeded. - See user manual.

STATION	BEGIN	END	SIDE LENGTH (ft.)	RADIUS (ft.)	IN WIDTH (ft.)	BACK SLOPE (ft./ft.)	GRADE (ft./ft.)	AREA (acres)	AREA SUM (acres)	CA COEFF. (Sum)	PROTECT TYPE	RAIN INT. (in./hr.)	STORM FREQ. (yrs.)	MANN. COEFF. (min.)	TIME FLOW (fps.)	VEL. FLOW (sq.ft.)	SHEAR DESIGN (cfs.)	DEPTH (ft.)	WIDTH (ft.)		
44+50	40+00	R	450.00	10.00	3.00	1.00	0.0899	1.11	1.11	0.72	0.80	Seed	3.68	5	0.030	17.40	3.04	0.53	2.94	0.10	10.38
												Jute Mat	3.63	5	0.040	17.87	2.54	0.63	2.91	0.11	10.45
												Temp. Mat	3.63	5	0.040	17.87	2.54	0.63	2.91	0.11	10.45
												Temp. Mat	4.27	10	0.040	17.69	2.70	0.69	3.42	0.12	10.49



DITCH ANALYSIS

PID : 77366 Date : 07/02/2007 Project : SCI-823-0.00
 Description : US52 A, STA. 44+50 TO STA. 62+50, RHS

Location : PORTSMOUTH, SCIOTO COUNTY

Designer : MDC

Rainfall Area : D

Allowable Shears

Seed:	0.40	Temporary Mat:	1.00
Permanent Mat Type 1:	2.00	Type 3:	5.00
RCP Type B:	6.00		

(*) Warning: Grade is steeper than allowable. If value is parantheses, design parameters have been exceeded. - See user manual.

STATION BEGIN END	SIDE LENGTH (ft.)	RADIUS (ft.)	IN SLOPE	BACK SLOPE	GRADE (ft./ft.)	AREA (acres)	AREA SUM (acres)	CA COEFF. (Sum)	PROTECT TYPE	RAIN INT. (in./hr.)	STORM FREQ. (yrs.)	MANN. COEFF. (min.)	TIME FLOW (fps.)	VEL. FLOW (sq.ft.)	SHEAR FLOW (cfs.)	DEPTH FLOW (ft.)	WIDTH FLOW (ft.)				
44+50	61+00	R	1650.0	10.00	3.00	0.50	0.0078	6.81	6.81	0.73	4.97	Seed	3.09	5	0.030	24.54	2.65	0.26	15.36	0.53	11.86
61+00	62+50	R	150.00	10.00	3.00	0.50	0.1587*	0.34	7.16	0.71	5.22	Seed	3.51	10	0.040	25.90	2.30	0.33	17.45	0.68	12.38
												Seed	3.06	5	0.030	24.90	6.96	2.19	15.99	0.22	10.77
												Jute Mat	3.06	5	0.040	24.97	5.82	2.60	15.96	0.26	10.92
												Temp. Mat	3.06	5	0.040	24.97	5.82	2.60	15.96	0.26	10.92
												Perm, Type 1	3.06	5	0.040	24.97	5.82	2.60	15.96	0.26	10.92
												Perm, Type 2	3.06	5	0.040	24.97	5.82	2.60	15.96	0.26	10.92
												Perm, Type 2	3.48	10	0.040	26.31	6.10	2.80	18.14	0.28	10.99



DITCH ANALYSIS

PID : 77366 **Date :** 07/02/2007 **Project :** SCI-823-0.00 **Location :** PORTSMOUTH, SCIOTO COUNTY
Description : SR140 A, STA. 68+50 TO STA. 64+00, RHS **Designer :** MDC

Rainfall Area : D

Allowable Shears

Seed: 0.40	Jute Mat: 0.45	Temporary Mat: 1.00
Permanent Mat Type 1: 2.00	Type 2: 3.00	Type 3: 5.00
RCP Type B: 6.00		

(*) Warning: Grade is steeper than allowable. If value is parantheses, design parameters have been exceeded. - See user manual.

STATION	BEGIN	END	SIDE LENGTH (ft.)	RADIUS (ft.)	IN SLOPE (ft./ft.)	BACK SLOPE (ft./ft.)	GRADE (ft./ft.)	AREA (acres)	AREA SUM (acres)	CA COEFF. (Sum)	PROTECT TYPE	RAIN INT. (in./hr.)	STORM FREQ. (yrs.)	MANN. COEFF.	TIME (min.)	VEL. FLOW (fps.)	SHEAR (lbs./sq.ft.)	DESIGN FLOW (cfs.)	DEPTH (ft.)	WIDTH FLOW (ft.)
68+50	R	400.00	10.00	3.00	0.50	0.0618	1.58	1.58	0.73	1.15	Seed	3.71	5	0.030	17.08	3.14	0.51	4.27	0.13	10.47
											Jute Mat	3.67	5	0.040	17.48	2.62	0.61	4.22	0.16	10.55
											Temp. Mat	3.67	5	0.040	17.48	2.62	0.61	4.22	0.16	10.55
											Temp. Mat	4.31	10	0.040	17.34	2.79	0.67	4.96	0.17	10.61



DITCH ANALYSIS

PID : 77366 Date : 07/02/2007 Project : SCI-823-0.00
 Description : SR140 A, STA. 68+50 TO STA. 69+00, RHS

Location : PORTSMOUTH, SCIOTO COUNTY

Designer : MDC

Rainfall Area : D

Allowable Shears

Seed: 0.40
 Permanent Mat Type 1: 2.00
 RCP Type B: 6.00
 Jute Mat: 0.45
 Type 2: 3.00
 Temporary Mat: 1.00
 Type 3: 5.00

(*) Warning: Grade is steeper than allowable. If value is parantheses, design parameters have been exceeded. - See user manual.

STATION	BEGIN	END	SIDE LENGTH (ft.)	RADIUS (ft.)	IN SLOPE (ft./ft.)	BACK SLOPE (ft./ft.)	GRADE (ft./ft.)	AREA (acres)	AREA SUM (acres)	RUNOFF COEFF. (Sum)	CA TYPE	PROTECT INT. (in./hr.)	RAIN FREQ. (yrs.)	STORM MANN. COEFF. (min.)	TIME VEL. (fps.)	SHEAR FLOW (lbs./sq.ft.)	DESIGN FLOW (cfs.)	DEPTH (ft.)	WIDTH (ft.)		
68+50	69+00	R	50.00	10.00	2.00	2.00	0.0340	0.12	0.12	0.74	0.09	Seed	3.84	5	0.030	15.86	0.99	0.07	0.35	0.03	10.14
												Seed	4.48	10	0.040	15.95	0.88	0.10	0.40	0.05	10.18



DITCH ANALYSIS

PID : 77366 **Date :** 07/02/2007 **Project :** SCI-823-0.00 **Location :** PORTSMOUTH, SCIOTO COUNTY
Description : SR823, STA. 96+00 TO STA. 69+50, RHS **Designer :** MDC

Rainfall Area : D **Allowable Shears**
Seed: 0.40 **Jute Mat:** 0.45 **Temporary Mat:** 1.00
Permanent Mat Type 1: 2.00 **Type 2:** 3.00 **Type 3:** 5.00
RCP Type B: 6.00

(*) Warning: Grade is steeper than allowable. If value is parantheses, design parameters have been exceeded. - See user manual.

STATION	BEGIN	END	SIDE LENGTH (ft.)	RADIUS (ft.)	IN SLOPE (ft./ft.)	BACK SLOPE (ft./ft.)	AREA (acres)	AREA SUM (acres)	CA PROTECT TYPE	RAIN INT. (In./hr.)	STORM FREQ. (yrs.)	MANN. COEFF. (Sum)	TIME (min.)	VEL. FLOW (fps.)	SHEAR FLOW (lbs./sq.ft.)	DESIGN FLOW (cfs.)	DEPTH FLOW (ft.)	WIDTH FLOW (ft.)			
96+00	76+00	R	2000.0	10.00	3.00	0.50	0.0348	11.34	11.34	0.73	8.28	Seed	3.36	5	0.030	20.94	5.30	1.05	27.80	0.48	11.69
												Jute Mat	3.26	5	0.040	22.16	4.36	1.22	27.00	0.56	11.97
												Temp. Mat	3.26	5	0.040	22.16	4.36	1.22	27.00	0.56	11.97
												Perm, Type 1	3.26	5	0.040	22.16	4.36	1.22	27.00	0.56	11.97
												Perm, Type 1	3.85	10	0.040	21.78	4.62	1.35	31.88	0.62	12.18
												Seed	3.15	5	0.030	23.62	7.34	2.05	35.99	0.45	11.80
												Jute Mat	3.13	5	0.040	23.91	6.09	2.42	35.75	0.53	12.12
												Temp. Mat	3.13	5	0.040	23.91	6.09	2.42	35.75	0.53	12.12
												Perm, Type 1	3.13	5	0.040	23.91	6.09	2.42	35.75	0.53	12.12
												Perm, Type 2	3.13	5	0.040	23.91	6.09	2.42	35.75	0.53	12.12
												Perm, Type 2	3.71	10	0.040	23.43	6.46	2.67	42.29	0.59	12.34



DITCH ANALYSIS

PID : 77366 Date : 07/02/2007 Project : SCI-823-0.00 Location : PORTSMOUTH, SCIOTO COUNTY
 Description : SR823, STA. 96+00 TO STA. 105+00, RHS Designer : MDC

Rainfall Area : D

Seed: 0.40
 Permanent Mat Type 1: 2.00
 RCP Type B: 6.00
 Allowable Shears
 Jute Mat: 0.45
 Type 2: 3.00
 Temporary Mat: 1.00
 Type 3: 5.00

(* Warning: Grade is steeper than allowable. If value is parentheses, design parameters have been exceeded. - See user manual.

STATION	BEGIN	END	SIDE LENGTH (ft.)	RADIUS (ft.)	IN SLOPE (ft./ft.)	BACK SLOPE (ft./ft.)	GRADE (ft./ft.)	AREA (acres)	CA RUNOFF COEFF. (Sum)	PROTECT TYPE	RAIN INT. (in./hr.)	STORM FREQ. (yrs.)	MANN. COEFF. (cfs./sq.ft.)	TIME FLOW (min.)	VEL. FLOW (fps.)	SHEAR FLOW (lbs./sq.ft.)	DESIGN FLOW (cfs.)	DEPTH FLOW (ft.)	WIDTH FLOW (ft.)	
96+00	105+00	R	900.00	10.00	3.00	0.50	0.0172	2.72	0.75	2.04	Seed	3.39	5	0.030	20.58	2.54	0.28	6.91	0.26	10.91
											Seed	3.90	10	0.040	21.31	2.24	0.36	7.94	0.34	11.17



DITCH ANALYSIS

PID : 77366 **Date :** 07/02/2007 **Project :** SCI-823-0.00 **Location :** PORTSMOUTH, SCIOTO COUNTY **Designer :** MDC
Description : SR823, STA. 105+50 TO STA. 107+00, RHS

Rainfall Area : D

Allowable Shears
Seed: 0.40 **Temporary Mat:** 1.00
Permanent Mat Type 1: 2.00 **Type 2:** 3.00
RCP Type B: 6.00 **Type 3:** 5.00

(*) Warning: Grade is steeper than allowable. If value is parantheses, design parameters have been exceeded. - See user manual.

STATION	SIDE LENGTH (ft.)	RADIUS (ft.)	IN SLOPE (ft./ft.)	BACK SLOPE (ft./ft.)	AREA (acres)	AREA (acres)	CA RUNOFF COEFF. (Sum)	PROTECT TYPE	RAIN INT. (in./hr.)	STORM FREQ. (yrs.)	MANN. COEFF.	TIME (min.)	VEL. FLOW (fps.)	SHEAR FLOW (lbs./sq.ft.)	DEPTH (ft.)	WIDTH (ft.)						
105+50	106+00	R	50.00	10.00	4.00	4.00	0.0740	15.87	15.87	0.73	11.59	Seed	3.92	5	0.030	15.11	7.60	2.30	45.41	0.50	13.99	
													Jute Mat	3.92	5	0.040	15.13	6.27	2.71	45.38	0.59	14.69
													Temp. Mat	3.92	5	0.040	15.13	6.27	2.71	45.38	0.59	14.69
													Perm, Type 1	3.92	5	0.040	15.13	6.27	2.71	45.38	0.59	14.69
													Perm, Type 2	3.92	5	0.040	15.13	6.27	2.71	45.38	0.59	14.69
													Perm, Type 2	4.59	10	0.040	15.13	6.59	2.96	53.14	0.64	15.13
													Seed	3.89	5	0.030	15.34	7.94	2.51	47.88	0.50	14.02
													Jute Mat	3.89	5	0.040	15.39	6.54	2.95	47.82	0.59	14.73
													Temp. Mat	3.89	5	0.040	15.39	6.54	2.95	47.82	0.59	14.73
													Perm, Type 1	3.89	5	0.040	15.39	6.54	2.95	47.82	0.59	14.73
													Perm, Type 2	3.89	5	0.040	15.39	6.54	2.95	47.82	0.59	14.73
													Perm, Type 2	4.56	10	0.040	15.37	6.89	3.23	56.01	0.65	15.17



DITCH ANALYSIS

PID : 77366 **Date :** 07/02/2007 **Project :** SCI-823-0.00
Description : SR823, STA. 118+50 TO STA. 120+50, RHS

Location : PORTSMOUTH, SCIOTO COUNTY

Designer : MDC

Rainfall Area : D

Allowable Shears

Seed: 0.40	Jute Mat: 0.45	Temporary Mat: 1.00
Permanent Mat Type 1: 2.00	Type 2: 3.00	Type 3: 5.00
RCP Type B: 6.00		

(*) Warning: Grade is steeper than allowable.

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

STATION	SIDE LENGTH	RADIUS	IN	BACK	GRADE	AREA	AREA	AREA	RUNOFF	CA	PROTECT	RAIN	STORM	MANN.	TIME	VEL.	SHEAR	DESIGN	DEPTH	WIDTH
BEGIN	END	(ft.)	WIDTH	SLOPE	SLOPE	(ft./ft.)	(acres)	SUM	COEFF.	(Sum)	TYPE	INT.	FREQ.	COEFF.	FLOW	FLOW	(lbs./	FLOW	FLOW	FLOW
		(ft./ft.)	(ft./ft.)	(ft./ft.)	(ft./ft.)	(acres)	(acres)	(acres)	(in./hr.)	(yrs.)	(min.)	(min.)	(min.)	(min.)	(min.)	(fps.)	sq.ft.)	(cfs.)	(ft.)	(ft.)
118+50	120+50	R	200.00	10.00	4.00	4.00	0.0150	0.93	0.70	0.65	Seed	3.71	5	0.030	17.04	1.60	0.13	2.42	0.14	11.14
											Seed	4.32	10	0.040	17.31	1.41	0.17	2.81	0.19	11.48



DITCH ANALYSIS

PID : 77366 Date : 07/02/2007 Project : SCI-823-0.00
 Description : SR823, STA. 124+50 TO STA. 128+50, RHS

Location : PORTSMOUTH, SCIOTO COUNTY

Designer : MDC

Rainfall Area : D

Allowable Shears
 Jute Mat: 0.45 Temporary Mat: 1.00
 Type 2: 3.00 Type 3: 5.00
 Seed: 0.40
 Permanent Mat Type 1: 2.00
 RCP Type B: 6.00

(*) Warning: Grade is steeper than allowable. If value is parantheses, design parameters have been exceeded. - See user manual.

STATION	BEGIN	END	SIDE LENGTH (ft.)	RADIUS (ft.)	IN SLOPE (ft./ft.)	BACK SLOPE (ft./ft.)	AREA (acres)	AREA (acres)	CA RUNOFF COEFF. (Sum)	PROTECT TYPE	RAIN INT. (in./hr.)	FREQ. (yrs.)	COEFF. (min.)	FLOW (fps.)	DESIGN FLOW (cfs.)	DEPTH (ft.)	WIDTH (ft.)		
124+50	R	400.00	12.00	3.00	3.00	0.0538	2.27	2.27	0.70	1.59	Seed	5	0.030	17.07	3.16	0.50	5.90	0.15	12.90
										Jute Mat	3.67	5	0.040	17.47	2.63	0.59	5.83	0.18	13.06
										Temp. Mat	3.67	5	0.040	17.47	2.63	0.59	5.83	0.18	13.06
										Temp. Mat	4.31	10	0.040	17.33	2.80	0.65	6.85	0.19	13.17



DITCH ANALYSIS

PID : 77366 **Date :** 07/02/2007 **Project :** SCI-823-0.00
Description : SR823, STA. 131+50 TO STA. 129+00, RHS

Location : PORTSMOUTH, SCIOTO COUNTY
Designer : MDC

Rainfall Area : D

Allowable Shears

Permanent Mat	Seed:	Temporary Mat:
Type 1:	0.40	1.00
RCP	2.00	5.00
Type B:	6.00	
	Type 2:	
	3.00	
	Type 3:	
	3.00	

(*) Warning: Grade is steeper than allowable. If value is parantheses, design parameters have been exceeded. - See user manual.

STATION	SIDE	LENGTH	RADIUS	IN	BACK	GRADE	AREA	AREA	RUNOFF	CA	PROTECT	RAIN	STORM	MANN.	TIME	VEL.	SHEAR	DESIGN	DEPTH	WIDTH
BEGIN	END	(ft.)	(ft.)	SLOPE	SLOPE	(ft./ft.)	(acres)	SUM	COEFF.	(Sum)	TYPE	INT.	FREQ.	COEFF.	FLOW	FLOW	(lbs./	FLOW	DEPTH	WIDTH
		(ft./ft.)	(ft./ft.)			(ft./ft.)	(acres)				(in./hr.)	(in./hr.)	(yrs.)	(min.)	(min.)	(fps.)	sq.ft.)	(cfs.)	(ft.)	(ft.)
131+50	130+00	R	150.00	10.00	4.00	4.00	0.0167	0.63	0.70	0.44	Seed	3.75	5	0.030	16.72	1.43	0.12	1.65	0.11	10.89
130+00	129+50	R	50.00	10.00	4.00	0.0900	2.02	2.65	0.87	2.20	Seed	4.36	10	0.040	16.94	1.27	0.15	1.92	0.14	11.15
											Seed	3.73	5	0.030	16.91	4.42	0.97	8.19	0.17	11.39
											Jute Mat	3.72	5	0.040	16.95	3.68	1.15	8.18	0.21	11.64
											Temp. Mat	3.72	5	0.040	16.95	3.68	1.15	8.18	0.21	11.64
											Perm, Type 1	3.72	5	0.040	16.95	3.68	1.15	8.18	0.21	11.64
											Perm, Type 1	4.33	10	0.040	17.15	3.89	1.26	9.52	0.22	11.80
											Seed	3.70	5	0.030	17.15	6.12	2.05	10.59	0.11	15.90
											Jute Mat	3.70	5	0.040	17.19	5.12	2.44	10.58	0.13	16.06
											Temp. Mat	3.70	5	0.040	17.19	5.12	2.44	10.58	0.13	16.06
											Perm, Type 1	3.70	5	0.040	17.19	5.12	2.44	10.58	0.13	16.06
											Perm, Type 2	3.70	5	0.040	17.19	5.12	2.44	10.58	0.13	16.06
											Perm, Type 2	4.31	10	0.040	17.38	5.43	2.67	12.32	0.15	16.17



DITCH ANALYSIS

PID : 77366 Date : 07/02/2007 Project : SCI-823-0.00
Description : SR823, STA. 166+00 TO STA. 140+00, RHS

Location : PORTSMOUTH, SCIOTO COUNTY

Designer : MDC

Rainfall Area : D

Allowable Shears

Seed: 0.40
Permanent Mat Type 1: 2.00
RCP Type B: 6.00
Temporary Mat: 1.00
Type 2: 3.00
Type 3: 5.00
Jute Mat: 0.45

(*) Warning: Grade is steeper than allowable.

