



**SCI-823-0.00
PID 77366
(Portsmouth Bypass)**

Phase – 3, Stage 1

Preliminary Hydraulic Calculations

Submitted January 8, 2008



5747 Perimeter Drive, Suite 240, Dublin, Ohio 43017



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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

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 1¹/₂": Full flow 0.025

3" x 1": Full flow 0.025

6" x 2": Full flow 0.025

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 Dissipators 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 T_c 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 \geq 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.)	LONG. 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 SPREAD (ft.)
58+85	Begin															
59+95	CB-3	109.49	0.00	0.00	0.00	0.00	0.0001	0.0400	0.0160	12.00	0.00	0.0000	0.0000	0.29	0.272	6.80
61+00	Begin															
59+95	CB-3	104.55	0.00	0.00	0.00	0.00	0.0001	0.0400	0.0160	12.00	0.00	0.0000	0.0000	0.28	0.268	6.71



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 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 FLOW (cfs.)	BYPASS FLOW (cfs.)	TOTAL FLOW (cfs.)	DEPTH (ft.)	PAVT. FLOW SPREAD (ft.)	
63+08	Begin																	
61+00	CB-3A	208.83	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 :** 06/04/2007 **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)	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.)	INTERCPTD FLOW (cfs.)	BYPASS FLOW (cfs.)	TOTAL FLOW (cfs.)	DEPTH (ft.)	PAVT. FLOW SPREAD (ft.)
112+26	Begin																
118+00	CB-3A	573.64	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 (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.)
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121+02	Begin																			
126+00	CB-3A	497.39	0.00	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. FLOW (ft.)	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	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	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	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	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	0.234	5.84	
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	0.480	11.99	



INLET SPACING DESIGN

PID : 77366 Date : 05/23/2007 Project : SCI-823-0.00
 Description : STA. 16+76.64 TO 13+60; SR140, RHS

Location : PORTSMOUTH, SCIOTO COUNTY

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.)	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.)	
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	0.53	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.)	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 FLOW (cfs.)	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	0.00	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	0.00	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	0.00	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	0.00	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	0.00	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	0.00	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	0.00	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	0.00	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	0.00	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	0.00	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	0.00	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 : 12/24/2006 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 : 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.)	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	0.00	0.00	0.00	0.00	0.00	0.0390	0.0400	0.0000	6.00	0.0600	0.69	0.14	0.83	0.132	3.30
112+00	I-3B	600.00	0.00	0.00	0.00	0.00	0.00	0.0410	0.0400	0.0000	6.00	0.0600	0.57	0.07	0.64	0.118	2.96
120+00	I-3B	800.00	0.00	0.00	0.00	0.00	0.00	0.0410	0.0400	0.0000	6.00	0.0600	0.63	0.11	0.74	0.125	3.13
126+00	I-3B	600.00	0.00	0.00	0.00	0.00	0.00	0.0223	0.0400	0.0000	6.00	0.0600	0.59	0.02	0.61	0.130	3.26
128+50	I-3B	250.00	0.00	0.00	0.00	0.00	0.00	0.0089	0.0400	0.0000	6.00	0.0600	0.64	0.00	0.64	0.158	3.95
129+50	I-3C	100.00	0.00	0.00	0.00	0.00	0.00	0.0035	0.0400	0.0000	6.00	0.0600	0.35	0.00	0.35	0.150	3.75
130+16	I-3C	66.00	0.00	0.00	0.00	0.00	0.00	0.0030	0.0400	0.0000	6.00	0.0600	*****	*****	0.23	0.132	3.30
131+64	Begin																
130+16	I-3C	148.00	0.00	0.00	0.00	0.00	0.00	0.0030	0.0400	0.0000	6.00	0.0600	*****	*****	1.10	0.237	5.93

SUMP DATA

Total Flow (cfs) : 1.33

Ponded Depth (ft.) : 0.123

Spread on Pavement (ft.) : 2.46



INLET SPACING DESIGN

PID : 77366 Date : 12/24/2006 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 : 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.)	INTERCPTD FLOW (cfs.)	BYPASS FLOW (cfs.)	TOTAL FLOW (cfs.)	DEPTH (ft.)	PAVT. FLOW (ft.)	SPREAD (ft.)	
96+13	Begin																		
106+00	I-3B	987.00	0.00	0.00	0.00	0.00	0.0390	0.0400	0.0000	6.00	0.1670	0.00	0.83	0.00	0.83	0.132		3.30	
112+00	I-3B	600.00	0.00	0.00	0.00	0.00	0.0410	0.0400	0.0000	6.00	0.1670	0.00	0.50	0.00	0.50	0.108		2.70	
120+00	I-3B	800.00	0.00	0.00	0.00	0.00	0.0410	0.0400	0.0000	6.00	0.1670	0.00	0.67	0.00	0.67	0.121		3.01	
126+00	I-3B	600.00	0.00	0.00	0.00	0.00	0.0223	0.0400	0.0000	6.00	0.1670	0.00	0.50	0.00	0.50	0.121		3.03	
128+50	I-3B	250.00	0.00	0.00	0.00	0.00	0.0089	0.0400	0.0000	6.00	0.1670	0.00	0.21	0.00	0.21	0.104		2.60	
129+50	I-3C	100.00	0.00	0.00	0.00	0.00	0.0035	0.0400	0.0000	6.00	0.1670	0.00	0.07	0.00	0.07	0.082		2.05	
130+16	I-3C	66.00	0.00	0.00	0.00	0.00	0.0030	0.0400	0.0000	6.00	0.1670	0.00	*****	*****	0.04	0.068		1.71 Sag	
131+64	Begin																		
130+16	I-3C	148.00	0.00	0.00	0.00	0.00	0.0030	0.0400	0.0000	6.00	0.1670	0.00	*****	*****	0.21	0.128		3.20 End	

SUMP DATA

Total Flow (cfs) : 0.25

Ponded Depth (ft.) : 0.041

Spread on Pavement (ft.) : 0.60



INLET SPACING DESIGN

PID : 77366 **Date :** 12/28/2007 **Project :** SCI-823-0.00 **Location :** PORTSMOUTH, SCIOTO COUNTY
Description : REACH # 2, 96+13.37(HP) TO 130+15.93(LP) TO 167+27.78(HP), SR823, LHS **Designer :** MDC

Rainfall Area: D **Storm Frequency (yr.) :** 10 **Total Allow. Spread (ft.) :** 0.00 **Allowable Depth (ft.) :** 0.22

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																	
161+00	I-3C	627.00	0.00	0.00	0.00	0.00	0.00	0.0246	0.0400	0.0000	6.00	0.0600	0.00	1.51	0.87	2.38	0.213	5.33
155+00	I-3C	600.00	0.00	0.00	0.00	0.00	0.00	0.0480	0.0400	0.0000	6.00	0.0600	0.00	1.58	1.57	3.15	0.209	5.23
150+00	I-3C	500.00	0.00	0.00	0.00	0.00	0.00	0.0500	0.0400	0.0000	6.00	0.0600	0.00	1.66	1.81	3.46	0.215	5.38
146+00	I-3C	400.00	0.00	0.00	0.00	0.00	0.00	0.0500	0.0400	0.0000	6.00	0.0600	0.00	1.61	1.70	3.32	0.212	5.29
142+00	I-3C	400.00	0.00	0.00	0.00	0.00	0.00	0.0500	0.0400	0.0000	6.00	0.0600	0.00	1.58	1.63	3.21	0.209	5.23
141+50	I-3C	50.00	0.00	0.00	0.00	0.00	0.00	0.0500	0.0400	0.0000	6.00	0.0600	0.00	1.11	0.71	1.82	0.169	4.22
141+00	I-3C	50.00	0.00	0.00	0.00	0.00	0.00	0.0500	0.0400	0.0000	6.00	0.0600	0.00	*****	*****	0.90	0.130	3.24
																		End



INLET SPACING DESIGN

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

Location : PORTSMOUTH, SCIOTO COUNTY

Description : REACH # 2, 96+13.37(HP) TO 130+15.93(LP) TO 167+27.78(HP), SR823, RHS

Designer : MDC

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

Total Allow. Spread (ft.): 0.00

Allowable Depth (ft.): 0.22

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.)	INTERCEPTED FLOW (cfs.)	BYPASS FLOW (cfs.)	TOTAL FLOW (cfs.)	DEPTH (ft.)	PAVT. SPREAD (ft.)
167+27	Begin																	
161+00	I-3C	627.00	0.00	0.00	0.00	0.00	0.00	0.0246	0.0400	0.0000	4.00	0.1670	0.00	0.41	0.00	0.41	0.111	2.76
155+00	I-3C	600.00	0.00	0.00	0.00	0.00	0.00	0.0480	0.0400	0.0000	4.00	0.1670	0.00	0.39	0.00	0.39	0.096	2.39
150+00	I-3C	500.00	0.00	0.00	0.00	0.00	0.00	0.0500	0.0400	0.0000	4.00	0.1670	0.00	0.31	0.00	0.31	0.087	2.16
146+00	I-3C	400.00	0.00	0.00	0.00	0.00	0.00	0.0500	0.0400	0.0000	4.00	0.1670	0.00	0.24	0.00	0.24	0.079	1.98
142+00	I-3C	400.00	0.00	0.00	0.00	0.00	0.00	0.0500	0.0400	0.0000	4.00	0.1670	0.00	0.24	0.00	0.24	0.079	1.98
141+50	I-3C	50.00	0.00	0.00	0.00	0.00	0.00	0.0500	0.0400	0.0000	4.00	0.1670	0.00	0.03	0.00	0.03	0.037	0.92
141+00	I-3C	50.00	0.00	0.00	0.00	0.00	0.00	0.0500	0.0400	0.0000	4.00	0.1670	0.00	*****	*****	0.03	0.037	0.92



INLET SPACING DESIGN

PID : 77366 **Date :** 12/10/2006 **Project :** SCI-823-0.00 **Location :** PORTSMOUTH, SCIOTO COUNTY
Description : REACH # 3, 167+27.78(HP) TO 186+32.39 TO 253+03.70(HP), SR823, LHS **Designer :** RN

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	0.00	0.00	0.00	0.00	0.00	0.0380	0.0400	0.0000	6.00	0.1670	0.00	0.87	0.00	0.87	0.135	3.37
180+00	I-3C	300.00	0.00	0.00	0.00	0.00	0.00	0.0345	0.0400	0.0000	6.00	0.1670	0.00	0.34	0.00	0.34	0.097	2.41
183+00	I-3C	300.00	0.00	0.00	0.00	0.00	0.00	0.0182	0.0400	0.0000	6.00	0.1670	0.00	0.33	0.00	0.33	0.108	2.69
185+00	I-3C	200.00	0.00	0.00	0.00	0.00	0.00	0.0072	0.0400	0.0000	6.00	0.1670	0.00	0.21	0.00	0.21	0.108	2.70
186+32	I-3B	132.00	0.00	0.00	0.00	0.00	0.00	0.0010	0.0400	0.0000	6.00	0.1670	0.00	*****	*****	0.13	0.131	3.27
253+03	Begin																	
243+00	I-3B	1003.00	0.00	0.00	0.00	0.00	0.00	0.0310	0.0400	0.0000	9.50	0.1670	0.00	1.13	0.10	1.23	0.160	3.99
235+00	I-3B	800.00	0.00	0.00	0.00	0.00	0.00	0.0310	0.0400	0.0000	9.50	0.1670	0.00	1.04	0.04	1.08	0.152	3.80
229+00	I-3B	600.00	0.00	0.00	0.00	0.00	0.00	0.0310	0.0400	0.0000	9.50	0.1670	0.00	0.78	0.00	0.78	0.135	3.36
224+00	I-3B	500.00	0.00	0.00	0.00	0.00	0.00	0.0310	0.0400	0.0000	9.50	0.1670	0.00	0.61	0.00	0.61	0.123	3.07
219+00	I-3B	500.00	0.00	0.00	0.00	0.00	0.00	0.0310	0.0400	0.0000	9.50	0.1670	0.00	0.61	0.00	0.61	0.123	3.07
214+00	I-3B	500.00	0.00	0.00	0.00	0.00	0.00	0.0310	0.0400	0.0000	9.50	0.1670	0.00	0.61	0.00	0.61	0.123	3.07
209+00	I-3B	500.00	0.00	0.00	0.00	0.00	0.00	0.0310	0.0400	0.0000	9.50	0.1670	0.00	0.61	0.00	0.61	0.123	3.07
204+00	I-3B	500.00	0.00	0.00	0.00	0.00	0.00	0.0310	0.0400	0.0000	9.50	0.1670	0.00	0.61	0.00	0.61	0.123	3.07
199+00	I-3B	500.00	0.00	0.00	0.00	0.00	0.00	0.0310	0.0400	0.0000	9.50	0.1670	0.00	0.61	0.00	0.61	0.123	3.07



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 BYPASS FLOW (cfs.)	TOTAL FLOW (cfs.)	DEPTH FLOW (ft.)	PAVT. SPREAD (ft.)
189+00	I-3B	1000.00	0.00	0.00	0.00	0.00	0.00	0.0146	0.0400	0.0000	9.50	0.1670	0.00	1.23	1.23	0.184	4.59
187+00	I-3B	200.00	0.00	0.00	0.00	0.00	0.00	0.0037	0.0400	0.0000	9.50	0.1670	0.00	0.25	0.25	0.131	3.28
186+32	I-3B	68.00	0.00	0.00	0.00	0.00	0.00	0.0010	0.0400	0.0000	6.00	0.1670	0.00	*****	0.08	0.110	2.75 End

SUMP DATA

Total Flow (cfs) : 0.21

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 # 3, 167+27.78(HP) TO 186+32.39 TO 253+03.70(HP), SR823, RHS **Designer :** RN

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	0.00	0.00	0.00	0.00	0.00	0.0380	0.0600	0.0000	9.50	0.0600	0.00	2.19	1.59	3.78	0.272	4.54	
180+00	I-3C	300.00	0.00	0.00	0.00	0.00	0.00	0.0345	0.0600	0.0000	9.50	0.0600	0.00	1.96	1.14	3.10	0.258	4.29	
183+00	I-3C	300.00	0.00	0.00	0.00	0.00	0.00	0.0182	0.0560	0.0000	9.50	0.0600	0.00	1.89	0.68	2.56	0.263	4.70	
185+00	I-3C	200.00	0.00	0.00	0.00	0.00	0.00	0.0072	0.0400	0.0000	9.50	0.0600	0.00	1.34	0.18	1.53	0.228	5.69	
186+32	I-3C	132.00	0.00	0.00	0.00	0.00	0.00	0.0010	0.0400	0.0000	9.50	0.0600	0.00	*****	*****	0.72	0.249	6.22	Sag
253+03	Begin																		
243+00	I-3B	1003.00	0.00	0.00	0.00	0.00	0.00	0.0310	0.0400	0.0000	9.50	0.0600	0.00	1.08	0.44	1.52	0.173	4.32	
235+00	I-3B	800.00	0.00	0.00	0.00	0.00	0.00	0.0310	0.0400	0.0000	9.50	0.0600	0.00	1.86	1.70	3.56	0.238	5.94	
229+00	I-3B	600.00	0.00	0.00	0.00	0.00	0.00	0.0310	0.0400	0.0000	9.50	0.0600	0.00	2.01	2.03	4.04	0.249	6.23	
224+00	I-3B	500.00	0.00	0.00	0.00	0.00	0.00	0.0310	0.0400	0.0000	9.50	0.0600	0.00	1.99	1.98	3.98	0.248	6.19	
219+00	I-3B	500.00	0.00	0.00	0.00	0.00	0.00	0.0310	0.0400	0.0000	9.50	0.0600	0.00	1.98	1.95	3.93	0.247	6.17	
214+00	I-3B	500.00	0.00	0.00	0.00	0.00	0.00	0.0310	0.0400	0.0000	9.50	0.0600	0.00	1.97	1.93	3.90	0.246	6.15	
209+00	I-3B	500.00	0.00	0.00	0.00	0.00	0.00	0.0310	0.0400	0.0000	9.50	0.0600	0.00	1.96	1.92	3.88	0.246	6.14	
204+00	I-3B	500.00	0.00	0.00	0.00	0.00	0.00	0.0310	0.0400	0.0000	9.50	0.0600	0.00	1.96	1.91	3.87	0.245	6.13	
199+00	I-3B	500.00	0.00	0.00	0.00	0.00	0.00	0.0310	0.0400	0.0000	9.50	0.0600	0.00	1.55	1.11	2.66	0.213	5.33	



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.)
189+00	I-3B	1000.00	0.00	0.00	0.00	0.00	0.00	0.0146	0.0400	0.00000	9.50	0.0600	0.00	1.64	0.70	2.34	0.234	5.84
187+00	I-3B	200.00	0.00	0.00	0.00	0.00	0.00	0.0037	0.0400	0.00000	9.50	0.0600	0.00	0.95	0.00	0.95	0.216	5.39
186+32	I-3B	68.00	0.00	0.00	0.00	0.00	0.00	0.0010	0.0400	0.00000	9.50	0.0600	0.00	*****	*****	0.08	0.110	2.75 End

SUMP DATA

Total Flow (cfs) : 0.81

Ponded Depth (ft.) : 0.027

Spread on Pavement (ft.) : 2.82



INLET SPACING DESIGN

PID : 77366 **Date :** 12/30/2006 **Project :** SCI-823-0.00 **Location :** PORTSMOUTH, SCIOTO COUNTY
Description : REACH # 4, 253+03.70(HP) TO 350+59.68(LP) TO 425+25(HP), SR823, LHS **Designer :** RN

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.)	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 FLOW (cfs.)	BYPASS FLOW (cfs.)	TOTAL FLOW (cfs.)	DEPTH (ft.)	PAVT. FLOW (ft.)	SPREAD (ft.)	
253+03	Begin																			
263+00	I-3C	997.00	0.00	0.00	0.00	0.00	0.00	0.0230	0.0440	0.0000	9.50	0.0600	0.00	1.47	0.66	2.13	0.215	4.88		
273+00	I-3C	1000.00	0.00	0.00	0.00	0.00	0.00	0.0230	0.0440	0.0000	9.50	0.0600	0.00	2.49	2.34	4.83	0.292	6.64		
283+00	I-3C	1000.00	0.00	0.00	0.00	0.00	0.00	0.0230	0.0440	0.0000	9.50	0.0600	0.00	3.00	3.51	6.51	0.327	7.42		
293+00	I-3B	1000.00	0.00	0.00	0.00	0.00	0.00	0.0230	0.0400	0.0000	9.50	0.0600	0.00	2.88	3.65	6.53	0.316	7.89		
303+00	I-3B	1000.00	0.00	0.00	0.00	0.00	0.00	0.0230	0.0400	0.0000	9.50	0.0600	0.00	2.41	2.47	4.88	0.283	7.07		
313+00	I-3B	1000.00	0.00	0.00	0.00	0.00	0.00	0.0181	0.0400	0.0000	9.50	0.0600	0.00	2.13	1.57	3.70	0.267	6.67		
323+00	I-3B	1000.00	0.00	0.00	0.00	0.00	0.00	0.0181	0.0400	0.0000	9.50	0.1670	0.00	2.04	0.77	2.80	0.240	6.01		
333+00	I-3B	1000.00	0.00	0.00	0.00	0.00	0.00	0.0325	0.0400	0.0000	9.50	0.1670	0.00	1.51	0.49	2.00	0.190	4.74		
340+00	I-3B	700.00	0.00	0.00	0.00	0.00	0.00	0.0470	0.0400	0.0000	9.50	0.1670	0.00	1.13	0.22	1.36	0.153	3.83		
346+00	I-3B	600.00	0.00	0.00	0.00	0.00	0.00	0.0237	0.0400	0.0000	9.50	0.1670	0.00	0.96	0.00	0.96	0.153	3.83		
349+00	I-3B	300.00	0.00	0.00	0.00	0.00	0.00	0.0082	0.0400	0.0000	9.50	0.1670	0.00	0.37	0.00	0.37	0.130	3.26		
350+00	I-3B	100.00	0.00	0.00	0.00	0.00	0.00	0.0031	0.0400	0.0000	9.50	0.1670	0.00	0.12	0.00	0.12	0.103	2.57		
350+60	I-3B	60.00	0.00	0.00	0.00	0.00	0.00	0.0030	0.0400	0.0000	9.50	0.1670	0.00	*****	*****	0.07	0.086	2.14	Sag	
355+00	Begin																			
351+50	I-3B	350.00	0.00	0.00	0.00	0.00	0.00	0.0047	0.0400	0.0000	9.50	0.1670	0.00	0.43	0.00	0.43	0.153	3.83		



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 (ft.)	PAVT. SPREAD (ft.)	
350+60	1-3B	90.00	0.00	0.00	0.00	0.00	0.00	0.0030	0.0400	0.0000	9.50	0.1670	0.00	*****	*****	0.11	0.100	2.50	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 :** 12/30/2006 **Project :** SCI-823-0.00 **Location :** PORTSMOUTH, SCIOTO COUNTY
Description : REACH # 4, 253+03.70(HP) TO 350+59.68(LP) TO 425+25(HP), SR823, RHS **Designer :** RN

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.)	
253+03	Begin																			
263+00	I-3C	997.00	0.00	0.00	0.00	0.00	0.00	0.0230	0.0400	0.0000	7.00	0.1670	0.00	1.16	0.05	1.21	0.168	4.19		
273+00	I-3C	1000.00	0.00	0.00	0.00	0.00	0.00	0.0230	0.0400	0.0000	7.00	0.1670	0.00	1.02	0.00	1.02	0.157	3.94		
283+00	I-3C	1000.00	0.00	0.00	0.00	0.00	0.00	0.0230	0.0400	0.0000	7.00	0.1670	0.00	0.97	0.00	0.97	0.154	3.86		
293+00	I-3B	1000.00	0.00	0.00	0.00	0.00	0.00	0.0230	0.0400	0.0000	9.50	0.1670	0.00	1.08	0.01	1.09	0.161	4.03		
303+00	I-3B	1000.00	0.00	0.00	0.00	0.00	0.00	0.0218	0.0400	0.0000	9.50	0.1670	0.00	1.18	0.06	1.24	0.171	4.27		
313+00	I-3B	1000.00	0.00	0.00	0.00	0.00	0.00	0.0181	0.0400	0.0000	9.50	0.1670	0.00	1.24	0.05	1.29	0.179	4.49		
323+00	I-3B	1000.00	0.00	0.00	0.00	0.00	0.00	0.0181	0.0400	0.0000	9.50	0.0600	0.00	2.03	1.42	3.45	0.260	6.49		
333+00	I-3B	1000.00	0.00	0.00	0.00	0.00	0.00	0.0325	0.0400	0.0000	9.50	0.0600	0.00	2.36	2.96	5.32	0.274	6.84		
340+00	I-3B	700.00	0.00	0.00	0.00	0.00	0.00	0.0470	0.0400	0.0000	9.50	0.0600	0.00	2.26	3.43	5.69	0.262	6.55		
346+00	I-3B	600.00	0.00	0.00	0.00	0.00	0.00	0.0237	0.0400	0.0000	9.50	0.0600	0.00	2.65	3.11	5.77	0.299	7.49		
349+00	I-3B	300.00	0.00	0.00	0.00	0.00	0.00	0.0082	0.0400	0.0000	9.50	0.0600	0.00	2.73	1.55	4.27	0.327	8.16		
350+00	I-3B	100.00	0.00	0.00	0.00	0.00	0.00	0.0031	0.0400	0.0000	9.50	0.0600	0.00	1.78	0.16	1.94	0.291	7.28		
350+60	I-3B	60.00	0.00	0.00	0.00	0.00	0.00	0.0030	0.0400	0.0000	9.50	0.0600	0.00	*****	*****	0.39	0.160	4.01	Sag	
355+00	Begin																			
351+50	I-3B	350.00	0.00	0.00	0.00	0.00	0.00	0.0047	0.0400	0.0000	9.50	0.0600	0.00	2.85	1.08	3.93	0.351	8.78		



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. SLOPE (ft./ft.)	PAVT. SLOPE (ft./ft.)	GUTT. WIDTH (ft.)	LOCAL DEPRESS. (ft.)	RAIN FALL (in./hrs.)	INTERCPTD BYPASS FLOW (cfs.)	FLOW (cfs.)	TOTAL FLOW (cfs.)	DEPTH (ft.)	PAVT. SPREAD (ft.)	
350+60	I-3B	90.00	0.00	0.00	0.00	0.00	0.0030	0.0400	0.0000	9.50	0.0600	0.00	*****	*****	1.44	0.262	6.55	End

SUMP DATA

Total Flow (cfs) : 1.82 Ponded Depth (ft.) : 0.108 Spread on Pavement (ft.) : 3.79



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 AREA (acres)	CONC. GUTTER TIME (min.)	USED 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.)	INTERCPTD FLOW (cfs.)	BYPASS FLOW (cfs.)	TOTAL FLOW (cfs.)	DEPTH (ft.)	PAVT. SPREAD (ft.)
42+30	Begin															
37+40	I-3D	490.00	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)	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.)	
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)	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.)	INTERCPTD FLOW (cfs.)	BYPASS FLOW (cfs.)	TOTAL FLOW (cfs.)	DEPTH (ft.)	PAVT. SLOPE (ft.)
43+40	Begin																	
32+40	I-3D	1100.00	0.00	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 Designer : DL
 Description : STA. 56+00.00 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	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	IN / OUT	VEL	CAPACITY	SLOPE	IN / OUT	IN / OUT	MINUS	MANNING'S								
		(acres)		(min.)	(10 yrs.)	(25 yrs.)	(10 yrs.)	(25 yrs.)	(ft.)	(ft.)	(ft./ft.)	(ft.)	(ft.)	(ft.)	'n'								
0	1	56+00	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		
		56+00	0.21	0.19									583.18				584.02	586.43				0.015	

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, L,H,S 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	MINUS	MANNING'S						
		(acres)		(min.)	(10 yrs.)	(25 yrs.)	(in.)	(ft.)	(ft./ft.)	(fps.)	(cfs.)	(ft./ft.)	(ft.)	(ft.)	HY GR	CROWN	'n'					
0	1	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	1.3B	0.015	
	begin	0.10	0.09									579.97				580.75	586.67					
0	1	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	1.3B	0.015	
	begin	0.19	0.17									579.97				580.73	586.67					
1	2	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	1.3B	0.015	
	begin	0.26	0.23									579.68				580.55	586.14					
0	2	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	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

Description : STA. 63+50.00 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	IN / OUT	VEL	CAPACITY	SLOPE	IN / OUT	IN / OUT	MINUS	MANNING'S						
		(acres)	(acres)	(min.)	(10 yrs.) (25 yrs.)	(10 yrs.) (25 yrs.)	(in.)	(ft.)	(ft./ft.)	(cfs.)	(ft./ft.)	(ft.)	(ft.)	HY GR	CROWN	'n'					
0	1	63+50	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	63+50	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	63+50	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 Designer : DL
 Description : STA. 66+00.00 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	ΔAREA	ΔCA	BEGIN	RAINFALL	DISCHARGE	PIPE	F/I	PIPE	MEAN	JUST	FULL	FRICT	HYGR	EL.	COVER	COVER	INLET	TYPE		
From	To	Σ	Σ	TIME	INTENSITY	(cfs.)	DIAM.	LENGTH	SLOPE	IN /	OUT	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.)	(cfs.)	(ft./ft.)	(ft.)	(ft.)	(ft.)	(ft.)	HY GR	CROWN	'n'	
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	1.38
		begin	0.17	0.15									586.67				587.50	589.92			0.015
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
		66+00	0.17	0.15									566.20				567.02	569.45			0.015
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
		66+00	0.17	0.15									565.97				566.79	569.22			0.015
		final																			



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

JUNCTION STATION		Δ AREA	Δ CA	BEGIN	RAINFALL	DISCHARGE	PIPE	F/I 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.) (25 yrs.)	DIAM. (in.)	LENGTH (ft.)	SLOPE (ft./ft.)	VEL (fps.)	IN / OUT (ft.)	CAPACITY (cfs.)	FRIC (ft./ft.)	IN / OUT (ft.)	HYGR	MINUS CROWN	MINUS MANNING'S	'n'		
0	1	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 Designer : DL
 Description : STA. 76+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	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./ft.)	IN / OUT	IN / OUT	MINUS	MINUS	MANNING'S
		(acres)		(min.)	(10 yrs.)	(25 yrs.)	(10 yrs.)	(25 yrs.)	(cfs.)	(fps.)	(ft./ft.)	(ft.)	(ft.)	HY GR	CROWN	'n'
0	1	0.34	0.31	10.00	5.39	6.65	1.7	2.1	8.07	4.91	0.0014	626.28	630.53	4.25	3.45	1.38
	begin	0.34	0.31						8.07	4.91	0.0014	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/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 / OUT	VEL	CAPACITY	SLOPE	IN / OUT	HY GR	MINUS	MANNING'S				
		(acres)		(min.)	(10 yrs.)	(25 yrs.)	(in.)	(ft./ft.)	(ft.)	(fps.)	(cfs.)	(ft./ft.)	(ft.)	(ft.)	MINUS	"n"				
0	1	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	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
Description : 104+50 TO 105+00 (MH3); 106+00 (13B) TO 106+00 (MH3) 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	VEL	CAPACITY	SLOPE	IN / OUT	HY GR	MINUS	MANNINGS				
		(acres)	(min.)	(10 yrs.)	(25 yrs.)	(10 yrs.)	(25 yrs.)	(in.)	(ft.)	(ft./ft.)	(ft.)	(fps.)	(cfs.)	(ft./ft.)	(ft.)	(ft.)	'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	580.38	5.55	4.55	1.3B
		106+00	0.34	0.31							667.12		668.35		673.87		0.015				
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
		105+00	2.92	2.24							672.95		674.18		677.95		0.015				
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
		106+00	3.02	2.32							667.12		668.35		673.87		0.015				
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
		106+00	3.02	2.32							666.74		667.98		670.39		0.015				
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
		106+00	3.02	2.32							572.90		574.14		576.23		0.015				
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
		106+00	3.02	2.32							572.19		573.43		575.72		0.015				



STORM SEWER SYSTEM

PID : 77366 Date : 02/07/2007 Project : SCI-823-0.00 Location : PORTSMOUTH, SCIOTO COUNTY Designer : DL

Description : FROM STA. 112+00 (3B1) TO STA. 112+00 (3D), 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	RAINFALL	DISCHARGE	PIPE	F/I 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	CAPACITY	SLOPE	IN / OUT	MINUS	MANNING'S					
		(acres)		(min.)	(10 yrs.)	(25 yrs.)	(in.)	(ft.)	(ft./ft.)	(cfs.)	(ft./ft.)	(ft.)	(ft.)	HY GR	'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	1 3B
	begin	0.21	0.19									649.64				650.48	652.89			0.015
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	1 3D
	112+00	0.38	0.34									649.51				650.43	652.76			0.015
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
	112+00	0.38	0.34									557.99				558.91	561.24			0.015
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
	final	0.38	0.34									557.83				558.75	561.08			0.015



STORM SEWER SYSTEM

PID : 77366 **Date :** 05/31/2007 **Project :** SCI-823-0.00 **Location :** PORTSMOUTH, SCIOTO COUNTY **Designer :** DL
Description : STA. 118+00.00 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		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)	(acres)	(min.)	(10 yrs.)	(25 yrs.)	(in.)	(ft.)	(ft./ft.)	(cfs.)	(ft./ft.)	(ft.)	(ft.)	HY GR	CROWN					
				(10 yrs.)	(25 yrs.)	(10 yrs.)	(25 yrs.)	(ft.)	(ft.)	(cfs.)	(ft./ft.)	(ft.)	(ft.)		"n"					
0	1	0.47	0.43	10.00	5.39	6.69	2.3	2.9	15	8.2	0.0100	626.42	4.33	6.02	0.0026	627.32	630.42	3.10	2.75	CB 3A
	begin	0.47	0.43									626.34		627.30	529.59					0.015
1	2	0.00	0.00	10.03	5.39	6.65	2.3	2.8	15	175.4	0.4000	626.34	16.28	38.09	0.0026	626.58	629.59	3.01	2.00	MH 3
	118+00	0.47	0.43									556.18		557.14	559.43					0.015
2	3	0.00	0.00	10.21	5.35	6.63	2.3	2.8	15	18.1	0.0100	556.18	4.33	6.02	0.0026	557.01	559.43	2.42	2.00	MH 3
	final	0.47	0.43									556.00		556.96	559.25					0.015



STORM SEWER SYSTEM

PID : 77366 **Date :** 05/09/2007 **Project :** SCI-823-0.00 **Location :** PORTSMOUTH, SCIOTO COUNTY
Description : FROM 120+00 TO 120+00 (CB) SR823 TO 15+50 PERS; FROM 119+00 TO 120+00 (CB) SR823 **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	INLET TYPE					
From	To	ΣAREA	ΣCA	TIME	INTENSITY	(cfs.)	DIAM.	LENGTH	SLOPE	IN / OUT	VELOCITY	IN / OUT	IN / OUT	MINUS	MANNING'S					
		(acres)	(min.)	(10 yrs.)	(25 yrs.)	(10 yrs.)	(in.)	(ft.)	(ft./ft.)	(cfs.)	(ft./ft.)	(ft.)	(ft.)	HY GR	CROWN	'n'				
0	120+00	0.66	0.59	10.00	5.39	6.63	3.2	3.9	15	44.5	0.0270	618.43	6.81	9.89	0.0049	619.00	622.43	3.43	2.75	13D
	begin	0.66	0.59									618.33	623.03							0.015
1	120+00	0.28	0.25	10.11	5.37	6.63	4.5	5.6	15	52.6	0.0100	617.23	5.07	6.02	0.0100	618.33	623.03	4.70	4.55	13B
	begin	0.94	0.84									617.81	619.96							0.015
2	120+00	0.00	0.00	10.28	5.34	6.60	4.5	5.6	15	165.4	0.4000	616.71	19.78	38.09	0.0099	617.04	619.96	2.91	2.00	MH 3
	begin	0.94	0.84									550.55	553.57							0.015
3	119+00	4.93	3.57	15.00	4.60	5.68	16.4	20.3	24	104.6	0.0120	548.00	7.53	23.10	0.0107	549.67	552.00	2.33	2.00	CB 2-3
	begin	5.87	4.41									546.75	549.57							0.015
4	120+00	0.26	0.18	15.23	4.57	5.66	21.0	26.0	24	75.8	0.0200	546.75	9.70	29.82	0.0175	548.45	553.57	5.12	4.83	CB 2-3
	final	6.13	4.59									545.23	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	Σ CA	TIME	INTENSITY	(cfs.)	DIAM.	LENGTH	SLOPE	(ft.)	(ft./ft.)	IN / OUT	IN / OUT	IN / OUT	MINUS	MANNING'S					
		(acres)		(min.)	(10 yrs.)	(25 yrs.)	(in.)	(ft.)	(ft./ft.)	(cfs.)	(ft./ft.)	(ft.)	(ft.)	(ft.)	HY GR	CROWN	'n'				
0	1	126+00	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
		126+00	0.21	0.19									595.50				598.75				0.015
1	2	126+00	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	126+00	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	126+00	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



STORM SEWER SYSTEM

PID : 77366 Date : 04/06/2007 Project : SCI-823-0.00 Location : PORTSMOUTH, SCIOTO COUNTY
 Designer : DL
 Description : REACH # 2; FROM 128+50 TO 129+50 TO 130+15.93 (LP) (3C1) TO 130+15.93 (3D)

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	IN	OUT	MEAN	JUST FULL	FRICT	HYGR	EL.	COVER	COVER	MINUS	MINUS	INLET	TYPE
From	To	Σ (acres)	Σ (acres)	(min.)	(10 yrs.)	(25 yrs.)	(10 yrs.)	(25 yrs.)	(in.)	(ft./ft.)	(ft.)	(ft.)	(fps.)	(cfs.)	(ft./ft.)	(ft.)	(ft.)	(ft.)	(ft.)	(ft.)	(ft.)	(ft.)	'ft'
1	2	128+50	0.17	0.15	10.00	5.39	6.59	0.8	1.0	15	100.0	0.0112	593.12	3.41	6.37	0.0003	593.47	597.82	4.35	3.45	1.38	1.38	0.015
		129+50	0.17	0.15									592.00				592.82	597.20					
2	3	129+50	0.09	0.08	10.49	5.30	6.52	1.2	1.5	15	65.9	0.0109	592.00	3.78	6.29	0.0007	592.44	597.20	4.76	3.95	1.38	1.38	0.015
		130+15	0.26	0.23									591.28				592.15	597.08					
3	4	130+15	0.20	0.18	10.78	5.25	6.48	2.2	2.7	15	40.7	0.0100	591.28	4.26	6.02	0.0022	591.93	597.08	5.15	4.55	1.38	1.38	0.015
		130+15	0.45	0.41									590.87				591.84	597.57					
4	5	130+15	0.25	0.23	10.94	5.22	6.48	3.3	4.1	15	15.0	0.0100	590.87	4.76	6.02	0.0054	591.84	597.57	5.73	5.45	1.38	1.38	0.015
		130+15	0.71	0.64									590.72				591.76	593.97					
5	6	130+15	0.00	0.00	10.99	5.21	6.46	3.3	4.1	15	116.4	0.4000	590.72	18.16	38.09	0.0054	591.01	593.97	2.96	2.00	1.38	1.38	0.015
		130+15	0.71	0.64									544.16				545.19	547.41					
6	7	130+15	0.00	0.00	11.10	5.20	6.44	3.3	4.1	15	16.1	0.0100	544.16	4.75	6.02	0.0054	545.12	547.41	2.29	2.00	1.38	1.38	0.015
		130+15	0.71	0.64									543.99				545.03	547.24					



STORM SEWER SYSTEM

PID : 77366 Date : 04/06/2007 Project : SCI-823-0.00 Location : PORTSMOUTH, SCIOTO COUNTY
 Designer : DL
 Description : REACH # 2; FROM 128+50 TO 129+50 TO 130+15.93 (LP); SR823, 41.75' RT

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	From To	Σ AREA (acres)	Σ AREA (acres)	TIME (min.)	INTENSITY (10 yrs.) (25 yrs.) (10 yrs.) (25 yrs.)	(cfs.)	DIAM. LENGTH (ft.)	IN / OUT (ft.)	VEL (fps.)	CAPACITY (cfs.)	SLOPE (ft./ft.)	IN / OUT (ft.)	IN / OUT (ft.)	MINUS HYGR	MINUS MANNING'S 'n'	
0	128+50 begin	0.70	0.70	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	1 3D
	129+50	0.70	0.63					591.64				592.68	596.12		0.015	
1	129+50 130+15	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	1 3D
		0.79	0.71					590.98				592.07	596.00		0.015	
2	130+15 130+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	1 3D
		1.71	1.54					590.56				591.92	594.06		0.015	
3	130+15 130+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
		1.71	1.54					551.16				552.52	554.66		0.015	
4	130+15 final	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
		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	F/L PIPE	MEAN	JUST FULL	FRICT	HYGR EL.	COVER	COVER	INLET TYPE					
From	To	Σ (acres)	Σ (min.)	Σ (10 yrs.)	Σ (25 yrs.)	(cfs.)	DIAM. (in.)	LENGTH (ft.)	IN / OUT (ft.)	VEL (fps.)	CAPACITY (cfs.)	SLOPE (ft./ft.)	IN / OUT (ft.)	IN / OUT (ft.)	MINUS HYGR	MINUS CROWN	MANNING'S 'n'			
0	1	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
	begin	1.66	1.17									609.75				611.00	623.05			0.015
1	2	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
	begin	2.63	1.85									608.43				609.80	627.93			0.015
0	2	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
	begin	2.67	1.89									623.23				623.95	628.08			0.015
2	3	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
	final	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
 Designer : DL

Description : FROM STA. 142+00 (55.7' LT) TO STA. 142+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	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	VEL	CAPACITY	SLOPE	IN / OUT	IN / OUT	MINUS	MINUS	MANNING'S				
		(acres)		(min.)	(10 yrs.)	(25 yrs.)	(in.)	(ft.)	(fps.)	(cfs.)	(ft./ft.)	(ft.)	(ft.)	HY GR	CROWN	'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 **Location :** PORTSMOUTH, SCIOTO COUNTY
Description : STA. 146+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	HYGREL	COVER	COVER	INLET TYPE						
From	To	Σ AREA (acres)	Σ CA (min.)	TIME (10 yrs.)	INTENSITY (25 yrs.)	(cfs.) (10 yrs.)	DIAM. (in.)	LENGTH (ft.)	SLOPE (ft./ft.)	VEL (fps.)	CAPACITY (cfs.)	SLOPE (ft./ft.)	IN / OUT (ft.)	HY GR	MINUS CROWN "r"					
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	13C
begin	146+00	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/I 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	MINUS	MANNING'S					
		(acres)		(min.)	(10 yrs.)	(25 yrs.)	(in.)	(ft.)	(ft./ft.)	(cfs.)	(fps.)	(ft.)	(ft.)	(ft.)	'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	13C
	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 Designer : DL
 Description : STA. 155+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	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	IN / OUT	MINUS	MINUS	MANNING'S			
		(acres)		(min.)	(10 yrs.)	(25 yrs.)	(10 yrs.)	(25 yrs.)	(in.)	(ft.)	(ft./ft.)	(ft.)	(ft.)	(ft.)	(ft.)	(cfs.)	(ft.)	(ft.)	HY GR	CROWN	'n'
0	1	155+00	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
		155+00	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 **Location :** PORTSMOUTH, SCIOTO COUNTY
Description : STA. 161+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/I 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.)	(cfs.) (10 yrs.) (25 yrs.)	DIAM. (in.)	LENGTH (ft.)	SLOPE (ft./ft.)	VEL (fps.)	CAPACITY (cfs.)	SLOPE (ft./ft.)	IN / OUT (ft.)	IN / OUT (ft.)	MINUS HYGR	MINUS 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	4.59	4.05	1 3C
begin	161+00	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		ΔAREA	ΔCA	BEGIN	RAINFALL	DISCHARGE	PIPE	F/L PIPE	MEAN	JUST FULL	FRICT	HYGREL.	COVER	COVER	INLET TYPE					
From	To	Σ (acres)	Σ (min.)	TIME (10 yrs.)	INTENSITY (25 yrs.)	(cfs.) (10 yrs.)	DIAM. (in.)	LENGTH (ft.)	SLOPE (ft./ft.)	VEL (fps.)	CAPACITY (cfs.)	SLOPE (ft./ft.)	IN / OUT (ft.)	IN / OUT (ft.)	MINUS HY GR	MINUS CROWN	MANNINGS 'n'			
0	1	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
	begin	0.96	0.86									701.61		702.72		704.86				0.015
1	2	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
	177+00	0.96	0.86									683.65		684.75		686.90				0.015
2	3	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
	final	0.96	0.86									683.45		684.56		686.70				0.015



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	HYGREL	COVER	COVER	INLET TYPE					
From	To	Σ AREA (acres)	Σ CA (min.)	TIME (10 yrs.)	INTENSITY (25 yrs.)	(cfs.) (10 yrs.)	DIAM. (in.)	LENGTH (ft.)	SLOPE (ft./ft.)	VEL (fps.)	CAPACITY (cfs.)	SLOPE (ft./ft.)	IN / OUT (ft.)	COVER (ft.)	MINUS HY GR	MINUS 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	Δ AREA	Δ CA	BEGIN	RAINFALL	DISCHARGE	PIPE	F/I 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.)	VELOCITY	(fps.)	CAPACITY	(cfs.)	(ft./ft.)	IN / OUT	HYGR	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.)	(ft.)	(ft.)	(ft.)	'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	1.3C	0.015	
	begin	183+00	0.36	0.32									682.30				683.21	685.55					
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	0.015	
	begin	183+00	0.36	0.32									622.74				623.65	625.99					
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	0.015	
	final	183+00	0.36	0.32									622.57				623.48	625.82					



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	Δ CA	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.) (25 yrs.)	(cfs.)	DIAM. LENGTH (ft.)	IN / OUT (ft.)	VEL (fps.)	CAPACITY (cfs.)	SLOPE (ft./ft.)	IN / OUT (ft.)	MINUS HY GR	MINUS MANNINGS 'n'						
0	1	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
	begin	0.22	0.20									680.30	686.15							0.015
0	1	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
	begin	0.32	0.29									679.45	686.15							0.015
1	2	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
	final	0.49	0.44									673.42	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
 Minimum Pipe Size : 15.00 Tailwater Elevation (ft.): 0.00

Hydraulic Gradient Frequency (yrs.): 25

JUNCTION	STATION	ΔAREA	ΔCA	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.)	(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	0.51	0.46	10.00	5.39	6.65	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	189+00	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 Designer : DL
 Description : STA. 199+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	RAINFALL	DISCHARGE	PIPE	F/I/L	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	MINUS	MANNING'S				
		(acres)		(min.)	(10 yrs.)	(25 yrs.)	(in.)	(ft.)	(ft./ft.)	(ft.)	(fps.)	(cfs.)	(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	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

Location : PORTSMOUTH, SCIOTO COUNTY

Description : STA. 204+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/I 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.)	(ft.)	(fps.)	(cfs.)	(ft./ft.)	(ft.)	(ft.)	HY GR	CROWN	'n'						
0	1	204+00	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	204+00	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	From To	ΔAREA (acres)	ΔCA	BEGIN TIME (min.)	RAIN INTENSITY (10 yrs.) (10 yrs.) (25 yrs.) (cfs.)	DISCHARGE (cfs.)	PIPE DIAM. (in.)	LENGTH (ft.)	SLOPE (ft./ft.)	F/I PIPE		MEAN VEL (fps.)	JUST FULL CAPACITY (cfs.)	FRICT SLOPE (ft./ft.)	HYGR IN (ft.)	EL. IN (ft.)	HYGR OUT (ft.)	EL. OUT (ft.)	COVER IN	COVER MINUS HYGR	COVER MINUS CROWN	INLET TYPE	MANNING'S 'n'
											IN (ft.)	OUT (ft.)												
0	1	209+00 begin	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	1.38	0.015		
		209+00	0.53	0.48								741.27				742.25	744.52							
1	2	209+00 209+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		
			0.53	0.48								679.07				680.05	682.32							
2	3	209+00 209+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		
			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 **Designer :** DL
Description : STA. 214+00.00 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/I 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	MINUS	MANNING'S					
		(acres)		(min.)	(10 yrs.)	(25 yrs.)	(10 yrs.)	(25 yrs.)	(cfs.)	(ft./ft.)	(ft.)	(ft.)	(ft.)	(ft.)	HY GR	CROWN	'n'				
0	1	214+00	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	13B
		214+00	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	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	(ft.)	IN / OUT	MINUS	MINUS	MANNING'S		
		(acres)		(min.)	(10 yrs.)	(25 yrs.)	(in.)	(ft.)	(ft./ft.)	(ft.)	(fps.)	(cfs.)	(ft./ft.)	(ft.)	(ft.)	(ft.)	HY GR	CROWN	'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	776.64	4.03	3.45	1.3B
		219+00	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 Designer : DL
 Description : STA. 224+00.00 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	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	IN / OUT	VEL	CAPACITY	SLOPE	IN / OUT	IN / OUT	MINUS	MANNING'S							
		(acres)		(min.)	(10 yrs.) (25 yrs.)	(10 yrs.) (25 yrs.)	(ft.)	(ft.)	(fps.)	(cfs.)	(ft./ft.)	(ft.)	(ft.)	HY GR	'n'							
0	1	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	1.3B		
												789.81	792.08								0.015	
												788.83										