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

STATION BEGIN END	SIDE LENGTH (ft.)	RADIUS (ft.)	IN SLOPE (ft./ft.)	BACK SLOPE (ft./ft.)	AREA (acres)	AREA (acres)	CA SUM	PROTECT TYPE	RAIN INT. (in./hr.)	STORM FREQ. (yrs.)	MANN. COEFF. (min.)	TIME (min.)	VEL. FLOW (fps.)	SHEAR FLOW (lbs./sq.ft.)	DESIGN FLOW (cfs.)	DEPTH (ft.)	WIDTH FLOW (ft.)			
166+00	R	500.00	10.00	3.00	0.50	0.0150	2.14	2.14	0.74	1.58	Seed	3.57	5	0.030	18.56	2.26	0.22	5.64	0.24	10.84
161+00	R	600.00	10.00	3.00	0.50	0.0363	2.62	4.76	0.78	3.63	Seed	4.12	10	0.040	19.02	1.99	0.29	6.52	0.31	11.09
155+00	R	500.00	10.00	3.00	0.50	0.0498	3.01	7.77	0.76	5.91	Seed	3.35	5	0.030	21.02	3.97	0.66	12.16	0.29	11.02
150+00	R	500.00	10.00	3.00	0.50	0.0498	3.01	7.77	0.76	5.91	Jute Mat	3.31	5	0.040	21.51	3.30	0.78	12.02	0.34	11.20
											Temp. Mat	3.31	5	0.040	21.51	3.30	0.78	12.02	0.34	11.20
											Temp. Mat	3.85	10	0.040	21.82	3.48	0.85	13.96	0.38	11.32
											Seed	3.19	5	0.030	23.11	5.16	1.07	18.86	0.34	11.21
											Jute Mat	3.17	5	0.040	23.42	4.29	1.27	18.73	0.41	11.43
											Temp. Mat	3.17	5	0.040	23.42	4.29	1.27	18.73	0.41	11.43
											Perm, Type 1	3.17	5	0.040	23.42	4.29	1.27	18.73	0.41	11.43
											Perm, Type 1	3.69	10	0.040	23.63	4.53	1.39	21.81	0.45	11.56
											Seed	3.08	5	0.030	24.59	5.66	1.25	24.20	0.40	11.40
											Jute Mat	3.07	5	0.040	24.83	4.70	1.48	24.07	0.47	11.65



DITCH ANALYSIS

STATION BEGIN END	SIDE LENGTH (ft.)	RADIUS (ft.)	IN WIDTH (ft.)	SLOPE SLOPE (ft./ft.)	BACK GRADE (ft./ft.)	AREA SUM (acres)	AREA SUM (acres)	RUNOFF COEFF. (Sum)	CA	PROTECT TYPE	RAIN INT. (in./hr.)	STORM FREQ. (yrs.)	MANN. COEFF.	TIME FLOW (min.)	VEL. FLOW (fps.)	SHEAR FLOW (lbs./sq.ft.)	DESIGN FLOW (cfs.)	DEPTH FLOW (ft.)	WIDTH FLOW (ft.)
143+00	R	300.00	10.00	3.00	0.50	0.0500	1.17	11.48	0.80	8.78	3.01	5	0.040	24.83	4.70	1.48	24.07	0.47	11.65
										Temp. Mat	3.07	5	0.040	24.83	4.70	1.48	24.07	0.47	11.65
										Perm, Type 1	3.07	5	0.040	24.83	4.70	1.48	24.07	0.47	11.65
146+00	R	300.00	10.00	3.00	0.50	0.0500	1.17	11.48	0.80	8.78	3.01	5	0.030	25.68	5.84	1.31	26.45	0.42	11.48
										Perm, Type 1	3.58	10	0.040	24.96	4.97	1.62	28.09	0.52	11.81
										Seed	3.01	5	0.030	25.68	5.84	1.31	26.45	0.42	11.48
										Jute Mat	3.00	5	0.040	25.85	4.86	1.56	26.35	0.50	11.75
										Temp. Mat	3.00	5	0.040	25.85	4.86	1.56	26.35	0.50	11.75
143+00	R	100.00	10.00	4.00	2.00	0.0760	4.36	15.84	0.70	11.83	2.99	5	0.040	25.85	4.86	1.56	26.35	0.50	11.75
										Perm, Type 1	3.00	5	0.040	25.85	4.86	1.56	26.35	0.50	11.75
										Perm, Type 1	3.51	10	0.040	25.92	5.13	1.71	30.79	0.55	11.92
										Seed	2.99	5	0.030	26.08	7.21	2.06	35.33	0.43	12.60
142+00	R	100.00	15.00	4.00	2.00	0.1800*	12.37	28.21	0.89	22.84	2.97	5	0.040	26.13	5.97	2.43	35.30	0.51	13.07
										Jute Mat	2.98	5	0.040	26.13	5.97	2.43	35.30	0.51	13.07
										Temp. Mat	2.98	5	0.040	26.13	5.97	2.43	35.30	0.51	13.07
										Perm, Type 1	2.98	5	0.040	26.13	5.97	2.43	35.30	0.51	13.07
										Perm, Type 2	2.98	5	0.040	26.13	5.97	2.43	35.30	0.51	13.07
142+00	R	100.00	15.00	4.00	2.00	0.1800*	12.37	28.21	0.89	22.84	2.97	5	0.040	26.19	6.30	2.66	41.25	0.56	13.36
										Perm, Type 2	3.49	10	0.040	26.19	6.30	2.66	41.25	0.56	13.36
										Seed	2.97	5	0.030	26.28	10.69	4.41	67.89	0.39	17.36
										Jute Mat	2.97	5	0.040	26.31	8.90	5.22	67.85	0.46	17.79
										Temp. Mat	2.97	5	0.040	26.31	8.90	5.22	67.85	0.46	17.79
141+00	R	100.00	15.00	4.00	2.00	0.1800*	12.37	28.21	0.89	22.84	2.97	5	0.040	26.31	8.90	5.22	67.85	0.46	17.79
										Perm, Type 1	2.97	5	0.040	26.31	8.90	5.22	67.85	0.46	17.79
										Perm, Type 2	2.97	5	0.040	26.31	8.90	5.22	67.85	0.46	17.79
										Perm, Type 3	2.97	5	0.040	26.31	8.90	5.22	67.85	0.46	17.79



DITCH ANALYSIS

STATION BEGIN	END	SIDE LENGTH (ft.)	RADIUS (ft.)	IN SLOPE	BACK SLOPE	GRADE (ft./ft.)	AREA (acres)	AREA SUM	RUNOFF COEFF. (Sum)	CA	PROTECT TYPE	RAIN INT. (in./hr.)	STORM FREQ. (yrs.)	MANN. COEFF.	TIME FLOW (min.)	VEL. FLOW (fps.)	SHEAR FLOW (lbs./ sq.ft.)	DESIGN FLOW (cfs.)	DEPTH FLOW (ft.)	WIDTH FLOW (ft.)
												2.97	5	0.060	26.37	6.86		67.77	0.59	18.54



DITCH ANALYSIS

PID : 77366 **Date :** 07/02/2007 **Project :** SCI-823-0.00
Description : SR823, STA. 166+00 TO STA. 168+50, RHS

Location : PORTSMOUTH, SCIOTO COUNTY

Designer : MDC

Rainfall Area : D

Allowable Shears

Jute Mat: 0.45 **Temporary Mat:** 1.00
Type 2: 3.00 **Type 3:** 5.00

Seed: 0.40
Permanent Mat Type 1: 2.00
RCP Type 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 (ft.)	IN SLOPE (ft./ft.)	BACK SLOPE (ft./ft.)	GRADE (ft./ft.)	AREA (acres)	AREA SUM (acres)	RUNOFF COEFF. (Sum)	CA TYPE	PROTECT TYPE	RAIN INT. (in./hr.)	STORM FREQ. (yrs.)	MANN. COEFF.	TIME (min.)	VEL. FLOW (fps.)	SHEAR (lbs./sq.ft.)	DESIGN FLOW (cfs.)	DEPTH (ft.)	WIDTH (ft.)
166+00	166+50	R	50.00	10.00	3.00	0.50	0.2240*	0.29	0.73	0.21	Seed	3.89	5	0.030	15.34	2.40	0.47	0.81	0.03	10.12
											Jute Mat	3.89	5	0.040	15.41	2.03	0.55	0.81	0.04	10.14
											Temp. Mat	3.89	5	0.040	15.41	2.03	0.55	0.81	0.04	10.14
											Temp. Mat	4.55	10	0.040	15.38	2.15	0.61	0.95	0.04	10.15
											Seed	3.83	5	0.030	15.96	9.05	3.55	27.67	0.28	11.69
											Jute Mat	3.82	5	0.040	16.07	7.52	4.20	27.58	0.33	12.00
											Temp. Mat	3.82	5	0.040	16.07	7.52	4.20	27.58	0.33	12.00
											Perm, Type 1	3.82	5	0.040	16.07	7.52	4.20	27.58	0.33	12.00
											Perm, Type 2	3.82	5	0.040	16.07	7.52	4.20	27.58	0.33	12.00
											Perm, Type 3	3.82	5	0.040	16.07	7.52	4.20	27.58	0.33	12.00
											Perm, Type 3	4.47	10	0.040	16.01	7.96	4.61	32.34	0.37	12.20



DITCH ANALYSIS

PID : 77366 **Date :** 07/02/2007 **Project :** SCI-823-0.00
Description : SR823, STA. 169+50 TO STA. 173+00, RHS

Location : PORTSMOUTH, SCIOTO COUNTY
Designer : MDC

Rainfall Area : D

Seed: 0.40	Allowable Shears	
Permanent Mat Type 1: 2.00	Jute Mat: 0.45	Temporary Mat: 1.00
RCP Type B: 6.00	Type 2: 3.00	Type 3: 5.00

(* Warning: Grade is steeper than allowable. If value is parantheses, design parameters have been exceeded. - See user manual.

STATION	SIDE LENGTH	RADIUS	IN	BACK	GRADE	AREA	AREA	RUNOFF	CA	PROTECT	RAIN	STORM	MANN.	TIME	VEL.	SHEAR	DESIGN	DEPTH	WIDTH		
BEGIN	END	(ft.)	WIDTH	SLOPE	SLOPE	(ft./ft.)	(acres)	SUM	COEFF.	(Sum)	TYPE	INT.	FREQ.	COEFF.	FLOW	FLOW	(lbs./	FLOW	FLOW		
		(ft./ft.)	(ft./ft.)	(ft./ft.)	(ft./ft.)	(ft./ft.)	(acres)				(in./hr.)	(min.)	(min.)	(min.)	(fps.)	sq.ft.)	(cfs.)	(ft.)	(ft.)		
169+50	173+00	R	350.00	10.00	3.00	0.50	0.0114	0.78	0.78	0.74	0.58	Seed	3.53	5	0.030	18.98	1.41	0.10	2.03	0.14	10.49
												Seed	4.08	10	0.040	19.48	1.25	0.13	2.35	0.18	10.64



DITCH ANALYSIS

PID : 77366 Date : 07/02/2007 Project : SCI-823-0.00
 Description : SR823, STA. 179+00 TO STA. 177+00, RHS

Location : PORTSMOUTH, SCIOTO COUNTY

Designer : MDC

Rainfall Area : D

Allowable Shears
 Jute Mat: 0.45 Temporary Mat: 1.00
 Type 2: 3.00 Type 3: 5.00
 Seed: 0.40
 Permanent Mat Type 1: 2.00
 RCP Type B: 6.00

(* Warning: Grade is steeper than allowable. If value is parantheses, design parameters have been exceeded. - See user manual.

STATION	SIDE LENGTH	RADIUS	IN	BACK	GRADE	AREA	AREA	AREA	RUNOFF	CA	PROTECT	RAIN	STORM	MANN.	TIME	VEL.	SHEAR	DESIGN	DEPTH	WIDTH	
BEGIN	END	(ft.)	SLOPE	SLOPE	(ft./ft.)	(acres)	SUM	COEFF.	(Sum)	TYPE	INT.	FREQ.	COEFF.	FLOW	FLOW	(lbs./	FLOW	DESIGN	FLOW	FLOW	
		(ft./ft.)	(ft./ft.)	(ft./ft.)	(ft./ft.)	(acres)					(in./hr.)	(yrs.)	(min.)	(fps.)	(cfs.)	sq.ft.)	(cfs.)	(ft.)	(ft.)	(ft.)	(ft.)
179+00	177+00	R	200.00	10.00	4.00	2.00	0.1975*	2.36	2.36	0.70	1.65	Seed	3.86	5	0.030	15.64	5.18	1.46	6.37	0.12	10.71
												Jute Mat	3.85	5	0.040	15.76	4.33	1.73	6.35	0.14	10.84
												Temp. Mat	3.85	5	0.040	15.76	4.33	1.73	6.35	0.14	10.84
												Perm, Type 1	3.85	5	0.040	15.76	4.33	1.73	6.35	0.14	10.84
												Perm, Type 1	4.51	10	0.040	15.72	4.61	1.90	7.44	0.15	10.93



DITCH ANALYSIS

PID : 77366 Date : 07/02/2007 Project : SCI-823-0.00
 Description : SR823, STA. 179+00 TO STA. 182+00, RHS

Location : PORTSMOUTH, SCIOTO COUNTY

Designer : MDC

Rainfall Area : D

Seed: 0.40
 Permanent Mat Type 1: 2.00
 RCP Type B: 6.00
 Allowable Shears
 Jute Mat: 0.45
 Type 2: 3.00
 Temporary Mat: 1.00
 Type 3: 5.00

(*) Warning: Grade is steeper than allowable. If value is parantheses, design parameters have been exceeded. - See user manual.

STATION	SIDE LENGTH	RADIUS	IN	BACK	GRADE	AREA	AREA	RUNOFF	CA	PROTECT	RAIN	STORM	MANN.	TIME	VEL.	SHEAR	DESIGN	DEPTH	WIDTH		
BEGIN	END	(ft.)	WIDTH	SLOPE	(ft./ft.)	(acres)	SUM	COEFF.	(Sum)	TYPE	INT.	FREQ.	COEFF.	FLOW	FLOW	(lbs./	FLOW	FLOW	FLOW		
		(ft./ft.)	(ft./ft.)	(ft./ft.)		(acres)				(in./hr.)	(yrs.)	(min.)	(fps.)	(cfs.)	(ft.)	(ft.)	(ft.)	(ft.)	(ft.)		
179+00	182+00	R	300.00	10.00	3.00	2.00	0.1150*	3.45	3.45	0.70	2.41	Seed	3.82	5	0.030	15.98	5.07	1.25	9.22	0.17	10.87
										Jute Mat	3.80	5	0.040	16.17	4.23	1.48	9.17	0.21	11.03		
										Temp. Mat	3.80	5	0.040	16.17	4.23	1.48	9.17	0.21	11.03		
										Perm, Type 1	3.80	5	0.040	16.17	4.23	1.48	9.17	0.21	11.03		
										Perm, Type 1	4.46	10	0.040	16.10	4.49	1.63	10.76	0.23	11.13		



DITCH ANALYSIS

PID : 77366 Date : 07/02/2007 Project : SCI-823-0.00 Location : PORTSMOUTH, SCIOTO COUNTY Designer : MDC
 Description : SR823, STA. 207+00 TO STA. 182+00, RHS

Rainfall Area : D

Allowable Shears
 Seed: 0.40
 Permanent Mat Type 1: 2.00 Temporary Mat: 1.00
 RCP Type B: 6.00 Type 2: 3.00 Type 3: 5.00

(*) 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 (ft.)	IN SLOPE (ft./ft.)	BACK SLOPE (ft./ft.)	GRADE (ft./ft.)	AREA (acres)	CA RUNOFF COEFF. (Sum)	PROTECT TYPE	RAIN INT. (in./hr.)	STORM FREQ. (yrs.)	MANN. COEFF. (min.)	TIME FLOW (fps.)	VEL. FLOW (cfs.)	SHEAR DESIGN FLOW (cfs.)	DEPTH FLOW (ft.)	WIDTH FLOW (ft.)			
207+00	186+50	R	2050.0	10.00	3.00	1.00	0.0337	20.50	0.71	14.56	Seed	3.43	5	0.030	20.08	6.41	1.44	49.95	0.68	12.74
											Jute Mat	3.34	5	0.040	21.15	5.26	1.68	48.65	0.80	13.19
											Temp. Mat	3.34	5	0.040	21.15	5.26	1.68	48.65	0.80	13.19
											Perm, Type 1	3.34	5	0.040	21.15	5.26	1.68	48.65	0.80	13.19
											Perm, Type 1	3.94	10	0.040	20.84	5.56	1.84	57.36	0.88	13.51
											Seed	3.31	5	0.030	21.53	6.69	1.55	51.60	0.68	12.72
											Jute Mat	3.31	5	0.040	21.60	5.53	1.84	51.50	0.80	13.21
											Temp. Mat	3.31	5	0.040	21.60	5.53	1.84	51.50	0.80	13.21
											Perm, Type 1	3.31	5	0.040	21.60	5.53	1.84	51.50	0.80	13.21
											Perm, Type 1	3.90	10	0.040	21.26	5.85	2.02	60.75	0.88	13.53
185+00											3.29	5	0.030	21.80	12.56		53.73	0.40	11.59	



DITCH ANALYSIS

PID : 77366 Date : 07/02/2007 Project : SCI-823-0.00 Location : PORTSMOUTH, SCIOTO COUNTY Designer : MDC
 Description : SR823, STA. 207+00 TO STA. 210+00, RHS

Rainfall Area : D

Allowable Shears
 Jute Mat: 0.45 Temporary Mat: 1.00
 Type 2: 3.00 Type 3: 5.00
 Seed: 0.40
 Permanent Mat Type 1: 2.00
 RCP Type B: 6.00

(*) Warning: Grade is steeper than allowable. If value is parantheses, design parameters have been exceeded. - See user manual.

STATION	SIDE LENGTH	RADIUS	IN	BACK	GRADE	AREA	AREA	RUNOFF	CA	PROTECT	RAIN	STORM	MANN.	TIME	VEL.	SHEAR	DESIGN	DEPTH	WIDTH		
BEGIN	END	(ft.)	WIDTH	SLOPE	SLOPE	(ft./ft.)	(acres)	SUM	COEFF.	(Sum)	TYPE	INT.	FREQ.	COEFF.	FLOW	FLOW	(lbs./	FLOW	FLOW		
		(ft./ft.)	(ft./ft.)	(ft./ft.)	(ft./ft.)	(ft./ft.)	(acres)				(in./hr.)	(yrs.)	(min.)	(min.)	(fps.)	sq.ft.)	(cfs.)	(ft.)	(ft.)		
207+00	209+00	R	200.00	10.00	3.00	3.00	0.2905*	3.03	0.70	2.12	Seed	3.87	5	0.030	15.52	6.44	2.23	8.21	0.12	10.74	
											Jute Mat	3.86	5	0.040	15.62	5.38	2.64	8.19	0.15	10.88	
											Temp. Mat	3.86	5	0.040	15.62	5.38	2.64	8.19	0.15	10.88	
											Perm, Type 1	3.86	5	0.040	15.62	5.38	2.64	8.19	0.15	10.88	
											Perm, Type 2	3.86	5	0.040	15.62	5.38	2.64	8.19	0.15	10.88	
											Perm, Type 2	4.53	10	0.040	15.58	5.71	2.91	9.60	0.16	10.96	
209+00	210+00	R	100.00	15.00	3.00	4.00	0.1970*	1.19	4.22	0.80	3.07	Seed	3.83	5	0.030	15.91	5.65	1.65	11.77	0.13	15.94
											Jute Mat	3.83	5	0.040	15.97	4.73	1.96	11.75	0.16	16.12	
											Temp. Mat	3.83	5	0.040	15.97	4.73	1.96	11.75	0.16	16.12	
											Perm, Type 1	3.83	5	0.040	15.97	4.73	1.96	11.75	0.16	16.12	
											Perm, Type 1	4.49	10	0.040	15.91	5.03	2.16	13.78	0.18	16.23	



DITCH ANALYSIS

PID : 77366 **Date :** 07/02/2007 **Project :** SCI-823-0.00
Description : SR823, STA. 229+00 TO STA. 210+50, RHS

Location : PORTSMOUTH, SCIOTO COUNTY
Designer : MDC

Rainfall Area : D

Allowable Shears

Permanent Mat	Seed:	0.40
Type 1:	Permanent Mat:	1.00
RCP	Type 2:	3.00
Type B:	Type 3:	5.00
		6.00

(*) Warning: Grade is steeper than allowable. If value is parantheses, design parameters have been exceeded. - See user manual.