STORM SEWER SYSTEM

PID : 77366 **Date :** 04/13/2007 **Project :** SCI-823-0.00 **Location :** PORTSMOUTH, SCIOTO COUNTY
Description : STA. 229+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/I L PIPE	MEAN	JUST FULL	FRICT	HYGR EL.	COVER	COVER	INLET TYPE						
From	To	Σ AREA	Σ CA	TIME	INTENSITY	(cfs.)	DJAM. LENGTH	IN / OUT	VEL	CAPACITY	SLOPE	IN / OUT	IN / OUT	MINUS	MANNING'S						
		(acres)		(min.)	(10 yrs.)	(25 yrs.)	(10 yrs.)	(25 yrs.)	(fps.)	(cfs.)	(ft./ft.)	(ft.)	(ft.)	HY GR	'n'						
0	1	0.63	0.57	10.00	5.39	6.64	3.1	3.8	15	68.8	0.0100	803.84	4.67	6.02	0.0046	804.59	809.64	5.05	4.55	13B	
	begin	0.63	0.57						803.15			804.17	806.40								0.015



STORM SEWER SYSTEM

PID : 77366 Date : 03/02/2007 Project : SCI-823-0.00 Location : PORTSMOUTH, SCIOTO COUNTY Designer : DL
 Description : STA. 235+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	RAINFALL	DISCHARGE	PIPE	FIL 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	MINUS	MANNING'S					
		(acres)		(min.)	(10 yrs.)	(25 yrs.)	(in.)	(ft.)	(ft./ft.)	(cfs.)	(fps.)	(ft.)	(ft.)	(ft.)	HY GR	CROWN	'n'				
0	1	235+00	0.85	0.76	10.00	5.39	6.65	4.1	5.1	15	66.3	0.0100	822.44	4.99	6.02	0.0081	823.40	828.24	4.84	4.55	1.3B
		235+00	0.85	0.76							821.78		822.86		825.03						0.015
1	2	235+00	0.00	0.00	10.22	5.35	6.57	4.1	5.0	15	304.4	0.2000	821.78	14.99	26.93	0.0080	822.16	825.03	2.87	2.00	MH 3
		235+00	0.85	0.76							760.90		761.98		764.15						0.015
2	3	235+00	0.00	0.00	10.56	5.29	6.56	4.0	5.0	15	15.2	0.0100	760.90	4.96	6.02	0.0079	761.94	764.15	2.20	2.00	MH 3
		235+00	0.85	0.76							760.75		761.82		764.00						0.015



STORM SEWER SYSTEM

PID : 77366 Date : 03/05/2007 Project : SCI-823-0.00 Location : PORTSMOUTH, SCIOTO COUNTY
 Description : STA. 243+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	SLOPE	CAPACITY	SLOPE	IN / OUT	IN / OUT	MINUS	MINUS						
		(acres)		(min.)	(10 yrs.)	(25 yrs.)	(in.)	(ft.)	(ft./ft.)	(cfs.)	(ft./ft.)	(ft.)	(ft.)	HY GR	CROWN						
				(25 yrs.)	(10 yrs.)	(25 yrs.)									'n'						
0	1	243+00	0.57	0.51	10.00	5.39	6.64	2.7	3.4	15	66.0	0.0100	847.24	4.54	6.02	0.0036	847.94	853.04	5.10	4.55	1.3B
		begin	0.57	0.51									846.58		847.58			649.83			0.015
1	2	243+00	0.00	0.00	10.24	5.35	6.55	2.7	3.3	15	329.5	0.2000	846.58	13.33	26.93	0.0035	846.89	849.83	2.94	2.00	MH 3
		243+00	0.57	0.51									780.68		781.67			783.93			0.015
2	3	243+00	0.00	0.00	10.65	5.27	6.53	2.7	3.3	15	20.5	0.0100	780.68	4.52	6.02	0.0035	781.54	783.93	2.39	2.00	MH 3
		final	0.57	0.51									780.48		781.47			783.73			0.015



STORM SEWER SYSTEM

PID : 77366 Date : 02/02/2007 Project : SCI-823-0.00 Location : PORTSMOUTH, SCIOTO COUNTY Designer : DL
 Description : STA. 263+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	RAINFALL	DISCHARGE	PIPE	F/I PIPE	MEAN	JUST FULL	FRICT	HYGR	EL.	COVER	COVER	COVER	INLET	TYPE		
From	To	Σ AREA	Σ CA	TIME	INTENSITY	(cfs.)	DIAM. LENGTH	SLOPE	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./ft.)	(ft.)	(fps.)	(cfs.)	(ft./ft.)	(ft.)	(ft.)	(ft.)	HY GR	CROWN	'n'		
0	1	0.69	0.62	10.00	5.39	6.65	3.3	4.1	15	61.5	0.0100	850.32	4.76	6.02	0.0054	851.12	855.62	4.50	4.05	1.3C
	begin	0.69	0.62						849.71			850.74	852.96							0.015



STORM SEWER SYSTEM

PID : 77366 Date : 03/02/2007 Project : SCI-823-0.00 Location : PORTSMOUTH, SCIOTO COUNTY Designer : DL
 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	RAINFALL	DISCHARGE	PIPE	FIL PIPE	MEAN	JUST FULL	FRICT	HYGR EL.	COVER	COVER	INLET TYPE						
From	To	Σ AREA	Σ CA	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./ft.)	(fps.)	(cfs.)	(ft./ft.)	(ft.)	(ft.)	HY GR	CROWN	'n'				
0	1	273+00	1.06	0.95	10.00	5.39	6.66	5.1	6.4	15	61.7	0.0130	826.82	5.80	6.88	0.0129	827.94	832.62	4.68	4.55	I 3C
		273+00	1.06	0.95									826.02				827.15	829.27			0.015
1	2	273+00	0.00	0.00	10.18	5.36	6.64	5.1	6.3	15	104.7	0.3333	826.02	19.22	34.77	0.0128	826.39	829.27	2.87	2.00	MH 3
		273+00	1.06	0.95									791.13				792.27	794.38			0.015
2	3	273+00	0.00	0.00	10.27	5.34	6.63	5.1	6.3	15	16.1	0.0130	791.13	5.79	6.88	0.0127	792.26	794.38	2.12	2.00	MH 3
		273+00	1.06	0.95									790.92				792.05	794.17			0.015



STORM SEWER SYSTEM

PID : 77366 Date : 02/05/2007 Project : SCI-823-0.00

Location : PORTSMOUTH, SCIOTO COUNTY

Description : STA. 283+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/I 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.)	(in.)	(ft.)	(fps.)	(cfs.)	(ft./ft.)	(ft.)	(ft.)	HY GR	CROWN	'n'					
0	1	1.06	0.95	10.00	5.39	6.66	5.1	6.3	15	61.7	0.0120	804.32	5.61	6.61	0.0128	805.51	809.62	4.11	4.05	1.3C	
	begh	1.06	0.95									804.71	806.83								0.015



STORM SEWER SYSTEM

PID : 77366 Date : 06/05/2007 Project : SCI-823-0.00 Location : PORTSMOUTH, SCIOTO COUNTY Designer : DL

Description : FROM STA. 283+50 TO STA. 284+00 TO STA. 284+50, 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/I PIPE	MEAN	JUST FULL	FRICT	HYGREL.	COVER	COVER	INLET					
From	To	Σ AREA	Σ CA	TIME	INTENSITY	(cfs.)	DIAM.	LENGTH	SLOPE	CAPACITY	SLOPE	IN / OUT	IN / OUT	MINUS	TYPE					
		(acres)		(min.)	(10 yrs.)	(25 yrs.)	(in.)	(ft.)	(ft./ft.)	(cfs.)	(ft./ft.)	(ft.)	(ft.)	HY GR	'n'					
1	283+50	13.77	9.78	15.00	4.60	5.71	45.0	55.8	30	50.0	0.0420	800.05	15.63	78.37	0.0246	801.69	804.05	2.36	1.50	CB 8A
	begin		13.77	9.78								797.95				800.38	802.95			0.015
2	284+00	0.07	0.05	15.05	4.60	5.70	45.2	56.1	30	50.0	0.0486	797.95	16.54	84.30	0.0248	799.51	802.95	3.44	2.50	CB 8A
	284+50	13.84	9.83									795.52				797.95	802.27			0.015
3	284+50	0.00	0.00	15.10	4.59	5.70	45.1	56.0	30	4.3	0.0400	795.52	15.34	76.48	0.0248	797.89	802.27	4.38	4.25	MH 3
	284+50	13.84	9.83									795.35				797.78	797.85			0.015
4	284+50	0.00	0.00	15.11	4.59	5.68	45.1	55.8	30	242.4	0.3333	795.35	33.53	220.78	0.0246	796.24	797.96	1.72	0.11	MH 3
	284+50	13.84	9.83									714.55				716.98	719.05			0.015
5	284+50	0.00	0.00	15.23	4.57	5.68	45.0	55.8	30	17.1	0.0400	714.55	15.33	76.48	0.0246	716.72	719.05	2.33	2.00	MH 3
	final	13.84	9.83									713.86				716.29	718.36			0.015



STORM SEWER SYSTEM

PID : 77366 **Date :** 04/13/2007 **Project :** SCI-823-0.00 **Location :** PORTSMOUTH, SCIOTO COUNTY
Description : STA. 293+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/I PIPE	MEAN	JUST FULL	FRICT	HYGR EL.	COVER	COVER	INLET TYPE						
From	To	Σ AREA	Σ CA	TIME	INTENSITY	(cfs.)	DIAM.	LENGTH	SLOPE	(ft./ft.)	IN / OUT	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	1	0.85	0.76	10.00	5.39	6.65	4.1	5.1	15	64.1	0.0100	780.84	4.99	6.02	0.0082	781.80	786.64	4.84	4.55	1 3B	0.015
	begin	0.85	0.76									780.20				781.28	783.45				
1	2	0.00	0.00	10.21	5.35	6.60	4.1	5.0	15	182.5	0.1667	780.20	14.11	24.59	0.0081	780.60	783.45	2.85	2.00	MH 3	0.015
	293+00	0.85	0.76									749.78				750.86	753.03				
2	3	0.00	0.00	10.43	5.31	6.58	4.1	5.0	15	29.5	0.0100	749.78	4.97	6.02	0.0080	750.80	753.03	2.23	2.00	MH 3	0.015
	final	0.85	0.76									749.49				750.57	752.74				



STORM SEWER SYSTEM

PID : 77366 **Date :** 03/02/2007 **Project :** SCI-823-0.00 **Location :** PORTSMOUTH, SCIOTO COUNTY
Description : STA. 303+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/I PIPE	MEAN	JUST FULL	FRICT	HYGREL.	COVER	COVER	INLET TYPE							
From	To	Σ AREA (acres)	Σ CA	TIME (min.)	INTENSITY (10 yrs.)	(25 yrs.)	(10 yrs.)	(25 yrs.)	(cfs.)	DIAM. (in.)	LENGTH (ft.)	SLOPE (ft./ft.)	IN / OUT (ft.)	IN / OUT (ft.)	HY GR	MINUS CROWN	MINUS MANNING'S 'n'					
0	1	0.51	0.46	10.00	5.39	6.64	2.5	3.0	15	64.1	0.0100	757.90	4.41	6.02	0.0029	758.55	763.70	5.15	4.55	1.38	0.015	
	begin	0.51	0.46									757.26				758.24	760.51					
1	2	0.00	0.00	10.24	5.35	6.58	2.4	3.0	15	214.0	0.1667	757.26	12.15	24.59	0.0029	757.57	760.51	2.94	2.00	MH 3	0.015	
	begin	0.51	0.46									721.59				722.56	724.84					
2	3	0.00	0.00	10.54	5.29	6.57	2.4	3.0	15	9.9	0.0100	721.59	4.39	6.02	0.0029	722.49	724.84	2.35	2.00	MH 3	0.015	
	final	0.51	0.46									721.49				722.46	722.74					



STORM SEWER SYSTEM

PID : 77366 Date : 03/02/2007 Project : SCI-823-0.00 Location : PORTSMOUTH, SCIOTO COUNTY Designer : DL
 Description : STA. 313+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	RAINFALL	DISCHARGE	PIPE	F/I 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.)	(ft.)	(ft.)	(fps.)	(cfs.)	(ft./ft.)	(ft.)	(ft.)	HY GR	CROWN	'n'							
0	1	313+00	0.51	0.46	10.00	5.39	6.65	2.5	3.0	15	59.8	0.0100	739.25	4.41	6.02	0.0029	739.90	745.05	5.15	4.55	1.38	0.015	
		313+00	0.51	0.46									738.65				739.63	741.90					
1	2	313+00	0.00	0.00	10.23	5.35	6.59	2.4	3.0	15	196.1	0.2500	738.65	13.97	30.11	0.0029	738.93	741.90	2.97	2.00	MH 3	0.015	
		313+00	0.51	0.46									689.63				690.60	692.88					
2	3	313+00	0.00	0.00	10.46	5.31	6.58	2.4	3.0	15	14.1	0.0100	689.63	4.39	6.02	0.0029	690.50	692.88	2.38	2.00	MH 3	0.015	
		313+00	0.51	0.46									689.48				690.46	692.73					



STORM SEWER SYSTEM

PID : 77366 Date : 03/05/2007 Project : SCI-823-0.00 Location : PORTSMOUTH, SCIOTO COUNTY
 Designer : DL
 Description : STA. 323+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	ΔAREA	ΣAREA	ΔCA	BEGIN	RAINFALL	DISCHARGE	PIPE	DIAM.	LENGTH	SLOPE	IN / OUT	FIL PIPE	MEAN	JUST FULL	FRICT	HYGR EL.	COVER	COVER	INLET	TYPE
From	To	(acres)	(acres)	(acres)	TIME	INTENSITY	(cfs.)	(ft.)	(in.)	(ft.)	(ft./ft.)	(ft.)	(ft.)	(fps.)	(cfs.)	(ft./ft.)	(ft.)	(ft.)	MINUS	MINUS	MANNING'S
					(min.)	(10 yrs.)	(25 yrs.)	(10 yrs.)	(25 yrs.)	(ft.)	(ft./ft.)	(ft.)	(ft.)						HY GR	CROWN	'n'
0	1	323+00	0.95	0.86	10.00	5.39	6.66	4.6	5.7	15	57.6	0.0110	721.15	5.30	6.32	0.0104	722.22	726.95	4.73	4.55	1.3B
		begin	0.95	0.86									720.52				721.62	723.77			0.015
1	2	323+00	0.00	0.00	10.18	5.36	6.63	4.6	5.7	15	139.0	0.5000	720.52	21.56	42.58	0.0103	720.84	723.77	2.93	2.00	MH 3
		323+00	0.95	0.86									651.02				652.13	654.27			0.015
2	3	323+00	0.00	0.00	10.29	5.34	6.62	4.6	5.7	15	16.8	0.0110	651.02	5.30	6.32	0.0103	652.12	654.27	2.15	2.00	MH 3
		final	0.95	0.86									650.84				651.94	654.09			0.015



STORM SEWER SYSTEM

PID : 77366 Date : 02/02/2007 Project : SCI-823-0.00 Location : PORTSMOUTH, SCIOTO COUNTY
 Designer : DL
 Description : STA. 333+00.00 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/I 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.) (25 yrs.) (10 yrs.) (25 yrs.)	(cfs.)	DIAM. LENGTH (in.) (ft.)	IN / OUT (ft.)	VEL (fps.)	CAPACITY (cfs.)	SLOPE (ft./ft.)	IN / OUT (ft.)	IN / OUT (ft.)	MINUS HY GR	MINUS CROWN	MANNING'S 'n'				
0	1	1.06	0.95	10.00	5.39	6.66	5.1	6.3	15	61.2	0.0130	701.26	5.78	6.87	0.0128	702.38	705.96	3.58	3.45	1.3B
	begin	1.06	0.95									700.47				701.60	703.72			0.015



STORM SEWER SYSTEM

PID : 77366 Date : 02/02/2007 Project : SCI-823-0.00 Location : PORTSMOUTH, SCIOTO COUNTY Designer : DL
 Description : STA. 340+00.00 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/I 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	CROWN	MANNING'S	'n'	
		(acres)		(min.)	(10 yrs.)	(25 yrs.)	(in.)	(ft.)	(ft./ft.)	(ft.)	(fps.)	(cfs.)	(ft./ft.)	(ft.)	(ft.)	(ft.)	(ft.)			
0	1	0.74	0.67	10.00	5.39	6.65	3.6	4.4	15	61.0	0.0100	671.25	4.84	6.02	0.0063	672.09	675.95	3.86	3.45	1.38
	begin	0.74	0.67									670.64				671.69	673.89			0.015



STORM SEWER SYSTEM

PID : 77366 Date : 03/05/2007 Project : SCI-823-0.00

Description : STA. 346+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/I/L	PIPE	MEAN	JUST FULL	FRICT	HYGR EL.	COVER	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	MINUS	MINUS	MANNING'S
		(acres)		(min.)	(10 yrs.)	(25 yrs.)	(10 yrs.)	(25 yrs.)			(ft.)	(ft.)	(fps.)	(cfs.)	(ft./ft.)	(ft.)	(ft.)	HY GR	CROWN	'n'
0	1	0.63	0.57	10.00	5.39	6.65	3.1	3.8	15	57.5	0.0100	647.18	4.67	6.02	0.0046	647.94	652.98	5.04	4.55	1.38
	begin	0.63	0.57								646.61					647.62	649.86			0.015
1	2	0.00	0.00	10.21	5.35	6.62	3.1	3.8	15	153.1	0.5000	646.61	19.11	42.58	0.0045	646.87	649.86	2.99	2.00	MH 3
	346+00	0.63	0.57								570.06					571.08	573.31			0.015
2	3	0.00	0.00	10.34	5.33	6.61	3.0	3.8	15	16.5	0.0100	570.06	4.66	6.02	0.0045	570.99	573.31	2.32	2.00	MH 3
	final	0.63	0.57								569.90					570.91	573.15			0.015



STORM SEWER SYSTEM

PID : 77366 **Date :** 02/02/2007 **Project :** SCI-823-0.00 **Location :** PORTSMOUTH, SCIOTO COUNTY
Description : STA. 349+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	COVER	INLET	TYPE		
From	To	ΣAREA	ΣCA	TIME	INTENSITY	(cfs.)	DIAM.	LENGTH	SLOPE	IN / OUT	VEL	CAPACITY	SLOPE	IN / OUT	IN / OUT	IN / OUT	MINUS	MINUS	MANNING'S	
		(acres)		(min.)	(10 yrs.)	(25 yrs.)	(10 yrs.)	(25 yrs.)	(ft./ft.)	(ft.)	(ft.)	(cfs.)	(ft./ft.)	(ft.)	(ft.)	(ft.)	HY GR	CROWN	'n'	
0	1	0.32	0.28	10.00	5.39	6.64	1.5	1.9	15	61.0	0.0100	643.48	3.89	6.02	0.0011	643.98	648.18	4.20	3.45	1.3B
	begin	0.32	0.28									642.87				643.77	646.12			0.015



STORM SEWER SYSTEM

PID : 77366 **Date :** 04/06/2007 **Project :** SCI-823-0.00 **Location :** PORTSMOUTH, SCIOTO COUNTY
Description : REACH # 4; FROM 350+00 TO 350+59.68 (LP); FROM 351+50 TO 350+59.68 (LP); 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	COVER	INLET TYPE						
From	To	Σ (acres)	Σ (min.)	TIME (10 yrs.)	INTENSITY (10 yrs.)	(cfs.) (25 yrs.)	DIAM. (in.)	LENGTH (ft.)	SLOPE (ft./ft.)	VEL (fps.)	CAPACITY (cfs.)	SLOPE (ft./ft.)	IN (ft.)	OUT (ft.)	MINUS HYGR	MINUS CROWN	MANNING'S 'n'					
0	1	0.11	0.09	10.00	5.39	6.63	0.5	0.6	15	59.7	0.0149	642.92	3.26	7.35	0.0001	643.18	647.62	4.44	3.45	1.38	0.015	
	begin	0.11	0.09									642.03				642.81	647.53					
0	1	0.37	0.33	10.00	5.39	6.62	1.8	2.2	15	90.3	0.0112	643.04	4.22	6.37	0.0015	643.57	647.74	4.17	3.45	1.38	0.015	
	begin	0.47	0.43									642.03				642.95	647.53					
1	2	0.16	0.14	10.36	5.33	6.57	3.0	3.7	15	62.6	0.0100	642.03	4.65	6.02	0.0045	642.78	647.53	4.75	4.25	1.38	0.015	
	final	0.63	0.57									641.40				642.42	644.65					



STORM SEWER SYSTEM

PID : 77366 **Date :** 05/29/2007 **Project :** SCI-823-0.00 **Location :** PORTSMOUTH, SCIOTO COUNTY
Description : STA. 37+25.00 TO 29+61.40 US52 RAMP A, 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	ΔAREA	ΔCA	BEGIN	RAINFALL	DISCHARGE	PIPE	FIL 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	IN / OUT	MINUS	MANNING'S				
		(acres)		(min.)	(10 yrs.) (25 yrs.)	(10 yrs.) (25 yrs.)	(in.)	(ft.)	(ft./ft.)	(ft.)	(fps.)	(cfs.)	(ft./ft.)	(ft.)	(ft.)	HY GR	CROWN			
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
	37+25	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
	35+50	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
	33+50	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
	31+50	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
	29+61	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		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.)	(in.)	(ft.)	(ft./ft.)	(ft.)	IN / OUT	VEL	CAPACITY	SLOPE	IN / OUT	IN / OUT	MINUS	MINUS	MANNINGS	
		(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	0.86	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
	begin	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	ΔAREA	ΔCA	BEGIN	RAINFALL	DISCHARGE	PIPE	F/I PIPE	MEAN	JUST FULL	FRICT	HYGR EL.	COVER	COVER	COVER	INLET TYPE					
From	To	Σ AREA	Σ CA	TIME	INTENSITY	(cfs.)	DIAM.	LENGTH	VEL	CAPACITY	SLOPE	IN / OUT	IN / OUT	MINUS	MINUS	MANNING'S					
		(acres)		(min.)	(10 yrs.)	(25 yrs.)	(in.)	(ft.)	(fps.)	(cfs.)	(ft./ft.)	(ft.)	(ft.)	HY GR	CROWN	'n'					
0	1	29+25	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
		29+25	0.20	0.18									550.00				550.84	552.25			0.015
1	2	29+25	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
		29+25	0.20	0.18									531.00				531.84	533.25			0.015
2	3	29+25	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
		29+25	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 **Location :** PORTSMOUTH, SCIOTO COUNTY
Description : STA. 34+70 TO 29+00 US52 RAMP B, 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		ΔAREA	ΔCA	BEGIN	RAINFALL	DISCHARGE	PIPE	FIL 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	IN / OUT	MINUS	MINUS	MANING'S			
		(acres)		(min.)	(10 yrs.)	(25 yrs.)	(10 yrs.)	(25 yrs.)	(ft.)	(fps.)	(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
	begin	1.00	0.88									537.87				538.98	541.45			0.015
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
	begin	1.62	1.44									537.87				538.89	541.45			0.015
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
	30+50	1.97	1.68									535.46				537.05	538.70			0.015
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
	29+00	2.50	2.05									531.83				533.51	535.90			0.015
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
	final	6.50	5.45									530.59				533.04	535.90			0.015

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



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



STORM SEWER SYSTEM

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 (acres)	Σ CA	(min.)	(10 yrs.) (25 yrs.)	(10 yrs.) (25 yrs.)	(in.)	(ft.)	(ft./ft.)	IN / OUT (ft.)	(fps.)	(cfs.)	(ft./ft.)	(ft.)	(ft.)	HY GR	'n'	
5	9	0.07	0.06	16.29	4.44	5.41	24	235.0	0.0075	551.75	5.88	18.25	0.0058	553.21	559.04	5.83	5.29	13D
		4.94	2.77							549.99				551.69	560.03		0.015	
9	10	0.11	0.10	16.96	4.36	5.40	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 Location : PORTSMOUTH, SCIOTO COUNTY Designer : DL
 Description : STA. 47+00; US52 RAMP B, 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	Σ CA	TIME	INTENSITY	(cfs.)	DIAM.	LENGTH	SLOPE	IN / OUT	VEL	CAPACITY	SLOPE	IN / OUT	HY GR	MINUS	COVER	MINUS	MANNING'S	
		(acres)		(min.)	(10 yrs.)	(25 yrs.)	(in.)	(ft.)	(ft./ft.)	(ft.)	(fps.)	(cfs.)	(ft./ft.)	(ft.)	(ft.)	(ft.)	(ft.)	(ft.)	(ft.)	"n"
0	1	0.08	0.07	10.00	5.39	6.63	0.4	0.5	15	46.2	0.0100	590.56	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	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/I 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.) (25 yrs.)	(cfs.)	DIAM. LENGTH (in.) (ft.)	SLOPE (ft./ft.)	IN / OUT (ft.) (fps.)	CAPACITY (cfs.)	SLOPE (ft./ft.)	IN / OUT (ft.) (ft.)	IN / OUT (ft.) (ft.)	MINUS HYGR	MINUS CROWN	MANNING'S '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	0.012
	begin	80.23	36.10									551.33				555.88	557.69				
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	0.012
	9+30	80.23	36.10									550.07				554.61	556.41				
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	0.012
	8+50	80.23	36.10									546.77				551.77	553.09				
0	3	101.5	45.68	15.00	4.60	5.67	210.3	258.8	60	100.0	0.0053	547.30	11.91	220.96	0.0084	552.61	554.30	1.69	2.00	HW Half He	0.012
	begin	181.73	81.78									546.77				551.77	553.09				
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	0.012
	final	181.73	81.78									546.11				551.52	553.68				



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	ΔAREA	ΔCA	BEGIN	RAINFALL	DISCHARGE	PIPE	DIAM.	LENGTH	SLOPE	IN / OUT	F/L PIPE	MEAN	JUST FULL	FRICT	HYGR EL.	COVER	COVER	INLET TYPE	
From	To	Σ AREA	Σ CA	TIME	INTENSITY	(cfs.)	(ft.)	(ft.)	(ft./ft.)	(ft.)	(ft.)	(ft.)	(ft.)	(cfs.)	(ft./ft.)	(ft.)	(ft.)	MINUS	MINUS	'n'
		(acres)		(min.)	(10 yrs.)	(25 yrs.)	(10 yrs.)	(25 yrs.)		(fps.)								HY GR	CROWN	
0	1	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
	begin	0.13	0.12									560.12				560.92	563.37			0.015
1	2	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
	begin	0.13	0.12									555.92				556.72	559.17			0.015
2	3	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
	final	0.13	0.12									555.85				556.65	559.10			0.015

APPENDIX D

Culvert Analysis

STA 823 STA 68+64



AREA 3
65.03 AC
= 0.102 Sq. mi.

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

PAIJA 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.	L₁₀ = 10% of the Distance along channel
	585	FT.	Elev₁₀ = Elevation at point L₁₀
	1171.30	FT.	L₈₅ = 85% of the Distance along channel
	754	FT.	Elev₈₅ = Elevation at point L₈₅
	1033.50	FT.	Length = L₈₅ - L₁₀
	862.37	FT./MI.	SLOPE = (Elev₁₀ - Elev₈₅)/ Length
		CFS	Q_# = Flood-Peak Discharge
			# = Frequency of Storm
Q₂	30.01	CFS	$= 56.1(\text{CONTDA})^{0.782}(\text{SLOPE})^{0.172}(\text{STORAGE}+1)^{-0.297}$
Q₅	64.86	CFS	$= 84.5(\text{CONTDA})^{0.769}(\text{SLOPE})^{0.221}(\text{STORAGE}+1)^{-0.322}$
Q₁₀	94.32	CFS	$= 104(\text{CONTDA})^{0.764}(\text{SLOPE})^{0.244}(\text{STORAGE}+1)^{-0.335}$
Q₂₅	135.16	CFS	$= 129(\text{CONTDA})^{0.760}(\text{SLOPE})^{0.264}(\text{STORAGE}+1)^{-0.347}$
Q₅₀	169.33	CFS	$= 148(\text{CONTDA})^{0.757}(\text{SLOPE})^{0.276}(\text{STORAGE}+1)^{-0.355}$
Q₁₀₀	203.52	CFS	$= 167(\text{CONTDA})^{0.756}(\text{SLOPE})^{0.285}(\text{STORAGE}+1)^{-0.363}$

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 :** 01/17/2007 **Project :** SR 823 Portsmouth Bypass **Location :** Portsmouth Ohio **Designer :** hjs

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.) : 576.67 **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.) : 326.00 **Culvert Slope (ft./ft.) :** 0.0310 **Design Manning 'n' :** 0.0120
Design Discharge (cfs) : 169.33 @ 50 yrs. **Flood Discharge (cfs) :** 203.52 @ 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.)
169.33	1	60 in.	582.48	N/A	1 - C	22.88	2.01	3.73	0.0120	INLET	0.00	D	0.00
169.33	1	54 in.	583.32	574.89	2 - E	22.97	2.12	3.79	0.0120	INLET	0.00	D - 1	0.00
169.33	1	48 in.	585.07	577.66	2 - E	22.93	2.28	3.72	0.0120	INLET	0.00	D - 2	0.00
169.33	1	66 in.	582.06	N/A	1 - C	22.74	1.93	3.64	0.0120	INLET	0.00	D + 1	0.00
203.52	1	60 in.	583.49	574.80	2 - E	24.03	2.23	4.07	0.0120	INLET	0.00	F	0.00
203.52	1	54 in.	584.87	576.87	2 - E	24.05	2.36	4.06	0.0120	INLET	0.00	F - 1	0.00
203.52	1	48 in.	587.52	580.94	2 - E	23.86	2.57	3.86	0.0120	INLET	0.00	F - 2	0.00
203.52	1	66 in.	582.80	N/A	1 - C	23.92	2.13	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)

FLOW #	PIPE	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.)
169.33	1	583.46	577.50	2 - E	13.96	2.96	3.73	0.0232	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.)
169.33	1	54 in.	585.16	581.79	2-E	13.69	3.27	3.79	0.0233	INLET	0.00	D-1	0.00
169.33	1	48 in.	588.14	590.52	2-F	13.89	4.00	3.72	0.0235	OUTLET**	0.00	D-2	0.00
169.33	1	66 in.	582.57	N/A	1-C	14.06	2.78	3.64	0.0231	INLET	0.00	D+1	0.00
203.52	1	60 in.	585.16	580.59	2-E	14.50	3.36	4.07	0.0232	INLET	0.00	F	0.00
203.52	1	54 in.	587.67	586.84	2-E	13.73	3.96	4.06	0.0233	INLET	0.00	F-1	0.00
180.92	1	48 in.	591.68	599.51	2-F	14.72	4.00	3.78	0.0235	OUTLET**	22.60	F-2	0.00
203.52	1	66 in.	583.71	577.25	2-E	14.70	3.11	3.99	0.0231	INLET	0.00	F+1	0.00
Corrugated Metal Pipe (3 x 1 in. corrugations)													
169.33	1	60 in.	583.46	579.09	2-E	12.35	3.29	3.73	0.0271	INLET	0.00	D	0.00
169.33	1	54 in.	585.16	584.67	2-E	11.79	3.81	3.79	0.0273	INLET	0.00	D-1	0.00
160.73	1	48 in.	588.14	595.96	2-F	13.31	4.00	3.67	0.0275	OUTLET**	8.60	D-2	0.00
169.33	1	66 in.	582.57	N/A	1-C	12.53	3.05	3.64	0.0269	INLET	0.00	D+1	0.00
203.52	1	60 in.	585.16	582.89	2-E	12.71	3.80	4.07	0.0271	INLET	0.00	F	0.00
203.52	1	54 in.	587.67	591.00	2-F	13.48	4.50	4.06	0.0273	OUTLET**	0.00	F-1	0.00
160.72	1	48 in.	591.68	607.37	2-F	13.31	4.00	3.67	0.0275	OUTLET**	42.80	F-2	0.00
203.52	1	66 in.	583.71	578.59	2-E	13.05	3.43	3.99	0.0269	INLET	0.00	F+1	0.00
Corrugated Metal Pipe (6 x 2 in. corrugations)													
169.33	1	66 in.	582.57	N/A	1-C	10.69	3.48	3.64	0.0330	INLET	0.00	D	0.00
169.33	1	60 in.	583.46	583.72	2-F	10.78	3.87	3.73	0.0332	OUTLET*	0.00	D-1	0.00
169.33	1	72 in.	582.10	N/A	1-C	10.82	3.25	3.54	0.0327	INLET	0.00	D+1	0.00
203.52	1	66 in.	583.71	581.16	2-E	11.04	3.98	3.99	0.0330	INLET	0.00	F	0.00
203.52	1	60 in.	585.16	587.19	2-F	11.90	5.00	4.07	0.0332	OUTLET**	0.00	F-1	0.00
203.52	1	72 in.	582.92	N/A	1-C	11.29	3.65	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.	583.46	578.62	2 - E	12.77	3.20	3.73	0.0260	INLET	0.00	D	0.00
169.33	1	66 in.	582.57	N/A	1 - C	12.85	2.99	3.64	0.0260	INLET	0.00	D + 1	0.00
203.52	1	60 in.	585.16	582.20	2 - E	13.18	3.67	4.07	0.0260	INLET	0.00	F	0.00
203.52	1	66 in.	583.71	578.25	2 - E	13.41	3.35	3.99	0.0260	INLET	0.00	F + 1	0.00

DESIGN = 60" USE F2" (FOR FUTURE LINDING)



CULVERT ANALYSIS

PID : 77356 Date : 01/17/2007 Project : SR 823, Portsmouth Bypass Location : Portsmouth, Ohio Designer : HJS
 Description : Drainage 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.

Pipe Number : 1 Use HW : 0 Inlet Invert Elevation (ft.) : 576.67 Outlet Invert Elevation (ft.) : 566.58
 Pipe Quantity : 1

Culvert Type : Circular Corrugated Pipe Length (ft.) : 326.00 Culvert Slope (ft./ft.) : 0.0310
 Corrugation Type : Corrugated Metal Pipe (6 x 2 in. corrugations)
 Pipe Size : 72 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.)
169.30	10.75	582.10	N/A	1 - C	10.82	3.25	3.54	0.0327	INLET	0.00	566.58
203.50	11.39	582.92	N/A	1 - C	11.29	3.65	3.90	0.0327	INLET	0.00	566.58

SR 823 STA 110+02

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

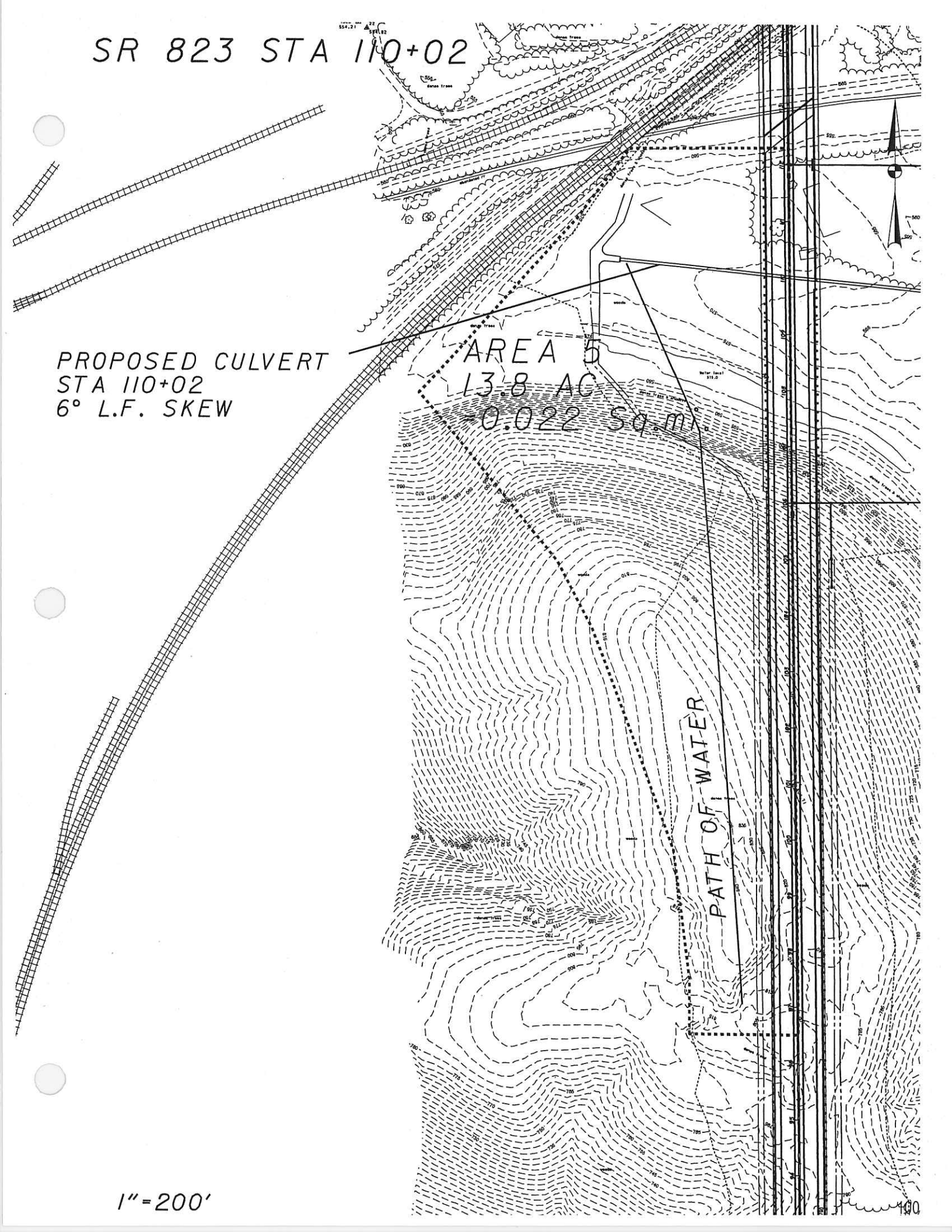
AREA 5
13.8 AC

0.022 SQ. M

PATH OF WATER

1" = 200'

100



SR 823 STA 110+02.00
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
	600977.70	SQ. FT.	
	0.022	SQ. MI.	CONTDA = Contributing Drainage Area
	0.00	SQ. FT.	
	0.00	%	STORAGE = Storage Area
	1350.00	FT.	TOTAL CHANNEL LENGTH
	135.00	FT.	L₁₀ = 10% of the Distance along channel
	580	FT.	Elev₁₀ = Elevation at point L₁₀
	1147.50	FT.	L₈₅ = 85% of the Distance along channel
	842	FT.	Elev₈₅ = Elevation at point L₈₅
	1012.50	FT.	Length = L₈₅ - L₁₀
	1366.28	FT./MI.	SLOPE = (Elev₁₀ - Elev₈₅)/ Length
		CFS	Q_# = Flood-Peak Discharge # = Frequency of Storm
Q₂	9.66	CFS	= 56.1(CONTDA) ^{0.782} (SLOPE) ^{0.172} (STORAGE +1) ^{-0.297}
Q₅	21.79	CFS	= 84.5(CONTDA) ^{0.769} (SLOPE) ^{0.221} (STORAGE +1) ^{-0.322}
Q₁₀	32.28	CFS	= 104(CONTDA) ^{0.764} (SLOPE) ^{0.244} (STORAGE +1) ^{-0.335}
Q₂₅	46.98	CFS	= 129(CONTDA) ^{0.760} (SLOPE) ^{0.264} (STORAGE +1) ^{-0.347}
Q₅₀	59.46	CFS	= 148(CONTDA) ^{0.757} (SLOPE) ^{0.276} (STORAGE +1) ^{-0.355}
Q₁₀₀	71.87	CFS	= 167(CONTDA) ^{0.756} (SLOPE) ^{0.285} (STORAGE +1) ^{-0.363}

Worksheet for SR 823 STA 110+02

Project Description

Friction Method Manning Formula
Solve For Normal Depth

Input Data

Roughness Coefficient	0.040	
Channel Slope	0.02890	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	59.50	ft ³ /s

Results

Normal Depth	1.31	ft
Flow Area	9.97	ft ²
Wetted Perimeter	10.85	ft
Top Width	10.24	ft
Critical Depth	1.36	ft
Critical Slope	0.02521	ft/ft
Velocity	5.97	ft/s
Velocity Head	0.55	ft
Specific Energy	1.86	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	1.31	ft
Critical Depth	1.36	ft
Channel Slope	0.02890	ft/ft
Critical Slope	0.02521	ft/ft



UNIVERSAL CULVERT DESIGN

PID : 77366 **Date :** 03/16/2007 **Project :** SR 823 Portsmouth Bypass **Location :** Portsmouth Ohio **Designer :** mdc

Description : Drainage area 5, Sta. 110+02 Maximum Q through this culvert

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.) : 559.81 **Outlet Invert Elevation (ft.) :** 556.62 **Tailwater Elevation (ft.) :** 557.93 **Overflow Elevation (ft.) :** 664.00
Allowable Headwater Elevation (ft.) : 661.70 or Diameter + 2 ft. *(whichever is less)*
Pipe Length (ft.) : 638.00 **Culvert Slope (ft./ft.) :** 0.0050 **Design Manning 'n' :** 0.0120
Design Discharge (cfs) : 59.50 @ 50 yrs. **Flood Discharge (cfs) :** 71.90 @ 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													
59.50	1	42 in.	563.44	N/A	1 - C	8.84	2.31	2.42	0.0120	INLET	0.00	D	0.00
59.50	1	36 in.	564.10	564.99	2 - F	9.48	3.00	2.49	0.0120	OUTLET**	0.00	D - 1	0.00
59.50	1	33 in.	564.83	567.95	2 - F	10.55	2.75	2.48	0.0120	OUTLET**	0.00	D - 2	0.00
59.50	1	48 in.	563.18	N/A	1 - C	8.93	2.09	2.32	0.0120	INLET	0.00	D + 1	0.00
71.90	1	42 in.	563.99	564.03	2 - F	9.18	2.68	2.66	0.0120	OUTLET*	0.00	F	0.00
71.90	1	36 in.	565.10	567.67	2 - F	10.78	3.00	2.68	0.0120	OUTLET**	0.00	F - 1	0.00
71.90	1	33 in.	566.25	572.02	2 - F	12.35	2.75	2.61	0.0120	OUTLET**	0.00	F - 2	0.00
71.90	1	48 in.	563.59	N/A	1 - C	9.34	2.36	2.56	0.0120	INLET	0.00	F + 1	0.00
CULVERT TYPE : CIRCULAR CORRUGATED													
Corrugated Metal Pipe (2 2/3 x 1/2 in. corrugations)													
59.50	1	48 in.	563.35	564.03	1 - A	7.86	3.55	2.32	0.0235	OUTLET*	0.00	D	0.00

Entrance Loss (Ke) : 0.20

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.)
59.50 1	42 in.	563.86	568.08	2 - F	8.39	3.50	2.42	0.0237	OUTLET**	0.00	D - 1	0.00
59.50 1	36 in.	565.23	578.81	2 - F	9.48	3.00	2.49	0.0241	OUTLET**	0.00	D - 2	0.00
59.50 1	54 in.	563.12	563.59	1 - A	7.52	2.95	2.24	0.0233	OUTLET*	0.00	D + 1	0.00
71.90 1	48 in.	563.89	566.06	2 - F	8.45	4.00	2.56	0.0235	OUTLET**	0.00	F	0.00
71.90 1	42 in.	564.76	572.11	2 - F	9.18	3.50	2.66	0.0237	OUTLET**	0.00	F - 1	0.00
71.90 1	36 in.	566.87	587.85	2 - F	10.78	3.00	2.68	0.0241	OUTLET**	0.00	F - 2	0.00
71.90 1	54 in.	563.52	564.10	1 - A	8.03	3.42	2.47	0.0233	OUTLET*	0.00	F + 1	0.00
Corrugated Metal Pipe (3 x 1 in. corrugations)												
59.50 1	48 in.	563.35	565.31	2 - F	7.86	4.00	2.32	0.0275	OUTLET**	0.00	D	0.00
59.50 1	42 in.	563.86	570.85	2 - F	8.39	3.50	2.42	0.0278	OUTLET**	0.00	D - 1	0.00
59.50 1	36 in.	565.23	585.05	2 - F	9.48	3.00	2.49	0.0281	OUTLET**	0.00	D - 2	0.00
59.50 1	54 in.	563.12	563.76	1 - A	7.52	3.33	2.24	0.0273	OUTLET*	0.00	D + 1	0.00
71.90 1	48 in.	563.89	567.98	2 - F	8.45	4.00	2.56	0.0275	OUTLET**	0.00	F	0.00
71.90 1	42 in.	564.76	576.16	2 - F	9.18	3.50	2.66	0.0278	OUTLET**	0.00	F - 1	0.00
71.90 1	36 in.	566.87	596.96	2 - F	10.78	3.00	2.68	0.0281	OUTLET**	0.00	F - 2	0.00
71.90 1	54 in.	563.52	564.43	1 - A	8.03	4.11	2.47	0.0273	OUTLET*	0.00	F + 1	0.00
Corrugated Metal Pipe (6 x 2 in. corrugations)												
59.50 1	60 in.	562.98	563.73	1 - A	7.29	3.46	2.17	0.0332	OUTLET*	0.00	D	0.00
59.50 1	66 in.	562.85	563.49	1 - A	7.10	3.19	2.11	0.0330	OUTLET*	0.00	D + 1	0.00
71.90 1	60 in.	563.34	564.32	1 - A	7.74	4.09	2.39	0.0332	OUTLET*	0.00	F	0.00
71.90 1	66 in.	563.20	563.95	1 - A	7.52	3.62	2.33	0.0330	OUTLET*	0.00	F + 1	0.00
Corrugated Metal Pipe (6 x 2 in. corrugations, Field Paved Invert)												
59.50 1	60 in.	562.98	563.45	1 - A	7.29	2.93	2.17	0.0260	OUTLET*	0.00	D	0.00
59.50 1	66 in.	562.85	563.27	1 - A	7.10	2.75	2.11	0.0260	OUTLET*	0.00	D + 1	0.00

110*02.xml



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.)
71.90	1	60 in.	563.34	563.91	1-A	7.74	3.32	2.39	0.0260	OUTLET*	0.00	F	0.00
71.90	1	66 in.	563.20	563.68	1-A	7.52	3.09	2.33	0.0260	OUTLET*	0.00	F+1	0.00