STATION	SIDE	LENGTH	RADIUS	IN	BACK	GRADE	AREA	AREA	AREA	RUNOFF	CA	PROTECT	RAIN	STORM	MANN.	TIME	VEL.	SHEAR	DESIGN	DEPTH	WIDTH	
BEGIN	END	(ft.)	WIDTH	SLOPE	SLOPE	(ft./ft.)	(acres)	SUM	COEFF.	(Sum)	TYPE	TYPE	INT.	FREQ.	COEFF.	FLOW	FLOW	(lbs./	FLOW	FLOW	FLOW	
		(ft.)	(ft./ft.)	(ft./ft.)	(ft./ft.)	(ft./ft.)	(acres)	(acres)				(in./hr.)	(yrs.)	(min.)	(fps.)	(sq.ft.)	(cfs.)	(ft.)	(ft.)	(ft.)	(ft.)	(ft.)
229+00	212+50	R	1650.0	10.00	3.00	0.50	0.0300	4.52	4.52	0.74	3.34	Seed	3.26	5	0.030	22.15	3.59	0.54	10.91	0.29	11.01	
												Jute Mat	3.16	5	0.040	23.57	2.96	0.63	10.56	0.34	11.18	
												Temp. Mat	3.16	5	0.040	23.57	2.96	0.63	10.56	0.34	11.18	
												Temp. Mat	3.73	10	0.040	23.09	3.15	0.70	12.49	0.37	11.30	
212+50	210+50	R	325.00	12.00	2.00	3.00	0.2920*	1.13	5.64	0.71	4.14	Seed	3.10	5	0.030	24.32	7.21	2.63	12.86	0.14	12.72	
												Jute Mat	3.09	5	0.040	24.46	6.03	3.12	12.82	0.17	12.86	
												Temp. Mat	3.09	5	0.040	24.46	6.03	3.12	12.82	0.17	12.86	
												Perm, Type 1	3.09	5	0.040	24.46	6.03	3.12	12.82	0.17	12.86	
												Perm, Type 2	3.09	5	0.040	24.46	6.03	3.12	12.82	0.17	12.86	
												Perm, Type 3	3.09	5	0.040	24.46	6.03	3.12	12.82	0.17	12.86	
												Perm, Type 3	3.66	10	0.040	23.93	6.43	3.45	15.18	0.19	12.95	



DITCH ANALYSIS

PID : 77366 Date : 07/02/2007 Project : SCI-823-0.00
 Description : SR823, STA. 258+00 TO STA. 239+00, RHS

Location : PORTSMOUTH, SCIOTO COUNTY
 Designer : MDC

Rainfall Area : D

Allowable Shears
 Jute Mat: 0.45 Temporary Mat: 1.00
 Type 2: 3.00 Type 3: 5.00
 Seed: 0.40
 Permanent Mat Type 1: 2.00
 RCP Type B: 6.00

(*) Warning: Grade is steeper than allowable. If value is parantheses, design parameters have been exceeded. - See user manual.

STATION	SIDE	LENGTH	RADIUS	IN	BACK	GRADE	AREA	AREA	RUNOFF	CA	PROTECT	RAIN	STORM	MANN.	TIME	VEL.	SHEAR	DESIGN	DEPTH	WIDTH	
BEGIN	END	(ft.)	(ft.)	SLOPE	SLOPE	(ft./ft.)	(acres)	SUM	COEFF.	(Sum)	TYPE	INT.	FREQ.	COEFF.	FLOW	FLOW	(lbs./	FLOW	DEPTH	WIDTH	
		(ft./ft.)	(ft./ft.)	(ft./ft.)	(ft./ft.)		(acres)					(in./hr.)	(yrs.)	(min.)	(fps.)	(cfs.)	sq.ft.)	(ft.)	(ft.)	(ft.)	
258+00	244+50	R	1350.0	10.00	5.00	3.00	0.0389	10.90	0.72	7.85	Seed	3.51	5	0.030	19.18	5.19	1.09	27.55	0.45	13.60	
											Jute Mat	3.43	5	0.040	20.06	4.25	1.27	26.94	0.52	14.19	
											Temp. Mat	3.43	5	0.040	20.06	4.25	1.27	26.94	0.52	14.19	
											Perm, Type 1	3.43	5	0.040	20.06	4.25	1.27	26.94	0.52	14.19	
											Perm, Type 1	4.04	10	0.040	19.81	4.49	1.39	31.72	0.57	14.60	
244+50	239+00	R	550.00	12.00	4.00	4.00	0.3164*	5.56	0.71	11.80	Seed	3.36	5	0.030	20.88	11.09	5.40	39.69	0.27	14.19	
											Seed	3.35	5	0.040	21.05	9.21	39.53	0.32	14.58		



DITCH ANALYSIS

PID : 77366 Date : 07/02/2007 Project : SCI-823-0.00
 Description : SR823, STA. 264+00 TO STA. 271+50, RHS

Location : PORTSMOUTH, SCIOTO COUNTY

Designer : MDC

Rainfall Area : D

Allowable Shears
 Seed: 0.40
 Permanent Mat Type 1: 2.00
 RCP Type B: 6.00
 Jute Mat: 0.45
 Type 2: 3.00
 Temporary Mat: 1.00
 Type 3: 5.00

(*) Warning: Grade is steeper than allowable. If value is in parentheses, design parameters have been exceeded. - See user manual.

STATION	SIDE	LENGTH	RADIUS	IN	BACK	GRADE	AREA	AREA	RUNOFF	CA	PROTECT	RAIN	STORM	MANN.	TIME	VEL.	SHEAR	DESIGN	DEPTH	WIDTH	
BEGIN	END	(ft.)	WIDTH	SLOPE	SLOPE	(ft./ft.)	(acres)	SUM	COEFF.	(Sum)	TYPE	INT.	FREQ.	COEFF.	FLOW	FLOW	(lbs./	FLOW	FLOW	FLOW	
			(ft.)	(ft./ft.)	(ft./ft.)		(acres)				(in./hr.)	(yrs.)	(min.)	(min.)	(fps.)	(cfs.)	sq.ft.)	(cfs.)	(ft.)	(ft.)	
264+00	268+50	R	450.00	10.00	3.00	1.00	0.0231	1.12	1.12	0.77	0.86	Seed	3.57	5	0.030	18.55	2.04	0.21	3.07	0.15	10.59
268+50	270+50	R	200.00	10.00	4.00	4.00	0.1475*	1.18	2.30	0.73	1.72	Seed	4.13	10	0.040	18.99	1.81	0.27	3.55	0.19	10.76
												Jute Mat	3.49	5	0.040	19.41	3.84	1.36	6.02	0.15	11.18
												Temp. Mat	3.49	5	0.040	19.41	3.84	1.36	6.02	0.15	11.18
												Perm, Type 1	3.49	5	0.040	19.41	3.84	1.36	6.02	0.15	11.18
												Perm, Type 1	4.04	10	0.040	19.80	4.05	1.49	6.97	0.16	11.29
270+50	271+50	R	100.00	10.00	3.00	4.00	0.3700*	0.75	3.05	0.72	2.26	Seed	3.47	5	0.030	19.65	6.79	2.57	7.85	0.11	10.78
												Jute Mat	3.46	5	0.040	19.70	5.68	3.05	7.84	0.13	10.92
												Temp. Mat	3.46	5	0.040	19.70	5.68	3.05	7.84	0.13	10.92
												Perm, Type 1	3.46	5	0.040	19.70	5.68	3.05	7.84	0.13	10.92
												Perm, Type 2	3.46	5	0.040	19.70	5.68	3.05	7.84	0.13	10.92
												Perm, Type 3	3.46	5	0.040	19.70	5.68	3.05	7.84	0.13	10.92



DITCH ANALYSIS

PID : 77366 **Date :** 07/02/2007 **Project :** SCI-823-0.00
Description : SR823, STA. 274+00 TO STA. 301+50, RHS

Location : PORTSMOUTH, SCIOTO COUNTY

Designer : MDC

Rainfall Area : D

Allowable Shears

Seed:	0.40	Temporary Mat:	1.00
Permanent Mat Type 1:	2.00	Type 3:	5.00
RCP Type B:	6.00		

(*) Warning: Grade is steeper than allowable.

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

STATION BEGIN END	SIDE LENGTH (ft.)	RADIUS (ft.)	IN SLOPE	BACK SLOPE	GRADE (ft./ft.)	AREA (acres)	AREA SUM (acres)	CA COEFF.	PROTECT TYPE	RAIN INT. (in./hr.)	STORM FREQ. (yrs.)	MANN. FLOW (cfs.)	TIME FLOW (min.)	VEL. FLOW (fps.)	SHEAR sq.ft. (sq.ft.)	DESIGN FLOW (cfs.)	DEPTH FLOW (ft.)	WIDTH FLOW (ft.)
274+00	R	900.00	10.00	3.00	0.50	0.0230	2.83	0.75	2.12	Seed	5	0.030	20.02	2.84	0.35	7.30	0.25	10.86
283+00	R	700.00	10.00	3.00	0.50	0.0226	4.14	0.78	5.35	Seed	10	0.040	20.67	2.50	0.46	8.40	0.32	11.11
290+00	R	100.00	10.00	3.00	3.00	0.2740*	1.68	0.71	6.55	Seed	5	0.030	23.73	8.95	3.70	20.59	0.22	11.30
							8.65			Jute Mat	5	0.040	23.55	3.21	0.68	16.90	0.49	11.70
										Temp. Mat	5	0.040	23.55	3.21	0.68	16.90	0.49	11.70
										Temp. Mat	10	0.040	24.03	3.38	0.75	19.56	0.53	11.85
290+00	R	100.00	10.00	3.00	3.00	0.2740*	1.68	0.71	6.55	Seed	5	0.030	23.73	8.95	3.70	20.59	0.22	11.30
							8.65			Jute Mat	5	0.040	23.77	7.45	4.38	20.58	0.26	11.54
										Temp. Mat	5	0.040	23.77	7.45	4.38	20.58	0.26	11.54
										Perm, Type 1	5	0.040	23.77	7.45	4.38	20.58	0.26	11.54
										Perm, Type 2	5	0.040	23.77	7.45	4.38	20.58	0.26	11.54
										Perm, Type 3	5	0.040	23.77	7.45	4.38	20.58	0.26	11.54
										Perm, Type 3	10	0.040	24.24	7.87	4.78	23.82	0.28	11.68



DITCH ANALYSIS

STATION BEGIN	END	SIDE LENGTH (ft.)	RADIUS (ft.)	IN SLOPE (ft./ft.)	BACK SLOPE (ft./ft.)	AREA (acres)	AREA SUM (acres)	CA RUNOFF COEFF. (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.)			
291+00	293+00	R	200.00	10.00	4.00	2.00	0.0550	3.70	12.35	0.71	9.17	Seed	3.10	5	0.030	24.32	6.02	1.44	28.47	0.42	12.52
									Jute Mat	3.10	5	0.040	24.43	4.99	1.70	28.40	0.50	12.97			
									Temp. Mat	3.10	5	0.040	24.43	4.99	1.70	28.40	0.50	12.97			
									Perm, Type 1	3.10	5	0.040	24.43	4.99	1.70	28.40	0.50	12.97			
									Perm, Type 1	3.59	10	0.040	24.87	5.24	1.85	32.91	0.54	13.24			
293+00	297+00	R	400.00	10.00	3.00	2.00	0.0200	5.84	18.19	0.74	13.49	Seed	3.01	5	0.030	25.77	4.95	0.87	40.56	0.70	13.49
									Jute Mat	2.99	5	0.040	26.05	4.08	1.02	40.31	0.82	14.10			
									Temp. Mat	2.99	5	0.040	26.05	4.08	1.02	40.31	0.82	14.10			
									Perm, Type 1	2.99	5	0.040	26.05	4.08	1.02	40.31	0.82	14.10			
									Perm, Type 1	3.47	10	0.040	26.41	4.29	1.11	46.82	0.89	14.46			
297+00	299+50	R	250.00	10.00	4.00	2.00	0.2080*	3.87	22.06	0.71	16.24	Seed	2.96	5	0.030	26.42	11.15	5.02	48.13	0.39	12.32
									Jute Mat	2.96	5	0.040	26.50	9.24	5.93	48.05	0.46	12.74			
									Temp. Mat	2.96	5	0.040	26.50	9.24	5.93	48.05	0.46	12.74			
									Perm, Type 1	2.96	5	0.040	26.50	9.24	5.93	48.05	0.46	12.74			
									Perm, Type 2	2.96	5	0.040	26.50	9.24	5.93	48.05	0.46	12.74			
									Perm, Type 3	2.96	5	0.040	26.50	9.24	5.93	48.05	0.46	12.74			
										2.95	5	0.060	26.64	7.07		47.91	0.58	13.46			



DITCH ANALYSIS

PID : 77366 Date : 07/02/2007 Project : SCI-823-0.00
 Description : SR823, STA. 314+50 TO STA. 311+00, RHS

Location : PORTSMOUTH, SCIOTO COUNTY

Designer : MDC

Rainfall Area : D

Allowable Shears
 Jute Mat: 0.45 Temporary Mat: 1.00
 Type 2: 3.00 Type 3: 5.00
 Seed: 0.40
 Permanent Mat Type 1: 2.00
 RCP Type B: 6.00

(*) Warning: Grade is steeper than allowable. If value is parantheses, design parameters have been exceeded. - See user manual.

STATION	SIDE LENGTH	RADIUS	IN	BACK	GRADE	AREA	AREA	RUNOFF	CA	PROTECT	RAIN	STORM	MANN.	TIME	VEL.	SHEAR	DESIGN	DEPTH	WIDTH		
BEGIN	END	(ft.)	WIDTH	SLOPE	SLOPE	(ft./ft.)	(acres)	SUM	COEFF.	(Sum)	TYPE	INT.	FREQ.	COEFF.	FLOW	FLOW	(lbs./	FLOW	FLOW		
		(ft./ft.)	(ft./ft.)	(ft./ft.)	(ft./ft.)	(ft./ft.)	(acres)				(in./hr.)	(yrs.)	(min.)	(fps.)	(cfs.)	sq.ft.)	(cfs.)	(ft.)	(ft.)		
314+50	313+00	R	260.00	10.00	4.00	2.00	0.1500*	1.77	1.77	0.71	1.26	Seed	3.82	5	0.030	16.00	4.27	1.02	4.80	0.11	10.65
												Jute Mat	3.80	5	0.040	16.20	3.57	1.20	4.77	0.13	10.77
												Temp. Mat	3.80	5	0.040	16.20	3.57	1.20	4.77	0.13	10.77
												Perm, Type 1	3.80	5	0.040	16.20	3.57	1.20	4.77	0.13	10.77
												Perm, Type 1	4.46	10	0.040	16.13	3.79	1.33	5.60	0.14	10.85
												Seed	3.76	5	0.030	16.64	9.05	4.21	13.66	0.14	10.87
												Jute Mat	3.75	5	0.040	16.72	7.56	4.99	13.63	0.17	11.03
												Temp. Mat	3.75	5	0.040	16.72	7.56	4.99	13.63	0.17	11.03
												Perm, Type 1	3.75	5	0.040	16.72	7.56	4.99	13.63	0.17	11.03
												Perm, Type 2	3.75	5	0.040	16.72	7.56	4.99	13.63	0.17	11.03
												Perm, Type 3	3.75	5	0.040	16.72	7.56	4.99	13.63	0.17	11.03
												Perm, Type 3	4.40	10	0.040	16.63	8.03	5.49	15.99	0.19	11.13



DITCH ANALYSIS

PID : 77366 **Date :** 07/02/2007 **Project :** SCI-823-0.00 **Location :** PORTSMOUTH, SCIOTO COUNTY
Description : SR823, STA. 314+50 TO STA. 322+00, RHS **Designer :** MDC

Rainfall Area : D

Allowable Shears

Seed:	0.40	Temporary Mat:	1.00
Permanent Mat	Type 1: 2.00	Type 2:	3.00
RCP	Type B: 6.00	Type 3:	5.00

(*) Warning: Grade is steeper than allowable. If value is parantheses, design parameters have been exceeded. - See user manual.

STATION	END	SIDE LENGTH (ft.)	RADIUS (ft.)	IN SLOPE (ft./ft.)	BACK SLOPE (ft./ft.)	GRADE (ft./ft.)	AREA (acres)	CA COEFF. (Sum)	PROTECT TYPE	RAIN INT. (in./hr.)	STORM MANN. FREQ. (yrs.)	COEFF. (min.)	FLOW (cfs.)	VEL. (fps.)	SHEAR (lbs./sq.ft.)	DESIGN DEPTH (ft.)	WIDTH (ft.)	FLOW (cfs.)	DESIGN DEPTH (ft.)		
314+50	319+00	R	450.00	10.00	4.00	2.00	0.0667	2.87	2.87	0.71	2.03	Seed	3.73	5	0.030	16.86	3.96	0.76	7.59	0.18	11.09
									Jute Mat	3.70	5	0.040	17.23	3.29	0.89	7.52	0.21	11.29			
									Temp. Mat	3.70	5	0.040	17.23	3.29	0.89	7.52	0.21	11.29			
									Temp. Mat	4.34	10	0.040	17.10	3.49	0.98	8.83	0.24	11.42			
319+00	322+00	R	300.00	10.00	2.00	2.00	0.3000*	4.71	7.57	0.75	5.56	Seed	3.64	5	0.030	17.76	9.27	3.93	20.27	0.21	10.84
									Jute Mat	3.63	5	0.040	17.87	7.74	4.65	20.21	0.25	10.99			
									Temp. Mat	3.63	5	0.040	17.87	7.74	4.65	20.21	0.25	10.99			
									Perm, Type 1	3.63	5	0.040	17.87	7.74	4.65	20.21	0.25	10.99			
									Perm, Type 2	3.63	5	0.040	17.87	7.74	4.65	20.21	0.25	10.99			
									Perm, Type 3	3.63	5	0.040	17.87	7.74	4.65	20.21	0.25	10.99			
									Perm, Type 3	4.27	10	0.040	17.70	8.23	5.12	23.75	0.27	11.09			



DITCH ANALYSIS

PID : 79977 **Date :** 07/02/2007 **Project :** SCI-823-0.00
Description : SR823, STA. 325+00 TO STA. 329+00, RHS

Location : PORTSMOUTH, SCIOTO COUNTY

Designer : mdc

Rainfall Area : D

Allowable Shears
Jute Mat: 0.45 **Temporary Mat:** 1.00
Type 2: 3.00 **Type 3:** 5.00

Seed: 0.40
Permanent Mat Type 1: 2.00
RCP Type B: 6.00

(*) Warning: Grade is steeper than allowable. If value is parantheses, design parameters have been exceeded. - See user manual.

STATION BEGIN END	SIDE LENGTH (ft.)	RADIUS (ft.)	IN SLOPE (ft./ft.)	BACK GRADE (ft./ft.)	AREA (acres)	AREA SUM (acres)	CA COEFF. (Sum)	PROTECT TYPE	RAIN INT. (in./hr.)	STORM MANN. FREQ. (yrs.)	TIME FLOW (min.)	VEL. FLOW (fps.)	SHEAR DESIGN (lbs./ sq.ft.)	DEPTH FLOW (ft.)	WIDTH FLOW (ft.)					
325+00	R	250.00	10.00	3.00	0.50	0.0180	0.46	0.46	0.73	0.34	Seed	3.61	5	0.030	18.06	1.32	0.10	1.21	0.09	10.32
327+50	R	60.00	10.00	3.00	1.00	0.2050*	1.18	1.64	0.88	1.38	Seed	4.19	10	0.040	18.42	1.17	0.13	1.41	0.12	10.41
											Seed	3.59	5	0.030	18.27	4.79	1.30	4.95	0.10	10.41
											Jute Mat	3.59	5	0.040	18.31	4.02	1.54	4.94	0.12	10.48
											Temp. Mat	3.59	5	0.040	18.31	4.02	1.54	4.94	0.12	10.48
											Perm, Type 1	3.59	5	0.040	18.31	4.02	1.54	4.94	0.12	10.48
											Perm, Type 1	4.16	10	0.040	18.65	4.26	1.68	5.73	0.13	10.53
328+00	R	50.00	10.00	3.00	2.00	0.0060	2.28	3.92	0.89	3.41	Seed	3.56	5	0.030	18.68	2.20	0.18	12.11	0.49	12.45
											Seed	4.12	10	0.040	19.09	1.92	0.24	14.03	0.63	13.16
328+50	R	60.00	15.00	3.00	3.00	0.3750*	3.37	7.29	0.89	6.40	Seed	3.55	5	0.030	18.80	8.90	3.85	22.70	0.16	15.99
											Jute Mat	3.54	5	0.040	18.82	7.45	4.57	22.69	0.20	16.17
											Temp. Mat	3.54	5	0.040	18.82	7.45	4.57	22.69	0.20	16.17
											Perm, Type 1	3.54	5	0.040	18.82	7.45	4.57	22.69	0.20	16.17



DITCH ANALYSIS

STATION BEGIN	END	SIDE LENGTH (ft.)	RADIUS (ft.)	IN SLOPE (ft./ft.)	BACK SLOPE (ft./ft.)	AREA SUM (acres)	AREA COEFF. (Sum)	CA	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.)
									Perm, Type 2	3.54	5	0.040	18.82	7.45	4.57	22.69	0.20	16.17
									Perm, Type 3	3.54	5	0.040	18.82	7.45	4.57	22.69	0.20	16.17
									Perm, Type 3	4.10	10	0.040	19.21	7.88	4.99	26.28	0.21	16.28



DITCH ANALYSIS

PID : 77366 **Date :** 07/02/2007 **Project :** SCI-823-0.00 **Location :** PORTSMOUTH, SCIOTO COUNTY
Description : SR823, STA. 330+50 TO STA. 333+50, RHS **Designer :** MDC

Rainfall Area : D **Allowable Shears**
Seed: 0.40 **Jute Mat:** 0.45 **Temporary Mat:** 1.00
Permanent Mat Type 1: 2.00 **Type 2:** 3.00 **Type 3:** 5.00
RCP Type B: 6.00

(*) Warning: Grade is steeper than allowable. If value is parantheses, design parameters have been exceeded. - See user manual.

STATION	SIDE LENGTH	RADIUS	IN	BACK	GRADE	AREA	AREA	RUNOFF	CA	PROTECT	RAIN	STORM	MANN.	TIME	VEL.	SHEAR	DESIGN	DEPTH	WIDTH		
BEGIN	END				SLOPE	(ft./ft.)	(acres)	SUM	COEFF.	(Sum)	TYPE	INT.	FREQ.	COEFF.	FLOW	FLOW	(lbs./	FLOW	FLOW		
			(ft.)	(ft./ft.)	(ft./ft.)	(ft./ft.)	(acres)	(acres)	(in./hr.)	(yrs.)	(in./hr.)	(yrs.)	(min.)	(fps.)	(cfs.)	(cfs.)	sq.ft.)	(ft.)	(ft.)		
330+50	333+50	R	300.00	10.00	3.00	1.00	0.0743	0.59	0.59	0.72	0.42	Seed	3.70	5	0.030	17.17	2.24	0.32	1.57	0.07	10.28
												Seed	4.30	10	0.040	17.43	2.00	0.42	1.82	0.09	10.36



DITCH ANALYSIS

PID : 77366 Date : 07/02/2007 Project : SCI-823-0.00 Location : PORTSMOUTH, SCIOTO COUNTY Designer : MDC
 Description : SR823, STA. 334+00 TO STA. 344+50, RHS

Rainfall Area : D

Allowable Shears
 Jute Mat: 0.45 Temporary Mat: 1.00
 Type 2: 3.00 Type 3: 5.00

Seed: 0.40
 Permanent Mat Type 1: 2.00
 RCP Type B: 6.00

(*) Warning: Grade is steeper than allowable. If value is parantheses, design parameters have been exceeded. - See user manual.

STATION	SIDE LENGTH	RADIUS	IN	BACK	GRADE	AREA	AREA	RUNOFF	CA	PROTECT	RAIN	STORM	MANN.	TIME	VEL.	SHEAR	DESIGN	DEPTH	WIDTH		
BEGIN	END	(ft.)	WIDTH	SLOPE	SLOPE	(ft./ft.)	(acres)	SUM	COEFF.	(Sum)	TYPE	INT.	FREQ.	COEFF.	FLOW	FLOW	(lbs./	FLOW	FLOW		
		(ft./ft.)	(ft./ft.)	(ft./ft.)	(ft./ft.)	(ft./ft.)	(acres)	(acres)			(in./hr.)	(yrs.)	(min.)	(min.)	(fps.)	sq.ft.)	(cfs.)	(ft.)	(ft.)		
334+00	343+00	R	900.00	10.00	3.00	0.50	0.0446	2.08	2.08	0.72	1.49	Seed	3.47	5	0.030	19.67	3.06	0.46	5.18	0.16	10.58
												Jute Mat	3.39	5	0.040	20.58	2.54	0.54	5.07	0.19	10.68
												Temp. Mat	3.39	5	0.040	20.58	2.54	0.54	5.07	0.19	10.68
												Temp. Mat	4.00	10	0.040	20.25	2.71	0.59	5.98	0.21	10.74
343+00	344+50	R	250.00	10.00	2.00	3.00	0.3808*	1.37	3.44	0.71	2.47	Seed	3.34	5	0.030	21.17	7.03	2.71	8.24	0.11	10.57
												Jute Mat	3.33	5	0.040	21.28	5.89	3.21	8.21	0.13	10.67
												Temp. Mat	3.33	5	0.040	21.28	5.89	3.21	8.21	0.13	10.67
												Perm, Type 1	3.33	5	0.040	21.28	5.89	3.21	8.21	0.13	10.67
												Perm, Type 2	3.33	5	0.040	21.28	5.89	3.21	8.21	0.13	10.67
												Perm, Type 3	3.33	5	0.040	21.28	5.89	3.21	8.21	0.13	10.67
												Perm, Type 3	3.93	10	0.040	20.91	6.27	3.54	9.70	0.15	10.75



DITCH ANALYSIS

PID : 77366 **Date :** 07/02/2007 **Project :** SCI-823-0.00 **Location :** PORTSMOUTH, SCIOTO COUNTY
Description : SR823, STA. 348+00 TO STA. 346+00, RHS **Designer :** MDC

Rainfall Area : D

Allowable Shears
Jute Mat: 0.45 **Temporary Mat:** 1.00
Type 2: 3.00 **Type 3:** 5.00

Seed: 0.40
Permanent Mat Type 1: 2.00
RCP Type B: 6.00

(*) Warning: Grade is steeper than allowable. If value is parantheses, design parameters have been exceeded. - See user manual.

STATION	SIDE LENGTH	RADIUS	IN	BACK	GRADE	AREA	AREA	RUNOFF	CA	PROTECT	RAIN	STORM	MANN.	TIME	VEL.	SHEAR	DESIGN	DEPTH	WIDTH		
BEGIN	END		(ft.)	WIDTH	SLOPE	(ft./ft.)	(acres)	SUM	COEFF.	(Sum)	TYPE	INT.	FREQ.	COEFF.	FLOW	FLOW	(lbs./	FLOW	FLOW		
			(ft./ft.)	(ft./ft.)	(ft./ft.)	(ft./ft.)	(acres)			(in./hr.)	(yrs.)	(min.)	(min.)	(min.)	(fps.)	(cfs.)	sq.ft.)	(ft.)	(ft.)		
348+00	346+00	R	200.00	10.00	4.00	6.00	0.3825*	1.03	1.03	0.71	0.73	Seed	3.85	5	0.030	15.72	4.58	1.43	2.82	0.06	10.60
												Jute Mat	3.84	5	0.040	15.86	3.83	1.69	2.81	0.07	10.71
												Temp. Mat	3.84	5	0.040	15.86	3.83	1.69	2.81	0.07	10.71
												Perm, Type 1	3.84	5	0.040	15.86	3.83	1.69	2.81	0.07	10.71
												Perm, Type 1	4.50	10	0.040	15.81	4.08	1.85	3.29	0.08	10.78



DITCH ANALYSIS

PID : 77366 **Date :** 07/02/2007 **Project :** SCI-823-0.00 **Location :** PORTSMOUTH, SCIOTO COUNTY
Description : SR823, STA. 348+00 TO STA. 352+00, RHS **Designer :** MDC

Rainfall Area : D

Allowable Shears
Jute Mat: 0.45 **Temporary Mat:** 1.00
Type 2: 3.00 **Type 3:** 5.00

Seed: 0.40
Permanent Mat Type 1: 2.00
RCP Type B: 6.00

(*) Warning: Grade is steeper than allowable. If value is parantheses, design parameters have been exceeded. - See user manual.

STATION	BEGIN	END	SIDE LENGTH (ft.)	RADIUS (ft.)	IN SLOPE (ft./ft.)	BACK SLOPE (ft./ft.)	GRADE (ft./ft.)	AREA (acres)	CA RUNOFF COEFF. (Sum)	PROTECT TYPE	RAIN INT. (in./hr.)	STORM FREQ. (yrs.)	MANN. COEFF. (min.)	TIME FLOW (fps.)	VEL. FLOW (lbs./sq.ft.)	SHEAR DESIGN (cfs.)	DEPTH FLOW (ft.)	WIDTH FLOW (ft.)		
348+00	R	400.00	10.00	3.00	2.00	0.0105	0.69	0.69	0.73	0.50	Seed	3.44	5	0.030	19.96	1.28	0.09	1.73	0.13	10.65
											Seed	3.97	10	0.040	20.58	1.13	0.11	1.99	0.17	10.85



DITCH ANALYSIS

PID : 77366 **Date :** 07/02/2007 **Project :** SCI-823-0-00 **Location :** PORTSMOUTH, SCIOTO COUNTY **Designer :** MDC
Description : US52 B, STA. 44+00 TO STA. 44+50, LHS

Rainfall Area : D **Allowable Shears**
Seed: 0.40 **Jute Mat:** 0.45 **Temporary Mat:** 1.00
Permanent Mat Type 1: 2.00 **Type 2:** 3.00 **Type 3:** 5.00
RCP Type B: 6.00

(*) Warning: Grade is steeper than allowable. If value is parantheses, design parameters have been exceeded. - See user manual.

STATION	BEGIN	END	SIDE LENGTH (ft.)	RADIUS (ft.)	IN SLOPE (ft./ft.)	BACK SLOPE (ft./ft.)	AREA (acres)	GRADE (ft./ft.)	AREA (acres)	CA	PROTECT TYPE	RAIN INT. (in./hr.)	STORM FREQ. (yrs.)	MANN. COEFF. (sum)	FLOW (cfs.)	TIME (min.)	VEL. (fps.)	SHEAR (sq.ft.)	DEPTH (ft.)	WIDTH (ft.)	
44+00	44+50	L	50.00	10.00	3.00	2.00	0.0040	1.14	1.14	0.70	0.80	Seed	3.85	5	0.030	15.70	1.18	0.06	3.07	0.25	11.23
												Seed	4.50	10	0.040	15.80	1.04	0.08	3.58	0.32	11.60



DITCH ANALYSIS

PID : 77366 Date : 07/02/2007 Project : SCI-823-0.00
 Description : US52 B, STA. 45+00 TO STA. 44+50, LHS

Location : PORTSMOUTH, SCIOTO COUNTY

Designer : MDC

Rainfall Area : D

Allowable Shears

Seed: 0.40 Jute Mat: 0.45 Temporary Mat: 1.00
 Permanent Mat Type 1: 2.00 Type 2: 3.00 Type 3: 5.00
 RCP Type B: 6.00

(*) Warning: Grade is steeper than allowable. If value is parentheses, design parameters have been exceeded. - See user manual.

STATION	BEGIN	END	SIDE	LENGTH	RADIUS	IN	BACK	GRADE	AREA	AREA	SUM	CA	PROTECT	RAIN	STORM	MANN.	TIME	VEL.	SHEAR	DESIGN	DEPTH	WIDTH
				(ft.)		(ft./ft.)	(ft./ft.)	(ft./ft.)	(acres)	(acres)	(Sum)	TYPE	TYPE	INT.	FREQ.	COEFF.	FLOW	FLOW	(lbs./	FLOW	FLOW	FLOW
									(acres)				(in./hr.)	(yrs.)	(min.)	(min.)	(min.)	(fps.)	sq.ft.)	(cfs.)	(ft.)	(ft.)
44+00	44+50	L	50.00	10.00	3.00	0.50	0.0120	0.80	0.80	0.75	0.60	Seed	Seed	3.87	5	0.030	15.55	1.50	0.11	2.33	0.15	10.53
												Seed	Seed	4.52	10	0.040	15.62	1.33	0.15	2.72	0.20	10.69



DITCH ANALYSIS

PID : 77366 Date : 07/02/2007 Project : SCI-823-0.00 Location : PORTSMOUTH, SCIOTO COUNTY Designer : MDC
 Description : US52 B, STA. 45+00 TO STA. 60+50, LHS

Rainfall Area : D Allowable Shears Temporary Mat: 1.00
 Seed: 0.40 Jute Mat: 0.45 Type 3: 5.00
 Permanent Mat Type 1: 2.00 Type 2: 3.00

(*) Warning: Grade is steeper than allowable. if value is parantheses, design parameters have been exceeded. - See user manual.

STATION	BEGIN	END	SIDE	LENGTH	RADIUS	IN	BACK	GRADE	AREA	AREA	RUNOFF	CA	PROTECT	RAIN	STORM	MANN.	TIME	VEL.	SHEAR	DESIGN	DEPTH	WIDTH
				(ft.)	(ft.)	SLOPE	(ft./ft.)	(ft./ft.)	(acres)	SUM	COEFF.	(Sum)	TYPE	INT.	FREQ.	COEFF.	FLOW	FLOW	(lbs./	FLOW	FLOW	FLOW
						(ft./ft.)	(ft./ft.)	(acres)		(acres)				(in./hr.)	(yrs.)		(min.)	(fps.)	sq.ft.)	(cfs.)	(ft.)	(ft.)
45+00	L	200.00	10.00	3.00	0.50	0.0045	0.50	0.50	0.71	0.35	Seed	Seed	3.56	5	0.030	18.67	0.88	0.04	1.26	0.14	10.49	
47+00	L	900.00	10.00	3.00	0.50	0.0082	3.62	4.12	0.72	2.96	Seed	Seed	4.12	10	0.040	19.10	0.78	0.05	1.45	0.18	10.63	
59+50	L	350.00	10.00	3.00	0.50	0.0051	1.08	5.20	0.77	3.80	Seed	Seed	3.05	5	0.030	25.04	2.23	0.20	9.04	0.38	11.33	
59+50	L	50.00	10.00	3.00	0.50	0.0580	0.08	5.28	0.70	3.85	Seed	Seed	3.47	10	0.040	26.37	1.94	0.25	10.28	0.49	11.71	
59+50	L	350.00	10.00	3.00	0.50	0.0051	1.08	5.20	0.77	3.80	Seed	Seed	2.88	5	0.030	27.83	2.05	0.16	10.92	0.49	11.71	
59+50	L	50.00	10.00	3.00	0.50	0.0580	0.08	5.28	0.70	3.85	Seed	Seed	3.25	10	0.040	29.57	1.78	0.20	12.34	0.62	12.19	
60+00	L	50.00	10.00	3.00	0.50	0.0580	0.08	5.28	0.70	3.85	Jute Mat	Jute Mat	2.87	5	0.030	28.01	4.43	0.87	11.04	0.24	10.84	
60+00	L	85.00	10.00	3.00	0.50	0.3824*	0.60	5.89	0.87	4.38	Temp. Mat	Temp. Mat	2.86	5	0.040	28.05	3.70	1.03	11.03	0.28	10.99	
60+00	L	85.00	10.00	3.00	0.50	0.3824*	0.60	5.89	0.87	4.38	Perm, Type 1	Perm, Type 1	2.86	5	0.040	28.05	3.70	1.03	11.03	0.28	10.99	
60+00	L	85.00	10.00	3.00	0.50	0.3824*	0.60	5.89	0.87	4.38	Perm, Type 1	Perm, Type 1	3.24	10	0.040	29.79	3.87	1.11	12.47	0.31	11.07	
60+00	L	85.00	10.00	3.00	0.50	0.3824*	0.60	5.89	0.87	4.38	Seed	Seed	2.85	5	0.030	28.22	8.31	3.49	12.48	0.15	10.51	
60+00	L	85.00	10.00	3.00	0.50	0.3824*	0.60	5.89	0.87	4.38	Jute Mat	Jute Mat	2.85	5	0.040	28.25	6.96	4.15	12.48	0.17	10.61	



DITCH ANALYSIS

PID : 77366 Date : 07/02/2007 Project : SCI-823-0.00 Location : PORTSMOUTH, SCIOTO COUNTY
 Designer : MDC
 Description : SR140 B, STA. 68+00 TO STA. 61+00, LHS

Rainfall Area : D
 Allowable Shears
 Seed: 0.40 Temporary Mat: 1.00
 Permanent Mat Type 1: 2.00 Type 2: 3.00 Type 3: 5.00
 RCP Type B: 6.00

(*) Warning: Grade is steeper than allowable. If value is parentheses, design parameters have been exceeded. - See user manual.

STATION BEGIN	STATION END	SIDE LENGTH (ft.)	RADIUS (ft.)	IN SLOPE (ft./ft.)	BACK SLOPE (ft./ft.)	GRADE (ft./ft.)	AREA (acres)	AREA (acres)	CA COEFF. (Sum)	PROTECT TYPE	RAIN INT. (in./hr.)	STORM FREQ. (yrs.)	MANN. COEFF. (min.)	FLOW (fps.)	VEL. (lbs./sq.ft.)	SHEAR DESIGN FLOW (cfs.)	DEPTH (ft.)	WIDTH (ft.)		
68+00	61+00	L	700.00	10.00	3.00	0.50	0.0444	3.94	0.70	2.75	Seed	3.63	5	0.030	17.88	3.93	0.68	10.00	0.24	10.86
											Jute Mat	3.58	5	0.040	18.45	3.26	0.80	9.85	0.29	11.01
											Temp. Mat	3.58	5	0.040	18.45	3.26	0.80	9.85	0.29	11.01
											Temp. Mat	4.21	10	0.040	18.26	3.47	0.88	11.59	0.32	11.11



DITCH ANALYSIS

PID : 77366 **Date :** 07/02/2007 **Project :** SCI-823-0-00 **Location :** PORTSMOUTH, SCIOTO COUNTY **Designer :** MDC
Description : SR140 B, STA. 68+00 TO STA. 68+50, LHS

Rainfall Area : D **Allowable Shears**
Seed: 0.40 **Jute Mat:** 0.45 **Temporary Mat:** 1.00
Permanent Mat Type 1: 2.00 **Type 2:** 3.00 **Type 3:** 5.00
RCP Type B: 6.00

(*) Warning: Grade is steeper than allowable. If value is parantheses, design parameters have been exceeded. - See user manual.

STATION	BEGIN	END	SIDE LENGTH (ft.)	RADIUS (ft.)	IN SLOPE (ft./ft.)	BACK SLOPE (ft./ft.)	AREA (acres)	AREA (acres)	CA	PROTECT TYPE	RAIN INT. (in./hr.)	STORM FREQ. (yrs.)	MANN. COEFF. (min.)	FLOW (cfs.)	VEL. (fps.)	DESIGN FLOW (cfs.)	DEPTH (ft.)	WIDTH (ft.)			
68+00	68+50	L	50.00	10.00	3.00	0.50	0.1300*	0.13	0.13	0.71	0.09	Seed	3.87	5	0.030	15.56	1.51	0.20	0.37	0.02	10.08
												Seed	4.52	10	0.040	15.62	1.35	0.26	0.43	0.03	10.11



DITCH ANALYSIS

PID : 77366 **Date :** 07/02/2007 **Project :** SCI-823-0-00 **Location :** PORTSMOUTH, SCIOTO COUNTY
Description : SR140 B, STA. 73+00 TO STA. 68+50, LHS **Designer :** MDC

Rainfall Area : D **Allowable Shears**
Seed: 0.40 **Jute Mat:** 0.45 **Temporary Mat:** 1.00
Permanent Mat Type 1: 2.00 **Type 2:** 3.00 **Type 3:** 5.00
RCP Type B: 6.00

(*) Warning: Grade is steeper than allowable. if value is parantheses, design parameters have been exceeded. - See user manual.