48" REQUIRED USE 60" STRUCTURAL PLATE

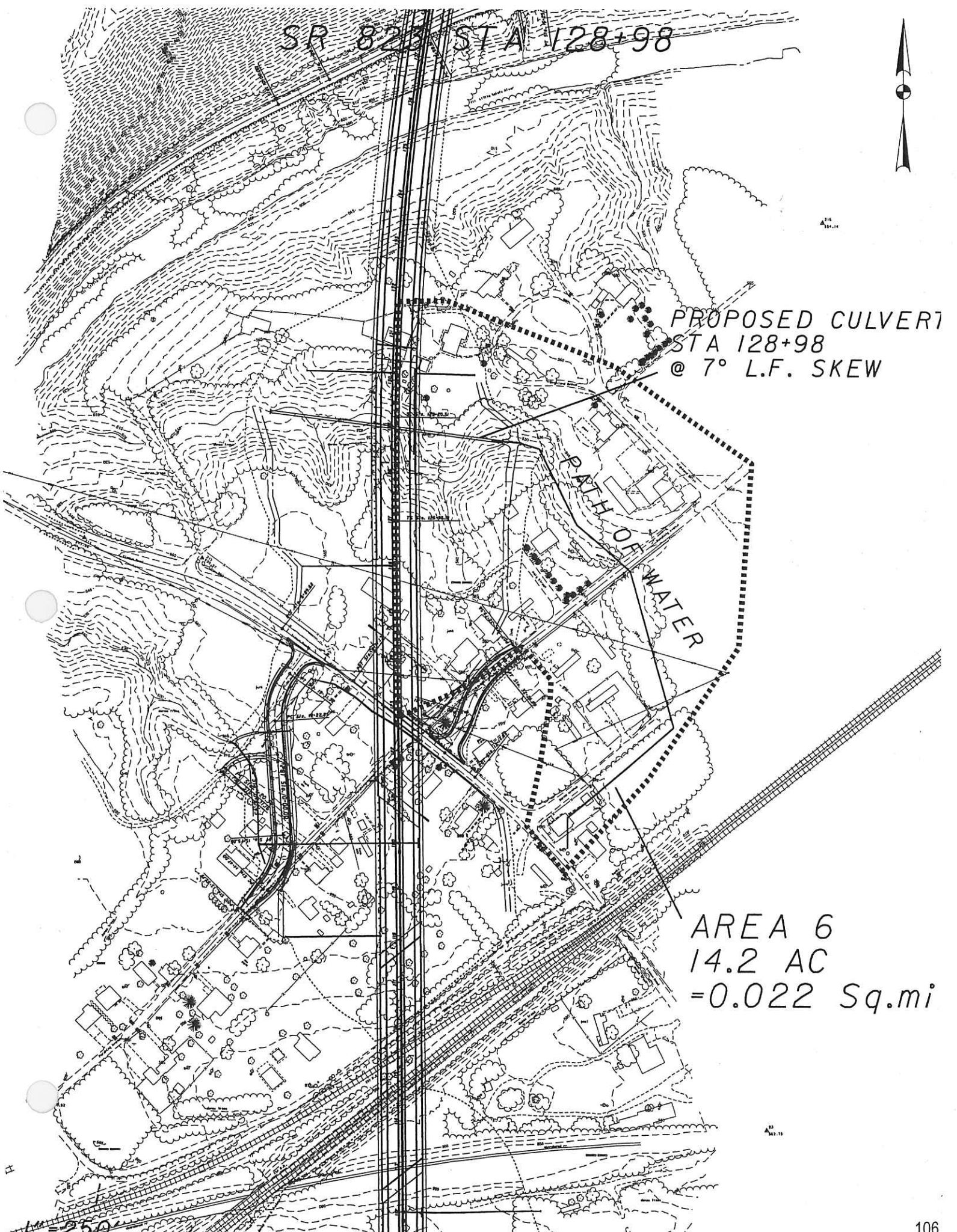
SR 823 STA 128+98



PROPOSED CULVERT
STA 128+98
@ 7° L.F. SKEW

PATH OF WATER

AREA 6
14.2 AC
= 0.022 Sq.mi



SR 823 128+98.00
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
	618239.30	SQ. FT.	
	0.022	SQ. MI.	CONTDA = Contributing Drainage Area
	0.00	SQ. FT.	
	0.00	%	STORAGE = Storage Area
	1160.00	FT.	TOTAL CHANNEL LENGTH
	116.00	FT.	L ₁₀ = 10% of the Distance along channel
	527	FT.	Elev ₁₀ = Elevation at point L ₁₀
	986.00	FT.	L ₈₅ = 85% of the Distance along channel
	555	FT.	Elev ₈₅ = Elevation at point L ₈₅
	870.00	FT.	Length = L ₈₅ - L ₁₀
	167.50	FT./MI.	SLOPE = (Elev ₁₀ -Elev ₈₅)/Length
		CFS	Q _# = Flood-Peak Discharge
			# = Frequency of Storm
Q ₂	6.89	CFS	= 56.1(CONTDA) ^{0.782} (SLOPE) ^{0.172} (STORAGE+1) ^{-0.297}
Q ₅	14.01	CFS	= 84.5(CONTDA) ^{0.769} (SLOPE) ^{0.221} (STORAGE+1) ^{-0.322}
Q ₁₀	19.77	CFS	= 104(CONTDA) ^{0.764} (SLOPE) ^{0.244} (STORAGE+1) ^{-0.335}
Q ₂₅	27.58	CFS	= 129(CONTDA) ^{0.760} (SLOPE) ^{0.264} (STORAGE+1) ^{-0.347}
Q ₅₀	34.04	CFS	= 148(CONTDA) ^{0.757} (SLOPE) ^{0.276} (STORAGE+1) ^{-0.355}
Q ₁₀₀	40.37	CFS	= 167(CONTDA) ^{0.756} (SLOPE) ^{0.285} (STORAGE+1) ^{-0.363}

Worksheet for SR 823 STA 128+98

Project Description

Friction Method Manning Formula
Solve For Normal Depth

Input Data

Roughness Coefficient	0.040	
Channel Slope	0.02230	ft/ft
Left Side Slope	4.00	ft/ft (H:V)
Right Side Slope	4.00	ft/ft (H:V)
Bottom Width	6.00	ft
Discharge	34.00	ft ³ /s

Results

Normal Depth	0.88	ft
Flow Area	8.34	ft ²
Wetted Perimeter	13.23	ft
Top Width	13.02	ft
Critical Depth	0.83	ft
Critical Slope	0.02810	ft/ft
Velocity	4.08	ft/s
Velocity Head	0.26	ft
Specific Energy	1.14	ft
Froude Number	0.90	
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	0.88	ft
Critical Depth	0.83	ft
Channel Slope	0.02230	ft/ft
Critical Slope	0.02810	ft/ft



UNIVERSAL CULVERT DESIGN

PID : 77366 **Date :** 03/16/2007 **Project :** SR 823 Portsmouth Bypass **Location :** Portsmouth Ohio **Designer :** mdc

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) : 34.00 @ 50 yrs. **Flood Discharge (cfs) :** 40.40 @ 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.)
34.00	1	27 in.	527.73	521.19	2 - E	13.57	1.36	1.99	0.0120	INLET	0.00	D	0.00
34.00	1	24 in.	528.90	526.36	2 - E	13.27	1.52	1.91	0.0120	INLET	0.00	D - 1	0.00
34.00	1	21 in.	531.20	537.74	2 - F	14.17	1.75	1.73	0.0120	OUTLET**	0.00	D - 2	0.00
34.00	1	30 in.	527.14	518.62	2 - E	13.64	1.27	1.98	0.0120	INLET	0.00	D + 1	0.00
40.40	1	27 in.	528.66	523.93	2 - E	14.06	1.53	2.10	0.0120	INLET	0.00	F	0.00
40.40	1	24 in.	530.35	531.27	2 - F	12.94	2.00	1.95	0.0120	OUTLET**	0.00	F - 1	0.00
40.40	1	21 in.	534.11	547.41	2 - F	16.81	1.75	1.74	0.0120	OUTLET**	0.00	F - 2	0.00
40.40	1	30 in.	527.74	520.28	2 - E	14.21	1.41	2.14	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)

34.00	1	30 in.	527.85	528.38	2 - F	8.15	2.15	1.98	0.0244	OUTLET**	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.)
34.00 1	27 in.	528.97	538.36	2 - F	9.13	2.25	1.99	0.0245	OUTLET**	0.00	D - 1	0.00
34.00 1	24 in.	530.80	558.98	2 - F	11.00	2.00	1.91	0.0247	OUTLET**	0.00	D - 2	0.00
34.00 1	33 in.	527.22	523.00	2 - E	7.99	1.85	1.94	0.0241	INLET	0.00	D + 1	0.00
40.40 1	30 in.	528.86	534.05	2 - F	9.04	2.50	2.14	0.0244	OUTLET**	0.00	F	0.00
40.40 1	27 in.	530.40	548.17	2 - F	10.47	2.25	2.10	0.0245	OUTLET**	0.00	F - 1	0.00
40.40 1	24 in.	532.89	577.32	2 - F	12.94	2.00	1.95	0.0247	OUTLET**	0.00	F - 2	0.00
40.40 1	33 in.	527.91	528.01	2 - F	8.25	2.13	2.11	0.0241	OUTLET*	0.00	F + 1	0.00
Corrugated Metal Pipe (3 x 1 in. corrugations)												
34.00 1	36 in.	526.89	527.32	1 - A	7.23	1.91	1.89	0.0281	OUTLET*	0.00	D	0.00
34.00 1	42 in.	526.58	N/A	1 - C	7.26	1.71	1.81	0.0278	INLET	0.00	D + 1	0.00
40.40 1	36 in.	527.37	527.67	2 - F	7.77	2.17	2.07	0.0281	OUTLET*	0.00	F	0.00
40.40 1	42 in.	526.89	N/A	1 - C	7.58	1.90	1.98	0.0278	INLET	0.00	F + 1	0.00
Corrugated Metal Pipe (6 x 2 in. corrugations)												
34.00 1	60 in.	526.20	N/A	1 - C	6.26	1.60	1.62	0.0332	INLET	0.00	D	0.00
34.00 1	66 in.	526.10	N/A	1 - C	6.24	1.54	1.58	0.0330	INLET	0.00	D + 1	0.00
40.40 1	60 in.	526.44	N/A	1 - C	6.57	1.75	1.77	0.0332	INLET	0.00	F	0.00
40.40 1	66 in.	526.33	N/A	1 - C	6.55	1.68	1.72	0.0330	INLET	0.00	F + 1	0.00
Corrugated Metal Pipe (6 x 2 in. corrugations, Field Paved Invert)												
34.00 1	60 in.	526.20	N/A	1 - C	7.46	1.41	1.62	0.0260	INLET	0.00	D	0.00
34.00 1	66 in.	526.10	N/A	1 - C	7.39	1.37	1.58	0.0260	INLET	0.00	D + 1	0.00
40.40 1	60 in.	526.44	N/A	1 - C	7.84	1.54	1.77	0.0260	INLET	0.00	F	0.00
40.40 1	66 in.	526.33	N/A	1 - C	7.77	1.49	1.72	0.0260	INLET	0.00	F + 1	0.00

REQUIRED 30" USE 60" STRUCTURAL STEEL PLATE

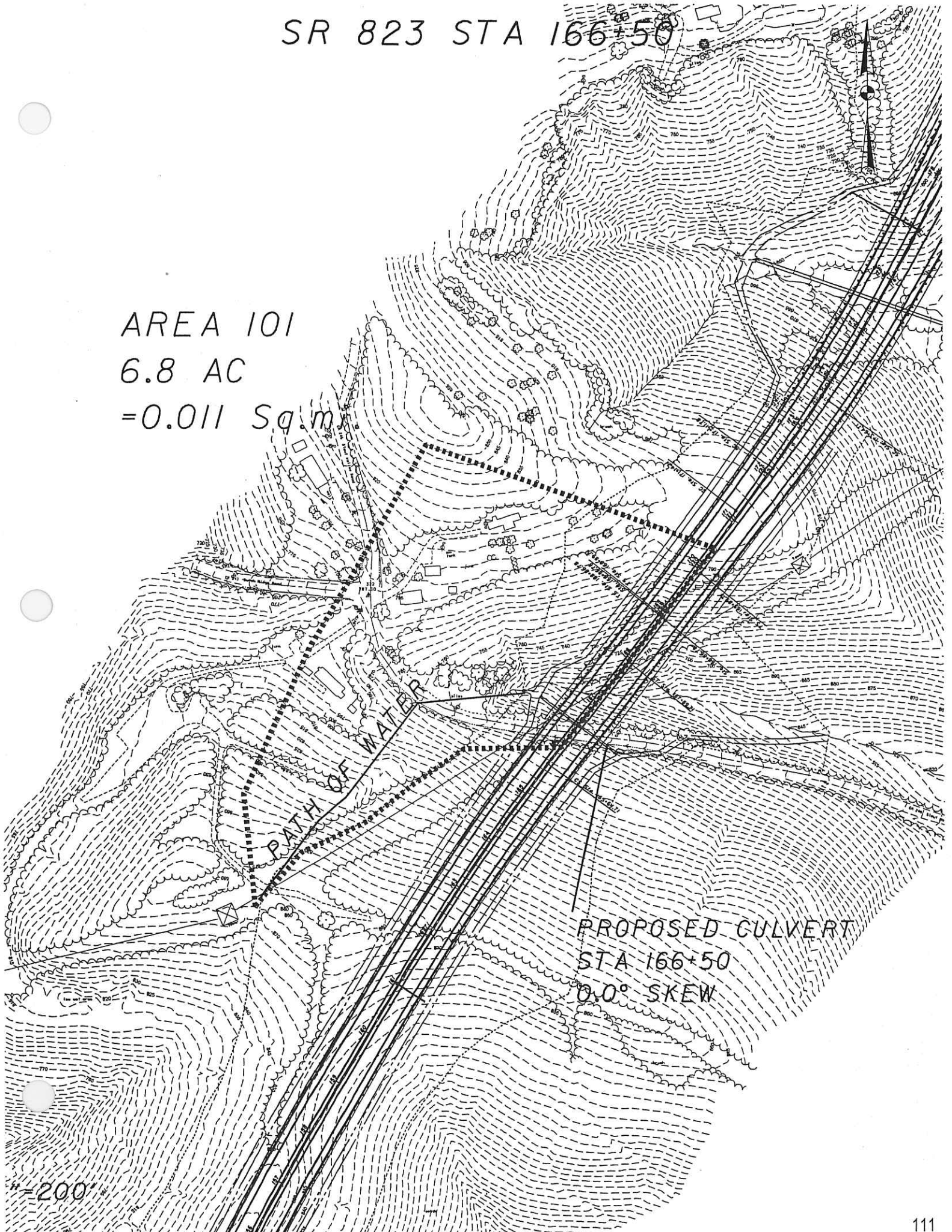
SR 823 STA 166+50

AREA 101
6.8 AC
=0.011 Sq.m

PATH OF WATER

PROPOSED CULVERT
STA 166+50
0.0° SKEW

"=200"



Client: ODOT Sheet: of



Subject: Pipe Culvert Calculations
@ STA 166+50

Date: 7/24/2006

Computed by: MDC
Checked by:

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_o	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 :** 04/06/2007 **Project :** SR 823 Portsmouth Bypass **Location :** Portsmouth Ohio **Designer :** mdc

Description : Drainage area 101, Sta. 166+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.) : 711.74 ✓ **Outlet Invert Elevation (ft.) :** 710.12 ✓ **Tailwater Elevation (ft.) :** 710.50 / **Overflow Elevation (ft.) :** 727.00
Allowable Headwater Elevation (ft.) : 725.00 **or Diameter + 2 ft.** *(whichever is less)*
Pipe Length (ft.) : 162.00 **Culvert Slope (ft./ft.) :** 0.0100 **Design Manning 'n' :** 0.0120
Design Discharge (cfs) : 23.50 **@ 50 yrs.** **Flood Discharge (cfs) :** 26.80 **@ 100 yrs.**

FLOW PIPE #	PIPE	CULVERT SIZE	HWI	HWO	FLOW TYPE	VELOCITY (fps.)	DN	DC	MANNING N	HEADWATER CONTROL	OVER FLOW	DESIGN CODE	BURIAL DEPTH (ft.)
23.50	1	24 in.	714.87	714.50	2 - E	8.89	1.57	1.72	0.0120	INLET	0.00	D	0.00
23.50	1	21 in.	715.91	716.62	2 - F	9.96	1.75	1.66	0.0120	OUTLET**	0.00	D - 1	0.00
23.50	1	18 in.	718.17	721.78	2 - F	13.33	1.50	1.48	0.0120	OUTLET**	0.00	D - 2	0.00
23.50	1	27 in.	714.40	N/A	1 - C	9.13	1.39	1.70	0.0120	INLET	0.00	D + 1	0.00
26.80	1	24 in.	715.38	715.30	2 - E	8.53	2.00	1.80	0.0120	INLET	0.00	F	0.00
26.80	1	21 in.	716.77	718.08	2 - F	11.24	1.75	1.70	0.0120	OUTLET**	0.00	F - 1	0.00
26.80	1	18 in.	720.01	724.84	2 - F	15.18	1.50	1.49	0.0120	OUTLET**	0.00	F - 2	0.00
26.80	1	27 in.	714.72	714.02	2 - E	9.37	1.52	1.81	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)

FLOW PIPE #	PIPE	CULVERT SIZE	HWI	HWO	FLOW TYPE	VELOCITY (fps.)	DN	DC	MANNING N	HEADWATER CONTROL	OVER FLOW	DESIGN CODE	BURIAL DEPTH (ft.)
23.50	1	30 in.	714.41	714.71	1 - A	6.84	2.28	1.65	0.0244	OUTLET*	0.00	D	0.00



UNIVERSAL CULVERT DESIGN

FLOW PIPE #	PIPE #	CULVERT SIZE	HWI (ft.)	HWO (ft.)	FLOW VELOCITY TYPE (fps.)	DN (ft.)	DC (ft.)	MANNING N	HEADWATER CONTROL	OVER FLOW (cfs.)	DESIGN CODE	BURIAL DEPTH (ft.)
23.50	1	27 in.	714.87	716.42	2-F	2.25	1.70	0.0245	OUTLET**	0.00	D-1	0.00
23.50	1	24 in.	715.80	719.91	2-F	2.00	1.72	0.0247	OUTLET**	0.00	D-2	0.00
23.50	1	33 in.	714.19	714.47	1-A	1.90	1.60	0.0241	OUTLET*	0.00	D+1	0.00
26.80	1	30 in.	714.76	715.55	2-F	2.50	1.76	0.0244	OUTLET**	0.00	F	0.00
26.80	1	27 in.	715.41	717.77	2-F	2.25	1.81	0.0245	OUTLET**	0.00	F-1	0.00
26.80	1	24 in.	716.63	722.33	2-F	2.00	1.80	0.0247	OUTLET**	0.00	F-2	0.00
26.80	1	33 in.	714.43	714.72	1-A	2.12	1.72	0.0241	OUTLET*	0.00	F+1	0.00
Corrugated Metal Pipe (3 x 1 in. corrugations)												
23.50	1	36 in.	714.06	714.35	1-A	1.96	1.56	0.0281	OUTLET*	0.00	D	0.00
23.50	1	42 in.	713.91	714.19	1-A	1.75	1.49	0.0278	OUTLET*	0.00	D+1	0.00
26.80	1	36 in.	714.26	714.59	1-A	2.16	1.67	0.0281	OUTLET*	0.00	F	0.00
26.80	1	42 in.	714.08	714.36	1-A	1.89	1.60	0.0278	OUTLET*	0.00	F+1	0.00
Corrugated Metal Pipe (6 x 2 in. corrugations)												
23.50	1	60 in.	713.59	713.88	1-A	1.63	1.34	0.0332	OUTLET*	0.00	D	0.00
23.50	1	66 in.	713.52	713.82	1-A	1.57	1.30	0.0330	OUTLET*	0.00	D+1	0.00
26.80	1	60 in.	713.74	714.05	1-A	1.75	1.43	0.0332	OUTLET*	0.00	F	0.00
26.80	1	66 in.	713.65	713.96	1-A	1.68	1.40	0.0330	OUTLET*	0.00	F+1	0.00
Corrugated Metal Pipe (6 x 2 in. corrugations, Field Paved Invert)												
23.50	1	60 in.	713.59	713.92	1-A	1.44	1.34	0.0260	OUTLET*	0.00	D	0.00
23.50	1	66 in.	713.52	713.86	1-A	1.39	1.30	0.0260	OUTLET*	0.00	D+1	0.00
26.80	1	60 in.	713.74	714.08	1-A	1.54	1.43	0.0260	OUTLET*	0.00	F	0.00
26.80	1	66 in.	713.65	714.01	1-A	1.49	1.40	0.0260	OUTLET*	0.00	F+1	0.00

REQUIRED 30" USE 36"

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

1" = 200'

SR 823 175+57.00
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
	838426.20	SQ. FT.	
	0.030	SQ. MI.	CONTDA = Contributing Drainage Area
	0.00	SQ. FT.	
	0.00	%	STORAGE = Storage Area
	936.00	FT.	TOTAL CHANNEL LENGTH
	93.60	FT.	L₁₀ = 10% of the Distance along channel
	667	FT.	Elev₁₀ = Elevation at point L₁₀
	795.60	FT.	L₈₅ = 85% of the Distance along channel
	855	FT.	Elev₈₅ = Elevation at point L₈₅
	702.00	FT.	Length = L₈₅ - L₁₀
	1414.02	FT./MI.	SLOPE = (Elev ₁₀ -Elev ₈₅)/Length
		CFS	Q_# = Flood-Peak Discharge # = Frequency of Storm
Q₂	12.61	CFS	= 56.1(CONTDA) ^{0.782} (SLOPE) ^{0.172} (STORAGE+1) ^{-0.297}
Q₅	28.37	CFS	= 84.5(CONTDA) ^{0.769} (SLOPE) ^{0.221} (STORAGE+1) ^{-0.322}
Q₁₀	41.98	CFS	= 104(CONTDA) ^{0.764} (SLOPE) ^{0.244} (STORAGE+1) ^{-0.335}
Q₂₅	61.06	CFS	= 129(CONTDA) ^{0.760} (SLOPE) ^{0.264} (STORAGE+1) ^{-0.347}
Q₅₀	77.23	CFS	= 148(CONTDA) ^{0.757} (SLOPE) ^{0.276} (STORAGE+1) ^{-0.355}
Q₁₀₀	93.35	CFS	= 167(CONTDA) ^{0.756} (SLOPE) ^{0.285} (STORAGE+1) ^{-0.363}

Worksheet for SR 823 STA 175+57

Project Description

Friction Method Manning Formula
Solve For Normal Depth

Input Data

Roughness Coefficient	0.040	
Channel Slope	0.08550	ft/ft
Left Side Slope	4.00	ft/ft (H:V)
Right Side Slope	4.00	ft/ft (H:V)
Bottom Width	6.00	ft
Discharge	77.20	ft ³ /s

Results

Normal Depth	0.95	ft
Flow Area	9.27	ft ²
Wetted Perimeter	13.81	ft
Top Width	13.58	ft
Critical Depth	1.29	ft
Critical Slope	0.02492	ft/ft
Velocity	8.33	ft/s
Velocity Head	1.08	ft
Specific Energy	2.02	ft
Froude Number	1.78	
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	0.95	ft
Critical Depth	1.29	ft
Channel Slope	0.08550	ft/ft
Critical Slope	0.02492	ft/ft



UNIVERSAL CULVERT DESIGN

PID : 77366 **Date :** 04/10/2007 **Project :** SR 823 Portsmouth Bypass **Location :** Portsmouth Ohio **Designer :** mdc

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) : 77.20 @ 50 yrs. **Flood Discharge (cfs) :** 93.40 @ 100 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.)
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CULVERT TYPE : CIRCULAR SMOOTH													
Entrance Type : Half Headwall													
Entrance Loss (Ke) : 0.20													
77.20	1	42 in.	653.65	609.87	2 - E	27.13	1.18	2.75	0.0120	INLET	0.00	D	0.00
77.20	1	36 in.	654.98	614.15	2 - E	27.39	1.26	2.74	0.0120	INLET	0.00	D - 1	0.00
77.20	1	33 in.	656.32	618.60	2 - E	27.45	1.32	2.64	0.0120	INLET	0.00	D - 2	0.00
77.20	1	48 in.	653.15	N/A	1 - C	26.80	1.12	2.66	0.0120	INLET	0.00	D + 1	0.00
93.40	1	42 in.	654.56	611.82	2 - E	28.62	1.30	2.99	0.0120	INLET	0.00	F	0.00
93.40	1	36 in.	656.67	618.15	2 - E	28.81	1.40	2.87	0.0120	INLET	0.00	F - 1	0.00
93.40	1	33 in.	658.65	624.71	2 - E	28.79	1.48	2.70	0.0120	INLET	0.00	F - 2	0.00
93.40	1	48 in.	653.72	N/A	1 - C	28.30	1.24	2.93	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)													
77.20	1	42 in.	654.59	618.55	2 - E	16.49	1.71	2.75	0.0237	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.)
77.20 1	36 in.	657.02	634.45	2 - E	16.15	1.92	2.74	0.0241	INLET	0.00	D - 1	0.00
77.20 1	33 in.	659.03	650.66	2 - E	15.83	2.10	2.64	0.0241	INLET	0.00	D - 2	0.00
77.20 1	48 in.	653.53	N/A	1 - C	16.52	1.59	2.66	0.0235	INLET	0.00	D + 1	0.00
93.40 1	42 in.	656.11	624.54	2 - E	17.28	1.92	2.99	0.0237	INLET	0.00	F	0.00
93.40 1	36 in.	659.51	647.87	2 - E	16.69	2.22	2.87	0.0241	INLET	0.00	F - 1	0.00
93.40 1	33 in.	662.50	671.64	2 - F	15.80	2.75	2.70	0.0241	OUTLET**	0.00	F - 2	0.00
93.40 1	48 in.	654.42	615.47	2 - E	17.38	1.77	2.93	0.0235	INLET	0.00	F + 1	0.00
Corrugated Metal Pipe (3 x 1 in. corrugations)												
77.20 1	42 in.	654.59	622.59	2 - E	14.62	1.88	2.75	0.0278	INLET	0.00	D	0.00
77.20 1	36 in.	657.02	643.54	2 - E	14.24	2.15	2.74	0.0281	INLET	0.00	D - 1	0.00
77.20 1	48 in.	653.53	N/A	1 - C	14.72	1.74	2.66	0.0275	INLET	0.00	D + 1	0.00
93.40 1	42 in.	656.11	630.45	2 - E	15.26	2.13	2.99	0.0278	INLET	0.00	F	0.00
93.40 1	36 in.	659.51	661.16	2 - F	13.43	2.60	2.87	0.0281	OUTLET**	0.00	F - 1	0.00
93.40 1	48 in.	654.42	618.27	2 - E	15.47	1.94	2.93	0.0275	INLET	0.00	F + 1	0.00
Corrugated Metal Pipe (6 x 2 in. corrugations)												
77.20 1	60 in.	652.87	N/A	1 - C	12.67	1.74	2.49	0.0332	INLET	0.00	D	0.00
77.20 1	66 in.	652.73	N/A	1 - C	12.63	1.67	2.41	0.0330	INLET	0.00	D + 1	0.00
93.40 1	60 in.	653.32	N/A	1 - C	13.35	1.93	2.75	0.0332	INLET	0.00	F	0.00
93.40 1	66 in.	653.13	N/A	1 - C	13.32	1.85	2.67	0.0330	INLET	0.00	F + 1	0.00
Corrugated Metal Pipe (6 x 2 in. corrugations, Field Paved Invert)												
77.20 1	60 in.	652.87	N/A	1 - C	15.11	1.53	2.49	0.0260	INLET	0.00	D	0.00
77.20 1	66 in.	652.73	N/A	1 - C	14.98	1.48	2.41	0.0260	INLET	0.00	D + 1	0.00
93.40 1	60 in.	653.32	N/A	1 - C	15.93	1.69	2.75	0.0260	INLET	0.00	F	0.00
93.40 1	66 in.	653.13	N/A	1 - C	15.82	1.63	2.67	0.0260	INLET	0.00	F + 1	0.00

REQUIRED #2" USE 60" STRUCTURAL STEEL PLATE

SR 823 STA 176+31.38
TO STA 181+91.80

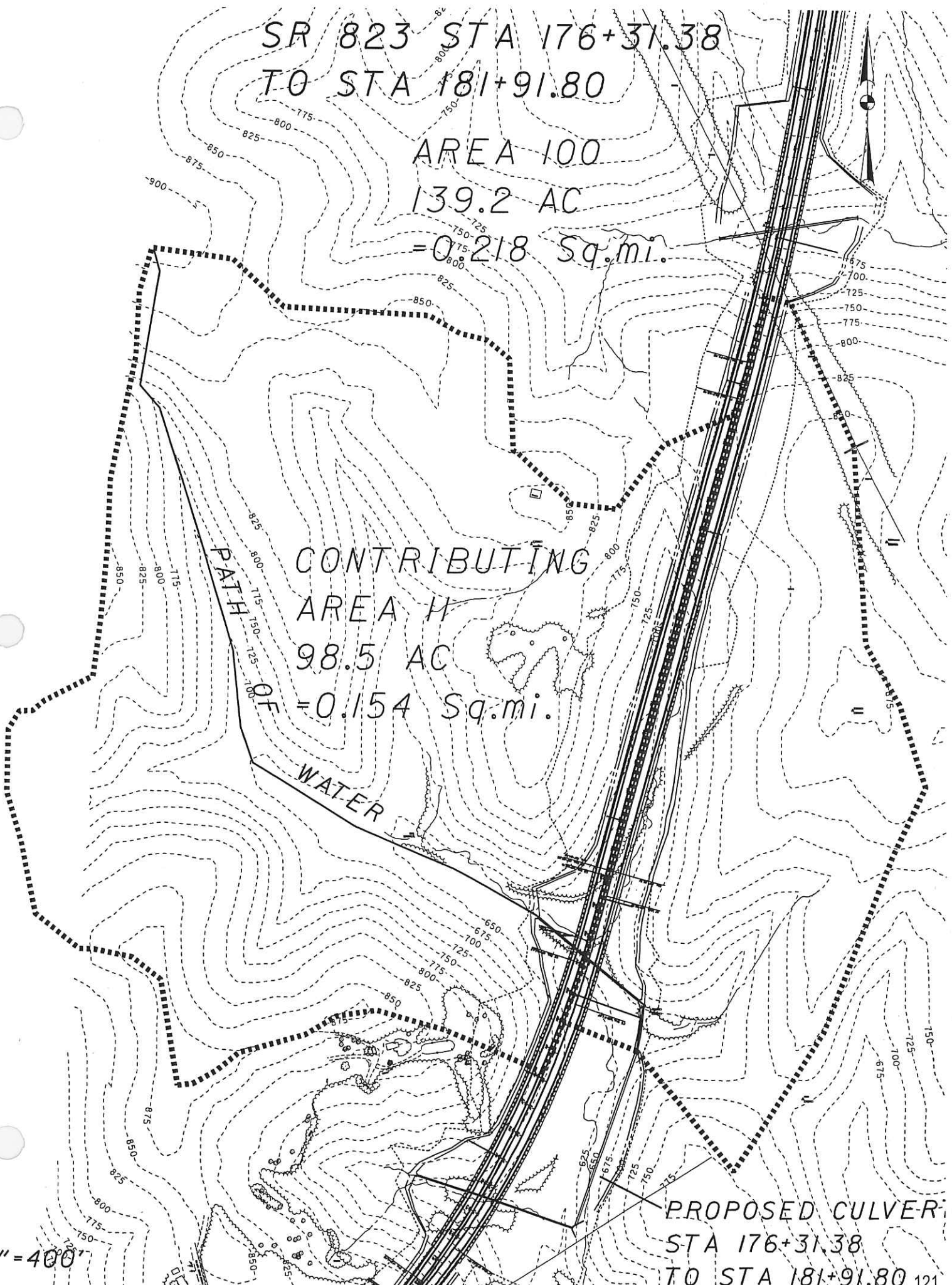
AREA 100
139.2 AC
= 0.218 Sq.mi.

CONTRIBUTING
AREA II
98.5 AC
= 0.154 Sq.mi.

PATH OF WATER

PROPOSED CULVER
STA 176+31.38
TO STA 181+91.80

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 + 2 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 #	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.	625.46	610.22	2 - E	24.03	2.31	4.22	0.0120	INLET	0.00	D	0.00
227.90	1	60 in.	626.41	612.36	2 - E	24.09	2.43	4.27	0.0120	INLET	0.00	D - 1	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 - 2	0.00
227.90	1	72 in.	624.95	N/A	1 - C	23.92	2.22	4.13	0.0120	INLET	0.00	D + 1	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	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 - 1	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 - 2	0.00
271.20	1	72 in.	625.81	N/A	1 - C	25.08	2.44	4.51	0.0120	INLET	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)

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.)
227.90	1	72 in.	625.67	N/A	1 - C	14.84	3.20	4.13	0.0229	INLET	0.00	D	0.00



UNIVERSAL CULVERT DESIGN

FLOW PIPE #	CULVERT SIZE	HWI (ft.)	HWO (ft.)	FLOW VELOCITY TYPE (fps.)	DN (ft.)	DC (ft.)	MANNING N	HEADWATER CONTROL	OVER FLOW (cfs.)	DESIGN CODE	BURIAL DEPTH (ft.)
227.90 1	66 in.	626.75	617.62	2 - E 14.66	3.42	4.22	0.0231	INLET	0.00	D - 1	0.00
227.90 1	60 in.	628.63	624.58	2 - E 14.32	3.78	4.27	0.0232	INLET	0.00	D - 2	0.00
227.90 1	78 in.	625.07	N/A	1 - C 14.89	3.05	4.04	0.0228	INLET	0.00	D + 1	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	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 - 1	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 - 2	0.00
271.20 1	78 in.	626.06	N/A	1 - C 15.55	3.38	4.42	0.0228	INLET	0.00	F + 1	0.00
Corrugated Metal Pipe (3 x 1 in. corrugations)											
227.90 1	72 in.	625.67	N/A	1 - C 13.19	3.53	4.13	0.0267	INLET	0.00	D	0.00
227.90 1	66 in.	626.75	620.74	2 - E 12.96	3.81	4.22	0.0269	INLET	0.00	D - 1	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 - 2	0.00
227.90 1	78 in.	625.07	N/A	1 - C 13.26	3.34	4.04	0.0266	INLET	0.00	D + 1	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	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 - 1	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 - 2	0.00
271.20 1	78 in.	626.06	N/A	1 - C 13.82	3.72	4.42	0.0266	INLET	0.00	F + 1	0.00
Corrugated Metal Pipe (6 x 2 in. corrugations)											
227.90 1	72 in.	625.67	N/A	1 - C 11.22	4.05	4.13	0.0327	INLET	0.00	D	0.00
227.90 1	66 in.	626.75	626.75	2 - F 11.64	4.58	4.22	0.0330	OUTLET*	0.00	D - 1	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 - 2	0.00
227.90 1	78 in.	625.07	N/A	1 - C 11.39	3.78	4.04	0.0325	INLET	0.00	D + 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	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 - 1	0.00

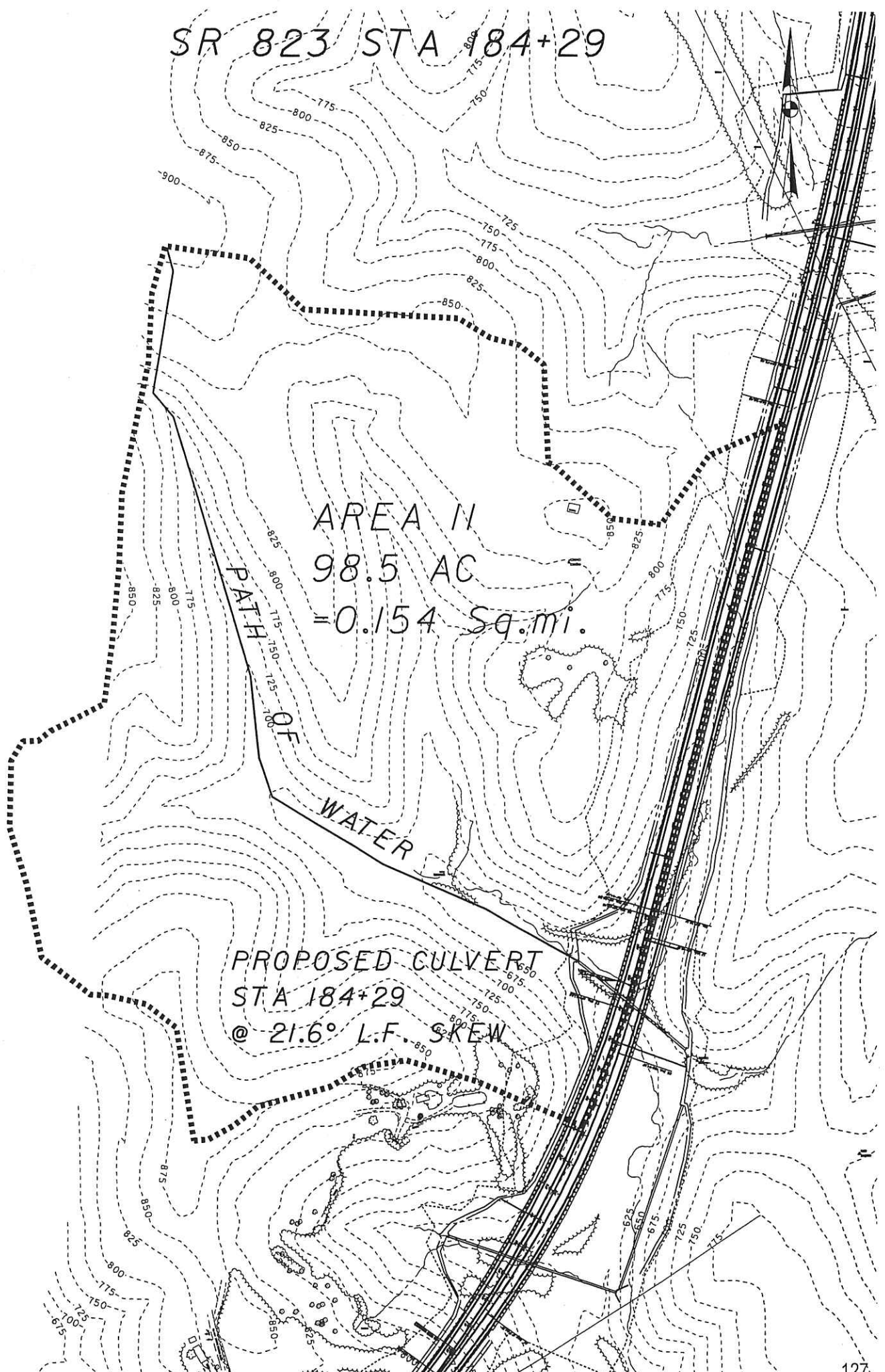


UNIVERSAL CULVERT DESIGN

FLOW 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.)	
271.20 1	60 in.	631.40	654.30	14.47	5.00	4.54	0.0332	OUTLET**	0.00	F - 2	0.00	
271.20 1	78 in.	626.06	N/A	11.81	4.25	4.42	0.0325	INLET	0.00	F + 1	0.00	
Corrugated Metal Pipe (6 x 2 in. corrugations, Field Paved Invert)												
227.90 1	72 in.	625.67	N/A	13.46	3.47	4.13	0.0260	INLET	0.00	D	0.00	
227.90 1	66 in.	626.75	619.96	13.33	3.72	4.22	0.0260	INLET	0.00	D - 1	0.00	
227.90 1	60 in.	628.63	628.35	12.81	4.25	4.27	0.0260	INLET	0.00	D - 2	0.00	
227.90 1	78 in.	625.07	N/A	13.50	3.30	4.04	0.0260	INLET	0.00	D + 1	0.00	
271.20 1	72 in.	627.04	619.13	13.97	3.89	4.51	0.0260	INLET	0.00	F	0.00	
271.20 1	66 in.	628.71	625.88	13.66	4.28	4.57	0.0260	INLET	0.00	F - 1	0.00	
271.20 1	60 in.	631.40	637.82	14.47	5.00	4.54	0.0260	OUTLET**	0.00	F - 2	0.00	
271.20 1	78 in.	626.06	N/A	14.07	3.66	4.42	0.0260	INLET	0.00	F + 1	0.00	

REQUIRED 72" (USE 78" S.S.P)

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. SKEN

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.	L₁₀ = 10% of the Distance along channel
	624	FT.	Elev₁₀ = Elevation at point L ₁₀
	2533.00	FT.	L₈₅ = 85% of the Distance along channel
	792	FT.	Elev₈₅ = 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 :** 03/19/2007 **Project :** SR 823 Portsmouth Bypass **Location :** Portsmouth Ohio **Designer :** mdc

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.) : 628.12 ✓ **Outlet Invert Elevation (ft.) :** 624.80 ✓ **Tailwater Elevation (ft.) :** 627.19 ✓ **Overflow Elevation (ft.) :** 687.67

Allowable Headwater Elevation (ft.) : 746.00 or Diameter + 2 ft. *(whichever is less)*

Pipe Length (ft.) : 442.00 ✓ **Culvert Slope (ft./ft.) :** 0.0075 **Design Manning 'n' :** 0.0120

Design Discharge (cfs) : 187.10 @ 50 yrs. ✓ **Flood Discharge (cfs) :** 223.30 @ 100 yrs. ✓

FLOW PIPE #	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.)
CULVERT TYPE : CIRCULAR SMOOTH													
187.10	1	60 in.	634.43	632.88	2 - E	13.72	3.28	3.91	0.0120	INLET	0.00	D	0.00
187.10	1	54 in.	635.54	634.99	2 - E	13.23	3.74	3.94	0.0120	INLET	0.00	D - 1	0.00
187.10	1	48 in.	637.75	639.19	2 - F	15.16	4.00	3.80	0.0120	OUTLET**	0.00	D - 2	0.00
187.10	1	66 in.	633.89	N/A	1 - C	13.83	3.05	3.83	0.0120	INLET	0.00	D + 1	0.00
223.30	1	60 in.	635.61	634.58	2 - E	14.12	3.75	4.23	0.0120	INLET	0.00	F	0.00
223.30	1	54 in.	637.35	637.64	2 - F	14.52	4.50	4.17	0.0120	OUTLET**	0.00	F - 1	0.00
223.30	1	48 in.	640.57	643.68	2 - F	17.89	4.00	3.90	0.0120	OUTLET**	0.00	F - 2	0.00
223.30	1	66 in.	634.71	N/A	1 - C	14.40	3.42	4.18	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)													
187.10	1	66 in.	634.59	635.60	2 - F	10.60	5.50	3.83	0.0231	OUTLET**	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.)
187.10	1 60 in.	635.76	639.16	2 - F	11.35	5.00	3.91	0.0232	OUTLET**	0.00	D - 1	0.00
187.10	1 54 in.	637.88	645.89	2 - F	12.67	4.50	3.94	0.0233	OUTLET**	0.00	D - 2	0.00
187.10	1 72 in.	633.96	634.60	1 - A	10.12	4.44	3.73	0.0229	OUTLET*	0.00	D + 1	0.00
223.30	1 66 in.	635.93	638.38	2 - F	11.52	5.50	4.18	0.0231	OUTLET**	0.00	F	0.00
223.30	1 60 in.	637.73	643.52	2 - F	12.59	5.00	4.23	0.0232	OUTLET**	0.00	F - 1	0.00
223.30	1 54 in.	640.70	653.16	2 - F	14.52	4.50	4.17	0.0233	OUTLET**	0.00	F - 2	0.00
223.30	1 72 in.	634.91	635.49	2 - F	10.87	6.00	4.09	0.0229	OUTLET*	0.00	F + 1	0.00
Corrugated Metal Pipe (3 x 1 in. corrugations)												
187.10	1 72 in.	633.96	634.76	1 - A	10.12	5.22	3.73	0.0267	OUTLET*	0.00	D	0.00
187.10	1 66 in.	634.59	637.14	2 - F	10.60	5.50	3.83	0.0269	OUTLET**	0.00	D - 1	0.00
187.10	1 60 in.	635.76	641.79	2 - F	11.35	5.00	3.91	0.0271	OUTLET**	0.00	D - 2	0.00
187.10	1 78 in.	633.62	634.34	1 - A	9.78	4.57	3.64	0.0266	OUTLET*	0.00	D + 1	0.00
223.30	1 72 in.	634.91	636.84	2 - F	10.87	6.00	4.09	0.0267	OUTLET**	0.00	F	0.00
223.30	1 66 in.	635.93	640.57	2 - F	11.52	5.50	4.18	0.0269	OUTLET**	0.00	F - 1	0.00
223.30	1 60 in.	637.73	647.27	2 - F	12.59	5.00	4.23	0.0271	OUTLET**	0.00	F - 2	0.00
223.30	1 78 in.	634.34	635.15	1 - A	10.43	5.36	4.00	0.0266	OUTLET*	0.00	F + 1	0.00
Corrugated Metal Pipe (6 x 2 in. corrugations)												
187.10	1 78 in.	633.62	634.64	1 - A	9.78	5.52	3.64	0.0325	OUTLET*	0.00	D	0.00
187.10	1 72 in.	633.96	636.39	2 - F	10.12	6.00	3.73	0.0327	OUTLET**	0.00	D - 1	0.00
187.10	1 66 in.	634.59	640.09	2 - F	10.60	5.50	3.83	0.0330	OUTLET**	0.00	D - 2	0.00
187.10	1 84 in.	633.40	634.25	1 - A	9.51	4.91	3.56	0.0323	OUTLET*	0.00	D + 1	0.00
223.30	1 78 in.	634.34	636.37	2 - F	10.43	6.50	4.00	0.0325	OUTLET**	0.00	F	0.00
223.30	1 72 in.	634.91	639.42	2 - F	10.87	6.00	4.09	0.0327	OUTLET**	0.00	F - 1	0.00



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.)
223.30 1	66 in.	635.93	644.77	2 - F	11.52	5.50	4.18	0.0330	OUTLET**	0.00	F - 2	0.00
223.30 1	84 in.	634.01	635.04	1 - A	10.11	5.75	3.91	0.0323	OUTLET*	0.00	F + 1	0.00
Corrugated Metal Pipe (6 x 2 in. corrugations, Field Paved Invert)												
187.10 1	72 in.	633.96	634.72	1 - A	10.12	5.03	3.73	0.0260	OUTLET*	0.00	D	0.00
187.10 1	66 in.	634.59	636.75	2 - F	10.60	5.50	3.83	0.0260	OUTLET**	0.00	D - 1	0.00
187.10 1	60 in.	635.76	641.01	2 - F	11.35	5.00	3.91	0.0260	OUTLET**	0.00	D - 2	0.00
187.10 1	78 in.	633.62	634.32	1 - A	9.78	4.49	3.64	0.0260	OUTLET*	0.00	D + 1	0.00
223.30 1	72 in.	634.91	636.57	2 - F	10.87	6.00	4.09	0.0260	OUTLET**	0.00	F	0.00
223.30 1	66 in.	635.93	640.02	2 - F	11.52	5.50	4.18	0.0260	OUTLET**	0.00	F - 1	0.00
223.30 1	60 in.	637.73	646.16	2 - F	12.59	5.00	4.23	0.0260	OUTLET**	0.00	F - 2	0.00
223.30 1	78 in.	634.34	635.11	1 - A	10.43	5.23	4.00	0.0260	OUTLET*	0.00	F + 1	0.00

REQUIRED 66" USE 78" S.S.P

SR 823 STA 209+30

AREA 12
73.9 AC
= 0.115 Sq.mi.

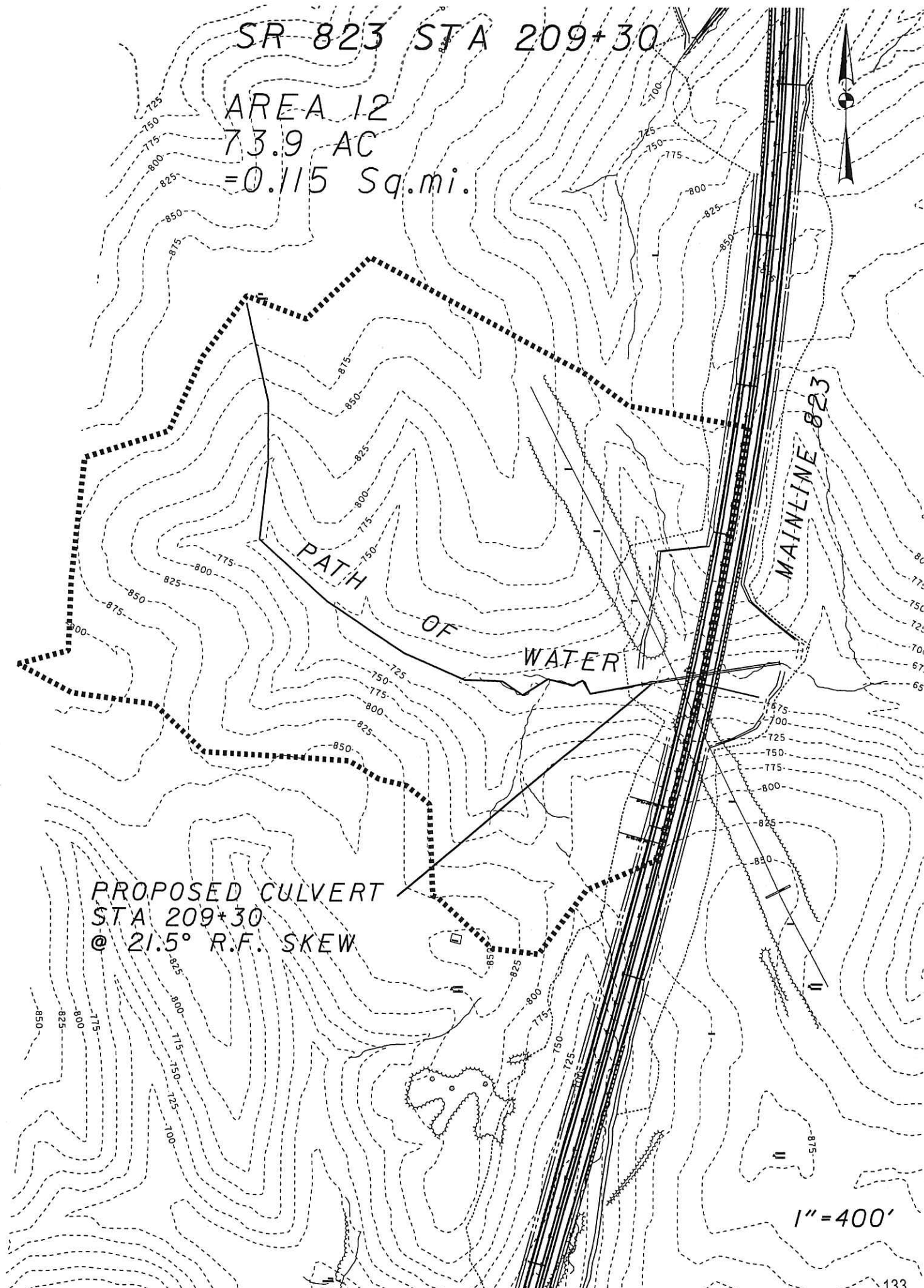


MAINLINE 823

PATH OF WATER

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.	L₁₀ = 10% of the Distance along channel
	717	FT.	Elev₁₀ = Elevation at point L₁₀
	1927.80	FT.	L₈₅ = 85% of the Distance along channel
	832	FT.	Elev₈₅ = Elevation at point L₈₅
	1701.00	FT.	Length = L₈₅ - L₁₀
	356.97	FT./MI.	SLOPE = (Elev ₁₀ -Elev ₈₅)/Length
		CFS	Q_# = Flood-Peak Discharge
			# = Frequency of Storm
Q₂	28.49	CFS	= 56.1(CONTDA) ^{0.782} (SLOPE) ^{0.172} (STORAGE+1) ^{-0.297}
Q₅	58.87	CFS	= 84.5(CONTDA) ^{0.769} (SLOPE) ^{0.221} (STORAGE+1) ^{-0.322}
Q₁₀	83.85	CFS	= 104(CONTDA) ^{0.764} (SLOPE) ^{0.244} (STORAGE+1) ^{-0.335}
Q₂₅	117.99	CFS	= 129(CONTDA) ^{0.760} (SLOPE) ^{0.264} (STORAGE+1) ^{-0.347}
Q₅₀	146.21	CFS	= 148(CONTDA) ^{0.757} (SLOPE) ^{0.276} (STORAGE+1) ^{-0.355}
Q₁₀₀	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 :** 01/10/2007 **Project :** SR 823 Portsmouth Bypass **Location :** Portsmouth Ohio **Designer :** hjs

Description : Drainage area 12, Sta. 209+30
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.) :** 660.25 / **Overflow Elevation (ft.) :** 748.13 ✓
Allowable Headwater Elevation (ft.) : 746.13 or Diameter + 2 ft. (whichever is less)
Pipe Length (ft.) : 476.00 **Culvert Slope (ft./ft.) :** 0.0361 ✓ **Design Manning 'n' :** 0.0120
Design Discharge (cfs) : 146.20 @ 50 yrs. ✓ **Flood Discharge (cfs) :** 174.30 @ 100 yrs. ✓

FLOW PIPE # (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													
146.20	1	54 in.	681.52	666.42	2 - E	23.38	1.87	3.55	0.0120	INLET	0.00	D	0.00
146.20	1	48 in.	682.72	669.07	2 - E	23.46	1.99	3.57	0.0120	INLET	0.00	D - 1	0.00
146.20	1	42 in.	685.29	674.85	2 - E	23.32	2.17	3.38	0.0120	INLET	0.00	D - 2	0.00
146.20	1	60 in.	680.96	N/A	1 - C	23.23	1.79	3.46	0.0120	INLET	0.00	D + 1	0.00
174.30	1	54 in.	682.61	668.16	2 - E	24.48	2.06	3.84	0.0120	INLET	0.00	F	0.00
174.30	1	48 in.	684.48	671.99	2 - E	24.48	2.21	3.75	0.0120	INLET	0.00	F - 1	0.00
174.30	1	42 in.	688.18	680.28	2 - E	24.10	2.46	3.44	0.0120	INLET	0.00	F - 2	0.00
174.30	1	60 in.	681.70	N/A	1 - C	24.38	1.96	3.78	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)

FLOW PIPE # (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.)
146.20	1	60 in.	681.58	N/A	1 - C	14.30	2.58	3.46	0.0232	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.)
146.20	1 54 in.	682.76	673.51	2-E	14.18	2.78	3.55	0.0233	INLET	0.00	D-1	0.00
146.20	1 48 in.	685.03	682.39	2-E	13.68	3.17	3.57	0.0235	INLET	0.00	D-2	0.00
146.20	1 66 in.	680.99	N/A	1-C	14.33	2.44	3.37	0.0231	INLET	0.00	D+1	0.00
174.30	1 60 in.	682.77	672.06	2-E	14.91	2.88	3.78	0.0232	INLET	0.00	F	0.00
174.30	1 54 in.	684.59	678.25	2-E	14.67	3.15	3.84	0.0233	INLET	0.00	F-1	0.00
174.30	1 48 in.	687.71	690.91	2-F	14.24	4.00	3.75	0.0235	OUTLET**	0.00	F-2	0.00
174.30	1 66 in.	681.80	N/A	1-C	14.99	2.70	3.69	0.0231	INLET	0.00	F+1	0.00
Corrugated Metal Pipe (3 x 1 in. corrugations)												
146.20	1 60 in.	681.58	N/A	1-C	12.71	2.84	3.46	0.0271	INLET	0.00	D	0.00
146.20	1 54 in.	682.76	676.65	2-E	12.48	3.11	3.55	0.0273	INLET	0.00	D-1	0.00
146.20	1 48 in.	685.03	688.31	2-F	12.36	4.00	3.57	0.0275	OUTLET**	0.00	D-2	0.00
146.20	1 66 in.	680.99	N/A	1-C	12.80	2.67	3.37	0.0269	INLET	0.00	D+1	0.00
174.30	1 60 in.	682.77	674.52	2-E	13.20	3.19	3.78	0.0271	INLET	0.00	F	0.00
174.30	1 54 in.	684.59	682.70	2-E	12.74	3.61	3.84	0.0273	INLET	0.00	F-1	0.00
174.30	1 48 in.	687.71	699.33	2-F	14.24	4.00	3.75	0.0275	OUTLET**	0.00	F-2	0.00
174.30	1 66 in.	681.80	N/A	1-C	13.37	2.96	3.69	0.0269	INLET	0.00	F+1	0.00
Corrugated Metal Pipe (6 x 2 in. corrugations)												
146.20	1 60 in.	681.58	N/A	1-C	10.83	3.25	3.46	0.0332	INLET	0.00	D	0.00
146.20	1 66 in.	680.99	N/A	1-C	10.97	3.01	3.37	0.0330	INLET	0.00	D+1	0.00
174.30	1 60 in.	682.77	679.13	2-E	11.16	3.71	3.78	0.0332	INLET	0.00	F	0.00
174.30	1 66 in.	681.80	N/A	1-C	11.42	3.37	3.69	0.0330	INLET	0.00	F+1	0.00
Corrugated Metal Pipe (6 x 2 in. corrugations, Field Paved Invert)												
146.20	1 60 in.	681.58	N/A	1-C	13.11	2.77	3.46	0.0260	INLET	0.00	D	0.00
146.20	1 66 in.	680.99	N/A	1-C	13.13	2.62	3.37	0.0260	INLET	0.00	D+1	0.00



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.)
174.30	1	60 in.	682.77	673.79	2 - E	13.64	3.10	3.78	0.0260	INLET	0.00	F	0.00
174.30	1	66 in.	681.80	N/A	1 - C	13.71	2.90	3.69	0.0260	INLET	0.00	F+1	0.00

REQUIRED 60" USE 72" S.S.P



CULVERT ANALYSIS

PID : 77366 **Date :** 01/10/2007 **Project :** SR 823 Portsmouth Bypass **Location :** Portsmouth, Ohio **Designer :** hjs

Description : Drainage Area 12, 209+30

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.) :** 675.75 **Outlet Invert Elevation (ft.) :** 658.59

Pipe Quantity : 1

Culvert Type : Circular Corrugated

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

Pipe Size : 72 in.

Design Manning 'n' : (default)

Pipe Length (ft.) : 476.00

Culvert Slope (ft./ft.) : 0.0361

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.)
146.20	17.44	680.67	N/A	1 - C	11.05	2.85	3.28	0.0327	INLET	0.00	658.59
174.30	17.90	681.29	N/A	1 - C	11.55	3.16	3.60	0.0327	INLET	0.00	658.59

SR 823 STA 233+87.39

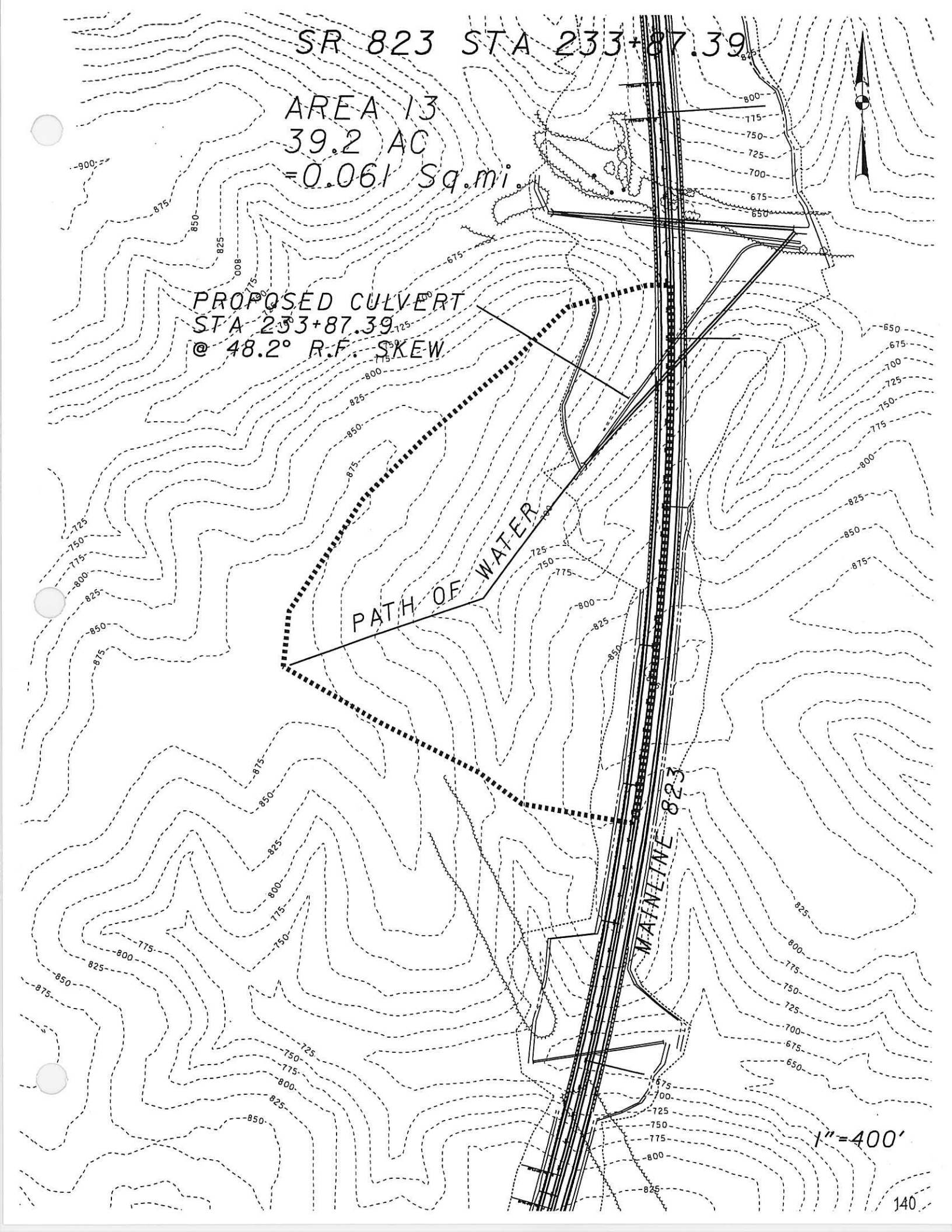
AREA 13
39.2 AC
= 0.061 Sq.mi.

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

PATH OF WATER

MAINLINE 823

1" = 400'



SR 823 STA 233+87.39
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
	1705828.00	SQ. FT.	
	0.061	SQ. MI.	CONTDA = Contributing Drainage Area
	0.00	SQ. FT.	
	0.00	%	STORAGE = Storage Area
	1370.00	FT.	TOTAL CHANNEL LENGTH
	137.00	FT.	L₁₀ = 10% of the Distance along channel
	695	FT.	Elev₁₀ = Elevation at point L ₁₀
	1164.50	FT.	L₈₅ = 85% of the Distance along channel
	830	FT.	Elev₈₅ = Elevation at point L ₈₅
	1027.50	FT.	Length = L ₈₅ - L ₁₀
	693.72	FT./MI.	SLOPE = (Elev ₁₀ -Elev ₈₅)/Length
		CFS	Q_# = Flood-Peak Discharge
			# = Frequency of Storm
Q ₂	19.45	CFS	= 56.1(CONTDA) ^{0.782} (SLOPE) ^{0.172} (STORAGE+1) ^{-0.297}
Q ₅	41.85	CFS	= 84.5(CONTDA) ^{0.769} (SLOPE) ^{0.221} (STORAGE+1) ^{-0.322}
Q ₁₀	60.72	CFS	= 104(CONTDA) ^{0.764} (SLOPE) ^{0.244} (STORAGE+1) ^{-0.335}
Q ₂₅	86.80	CFS	= 129(CONTDA) ^{0.760} (SLOPE) ^{0.264} (STORAGE+1) ^{-0.347}
Q ₅₀	108.63	CFS	= 148(CONTDA) ^{0.757} (SLOPE) ^{0.276} (STORAGE+1) ^{-0.355}
Q ₁₀₀	130.37	CFS	= 167(CONTDA) ^{0.756} (SLOPE) ^{0.285} (STORAGE+1) ^{-0.363}

HY-8 Culvert Analysis Report
BOX CULVERT AT STA. 233+87.39

Table 1 - Summary of Culvert Flows at Crossing: CUL233+87.39

Headwater Elevation (ft)	Total Discharge (cfs)	233+87.39 Discharge (cfs)	Roadway Discharge (cfs)	Iterations
684.68	19.45	19.45	0.00	1
684.96	30.54	30.54	0.00	1
685.22	41.63	41.63	0.00	1
685.46	52.73	52.73	0.00	1
685.68	63.82	63.82	0.00	1
685.89	74.91	74.91	0.00	1
686.09	86.00	86.00	0.00	1
686.28	97.09	97.09	0.00	1
686.46	108.19	108.19	0.00	1
686.47	108.63	108.63	0.00	1
686.81	130.37	130.37	0.00	1

Rating Curve Plot for Crossing: CUL233+87.39

Total Rating Curve

Crossing: CUL233+87.39

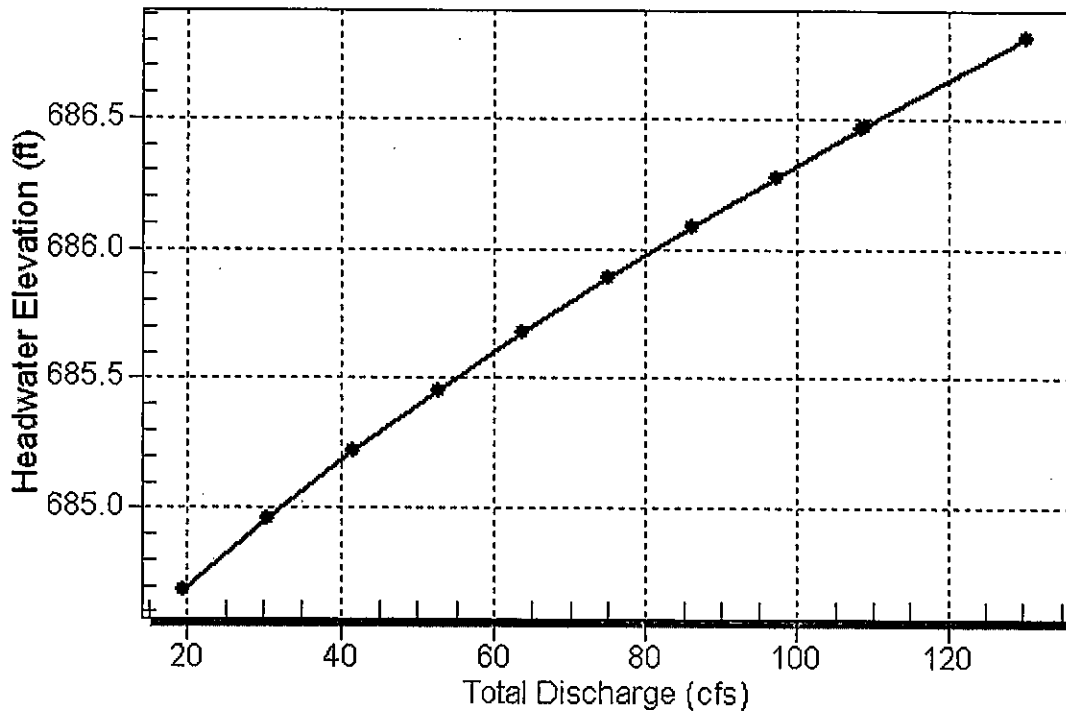


Table 2 - Culvert Summary Table: 233+87.39

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)
19.45	19.45	684.68	0.863	0.863	1-S2n	0.129	0.570	0.170	0.485	14.340	2.873
30.54	30.54	684.96	1.136	1.136	1-S2n	0.203	0.769	0.269	0.633	14.169	3.380
41.63	41.63	685.22	1.397	1.397	1-S2n	0.276	0.946	0.346	0.760	15.042	3.772
52.73	52.73	685.46	1.636	1.636	1-S2n	0.350	1.107	0.407	0.873	16.181	4.094
63.82	63.82	685.68	1.858	1.858	1-S2n	0.424	1.258	0.458	0.976	17.432	4.375
74.91	74.91	685.89	2.067	2.067	1-S2n	0.497	1.399	0.499	1.071	18.750	4.619
86.00	86.00	686.09	2.266	2.266	1-S2n	0.571	1.534	0.624	1.160	17.218	4.841
97.09	97.09	686.28	2.457	2.457	1-S2n	0.645	1.664	0.654	1.244	18.569	5.038
108.19	108.19	686.46	2.641	2.641	1-S2n	0.718	1.788	0.738	1.324	18.324	5.223
108.63	108.63	686.47	2.648	2.648	1-S2n	0.721	1.793	0.743	1.327	18.279	5.231
130.37	130.37	686.81	2.990	2.990	1-S2n	0.835	2.025	0.844	1.474	19.314	5.545

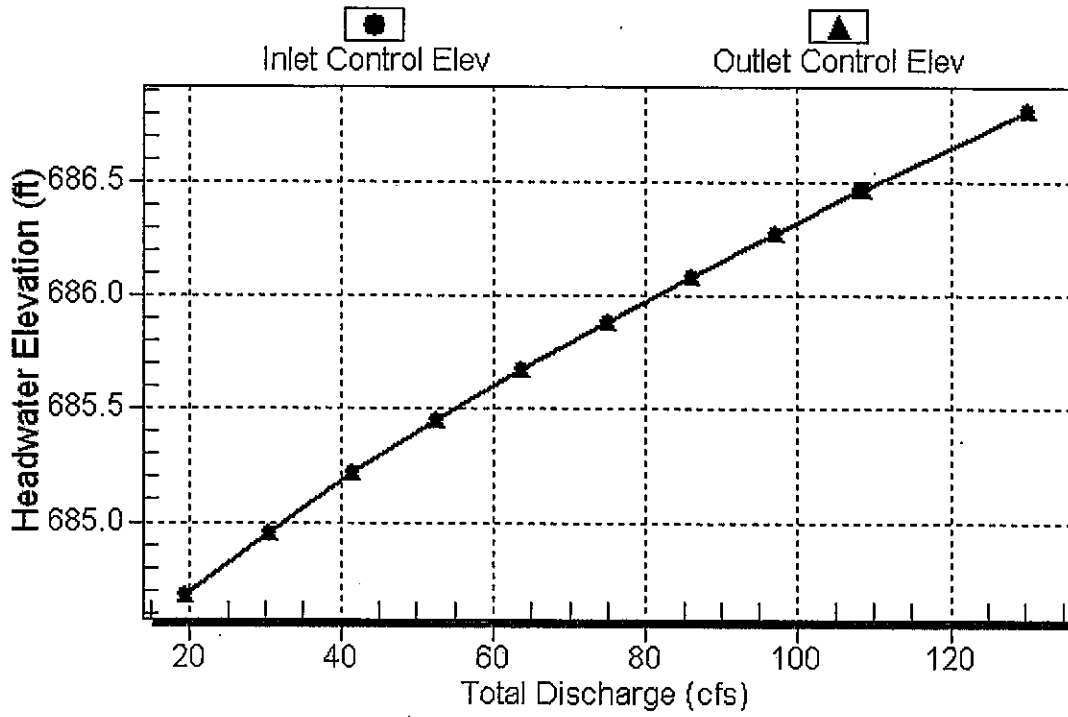
Inlet Elevation (invert): 683.82 ft, Outlet Elevation (invert): 639.44 ft

Culvert Length: 1123.18 ft, Culvert Slope: 0.0395

Culvert Performance Curve Plot: 233+87.39

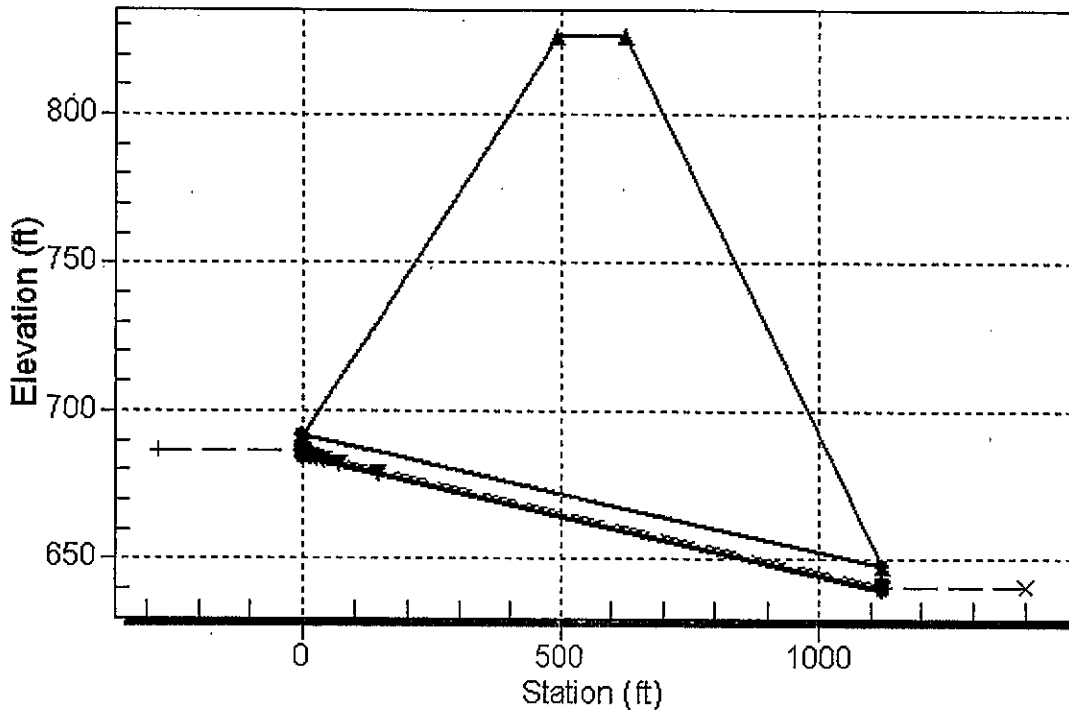
Performance Curve

Culvert: 233+87.39



Water Surface Profile Plot for Culvert: 233+87.39

Crossing - CUL233+87.39, Design Discharge - 108.6 cfs
Culvert - 233+87.39, Culvert Discharge - 108.6 cfs



Site Data - 233+87.39

Site Data Option: Culvert Invert Data

Inlet Station: 0.00 ft

Inlet Elevation: 683.82 ft

Outlet Station: 1122.30 ft

Outlet Elevation: 639.44 ft

Number of Barrels: 1

Culvert Data Summary - 233+87.39

Barrel Shape: Concrete Box

Barrel Span: 8.00 ft

Barrel Rise: 8.00 ft

Barrel Material: Concrete

Barrel Manning's n: 0.0120

Inlet Type: Conventional

Inlet Edge Condition: Square Edge (30-75° flare) Wingwall

Inlet Depression: None

Table 3 - Downstream Channel Rating Curve (Crossing: CUL233+87.39)

Flow (cfs)	Water Surface Elev (ft)	Depth (ft)	Velocity (ft/s)	Shear (psf)	Froude Number
19.45	639.92	0.48	2.87	0.53	0.75
30.54	640.07	0.63	3.38	0.69	0.78
41.63	640.20	0.76	3.77	0.83	0.80
52.73	640.31	0.87	4.09	0.95	0.82
63.82	640.42	0.98	4.38	1.07	0.83
74.91	640.51	1.07	4.62	1.17	0.84
86.00	640.60	1.16	4.84	1.27	0.85
97.09	640.68	1.24	5.04	1.36	0.86
108.19	640.76	1.32	5.22	1.45	0.87
108.63	640.77	1.33	5.23	1.45	0.87
130.37	640.91	1.47	5.55	1.61	0.88

Tailwater Channel Data - CUL233+87.39

Tailwater Channel Option: Trapezoidal Channel

Bottom Width: 13.00 ft

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

Channel Slope: 0.0175

Channel Manning's n: 0.0400

Channel Invert Elevation: 639.44 ft

Roadway Data for Crossing: CUL233+87.39

Roadway Profile Shape: Constant Roadway Elevation

Crest Length: 1000.00 ft

Crest Elevation: 826.00 ft

Roadway Surface: Paved

Roadway Top Width: 134.00 ft

SR 823 STA 239+18.05

PROPOSED CULVERT
STA 239+18.05
5.5° R.F. SKEW

AREA 19
296.9 AC
= 0.464 Sq.mi.

PATH OF WATER

1" = 1000'

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
	12930826.00	SQ. FT.	
	0.464	SQ. MI.	CONTDA = Contributing Drainage Area
	0.00	SQ. FT.	
	0.00	%	STORAGE = Storage Area
	4305.00	FT.	TOTAL CHANNEL LENGTH
	430.50	FT.	L ₁₀ = 10% of the Distance along channel
	667	FT.	Elev ₁₀ = Elevation at point L ₁₀
	3659.25	FT.	L ₈₅ = 85% of the Distance along channel
	813	FT.	Elev ₈₅ = Elevation at point L ₈₅
	3228.75	FT.	Length = L ₈₅ - L ₁₀
	238.75	FT./MI.	SLOPE = (Elev ₁₀ -Elev ₈₅)/Length
		CFS	Q _# = Flood-Peak Discharge
			# = Frequency of Storm
Q ₂	78.90	CFS	= 56.1(CONTDA) ^{0.782} (SLOPE) ^{0.172} (STORAGE+1) ^{-0.297}
Q ₅	156.97	CFS	= 84.5(CONTDA) ^{0.769} (SLOPE) ^{0.221} (STORAGE+1) ^{-0.322}
Q ₁₀	219.96	CFS	= 104(CONTDA) ^{0.764} (SLOPE) ^{0.244} (STORAGE+1) ^{-0.335}
Q ₂₅	305.35	CFS	= 129(CONTDA) ^{0.760} (SLOPE) ^{0.264} (STORAGE+1) ^{-0.347}
Q ₅₀	374.98	CFS	= 148(CONTDA) ^{0.757} (SLOPE) ^{0.276} (STORAGE+1) ^{-0.355}
Q ₁₀₀	444.84	CFS	= 167(CONTDA) ^{0.756} (SLOPE) ^{0.285} (STORAGE+1) ^{-0.363}

HY-8 Culvert Analysis Report
BOX CULVERT AT STA. 239+18.05

Table 1 - Summary of Culvert Flows at Crossing: CUL239+18

Headwater Elevation (ft)	Total Discharge (cfs)	CUL239+18 Discharge (cfs)	Roadway Discharge (cfs)	Iterations
654.39	78.90	78.90	0.00	1
655.03	115.49	115.49	0.00	1
655.59	152.09	152.09	0.00	1
656.12	188.68	188.68	0.00	1
656.63	225.28	225.28	0.00	1
657.11	261.87	261.87	0.00	1
657.57	298.46	298.46	0.00	1
658.00	335.06	335.06	0.00	1
658.42	371.65	371.65	0.00	1
658.46	374.98	374.98	0.00	1
659.24	444.84	444.84	0.00	1

Rating Curve Plot for Crossing: CUL239+18

Total Rating Curve
Crossing: CUL239+18

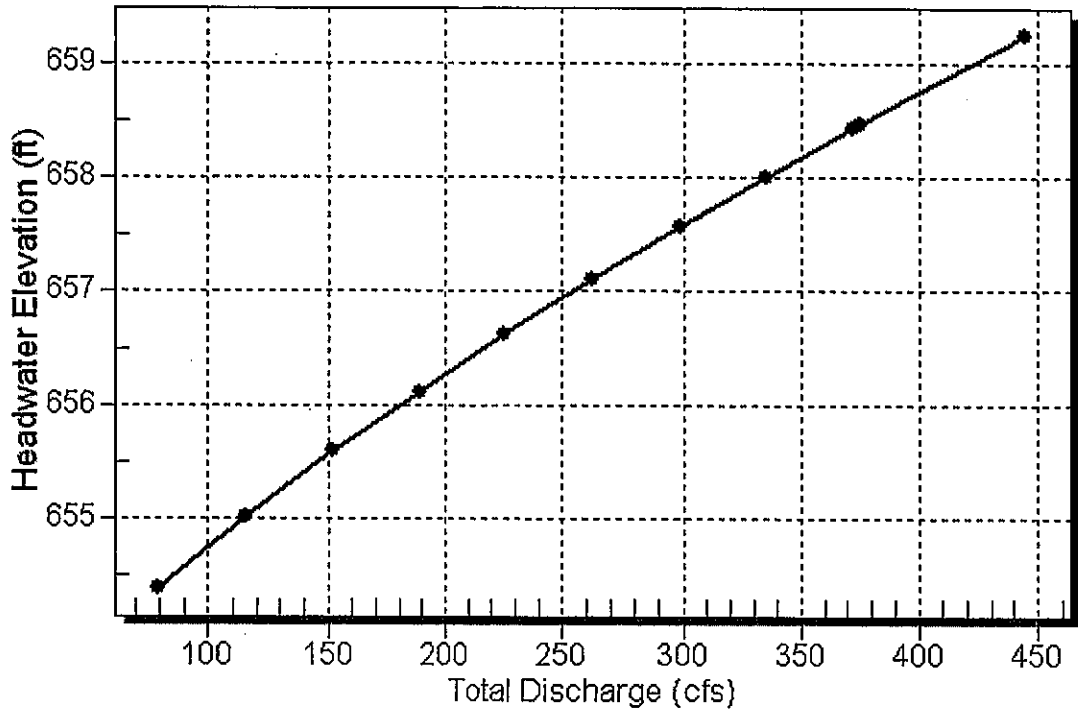


Table 2 - Culvert Summary Table: CUL239+18

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)
78.90	78.90	654.39	2.192	2.192	1-S2n	0.831	1.449	0.839	1.104	11.760	4.700
115.49	115.49	655.03	2.825	2.825	1-S2n	1.045	1.868	1.058	1.375	13.650	5.334
152.09	152.09	655.59	3.394	3.394	1-S2n	1.258	2.244	1.274	1.609	14.925	5.828
188.68	188.68	656.12	3.918	3.918	1-S2n	1.472	2.591	1.481	1.818	15.929	6.240
225.28	225.28	656.63	4.428	4.428	1-S2n	1.669	2.916	1.675	2.008	16.816	6.594
261.87	261.87	657.11	4.910	4.910	1-S2n	1.844	3.223	1.857	2.184	17.624	6.905
298.46	298.46	657.57	5.365	5.365	1-S2n	2.018	3.517	2.027	2.347	18.405	7.187
335.06	335.06	658.00	5.801	5.801	1-S2n	2.192	3.799	2.198	2.502	19.055	7.440
371.65	371.65	658.42	6.223	6.223	1-S2n	2.366	4.071	2.370	2.648	19.604	7.672
374.98	374.98	658.46	6.260	6.260	1-S2n	2.382	4.095	2.385	2.661	19.653	7.693
444.84	444.84	659.24	7.039	7.039	1-S2n	2.683	4.589	2.714	2.920	20.488	8.086

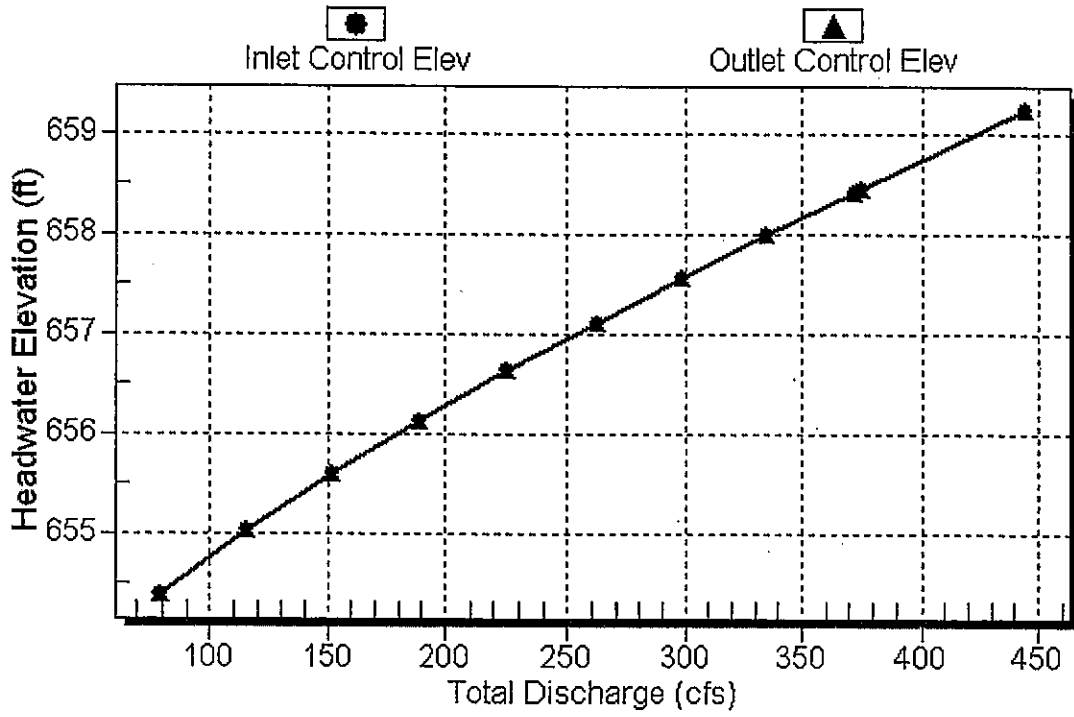
Inlet Elevation (invert): 652.20 ft, Outlet Elevation (invert): 639.44 ft

Culvert Length: 866.69 ft, Culvert Slope: 0.0147

Culvert Performance Curve Plot: CUL239+18

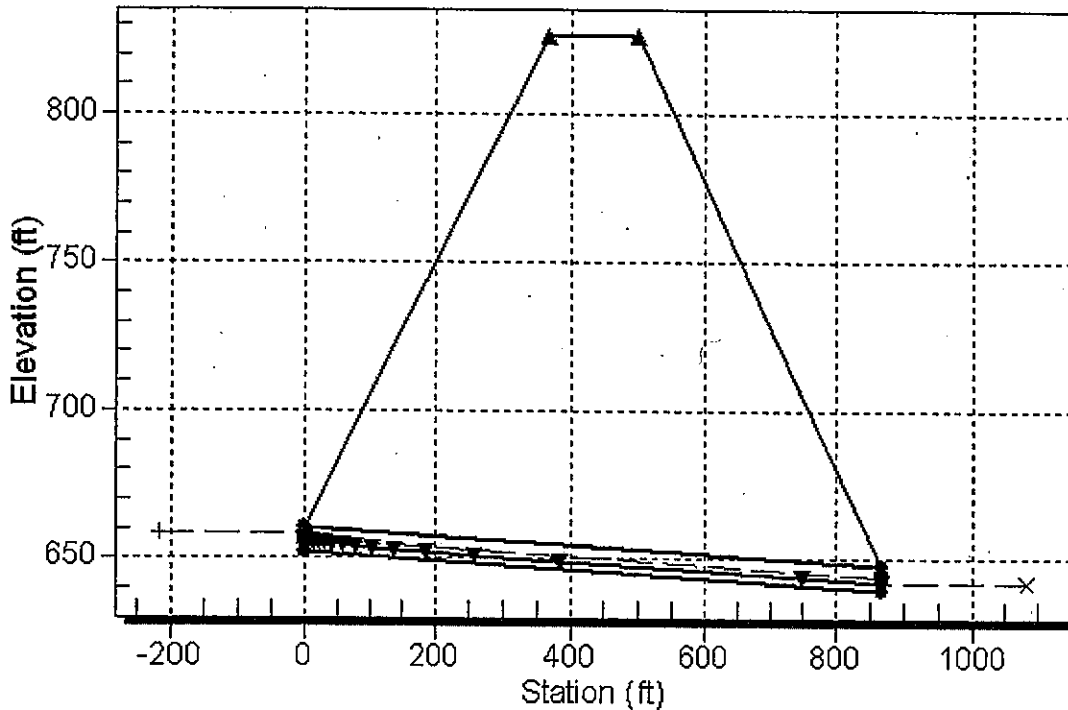
Performance Curve

Culvert: CUL239+18



Water Surface Profile Plot for Culvert: CUL239+18

Crossing - CUL239+18, Design Discharge - 375.0 cfs
Culvert - CUL239+18, Culvert Discharge - 375.0 cfs



Site Data - CUL239+18

Site Data Option: Culvert Invert Data

Inlet Station: 0.00 ft

Inlet Elevation: 652.20 ft

Outlet Station: 866.60 ft

Outlet Elevation: 639.44 ft

Number of Barrels: 1

Culvert Data Summary - CUL239+18

Barrel Shape: Concrete Box

Barrel Span: 8.00 ft

Barrel Rise: 8.00 ft

Barrel Material: Concrete

Barrel Manning's n: 0.0120

Inlet Type: Conventional

Inlet Edge Condition: Square Edge (30-75° flare) Wingwall

Inlet Depression: None

Table 3 - Downstream Channel Rating Curve (Crossing: CUL239+18)

Flow (cfs)	Water Surface Elev (ft)	Depth (ft)	Velocity (ft/s)	Shear (psf)	Froude Number
78.90	640.54	1.10	4.70	1.21	0.84
115.49	640.81	1.37	5.33	1.50	0.87
152.09	641.05	1.61	5.83	1.76	0.89
188.68	641.26	1.82	6.24	1.98	0.90
225.28	641.45	2.01	6.59	2.19	0.91
261.87	641.62	2.18	6.90	2.38	0.92
298.46	641.79	2.35	7.19	2.56	0.93
335.06	641.94	2.50	7.44	2.73	0.94
371.65	642.09	2.65	7.67	2.89	0.94
374.98	642.10	2.66	7.69	2.91	0.94
444.84	642.36	2.92	8.09	3.19	0.95

Tailwater Channel Data - CUL239+18

Tailwater Channel Option: Trapezoidal Channel

Bottom Width: 13.00 ft

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

Channel Slope: 0.0175

Channel Manning's n: 0.0400

Channel Invert Elevation: 639.44 ft

Roadway Data for Crossing: CUL239+18

Roadway Profile Shape: Constant Roadway Elevation

Crest Length: 1000.00 ft

Crest Elevation: 826.00 ft

Roadway Surface: Paved

Roadway Top Width: 134.00 ft

SR 823 STA 297+33.59

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

PATH OF WATER

AREA 21
603.0 AC
= 0.942 Sq. mi.