STATION	SIDE LENGTH	RADIUS	IN	BACK	GRADE	AREA	AREA	RUNOFF	CA	PROTECT	RAIN	STORM	MANN.	TIME	VEL.	SHEAR	DESIGN	DEPTH	WIDTH		
BEGIN	END	(ft.)	WIDTH	SLOPE	SLOPE	(ft./ft.)	(ft./ft.)	(ft./ft.)	(ft./ft.)	(ft./ft.)	(ft./ft.)	(ft./ft.)	(ft./ft.)	(ft./ft.)	(ft./ft.)	(ft./ft.)	(ft./ft.)	(ft./ft.)	(ft./ft.)		
			(ft.)	(ft./ft.)	(ft./ft.)	(ft./ft.)	(ft./ft.)	(ft./ft.)	(ft./ft.)	(ft./ft.)	(ft./ft.)	(ft./ft.)	(ft./ft.)	(ft./ft.)	(ft./ft.)	(ft./ft.)	(ft./ft.)	(ft./ft.)	(ft./ft.)		
73+00	68+50	L	450.00	10.00	3.00	0.50	0.0756	1.29	1.29	0.74	0.95	Seed	3.68	5	0.030	17.36	3.09	0.53	3.51	0.11	10.39
												Jute Mat	3.64	5	0.040	17.82	2.58	0.62	3.47	0.13	10.46
												Temp. Mat	3.64	5	0.040	17.82	2.58	0.62	3.47	0.13	10.46
												Temp. Mat	4.28	10	0.040	17.65	2.75	0.68	4.08	0.14	10.51



DITCH ANALYSIS

PID : 77366 Date : 07/02/2007 Project : SCI-823-0.00 Location : PORTSMOUTH, SCIOTO COUNTY Designer : MDC
 Description : SR140 B, STA. 73+00 TO STA. 73+50, LHS

Rainfall Area : D

Allowable Shears
 Seed: 0.40 Temporary Mat: 1.00
 Permanent Mat Type 1: 2.00 Type 2: 3.00 Type 3: 5.00
 RCP Type B: 6.00

(*) Warning: Grade is steeper than allowable. if value is parantheses, design parameters have been exceeded. - See user manual.

STATION	BEGIN	END	SIDE LENGTH (ft.)	RADIUS (ft.)	IN SLOPE (ft./ft.)	BACK SLOPE (ft./ft.)	GRADE (ft./ft.)	AREA (acres)	AREA (acres)	SUM COEFF. (Sum)	CA TYPE	PROTECT (in./hr.)	RAIN INT. (yrs.)	STORM FREQ. (min.)	MANN. FLOW (fps.)	VEL. FLOW (sq.ft.)	SHEAR (lbs./sq.ft.)	DESIGN FLOW (cfs.)	DEPTH (ft.)	WIDTH (ft.)	
73+00	73+50	L	50.00	10.00	2.00	2.00	0.8000*	0.29	0.29	0.72	0.21	Seed	3.91	5	0.030	15.23	3.59	1.14	0.82	0.02	10.09
												Jute Mat	3.90	5	0.040	15.28	3.01	1.36	0.82	0.03	10.11
												Temp. Mat	3.90	5	0.040	15.28	3.01	1.36	0.82	0.03	10.11
												Perm, Type 1	3.90	5	0.040	15.28	3.01	1.36	0.82	0.03	10.11
												Perm, Type 1	4.57	10	0.040	15.26	3.21	1.49	0.96	0.03	10.12



DITCH ANALYSIS

STATION BEGIN END	SIDE LENGTH (ft.)	RADIUS (ft.)	IN SLOPE	BACK SLOPE	AREA (acres)	CA SUM	PROTECT TYPE	RAIN INT.	STORM FREQ.	MANN. COEFF.	TIME (min.)	VEL. FLOW (fps.)	SHEAR (lbs./ sq.ft.)	DESIGN FLOW (cfs.)	DEPTH FLOW (ft.)	WIDTH FLOW (ft.)					
74+50	73+50	L	100.00	10.00	3.00	0.50	0.0150	0.20	7.69	0.75	5.81	Seed	3.02	5	0.030	25.59	3.43	0.44	17.54	0.47	11.65
							Perm, Type 3	3.53	10	0.040	25.63	6.71	3.44	19.99	0.28	11.39					
							Jute Mat	3.01	5	0.040	25.68	2.85	0.52	17.50	0.56	11.96					
							Temp. Mat	3.01	5	0.040	25.68	2.85	0.52	17.50	0.56	11.96					
							Temp. Mat	3.49	10	0.040	26.19	3.00	0.57	20.26	0.61	12.14					



DITCH ANALYSIS

PID : 79977 Date : 07/02/2007 Project : SCI-823-0.00 Location : PORTSMOUTH, SCIOTO COUNTY Designer : mdc
 Description : SR823, STA. 68+00 TO STA. 110+50, LHS

Rainfall Area : D

Allowable Shears
 Seed: 0.40 Jute Mat: 0.45 Temporary Mat: 1.00
 Permanent Mat Type 1: 2.00 Type 2: 3.00 Type 3: 5.00
 RCP Type B: 6.00

(*) Warning: Grade is steeper than allowable. If value is parantheses, design parameters have been exceeded. - See user manual.

STATION	BEGIN	END	SIDE LENGTH (ft.)	RADIUS (ft.)	IN SLOPE (ft./ft.)	BACK SLOPE (ft./ft.)	GRADE (ft./ft.)	AREA (acres)	AREA (acres)	CA RUNOFF COEFF. (Sum)	PROTECT TYPE	RAIN INT. (in./hr.)	STORM FREQ. (yrs.)	COEFF. (min.)	FLOW (fps.)	VEL. (lbs./sq.ft.)	SHEAR DESIGN (ft.)	DEPTH (ft.)	WIDTH (ft.)		
96+00	106+00	L	1000.0	10.00	3.00	0.50	0.0132	4.82	4.82	0.73	3.52	Seed	3.40	5	0.030	20.51	2.87	0.32	11.95	0.39	11.37
106+00	108+50	L	380.00	10.00	4.00	2.00	0.4060*	2.80	7.62	0.71	5.51	Seed	3.90	10	0.040	21.26	2.51	0.42	13.72	0.50	11.76
												Seed	3.34	5	0.030	21.16	9.70	4.56	18.41	0.18	11.08
												Jute Mat	3.33	5	0.040	21.29	8.09	5.40	18.35	0.21	11.28
												Temp. Mat	3.33	5	0.040	21.29	8.09	5.40	18.35	0.21	11.28
												Perm, Type 1	3.33	5	0.040	21.29	8.09	5.40	18.35	0.21	11.28
												Perm, Type 2	3.33	5	0.040	21.29	8.09	5.40	18.35	0.21	11.28
												Perm, Type 3	3.33	5	0.040	21.29	8.09	5.40	18.35	0.21	11.28
													3.31	5	0.060	21.51	6.25		18.25	0.27	11.62



DITCH ANALYSIS

PID : 77366 **Date :** 07/02/2007 **Project :** SCI-823-0.00 **Location :** PORTSMOUTH, SCIOTO COUNTY
Description : SR823, STA. 111+50 TO STA. 110+50, LHS **Designer :** MDC

Rainfall Area : D

Allowable Shears
Seed: 0.40 **Jute Mat:** 0.45 **Temporary Mat:** 1.00
Permanent Mat Type 1: 2.00 **Type 2:** 3.00 **Type 3:** 5.00
RCP Type B: 6.00

(*) Warning: Grade is steeper than allowable. If value is parantheses, design parameters have been exceeded. - See user manual.

STATION	SIDE LENGTH	RADIUS	IN	BACK	GRADE	AREA	AREA	AREA	RUNOFF	CA	PROTECT	RAIN	STORM	MANN.	TIME	VEL.	SHEAR	DESIGN	DEPTH	WIDTH
BEGIN	END	(ft.)	WIDTH	SLOPE	SLOPE	(ft./ft.)	(acres)	SUM	COEFF.	(Sum)	TYPE	INT.	FREQ.	COEFF.	FLOW	FLOW	(lbs./	FLOW	FLOW	FLOW
		(ft./ft.)	(ft./ft.)	(ft./ft.)	(ft./ft.)	(acres)	(acres)	(in./hr.)	(yrs.)	(min.)	(min.)	(min.)	(min.)	(min.)	(min.)	(min.)	(min.)	(min.)	(min.)	(min.)
111+50	110+50	L	100.00	4.00	4.00	0.0750	0.87	0.87	0.72	0.62	Seed	3.86	5	0.030	15.63	2.62	0.41	2.41	0.09	10.71
											Jute Mat	3.85	5	0.040	15.75	2.20	0.49	2.40	0.10	10.84
											Temp. Mat	3.85	5	0.040	15.75	2.20	0.49	2.40	0.10	10.84
											Temp. Mat	4.51	10	0.040	15.71	2.34	0.54	2.81	0.12	10.92



DITCH ANALYSIS

PID : 77366 **Date :** 07/02/2007 **Project :** SCI-823-0.00 **Location :** PORTSMOUTH, SCIOTO COUNTY
Description : SR823, STA. 118+00 TO STA. 119+00, LHS **Designer :** MDC

Rainfall Area : D

Seed: 0.40 **Allowable Shears**
Permanent Mat Type 1: 2.00 **Jute Mat:** 0.45 **Temporary Mat:** 1.00
RCP Type B: 6.00 **Type 2:** 3.00 **Type 3:** 5.00

(*) Warning: Grade is steeper than allowable. If value is parantheses, design parameters have been exceeded. - See user manual.

STATION	SIDE LENGTH (ft.)	RADIUS (ft.)	IN SLOPE (ft./ft.)	BACK SLOPE (ft./ft.)	GRADE (ft./ft.)	AREA (acres)	AREA SUM (acres)	RUNOFF COEFF. (Sum)	CA TYPE	PROTECT TYPE	RAIN INT. (in./hr.)	STORM FREQ. (yrs.)	MANN. COEFF. (min.)	FLOW (fps.)	VEL. (lbs./sq.ft.)	SHEAR DESIGN (cfs.)	DEPTH (ft.)	WIDTH (ft.)		
118+00	119+00	L	100.00	4.00	4.00	0.0300	1.16	1.16	0.79	0.92	Seed	3.85	5	0.030	15.72	2.29	0.27	3.54	0.15	11.17
									Seed		4.50	10	0.040	15.82	2.03	0.36	4.13	0.19	11.52	



DITCH ANALYSIS

PID : 77366 Date : 07/02/2007 Project : SCI-823-0.00
 Description : SR823, STA. 125+50 TO STA. 125+00, LHS

Location : PORTSMOUTH, SCIOTO COUNTY
 Designer : MDC

Rainfall Area : D

Allowable Shears
 Jute Mat: 0.45 Temporary Mat: 1.00
 Type 2: 3.00 Type 3: 5.00
 Seed: 0.40
 Permanent Mat Type 1: 2.00
 RCP Type B: 6.00

(*) Warning: Grade is steeper than allowable. If value is parantheses, design parameters have been exceeded. - See user manual.

STATION	SIDE LENGTH	RADIUS	IN	BACK	GRADE	AREA	AREA	AREA	RUNOFF	CA	PROTECT	RAIN	STORM	MANN.	TIME	VEL.	SHEAR	DESIGN	DEPTH	WIDTH	
BEGIN	END	(ft.)	WIDTH	SLOPE	SLOPE	(ft./ft.)	(acres)	SUM	COEFF.	(Sum)	TYPE	INT.	FREQ.	COEFF.	FLOW	FLOW	(lbs./	FLOW	FLOW	FLOW	
		(ft./ft.)	(ft./ft.)	(ft./ft.)	(ft./ft.)	(acres)	(acres)	(acres)	(Sum)	(Sum)	(in./hr.)	(yrs.)	(min.)	(min.)	(min.)	(fps.)	sq.ft.)	(cfs.)	(ft.)	(ft.)	
125+50	125+00	L	50.00	10.00	4.00	4.00	0.0200	0.22	0.22	0.70	0.16	Seed	3.84	5	0.030	15.80	1.02	0.07	0.60	0.06	10.46
												Seed	4.49	10	0.040	15.91	0.91	0.09	0.70	0.08	10.60



DITCH ANALYSIS

PID : 77366 **Date :** 07/02/2007 **Project :** SCI-823-0.00
Description : SR823, STA. 125+50 TO STA. 129+00, LHS

Location : PORTSMOUTH, SCIOTO COUNTY
Designer : MDC

Rainfall Area : D

Seed: 0.40 **Temporary Mat:** 1.00
Permanent Mat Type 1: 2.00 **Type 3:** 5.00
RCP Type B: 6.00

Allowable Shears

(*) Warning: Grade is steeper than allowable. If value is parantheses, design parameters have been exceeded. - See user manual.

STATION BEGIN END	SIDE LENGTH (ft.)	RADIUS (ft.)	IN SLOPE (ft./ft.)	BACK GRADE SLOPE (ft./ft.)	AREA (acres)	AREA SUM (acres)	CA COEFF. (Sum)	PROTECT TYPE	RAIN INT. (in./hr.)	STORM FREQ. (yrs.)	MANN. FLOW (min.)	VEL. FLOW (fps.)	SHEAR COEFF. (lbs./ sq.ft.)	DESIGN FLOW (cfs.)	DEPTH FLOW (ft.)	WIDTH FLOW (ft.)					
125+50	126+00	L	50.00	10.00	4.00	4.00	0.0200	0.21	0.21	0.70	0.14	Seed	3.84	5	0.030	15.83	0.98	0.07	0.55	0.06	10.44
126+00	128+00	L	200.00	10.00	4.00	4.00	0.0450	1.84	2.04	0.78	1.58	Seed	4.48	10	0.040	15.94	0.88	0.09	0.65	0.07	10.57
128+00	128+50	L	50.00	10.00	2.00	2.00	0.5000*	0.36	2.40	0.72	1.83	Seed	3.70	5	0.030	17.20	7.11	2.92	6.78	0.09	10.37
												Jute Mat	3.71	5	0.040	17.08	2.61	0.58	5.85	0.21	11.65
												Temp. Mat	3.71	5	0.040	17.08	2.61	0.58	5.85	0.21	11.65
												Temp. Mat	4.34	10	0.040	17.13	2.77	0.64	6.84	0.23	11.81
												Jute Mat	3.70	5	0.040	17.22	5.97	3.47	6.78	0.11	10.44
												Temp. Mat	3.70	5	0.040	17.22	5.97	3.47	6.78	0.11	10.44
												Perm, Type 1	3.70	5	0.040	17.22	5.97	3.47	6.78	0.11	10.44
												Perm, Type 2	3.70	5	0.040	17.22	5.97	3.47	6.78	0.11	10.44
												Perm, Type 3	3.70	5	0.040	17.22	5.97	3.47	6.78	0.11	10.44
												Perm, Type 3	4.32	10	0.040	17.26	6.34	3.81	7.93	0.12	10.49



DITCH ANALYSIS

STATION BEGIN	END	SIDE LENGTH (ft.)	RADIUS (ft.)	IN SLOPE	BACK SLOPE	AREA (ft./ft.)	AREA (acres)	SUM COEFF. (Sum)	CA TYPE	PROTECT INT. (in./hr.)	RAIN FREQ. (yrs.)	STORM COEFF. (min.)	TIME FLOW (min.)	VEL. FLOW (fps.)	SHEAR (lbs./sq.ft.)	DESIGN FLOW (cfs.)	DEPTH FLOW (ft.)	WIDTH FLOW (ft.)			
128+50	129+00	L	50.00	10.00	2.00	3.00	0.1200*	0.37	2.77	0.72	2.10	Seed	3.68	5	0.030	17.40	4.81	1.16	7.73	0.15	10.77
									Jute Mat	3.68	5	0.040	17.43	4.02	1.37	7.72	0.18	10.92			
									Temp. Mat	3.68	5	0.040	17.43	4.02	1.37	7.72	0.18	10.92			
									Perm, Type 1	3.68	5	0.040	17.43	4.02	1.37	7.72	0.18	10.92			
									Perm, Type 1	4.30	10	0.040	17.45	4.27	1.51	9.03	0.20	11.01			



DITCH ANALYSIS

PID : 77366 Date : 07/02/2007 Project : SCI-823-0.00
 Description : SR823, STA. 166+00 TO STA. 139+50, LHS

Location : PORTSMOUTH, SCIOTO COUNTY
 Designer : MDC

Rainfall Area : D

Allowable Shears
 Seed: 0.40
 Permanent Mat Type 1: 2.00
 RCP Type B: 6.00
 Jute Mat: 0.45
 Type 2: 3.00
 Temporary Mat: 1.00
 Type 3: 5.00

(*) Warning: Grade is steeper than allowable. If value is parantheses, design parameters have been exceeded. - See user manual.

STATION BEGIN END	SIDE LENGTH (ft.)	RADIUS WIDTH (ft.)	IN SLOPE (ft./ft.)	BACK GRADE SLOPE (ft./ft.)	AREA (acres)	AREA SUM (acres)	CA COEFF. (Sum)	PROTECT TYPE	RAIN INT. (in./hr.)	STORM FREQ. (yrs.)	MANN. COEFF. (min.)	TIME FLOW (fps.)	VEL. FLOW (lbs./ sq.ft.)	SHEAR FLOW (cfs.)	DESIGN FLOW (cfs.)	DEPTH FLOW (ft.)	WIDTH FLOW (ft.)				
166+00	142+00	L	2400.0	10.00	3.00	0.50	0.0392	11.16	11.16	0.71	7.92	Seed	3.28	5	0.030	21.97	5.37	1.10	25.96	0.45	11.57
												Jute Mat	3.17	5	0.040	23.39	4.41	1.28	25.11	0.52	11.82
												Temp. Mat	3.17	5	0.040	23.39	4.41	1.28	25.11	0.52	11.82
												Perm, Type 1	3.17	5	0.040	23.39	4.41	1.28	25.11	0.52	11.82
												Perm, Type 1	3.75	10	0.040	22.94	4.69	1.41	29.69	0.58	12.01
142+00	141+00	L	100.00	10.00	3.00	0.50	0.0500	0.95	12.11	0.70	8.59	Seed	3.15	5	0.030	23.67	5.89	1.33	27.04	0.43	11.49
												Jute Mat	3.15	5	0.040	23.73	4.90	1.58	27.01	0.51	11.77
												Temp. Mat	3.15	5	0.040	23.73	4.90	1.58	27.01	0.51	11.77
												Perm, Type 1	3.15	5	0.040	23.73	4.90	1.58	27.01	0.51	11.77
												Perm, Type 1	3.72	10	0.040	23.26	5.20	1.74	31.94	0.56	11.96
141+00	139+50	L	150.00	10.00	3.00	0.50	0.0500	1.40	13.50	0.70	9.56	Seed	3.12	5	0.030	24.14	6.10	1.41	29.80	0.45	11.58
												Jute Mat	3.11	5	0.040	24.22	5.07	1.67	29.75	0.54	11.88
												Temp. Mat	3.11	5	0.040	24.22	5.07	1.67	29.75	0.54	11.88



DITCH ANALYSIS

STATION	SIDE LENGTH	RADIUS	IN	BACK	GRADE	AREA	AREA	RUNOFF	CA	PROTECT	RAIN	STORM	MANN.	TIME	VEL.	SHEAR	DESIGN	DEPTH	WIDTH
BEGIN	END	(ft.)	SLOPE	SLOPE	(ft./ft.)	(acres)	SUM	COEFF.	(Sum)	TYPE	INT.	FREQ.	COEFF.	(min.)	(fps.)	(lbs./sq.ft.)	FLOW	FLOW	FLOW
		(ft./ft.)	(ft./ft.)	(ft./ft.)	(acres)			(yrs.)	(in./hr.)								(cfs.)	(ft.)	(ft.)
								5	3.11	Perm, Type 1	3.11	5	0.040	24.22	5.07	1.67	29.75	0.54	11.88
								10	3.68	Perm, Type 1	3.68	10	0.040	23.72	5.38	1.85	35.20	0.59	12.07



DITCH ANALYSIS

PID : 77366 **Date :** 07/02/2007 **Project :** SCI-823-0.00 **Location :** PORTSMOUTH, SCIOTO COUNTY
Description : SR823, STA. 166+00 TO STA. 166+50, LHS **Designer :** MDC

Rainfall Area : D

Allowable Shears
Jute Mat: 0.45 **Temporary Mat:** 1.00
Type 2: 3.00 **Type 3:** 5.00

Seed: 0.40
Permanent Mat Type 1: 2.00
RCP Type B: 6.00

(*) Warning: Grade is steeper than allowable. If value is parantheses, design parameters have been exceeded. - See user manual.

STATION	SIDE LENGTH	RADIUS	IN	BACK	GRADE	AREA	AREA	AREA	RUNOFF	CA	PROTECT	RAIN	STORM	MANN.	TIME	VEL.	SHEAR	DESIGN	DEPTH	WIDTH	
BEGIN	END	(ft.)	WIDTH	SLOPE	(ft./ft.)	(acres)	SUM	COEFF.	(Sum)	TYPE	INT.	FREQ.	COEFF.	FLOW	FLOW	(lbs./	FLOW	FLOW	FLOW	FLOW	
		(ft./ft.)	(ft./ft.)	(ft./ft.)	(ft./ft.)	(acres)	(acres)	(Sum)	(in./hr.)	(yrs.)	(in./hr.)	(yrs.)	(min.)	(cfs.)	sq.ft.)	(cfs.)	(ft.)	(ft.)	(ft.)	(ft.)	(ft.)
166+00	166+50	L	50.00	3.00	0.50	0.2080*	0.08	0.08	0.73	0.06	Seed	3.86	5	0.030	15.66	1.23	0.17	0.24	0.01	15.04	
											Seed	4.51	10	0.040	15.74	1.10	0.22	0.28	0.02	15.06	



DITCH ANALYSIS

PID : **Date :** 07/02/2007 **Project :** SCI-823-0.00 **Location :** PORTSMOUTH, SCIOTO COUNTY **Designer :** MDC
Description : SR823, STA. 167+50 TO STA. 166+50, LHS

Rainfall Area : D

Allowable Shears

Seed:	0.40	Temporary Mat:	1.00
Permanent Mat Type 1:	2.00	Type 3:	5.00
RCP Type B:	6.00		

(*) Warning: Grade is steeper than allowable. If value is parantheses, design parameters have been exceeded. - See user manual.