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
	26266462.00	SQ. FT.	
	0.942	SQ. MI.	CONTDA = Contributing Drainage Area
	0.00	SQ. FT.	
	0.00	%	STORAGE = Storage Area
	8430.00	FT.	TOTAL CHANNEL LENGTH
	843.00	FT.	L₁₀ = 10% of the Distance along channel
	579	FT.	Elev₁₀ = Elevation at point L₁₀
	7165.50	FT.	L₈₅ = 85% of the Distance along channel
	759	FT.	Elev₈₅ = Elevation at point L₈₅
	6322.50	FT.	Length = L₈₅ - L₁₀
	150.32	FT./MI.	SLOPE = (Elev ₁₀ -Elev ₈₅)/Length
		CFS	Q_# = Flood-Peak Discharge
			# = Frequency of Storm
Q₂	126.82	CFS	= 56.1(CONTDA)^{0.782}(SLOPE)^{0.172}(STORAGE+1)^{-0.297}
Q₅	244.39	CFS	= 84.5(CONTDA)^{0.769}(SLOPE)^{0.221}(STORAGE+1)^{-0.322}
Q₁₀	337.65	CFS	= 104(CONTDA)^{0.764}(SLOPE)^{0.244}(STORAGE+1)^{-0.335}
Q₂₅	463.09	CFS	= 129(CONTDA)^{0.760}(SLOPE)^{0.264}(STORAGE+1)^{-0.347}
Q₅₀	564.34	CFS	= 148(CONTDA)^{0.757}(SLOPE)^{0.276}(STORAGE+1)^{-0.355}
Q₁₀₀	666.21	CFS	= 167(CONTDA)^{0.756}(SLOPE)^{0.285}(STORAGE+1)^{-0.363}

HY-8 Culvert Analysis Report

BOX CULVERT AT STA. 297+33.59

Table 1 - Summary of Culvert Flows at Crossing: CUL297+33.59

Headwater Elevation (ft)	Total Discharge (cfs)	CUL297+33 Discharge (cfs)	Roadway Discharge (cfs)	Iterations
579.27	126.82	126.82	0.00	1
580.07	180.76	180.76	0.00	1
580.82	234.70	234.70	0.00	1
581.51	288.64	288.64	0.00	1
582.15	342.58	342.58	0.00	1
582.76	396.52	396.52	0.00	1
583.36	450.45	450.45	0.00	1
583.96	504.39	504.39	0.00	1
584.56	558.33	558.33	0.00	1
584.63	564.34	564.34	0.00	1
585.84	666.21	666.21	0.00	1

Rating Curve Plot for Crossing: CUL297+33.59

Total Rating Curve

Crossing: CUL297+33.59

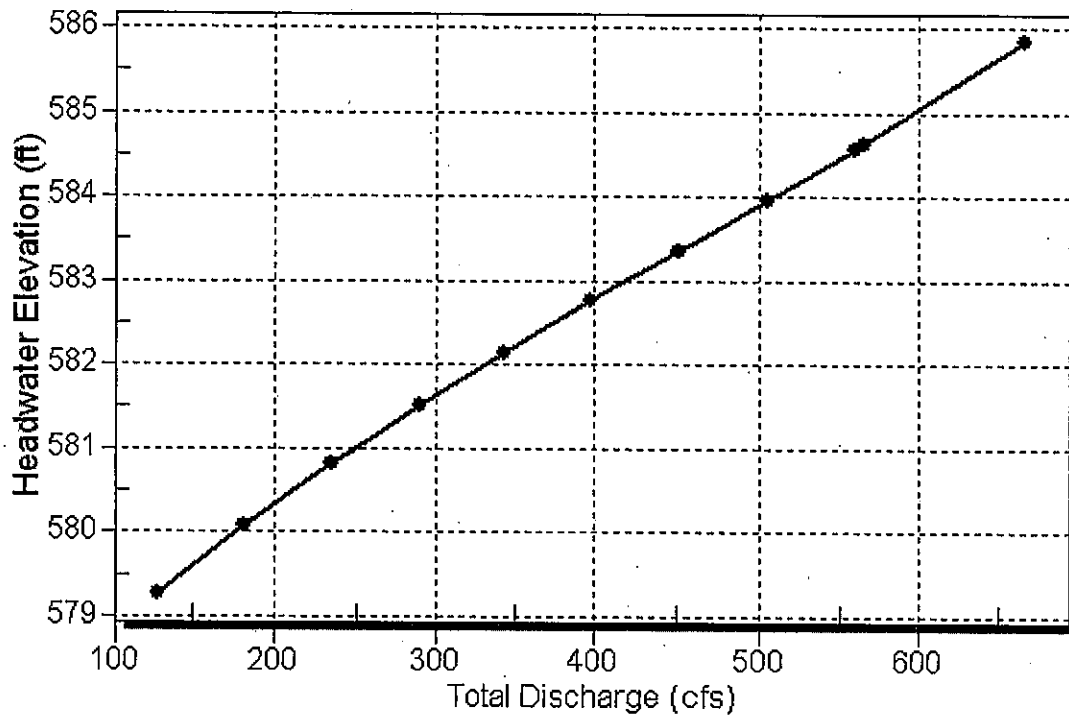


Table 2 - Culvert Summary Table: CUL297+33

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)
126.82	126.82	579.27	3.008	0.000	1-S2n	1.115	1.988	1.138	1.072	13.932	7.808
180.76	180.76	580.07	3.808	0.000	1-S2n	1.431	2.518	1.438	1.315	15.717	8.793
234.70	234.70	580.82	4.556	0.000	1-S2n	1.720	2.996	1.729	1.528	16.964	9.566
288.64	288.64	581.51	5.246	0.000	1-S2n	1.979	3.439	1.989	1.718	18.136	10.220
342.58	342.58	582.15	5.890	0.000	1-S2n	2.237	3.856	2.246	1.893	19.070	10.782
396.52	396.52	582.76	6.504	0.000	1-S2n	2.485	4.250	2.489	2.053	19.911	11.290
450.45	450.45	583.36	7.102	0.000	1-S2n	2.717	4.628	2.718	2.205	20.720	11.734
504.39	504.39	583.96	7.698	0.000	1-S2n	2.950	4.990	2.950	2.347	21.373	12.146
558.33	558.33	584.56	8.304	0.000	5-S2n	3.182	5.340	3.189	2.482	21.888	12.524
564.34	564.34	584.63	8.373	0.000	5-S2n	3.207	5.378	3.211	2.497	21.967	12.558
666.21	666.21	585.84	9.583	0.000	5-S2n	3.619	6.007	3.626	2.734	22.966	13.192

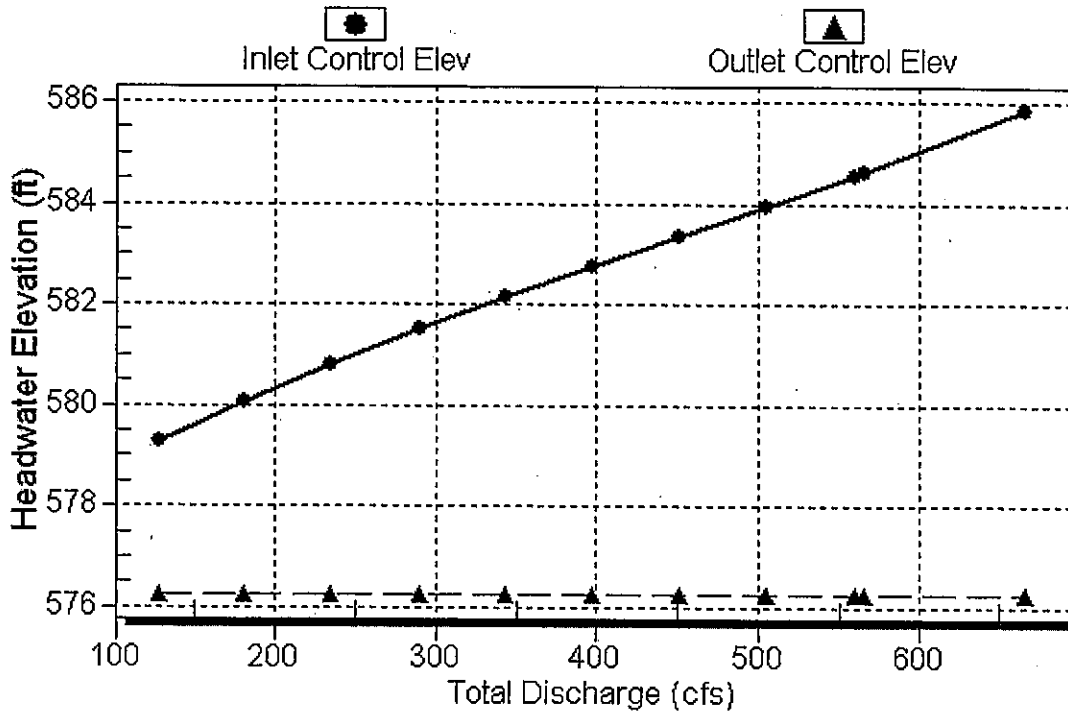
 Inlet Elevation (invert): 576.26 ft, Outlet Elevation (invert): 554.27 ft

Culvert Length: 1510.08 ft, Culvert Slope: 0.0146

Culvert Performance Curve Plot: CUL297+33

Performance Curve

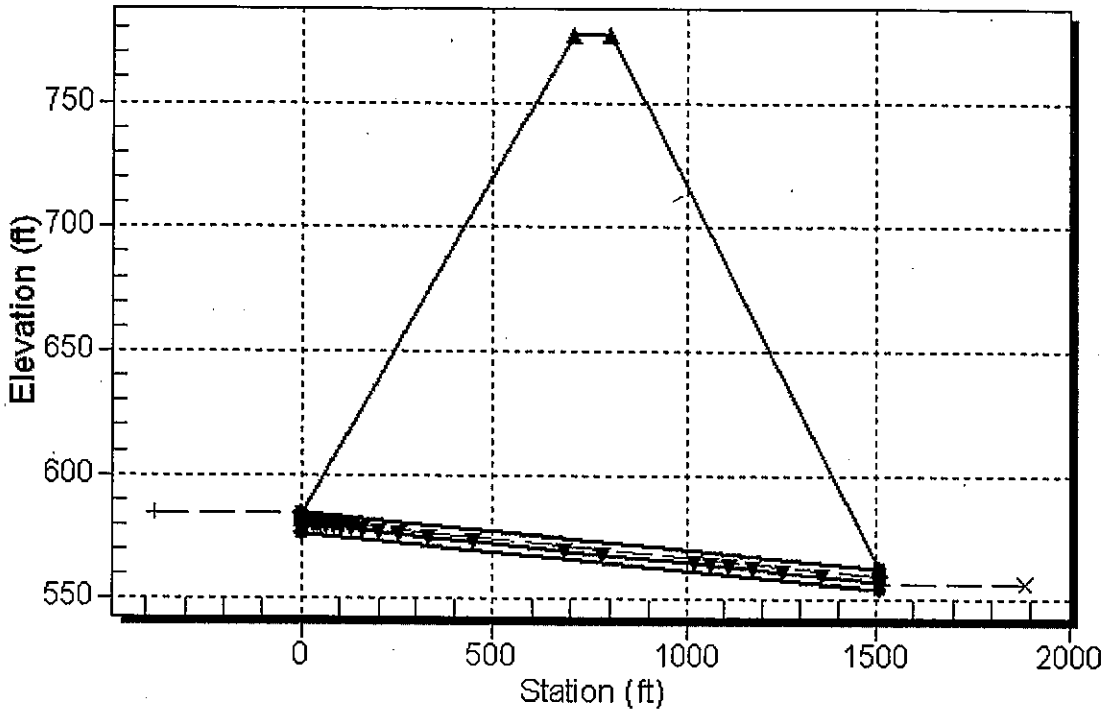
Culvert: CUL297+33



Water Surface Profile Plot for Culvert: CUL297+33

Crossing - CUL297+33.59, Design Discharge - 564.3 cfs

Culvert - CUL297+33, Culvert Discharge - 564.3 cfs



Site Data - CUL297+33

Site Data Option: Culvert Invert Data

Inlet Station: 0.00 ft

Inlet Elevation: 576.26 ft

Outlet Station: 1509.92 ft

Outlet Elevation: 554.27 ft

Number of Barrels: 1

Culvert Data Summary - CUL297+33

Barrel Shape: Concrete Box

Barrel Span: 8.00 ft

Barrel Rise: 8.00 ft

Barrel Material: Concrete

Barrel Manning's n: 0.0120

Inlet Type: Conventional

Inlet Edge Condition: Square Edge (30-75° flare) Wingwall

Inlet Depression: None

Table 3 - Downstream Channel Rating Curve (Crossing: CUL297+33.59)

Flow (cfs)	Water Surface Elev (ft)	Depth (ft)	Velocity (ft/s)	Shear (psf)	Froude Number
126.82	555.34	1.07	7.81	3.35	1.42
180.76	555.59	1.32	8.79	4.10	1.46
234.70	555.80	1.53	9.57	4.77	1.49
288.64	555.99	1.72	10.22	5.36	1.51
342.58	556.16	1.89	10.78	5.91	1.53
396.52	556.32	2.05	11.29	6.41	1.55
450.45	556.48	2.21	11.73	6.88	1.56
504.39	556.62	2.35	12.15	7.32	1.57
558.33	556.75	2.48	12.52	7.74	1.58
564.34	556.77	2.50	12.56	7.79	1.58
666.21	557.00	2.73	13.19	8.53	1.60

Tailwater Channel Data - CUL297+33.59

Tailwater Channel Option: Trapezoidal Channel

Bottom Width: 13.00 ft

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

Channel Slope: 0.0500

Channel Manning's n: 0.0400

Channel Invert Elevation: 554.27 ft

Roadway Data for Crossing: CUL297+33.59

Roadway Profile Shape: Constant Roadway Elevation

Crest Length: 1000.00 ft

Crest Elevation: 777.00 ft

Roadway Surface: Paved

Roadway Top Width: 90.00 ft

SR 823 STA 300+96.46



AREA 22
333.9 AC
= 0.522 Sq. mi.

PATH OF WATER

PROPOSED CULVERT
STA 300+96.46
28° R.F. SKEW

1" = 1000'

SR 823 STA 300+96.46
**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
	14545689.00	SQ. FT.	
	0.522	SQ. MI.	CONTDA = Contributing Drainage Area
	0.00	SQ. FT.	
	0.00	%	STORAGE = Storage Area
	5740.00	FT.	TOTAL CHANNEL LENGTH
	574.00	FT.	L ₁₀ = 10% of the Distance along channel
	585	FT.	Elev ₁₀ = Elevation at point L ₁₀
	4879.00	FT.	L ₈₅ = 85% of the Distance along channel
	770	FT.	Elev ₈₅ = Elevation at point L ₈₅
	4305.00	FT.	Length = L ₈₅ - L ₁₀
	226.90	FT./MI.	SLOPE = (Elev ₁₀ -Elev ₈₅)/Length
		CFS	Q _# = Flood-Peak Discharge
			# = Frequency of Storm
Q ₂	85.75	CFS	= 56.1(CONTDA) ^{0.782} (SLOPE) ^{0.172} (STORAGE+1) ^{-0.297}
Q ₅	169.91	CFS	= 84.5(CONTDA) ^{0.769} (SLOPE) ^{0.221} (STORAGE+1) ^{-0.322}
Q ₁₀	237.68	CFS	= 104(CONTDA) ^{0.764} (SLOPE) ^{0.244} (STORAGE+1) ^{-0.335}
Q ₂₅	329.46	CFS	= 129(CONTDA) ^{0.760} (SLOPE) ^{0.264} (STORAGE+1) ^{-0.347}
Q ₅₀	404.20	CFS	= 148(CONTDA) ^{0.757} (SLOPE) ^{0.276} (STORAGE+1) ^{-0.355}
Q ₁₀₀	479.22	CFS	= 167(CONTDA) ^{0.756} (SLOPE) ^{0.285} (STORAGE+1) ^{-0.363}

HY-8 Culvert Analysis Report
BOX CULVERT AT STA. 300+96.46

Table 1 - Summary of Culvert Flows at Crossing: CUL300+96.46

Headwater Elevation (ft)	Total Discharge (cfs)	CUL300+96 Discharge (cfs)	Roadway Discharge (cfs)	Iterations
568.86	85.75	85.75	0.00	1
569.53	125.10	125.10	0.00	1
570.12	164.44	164.44	0.00	1
570.68	203.79	203.79	0.00	1
571.22	243.14	243.14	0.00	1
571.72	282.49	282.49	0.00	1
572.20	321.83	321.83	0.00	1
572.66	361.18	361.18	0.00	1
573.10	400.53	400.53	0.00	1
573.14	404.20	404.20	0.00	1
573.97	479.22	479.22	0.00	1

Rating Curve Plot for Crossing: CUL300+96.46

Total Rating Curve
Crossing: CUL300+96.46

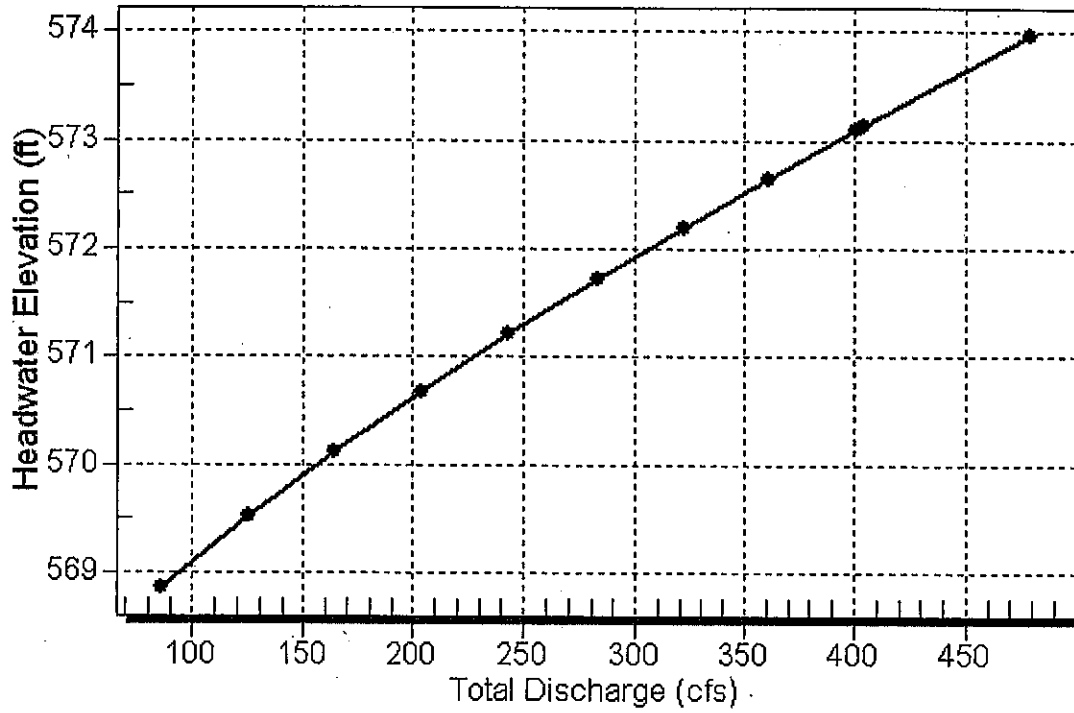


Table 2 - Culvert Summary Table: CUL300+96

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)
85.75	85.75	568.86	2.323	0.000	1-S2n	0.929	1.531	0.930	0.853	11.521	6.837
125.10	125.10	569.53	2.988	0.000	1-S2n	1.186	1.970	1.210	1.063	12.926	7.781
164.44	164.44	570.12	3.585	0.000	1-S2n	1.442	2.364	1.454	1.246	14.140	8.522
203.79	203.79	570.68	4.143	0.000	1-S2n	1.680	2.727	1.686	1.409	15.108	9.145
243.14	243.14	571.22	4.678	0.000	1-S2n	1.889	3.068	1.898	1.558	16.015	9.684
282.49	282.49	571.72	5.181	0.000	1-S2n	2.098	3.390	2.100	1.697	16.812	10.154
321.83	321.83	572.20	5.658	0.000	1-S2n	2.307	3.698	2.308	1.826	17.428	10.584
361.18	361.18	572.66	6.115	0.000	1-S2n	2.504	3.994	2.513	1.950	17.966	10.963
400.53	400.53	573.10	6.559	0.000	1-S2n	2.692	4.279	2.703	2.065	18.522	11.326
404.20	404.20	573.14	6.600	0.000	1-S2n	2.710	4.305	2.715	2.076	18.609	11.352
479.22	479.22	573.97	7.431	0.000	1-S2n	3.068	4.823	3.076	2.282	19.474	11.959

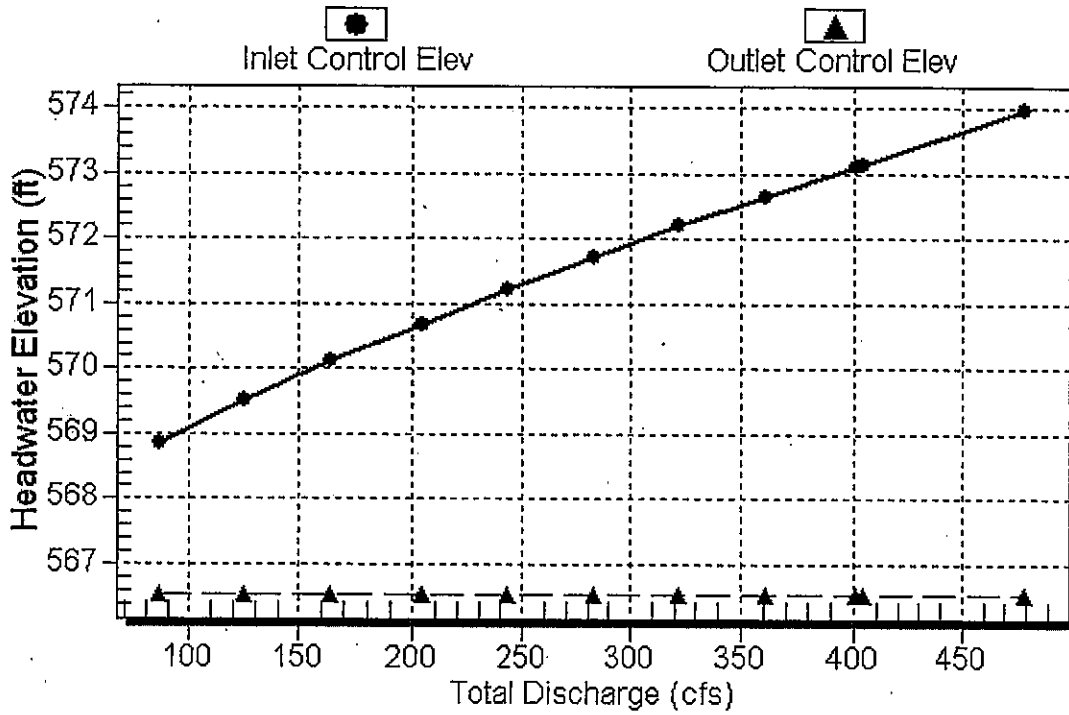
 Inlet Elevation (invert): 566.54 ft, Outlet Elevation (invert): 554.27 ft

Culvert Length: 1038.28 ft, Culvert Slope: 0.0118

Culvert Performance Curve Plot: CUL300+96

Performance Curve

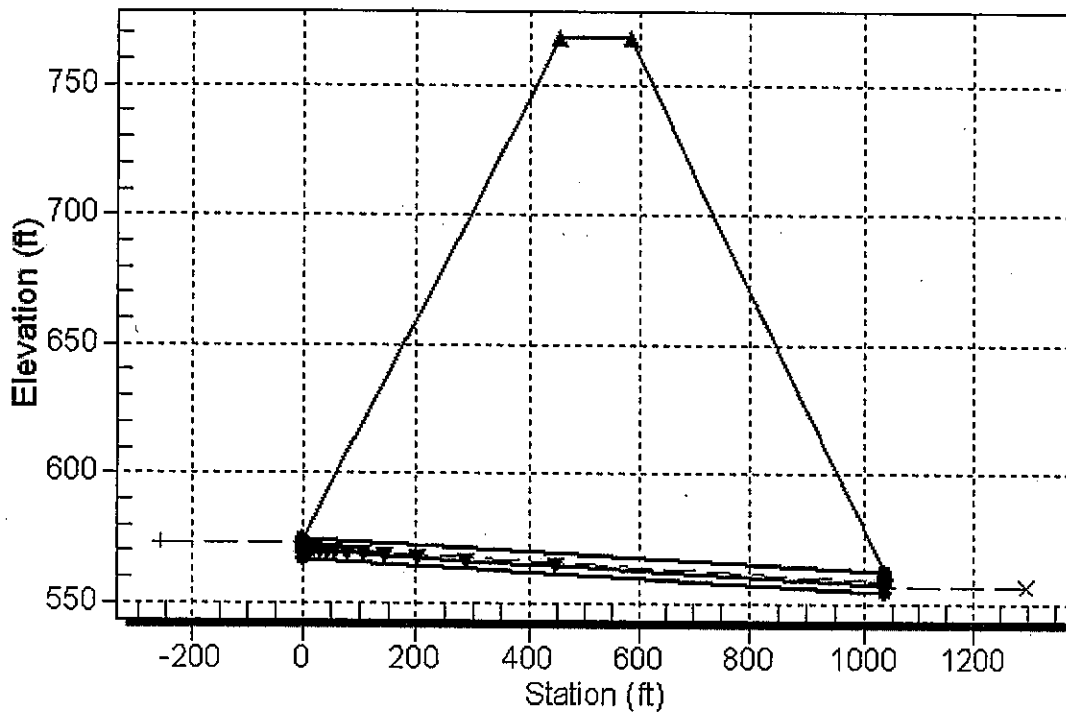
Culvert: CUL300+96



Water Surface Profile Plot for Culvert: CUL300+96

Crossing - CUL300+96.46, Design Discharge - 404.2 cfs

Culvert - CUL300+96, Culvert Discharge - 404.2 cfs



Site Data - CUL300+96

Site Data Option: Culvert Invert Data

Inlet Station: 0.00 ft

Inlet Elevation: 566.54 ft

Outlet Station: 1038.21 ft

Outlet Elevation: 554.27 ft

Number of Barrels: 1

Culvert Data Summary - CUL300+96

Barrel Shape: Concrete Box

Barrel Span: 8.00 ft

Barrel Rise: 8.00 ft

Barrel Material: Concrete

Barrel Manning's n: 0.0120

Inlet Type: Conventional

Inlet Edge Condition: Square Edge (30-75° flare) Wingwall

Inlet Depression: None

Table 3 - Downstream Channel Rating Curve (Crossing: CUL300+96.46)

Flow (cfs)	Water Surface Elev (ft)	Depth (ft)	Velocity (ft/s)	Shear (psf)	Froude Number
85.75	555.12	0.85	6.84	2.66	1.38
125.10	555.33	1.06	7.78	3.32	1.42
164.44	555.52	1.25	8.52	3.89	1.45
203.79	555.68	1.41	9.14	4.40	1.47
243.14	555.83	1.56	9.68	4.86	1.49
282.49	555.97	1.70	10.15	5.29	1.51
321.83	556.10	1.83	10.58	5.70	1.52
361.18	556.22	1.95	10.96	6.08	1.53
400.53	556.33	2.06	11.33	6.44	1.55
404.20	556.35	2.08	11.35	6.48	1.55
479.22	556.55	2.28	11.96	7.12	1.57

Tailwater Channel Data - CUL300+96.46

Tailwater Channel Option: Trapezoidal Channel

Bottom Width: 13.00 ft

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

Channel Slope: 0.0500

Channel Manning's n: 0.0400

Channel Invert Elevation: 554.27 ft

Roadway Data for Crossing: CUL300+96.46

Roadway Profile Shape: Constant Roadway Elevation

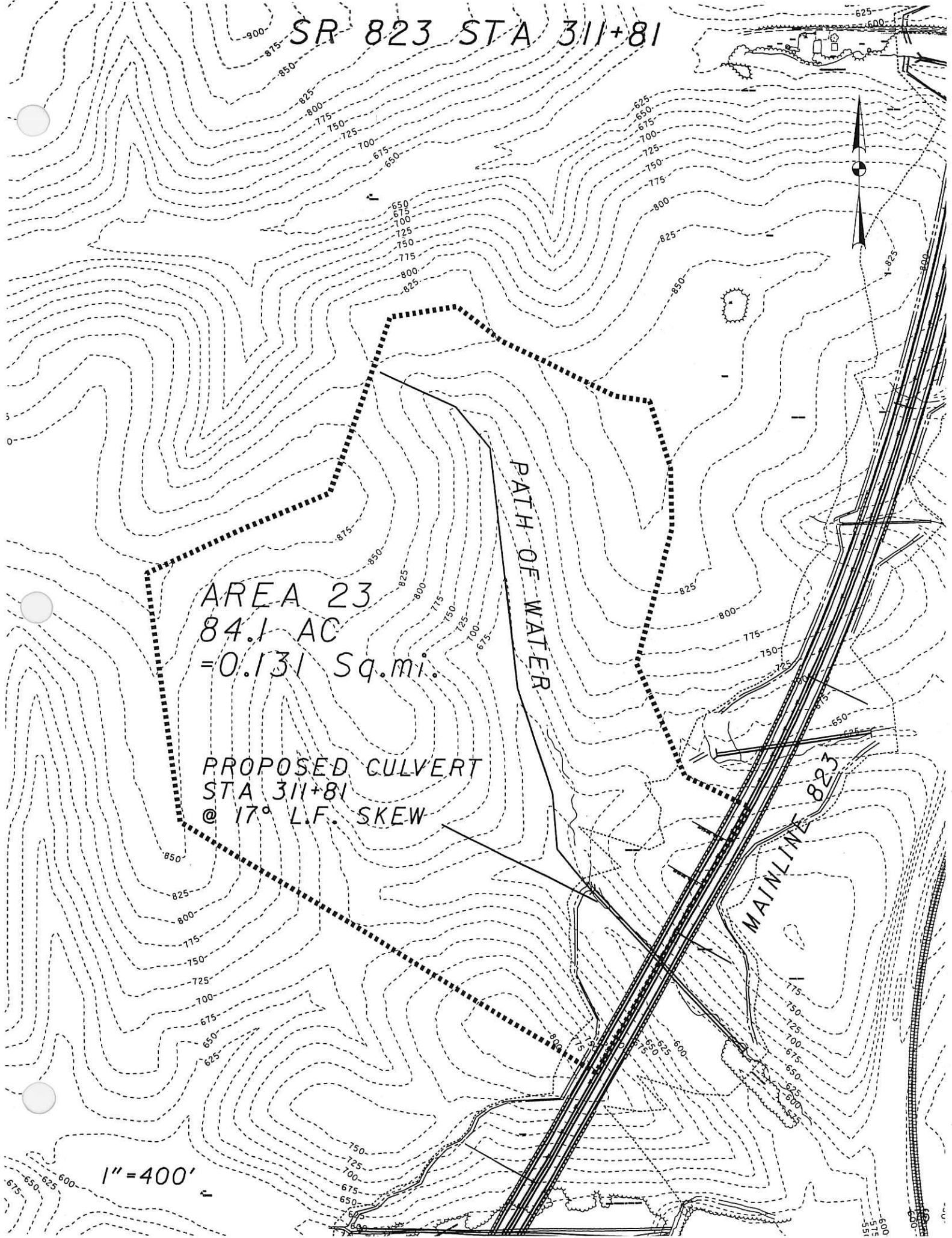
Crest Length: 1000.00 ft

Crest Elevation: 768.00 ft

Roadway Surface: Paved

Roadway Top Width: 134.00 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
BOX CULVERT AT STA. 311+81.00

Table 1 - Summary of Culvert Flows at Crossing: 311+81.00

Headwater Elevation (ft)	Total Discharge (cfs)	Culvert 1 Discharge (cfs)	Roadway Discharge (cfs)	Iterations
601.97	0.00	0.00	0.00	1
602.85	20.05	20.05	0.00	1
603.33	40.10	40.10	0.00	1
603.75	60.15	60.15	0.00	1
604.13	80.20	80.20	0.00	1
604.48	100.25	100.25	0.00	1
604.80	120.30	120.30	0.00	1
605.11	140.35	140.35	0.00	1
605.40	160.40	160.40	0.00	1
605.51	168.00	168.00	0.00	1
605.95	200.50	200.50	0.00	1

Rating Curve Plot for Crossing: 311+81.00

Total Rating Curve
Crossing: 311+81.00

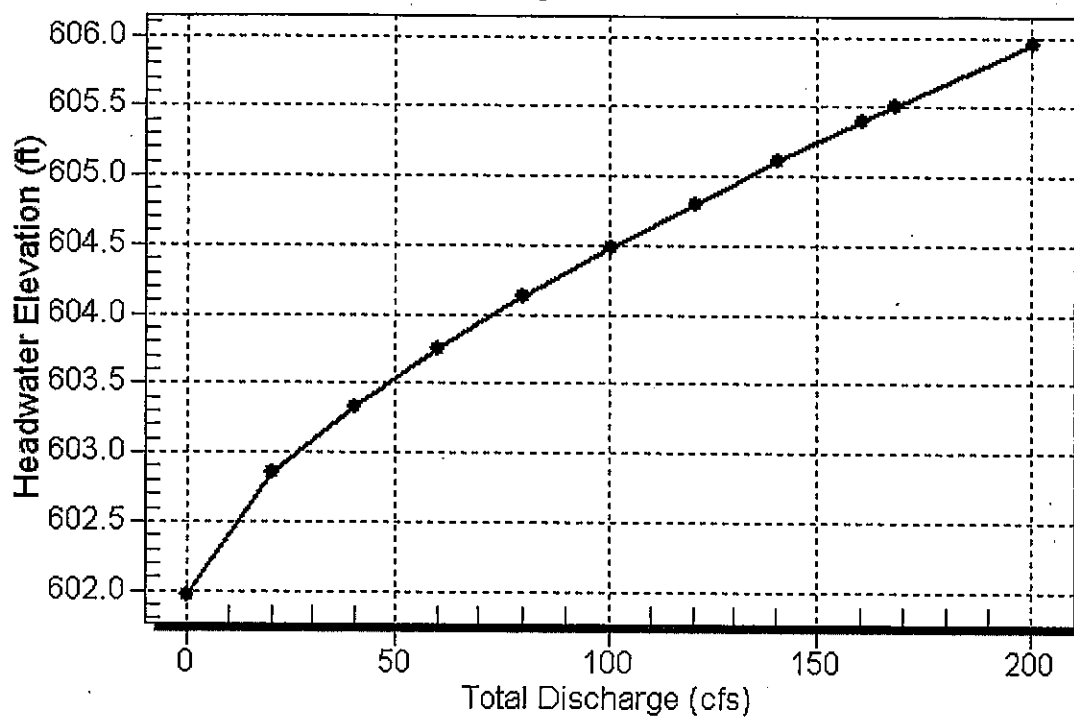


Table 2 - Culvert Summary Table: Culvert 1

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)
0.00	0.00	601.97	0.000	0.000	0-NF	0.000	0.000	0.000	0.000	0.000	0.000
20.05	20.05	602.85	0.877	0.877	1-S2n	0.131	0.581	0.181	0.509	13.831	4.367
40.10	40.10	603.33	1.361	1.361	1-S2n	0.263	0.923	0.323	0.761	15.538	5.537
60.15	60.15	603.75	1.784	1.784	1-S2n	0.394	1.209	0.409	0.960	18.386	6.312
80.20	80.20	604.13	2.161	2.161	1-S2n	0.526	1.465	0.605	1.130	16.583	6.917
100.25	100.25	604.48	2.508	2.508	1-S2n	0.657	1.699	0.689	1.280	18.176	7.416
120.30	120.30	604.80	2.832	2.832	1-S2n	0.789	1.919	0.792	1.418	18.985	7.832
140.35	140.35	605.11	3.138	3.138	1-S2n	0.864	2.127	0.867	1.543	20.240	8.208
160.40	160.40	605.40	3.431	3.431	1-S2n	0.935	2.325	0.945	1.660	21.221	8.533
168.00	168.00	605.51	3.538	3.538	1-S2n	0.961	2.398	0.988	1.701	21.262	8.659
200.50	200.50	605.95	3.981	3.981	1-S2n	1.076	2.698	1.088	1.873	23.042	9.112

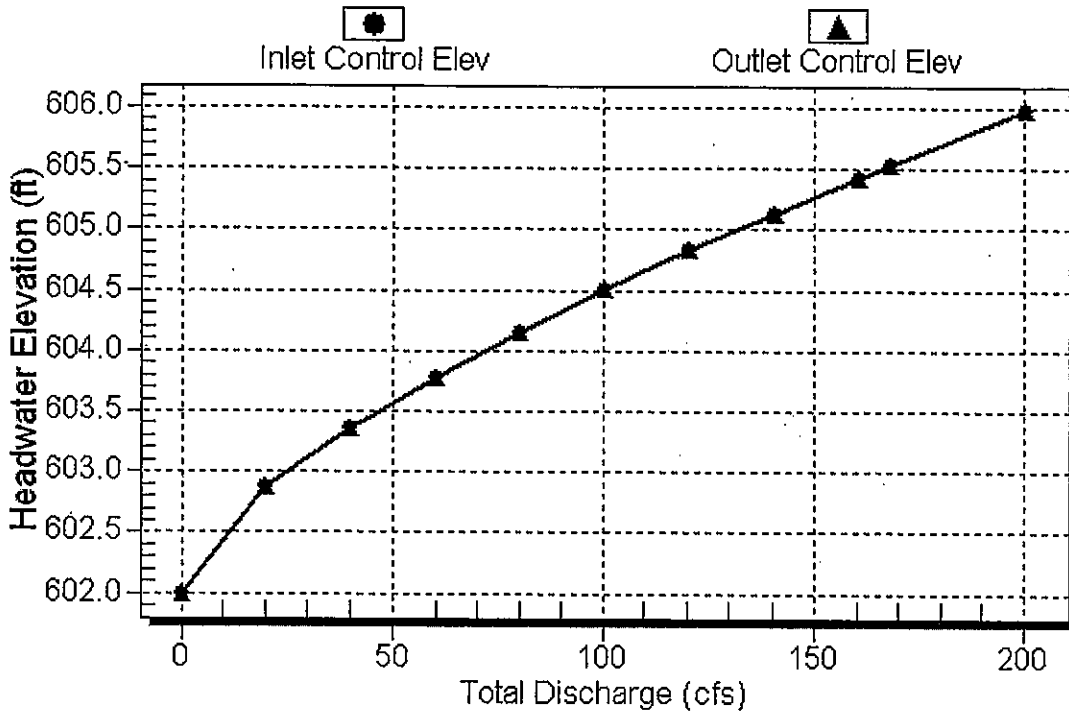
Inlet Elevation (invert): 601.97 ft, Outlet Elevation (invert): 570.86 ft

Culvert Length: 767.63 ft, Culvert Slope: 0.0406

Culvert Performance Curve Plot: Culvert 1

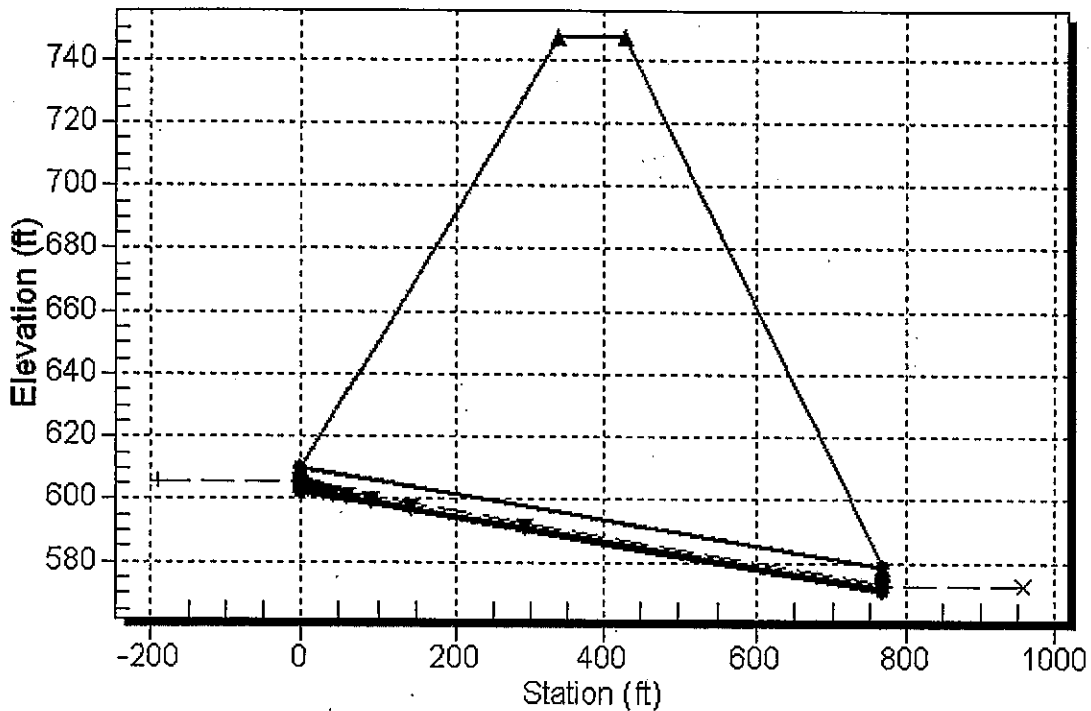
Performance Curve

Culvert: Culvert 1



Water Surface Profile Plot for Culvert: Culvert 1

Crossing - 311+81.00, Design Discharge - 168.0 cfs
Culvert - Culvert 1, Culvert Discharge - 168.0 cfs



Site Data - Culvert 1

Site Data Option: Culvert Invert Data

Inlet Station: 0.00 ft

Inlet Elevation: 601.97 ft

Outlet Station: 767.00 ft

Outlet Elevation: 570.86 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

Barrel Manning's n: 0.0120

Inlet Type: Conventional

Inlet Edge Condition: Square Edge (30-75° flare) Wingwall

Inlet Depression: None

Table 3 - Downstream Channel Rating Curve (Crossing: 311+81.00)

Flow (cfs)	Water Surface Elev (ft)	Depth (ft)	Velocity (ft/s)	Shear (psf)	Froude Number
0.00	570.86	0.00	0.00	0.00	0.00
20.05	571.37	0.51	4.37	1.29	1.14
40.10	571.62	0.76	5.54	1.93	1.20
60.15	571.82	0.96	6.31	2.43	1.24
80.20	571.99	1.13	6.92	2.86	1.27
100.25	572.14	1.28	7.42	3.24	1.29
120.30	572.28	1.42	7.83	3.59	1.30
140.35	572.40	1.54	8.21	3.91	1.32
160.40	572.52	1.66	8.53	4.21	1.33
168.00	572.56	1.70	8.66	4.31	1.33
200.50	572.73	1.87	9.11	4.75	1.35

Tailwater Channel Data - 311+81.00

Tailwater Channel Option: Trapezoidal Channel

Bottom Width: 8.00 ft

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

Channel Slope: 0.0406

Channel Manning's n: 0.0400

Channel Invert Elevation: 570.86 ft

Roadway Data for Crossing: 311+81.00

Roadway Profile Shape: Constant Roadway Elevation

Crest Length: 1000.00 ft

Crest Elevation: 747.00 ft

Roadway Surface: Paved

Roadway Top Width: 90.00 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'

SR 823 STA 320+42.81
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
	338493.00	SQ. FT.	
	0.012	SQ. MI.	CONTDA = Contributing Drainage Area
	0.00	SQ. FT.	
	0.00	%	STORAGE = Storage Area
	865.00	FT.	TOTAL CHANNEL LENGTH
	86.50	FT.	L₁₀ = 10% of the Distance along channel
	667	FT.	Elev₁₀ = Elevation at point L₁₀
	735.25	FT.	L₈₅ = 85% of the Distance along channel
	832	FT.	Elev₈₅ = Elevation at point L₈₅
	648.75	FT.	Length = L₈₅ - L₁₀
	1342.89	FT./MI.	SLOPE = (Elev₁₀ - Elev₈₅)/ Length
		CFS	Q_# = Flood-Peak Discharge # = Frequency of Storm
Q₂	6.15	CFS	= 56.1(CONTDA) ^{0.782} (SLOPE) ^{0.172} (STORAGE +1) ^{-0.297}
Q₅	13.96	CFS	= 84.5(CONTDA) ^{0.769} (SLOPE) ^{0.221} (STORAGE +1) ^{-0.322}
Q₁₀	20.73	CFS	= 104(CONTDA) ^{0.764} (SLOPE) ^{0.244} (STORAGE +1) ^{-0.335}
Q₂₅	30.23	CFS	= 129(CONTDA) ^{0.760} (SLOPE) ^{0.264} (STORAGE +1) ^{-0.347}
Q₅₀	38.32	CFS	= 148(CONTDA) ^{0.757} (SLOPE) ^{0.276} (STORAGE +1) ^{-0.355}
Q₁₀₀	46.34	CFS	= 167(CONTDA) ^{0.756} (SLOPE) ^{0.285} (STORAGE +1) ^{-0.363}



UNIVERSAL CULVERT DESIGN

PID : 77366 **Date :** 02/24/2007 **Project :** SR 823 Portsmouth Bypass **Location :** Portsmouth, Ohio **Designer :** mdc

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.) : 660.56 ✓ **Outlet Invert Elevation (ft.) :** 616.59 ✓ **Tailwater Elevation (ft.) :** 617.20 ✓ **Overflow Elevation (ft.) :** 736.67 ✓
Allowable Headwater Elevation (ft.) : 734.67 or Diameter + 2 ft. (whichever is less)
Pipe Length (ft.) : 567.30 ✓ **Culvert Slope (ft./ft.) :** 0.0775 ✓ **Design Manning 'n' :** 0.0120
Design Discharge (cfs) : 38.30 @ 50 yrs. **Flood Discharge (cfs) :** 46.30 @ 100 yrs. ✓

FLOW PIPE #	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.)
38.30	1	30 in.	664.19	624.21	2 - E	22.21	0.96	2.09	0.0120	INLET	0.00	D	0.00
38.30	1	27 in.	665.00	627.83	2 - E	22.33	1.00	2.07	0.0120	INLET	0.00	D - 1	0.00
38.30	1	24 in.	666.51	635.11	2 - E	22.36	1.07	1.94	0.0120	INLET	0.00	D - 2	0.00
38.30	1	33 in.	663.78	N/A	1 - C	22.06	0.92	2.06	0.0120	INLET	0.00	D + 1	0.00
46.30	1	30 in.	665.05	626.75	2 - E	23.40	1.06	2.25	0.0120	INLET	0.00	F	0.00
46.30	1	27 in.	666.31	632.06	2 - E	23.45	1.12	2.15	0.0120	INLET	0.00	F - 1	0.00
46.30	1	24 in.	668.55	642.76	2 - E	23.34	1.21	1.97	0.0120	INLET	0.00	F - 2	0.00
46.30	1	33 in.	664.36	623.91	2 - E	23.27	1.01	2.25	0.0120	INLET	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)

FLOW PIPE #	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.)
38.30	1	33 in.	664.33	630.39	2 - E	13.25	1.35	2.06	0.0241	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.)
38.30	1 30 in.	665.17	638.01	2-E	13.10	1.44	2.09	0.0244	INLET	0.00	D-1	0.00
38.30	1 27 in.	666.58	652.13	2-E	12.88	1.57	2.07	0.0245	INLET	0.00	D-2	0.00
38.30	1 36 in.	663.86	N/A	1-C	13.22	1.29	2.01	0.0241	INLET	0.00	D+1	0.00
46.30	1 33 in.	665.32	635.74	2-E	13.88	1.51	2.25	0.0241	INLET	0.00	F	0.00
46.30	1 30 in.	666.57	646.91	2-E	13.65	1.63	2.25	0.0244	INLET	0.00	F-1	0.00
46.30	1 27 in.	668.49	667.57	2-E	13.11	1.87	2.15	0.0245	INLET	0.00	F-2	0.00
46.30	1 36 in.	664.55	629.81	2-E	13.89	1.43	2.22	0.0241	INLET	0.00	F+1	0.00
Corrugated Metal Pipe (3 x 1 in. corrugations)												
38.30	1 36 in.	663.86	N/A	1-C	11.80	1.40	2.01	0.0281	INLET	0.00	D	0.00
38.30	1 42 in.	663.45	N/A	1-C	11.82	1.30	1.92	0.0278	INLET	0.00	D+1	0.00
46.30	1 36 in.	664.55	633.16	2-E	12.38	1.57	2.22	0.0281	INLET	0.00	F	0.00
46.30	1 42 in.	663.84	N/A	1-C	12.45	1.44	2.12	0.0278	INLET	0.00	F+1	0.00
Corrugated Metal Pipe (6 x 2 in. corrugations)												
38.30	1 60 in.	663.02	N/A	1-C	10.08	1.24	1.73	0.0332	INLET	0.00	D	0.00
38.30	1 66 in.	662.92	N/A	1-C	10.02	1.20	1.68	0.0330	INLET	0.00	D+1	0.00
46.30	1 60 in.	663.31	N/A	1-C	10.65	1.37	1.90	0.0332	INLET	0.00	F	0.00
46.30	1 66 in.	663.20	N/A	1-C	10.60	1.32	1.85	0.0330	INLET	0.00	F+1	0.00
Corrugated Metal Pipe (6 x 2 in. corrugations, Field Paved Invert)												
38.30	1 60 in.	663.02	N/A	1-C	11.99	1.10	1.73	0.0260	INLET	0.00	D	0.00
38.30	1 66 in.	662.92	N/A	1-C	11.87	1.06	1.68	0.0260	INLET	0.00	D+1	0.00
46.30	1 60 in.	663.31	N/A	1-C	12.68	1.21	1.90	0.0260	INLET	0.00	F	0.00
46.30	1 66 in.	663.20	N/A	1-C	12.55	1.17	1.85	0.0260	INLET	0.00	F+1	0.00

USE F2" S.S.P



CULVERT ANALYSIS

PID : 77366 **Date :** 02/24/2007 **Project :** SR 823 Portsmouth Bypass **Location :** Portsmouth OH **Designer :** mdc

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.
- OUTLET*** - Outlet Control with low headwater and low tailwater. Control Section is at the inlet.
- 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.) :** 660.56 **Outlet Invert Elevation (ft.) :** 616.59

Pipe Quantity : 1

Culvert Type : Circular Corrugated

Corrugation Type : Corrugated Metal Pipe (6 x 2 in. corrugations, Field Paved Invert)

Pipe Size : 72 in.

Design Manning 'n' : (default) **Buried Manning 'n' :** N/A

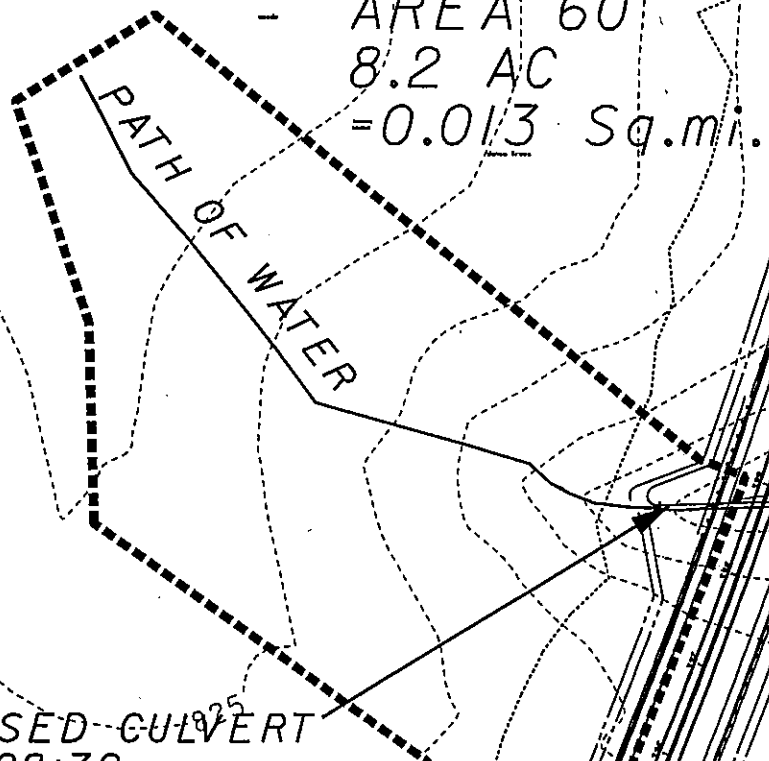
Entrance Type : Headwall

Loss Coef. Ke : 0.2500 **K :** 0.0083 **M :** 2.00 **Max. Q :** 3.30

CD : 0.6405 **c :** 0.0379 **Y :** 0.6900 **Min. Q :** 3.80

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.)
38.30	42.16	662.56	N/A	1 - C	11.74	1.04	1.64	0.0260	INLET	0.00	616.59
46.30	42.31	662.80	N/A	1 - C	12.42	1.14	1.80	0.0260	INLET	0.00	616.59

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

1" = 200'

SR 823 STA 328+79.00
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
	355411.00	SQ. FT.	
	0.013	SQ. MI.	CONTDA = Contributing Drainage Area
	0.00	SQ. FT.	
	0.00	%	STORAGE = Storage Area
	800.00	FT.	TOTAL CHANNEL LENGTH
	80.00	FT.	L₁₀ = 10% of the Distance along channel
	717	FT.	Elev₁₀ = Elevation at point L ₁₀
	680.00	FT.	L₈₅ = 85% of the Distance along channel
	863	FT.	Elev₈₅ = Elevation at point L ₈₅
	600.00	FT.	Length = L ₈₅ - L ₁₀
	1284.80	FT./MI.	SLOPE = (Elev ₁₀ -Elev ₈₅)/Length
		CFS	Q_# = Flood-Peak Discharge # = Frequency of Storm
Q₂	6.34	CFS	= 56.1(CONTDA) ^{0.782} (SLOPE) ^{0.172} (STORAGE+1) ^{-0.297}
Q₅	14.36	CFS	= 84.5(CONTDA) ^{0.769} (SLOPE) ^{0.221} (STORAGE+1) ^{-0.322}
Q₁₀	21.29	CFS	= 104(CONTDA) ^{0.764} (SLOPE) ^{0.244} (STORAGE+1) ^{-0.335}
Q₂₅	31.01	CFS	= 129(CONTDA) ^{0.760} (SLOPE) ^{0.264} (STORAGE+1) ^{-0.347}
Q₅₀	39.28	CFS	= 148(CONTDA) ^{0.757} (SLOPE) ^{0.276} (STORAGE+1) ^{-0.355}
Q₁₀₀	47.47	CFS	= 167(CONTDA) ^{0.756} (SLOPE) ^{0.285} (STORAGE+1) ^{-0.363}



UNIVERSAL CULVERT DESIGN

PID : 77366 **Date :** 03/23/2007 **Project :** SR 823 Portsmouth Bypass **Location :** Portsmouth, Ohio **Designer :** mdc

Description : Drainage area 60, Sta. 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.

Inlet Invert Elevation (ft.) : 695.94 **Outlet Invert Elevation (ft.) :** 651.31 **Tailwater Elevation (ft.) :** 651.93 **Overflow Elevation (ft.) :** 717.33

Allowable Headwater Elevation (ft.) : 714.50 or Diameter + 2 ft. (whichever is less)

Pipe Length (ft.) : 312.00 **Culvert Slope (ft./ft.) :** 0.1430 **Design Manning 'n' :** 0.0120

Design Discharge (cfs) : 39.30 @ 50 yrs. **Flood Discharge (cfs) :** 47.50 @ 100 yrs.

FLOW PIPE #	PIPE (cfs.)	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.)
39.30	1	30 in.	699.67	657.24	2 - E	27.95	0.82	2.11	0.0120	INLET	0.00	D	0.00
39.30	1	27 in.	700.53	659.55	2 - E	28.14	0.86	2.08	0.0120	INLET	0.00	D - 1	0.00
39.30	1	24 in.	702.12	664.18	2 - E	28.29	0.91	1.95	0.0120	INLET	0.00	D - 2	0.00
39.30	1	33 in.	699.22	N/A	1 - C	27.71	0.79	2.09	0.0120	INLET	0.00	D + 1	0.00
47.50	1	30 in.	700.58	658.98	2 - E	29.46	0.91	2.27	0.0120	INLET	0.00	F	0.00
47.50	1	27 in.	701.90	662.39	2 - E	29.59	0.95	2.16	0.0120	INLET	0.00	F - 1	0.00
47.50	1	24 in.	704.29	669.21	2 - E	29.69	1.01	1.98	0.0120	INLET	0.00	F - 2	0.00
47.50	1	33 in.	699.84	657.15	2 - E	29.23	0.87	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

FLOW PIPE #	PIPE (cfs.)	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.)
39.30	1	33 in.	699.82	660.91	2 - E	16.75	1.15	2.09	0.0241	INLET	0.00	D	0.00



UNIVERSAL CULVERT DESIGN

FLOW PIPE #	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.)
39.30 1	30 in.	700.72	665.54	16.62	1.21	2.11	0.0244	INLET	0.00	D - 1	0.00
39.30 1	27 in.	702.19	674.10	16.54	1.30	2.08	0.0245	INLET	0.00	D - 2	0.00
39.30 1	36 in.	699.32	N/A	16.66	1.10	2.04	0.0241	INLET	0.00	D + 1	0.00
47.50 1	33 in.	700.86	654.31	17.58	1.28	2.28	0.0241	INLET	0.00	F	0.00
47.50 1	30 in.	702.18	671.11	17.42	1.36	2.27	0.0244	INLET	0.00	F - 1	0.00
47.50 1	27 in.	704.17	683.65	17.22	1.47	2.16	0.0245	INLET	0.00	F - 2	0.00
47.50 1	36 in.	700.04	660.67	17.52	1.22	2.24	0.0241	INLET	0.00	F + 1	0.00
Corrugated Metal Pipe (3 x 1 in. corrugations)											
39.30 1	36 in.	699.32	N/A	14.90	1.20	2.04	0.0281	INLET	0.00	D	0.00
39.30 1	42 in.	698.87	N/A	14.87	1.12	1.95	0.0278	INLET	0.00	D + 1	0.00
47.50 1	36 in.	700.04	662.62	15.67	1.33	2.24	0.0281	INLET	0.00	F	0.00
47.50 1	42 in.	699.29	N/A	15.66	1.23	2.15	0.0278	INLET	0.00	F + 1	0.00
Corrugated Metal Pipe (6 x 2 in. corrugations)											
39.30 1	60 in.	698.44	N/A	12.62	1.08	1.75	0.0332	INLET	0.00	D	0.00
39.30 1	66 in.	698.34	N/A	12.54	1.04	1.70	0.0330	INLET	0.00	D + 1	0.00
47.50 1	60 in.	698.73	N/A	13.35	1.18	1.93	0.0332	INLET	0.00	F	0.00
47.50 1	66 in.	698.62	N/A	13.26	1.14	1.88	0.0330	INLET	0.00	F + 1	0.00
Corrugated Metal Pipe (6 x 2 in. corrugations, Field Paved Invert)											
39.30 1	60 in.	698.44	N/A	15.01	0.96	1.75	0.0260	INLET	0.00	D	0.00
39.30 1	66 in.	698.34	N/A	14.85	0.93	1.70	0.0260	INLET	0.00	D + 1	0.00
47.50 1	60 in.	698.73	N/A	15.86	1.05	1.93	0.0260	INLET	0.00	F	0.00
47.50 1	66 in.	698.62	N/A	15.68	1.02	1.88	0.0260	INLET	0.00	F + 1	0.00

REQUIRED 33" USE 60" S.S.P

SR 823 STA-344+82



AREA-24
328.8 AC
= 0.514 Sq.mt.

PATH OF WATER

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

ONLINE 823

1"=1000'

SR 823 STA 344+82.00
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
	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 = (Elev ₁₀ -Elev ₈₅)/Length
		CFS	Q_# = Flood-Peak Discharge
			# = Frequency of Storm
Q₂	85.48	CFS	= 56.1(CONTDA) ^{0.782} (SLOPE) ^{0.172} (STORAGE+1) ^{-0.297}
Q₅	169.85	CFS	= 84.5(CONTDA) ^{0.769} (SLOPE) ^{0.221} (STORAGE+1) ^{-0.322}
Q₁₀	237.91	CFS	= 104(CONTDA) ^{0.764} (SLOPE) ^{0.244} (STORAGE+1) ^{-0.335}
Q₂₅	330.13	CFS	= 129(CONTDA) ^{0.760} (SLOPE) ^{0.264} (STORAGE+1) ^{-0.347}
Q₅₀	405.30	CFS	= 148(CONTDA) ^{0.757} (SLOPE) ^{0.276} (STORAGE+1) ^{-0.355}
Q₁₀₀	480.76	CFS	= 167(CONTDA) ^{0.756} (SLOPE) ^{0.285} (STORAGE+1) ^{-0.363}

HY-8 Culvert Analysis Report

BOX CULVERT AT STA. 344+82.00

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

Headwater Elevation (ft)	Total Discharge (cfs)	344+82 Discharge (cfs)	Roadway Discharge (cfs)	Iterations
572.79	0.00	0.00	0.00	1
574.35	48.08	48.08	0.00	1
575.27	96.16	96.16	0.00	1
576.03	144.24	144.24	0.00	1
576.72	192.32	192.32	0.00	1
577.38	240.40	240.40	0.00	1
577.99	288.48	288.48	0.00	1
578.57	336.56	336.56	0.00	1
579.12	384.64	384.64	0.00	1
579.35	405.30	405.30	0.00	1
580.19	480.80	480.80	0.00	1

Rating Curve Plot for Crossing: 344+82

Total Rating Curve

Crossing: 344+82

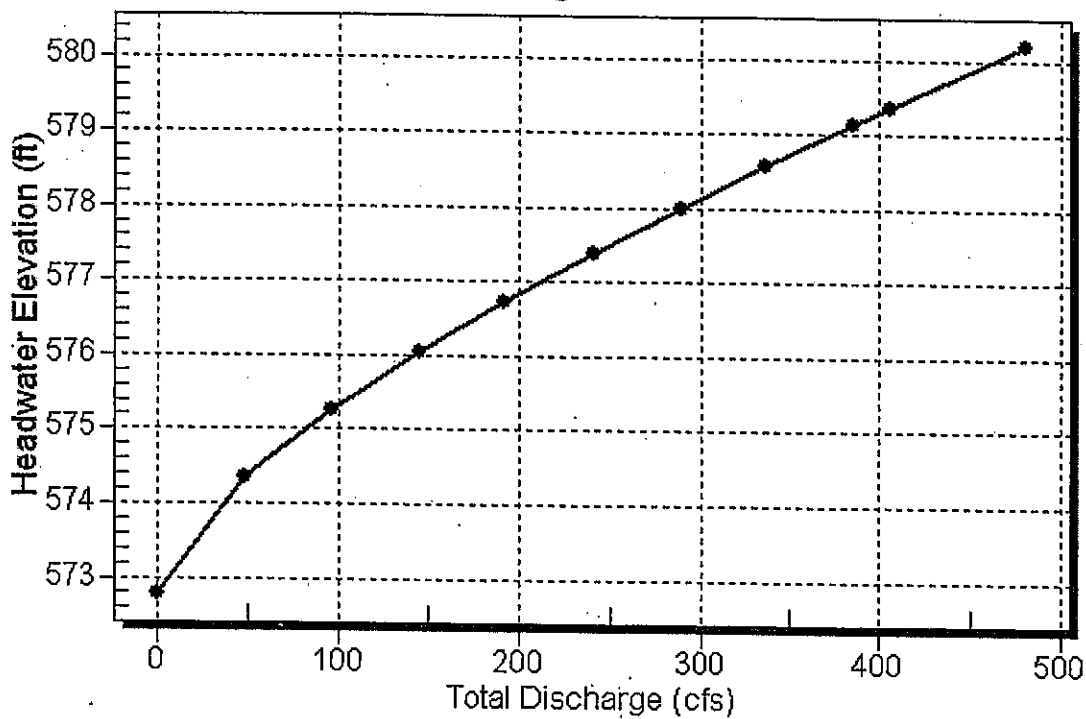


Table 2 - Culvert Summary Table: 344+82

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)
0.00	0.00	572.79	0.000	0.000	0-NF	0.000	0.000	0.000	0.000	0.000	0.000
48.08	48.08	574.35	1.561	1.561	1-S2n	0.403	1.041	0.441	0.864	13.620	4.746
96.16	96.16	575.27	2.476	2.476	1-S2n	0.803	1.653	0.804	1.286	14.952	5.950
144.24	144.24	576.03	3.245	3.245	1-S2n	1.020	2.166	1.056	1.615	17.075	6.752
192.32	192.32	576.72	3.930	3.930	1-S2n	1.236	2.624	1.254	1.893	19.173	7.372
240.40	240.40	577.38	4.590	4.590	1-S2n	1.452	3.045	1.469	2.139	20.451	7.871
288.48	288.48	577.99	5.203	5.203	1-S2n	1.656	3.438	1.663	2.361	21.679	8.300
336.56	336.56	578.57	5.779	5.779	1-S2n	1.832	3.810	1.840	2.564	22.860	8.678
384.64	384.64	579.12	6.329	6.329	1-S2n	2.008	4.165	2.114	2.753	22.743	9.012
405.30	405.30	579.35	6.561	6.561	1-S2n	2.084	4.313	2.198	2.829	23.051	9.150
480.80	480.80	580.19	7.396	7.396	1-S2n	2.361	4.833	2.505	3.094	23.991	9.598

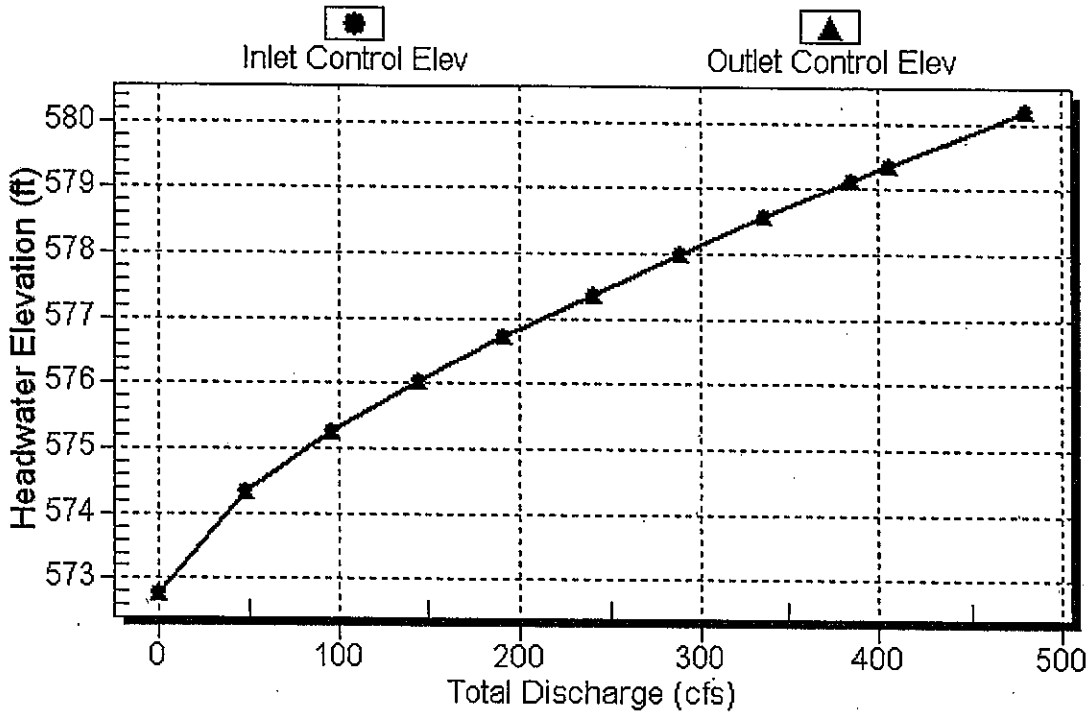
 Inlet Elevation (invert): 572.79 ft, Outlet Elevation (invert): 561.92 ft

Culvert Length: 438.83 ft, Culvert Slope: 0.0248

Culvert Performance Curve Plot: 344+82

Performance Curve

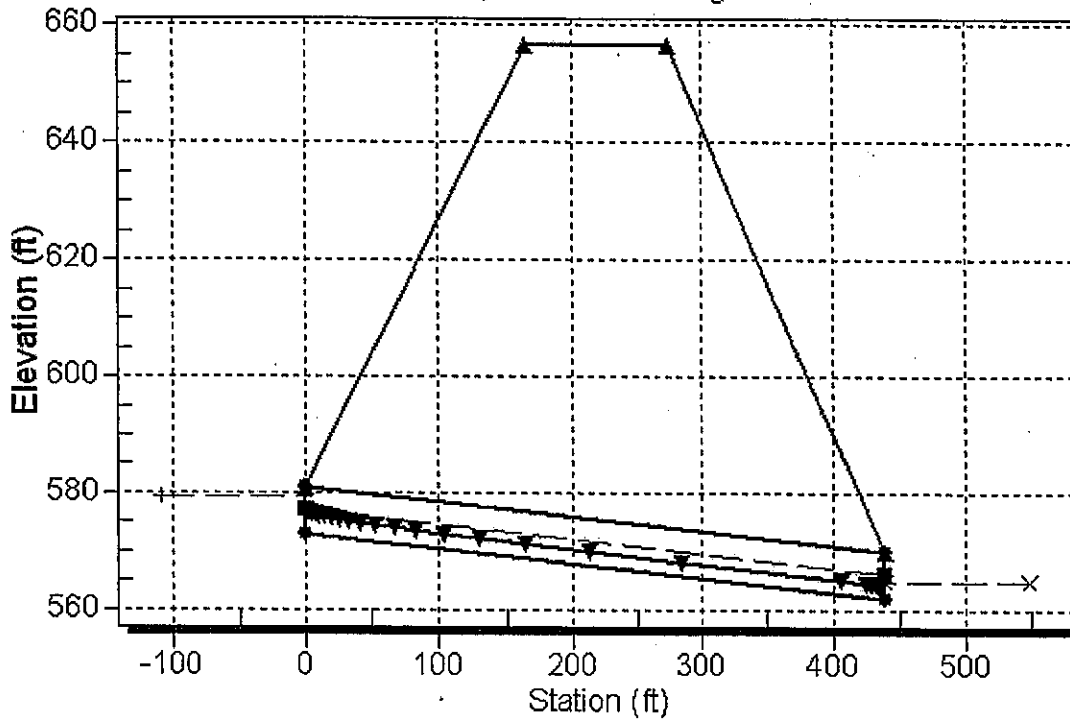
Culvert: 344+82



Water Surface Profile Plot for Culvert: 344+82

Crossing - 344+82, Design Discharge - 405.3 cfs

Culvert - 344+82, Culvert Discharge - 405.3 cfs



Site Data - 344+82

Site Data Option: Culvert Invert Data

Inlet Station: 0.00 ft

Inlet Elevation: 572.79 ft

Outlet Station: 438.70 ft

Outlet Elevation: 561.92 ft

Number of Barrels: 1

Culvert Data Summary - 344+82

Barrel Shape: Concrete Box

Barrel Span: 8.00 ft

Barrel Rise: 8.00 ft

Barrel Material: Concrete

Barrel Manning's n: 0.0120

Inlet Type: Conventional

Inlet Edge Condition: Square Edge (30-75° flare) Wingwall

Inlet Depression: None

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

Flow (cfs)	Water Surface Elev (ft)	Depth (ft)	Velocity (ft/s)	Shear (psf)	Froude Number
0.00	561.92	0.00	0.00	0.00	0.00
48.08	562.78	0.86	4.75	1.34	0.96
96.16	563.21	1.29	5.95	1.99	1.02
144.24	563.53	1.61	6.75	2.50	1.04
192.32	563.81	1.89	7.37	2.93	1.07
240.40	564.06	2.14	7.87	3.31	1.08
288.48	564.28	2.36	8.30	3.65	1.09
336.56	564.48	2.56	8.68	3.97	1.11
384.64	564.67	2.75	9.01	4.26	1.11
405.30	564.75	2.83	9.15	4.38	1.12
480.80	565.01	3.09	9.60	4.79	1.13

Tailwater Channel Data - 344+82

Tailwater Channel Option: Trapezoidal Channel

Bottom Width: 10.00 ft

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

Channel Slope: 0.0248

Channel Manning's n: 0.0400

Channel Invert Elevation: 561.92 ft

Roadway Data for Crossing: 344+82

Roadway Profile Shape: Constant Roadway Elevation

Crest Length: 1000.00 ft

Crest Elevation: 656.56 ft

Roadway Surface: Paved

Roadway Top Width: 110.00 ft

SR 140 RAMP A STA 64+00

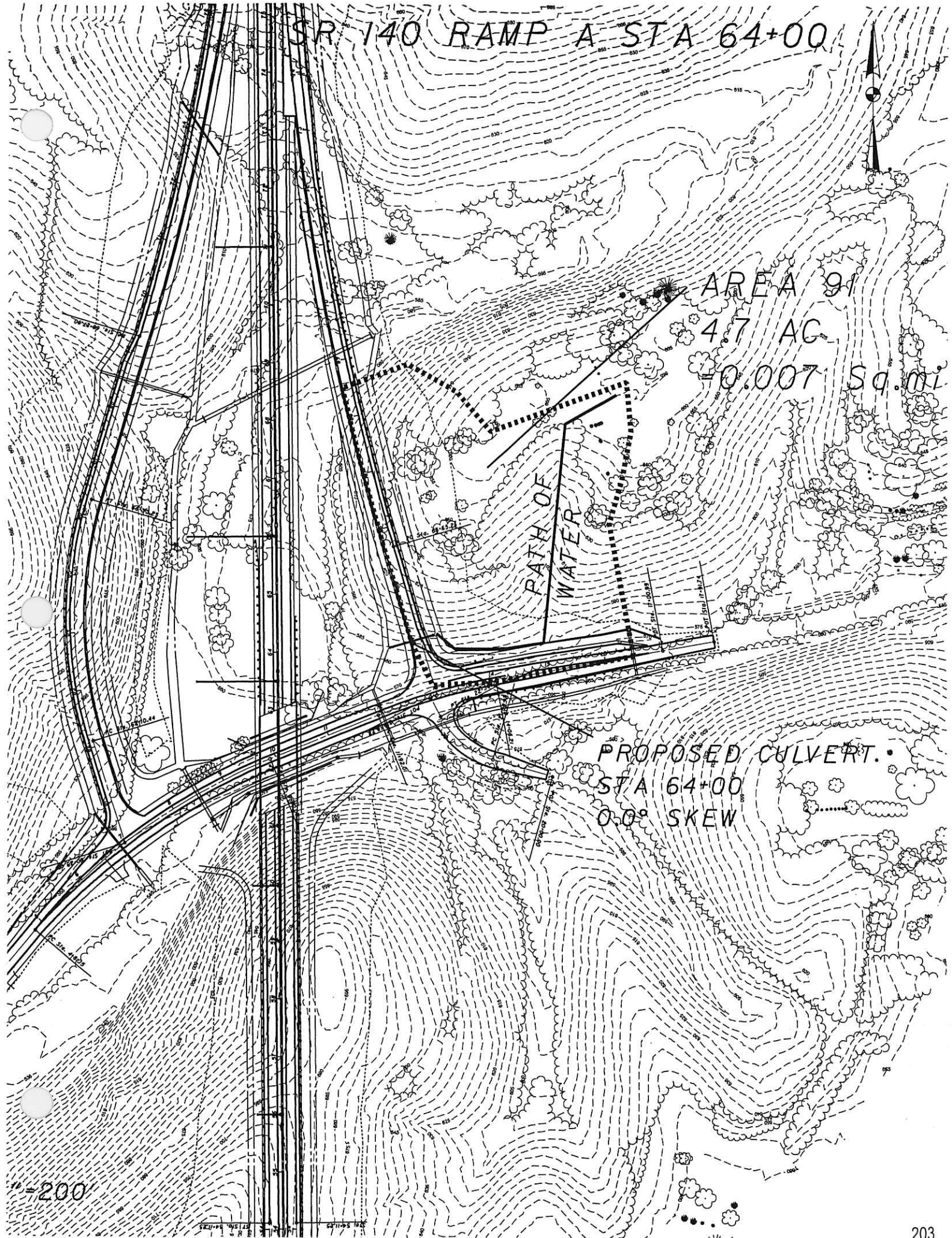


AREA 91
4.7 AC
0.007 Sq. mi

PATH OF
WATER

PROPOSED CULVERT.
STA 64+00
0.0° SKEW

-200



Area 91

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
Other			
Total Area	202529	4.65 acres	

BERMS STEEPER THAN 4:1

Weighted "C" = 0.72

Overland Flow

Length
High Elevation
Low Elevation
Slope %

#DIV/0! (1101.2.2)
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 :** 05/13/2007 **Project :** SR 823 Portsmouth Bypass **Location :** Portsmouth Ohio **Designer :** mdc

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.) :** 554.05 **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.) : 76.00 **Culvert Slope (ft./ft.) :** 0.0242 **Design Manning 'n' :** 0.0120
Design Discharge (cfs) : 22.60 @ 25 yrs. **Flood Discharge (cfs) :** 27.60 @ 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.)
CULVERT TYPE : CIRCULAR SMOOTH													
22.60	1	24 in.	558.89	557.50	2 - E	12.65	1.11	1.69	0.0120	INLET	0.00	D	0.00
22.60	1	21 in.	559.84	558.70	2 - E	12.46	1.23	1.65	0.0120	INLET	0.00	D - 1	0.00
21.10	1	18 in.	561.91	561.57	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	12.65	1.04	1.66	0.0120	INLET	0.00	D + 1	0.00
27.60	1	24 in.	559.67	558.36	2 - E	13.23	1.26	1.82	0.0120	INLET	0.00	F	0.00
27.60	1	21 in.	561.14	560.18	2 - E	12.63	1.49	1.70	0.0120	INLET	0.00	F - 1	0.00
21.10	1	18 in.	564.73	564.54	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	13.31	1.16	1.83	0.0120	INLET	0.00	F + 1	0.00
CULVERT TYPE : CIRCULAR CORRUGATED													
Corrugated Metal Pipe (2 2/3 x 1/2 in. corrugations)													
22.60	1	27 in.	558.89	558.39	2 - E	7.26	1.64	1.66	0.0245	INLET	0.00	D	0.00

Entrance Loss (Ke) : 0.20 **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.)
22.60	1 24 in.	559.73	560.15	2-F	7.96	2.00	1.69	0.0247	OUTLET**	0.00	D-1	0.00
18.60	1 21 in.	561.31	563.95	2-F	8.20	1.75	1.56	0.0248	OUTLET**	4.00	D-2	0.00
22.60	1 30 in.	558.48	N/A	1-C	7.41	1.49	1.62	0.0244	INLET	0.00	D+1	0.00
27.60	1 27 in.	559.70	559.64	2-E	6.94	2.25	1.83	0.0245	INLET	0.00	F	0.00
25.30	1 24 in.	560.99	562.30	2-F	8.61	2.00	1.77	0.0247	OUTLET**	2.30	F-1	0.00
18.60	1 21 in.	563.18	568.01	2-F	8.20	1.75	1.56	0.0248	OUTLET**	9.00	F-2	0.00
27.60	1 30 in.	559.00	558.33	2-E	7.72	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	6.69	1.45	1.53	0.0281	INLET	0.00	D	0.00
22.60	1 42 in.	558.01	N/A	1-C	6.70	1.34	1.46	0.0278	INLET	0.00	D+1	0.00
27.60	1 36 in.	558.46	N/A	1-C	7.03	1.63	1.70	0.0281	INLET	0.00	F	0.00
27.60	1 42 in.	558.27	N/A	1-C	7.07	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	5.73	1.28	1.31	0.0332	INLET	0.00	D	0.00
22.60	1 66 in.	557.63	N/A	1-C	5.69	1.23	1.28	0.0330	INLET	0.00	D+1	0.00
27.60	1 60 in.	557.93	N/A	1-C	6.06	1.41	1.46	0.0332	INLET	0.00	F	0.00
27.60	1 66 in.	557.84	N/A	1-C	6.03	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	6.81	1.13	1.31	0.0260	INLET	0.00	D	0.00
22.60	1 66 in.	557.63	N/A	1-C	6.74	1.09	1.28	0.0260	INLET	0.00	D+1	0.00
27.60	1 60 in.	557.93	N/A	1-C	7.21	1.25	1.46	0.0260	INLET	0.00	F	0.00
27.60	1 66 in.	557.84	N/A	1-C	7.14	1.21	1.42	0.0260	INLET	0.00	F+1	0.00

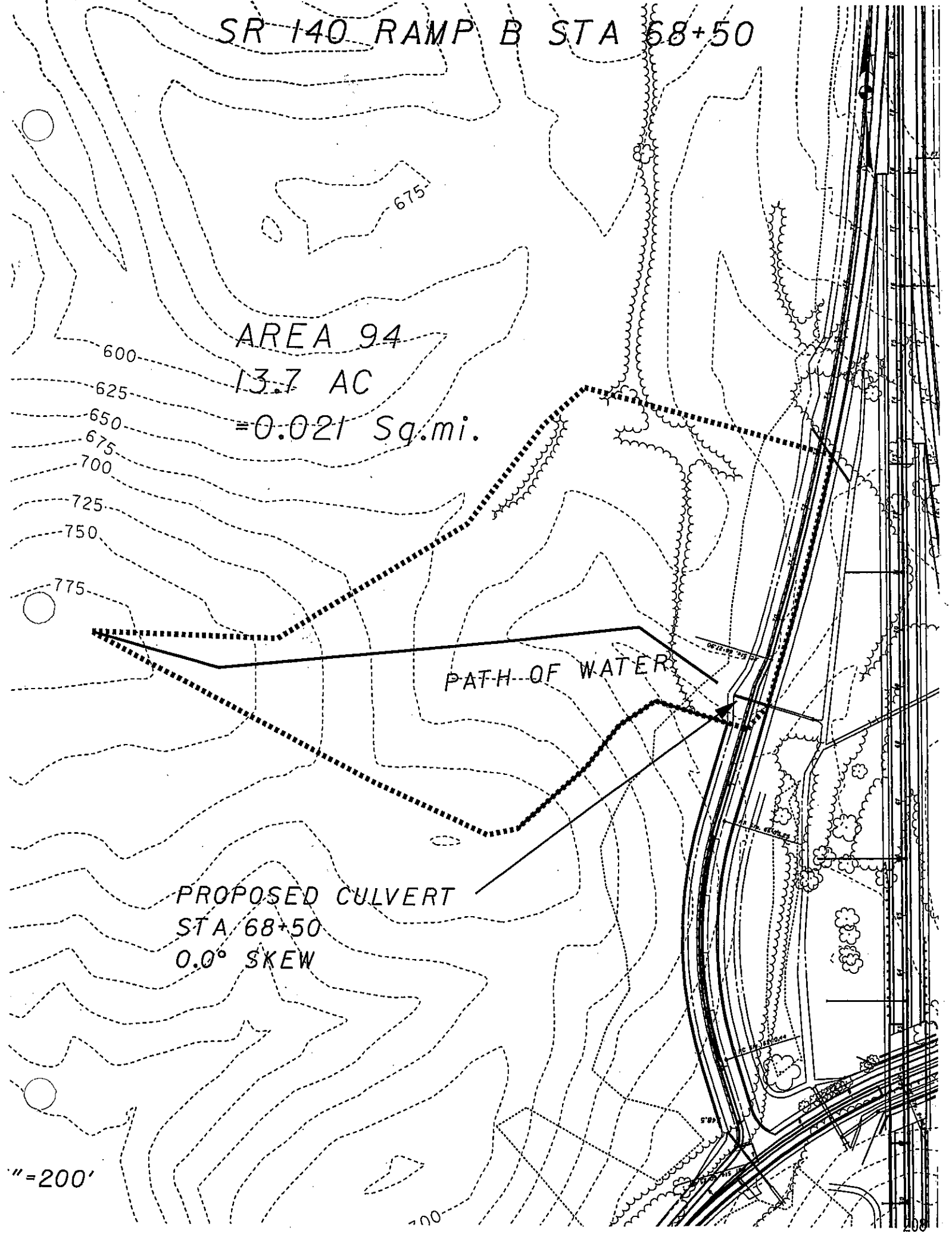
SR 140 RAMP B STA 68+50

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}

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

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

Description : Drainage area 94, SR 140 RAMP B Sta. 68+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.) : 572.85 / **Outlet Invert Elevation (ft.) :** 570.00 / **Tailwater Elevation (ft.) :** 570.61 / **Overflow Elevation (ft.) :** 587.70
Allowable Headwater Elevation (ft.) : 586.70 or Diameter + 2 ft. (*whichever is less*)
Pipe Length (ft.) : 146.00 **Culvert Slope (ft./ft.) :** 0.0195 **Design Manning 'n' :** 0.0120
Design Discharge (cfs) : 44.00 @ 25 yrs. **Flood Discharge (cfs) :** 67.10 @ 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.)
44.00	1	30 in.	577.08	575.27	2 - E	13.71	1.55	2.21	0.0120	INLET	0.00	D	0.00
44.00	1	27 in.	578.20	576.97	2 - E	13.41	1.73	2.14	0.0120	INLET	0.00	D - 1	0.00
44.00	1	24 in.	580.21	580.32	2 - F	14.05	2.00	1.97	0.0120	OUTLET**	0.00	D - 2	0.00
44.00	1	33 in.	576.47	574.35	2 - E	13.80	1.45	2.20	0.0120	INLET	0.00	D + 1	0.00
67.10	1	30 in.	580.32	579.26	2 - E	13.67	2.50	2.43	0.0120	INLET	0.00	F	0.00
67.10	1	27 in.	583.12	583.35	2 - F	16.90	2.25	2.23	0.0120	OUTLET**	0.00	F - 1	0.00
60.30	1	24 in.	592.12	591.38	2 - F	19.19	2.00	1.99	0.0120	OUTLET**	6.80	F - 2	0.00
67.10	1	33 in.	578.71	577.03	2 - E	15.10	1.93	2.57	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)

44.00	1	33 in.	577.30	577.55	2 - F	8.64	2.75	2.20	0.0241	OUTLET**	0.00	D	0.00
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UNIVERSAL CULVERT DESIGN

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

USE 36"

SR 140 RAMP B 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}

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 (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.)
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 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)

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
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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.)
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



823
MAINLINE

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.	L₁₀ = 10% of the Distance along channel
	559	FT.	Elev₁₀ = Elevation at point L₁₀
	926.50	FT.	L₈₅ = 85% of the Distance along channel
	662	FT.	Elev₈₅ = Elevation at point L₈₅
	817.50	FT.	Length = L₈₅ - L₁₀
	663.96	FT./MI.	SLOPE = (Elev ₁₀ -Elev ₈₅)/Length
		CFS	Q_# = Flood-Peak Discharge
			# = Frequency of Storm
Q₂	13.70	CFS	= 56.1(CONTDA) ^{0.782} (SLOPE) ^{0.172} (STORAGE+1) ^{-0.297}
Q₅	29.59	CFS	= 84.5(CONTDA) ^{0.769} (SLOPE) ^{0.221} (STORAGE+1) ^{-0.322}
Q₁₀	42.98	CFS	= 104(CONTDA) ^{0.764} (SLOPE) ^{0.244} (STORAGE+1) ^{-0.335}
Q₂₅	61.50	CFS	= 129(CONTDA) ^{0.760} (SLOPE) ^{0.264} (STORAGE+1) ^{-0.347}
Q₅₀	77.03	CFS	= 148(CONTDA) ^{0.757} (SLOPE) ^{0.276} (STORAGE+1) ^{-0.355}
Q₁₀₀	92.45	CFS	= 167(CONTDA) ^{0.756} (SLOPE) ^{0.285} (STORAGE+1) ^{-0.363}

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 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.)
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) :** 0.90

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 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.)
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 ETSING USE 78"



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

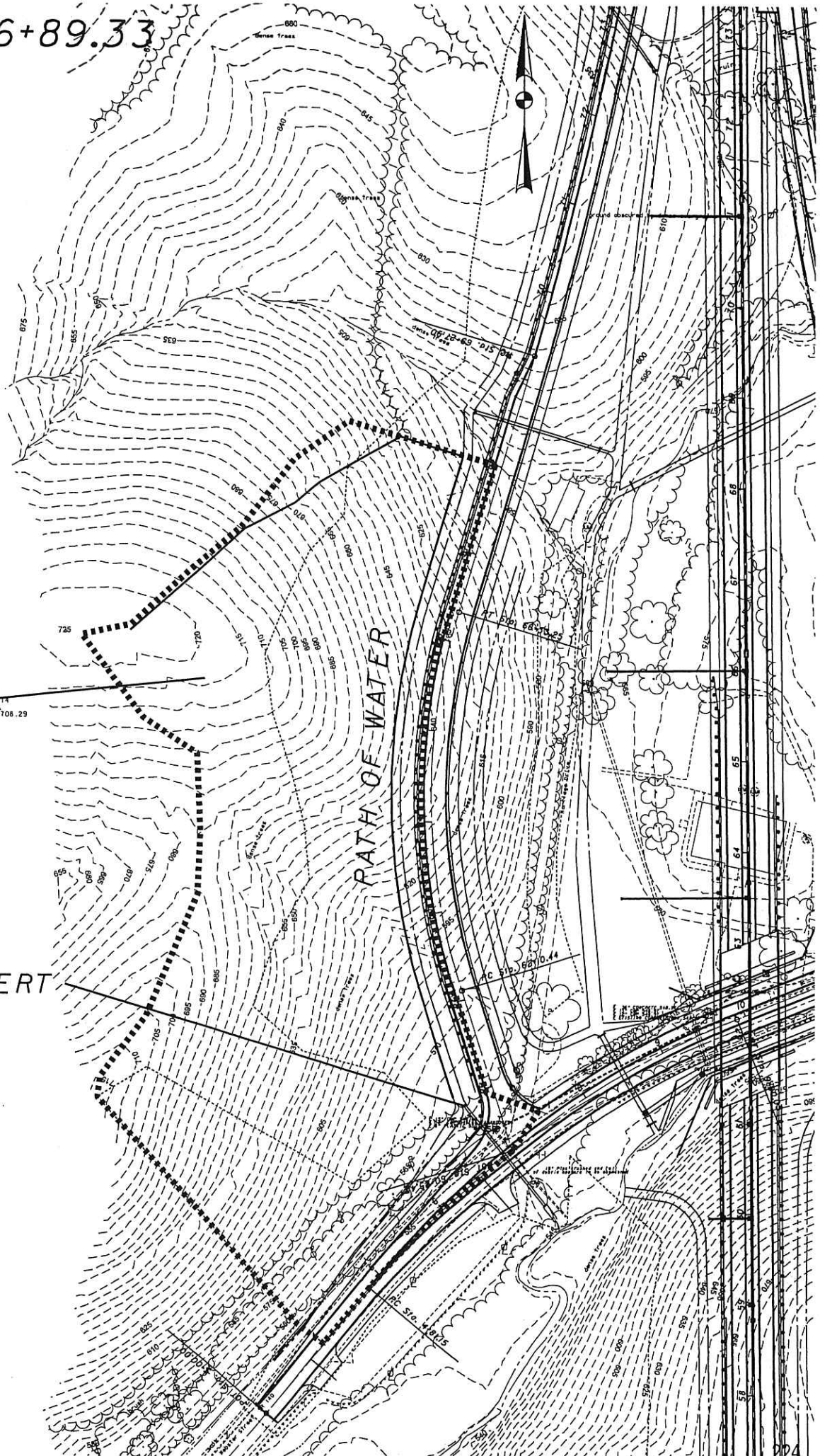
FLOW LOSS (cfs.)	HEAD LOSS (ft.)	HWI (ft.)	HWO (ft.)	FLOW TYPE	VELOCITY (fps.)	DN (ft.)	DC (ft.)	MANNING N	HEADWATER CONTROL	BURIED DEPTH (ft.)	TAILWATER ELEVATION (ft.)
61.50	1.11	552.01	N/A	1 - C	16.47	1.10	2.04	0.0120	INLET	0.00	546.63
92.50	1.63	552.77	N/A	1 - C	18.56	1.35	2.52	0.0120	INLET	0.00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

SRI40 STA. 6+89.33

AREA 104
6.5 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

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	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_o	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 = $t_o + t_s$

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	6.492886	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.) : 124.50 **Culvert Slope (ft./ft.) :** 0.0100 **Design Manning 'n' :** 0.0120

Design Discharge (cfs) : 20.41 **@ 25 yrs. ✓** **Flood Discharge (cfs) :** 25.01 **@ 100 yrs. ✓**

FLOW PIPE #	PIPE	CULVERT SIZE	HWI	HWO	FLOW VELOCITY TYPE	DN	DC	MANNING N	HEADWATER CONTROL	OVER FLOW	DESIGN BURIAL DEPTH	
(cfs.)			(ft.)	(ft.)	(fps.)	(ft.)	(ft.)			(cfs.)	(ft.)	
CULVERT TYPE : CIRCULAR SMOOTH												
Entrance Type : Half Headwall												
20.41	1	21 in.	551.60	551.68	2 - F	8.83	1.75	1.61	0.0120	OUTLET**	0.00	D
19.71	1	18 in.	553.26	554.86	2 - F	11.22	1.50	1.47	0.0120	OUTLET**	0.70	D - 1
12.91	1	15 in.	559.57	563.84	2 - F	10.57	1.25	1.22	0.0120	OUTLET**	7.50	D - 2
20.41	1	24 in.	550.86	550.37	2 - E	8.72	1.40	1.62	0.0120	INLET	0.00	D + 1
25.01	1	21 in.	552.70	553.27	2 - F	10.54	1.75	1.68	0.0120	OUTLET**	0.00	F
19.71	1	18 in.	555.34	558.12	2 - F	11.22	1.50	1.47	0.0120	OUTLET**	5.30	F - 1
12.91	1	15 in.	576.16	N/A	2 - F	10.52	1.25	1.22	0.0120	OUTLET**	12.10	F - 2
25.01	1	24 in.	551.50	551.26	2 - E	8.87	1.68	1.76	0.0120	INLET	0.00	F + 1
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)												
20.41	1	27 in.	550.85	551.51	2 - F	6.83	2.25	1.58	0.0245	OUTLET**	0.00	D



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.)
20.41 1	24 in.	551.51	553.60	2 - F	7.49	2.00	1.62	0.0247	OUTLET**	0.00	D - 1	0.00
16.01 1	21 in.	552.82	558.19	2 - F	7.40	1.75	1.48	0.0248	OUTLET**	4.40	D - 2	0.00
20.41 1	30 in.	550.53	550.80	1 - A	6.46	1.92	1.53	0.0244	OUTLET*	0.00	D + 1	0.00
25.01 1	27 in.	551.52	552.94	2 - F	7.55	2.25	1.75	0.0245	OUTLET**	0.00	F	0.00
22.01 1	24 in.	552.58	556.12	2 - F	7.83	2.00	1.67	0.0247	OUTLET**	3.00	F - 1	0.00
16.01 1	21 in.	554.43	563.04	2 - F	7.40	1.75	1.48	0.0248	OUTLET**	9.00	F - 2	0.00
25.01 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)												
20.41 1	36 in.	550.29	550.56	1 - A	6.03	1.78	1.45	0.0281	OUTLET*	0.00	D	0.00
20.41 1	42 in.	550.15	550.40	1 - A	5.77	1.61	1.38	0.0278	OUTLET*	0.00	D + 1	0.00
25.01 1	36 in.	550.56	550.87	1 - A	6.45	2.05	1.61	0.0281	OUTLET*	0.00	F	0.00
25.01 1	42 in.	550.40	550.68	1 - A	6.14	1.82	1.54	0.0278	OUTLET*	0.00	F + 1	0.00
Corrugated Metal Pipe (6 x 2 in. corrugations)												
20.41 1	60 in.	549.86	550.14	1 - A	5.34	1.52	1.25	0.0332	OUTLET*	0.00	D	0.00
20.41 1	66 in.	549.79	550.07	1 - A	5.24	1.46	1.21	0.0330	OUTLET*	0.00	D + 1	0.00
25.01 1	60 in.	550.07	550.37	1 - A	5.65	1.69	1.38	0.0332	OUTLET*	0.00	F	0.00
25.01 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)												
20.41 1	60 in.	549.86	550.17	1 - A	5.34	1.34	1.25	0.0260	OUTLET*	0.00	D	0.00
20.41 1	66 in.	549.79	550.11	1 - A	5.24	1.30	1.21	0.0260	OUTLET*	0.00	D + 1	0.00
25.01 1	60 in.	550.07	550.41	1 - A	5.65	1.49	1.38	0.0260	OUTLET*	0.00	F	0.00
25.01 1	66 in.	549.99	550.34	1 - A	5.54	1.44	1.35	0.0260	OUTLET*	0.00	F + 1	0.00

USE 30" SINCE IT IS READILY AVAILABLE

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.

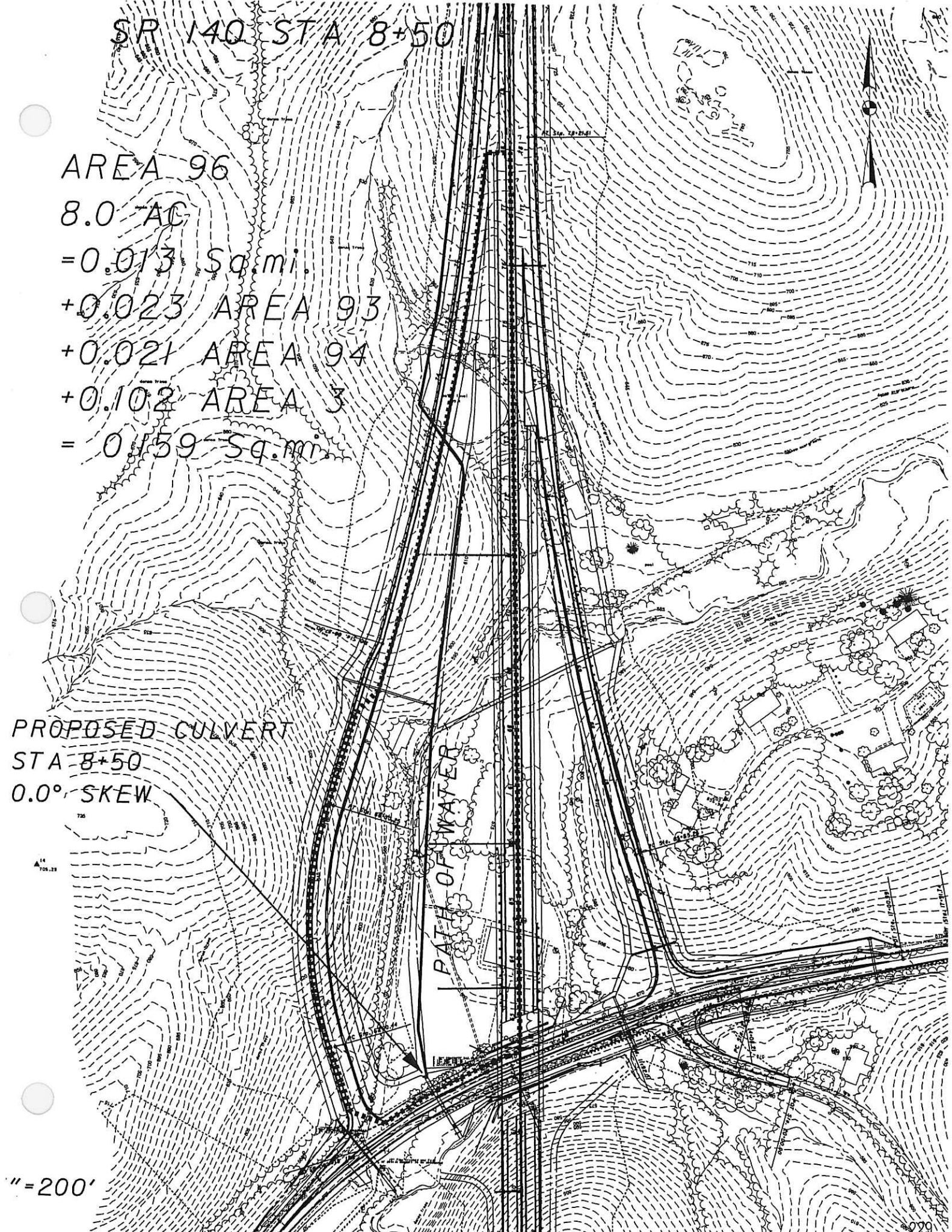
PROPOSED CULVERT

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.	L₁₀ = 10% of the Distance along channel
	559	FT.	Elev₁₀ = Elevation at point L₁₀
	3174.75	FT.	L₈₅ = 85% of the Distance along channel
	691	FT.	Elev₈₅ = Elevation at point L₈₅
	2801.25	FT.	Length = L₈₅ - L₁₀
	248.80	FT./MI.	SLOPE = (Elev ₁₀ -Elev ₈₅)/Length
		CFS	Q_# = Flood-Peak Discharge # = Frequency of Storm
Q₂	34.32	CFS	= 56.1(CONTDA) ^{0.782} (SLOPE) ^{0.172} (STORAGE+1) ^{-0.297}
Q₅	69.39	CFS	= 84.5(CONTDA) ^{0.769} (SLOPE) ^{0.221} (STORAGE+1) ^{-0.322}
Q₁₀	97.85	CFS	= 104(CONTDA) ^{0.764} (SLOPE) ^{0.244} (STORAGE+1) ^{-0.335}
Q₂₅	136.54	CFS	= 129(CONTDA) ^{0.760} (SLOPE) ^{0.264} (STORAGE+1) ^{-0.347}
Q₅₀	168.30	CFS	= 148(CONTDA) ^{0.757} (SLOPE) ^{0.276} (STORAGE+1) ^{-0.355}
Q₁₀₀	199.94	CFS	= 167(CONTDA) ^{0.756} (SLOPE) ^{0.285} (STORAGE+1) ^{-0.363}



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 #	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.)
Entrance Type : Half Headwall													
136.50	1	54 in.	552.74	552.52	2 - E	11.00	3.28	3.44	0.0120	INLET	0.00	D	0.00
136.50	1	48 in.	553.74	553.47	2 - E	10.86	4.00	3.48	0.0120	INLET	0.00	D - 1	0.00
128.70	1	42 in.	555.95	555.50	2 - E	13.38	3.50	3.30	0.0120	INLET	7.80	D - 2	0.00
136.50	1	60 in.	552.28	N/A	1 - C	11.19	2.98	3.35	0.0120	INLET	0.00	D + 1	0.00
198.80	1	54 in.	555.32	554.86	2 - E	12.50	4.50	4.03	0.0120	INLET	1.10	F	0.00
162.60	1	48 in.	557.88	557.05	2 - E	12.94	4.00	3.68	0.0120	INLET	37.30	F - 1	0.00
128.70	1	42 in.	562.91	561.64	2 - E	13.38	3.50	3.30	0.0120	INLET	71.20	F - 2	0.00
199.90	1	60 in.	554.01	553.72	2 - E	11.92	3.98	4.04	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)

136.50	1	60 in.	552.77	553.29	1 - A	9.78	4.57	3.35	0.0232	OUTLET*	0.00	D	0.00
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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	556.01	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 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**	F	0.00
199.90	1	66 in.	554.21	555.00	2 - F	10.92	5.50	3.96	0.0260	OUTLET**	F+1	0.00

SP 140 STA 12+00



AREA 92
3.3 AC
= 0.005 Sq.mi.
= 0.007 Sq.mi.
= 0.012 Sq.mi.