STATION BEGIN END	SIDE LENGTH (ft.)	RADIUS (ft.)	IN SLOPE (ft./ft.)	BACK SLOPE (ft./ft.)	GRADE (ft./ft.)	AREA (acres)	AREA SUM (acres)	CA COEFF. (Sum)	PROTECT TYPE	RAIN INT. (in./hr.)	STORM FREQ. (yrs.)	MANN. COEFF. (min.)	TIME FLOW (fps.)	VEL. FLOW (cfs.)	SHEAR DESIGN FLOW (lbs./sq.ft.)	DEPTH FLOW (ft.)	WIDTH FLOW (ft.)			
167+50 167+00	L	50.00	10.00	3.00	2.00	0.1360*	0.35	0.35	0.72	0.25	Seed	3.89	5	0.030	15.37	2.23	0.36	0.97	0.04	10.21
167+00 166+50	L	50.00	15.00	3.00	2.00	0.0700	0.12	0.47	0.72	0.33	Seed	4.55	10	0.040	15.42	1.99	0.48	1.13	0.06	10.28
											Seed	3.84	5	0.030	15.85	1.73	0.21	1.29	0.05	15.25
											Seed	4.48	10	0.040	15.95	1.55	0.28	1.50	0.06	15.32



DITCH ANALYSIS

PID : 77366 Date : 07/02/2007 Project : SCI-823-0.00
 Description : SR823, STA. 167+50 TO STA. 175+00, LHS

Location : PORTSMOUTH, SCIOTO COUNTY

Designer : MDC

Rainfall Area : D

Allowable Shears
 Jute Mat: 0.45 Temporary Mat: 1.00
 Type 2: 3.00 Type 3: 5.00
 Seed: 0.40
 Permanent Mat Type 1: 2.00
 RCP Type B: 6.00

(*) Warning: Grade is steeper than allowable. if value is parantheses, design parameters have been exceeded. - See user manual.

STATION	SIDE	LENGTH	RADIUS	IN	BACK	GRADE	AREA	AREA	AREA	RUNOFF	CA	PROTECT	RAIN	STORM	MANN.	TIME	VEL.	SHEAR	DESIGN	DEPTH	WIDTH	
BEGIN	END	(ft.)	WIDTH	SLOPE	SLOPE	(ft./ft.)	(acres)	SUM	COEFF.	(Sum)	TYPE	INT.	FREQ.	COEFF.	FLOW	FLOW	(lbs./	FLOW	FLOW	FLOW	FLOW	
(ft.)	(ft.)	(ft./ft.)	(ft./ft.)	(ft./ft.)	(ft./ft.)	(ft./ft.)	(acres)	(acres)				(in./hr.)	(yrs.)		(min.)	(fps.)	sq.ft.)	(cfs.)	(ft.)	(ft.)	(ft.)	(ft.)
167+50	173+50	L	600.00	10.00	3.00	0.50	0.0205	2.74	0.74	2.03	Seed	3.57	5	0.030	18.53	2.74	0.32	7.25	0.25	10.89		
173+50	175+00	L	210.00	15.00	3.00	3.00	0.2857*	3.07	0.71	4.21	Seed	4.13	10	0.040	18.99	2.41	0.42	8.38	0.33	11.15		
								5.82			Seed	3.52	5	0.030	19.03	6.95	2.47	14.84	0.14	15.83		
											Jute Mat	3.52	5	0.040	19.13	5.82	2.93	14.80	0.16	15.98		
											Temp. Mat	3.52	5	0.040	19.13	5.82	2.93	14.80	0.16	15.98		
											Perm, Type 1	3.52	5	0.040	19.13	5.82	2.93	14.80	0.16	15.98		
											Perm, Type 2	3.52	5	0.040	19.13	5.82	2.93	14.80	0.16	15.98		
											Perm, Type 2	4.07	10	0.040	19.55	6.16	3.19	17.14	0.18	16.08		



DITCH ANALYSIS

PID : 77366 **Date :** 07/02/2007 **Project :** SCI-823-0.00 **Location :** PORTSMOUTH, SCIOTO COUNTY
Description : SR823, STA. 178+00 TO STA. 175+50, LHS **Designer :** MDC

Rainfall Area : D

Seed: 0.40
Permanent Mat Type 1: 2.00 **Temporary Mat:** 1.00
RCP Type B: 6.00 **Type 2:** 3.00 **Type 3:** 5.00
Allowable Shears
Jute Mat: 0.45
Type 2: 3.00

(*) Warning: Grade is steeper than allowable. If value is parantheses, design parameters have been exceeded. - See user manual.

STATION BEGIN END	SIDE LENGTH (ft.)	RADIUS (ft.)	IN SLOPE	BACK SLOPE	GRADE (ft./ft.)	AREA (acres)	AREA SUM	RUNOFF CA	PROTECT TYPE	RAIN INT.	STORM FREQ.	MANN. COEFF.	TIME FLOW	VEL. FLOW	SHEAR FLOW	DESIGN FLOW	DEPTH FLOW	WIDTH FLOW		
			(ft./ft.)	(ft./ft.)	(ft./ft.)	(acres)	(acres)	(Sum)	(in./hr.)	(yrs.)	(min.)	(lbs./sq.ft.)	(cfs.)	(ft.)	(cfs.)	(ft.)	(ft.)	(ft.)		
178+00	L	250.00	10.00	3.00	1.00	0.0020	0.13	0.13	0.77	0.10	Seed	3.09	5	0.030	24.55	0.39	0.01	0.30	0.08	10.30
175+50	L	150.00	10.00	2.00	2.00	0.0967	1.94	2.06	0.80	1.65	Seed	3.52	10	0.040	25.76	0.35	0.01	0.34	0.10	10.39
											Seed	3.04	5	0.030	25.20	3.83	0.77	5.01	0.13	10.51
											Jute Mat	3.04	5	0.040	25.32	3.20	0.91	5.00	0.15	10.61
											Temp. Mat	3.04	5	0.040	25.32	3.20	0.91	5.00	0.15	10.61
											Temp. Mat	3.46	10	0.040	26.50	3.37	0.99	5.70	0.16	10.66
177+00	L	150.00	15.00	2.00	2.00	0.2133*	2.66	4.72	0.71	3.54	Seed	3.01	5	0.030	25.77	5.62	1.65	10.63	0.12	15.50
											Jute Mat	3.00	5	0.040	25.85	4.71	1.96	10.61	0.15	15.59
											Temp. Mat	3.00	5	0.040	25.85	4.71	1.96	10.61	0.15	15.59
											Perm, Type 1	3.00	5	0.040	25.85	4.71	1.96	10.61	0.15	15.59
											Perm, Type 1	3.43	10	0.040	27.00	4.96	2.12	12.11	0.16	15.64



DITCH ANALYSIS

PID : 77366 Date : 07/02/2007 Project : SCI-823-0.00
 Description : SR823, STA. 178+00 TO STA. 185+00, LHS

Location : PORTSMOUTH, SCIOTO COUNTY

Designer : MDC

Rainfall Area : D

Allowable Shears

Seed: 0.40
 Permanent Mat Type 1: 2.00
 RCP Type B: 6.00
 Jute Mat: 0.45
 Type 2: 3.00
 Temporary Mat: 1.00
 Type 3: 5.00

(*) Warning: Grade is steeper than allowable.

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

STATION	BEGIN	END	SIDE LENGTH (ft.)	RADIUS (ft.)	IN SLOPE (ft./ft.)	BACK SLOPE (ft./ft.)	GRADE (ft./ft.)	AREA (acres)	AREA SUM (acres)	CA COEFF. (Sum)	PROTECT TYPE	RAIN INT. (in./hr.)	STORM FREQ. (yrs.)	MANN. COEFF.	TIME (min.)	VEL. FLOW (fps.)	SHEAR FLOW (lbs./sq.ft.)	DESIGN FLOW (cfs.)	DEPTH FLOW (ft.)	WIDTH FLOW (ft.)
178+00	182+50	L	450.00	10.00	3.00	1.00	0.0324	2.71	2.71	0.73	1.98	Seed	5	0.030	17.32	3.15	0.45	7.29	0.22	10.89
											Jute Mat	3.64	5	0.040	17.78	2.62	0.53	7.20	0.26	11.04
											Temp. Mat	3.64	5	0.040	17.78	2.62	0.53	7.20	0.26	11.04
											Temp. Mat	4.28	10	0.040	17.62	2.79	0.58	8.46	0.29	11.15
182+50	185+00	L	250.00	12.00	2.00	2.00	0.2216*	1.70	4.41	0.72	3.20	Seed	5	0.030	18.43	6.36	2.03	11.46	0.15	12.59
											Jute Mat	3.57	5	0.040	18.56	5.33	2.40	11.42	0.17	12.69
											Temp. Mat	3.57	5	0.040	18.56	5.33	2.40	11.42	0.17	12.69
											Perm, Type 1	3.57	5	0.040	18.56	5.33	2.40	11.42	0.17	12.69
											Perm, Type 2	3.57	5	0.040	18.56	5.33	2.40	11.42	0.17	12.69
											Perm, Type 2	4.20	10	0.040	18.35	5.67	2.65	13.44	0.19	12.77



DITCH ANALYSIS

PID : 77366 Date : 07/02/2007 Project : SCI-823-0.00
 Description : SR823, STA. 226+00 TO STA. 209+00, LHS

Location : PORTSMOUTH, SCIOTO COUNTY

Designer : MDC

Rainfall Area : D

Allowable Shears

Seed: 0.40
 Permanent Mat Type 1: 2.00
 RCP Type B: 6.00
 Jute Mat: 0.45
 Type 2: 3.00
 Temporary Mat: 1.00
 Type 3: 5.00

(*) Warning: Grade is steeper than allowable. If value is parantheses, design parameters have been exceeded. - See user manual.

STATION BEGIN END	SIDE LENGTH (ft.)	RADIUS (ft.)	IN SLOPE	BACK SLOPE	GRADE (ft./ft.)	AREA (acres)	AREA SUM (acres)	CA COEFF.	RUNOFF (Sum)	PROTECT TYPE	RAIN INT. (in./hr.)	STORM FREQ. (yrs.)	MANN. FLOW (min.)	TIME FLOW (fps.)	VEL. FLOW (lbs./sq.ft.)	SHEAR DESIGN (cfs.)	DEPTH FLOW (ft.)	WIDTH FLOW (ft.)		
226+00 224+00	L	200.00	10.00	3.00	0.50	0.0310	0.46	0.46	0.77	0.35	Seed	3.72	5	0.030	17.03	1.61	0.16	1.31	0.08	10.28
224+00 219+00	L	500.00	10.00	3.00	0.50	0.0310	2.03	2.49	0.79	1.95	Seed	4.32	10	0.040	17.27	1.43	0.20	1.53	0.10	10.37
219+00 214+00	L	500.00	10.00	3.00	0.50	0.0310	1.88	4.36	0.80	3.46	Seed	3.46	5	0.030	19.70	3.03	0.42	6.77	0.22	10.75
											Jute Mat	3.42	5	0.040	20.23	2.52	0.49	6.68	0.25	10.89
											Temp. Mat	3.42	5	0.040	20.23	2.52	0.49	6.68	0.25	10.89
											Temp. Mat	3.99	10	0.040	20.30	2.67	0.54	7.80	0.28	10.98
											Seed	3.24	5	0.030	22.46	3.66	0.56	11.19	0.29	11.02
											Jute Mat	3.21	5	0.040	22.91	3.04	0.66	11.08	0.34	11.20
											Temp. Mat	3.21	5	0.040	22.91	3.04	0.66	11.08	0.34	11.20
											Temp. Mat	3.76	10	0.040	22.83	3.23	0.73	12.99	0.38	11.32
											Seed	3.19	5	0.030	23.13	3.80	0.59	12.75	0.32	11.26
											Jute Mat	3.19	5	0.040	23.17	3.16	0.70	12.74	0.37	11.50
											Temp. Mat	3.19	5	0.040	23.17	3.16	0.70	12.74	0.37	11.50



DITCH ANALYSIS

STATION BEGIN	END	SIDE LENGTH (ft.)	RADIUS (ft.)	IN SLOPE	BACK SLOPE	AREA (ft./ft.)	AREA SUM	AREA COEFF. (Sum)	CA TYPE	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.)		
213+50	213+00	L	165.00	10.00	2.00	2.00	0.2891*	6.42	11.40	0.70	8.50	Temp. Mat	3.74	10	0.040	23.07	3.35	0.77	14.94	0.41	11.65
												Seed	3.17	5	0.030	23.44	10.20	4.53	26.90	0.25	11.00
												Jute Mat	3.16	5	0.040	23.49	8.52	5.37	26.87	0.30	11.19
												Temp. Mat	3.16	5	0.040	23.49	8.52	5.37	26.87	0.30	11.19
												Perm, Type 1	3.16	5	0.040	23.49	8.52	5.37	26.87	0.30	11.19
												Perm, Type 2	3.16	5	0.040	23.49	8.52	5.37	26.87	0.30	11.19
												Perm, Type 3	3.16	5	0.040	23.49	8.52	5.37	26.87	0.30	11.19
													3.16	5	0.060	23.59	6.59		26.81	0.38	11.51



DITCH ANALYSIS

PID : 77366 **Date :** 07/02/2007 **Project :** SCI-823-0.00 **Location :** PORTSMOUTH, SCIOTO COUNTY
Description : SR823, STA. 236+50 TO STA. 230+00, LHS **Designer :** MDC

Rainfall Area : D

Allowable Shears
Seed: 0.40 **Temporary Mat:** 1.00
Permanent Mat Type 1: 2.00 **Type 3:** 5.00
RCP Type B: 6.00

(*) Warning: Grade is steeper than allowable. If value is parantheses, design parameters have been exceeded. - See user manual.

STATION	SIDE LENGTH	RADIUS	IN	BACK	GRADE	AREA	AREA	AREA	RUNOFF	CA	PROTECT	RAIN	STORM	MANN.	TIME	VEL.	SHEAR	DESIGN	DEPTH	WIDTH	FLOW	FLOW	DEPTH	FLOW	FLOW	DEPTH	WIDTH		
BEGIN	END	(ft.)	WIDTH	SLOPE	SLOPE	(ft./ft.)	(acres)	SUM	COEFF.	(Sum)	TYPE	INT.	FREQ.	COEFF.	FLOW	FLOW	(lbs./	DESIGN	DEPTH	WIDTH	FLOW	FLOW	DEPTH	FLOW	FLOW	DEPTH	WIDTH		
		(ft./ft.)	(ft./ft.)	(ft./ft.)	(ft./ft.)	(acres)	(acres)	(acres)				(in./hr.)	(yrs.)	(min.)	(min.)	(fps.)	sq.ft.)	(cfs.)	(ft.)	(ft.)	(ft.)	(cfs.)	(ft.)	(ft.)	(ft.)	(ft.)	(ft.)	(ft.)	
236+50	232+50	L	400.00	10.00	4.00	4.00	0.0775	4.16	0.71	2.96	Seed	3.78	5	0.030	16.39	4.73	1.05	11.18	0.22	11.74									
											Jute Mat	3.75	5	0.040	16.67	3.92	1.24	11.09	0.26	12.05									
											Temp. Mat	3.75	5	0.040	16.67	3.92	1.24	11.09	0.26	12.05									
											Perm, Type 1	3.75	5	0.040	16.67	3.92	1.24	11.09	0.26	12.05									
											Perm, Type 1	4.40	10	0.040	16.58	4.15	1.36	13.01	0.28	12.25									
232+50	230+00	L	250.00	12.00	4.00	4.00	0.3296*	4.31	0.71	6.01	Seed	3.71	5	0.030	17.13	9.08	3.95	22.28	0.19	13.54									
											Jute Mat	3.70	5	0.040	17.22	7.57	4.68	22.23	0.23	13.82									
											Temp. Mat	3.70	5	0.040	17.22	7.57	4.68	22.23	0.23	13.82									
											Perm, Type 1	3.70	5	0.040	17.22	7.57	4.68	22.23	0.23	13.82									
											Perm, Type 2	3.70	5	0.040	17.22	7.57	4.68	22.23	0.23	13.82									
											Perm, Type 3	3.70	5	0.040	17.22	7.57	4.68	22.23	0.23	13.82									
											Perm, Type 3	4.34	10	0.040	17.10	8.03	5.14	26.10	0.25	14.00									



DITCH ANALYSIS

PID : 77366 **Date :** 07/02/2007 **Project :** SCI-823-0.00 **Location :** PORTSMOUTH, SCIOTO COUNTY
Description : SR823, STA. 258+00 TO STA. 284+00, LHS **Designer :** MDC

Rainfall Area : D

Allowable Shears
Seed: 0.40 **Temporary Mat:** 1.00
Permanent Mat Type 1: 2.00 **Type 2:** 3.00 **Type 3:** 5.00
RCP Type B: 6.00

(*) Warning: Grade is steeper than allowable. If value is parantheses, design parameters have been exceeded. - See user manual.

STATION BEGIN END	SIDE LENGTH (ft.)	RADIUS (ft.)	IN SLOPE	BACK SLOPE	GRADE (ft./ft.)	AREA (acres)	AREA SUM	CA COEFF. (Sum)	PROTECT TYPE	RAIN INT. (in./hr.)	STORM FREQ. (yrs.)	MANN. FLOW (cfs.)	TIME (min.)	VEL. FLOW (fps.)	SHEAR FLOW (lbs./sq.ft.)	DESIGN FLOW (cfs.)	DEPTH FLOW (ft.)	WIDTH FLOW (ft.)		
258+00	L	2600.0	10.00	3.00	1.00	0.0223	12.73	12.73	0.71	9.04	Seed	3.15	5	0.030	23.70	4.61	0.77	28.45	0.56	12.22
											Jute Mat	3.02	5	0.040	25.50	3.77	0.89	27.32	0.64	12.57
											Temp. Mat	3.02	5	0.040	25.50	3.77	0.89	27.32	0.64	12.57
											Temp. Mat	3.58	10	0.040	24.96	4.00	0.99	32.36	0.71	12.84



DITCH ANALYSIS

PID : 77366 Date : 07/02/2007 Project : SCI-823-0.00
 Description : SR823, STA. 288+50 TO STA. 291+00, LHS

Location : PORTSMOUTH, SCIOTO COUNTY
 Designer : MDC

Rainfall Area : D

Allowable Shears
 Jute Mat: 0.45 Temporary Mat: 1.00
 Type 2: 3.00 Type 3: 5.00
 Seed: 0.40
 Permanent Mat Type 1: 2.00
 RCP Type B: 6.00

(*) Warning: Grade is steeper than allowable. If value is parantheses, design parameters have been exceeded. - See user manual.

STATION	SIDE LENGTH	RADIUS	IN	BACK	GRADE	AREA	AREA	AREA	RUNOFF	CA	PROTECT	RAIN	STORM	MANN.	TIME	VEL.	SHEAR	DESIGN	DEPTH	WIDTH	
BEGIN	END		WIDTH	SLOPE	SLOPE	(ft./ft.)	(acres)	SUM	COEFF.	(Sum)	TYPE	INT.	FREQ.	COEFF.	FLOW	FLOW	(lbs./	FLOW	FLOW	FLOW	
			(ft.)	(ft./ft.)	(ft./ft.)	(acres)	(acres)	(acres)	(in./hr.)	(yrs.)	(in./hr.)	(min.)	(min.)	(min.)	(min.)	(fps.)	sq.ft.)	(cfs.)	(ft.)	(ft.)	
288+50	291+00	L	250.00	15.00	2.00	3.00	0.0060	5.16	5.16	0.71	3.66	Seed	3.72	5	0.030	17.00	2.04	0.16	13.62	0.42	17.08
												Seed	4.32	10	0.040	17.27	1.79	0.20	15.82	0.54	17.70



DITCH ANALYSIS

PID : 77366 Date : 07/02/2007 Project : SCI-823-0.00 Location : PORTSMOUTH, SCIOTO COUNTY Designer : MDC

Description : SR823, STA. 295+00 TO STA. 291+00, LHS

Rainfall Area : D

Allowable Shears
 Seed: 0.40
 Permanent Mat Type 1: 2.00
 RCP Type B: 6.00
 Jute Mat: 0.45
 Type 2: 3.00
 Temporary Mat: 1.00
 Type 3: 5.00

(*) Warning: Grade is steeper than allowable. if value is parantheses, design parameters have been exceeded. - See user manual.