AREA 91

PATH OF WATER

AREA 91
= 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	Wiegthed "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 %	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	HWO	FLOW TYPE	VELOCITY (fps.)	DN (ft.)	DC	MANNING N	HEADWATER CONTROL	OVER FLOW (cfs.)	DESIGN BURIAL DEPTH (ft.)
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CULVERT TYPE : CIRCULAR SMOOTH												
Entrance Type : Half Headwall												
Entrance Loss (Ke)	: 0.20											
37.10	1	30 in.	557.24	556.78	2 - E	10.13	1.75	2.06	0.0120	INLET	0.00	D
37.10	1	27 in.	557.98	557.69	2 - E	9.33	2.25	2.05	0.0120	INLET	0.00	D - 1
35.80	1	24 in.	559.40	559.46	2 - F	11.53	2.00	1.93	0.0120	OUTLET**	1.30	D - 2
37.10	1	33 in.	556.86	N/A	1 - C	10.26	1.61	2.03	0.0120	INLET	0.00	D + 1
45.50	1	30 in.	558.12	557.73	2 - E	10.30	2.11	2.23	0.0120	INLET	0.00	F
44.40	1	27 in.	559.33	559.12	2 - E	11.17	2.25	2.14	0.0120	INLET	1.10	F - 1
35.80	1	24 in.	561.49	561.85	2 - F	11.53	2.00	1.93	0.0120	OUTLET**	9.70	F - 2
45.50	1	33 in.	557.46	556.96	2 - E	10.70	1.85	2.23	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)												
37.10	1	33 in.	557.36	557.89	2 - F	7.90	2.75	2.03	0.0241	OUTLET**	0.00	D



UNIVERSAL CULVERT DESIGN

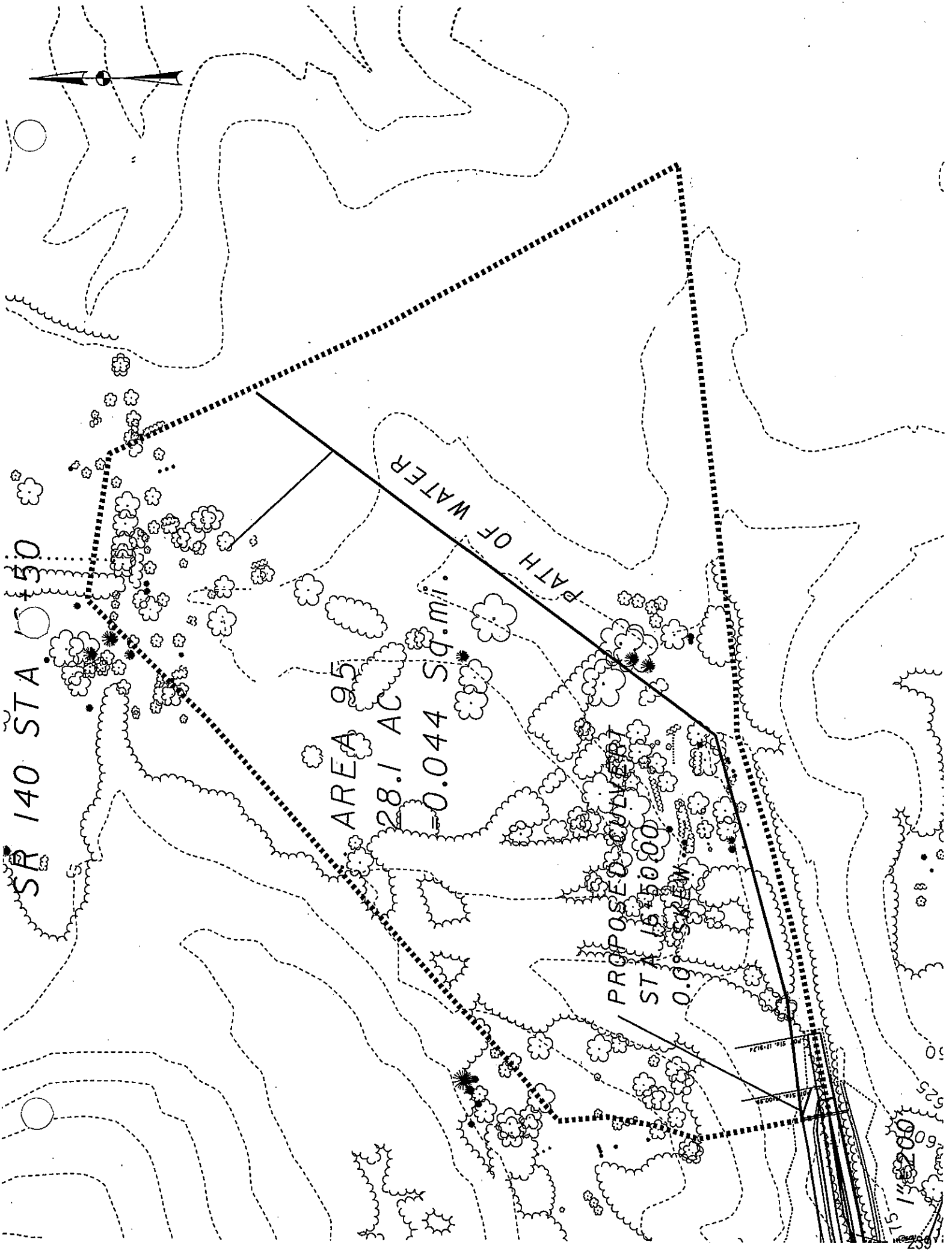
FLOW PIPE #	CULVERT SIZE	HWI (ft.)	HWO (ft.)	FLOW TYPE	VELOCITY (fps.)	DN (ft.)	DC (ft.)	MANNING N	HEADWATER CONTROL	OVER FLOW (cfs.)	DESIGN CODE	BURIAL DEPTH (ft.)
36.00 1	30 in.	558.14	559.40	2 - F	8.42	2.50	2.03	0.0244	OUTLET**	1.10	D - 1	0.00
28.50 1	27 in.	559.47	562.18	2 - F	8.12	2.25	1.86	0.0245	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

SR 140 STA 0+50

AREA 95
28.1 AC
= 0.044 Sq. mi.

PATH OF WATER

PROPOSED CONVECT
STA 15+50.00
0.00



15
20
25
30
35
40
45
50
55
60
65
70
75
80
85
90
95
100

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 = (Elev₁₀ - Elev₈₅)/ 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}

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 #	PIPE	CULVERT SIZE	HWI (ft.)	HWO (ft.)	FLOW TYPE	VELOCITY (fps.)	DN (ft.)	DC (ft.)	MANNING N	HEADWATER CONTROL	OVER FLOW (cfs.)	DESIGN 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
55.50	1	30 in.	572.63	572.18	2 - E	11.31	2.50	2.36	0.0120	INLET	0.00	D - 1
48.80	1	27 in.	574.45	574.14	2 - E	12.27	2.25	2.17	0.0120	INLET	6.70	D - 2
55.50	1	36 in.	570.95	570.47	2 - E	11.27	1.97	2.42	0.0120	INLET	0.00	D + 1
70.00	1	33 in.	574.74	574.03	2 - E	11.79	2.75	2.59	0.0120	INLET	12.20	F
59.00	1	30 in.	577.21	576.52	2 - E	12.02	2.50	2.39	0.0120	INLET	23.20	F - 1
48.80	1	27 in.	583.11	581.02	2 - E	12.27	2.25	2.17	0.0120	INLET	33.40	F - 2
81.60	1	36 in.	573.21	572.58	2 - E	11.54	3.00	2.78	0.0120	INLET	0.60	F + 1
CULVERT TYPE : CIRCULAR CORRUGATED												
Entrance Type : Half Headwall												
Entrance Loss (Ke) : 0.20												
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

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

USE 42" CONC. PIPE



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.)
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 :** m

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
Culvert Type : Circular Smooth **Pipe Length (ft.) :** 78.00 **Culvert Slope (ft./ft.) :** 0.0100
Corrugation Type :
Pipe Size : 42 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.)
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

CP 2511 STA 2+16.57



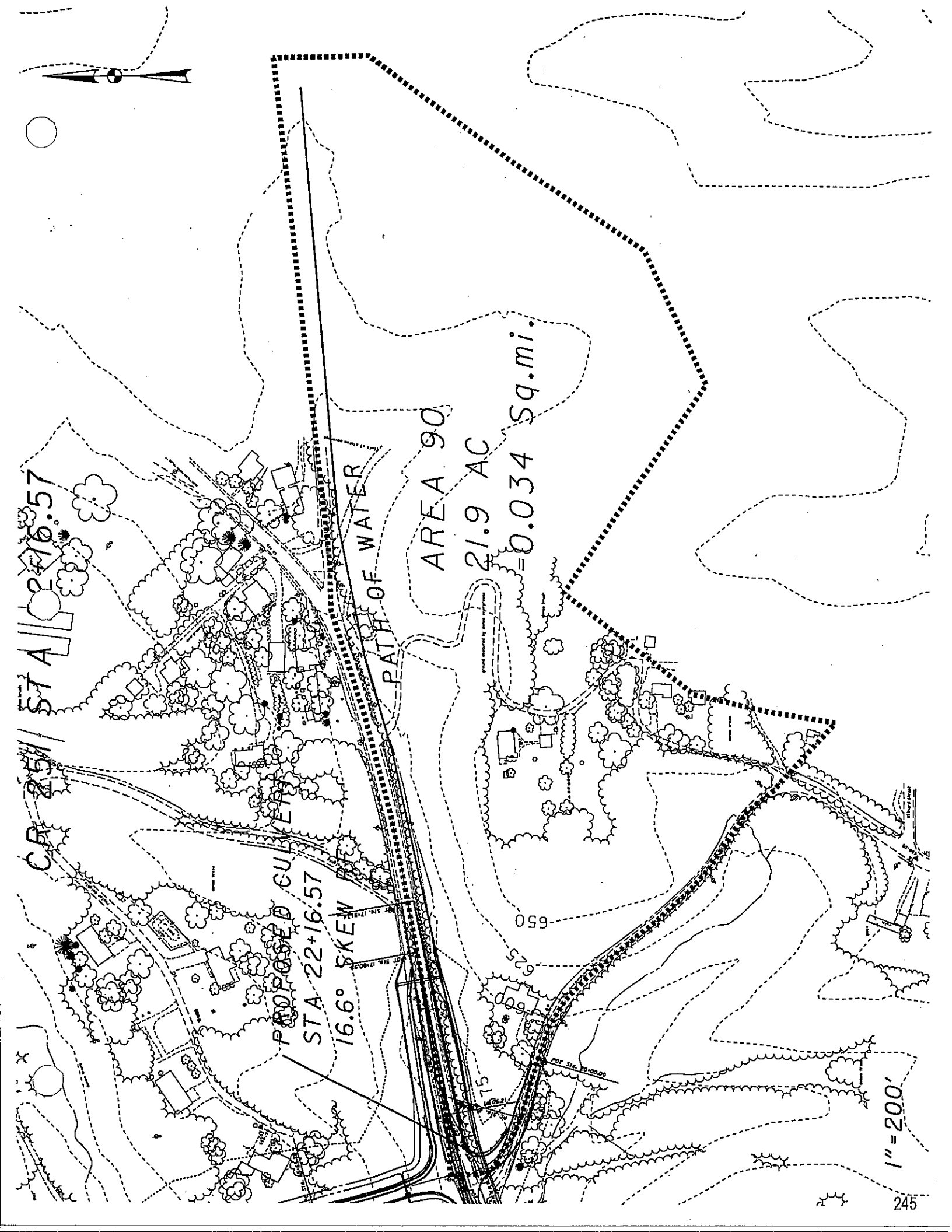
PROPOSED GULCH

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}



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

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.)
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

Entrance Loss (Ke) : 0.20
Entrance Loss (Ke) : 0.90



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"

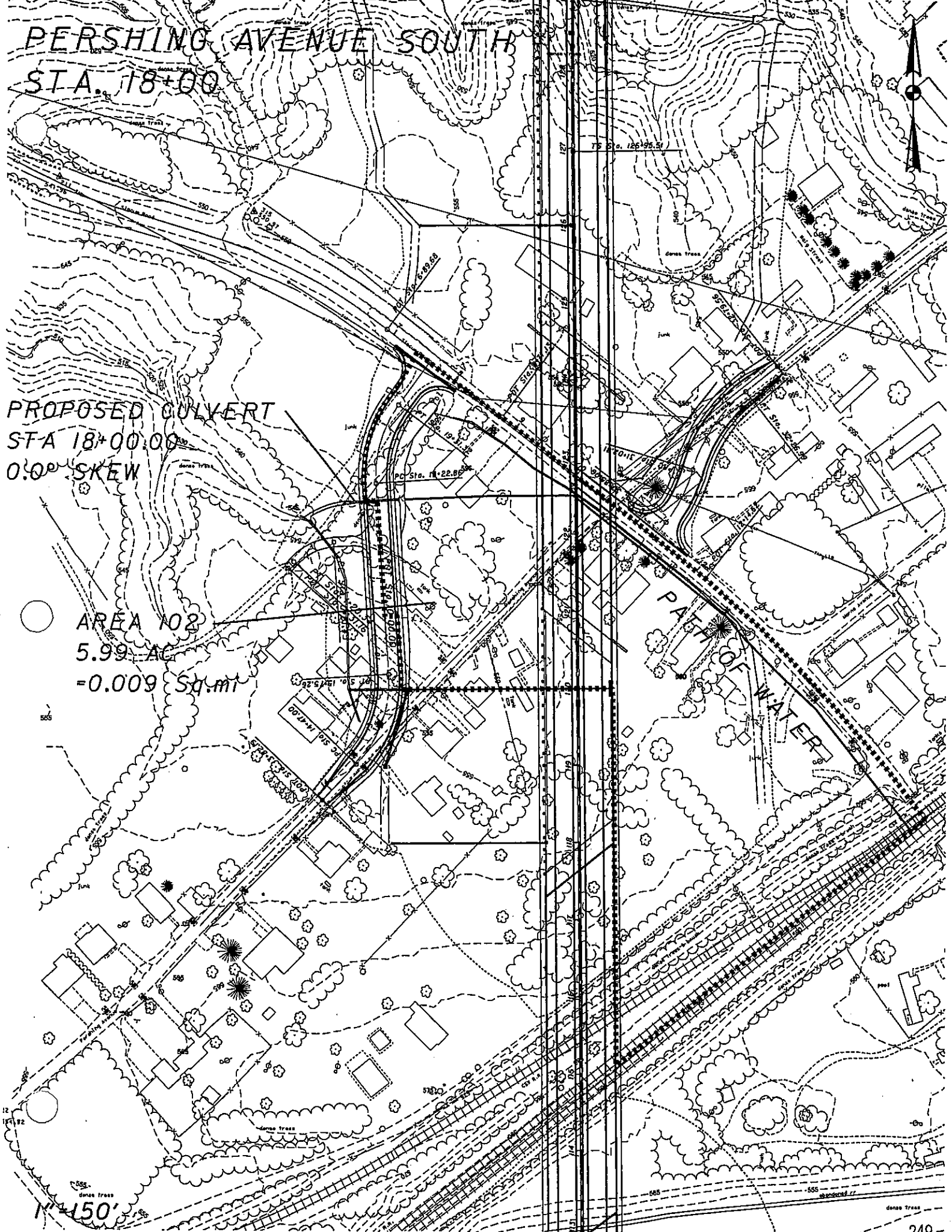
PERSHING AVENUE SOUTH

STA. 18+00

PROPOSED CULVERT
STA 18+00.00
0.00° SKEW

AREA 02
5.99 AC
= 0.009 Sq. mi

PATROL WATER



Client: ODOT Sheet: of



Subject: Pipe Culvert Calculations
@ STA 18+00 PERSHING SOUTH

Order No:

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	13376	0.31	0.9
Non-paved Area	247760	5.69	0.45
Other			
Total Area		5.99 acres	Weighted "C" = 0.47

Overland Flow

	Length	High Elevation	Low Elevation	Slope %	t_b	t_c
	0	0	0	0	0.00 (1101.2.2)	
	864	589.71	547	4.943287	0.00 Compare with Fig 1101-1	Negligible

Shallow Concentrated Flow

	Length	High Elevation	Low Elevation	Slope %	k	V	t_s
	864	589.71	547	4.943287	0.457 (Grassed waterways - Table 1101-1)		
					3.333729 (1101.2.2)		
					4.319487 (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	5.994845	10.00	0.47	3.80	10.79
5 Years	118.822	18.7	0.969	5.99	10.00	0.47	4.59	13.03
10 Years	112.172	16.8	0.923	5.994845	10.00	0.47	5.39	15.29
25 Years	198.92	19.3	1.004	5.994845	10.00	0.47	6.70	18.99
50 Years	206.025	19.6	0.99	5.994845	10.00	0.47	7.20	20.42
100 Years	355.551	23.199	1.076	5.994845	10.00	0.47	8.21	23.27

Worksheet for PERSS STA 18+00

Project Description

Friction Method Manning Formula
Solve For Normal Depth

Input Data

Roughness Coefficient	0.040	
Channel Slope	0.07800	ft/ft
Left Side Slope	2.00	ft/ft (H:V)
Right Side Slope	3.00	ft/ft (H:V)
Bottom Width	4.00	ft
Discharge	15.29	ft ³ /s

Results

Normal Depth	0.51	ft
Flow Area	2.71	ft ²
Wetted Perimeter	6.77	ft
Top Width	6.57	ft
Critical Depth	0.66	ft
Critical Slope	0.03052	ft/ft
Velocity	5.64	ft/s
Velocity Head	0.49	ft
Specific Energy	1.01	ft
Froude Number	1.55	
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	0.51	ft
Critical Depth	0.66	ft
Channel Slope	0.07800	ft/ft
Critical Slope	0.03052	ft/ft



UNIVERSAL CULVERT DESIGN

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

Description : Drainage area 102, Sta. 18+00, 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.) : 547.15 **Outlet Invert Elevation (ft.) :** 544.51 **Tailwater Elevation (ft.) :** 545.97 ^{545.97} _{545.97} **Overflow Elevation (ft.) :** 551.59
Allowable Headwater Elevation (ft.) : 550.59 **or Diameter + 2 ft.** *(whichever is less)*
Pipe Length (ft.) : 67.00 **Culvert Slope (ft./ft.) :** 0.0394 **Design Manning 'n' :** 0.0120
Design Discharge (cfs) : 15.29 **@ 10 yrs.** **Flood Discharge (cfs) :** 18.99 **@ 25 yrs.**

FLOW PIPE #	PIPE	CULVERT SIZE	HWI	HWO	FLOW TYPE	VELOCITY (fps.)	DN	DC	MANNING N	HEADWATER CONTROL	OVER FLOW (cfs.)	DESIGN CODE	BURIAL DEPTH (ft.)
15.29	1	18 in.	550.51	548.57	2 - E	13.73	0.90	1.41	0.0120	INLET	0.00	D	0.00
13.19	1	15 in.	552.76	552.04	2 - H	12.88	0.97	1.23	0.0120	INLET	2.10	D - 1	0.00
8.59	1	12 in.	579.36	563.49	2 - G	10.94	1.00	0.99	0.0120	OUTLET	6.70	D - 2	0.00
15.29	1	21 in.	549.62	547.39	2 - E	13.79	0.82	1.45	0.0120	INLET	0.00	D + 1	0.00
18.59	1	18 in.	551.73	550.00	2 - E	14.27	1.04	1.46	0.0120	INLET	0.40	F	0.00
13.19	1	15 in.	556.24	555.34	2 - H	12.88	0.97	1.23	0.0120	INLET	5.80	F - 1	0.00
8.59	1	12 in.	668.12	572.99	2 - G	10.94	1.00	0.99	0.0120	OUTLET	10.40	F - 2	0.00
18.99	1	21 in.	550.30	548.15	2 - E	14.54	0.93	1.57	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)

15.29	1	21 in.	550.27	549.56	2 - E	7.78	1.33	1.45	0.0248	INLET	0.00	D	0.00
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UNIVERSAL CULVERT DESIGN

FLOW 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.)
13.29 1	18 in.	551.76	553.36	7.58	1.50	1.36	0.0249	OUTLET	2.00	D-1	0.00
8.39 1	15 in.	555.81	564.35	6.84	1.25	1.13	0.0250	OUTLET	6.90	D-2	0.00
15.29 1	24 in.	549.56	548.01	8.00	1.17	1.41	0.0247	INLET	0.00	D+1	0.00
18.99 1	21 in.	551.36	551.49	8.34	1.75	1.57	0.0248	OUTLET**	0.00	F	0.00
13.29 1	18 in.	553.51	557.39	7.58	1.50	1.36	0.0249	OUTLET	5.70	F-1	0.00
8.39 1	15 in.	567.53	574.33	6.84	1.25	1.13	0.0250	OUTLET	10.60	F-2	0.00
18.99 1	24 in.	550.22	549.07	8.36	1.36	1.57	0.0247	INLET	0.00	F+1	0.00
Corrugated Metal Pipe (3 x 1 in. corrugations)											
15.29 1	36 in.	548.96	N/A	7.20	1.02	1.25	0.0281	INLET	0.00	D	0.00
15.29 1	42 in.	548.85	N/A	7.16	0.96	1.19	0.0278	INLET	0.00	D+1	0.00
18.99 1	36 in.	549.20	N/A	7.65	1.15	1.40	0.0281	INLET	0.00	F	0.00
18.99 1	42 in.	549.07	N/A	7.61	1.07	1.33	0.0278	INLET	0.00	F+1	0.00
Corrugated Metal Pipe (6 x 2 in. corrugations)											
15.29 1	60 in.	548.60	N/A	6.07	0.93	1.07	0.0332	INLET	0.00	D	0.00
15.29 1	66 in.	548.55	N/A	6.03	0.90	1.05	0.0330	INLET	0.00	D+1	0.00
18.99 1	60 in.	548.79	N/A	6.47	1.03	1.20	0.0332	INLET	0.00	F	0.00
18.99 1	66 in.	548.73	N/A	6.43	1.00	1.17	0.0330	INLET	0.00	F+1	0.00
7.65 2	60 in.	548.17	N/A	4.95	0.66	0.76	0.0332	INLET	0.00	D	0.00
7.65 2	66 in.	548.17	N/A	4.89	0.65	0.74	0.0330	INLET	0.00	D+1	0.00
9.50 2	60 in.	548.28	N/A	5.28	0.74	0.84	0.0332	INLET	0.00	F	0.00
9.50 2	66 in.	548.26	N/A	5.23	0.72	0.82	0.0330	INLET	0.00	F+1	0.00
Corrugated Metal Pipe (6 x 2 in. corrugations, Field Paved Invert)											
15.29 1	60 in.	548.60	N/A	7.22	0.82	1.07	0.0260	INLET	0.00	D	0.00
15.29 1	66 in.	548.55	N/A	7.12	0.80	1.05	0.0260	INLET	0.00	D+1	0.00

USE 2A



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.)
18.99	1	60 in.	548.79	N/A	1 - C	7.69	0.92	1.20	0.0260	INLET	0.00	F	0.00
18.99	1	66 in.	548.73	N/A	1 - C	7.60	0.89	1.17	0.0260	INLET	0.00	F + 1	0.00
7.65	2	60 in.	548.17	N/A	1 - C	5.87	0.59	0.76	0.0260	INLET	0.00	D	0.00
7.65	2	66 in.	548.17	N/A	1 - C	5.79	0.58	0.74	0.0260	INLET	0.00	D + 1	0.00
9.50	2	60 in.	548.28	N/A	1 - C	6.26	0.65	0.84	0.0260	INLET	0.00	F	0.00
9.50	2	66 in.	548.26	N/A	1 - C	6.17	0.64	0.82	0.0260	INLET	0.00	F + 1	0.00

Diameter exceeds 1.25 HWA

DRIVEWAY AT PERSHING AVENUE SOUTH

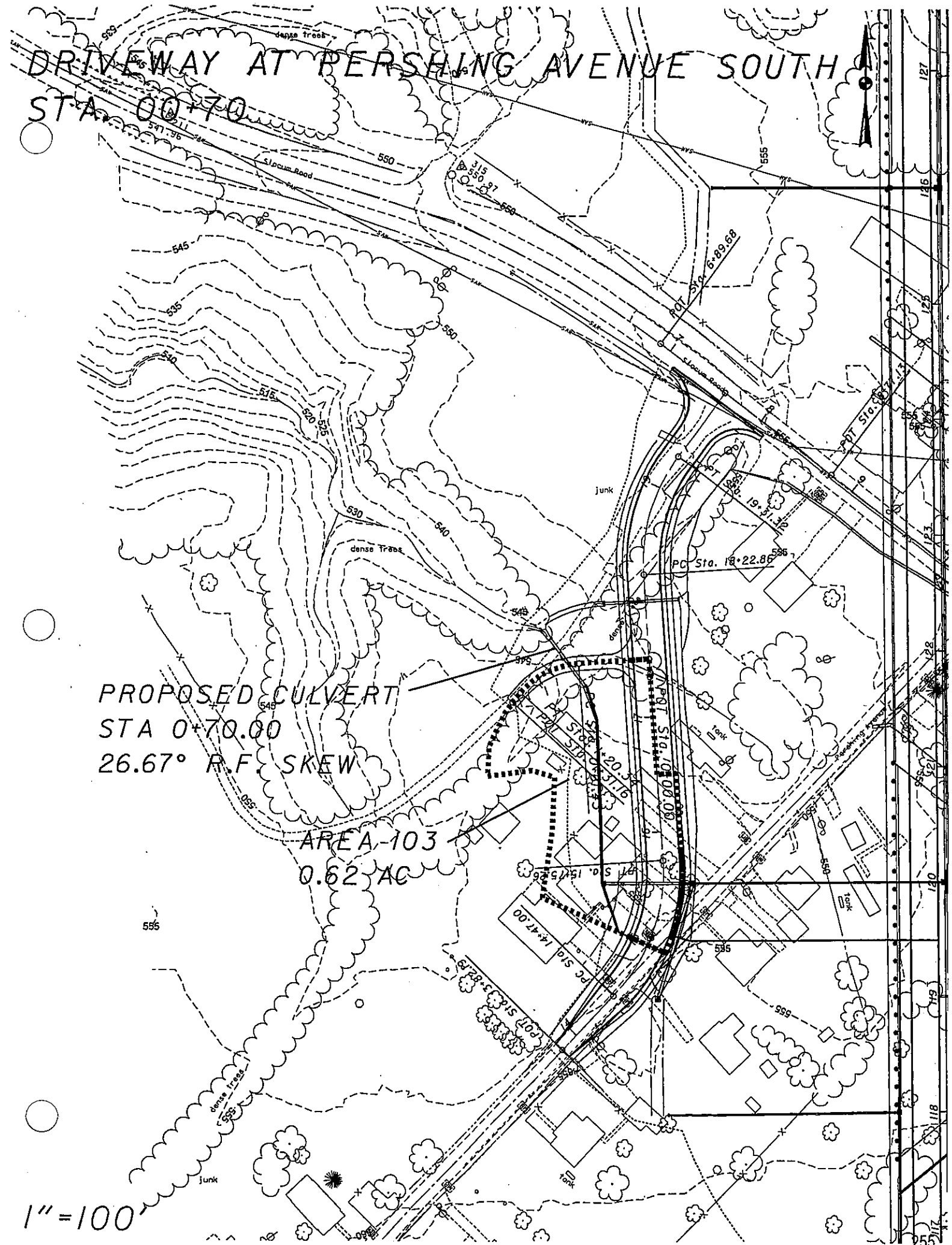
STA. 00+70



PROPOSED CULVERT
STA 0+70.00
26.67° R.F. SKEW

AREA-103
0.62 AC

1" = 100'



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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 #	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

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)

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

Corrugated Metal Pipe (3 x 1 in. corrugations)



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.)
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)												
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
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)												
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
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

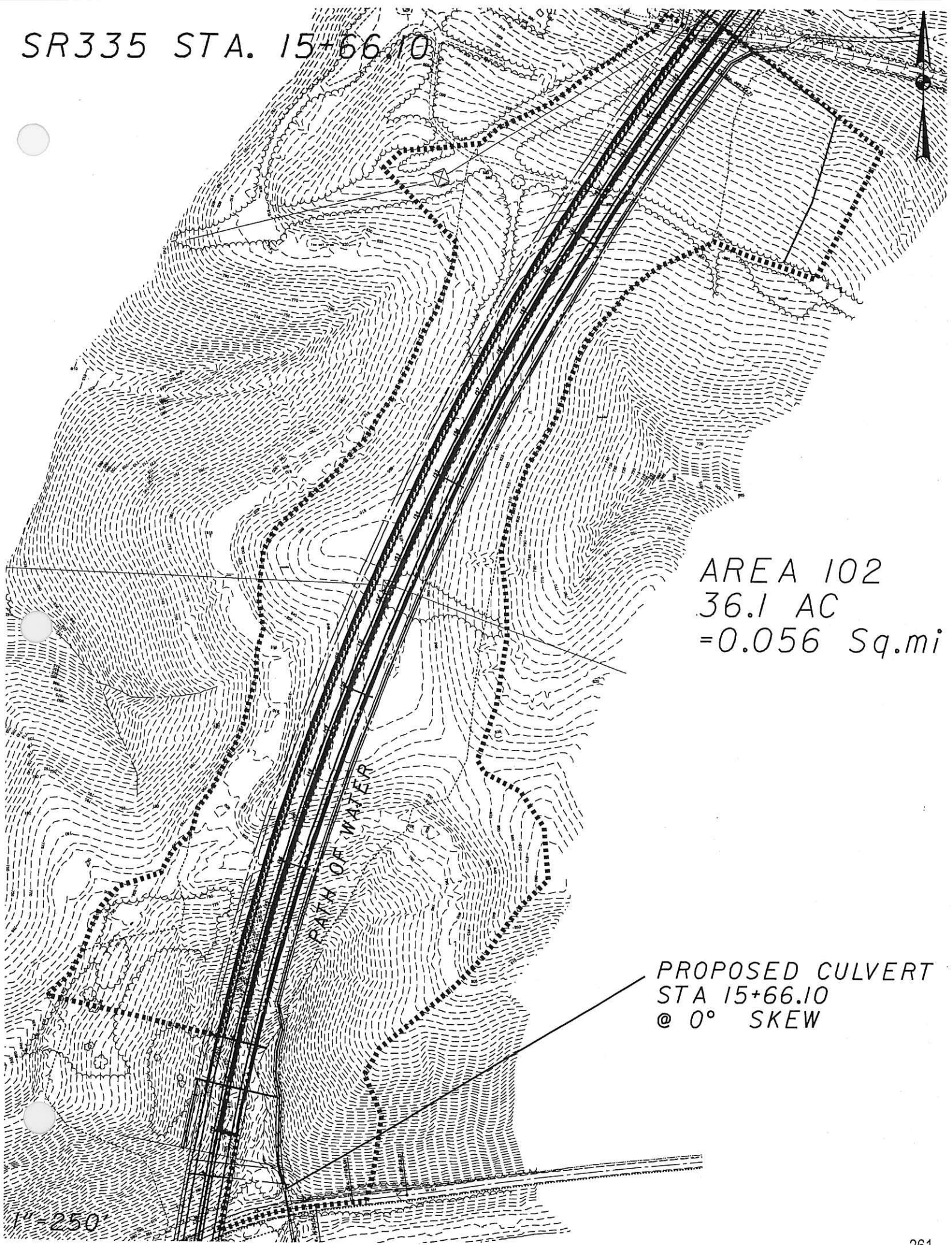
Culvert Type : Circular Corrugated **Pipe Length (ft.) :** 52.00 **Culvert Slope (ft./ft.) :** 0.0500
Corrugation Type : Corrugated Metal Pipe (2 2/3 x 1/2 in. corrugations)

Pipe Size : 24 in. ✓
Design Manning 'n' : (default)

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

FLOW LOSS (cfs.)	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.)
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

SR335 STA. 15+66.10



AREA 102
36.1 AC
= 0.056 Sq.mi

PROPOSED CULVERT
STA 15+66.10
@ 0° SKEW

1" = 250'

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}

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 #	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													
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

CDSS 1.0.0.3. SR335_15+66.10.xml 1

USE 42" CONC PIPE



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.)
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 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

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.)	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)			(in./hr.)	(yrs.)	(min.)	(fps.)	sq.ft.)	(cfs.)	(ft.)	(ft.)	(ft.)	(ft.)	(ft.)	(ft.)	(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 Location : PORTSMOUTH, SCIOTO COUNTY Designer : MDC
 Description : US52 A, STA. 44+50 TO STA. 62+50, RHS

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	BACK SLOPE	AREA (ft./ft.)	AREA SUM (acres)	CA COEFF.	PROTECT TYPE	RAIN INT. (in./hr.)	STORM FREQ. (yrs.)	MANN. COEFF.	TIME (min.)	FLOW (cfs.)	DESIGN 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	11.88
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 Designer : MDC
 Description : SR140 A, STA. 68+50 TO STA. 64+00, RHS

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.)	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.)	(fps.)	(cfs.)	(ft.)	(cfs.)	(ft.)	(ft.)	(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 Location : PORTSMOUTH, SCIOTO COUNTY Designer : MDC
 Description : SR140 A, STA. 68+50 TO STA. 69+00, RHS

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	FLOW	FLOW	FLOW	FLOW	FLOW	FLOW	
BEGIN	END	(ft.)	SLOPE	SLOPE	(ft./ft.)	(acres)	SUM	COEFF.	(Sum)	TYPE	INT.	FREQ.	COEFF.	FLOW	FLOW	(lbs./	sq.ft.)	DEPTH	FLOW	FLOW	FLOW	FLOW	FLOW	FLOW	FLOW	
		(ft./ft.)	(ft./ft.)	(ft./ft.)	(acres)	(acres)	(in./hr.)	(yrs.)	(in./hr.)	(min.)	(fps.)	(min.)	(min.)	(min.)	(min.)	(cfs.)	(cfs.)	(ft.)	(ft.)	(ft.)	(ft.)	(ft.)	(ft.)	(ft.)	(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 Designer : MDC
 Description : SR823, STA. 96+00 TO STA. 69+50, RHS

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 BEGIN	STATION END	SIDE LENGTH (ft.)	RADIUS (ft.)	IN SLOPE (ft./ft.)	BACK 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.)	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			
76+00	69+50	R	650.00	10.00	3.00	1.00	0.0730	4.24	15.58	0.74	11.41	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 Designer : MDC
 Description : SR823, STA. 96+00 TO STA. 105+00, RHS

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.)	AREA (acres)	AREA SUM (acres)	CA PROTECT TYPE	RAIN INT. (in./hr.)	STORM FREQ. (yrs.)	MANN. COEFF. (lbs./sq.ft.)	TIME FLOW (min.)	VEL. FLOW (fps.)	SHEAR DESIGN (cfs.)	DEPTH FLOW (ft.)	WIDTH FLOW (ft.)				
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 **Location :** PORTSMOUTH, SCIOTO COUNTY
Description : SR823, STA. 105+50 TO STA. 107+00, RHS **Designer :** MDC

Rainfall Area : D

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

Allowable Shears

(*) 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 SUM (acres)	PROTECT TYPE	RUNOFF COEFF. (Sum)	RAIN INT. (in./hr.)	STORM FREQ. (yrs.)	MANN. COEFF. (min.)	TIME FLOW (fps.)	VEL. FLOW (lbs./sq.ft.)	SHEAR DESIGN FLOW (cfs.)	DEPTH FLOW (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 Location : PORTSMOUTH, SCIOTO COUNTY Designer : MDC
 Description : SR823, STA. 118+50 TO STA. 120+50, RHS

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	BEGIN	END	SIDE LENGTH (ft.)	RADIUS (ft.)	IN SLOPE (ft./ft.)	BACK SLOPE (ft./ft.)	AREA (acres)	CA PROTECT COEFF. (Sum)	RAIN INT. (in./hr.)	STORM FREQ. (yrs.)	MANN. TIME (min.)	VEL. FLOW (fps.)	SHEAR (sq.ft.)	DEPTH (ft.)	WIDTH (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 **Location :** PORTSMOUTH, SCIOTO COUNTY
Description : SR823, STA. 124+50 TO STA. 128+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	AREA	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.)	(min.)	(fps.)	sq.ft.)	(cfs.)	(ft.)	(ft.)	
124+50	128+50	R	400.00	12.00	3.00	3.00	0.0538	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
 Description : SR823, STA. 131+50 TO STA. 129+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)	CA TYPE	PROTECT INT. (ft./hr.)	RAIN FREQ. (yrs)	STORM COEFF. (min.)	MANN. FLOW (cfs.)	TIME (min.)	VEL. (fps.)	SHEAR (sq.ft.)	DESIGN FLOW (cfs.)	DEPTH (ft.)	WIDTH (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 Designer : MDC
 Description : SR823, STA. 166+00 TO STA. 140+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 BEGIN END	SIDE LENGTH (ft.)	RADIUS (ft.)	BACK SLOPE (ft./ft.)	AREA (acres)	CA SUM (acres)	PROTECT TYPE	RAIN INT. (in./hr.)	STORM FREQ. (yrs.)	MANN. COEFF.	TIME (min.)	VEL. FLOW (fps.)	SHEAR FLOW (sq.ft.)	DEPTH FLOW (cfs.)	WIDTH FLOW (ft.)					
166+00 161+00	R	500.00	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+00 155+00	R	600.00	10.00	3.00	0.50	0.0363	2.62	4.76	3.63	Seed	4.12	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	7.77	5.91	Seed	3.19	5	0.030	23.11	5.16	1.07	18.86	0.34	11.21
										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	3.17	5	0.040	23.42	4.29	1.27	18.73	0.41	11.43
										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
150+00 146+00	R	400.00	10.00	3.00	0.50	0.0500	2.54	10.31	7.84	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 SLOPE (ft./ft.)	BACK SLOPE (ft./ft.)	AREA (acres)	AREA SUM (acres)	RUNOFF CA 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.)
146+00	300.00	10.00	3.00	0.50	0.0500	1.17	11.48	0.80	8.78	5	0.040	24.83	4.70	1.48	24.07	0.47	11.65
										5	0.040	24.83	4.70	1.48	24.07	0.47	11.65
										10	0.040	24.96	4.97	1.62	28.09	0.52	11.81
										5	0.030	25.68	5.84	1.31	26.45	0.42	11.48
										5	0.040	25.85	4.86	1.56	26.35	0.50	11.75
										5	0.040	25.85	4.86	1.56	26.35	0.50	11.75
										5	0.040	25.85	4.86	1.56	26.35	0.50	11.75
										10	0.040	25.92	5.13	1.71	30.79	0.55	11.92
143+00	100.00	10.00	4.00	2.00	0.0760	4.36	15.84	0.70	11.83	5	0.030	26.08	7.21	2.06	35.33	0.43	12.60
										5	0.040	26.13	5.97	2.43	35.30	0.51	13.07
										5	0.040	26.13	5.97	2.43	35.30	0.51	13.07
										5	0.040	26.13	5.97	2.43	35.30	0.51	13.07
										5	0.040	26.13	5.97	2.43	35.30	0.51	13.07
										5	0.040	26.13	5.97	2.43	35.30	0.51	13.07
										10	0.040	26.19	6.30	2.66	41.25	0.56	13.36
142+00	100.00	15.00	4.00	2.00	0.1800*	12.37	28.21	0.89	22.84	5	0.030	26.28	10.69	4.41	67.89	0.39	17.36
										5	0.040	26.31	8.90	5.22	67.85	0.46	17.79
										5	0.040	26.31	8.90	5.22	67.85	0.46	17.79
										5	0.040	26.31	8.90	5.22	67.85	0.46	17.79
										5	0.040	26.31	8.90	5.22	67.85	0.46	17.79
										5	0.040	26.31	8.90	5.22	67.85	0.46	17.79
										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.)	(cfs.)	(ft.)	FLOW
		(ft.)	(ft./ft.)	(ft./ft.)	(acres)			(yrs.)	(in./hr.)										FLOW
		(ft.)	(ft./ft.)	(ft./ft.)	(acres)			(yrs.)	(in./hr.)										(ft.)
								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 Location : PORTSMOUTH, SCIOTO COUNTY Designer : MDC
 Description : SR823, STA. 166+00 TO STA. 168+50, 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 BEGIN	STATION END	SIDE LENGTH (ft.)	RADIUS (ft.)	IN SLOPE (ft./ft.)	BACK 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 (ft.)	DEPTH FLOW (ft.)	WIDTH FLOW (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

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 GRADE (ft./ft.)	AREA (acres)	AREA SUM (acres)	CA TYPE	PROTECT TYPE	RAIN INT. (in./hr.)	STORM FREQ. (yrs.)	MANN. COEFF. (min.)	FLOW (fps.)	DESIGN FLOW (cfs.)	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				



DITCH ANALYSIS

PID : 77366 **Date :** 07/02/2007 **Project :** SCI-823-0.00 **Location :** PORTSMOUTH, SCIOTO COUNTY **Designer :** MDC
Description : SR823, STA. 179+00 TO STA. 177+00, RHS

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.)	SLOPE	SLOPE	(ft./ft.)	(acres)	SUM	COEFF.	(Sum)	TYPE	INT.	FREQ.	COEFF.	FLOW	FLOW	(lbs./	FLOW	DEPTH	FLOW	FLOW	
		(ft./ft.)	(ft./ft.)	(ft./ft.)	(acres)	(acres)	(acres)	(Sum)	(in./hr.)	(yrs.)	(min.)	(min.)	(min.)	(min.)	(min.)	(min.)	(min.)	(min.)	(min.)	(min.)	(min.)
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 Location : PORTSMOUTH, SCIOTO COUNTY
 Description : SR823, STA. 179+00 TO STA. 182+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 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.)	(in./hr.)	(min.)	(min.)	(fps.)	sq.ft.)	(cfs.)	(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 **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)	RUNOFF COEFF. (Sum)	CA TYPE	PROTECT TYPE	RAIN INT. (in./hr.)	STORM FREQ. (yrs.)	MANN. COEFF. (min.)	TIME VEL. (fps.)	SHEAR FLOW (lbs./sq.ft.)	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	
186+50 185+00	R	150.00	10.00	2.00	2.00	0.0367	1.31	21.81	0.78	15.58	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

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 BEGIN END	SIDE LENGTH (ft.)	RADIUS (ft.)	IN SLOPE (ft./ft.)	BACK SLOPE (ft./ft.)	GRADE (ft./ft.)	AREA (acres)	AREA SUM (acres)	CA PROTECT TYPE	RUNOFF COEFF. (Sum)	SEED	RAIN INT. (in./hr.)	STORM FREQ. (yrs.)	MANN. COEFF. (min.)	TIME FLOW (fps.)	VEL. FLOW (lbs./sq.ft.)	SHEAR DESIGN FLOW (cfs.)	DEPTH FLOW (ft.)	WIDTH FLOW (ft.)			
207+00	209+00	R	200.00	10.00	3.00	3.00	0.2905*	3.03	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 **Location :** PORTSMOUTH, SCIOTO COUNTY
Description : SR823, STA. 229+00 TO STA. 210+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	(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.)	(fps.)	(sq.ft.)	(cfs.)	(ft.)	(ft.)	(ft.)	(ft.)
229+00	212+50	R	1650.0	10.00	3.00	0.50	0.0300	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	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	AREA	RUNOFF	CA	PROTECT	RAIN	STORM	MANN.	TIME	VEL.	SHEAR	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.)	(acres)			(in./hr.)	(yrs.)	(min.)	(min.)	(min.)	(min.)	(min.)	(fps.)	sq.ft.)	(cfs.)	(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	16.46	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 **Location :** PORTSMOUTH, SCIOTO COUNTY
Description : SR823, STA. 264+00 TO STA. 271+50, 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 BEGIN END	SIDE LENGTH (ft.)	RADIUS (ft.)	IN SLOPE (ft./ft.)	BACK SLOPE (ft./ft.)	GRADE (ft./ft.)	AREA (acres)	AREA (acres)	RUNOFF SUM	CA COEFF.	PROTECT TYPE	RAIN INT.	STORM FREQ.	MANN. COEFF.	TIME (min.)	VEL. (fps.)	SHEAR FLOW sq.ft.)	DEPTH FLOW (ft.)	WIDTH FLOW (ft.)		
264+00	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	R	200.00	10.00	4.00	4.00	0.1475*	1.18	2.30	0.73	1.72	Seed	3.50	5	0.030	19.27	4.60	1.15	6.04	0.12	11.00
											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	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

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.)
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Perm, Type 3 4.02 10 0.040 20.08 6.01 3.32 9.09 0.14 11.01



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
Permanent Mat Type 1: 2.00
RCP Type B: 6.00