STATION BEGIN END	SIDE LENGTH (ft.)	RADIUS (ft.)	IN SLOPE	BACK SLOPE	GRADE (ft./ft.)	AREA (acres)	AREA (acres)	CA SUM	PROTECT TYPE	RAIN INT. (in./hr.)	STORM FREQ. (yrs.)	MANN. COEFF.	TIME FLOW (min.)	VEL. FLOW (fps.)	SHEAR FLOW (lbs./ sq.ft.)	DESIGN FLOW (cfs.)	DEPTH FLOW (ft.)	WIDTH FLOW (ft.)			
295+00 293+00	L	200.00	10.00	4.00	4.00	0.50	0.0650	2.68	2.68	0.71	1.90	Seed	3.84	5	0.030	15.85	3.89	0.73	7.30	0.18	10.81
												Jute Mat	3.82	5	0.040	16.01	3.25	0.87	7.27	0.21	10.96
												Temp. Mat	3.82	5	0.040	16.01	3.25	0.87	7.27	0.21	10.96
												Temp. Mat	4.48	10	0.040	15.96	3.45	0.95	8.52	0.23	11.06
293+00 291+00	L	200.00	15.00	4.00	4.00	2.00	0.3100*	3.42	6.10	0.71	4.33	Seed	3.77	5	0.030	16.46	7.39	2.77	16.33	0.14	15.86
												Jute Mat	3.76	5	0.040	16.55	6.19	3.28	16.29	0.17	16.02
												Temp. Mat	3.76	5	0.040	16.55	6.19	3.28	16.29	0.17	16.02
												Perm, Type 1	3.76	5	0.040	16.55	6.19	3.28	16.29	0.17	16.02
												Perm, Type 2	3.76	5	0.040	16.55	6.19	3.28	16.29	0.17	16.02
												Perm, Type 3	3.76	5	0.040	16.55	6.19	3.28	16.29	0.17	16.02
												Perm, Type 3	4.42	10	0.040	16.46	6.58	3.61	19.12	0.19	16.12



DITCH ANALYSIS

PID : 77366 **Date :** 07/02/2007 **Project :** SCI-823-0.00 **Location :** PORTSMOUTH, SCIOTO COUNTY
Description : SR823, STA. 295+00 TO STA. 298+00, LHS **Designer :** MDC

Rainfall Area : D

Allowable Shears
Jute Mat: 0.45 **Temporary Mat:** 1.00
Type 2: 3.00 **Type 3:** 5.00
Seed: 0.40
Permanent Mat Type 1: 2.00
RCP Type B: 6.00

(*) Warning: Grade is steeper than allowable. If value is parantheses, design parameters have been exceeded. - See user manual.

STATION	SIDE LENGTH	RADIUS	IN	BACK	GRADE	AREA	AREA	RUNOFF	CA	PROTECT	RAIN	STORM	MANN.	TIME	VEL.	SHEAR	DESIGN	DEPTH	WIDTH		
BEGIN	END	(ft.)	WIDTH	SLOPE	(ft./ft.)	(acres)	SUM	COEFF.	(Sum)	TYPE	INT.	FREQ.	COEFF.	FLOW	FLOW	(lbs./	FLOW	FLOW	FLOW		
		(ft.)	(ft./ft.)	(ft./ft.)	(ft./ft.)	(acres)	(acres)			(in./hr.)	(yrs.)	(min.)	(min.)	(min.)	(fps.)	sq.ft.)	(cfs.)	(ft.)	(ft.)	(ft.)	
295+00	298+00	L	300.00	15.00	4.00	2.00	0.2817*	4.02	4.02	0.71	2.86	Seed	3.84	5	0.030	15.81	6.16	2.04	10.98	0.12	15.70
												Jute Mat	3.83	5	0.040	15.96	5.15	2.42	10.93	0.14	15.83
												Temp. Mat	3.83	5	0.040	15.96	5.15	2.42	10.93	0.14	15.83
												Perm, Type 1	3.83	5	0.040	15.96	5.15	2.42	10.93	0.14	15.83
												Perm, Type 2	3.83	5	0.040	15.96	5.15	2.42	10.93	0.14	15.83
												Perm, Type 2	4.49	10	0.040	15.90	5.48	2.66	12.82	0.15	15.91



DITCH ANALYSIS

PID : 77366 Date : 07/02/2007 Project : SCI-823-0.00
 Description : SR823, STA. 306+00 TO STA. 298+50, LHS

Location : PORTSMOUTH, SCIOTO COUNTY

Designer : MDC

Rainfall Area : D

Allowable Shears
 Seed: 0.40
 Permanent Mat Type 1: 2.00
 RCP Type B: 6.00
 Jute Mat: 0.45
 Type 2: 3.00
 Temporary Mat: 1.00
 Type 3: 5.00

(*) Warning: Grade is steeper than allowable. if value is parantheses, design parameters have been exceeded. - See user manual.

STATION BEGIN END	SIDE LENGTH (ft.)	RADIUS (ft.)	IN SLOPE	BACK SLOPE	GRADE (ft./ft.)	AREA (acres)	AREA SUM	CA COEFF.	PROTECT TYPE	RAIN INT. (in./hr.)	STORM FREQ. (yrs.)	MANN. COEFF.	TIME FLOW (min.)	VEL. FLOW (fps.)	SHEAR FLOW (lbs./sq.ft.)	DESIGN FLOW (cfs.)	DEPTH FLOW (ft.)	WIDTH FLOW (ft.)			
306+00	303+00	L	400.00	10.00	4.00	2.00	0.0775	4.34	4.34	0.71	3.08	Seed	3.79	5	0.030	16.35	4.87	1.09	11.66	0.22	11.35
												Jute Mat	3.76	5	0.040	16.62	4.05	1.28	11.57	0.26	11.59
												Temp. Mat	3.76	5	0.040	16.62	4.05	1.28	11.57	0.26	11.59
												Perm, Type 1	3.76	5	0.040	16.62	4.05	1.28	11.57	0.26	11.59
												Perm, Type 1	4.41	10	0.040	16.53	4.29	1.41	13.58	0.29	11.75
303+00	298+50	L	450.00	10.00	4.00	2.00	0.3411*	5.37	9.70	0.73	7.00	Seed	3.68	5	0.030	17.34	10.41	4.93	25.78	0.23	11.39
												Jute Mat	3.67	5	0.040	17.48	8.66	5.83	25.69	0.27	11.64
												Temp. Mat	3.67	5	0.040	17.48	8.66	5.83	25.69	0.27	11.64
												Perm, Type 1	3.67	5	0.040	17.48	8.66	5.83	25.69	0.27	11.64
												Perm, Type 2	3.67	5	0.040	17.48	8.66	5.83	25.69	0.27	11.64
												Perm, Type 3	3.67	5	0.040	17.48	8.66	5.83	25.69	0.27	11.64
													3.65	5	0.060	17.73	6.67		25.51	0.35	12.08



DITCH ANALYSIS

PID : 77366 Date : 07/02/2007 Project : SCI-823-0.00
 Description : SR823, STA. 306+00 TO STA. 312+50, LHS

Location : PORTSMOUTH, SCIOTO COUNTY

Designer : MDC

Rainfall Area : D

Allowable Shears

Seed: 0.40
 Permanent Mat Type 1: 2.00
 RCP Type B: 6.00
 Jute Mat: 0.45
 Type 2: 3.00
 Temporary Mat: 1.00
 Type 3: 5.00

(*) Warning: Grade is steeper than allowable. if value is parantheses, design parameters have been exceeded. - See user manual.

STATION BEGIN END	SIDE LENGTH (ft.)	RADIUS WIDTH (ft.)	IN SLOPE (ft./ft.)	BACK GRADE SLOPE (ft./ft.)	AREA (acres)	AREA SUM (acres)	CA COEFF. (Sum)	PROTECT TYPE	RAIN INT. (in./hr.)	STORM FREQ. (yrs.)	MANN. FLOW (min.)	TIME FLOW (fps.)	VEL. FLOW (lbs./sq.ft.)	SHEAR DESIGN (cfs.)	DEPTH FLOW (ft.)	WIDTH FLOW (ft.)				
306+00	L	300.00	10.00	3.00	0.50	0.0300	0.88	0.88	0.75	0.66	Seed	3.68	5	0.030	17.41	2.03	0.22	2.43	0.12	10.41
309+00	L	350.00	12.00	4.00	3.00	0.3971*	3.68	4.56	0.71	3.27	Seed	4.27	10	0.040	17.70	1.80	0.29	2.82	0.15	10.54
											Seed	3.60	5	0.030	18.17	7.60	3.09	11.79	0.12	12.87
											Jute Mat	3.59	5	0.040	18.32	6.35	3.66	11.75	0.15	13.03
											Temp. Mat	3.59	5	0.040	18.32	6.35	3.66	11.75	0.15	13.03
											Perm, Type 1	3.59	5	0.040	18.32	6.35	3.66	11.75	0.15	13.03
											Perm, Type 2	3.59	5	0.040	18.32	6.35	3.66	11.75	0.15	13.03
											Perm, Type 3	3.59	5	0.040	18.32	6.35	3.66	11.75	0.15	13.03
											Perm, Type 3	4.17	10	0.040	18.56	6.73	4.01	13.66	0.16	13.13



DITCH ANALYSIS

PID : 77366 **Date :** 07/02/2007 **Project :** SCI-823-0.00 **Location :** PORTSMOUTH, SCIOTO COUNTY **Designer :** MDC
Description : SR823, STA. 318+50 TO STA. 319+00, LHS

Rainfall Area : D

Allowable Shears
Seed: 0.40
Permanent Mat Type 1: 2.00 **Jute Mat:** 0.45 **Temporary Mat:** 1.00
RCP Type B: 6.00 **Type 2:** 3.00 **Type 3:** 5.00

(*) 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 (ft.)	IN SLOPE (ft./ft.)	BACK SLOPE (ft./ft.)	GRADE (ft./ft.)	AREA (acres)	AREA SUM (acres)	RUNOFF COEFF. (Sum)	CA TYPE	PROTECT TYPE	RAIN INT. (in./hr.)	STORM FREQ. (yrs.)	MANN. COEFF. (min.)	FLOW VEL. (fps.)	DESIGN FLOW (cfs.)	DEPTH (ft.)	WIDTH (ft.)		
318+50	319+00	L	50.00	15.00	2.00	2.00	0.2720*	0.46	0.46	0.72	0.33	Seed	5	0.030	15.32	2.63	0.55	1.29	0.03	15.13
												Jute Mat	5	0.040	15.38	2.21	0.66	1.29	0.04	15.15
												Temp. Mat	5	0.040	15.38	2.21	0.66	1.29	0.04	15.15
												Temp. Mat	10	0.040	15.35	2.35	0.72	1.51	0.04	15.17



DITCH ANALYSIS

PID : 77366 Date : 07/02/2007 Project : SCI-823-0.00
 Description : SR823, STA. 323+50 TO STA. 320+50, LHS

Location : PORTSMOUTH, SCIOTO COUNTY
 Designer : MDC

Rainfall Area : D

Allowable Shears
 Jute Mat: 0.45 Temporary Mat: 1.00
 Type 2: 3.00 Type 3: 5.00
 Seed: 0.40
 Permanent Mat Type 1: 2.00
 RCP Type B: 6.00

(*) Warning: Grade is steeper than allowable. if value is parantheses, design parameters have been exceeded. - See user manual.

STATION	SIDE	LENGTH	RADIUS	IN	BACK	GRADE	AREA	AREA	AREA	RUNOFF	CA	PROTECT	RAIN	STORM	MANN.	TIME	VEL.	SHEAR	DESIGN	DEPTH	WIDTH
BEGIN	END	(ft.)	WIDTH	SLOPE	SLOPE	(ft./ft.)	(ft./ft.)	(acres)	SUM	COEFF.	(Sum)	TYPE	INT.	FREQ.	COEFF.	FLOW	FLOW	(lbs./	FLOW	FLOW	FLOW
		(ft.)	(ft./ft.)	(ft./ft.)	(ft./ft.)	(ft./ft.)	(acres)		(acres)			(in./hr.)	(yrs.)	(min.)	(fps.)	sq.ft.)	(cfs.)	(ft.)	(ft.)	(ft.)	(ft.)
323+50	320+50	L	300.00	10.00	4.00	2.00	0.1067*	3.30	3.30	0.71	2.34	Seed	3.82	5	0.030	16.02	4.87	1.16	8.95	0.17	11.05
												Jute Mat	3.80	5	0.040	16.21	4.06	1.37	8.90	0.21	11.24
												Temp. Mat	3.80	5	0.040	16.21	4.06	1.37	8.90	0.21	11.24
												Perm, Type 1	3.80	5	0.040	16.21	4.06	1.37	8.90	0.21	11.24
												Perm, Type 1	4.46	10	0.040	16.15	4.31	1.51	10.44	0.23	11.36



DITCH ANALYSIS

PID : 77366 Date : 07/02/2007 Project : SCI-823-0.00
 Description : SR823, STA. 323+50 TO STA. 328+00, LHS

Location : PORTSMOUTH, SCIOTO COUNTY

Designer : MDC

Rainfall Area : D

Allowable Shears

Seed: 0.40
 Permanent Mat Type 1: 2.00
 RCP Type B: 6.00
 Jute Mat: 0.45
 Type 2: 3.00
 Temporary Mat: 1.00
 Type 3: 5.00

(*) Warning: Grade is steeper than allowable. If value is parantheses, design parameters have been exceeded. - See user manual.

STATION BEGIN END	SIDE LENGTH (ft.)	RADIUS (ft.)	IN SLOPE (ft./ft.)	BACK SLOPE (ft./ft.)	GRADE (ft./ft.)	AREA (acres)	AREA SUM (acres)	CA COEFF. (Sum)	PROTECT TYPE	RAIN INT. (in./hr.)	STORM FREQ. (yrs.)	MANN. COEFF. (min.)	TIME FLOW (min.)	VEL. FLOW (fps.)	SHEAR (lbs./sq.ft.)	DESIGN FLOW (cfs.)	DEPTH FLOW (ft.)	WIDTH FLOW (ft.)	
323+50 327+50	L	400.00	10.00	3.00	0.50	0.0180	2.18	0.73	1.59	Seed	3.65	5	0.030	17.69	2.42	0.26	5.80	0.23	10.81
327+50 328+00	L	50.00	15.00	3.00	1.00	0.2180*	2.58	0.72	1.88	Seed	4.23	10	0.040	18.03	2.13	0.34	6.73	0.30	11.05
										Seed	3.63	5	0.030	17.86	4.75	1.29	6.83	0.09	15.38
										Jute Mat	3.63	5	0.040	17.90	3.99	1.53	6.82	0.11	15.45
										Temp. Mat	3.63	5	0.040	17.90	3.99	1.53	6.82	0.11	15.45
										Perm, Type 1	3.63	5	0.040	17.90	3.99	1.53	6.82	0.11	15.45
										Perm, Type 1	4.21	10	0.040	18.23	4.22	1.67	7.91	0.12	15.49



DITCH ANALYSIS

PID : 79977 **Date :** 07/02/2007 **Project :** SCI-823-0.00 **Location :** PORTSMOUTH, SCIOTO COUNTY
Description : SR823, STA. 329+00 TO STA. 328+50, LHS **Designer :** mdc

Rainfall Area : D

Seed: 0.40	Allowable Shears	
Permanent Mat Type 1: 2.00	Jute Mat: 0.45	Temporary Mat: 1.00
RCP Type B: 6.00	Type 2: 3.00	Type 3: 5.00

(*) Warning: Grade is steeper than allowable. If value is parantheses, design parameters have been exceeded. - See user manual.

STATION	SIDE LENGTH	RADIUS	IN	BACK	GRADE	AREA	AREA	AREA	RUNOFF	CA	PROTECT	RAIN	STORM	MANN.	TIME	VEL.	SHEAR	DESIGN	DEPTH	WIDTH	
BEGIN	END	(ft.)	SLOPE	SLOPE	(ft./ft.)	(acres)	SUM	COEFF.	(Sum)	TYPE	(in./hr.)	INT.	FREQ.	COEFF.	FLOW	FLOW	(lbs./	FLOW	FLOW	FLOW	
		(ft./ft.)	(ft./ft.)	(ft./ft.)	(ft./ft.)	(acres)	(acres)						(yrs.)	(min.)	(fps.)	(sq.ft.)	(cfs.)	(ft.)	(ft.)	(ft.)	
329+00	328+50	L	50.00	15.00	2.00	2.00	0.1320*	0.32	0.32	0.72	0.23	Seed	3.88	5	0.030	15.45	1.83	0.27	0.90	0.03	15.13
												Seed	4.54	10	0.040	15.51	1.64	0.35	1.05	0.04	15.17



DITCH ANALYSIS

PID : 77366 **Date :** 07/02/2007 **Project :** SCI-823-0.00
Description : SR823, STA. 329+00 TO STA. 345+00, LHS

Location : PORTSMOUTH, SCIOTO COUNTY

Designer : MDC

Rainfall Area : D

Allowable Shears

Seed: 0.40 **Temporary Mat:** 1.00
Permanent Mat Type 1: 2.00 **Type 2:** 3.00
RCP Type B: 6.00 **Type 3:** 5.00

(*) Warning: Grade is steeper than allowable. If value is parantheses, design parameters have been exceeded. - See user manual.

STATION BEGIN END	SIDE LENGTH (ft.)	RADIUS IN WIDTH (ft.)	BACK SLOPE (ft./ft.)	GRADE SLOPE (ft./ft.)	AREA (acres)	AREA SUM (acres)	CA TYPE	PROTECT TYPE	RAIN INT. (in./hr.)	STORM FREQ. (yrs.)	MANN. COEFF.	TIME (min.)	VEL. FLOW (fps.)	SHEAR FLOW (lbs./sq.ft.)	DESIGN FLOW (cfs.)	DEPTH FLOW (ft.)	WIDTH FLOW (ft.)			
329+00 333+00	L	400.00	10.00	3.00	0.50	0.0243	3.01	3.01	0.72	2.17	Seed	3.70	5	0.030	17.18	2.99	0.39	8.01	0.26	10.90
333+00 340+00	L	700.00	10.00	3.00	0.50	0.0429	9.23	12.24	0.73	8.90	Seed	4.30	10	0.040	17.46	2.64	0.50	9.30	0.33	11.17
											Seed	3.52	5	0.030	19.12	5.91	1.30	31.31	0.49	11.71
											Jute Mat	3.48	5	0.040	19.51	4.90	1.54	30.99	0.58	12.01
											Temp. Mat	3.48	5	0.040	19.51	4.90	1.54	30.99	0.58	12.01
											Perm, Type 1	3.48	5	0.040	19.51	4.90	1.54	30.99	0.58	12.01
											Perm, Type 1	4.06	10	0.040	19.68	5.17	1.68	36.12	0.63	12.20
340+00 343+50	L	350.00	10.00	3.00	0.50	0.0440	2.14	14.38	0.79	10.59	Seed	3.40	5	0.030	20.43	6.27	1.44	36.03	0.53	11.84
											Jute Mat	3.39	5	0.040	20.62	5.20	1.71	35.87	0.62	12.18
											Temp. Mat	3.39	5	0.040	20.62	5.20	1.71	35.87	0.62	12.18
											Perm, Type 1	3.39	5	0.040	20.62	5.20	1.71	35.87	0.62	12.18
343+50 345+00	L	150.00	15.00	3.00	2.00	0.3019*	1.74	16.12	0.71	11.83	Seed	3.37	5	0.030	20.86	10.37	4.63	39.82	0.25	16.23



DITCH ANALYSIS

PID : 77366 **Date :** 07/02/2007 **Project :** SCI-823-0.00 **Location :** PORTSMOUTH, SCIOTO COUNTY
Description : SR823, STA. 349+50 TO STA. 352+00, LHS **Designer :** MDC

Rainfall Area : D **Allowable Shears**
Seed: 0.40 **Jute Mat:** 0.45 **Temporary Mat:** 1.00
Permanent Mat Type 1: 2.00 **Type 2:** 3.00 **Type 3:** 5.00
RCP Type B: 6.00

(*) Warning: Grade is steeper than allowable. If value is parantheses, design parameters have been exceeded. - See user manual.

STATION	SIDE	LENGTH	RADIUS	IN	BACK	GRADE	AREA	AREA	AREA	RUNOFF	CA	PROTECT	RAIN	STORM	MANN.	TIME	VEL.	SHEAR	DESIGN	DEPTH	WIDTH
BEGIN	END	(ft.)	WIDTH	SLOPE	(ft./ft.)	(ft./ft.)	(acres)	SUM	COEFF.	(Sum)	TYPE	TYPE	INT.	FREQ.	COEFF.	FLOW	FLOW	(lbs./	FLOW	FLOW	FLOW
		(ft./ft.)	(ft./ft.)		(acres)			(in./hr.)	(yrs.)	(min.)	(fps.)	sq.ft.)	(cfs.)	(ft.)							
349+50	L	100.00	10.00	3.00	2.00	0.0060	1.47	1.47	0.80	1.17	Seed	3.81	5	0.030	16.07	1.54	0.10	4.47	0.27	11.36	
350+50	L	150.00	10.00	3.00	2.00	0.0060	0.96	2.42	0.72	1.86	Seed	4.45	10	0.040	16.21	1.36	0.13	5.21	0.35	11.77	
											Seed	3.67	5	0.030	17.44	1.79	0.13	6.84	0.35	11.75	
											Seed	4.26	10	0.040	17.78	1.58	0.17	7.93	0.45	12.26	

APPENDIX F

BMP CALCULATIONS

Project: SCI-823-PH3
Subject: BMP Summary
Task:
Job #: 71143



Originated: KAG-9/21/12
Checked:
Changes Made:
Corrections Verified:

1115.6.2 Treatment Requirements for New Construction Projects

All projects that do not meet the definition of redevelopment are considered new construction. New construction projects allow for a reduction of treatment based on existing impervious area. New impervious area requires treatment of 100% of the area. Existing impervious area, including all existing right-of-way area, requires treatment of 20% of the area. Consider all area within existing ODOT right-of-way to be impervious for post-construction BMP calculations.

Determine the Treatment Percent (weighted average of impervious areas for a drainage area) using the following equation:

$$T = [(Aix * 0.20) + (Ain * 1.00)] / (Aix + Ain)$$

Where,

T = Treatment percent (decimal)

Aix = Existing impervious area (acres)

Ain = New impervious area (acres)

The Treatment Percent determined above shall be used to determine treatment in the same manner as described for redevelopment projects (i.e. Treat the Treatment Percent of WQ_v for 100% of Project EDA, etc.).

Treatment Requirements

Aix = 50 Acres

Ain = 73 Acres

Aix + Ain = 122 Acres

T = 68%

EDA - Earth Disturbed Area

EDA = 310.00 Acres Estimated Construction

Treat 68% of the EDA for 100% of project
or

Treat 100% of the EDA for 68% of project

Area requiring treatment

EDA * T =

310 * 68% = 210 Acres

Project: SCI-823-PH3
 Subject: BMP Summary
 Task:
 Job #:71143



Originated:KAG-9/21/12
 Checked:
 Changes Made:
 Corrections Verified:

Total area within ROW receiving treatment in a BMP	241	acres
Required Treatment based on treatment percent	210	acres
Surplus	31	acres

Phase III Location	BMP Type	Acres of ROW treated	
Segment A/HUC 060			
	VBF	21.8	ac
	Sheet Flow or VFS	3.1	ac
	ExT	1.0	ac
	Basins	13.4	ac

Segment B/HUC 050

	VBF	43.5	ac
	Sheet Flow or VFS	14.9	ac
	ExT	0.0	ac
	Basins	0.0	ac

Segment C/HUC 050

1 limits not final

	VBF	61.0	ac
	Sheet Flow or VFS	58.5	ac
	ExT	3.9	ac
	Basins	19.8	ac

				A	B	C			
Total Treated				21.8	43.5	61.0			
V				Area within ROW	Contributing Drainage area				
Segment A	Location	STATION FROM	STATION TO	Acres	AREA (AC)	EBW (FT)	WIDTH PROVIDED	Notes	
	US52	7+00	11+00	LT	2.17	2.17	7.1	7	
	US52	006+00	010+50	RT	1.20	1.20	5.8	6	
		010+50	017+50	RT	2.91	2.91	7.9	8	
		017+50	020+00	RT	0.98	0.98	5.4	6	
		017+00	020+00	LT	0.96	0.96	5.3	6	
		020+00	027+00	RT	2.03	2.03	6.9	7	
	US52	020+50	2200 ramp 52B		1.40	1.40	6.1	6	
	R52B	022+00	029+00	LT	2.82	2.82	7.8	8	
	R52B rt	027+00	029+00	RT	0.63	0.63	4.6	5	
	R52B rt	029+00	030+50	RT	0.48	0.48	4.2	5	
	R52B rt	030+50	032+00	RT	0.49	0.49	4.2	5	
	R52B rt	032+00	037+00	RT	0.57	0.57	4.4	5	
	R52B rt	029+00	037+00	LT	0.72	1.19	5.7	6	
	R503B lt	031+50	034+00	LT		0.49	4.2	2	Area not treated BMP
	US 52	035+50	039+20	RT	0.56	0.56	4.4	5	
	US 52	041+00	042+00	RT	0.42	0.42	4.0	4	
	US 52A	031+50	033+50	RT		0.21	3.1	3	Area not treated BMP, not
	US 52A	033+50	035+50	RT	0.41	0.41	3.9	4	
	US 52A	035+50	037+20	RT	0.41	0.41	3.9	4	
	US 52A	037+20	039+00	RT	0.33	0.33	3.6	4	
	US52 A	044+50	040+00	RT	1.05	1.11	5.6	10	area, drains to VBF 503 St 2
	SR823	044+50	061+00	RT		7.32	11.0	10	drains to VBF 140 St 11+50 RT
	SR140 A	068+50	069+00	RT	0.12	0.12	2.6	10	
	SR823/R140A	096+00	69+00	RT		15.24	14.2	10	
LT	SR823	096+00	086+00	LT		2.93	7.9	10	
	SR140 B	73+00	073+50	LT	0.22	0.29	3.5	10	
LT	SR140 B	86+00	074+00			8.33	11.5	10	
RT	SR140 B	78+00	73+00		0.95	0.95	5.3	6	
Segment B									
RT		096+00	106+00		4.12	4.12	8.9	10	
RT		110+00	114+00		2.98	2.98	8.0	8	
LT		110+25	113+50		1.36	1.36	6.0	6	
LT		096+00	106+00		4.80	4.80	9.4	10	Rock cut drains to VBF
LT		113+50	121+00		4.80	6.44	10.5	10	
RT	SR 123	116+00	122+00			2.01	6.9	10	
RT	Pershing south	017+69	019+60		2.74	2.74	7.7	8	
LT	Pershing south	020+00	018+50		0.18	0.18	2.9	3	
LT	Pershing North	030+00	032+60			0.29	3.5	2	
RT	SR823	123+00	124+50			1.07	5.5	6	
RT	SR823	124+50	128+00		4.27	4.35	9.1	10	
LT	SR823	126+00	129+00		2.90	2.90	7.9	10	
RT	SR823	130+00	129+50		3.14	3.14	8.1	9	
								10	
LT		166+00	166+50		0.11	0.11	2.5	10	
RT		166+50	167+50		0.24	0.24	3.2	10	
LT		167+00	167+50		0.28	0.35	3.7	10	
LT		167+50	175+50		4.34	4.60	9.3	10	10.0
LT		174+50	177+50		2.52	4.09	8.9	10	10.0
LT		178+00	184+50		4.69	4.89	9.5	10	
LT		185+00	207+00			13.16	13.5	10	
Segment C									
RT		206+50	210+00		2.67	4.14	9.0	10	
RT		210+50	226+75		5.89	5.89	10.2	10	
RT		226+75	237+00		5.11	5.11	9.7	10	
LT		240+00	254+50		8.69	8.69	11.7	10	
RT		264+00	271+50		2.65	2.96	7.9	10	
LT		305+50	312+50	LT	4.47	4.47	9.2	10	
RT		311+00	314+50	RT	4.35	4.35	9.1	10	
LT		318+50	319+00	LT	0.31	0.31	3.6	10	
LT		319+25	323+50		3.58	4.88	9.5	10	
RT		314+50	322+00	RT	5.74	5.74	10.1	10	
LT		323+50	328+50	LT	2.08	2.50	7.5	10	
LT		328+50	329+00	LT	0.24	0.32	3.6	10	
RT		322+50	329+50	RT	1.21	1.21	5.8	10	
RT		331+50	333+50	RT	0.46	0.46	4.1	10	
LT		334+00	344+50	LT	6.55	6.55	10.5	10	
RT		334+00	344+50	RT	3.27	3.36	8.3	10	
LT		349+50	353+50	LT	1.78	2.19	7.1	10	
RT		346+00	348+00	RT	1.03	1.03	5.5	10	
RT		340+00	353+50	RT	0.97	0.97	5.3	10	

					A	B	C
				Total Treated	3.07	14.94	58.51
V					Area within ROW		
	Location	TATION FRO	STATION TO		Acres		
Segment A	US52	006+00	007+50	LT	0.34		
		011+50	017+00	LT	1.42		
	US52 RB	022+00	024+00	LT	0.34		
	US52 RB	044+00	044+50	LT	0.10		
	US 52	39+50	41+00	RT	0.41		
	CR 503	023+50	026+50	LT	0.46		
Segment B							
	SR823	107+00	110+00	RT	3.33	VFS	
	SR823	106+00	110+25	LT	2.26	VFS	
	SR823	120+50	121+00	LT	0.43	VFS	
	Pershing South		017+25	LT	0.06		
	SR823	129+00	130+00	LT	0.49	Sheet flow	
	SR823	166+00	169+50	RT	1.13	Sheet flow	
	SR823	173+50	176+00	RT	2.26	Sheet flow	
	SR823	176+00	183+50	RT	4.97	VFS	
Segment C							
	SR823	184+00	195+00	RT	3.01	VFS	
	SR823	207+00	208+50	LT	0.82	VFS	
	SR823	226+25	230+00	LT	2.56	VFS	
	SR823	231+00	238+50	LT	3.76	VFS	
	SR823	237+00	252+50	LT	6.91	VFS	
	SR823	254+50	256+00	LT	1.05	Sheet flow	
	SR823	259+00	264+00	RT	3.06	Sheet flow	
	SR823	272+00	274+00	RT	1.61	Sheet flow	
	SR823	284+00	289+75	LT	6.27	Sheet flow	
	SR823	284+00	289+75	LT	4.96	VFS	
	SR823	294+50	301+50	LT	4.62	VFS	
	SR823	299+00	306+00	LT	3.80	VFS	
	SR823	304+00	310+00	RT	7.59	Sheet flow	
	SR823	312+50	318+00	LT	4.81	Sheet flow	
	SR823	322+00	324+50	RT	1.84	Sheet flow	
	SR823	329+50	331+50	RT	0.60	VFS	
	SR823	344+50	345+50	LT	0.51	VFS	
	SR823	344+50	346+00	RT	0.73	Sheet flow	

Seg B basin not likely
Water Quality Control Preliminary Sizing
 Possible Basin CSXT bridge forward
 Outfall Station:
 Pond drainage areas

Discription	A	C	CA
	4.90	0.55	2.695
	2.90	0.9	2.610
	3.30	0.4	1.320
Total	11.10		6.625
C average			0.60

Use C average as Cq

Water Quality Volume (WQ_v) Calculation

1117.4.1 Detention Basin $WQ_v = (P \cdot A \cdot Cq) / 12$

P 0.75
 A 11.10
 Cq 0.60
 WQ_v = 0.41 ac ft
 WQ_v = 18000 cubic feet
 6000 3000
 54.77226

Extended Detention Treatment - 48 hour draw down minimum time

Required Treatment 1.2 x WQV
 Req'd Volume 21600 cubic feet
 Volume 0.496 ac ft
 Forebay Volume 2160 cubic feet ●
 7200
 3600 60

Countour	Area	Area	Avg Area	Delta V	Volume		
	(sf)	(ac ft)	SF	Cu Ft	Cu Ft		
573	6782	0.155693	0	0	0		
574	7980	0.183196	7381	7381	7381		
575	9236	0.212029	8608	8608	15989	WQV	21600
576	10547	0.242126	9892	9892	25881	575.77	
577	11915	0.273531	11231	11231	37112	1/2 WQV	10800
578	13340	0.306244	12628	12628	49739	574.48	
579	14821	0.340243	14081	14081	63820		

Seg C 15.50 ROW area

Water Quality Control Preliminary Sizing

Sta 293+00 Treats from sta 273+00 to 294+00

Outfall Station:

Pond drainage areas

Discription	A	C	CA
Gras	1.90	0.5	0.950
woods	4.14	0.3	1.242
Imper	13.58	0.9	12.222
Total	19.62		14.414
C average			0.73

Use C average as Cq

Water Quality Volume (WQ_v) Calculation

1117.4.1 Detention Basin $WQ_v = (P \cdot A \cdot Cq) / 12$

P	0.75
A	19.62
Cq	0.73
WQ _v =	0.90 ac ft
WQ_v =	39200 cubic feet
	13066.67 6533.333
	80.82904

Extended Detention Treatment - 48 hour draw down minimum time

Required Treatment 1.2 x WQV

Req'd Volume 47000 cubic feet

Volume 1.079 ac ft

Forebay Volume 4700 cubic feet ●

	15666.67
	7833.333 88.50612

Countour	Area (sf)	Area (ac ft)	Avg Area	Delta V	Volume		
			SF	Cu Ft	Cu Ft		
726	17127	0.393182	0	0	0		
727	18818	0.432002	17973	17973	17973		
728	20565	0.472107	19692	19692	37664	WQV	47000
729	22368	0.513499	21467	21467	59131	728.59	
730	24229	0.556221	23299	23299	82429	1/2 WQV	23500
731	26146	0.60023	25188	25188	107617	727.34	
732	28119	0.645523	27133	27133	134749		

ROW area 14.99

Water Quality Control Preliminary Sizing

Possible Basin 140 st 12+00 RT

Outfall Station:

Pond drainage areas

Discription		A	C	CA
Woods		7.20	0.3	2.160
Imper		3.26	0.9	2.933
Slopes		7.85	0.7	5.495
Total		18.31		10.588
C average				0.58

Use C average as Cq

Water Quality Volume (WQ_v) Calculation

1117.4.1 Detention Basin $WQ_v = (P \cdot A \cdot Cq) / 12$

P 0.75
 A 18.31
 Cq 0.58
 WQ_v = 0.66 ac ft
WQ_v = 28800 cubic feet
 9600 4800
 69.28203

Extended Detention Treatment - 48 hour draw down minimum time

Required Treatment 1.2 x WQV

Req'd Volume **34600** cubic feet

Volume 0.794 ac ft

Forebay Volume 3460 cubic feet ●

Countour	Area	Area	Avg Area	Delta V	Volume		
	(sf)	(ac ft)	SF	Cu Ft	Cu Ft		
0	8112	0.1862259	0	0	0		
1	9228	0.2118457	8670	8670	8670		
2	10401	0.2387741	9815	9815	18485	WQV	34600
3	11630	0.2669881	11016	11016	29500	3.50	
4	12916	0.2965106	12273	12273	41773	1/2 WQV	17300
5	15658	0.3594582	14287	14287	56060	1.89	
6	17114	0.3928834	16386	16386	72446		

APPENDIX G

LD-33 Form

NOT REVISED

FORM LD-33
REV. 12-82

OHIO DEPARTMENT OF TRANSPORTATION
COUNTY ENGINEER
APPROVAL FORM

DATE SUBMITTED TO DISTRICT DEPUTY DIRECTOR

December 10, 2007

DATE SUBMITTED TO COUNTY ENGINEER

December 10, 2007

COUNTY SCIOTO ROUTE 823 SECTION 0.00

CULVERT DATA

STATION	SIZE & TYPE	ELEVATION OF CULVERT INVERT		ELEVATION OF EXISTING CHANNEL AT		SKEW
		INLET	OUTLET	INLET	OUTLET	
68+64.0 SR 823	72" Type A, 707.03	576.67	566.58	576.67	∅	26.0° RF
110+02.0 SR 823	60" Type A, 707.03	559.81	556.62	∅	-	6.0° LF
128+98.0 SR 823	60" Type A, 707.03	523.90	512.54	*	512.54	7.0° LF
166+50.0 SR 823	36" Type A	711.74	710.12	∅	∅	90.0° ⊥
175+57.0 SR 823	60" Type A, 707.03	649.20	602.79	649.20	-	12.0° RF
176+31.4 TO 181+91.8 SR 823, RHS	78" Type A, 707.03	618.75	601.28	-	-	PARALLEL TO SR823
184+29.0 SR 823	78" Type A, 707.03	628.12	624.80	-	∅	21.5° LF
209+30.0 SR 823	72" Type A, 707.03	675.75	658.59	675.75	658.59	21.5° RF
233+87.4 SR 823	8' X 8' Box Culv	683.82	639.44	683.82	-	48.3° RF
239+18.1 SR 823	8' x 8' Box Culv.	652.20	639.44	652.20	-	5.5° LF
297+33.6 SR 823	8' X 8' Box Culv.	576.26	554.27	*	-	51.6° RF
300+96.5 SR 823	8' X 8' Box Culv.	566.54	554.27	*	∅	28.0° RF
311+81.0 SR 823	8' X 8' Box Culv.	601.97	570.86	*	*	17.0° LF
320+42.8 SR 823	72" Type A, 707.03	660.56	616.59	∅	*	34.8° RF
344+82.0 SR 823	8' X 8' Box Culv.	572.79	561.92	572.79	*	5.3° LF

I have reviewed and hereby approve the drainage proposed for the highway designated heron in accordance with the provisions of Section 6131.631 of the Revised Code of the State of Ohio.

COUNTY ENGINEER SCIOTO COUNTY

(SIGNATURE)

DATE

COMMENTS:

* Relocated Channel
∅ New Ditch Location

**OHIO DEPARTMENT OF TRANSPORTATION
COUNTY ENGINEER
APPROVAL FORM**

FORM LD-33

REV. 12-82

DATE SUBMITTED TO DISTRICT DEPUTY DIRECTOR

December 10, 2007

DATE SUBMITTED TO COUNTY ENGINEER

December 10, 2007

COUNTY SCIOTO ROUTE 823 SECTION 0.00

CULVERT DATA

STATION	SIZE & TYPE	ELEVATION OF CULVERT INVERT		ELEVATION OF EXISTING CHANNEL AT		SKEW	
		INLET	OUTLET	INLET	OUTLET		
64+00.0	SR140 RAMP A	24" Type A	555.91	554.02	◇	◇	90° ⊥
68+50.0	SR140 RAMP B	36" Type A	572.85	570.00	◇	◇	90° ⊥
73+12.6	SR140 RAMP B	30" Type A	606.50	603.18	◇	◇	43.5 LF
11+17.0	US52	48" TYPE A, 706.02	520.31	520.20	◇	◇	Exist.
20+14.0	US52	84" TYPE A, 706.02	519.41	516.74	◇	◇	Exist.
21+50.0	CR503	78" TYPE A, 706.02	549.25	546.63	◇	◇	90° ⊥
6+89.33	SR140	30" Type A	548.15	546.91	◇	-	90° ⊥
12+00.00	SR140	36" Type A	553.72	552.80	◇	◇	90° ⊥
16+50.00	SR140	42" Type A	566.94	566.16	◇	◇	90° ⊥
22+16.57	CR251	36" Type A	555.24	553.50	-	-	17.4° LF
18+00.00	PERSHING AVE, SOUTH	24" Type A	547.15	544.51	◇	-	90° ⊥
0+70.00	DRIVE @ PERSHING AVE, SOUTH	24" Type A	543.46	540.86	◇	-	26.8° RF
15+66.10	SR335	42" Type A	528.22	527.56	◇	-	90° ⊥

I have reviewed and hereby approve the drainage proposed for the highway designated heron in accordance with the provisions of Section 6131.631 of the Revised Code of the State of Ohio.

COUNTY ENGINEER SCIOTO COUNTY

(SIGNATURE)

DATE _____

COMMENTS:

* Relocated Channel
◇ New Ditch Location