Temporary Mat: 1.00
Type 3: 5.00

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 (ft./ft.)	BACK SLOPE (ft./ft.)	GRADE 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 DEPTH (ft.)	DESIGN FLOW (cfs.)	WIDTH FLOW (ft.)				
274+00 283+00	R	900.00	10.00	3.00	0.50	0.0230	2.83	2.83	0.75	2.12	Seed	3.44	5	0.030	20.02	2.84	0.35	7.30	0.25	10.86
283+00 290+00	R	700.00	10.00	3.00	0.50	0.0226	4.14	6.97	0.78	5.35	Seed	3.96	10	0.040	20.67	2.50	0.46	8.40	0.32	11.11
290+00 291+00	R	100.00	10.00	3.00	3.00	0.2740*	1.68	8.65	0.71	6.55	Seed	3.20	5	0.030	22.95	3.88	0.58	17.14	0.41	11.44
											Jute Mat	3.16	5	0.040	23.55	3.21	0.68	16.90	0.49	11.70
											Temp. Mat	3.16	5	0.040	23.55	3.21	0.68	16.90	0.49	11.70
											Temp. Mat	3.66	10	0.040	24.03	3.38	0.75	19.56	0.53	11.85
											Seed	3.15	5	0.030	23.73	8.95	3.70	20.59	0.22	11.30
											Jute Mat	3.14	5	0.040	23.77	7.45	4.38	20.58	0.26	11.54
											Temp. Mat	3.14	5	0.040	23.77	7.45	4.38	20.58	0.26	11.54
											Perm, Type 1	3.14	5	0.040	23.77	7.45	4.38	20.58	0.26	11.54
											Perm, Type 2	3.14	5	0.040	23.77	7.45	4.38	20.58	0.26	11.54
											Perm, Type 3	3.14	5	0.040	23.77	7.45	4.38	20.58	0.26	11.54
											Perm, Type 3	3.64	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.)	WIDTH (ft.)	IN SLOPE (ft./ft.)	BACK SLOPE (ft./ft.)	GRADE (ft./ft.)	AREA (acres)	AREA (acres)	Coeff. (Sum)	CA TYPE	PROTECT (in./hr.)	RAIN (yrs.)	STORM (min.)	MANN. FREQ.	COEFF. (yrs.)	TIME (min.)	FLOW (cfs.)	VEL. (fps.)	SHEAR (lbs./sq.ft.)	DESIGN (cfs.)	DEPTH (ft.)	WIDTH (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 Location : PORTSMOUTH, SCIOTO COUNTY Designer : MDC
 Description : SR823, STA. 314+50 TO STA. 311+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 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.)	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 DESIGN FLOW (cfs.)	DEPTH FLOW (ft.)	WIDTH FLOW (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	5	0.030	16.00	4.27	1.02	4.80	0.11	10.65
												Jute Mat	5	0.040	16.20	3.57	1.20	4.77	0.13	10.77
												Temp. Mat	5	0.040	16.20	3.57	1.20	4.77	0.13	10.77
												Perm, Type 1	5	0.040	16.20	3.57	1.20	4.77	0.13	10.77
313+00	311+00	R	240.00	10.00	4.00	2.00	0.4667*	3.22	4.99	0.74	3.64	Seed	5	0.030	16.64	9.05	4.21	13.66	0.14	10.87
												Jute Mat	5	0.040	16.72	7.56	4.99	13.63	0.17	11.03
												Temp. Mat	5	0.040	16.72	7.56	4.99	13.63	0.17	11.03
												Perm, Type 1	5	0.040	16.72	7.56	4.99	13.63	0.17	11.03
												Perm, Type 2	5	0.040	16.72	7.56	4.99	13.63	0.17	11.03
												Perm, Type 3	5	0.040	16.72	7.56	4.99	13.63	0.17	11.03
												Perm, Type 3	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 Designer : MDC
 Description : SR823, STA. 314+50 TO STA. 322+00, RHS

Rainfall Area : D

Seed:	0.40	Allowable Shears		
Permanent Mat	Type 1:	Jute Mat:	0.45	Temporary Mat:
	2.00	Type 2:	3.00	Type 3:
RCP	Type B:			1.00
	6.00			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	CA	PROTECT	RAIN	STORM	MANN.	TIME	VEL.	SHEAR	DESIGN	DEPTH				
BEGIN	END	(ft.)	WIDTH	SLOPE	(ft./ft.)	(acres)	SUM	COEFF. (Sum)	TYPE	INT.	FREQ.	COEFF.	FLOW	FLOW	(lbs./sq.ft.)	FLOW	FLOW				
		(ft./ft.)	(ft./ft.)	(ft./ft.)		(acres)		(in./hr.)	(yrs.)	(min.)	(min.)	(min.)	(fps.)	(cfs.)	(cfs.)	(ft.)	(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
												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 Location : PORTSMOUTH, SCIOTO COUNTY Designer : mdc
 Description : SR823, STA. 325+00 TO STA. 329+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	DEPTH	WIDTH	FLOW	FLOW	FLOW	FLOW	
BEGIN	END	(ft.)	WIDTH	SLOPE	SLOPE	(ft./ft.)	(acres)	SUM	COEFF.	(Sum)	TYPE	INT.	FREQ.	COEFF.	FLOW	(lbs./	DESIGN	DEPTH	FLOW	FLOW	FLOW	FLOW	
		(ft./ft.)	(ft./ft.)	(ft./ft.)	(ft./ft.)	(acres)	(acres)	(acres)			(in./hr.)	(yrs.)	(min.)	(min.)	(fps.)	sq.ft.)	(cfs.)	(ft.)	(ft.)	(ft.)	(ft.)	(ft.)	(ft.)
325+00	327+50	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	328+00	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	328+50	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		
												Seed	3.55	5	0.030	18.80	8.90	3.85	22.70	0.16	15.99		
328+50	329+00	R	60.00	15.00	3.00	3.00	0.3750*	3.37	7.29	0.89	6.40	Seed	3.54	5	0.040	18.82	7.45	4.57	22.69	0.20	16.17		
												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	BACK SLOPE (ft./ft.)	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 sq.ft. (lbs./ sq.ft.)	DESIGN FLOW (cfs.)	DEPTH FLOW (ft.)	WIDTH FLOW (ft.)
										5	0.040	18.82	7.45	4.57	22.69	0.20	16.17
										5	0.040	18.82	7.45	4.57	22.69	0.20	16.17
										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 Designer : MDC
 Description : SR823, STA. 330+50 TO STA. 333+50, RHS

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	BEGIN	END	SIDE LENGTH (ft.)	RADIUS (ft.)	IN SLOPE (ft./ft.)	BACK SLOPE (ft./ft.)	GRADE (ft./ft.)	AREA (acres)	CA PROTECT (Sum)	RAIN INT. (in./hr.)	STORM FREQ. (yrs.)	MANN. COEFF. (min.)	TIME VEL. (fps.)	DESIGN FLOW (cfs.)	DEPTH (ft.)	WIDTH (ft.)	FLOW (cfs.)			
330+50	R	333+50	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

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 BEGIN END	SIDE LENGTH (ft.)	RADIUS (ft.)	IN SLOPE	BACK SLOPE	AREA (ft./ft.)	AREA (acres)	SUM COEFF.	CA (Sum)	PROTECT TYPE	RAIN INT.	STORM FREQ.	MANN. COEFF.	TIME (min.)	VEL. FLOW (fps.)	SHEAR DESIGN FLOW (cfs.)	DEPTH FLOW (ft.)	WIDTH FLOW (ft.)		
334+00 343+00	R	900.00	10.00	3.00	0.50	0.0446	2.08	2.08	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	3.34	5	0.030	21.17	7.03	2.71	8.24	0.11	10.57
										Seed	3.33	5	0.040	21.28	5.89	3.21	8.21	0.13	10.67
										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	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	FLOW	FLOW	FLOW		
		(ft.)	(ft./ft.)	(ft./ft.)	(ft./ft.)	(acres)	(acres)			(in./hr.)	(yrs.)	(min.)	(min.)	(fps.)	(cfs.)	(cfs.)	(ft.)	(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	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.)	(fps.)	sq.ft.)	(cfs.)	(ft.)	(ft.)	(ft.)	(ft.)	
348+00	352+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	SIDE LENGTH RADIUS (ft.)	IN	BACK SLOPE (ft./ft.)	AREA (acres)	AREA (acres)	CA	PROTECT	RAIN	STORM MANN.	TIME	VEL.	SHEAR DESIGN DEPTH	WIDTH								
BEGIN	END	(ft.)	WIDTH SLOPE (ft./ft.)	SUM COEFF. (Sum)	TYPE	TYPE	INT.	FREQ.	COEFF.	FLOW (cfs.)	FLOW (cfs.)	FLOW (cfs.)	FLOW (ft.)								
		(ft./ft.)	(ft./ft.)	(acres)	(in./hr.)	(yrs.)	(min.)	(fps.)	(sq.ft.)	(ft.)	(ft.)	(ft.)	(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 Location : PORTSMOUTH, SCIOTO COUNTY Designer : MDC
 Description : US52 B, STA. 45+00 TO STA. 44+50, LHS

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	BEGIN	END	SIDE LENGTH (ft.)	RADIUS (ft.)	IN SLOPE (ft./ft.)	BACK SLOPE (ft./ft.)	GRADE (ft./ft.)	AREA (acres)	AREA SUM (acres)	CA PROTECT TYPE	RAIN INT. (in./hr.)	STORM FREQ. (yrs.)	MANN. COEFF. (min.)	VEL. FLOW (fps.)	SHEAR DESIGN (sq.ft.)	DEPTH (ft.)	WIDTH (ft.)	FLOW (cfs.)			
44+00	44+50	L	50.00	10.00	3.00	0.50	0.0120	0.80	0.80	0.75	0.60	Seed	3.87	5	0.030	15.55	1.50	0.11	2.33	0.15	10.53
												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
Description : US52 B, STA. 45+00 TO STA. 60+50, LHS

Location : PORTSMOUTH, SCIOTO COUNTY
Designer : MDC

Rainfall Area : D

Seed: 0.40
Permanent Mat Type 1: 2.00
RCP Type B: 6.00
Temporary Mat: 1.00
Type 3: 5.00

Allowable Shears

Jute Mat: 0.45
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	END	SIDE LENGTH (ft.)	RADIUS (ft.)	IN SLOPE (ft./ft.)	BACK SLOPE (ft./ft.)	GRADE (ft./ft.)	AREA (acres)	AREA SUM (acres)	CA PROTECT TYPE	CA PROTECT TYPE	CA PROTECT TYPE	CA PROTECT TYPE	CA PROTECT TYPE	RAIN INT. (in./hr.)	STORM FREQ. (yrs.)	MANN. COEFF. (min.)	TIME VEL. (fps.)	SHEAR DESIGN (sq.ft.)	DEPTH (ft.)	WIDTH (ft.)	FLOW (cfs.)	FLOW (cfs.)	FLOW (cfs.)	FLOW (cfs.)	DEPTH (ft.)	WIDTH (ft.)	FLOW (cfs.)	FLOW (cfs.)			
45+00	L	47+00	200.00	10.00	3.00	0.50	0.0045	0.50	0.50	0.71	0.35	Seed	Seed	Seed	3.56	5	0.030	18.67	0.88	0.04	1.26	0.14	10.49	1.45	0.18	10.63	9.04	0.38	11.33	10.28	0.49	11.71
47+00	L	56+00	900.00	10.00	3.00	0.50	0.0082	3.62	4.12	0.72	2.96	Seed	Seed	Seed	3.05	5	0.030	25.04	2.23	0.20	9.04	0.38	11.33	9.04	0.38	11.33	10.28	0.49	11.71	10.28	0.49	11.71
56+00	L	59+50	350.00	10.00	3.00	0.50	0.0051	1.08	5.20	0.77	3.80	Seed	Seed	Seed	2.88	5	0.030	27.83	2.05	0.16	10.92	0.49	11.71	10.92	0.49	11.71	12.34	0.62	12.19	12.34	0.62	12.19
59+50	L	60+00	50.00	10.00	3.00	0.50	0.0580	0.08	5.28	0.70	3.85	Seed	Seed	Seed	2.87	5	0.030	28.01	4.43	0.87	11.04	0.24	10.84	11.04	0.24	10.84	11.03	0.28	10.99	11.03	0.28	10.99
60+00	L	60+50	85.00	10.00	3.00	0.50	0.3824*	0.60	5.89	0.87	4.38	Jute Mat	Jute Mat	Jute Mat	2.86	5	0.040	28.05	3.70	1.03	11.03	0.28	10.99	11.03	0.28	10.99	12.48	0.15	10.51	12.48	0.15	10.51
												Temp. Mat	Temp. Mat	Temp. Mat	2.86	5	0.040	28.05	3.70	1.03	11.03	0.28	10.99	11.03	0.28	10.99	12.48	0.15	10.51	12.48	0.15	10.51
												Perm. Type 1	Perm. Type 1	Perm. Type 1	2.86	5	0.040	28.05	3.70	1.03	11.03	0.28	10.99	11.03	0.28	10.99	12.48	0.15	10.51	12.48	0.15	10.51
												Perm. Type 1	Perm. Type 1	Perm. Type 1	3.24	10	0.040	29.79	3.87	1.11	12.47	0.31	11.07	12.47	0.31	11.07	12.48	0.15	10.51	12.48	0.15	10.51
												Seed	Seed	Seed	2.85	5	0.030	28.22	8.31	3.49	12.48	0.15	10.51	12.48	0.15	10.51	12.48	0.15	10.51	12.48	0.15	10.51
												Jute Mat	Jute Mat	Jute Mat	2.85	5	0.040	28.25	6.96	4.15	12.48	0.17	10.61	12.48	0.17	10.61	12.48	0.17	10.61	12.48	0.17	10.61



DITCH ANALYSIS

STATION	END	SIDE LENGTH (ft.)	RADIUS (ft.)	IN SLOPE (ft./ft.)	BACK SLOPE (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 (ft.)
									Temp, Mat	2.85	5	0.040	28.25	6.96	4.15	12.48	0.17	10.61
									Perm, Type 1	2.85	5	0.040	28.25	6.96	4.15	12.48	0.17	10.61
									Perm, Type 2	2.85	5	0.040	28.25	6.96	4.15	12.48	0.17	10.61
									Perm, Type 3	2.85	5	0.040	28.25	6.96	4.15	12.48	0.17	10.61
									Perm, Type 3	3.22	10	0.040	29.98	7.30	4.47	14.11	0.19	10.68



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
 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)			(in./hr.)	(min.)	(min.)	(min.)	(min.)	(min.)	(min.)	(min.)	(min.)	(min.)	
68+00	61+00	L	700.00	10.00	3.00	0.50	0.0444	3.94	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
 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)	(in./hr.)	(yrs.)	(in./hr.)	(min.)	(fps.)	(sq.ft.)	(cfs.)	(ft.)	(ft.)	(ft.)	(ft.)	(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 Designer : MDC
 Description : SR140 B, STA. 73+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	STATION END	SIDE LENGTH (ft.)	RADIUS (ft.)	IN SLOPE (ft./ft.)	BACK SLOPE (ft./ft.)	GRADE (ft./ft.)	AREA (acres)	AREA SUM (acres)	CA PROTECT TYPE	RUNOFF COEFF. (Sum)	RAIN INT. (in./hr.)	STORM FREQ. (yrs.)	MANN. COEFF. (min.)	FLOW FREQ. (fps.)	DESIGN FLOW (cfs.)	DEPTH (ft.)	WIDTH (ft.)		
73+00	68+50	L	450.00	10.00	3.00	0.50	0.0756	1.29	0.74	0.95	Seed	5	0.030	17.36	3.09	0.53	3.51	0.11	10.39
											Jute Mat	5	0.040	17.82	2.58	0.62	3.47	0.13	10.46
											Temp. Mat	5	0.040	17.82	2.58	0.62	3.47	0.13	10.46
											Temp. Mat	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

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	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 VEL. (fps.)	SHEAR DESIGN (lbs./sq.ft.)	DEPTH (ft.)	WIDTH (ft.)	FLOW (cfs.)	FLOW (cfs.)	FLOW (ft.)
73+00	L	73+50	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

PID : 77366 Date : 07/02/2007 Project : SCI-823-0.00 Location : PORTSMOUTH, SCIOTO COUNTY Designer : MDC
 Description : SR140 B, STA. 96+00 TO STA. 73+50, LHS

Rainfall Area : D

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

Allowable Shears

Jute Mat: 0.45
 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	END	SIDE LENGTH (ft.)	RADIUS (ft.)	IN WIDTH (ft./ft.)	BACK SLOPE (ft./ft.)	GRADE (ft./ft.)	AREA (acres)	AREA SUM (acres)	RUNOFF CA COEFF. (Sum)	PROTECT TYPE	RAIN INT. (in./hr.)	STORM FREQ. (yrs.)	MANN. COEFF. (min.)	TIME FLOW (fps.)	VEL. FLOW (lbs./sq.ft.)	SHEAR DESIGN FLOW (cfs.)	DEPTH FLOW (ft.)			
96+00	86+00	L	1000.0	10.00	3.00	0.50	0.0203	2.93	2.93	0.75	2.20	Seed	3.38	5	0.030	20.73	2.75	0.33	7.41	0.26	10.90
86+00	75+00	L	1100.0	10.00	3.00	0.50	0.0505	4.48	7.40	0.76	5.60	Seed	3.88	10	0.040	21.48	2.42	0.42	8.52	0.33	11.17
												Seed	3.11	5	0.030	24.27	5.03	1.03	17.39	0.33	11.15
												Jute Mat	3.06	5	0.040	24.97	4.17	1.21	17.12	0.39	11.35
												Temp. Mat	3.06	5	0.040	24.97	4.17	1.21	17.12	0.39	11.35
												Perm, Type 1	3.06	5	0.040	24.97	4.17	1.21	17.12	0.39	11.35
												Perm, Type 1	3.54	10	0.040	25.51	4.39	1.32	19.80	0.42	11.47
75+00	74+50	L	50.00	10.00	3.00	2.00	0.1980*	0.09	7.49	0.76	5.67	Seed	3.05	5	0.030	25.08	7.62	2.66	17.29	0.22	11.08
												Jute Mat	3.05	5	0.040	25.10	6.36	3.15	17.28	0.26	11.28
												Temp. Mat	3.05	5	0.040	25.10	6.36	3.15	17.28	0.26	11.28
												Perm, Type 1	3.05	5	0.040	25.10	6.36	3.15	17.28	0.26	11.28
												Perm, Type 2	3.05	5	0.040	25.10	6.36	3.15	17.28	0.26	11.28
												Perm, Type 3	3.05	5	0.040	25.10	6.36	3.15	17.28	0.26	11.28



DITCH ANALYSIS

STATION BEGIN END	SIDE LENGTH (ft.)	RADIUS (ft.)	IN SLOPE	BACK SLOPE	AREA (ft./ft.)	AREA SUM	RUNOFF COEFF. (Sum)	CA TYPE	PROTECT RAIN INT.	RAIN FREQ.	STORM COEFF.	MANN. FLOW (min.)	TIME FLOW (fps.)	VEL. FLOW (lbs./ sq.ft.)	SHEAR 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	Perm, Type 3	3.53	10	0.040	25.63	6.71	3.44	19.99	0.28	11.39
												Seed	3.02	5	0.030	25.59	3.43	0.44	17.54	0.47	11.65
												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 Temporary Mat: 1.00
 Permanent Mat Type 1: 2.00 Type 2: 3.00
 RCP Type B: 6.00 Type 3: 5.00
 Jute Mat: .045

(* 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	(lbs./	sq.ft.)	FLOW	FLOW	
(ft.)	(ft./ft.)	(ft./ft.)	(ft./ft.)	(ft./ft.)	(ft./ft.)	(ft./ft.)	(acres)	(acres)	(Sum)	(in./hr.)	(yrs.)	(min.)	(min.)	(min.)	(fps.)	(cfs.)	(ft.)	(ft.)	(ft.)	
96+00	106+00	L	1000.0	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
											Seed	3.90	10	0.040	21.26	2.51	0.42	13.72	0.50	11.76
106+00	108+50	L	380.00	4.00	2.00	0.4060*	2.80	7.62	0.71	5.51	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

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.)	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 (ft.)	
111+50	110+50	L	100.00	10.00	4.00	4.00	0.0750	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

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	BACK SLOPE	AREA (ft./ft.)	AREA (acres)	SUM COEFF.	CA (Sum)	PROTECT TYPE	RAIN INT. (in./hr.)	STORM FREQ. (yrs.)	MANN. COEFF. (min.)	TIME FLOW (fps.)	VEL. FLOW (cfs.)	SHEAR FLOW (sq.ft.)	DEPTH FLOW (ft.)	WIDTH FLOW (ft.)		
118+00	119+00	L	100.00	4.00	4.00	0.0900	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 Location : PORTSMOUTH, SCIOTO COUNTY
 Description : SR823, STA. 125+50 TO STA. 125+00, LHS 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.)	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.)	(fps.)	sq.ft.)	(cfs.)	(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 **Location :** PORTSMOUTH, SCIOTO COUNTY
Description : SR823, STA. 125+50 TO STA. 129+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 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.)	WANN. COEFF. (min.)	TIME FLOW (fps.)	VEL. FLOW (lbs./sq.ft.)	SHEAR DEPTH FLOW (ft.)	WIDTH FLOW (ft.)			
125+50	L	50.00	10.00	4.00	4.00	0.0200	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	L	200.00	10.00	4.00	4.00	0.0450	1.84	0.78	1.58	Seed	4.48	10	0.040	15.94	0.88	0.09	0.65	0.07	10.57
128+00	L	50.00	10.00	2.00	2.00	0.5000*	0.36	0.72	1.83	Seed	3.70	5	0.030	16.88	3.15	0.49	5.89	0.17	11.40
										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
128+00	L	50.00	10.00	2.00	2.00	0.5000*	0.36	0.72	1.83	Seed	3.70	5	0.030	17.20	7.11	2.92	6.78	0.09	10.37
										Jute Mat	3.70	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	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.)	(acres)						(in./hr.)	(yrs.)	(min.)	(fps.)	sq.ft.)	(cfs.)	(ft.)	(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 **Location :** PORTSMOUTH, SCIOTO COUNTY
Description : SR823, STA. 166+00 TO STA. 139+50, 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	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	FLOW	FLOW		
		(ft./ft.)	(ft./ft.)	(ft./ft.)	(acres)	(acres)	(in./hr.)	(yrs.)	(min.)	(fps.)	(sq.ft.)	(cfs.)	(ft.)	(ft.)	(ft.)	(ft.)	(ft.)	(ft.)	(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 BEGIN	END	SIDE LENGTH (ft.)	RADIUS WIDTH (ft./ft.)	IN SLOPE (ft./ft.)	BACK GRADE AREA (acres)	AREA SUM (acres)	CA COEFF. (Sum)	PROTECT TYPE	RAIN INT. (in./hr.)	STORM FREQ. (yrs.)	MANN. FLOW (min.)	VEL. FLOW (fps.)	SHEAR sq.ft.	DESIGN FLOW (cfs.)	DEPTH FLOW (ft.)	WIDTH FLOW (ft.)	
										5	0.040	24.22	5.07	1.67	29.75	0.54	11.88
										10	0.040	23.72	5.38	1.85	35.20	0.59	12.07

Perm, Type 1 3.11 5 0.040 24.22 5.07 1.67 29.75 0.54 11.88

Perm, Type 1 3.68 10 0.040 23.72 5.38 1.85 35.20 0.59 12.07



DITCH ANALYSIS

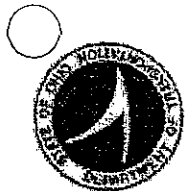
PID : 77366 **Date :** 07/02/2007 **Project :** SCI-823-0.00 **Location :** PORTSMOUTH, SCIOTO COUNTY
Description : SR823, STA. 166+00 TO STA. 166+50, LHS **Designer :** MDC

Rainfall Area : D

Allowable Shears		Jute Mat: 0.45	Temporary Mat: 1.00
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 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)	AREA SUM (acres)	RUNOFF COEFF. (Sum)	CA TYPE	PROTECT INT. (in./hr.)	RAIN FREQ. (yrs.)	STORM FLOW (cfs.)	MANN. FLOW (sq.ft.)	TIME (min.)	VEL. (fps.)	SHEAR DESIGN (lbs./sq.ft.)	DEPTH (ft.)	WIDTH (ft.)	
166+00	L	166+50	50.00	15.00	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
Description : SR823, STA. 167+50 TO STA. 166+50, LHS **Designer :** MDC

Rainfall Area : D

Allowable Shears

Seed: 0.40
Permanent Mat **Type 1:** 2.00 **Temporary Mat:** 1.00
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 (ft.)	BACK SLOPE (ft./ft.)	GRADE AREA (ft./ft.)	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 FLOW (ft.)	DESIGN FLOW (cfs.)	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 Location : PORTSMOUTH, SCIOTO COUNTY
 Description : SR823, STA. 167+50 TO STA. 175+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 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 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 (lbs./sq.ft.)	DESIGN FLOW (cfs.)	DEPTH FLOW (ft.)	WIDTH FLOW (ft.)		
167+50 L	600.00	10.00	3.00	0.50	0.0205	2.74	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 L	210.00	15.00	3.00	3.00	0.2857*	3.07	5.82	0.71	4.21	Seed	4.13	10	0.040	18.99	2.41	0.42	8.38	0.33	11.15
										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

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 WIDTH (ft.)	IN SLOPE (ft./ft.)	BACK SLOPE (ft./ft.)	AREA (acres)	AREA SUM (acres)	CA COEFF. (Sum)	PROTECT TYPE	RAIN INT. (in./hr.)	STORM FREQ. (yrs.)	MANN. COEFF.	TIME FLOW (min.)	VEL. FLOW (fps.)	SHEAR FLOW (sq.ft.)	DESIGN FLOW (cfs.)	DEPTH FLOW (ft.)	WIDTH FLOW (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
177+00	L	150.00	15.00	2.00	2.00	0.2133*	2.66	4.72	0.71	3.54	Seed	3.04	5	0.040	25.32	3.20	0.91	5.00	0.15	10.61
											Jute 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
											Temp. Mat	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 Location : PORTSMOUTH, SCIOTO COUNTY
 Description : SR823, STA. 178+00 TO STA. 185+00, LHS 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)	AREA SUM (acres)	CA PROTECT TYPE	RUNOFF COEFF. (Sum)	RAIN INT. (in./hr.)	STORM FREQ. (yrs.)	MANN. COEFF.	TIME (min.)	VEL. FLOW (fps.)	SHEAR (sq.ft.)	DESIGN FLOW (cfs.)	DEPTH (ft.)	WIDTH (ft.)
178+00	182+50	L	450.00	10.00	3.00	1.00	0.0324	2.71	0.73	1.98	Seed	5	0.030	17.32	3.15	0.45	7.29	0.22	10.89
											Jute Mat	5	0.040	17.78	2.62	0.53	7.20	0.26	11.04
											Temp. Mat	5	0.040	17.78	2.62	0.53	7.20	0.26	11.04
											Temp. Mat	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	0.72	3.20	Seed	5	0.030	18.43	6.36	2.03	11.46	0.15	12.59
											Jute Mat	5	0.040	18.56	5.33	2.40	11.42	0.17	12.69
											Temp. Mat	5	0.040	18.56	5.33	2.40	11.42	0.17	12.69
											Perm, Type 1	5	0.040	18.56	5.33	2.40	11.42	0.17	12.69
											Perm, Type 2	5	0.040	18.56	5.33	2.40	11.42	0.17	12.69
											Perm, Type 2	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 **Location :** PORTSMOUTH, SCIOTO COUNTY
Description : SR823, STA. 226+00 TO STA. 209+00, LHS **Designer :** MDC

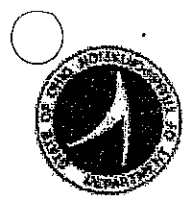
Rainfall Area : D

Allowable Shears

Permanent Mat	Seed:	Temporary Mat:
Type 1: 2.00	0.40	1.00
RCP Type B: 6.00		
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.)	GRADE (ft./ft.)	AREA (acres)	AREA SUM (acres)	CA TYPE	RUNOFF COEFF. (Sum)	PROTECT TYPE	RAIN INT. (in./hr.)	STORM FREQ. (yrs.)	MANN. COEFF. (min.)	TIME FLOW (fps.)	VEL. FLOW (sq.ft.)	SHEAR DESIGN FLOW (cfs.)	DEPTH FLOW (ft.)	WIDTH FLOW (ft.)	
226+00 L	200.00	10.00	3.00	0.50	0.0310	0.46	0.46	Seed	0.77	0.35	3.72	5	0.030	17.03	1.61	0.16	1.31	0.08	10.28
224+00 L	500.00	10.00	3.00	0.50	0.0310	2.03	2.49	Seed	0.79	1.95	3.46	5	0.030	19.70	3.03	0.42	6.77	0.22	10.75
219+00 L	500.00	10.00	3.00	0.50	0.0310	1.88	4.36	Jute Mat	0.80	3.46	3.42	5	0.040	20.23	2.52	0.49	6.68	0.25	10.89
219+00 L	500.00	10.00	3.00	0.50	0.0310	1.88	4.36	Temp. Mat	0.80	3.46	3.42	5	0.040	20.23	2.52	0.49	6.68	0.25	10.89
219+00 L	500.00	10.00	3.00	0.50	0.0310	1.88	4.36	Temp. Mat	0.80	3.46	3.99	10	0.040	20.30	2.67	0.54	7.80	0.28	10.98
214+00 L	50.00	10.00	2.00	2.00	0.0300	0.62	4.98	Seed	0.88	4.00	3.24	5	0.030	22.46	3.66	0.56	11.19	0.29	11.02
214+00 L	50.00	10.00	2.00	2.00	0.0300	0.62	4.98	Jute Mat	0.88	4.00	3.21	5	0.040	22.91	3.04	0.66	11.08	0.34	11.20
214+00 L	50.00	10.00	2.00	2.00	0.0300	0.62	4.98	Temp. Mat	0.88	4.00	3.21	5	0.040	22.91	3.04	0.66	11.08	0.34	11.20
214+00 L	50.00	10.00	2.00	2.00	0.0300	0.62	4.98	Temp. Mat	0.88	4.00	3.76	10	0.040	22.83	3.23	0.73	12.99	0.38	11.32
214+00 L	50.00	10.00	2.00	2.00	0.0300	0.62	4.98	Seed	0.88	4.00	3.19	5	0.030	23.13	3.80	0.59	12.75	0.32	11.26
214+00 L	50.00	10.00	2.00	2.00	0.0300	0.62	4.98	Jute Mat	0.88	4.00	3.19	5	0.040	23.17	3.16	0.70	12.74	0.37	11.50
214+00 L	50.00	10.00	2.00	2.00	0.0300	0.62	4.98	Temp. Mat	0.88	4.00	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	GRADE (ft./ft.)	AREA (acres)	AREA SUM	RUNOFF COEFF. (Sum)	CA TYPE	PROTECT INT. (in./hr.)	RAIN FREQ. (yrs.)	STORM COEFF. (min.)	MANN. FLOW (min.)	TIME FLOW (fps.)	VEL. FLOW (lbs./sq.ft.)	SHEAR 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	3.17	5	0.030	23.44	10.20	4.53	26.90	0.25	11.00
										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

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 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.)	DEPTH FLOW (ft.)	WIDTH FLOW (ft.)		
236+50	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	8.47	0.71	6.01	6.01	8.47	4.31	3.95	22.28	0.19	13.54
									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
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	BACK SLOPE	GRADE (ft./ft.)	AREA (acres)	AREA SUM	RUNOFF COEFF. (Sum)	CA TYPE	PROTECT (in./hr.)	RAIN (yrs.)	STORM MANN.	TIME (min.)	VEL. (fps.)	SHEAR FLOW (lbs./sq.ft.)	DESIGN FLOW (cfs.)	DEPTH FLOW (ft.)	WIDTH FLOW (ft.)		
258+00	284+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 **Location :** PORTSMOUTH, SCIOTO COUNTY
Description : SR823, STA. 288+50 TO STA. 291+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 (ft.)	RADIUS (ft.)	IN SLOPE (ft./ft.)	BACK SLOPE (ft./ft.)	GRADE AREA (acres)	AREA SUM (acres)	CA COEFF. (Sum)	PROTECT TYPE	RAIN INT. (in./hr.)	STORM FREQ. (yrs.)	MANN. COEFF.	TIME (min.)	VEL. (fps.)	SHEAR (sq.ft.)	DESIGN FLOW (cfs.)	DEPTH (ft.)	WIDTH (ft.)		
288+50	L	250.00	15.00	2.00	3.00	0.0060	5.16	0.71	3.66	Seed	3.72	5	0.030	17.00	2.04	0.16	13.62	0.42	17.08
291+00	L	250.00	15.00	2.00	3.00	0.0060	5.16	0.71	3.66	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 WIDTH (ft.)	IN SLOPE (ft./ft.)	BACK SLOPE (ft./ft.)	AREA (acres)	GRADE 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 FLOW (cfs.)	DEPTH FLOW (ft.)	WIDTH FLOW (ft.)				
295+00	L	200.00	10.00	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	L	200.00	15.00	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 (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 FREQ. (yrs.)	MANN. COEFF. (min.)	TIME FLOW (fps.)	VEL. FLOW (lbs./sq.ft.)	SHEAR DESIGN FLOW (cfs.)	DEPTH FLOW (ft.)	WIDTH FLOW (ft.)	
295+00	300.00	15.00	4.00	2.00	0.2817*	4.02	0.71	2.86	Seed	5	0.030	15.81	6.16	2.04	10.98	0.12	15.70
									Jute Mat	5	0.040	15.96	5.15	2.42	10.93	0.14	15.83
									Temp. Mat	5	0.040	15.96	5.15	2.42	10.93	0.14	15.83
									Perm, Type 1	5	0.040	15.96	5.15	2.42	10.93	0.14	15.83
									Perm, Type 2	5	0.040	15.96	5.15	2.42	10.93	0.14	15.83
									Perm, Type 2	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 **Location :** PORTSMOUTH, SCIOTO COUNTY
Description : SR823, STA. 306+00 TO STA. 298+50, 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
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	SIDE LENGTH	RADIUS	IN	BACK	GRADE	AREA	AREA	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.)	(fps.)	sq.ft.)	(cfs.)	(ft.)	(ft.)	(ft.)	(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 Location : PORTSMOUTH, SCIOTO COUNTY Designer : MDC
 Description : SR823, STA. 306+00 TO STA. 312+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 AREA (acres)	AREA SUM (acres)	CA PROTECT TYPE	RUNOFF COEFF. (Sum)	RAIN INT. (in./hr.)	STORM FREQ. (yrs.)	MANN. COEFF. (min.)	TIME FLOW (fps.)	VEL. FLOW (lbs./sq.ft.)	SHEAR FLOW (cfs.)	DEPTH FLOW (ft.)	WIDTH FLOW (ft.)					
306+00	309+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	312+50	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
 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 AREA (acres)	AREA SUM (acres)	RUNOFF COEFF. (Sum)	CA TYPE	PROTECT INT. (in./hr.)	RAIN FREQ. (yrs.)	STORM FREQ. (min.)	MANN. FLOW (fps.)	VEL. FLOW (lbs./sq.ft.)	SHEAR FLOW (cfs.)	DESIGN FLOW (ft.)	DEPTH FLOW (ft.)	WIDTH FLOW (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	3.90	5	0.030	15.32	2.63	0.55	1.29	0.03	15.13
										Jute Mat	3.89	5	0.040	15.38	2.21	0.66	1.29	0.04	15.15	
										Temp. Mat	3.89	5	0.040	15.38	2.21	0.66	1.29	0.04	15.15	
										Temp. Mat	4.56	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 Location : PORTSMOUTH, SCIOTO COUNTY Designer : MDC
 Description : SR823, STA. 323+50 TO STA. 320+50, 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	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	FLOW	FLOW		
		(ft./ft.)	(ft./ft.)	(ft./ft.)	(acres)	(acres)	(acres)			(in./hr.)	(yrs.)	(min.)	(min.)	(min.)	(fps.)	sq.ft.)	(cfs.)	(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 **Location :** PORTSMOUTH, SCIOTO COUNTY
Description : SR823, STA. 323+50 TO STA. 328+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 BEGIN END	SIDE LENGTH (ft.)	RADIUS WIDTH (ft.)	IN SLOPE (ft./ft.)	BACK SLOPE (ft./ft.)	GRADE AREA (acres)	AREA SUM (acres)	CA COEFF. (Sum)	PROTECT TYPE	RAIN INT. (in./hr.)	STORM FREQ. (yrs.)	MANN. COEFF.	TIME FLOW (min.)	VEL. FLOW (fps.)	SHEAR FLOW sq.ft.)	DESIGN FLOW (cfs.)	DEPTH FLOW (ft.)	WIDTH FLOW (ft.)			
323+50	L	400.00	10.00	3.00	0.50	0.0180	2.18	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	L	50.00	15.00	3.00	1.00	0.2180*	0.40	2.58	0.72	1.88	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

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.)	(acres)	(acres)	(in./hr.)	(yrs.)	(min.)	(fps.)	sq.ft.)	(cfs.)	(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 Location : PORTSMOUTH, SCIOTO COUNTY Designer : MDC
 Description : SR823, STA. 329+00 TO STA. 345+00, LHS

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)	CA PROTECT TYPE	RAIN INT. (in./hr.)	STORM FREQ. (yrs.)	MANN. COEFF. (Sum)	FLOW (cfs.)	TIME (min.)	VEL. (fps.)	SHEAR (lbs./sq.ft.)	DEPTH (ft.)	WIDTH (ft.)	FLOW (cfs.)	DEPTH (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
340+00	343+50	L	350.00	10.00	3.00	0.50	0.0440	2.14	14.38	0.79	10.59	Seed	3.48	5	0.040	19.51	4.90	1.54	30.99	0.58	12.01
												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
												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
												Perm, Type 1	3.95	10	0.040	20.73	5.49	1.87	41.85	0.68	12.39
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

STATION BEGIN	END	SIDE LENGTH (ft.)	RADIUS (ft.)	IN SLOPE	BACK SLOPE	AREA (ft./ft.)	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.)
									Jute Mat	3.36	5	0.040	20.91	8.67	5.49	39.77	0.29	16.46
									Temp. Mat	3.36	5	0.040	20.91	8.67	5.49	39.77	0.29	16.46
									Perm, Type 1	3.36	5	0.040	20.91	8.67	5.49	39.77	0.29	16.46
									Perm, Type 2	3.36	5	0.040	20.91	8.67	5.49	39.77	0.29	16.46
									Perm, Type 3	3.36	5	0.040	20.91	8.67	5.49	39.77	0.29	16.46
										3.36	5	0.060	20.99	6.72		39.69	0.37	16.85



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
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 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 FLOW (ft.)	WIDTH FLOW (ft.)		
349+50	L	100.00	3.00	2.00	0.0060	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	3.00	2.00	0.0060	0.96	0.72	1.86	Seed	4.45	10	0.040	16.21	1.36	0.13	5.21	0.35	11.77
						2.42	0.72	1.86	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



Made By: MHT Date: 1/30/2007
 Checked: DL RN Date: 3/13/2007
 Job No.: PID 77366 Sheet No.: 1 of 5
 Description: Exfiltration Trench (ExT) at Median for SR823 - Phase 3 (SCI-823-0.00)

Calculation to Determine Length of Exfiltration Trench - Lt for the equation $Lt = T(A \cdot Cq) / 689$ (where $Cq = 0.858i^3 - 0.78i^2 + 0.774i + 0.04$ and $i =$ impervious area divided by the total area)
 * Area values are from Phase 3 median inlet spacing calculations.

Inlet Station	Side	Treatment Percent	Impervious		A	i	Cq	Lt	Lt Rounded	Notes
			Area (acres)*	Impervious Area (SF)*						
56+00	Left	1.0	0.144	6,275	6,275	1.0	0.9	8.1238	12	
	Right	1.0	0.064	2,809	2,809	1.0	0.9	3.6369	4	
59+00	Left	1.0	0.052	2,250	2,250	1.0	0.9	2.9129	4	
	Right	1.0	0.052	2,250	2,250	1.0	0.9	2.9129	4	
59+95.45 (low point)	Left	1.0	0.016	716	716	1.0	0.9	0.9268		Sump inlet area less than
	Right	1.0	0.016	716	716	1.0	0.9	0.9268		
61+00	Left	1.0	0.018	784	784	1.0	0.9	1.0152		
	Right	1.0	0.018	784	784	1.0	0.9	1.0152		
63+50	Left	1.0	0.043	1,875	1,875	1.0	0.9	2.4274	4	
	Right	1.0	0.043	1,875	1,875	1.0	0.9	2.4274	4	
66+00	Left	1.0	0.043	1,875	1,875	1.0	0.9	2.4274	4	
	Right	1.0	0.043	1,875	1,875	1.0	0.9	2.4274	4	
71+00	Left	1.0	0.086	3,750	3,750	1.0	0.9	4.8549	8	
	Right	1.0	0.086	3,750	3,750	1.0	0.9	4.8549	8	
76+00	Left	1.0	0.172	7,500	7,500	1.0	0.9	9.7097	12	
	Right	1.0	0.172	7,500	7,500	1.0	0.9	9.7097	12	
86+00	Left	1.0	0.175	7,603	7,603	1.0	0.9	9.8431	12	
	Right	1.0	0.175	7,603	7,603	1.0	0.9	9.8431	12	
SR823, 61+00	Left	1	0.115	5012	5012	1.0	0.9	6.4886	8	6" curb w/o Gutter: Type C ExT, Not provided (ExT. extending into the bridge)
SR140, 13+60	Right	1	0.131	5716	5716	1.0	0.9	7.3997	8	Curb & Gutter: Type A ExT
US52 RAMP A, 29+61	Right	1	0.490			1.0	0.9	27.6331	28	Barrier: Type B ExT. Ext. Not provided (Taper of shoulder)
US52 RAMP A, 37+25	Right	1	0.290	21344	21344	1.0	0.9	16.3543	20	Barrier: Type B ExT
US52 RAMP B, 29+25	Left	1	0.200	8712	8712	1.0	0.9	11.2788	12	Barrier: Type B ExT
US52 RAMP B, 32+25	Right	1	0.620	27007	27007	1.0	0.9	34.9643	36	Barrier: Type B ExT
CR503, 24+00	Right	1	0.070	3049	3049	1.0	0.9	3.9476	4	Barrier: Type B ExT
CR503, 25+27	Right	1	0.010	436	436	1.0	0.9	0.5639	4	Barrier: Type B ExT



Made By: MHT Date: 1/30/2007
 Checked: DL, RN Date: 3/13/2007
 Job No.: PID 77366 Sheet No.: 2 of 5
 Descriptio Exfiltration Trench (Ext) at Median for SR823 - Phase 3 (SCI-823-0.00)

Calculation to Determine Length of Exfiltration Trench - Lt for the equation $Lt = T(A^*Cq)/689$ (where $Cq = 0.858i^3 - 0.78i^2 + 0.774i + 0.04$ and $i =$ impervious area divided by the total area)
 * Area values are from Phase 3 median inlet spacing calculations.

Inlet Station	Side	T		A		Total Area (SF)*	i	Cq	Lt	Lt Rounded	Notes
		Treatment Percent	Impervious Area (acres)*	Impervious Area (SF)*	Area (SF)*						
106+00	Left	1.0	0.170	7,397	7,397	1.0	0.9	9,5763	12		
	Right	1.0	0.170	7,397	7,397	1.0	0.9	9,5763	12		
112+00	Left	1.0	0.103	4,500	4,500	1.0	0.9	5,8258	8		
	Right	1.0	0.103	4,500	4,500	1.0	0.9	5,8258	8		
120+00	Left	1.0	0.138	6,000	6,000	1.0	0.9	7,7678	8		
	Right	1.0	0.138	6,000	6,000	1.0	0.9	7,7678	8		
126+00	Left	1.0	0.103	4,500	4,500	1.0	0.9	5,8258	8		
	Right	1.0	0.103	4,500	4,500	1.0	0.9	5,8258	8		
128+50	Left	1.0	0.128	5,583	5,583	1.0	0.9	7,2276	8		
	Right	1.0	0.043	1,875	1,875	1.0	0.9	2,4274	4		
129+50	Left	1.0	0.072	3,150	3,150	1.0	0.9	4,0781	8		
	Right	1.0	0.014	616	616	1.0	0.9	0,7975	4		
130+15.93 (low point)	Left	1.0	0.048	2,077	2,077	1.0	0.9	2,6887		Sump inlet area less than 0.25 acres, no Ext needed	
	Right	1.0	0.008	363	363	1.0	0.9	0,4695			
	Left	1.0	0.116	5,034	5,034	1.0	0.9	6,5177			
	Right	1.0	0.019	814	814	1.0	0.9	1,0543			
141+00	Left	1.0	0.039	1,700	1,700	1.0	0.9	2,2009	4		
	Right	1.0	0.006	275	275	1.0	0.9	0,3560	4		
141+50	Left	1.0	0.039	1,700	1,700	1.0	0.9	2,2009	4		
	Right	1.0	0.006	275	275	1.0	0.9	0,3560	4		
142+00	Left	1.0	0.312	13,600	13,600	1.0	0.9	17,6070	20		
	Right	1.0	0.051	2,200	2,200	1.0	0.9	2,8482	4		
146+00	Left	1.0	0.312	13,600	13,600	1.0	0.9	17,6070	20		
	Right	1.0	0.051	2,200	2,200	1.0	0.9	2,8482	4		
150+00	Left	1.0	0.390	17,000	17,000	1.0	0.9	22,0087	24		
	Right	1.0	0.063	2,750	2,750	1.0	0.9	3,5602	4		
155+00	Left	1.0	0.468	20,400	20,400	1.0	0.9	26,4104	28		
	Right	1.0	0.076	3,300	3,300	1.0	0.9	4,2723	8		
161+00	Left	1.0	0.490	21,345	21,345	1.0	0.9	27,6333	28		
	Right	1.0	0.085	3,704	3,704	1.0	0.9	4,7952	8		



Made By: MHT **Date:** 1/30/2007
Checked: DL RN **Date:** 3/13/2007
Job No.: PID 77366 **Sheet No.:** 3 of 5
Descriptio Exfiltration Trench (ExT) at Median for SR823 - Phase 3 (SCI-823-0.00)

Calculation to Determine Length of Exfiltration Trench - Lt for the equation $Lt = T(A \cdot Cq) / 689$ (where $Cq = 0.858i^3 - 0.78i^2 + 0.774i + 0.04$ and $i =$ impervious area divided by the total area)

* Area values are from Phase 3 median inlet spacing calculations.

Inlet Station	Side	T Treatment Percent	Impervious Area (acres)*	Impervious Area (SF)*	A		Cq	Lt	Lt Rounded	Notes
					Total Area (SF)*	i				
112+00	Right	1	0.165	7,200	7,200	1	0.9	9.4049	12	
120+00	Right	1	0.661	28,800	28,800	1	0.9	37.6197	40	
128+50	Right	1	0.702	30,600	30,600	1	0.9	39.9710	40	
129+50	Right	1	0.087	3,800	3,800	1	0.9	4.9637	8	

CB-3A										
118+00	Left	1	0.047	2,065	2,065	1	0.9	2.6974	4	
126+00	Left	1	0.411	17,906	17,906	1	0.9	23.3896	24	



Made By: MHT Date: 1/30/2007
 Checked: DL, RN Date: 3/13/2007
 Job No.: PID 77366 Sheet No.: 4 of 5
 Descriptio Exfiltration Trench (EXT) at Median for SR823 - Phase 3 (SCI-823-0.00)

Calculation to Determine Length of Exfiltration Trench - Lt for the equation $Lt = T(A^*Cq)/689$ (where $Cq = 0.858i^3 - 0.78i^2 + 0.774i + 0.04$ and $i =$ impervious area divided by the total area)
 * Area values are from Phase 3 median inlet spacing calculations.

Inlet Station	Side	Treatment Percent	Impervious Area (acres)*	Impervious Area (SF)*	Total Area (SF)*	i	Cq	Lt	Lt Rounded	Notes
177+00	Left	1.0	0.176	7,686	33,784	1.0	0.9	9,9505	12	
	Right	1.0	0.776	33,784	33,784	1.0	0.9	43,7378	44	
180+00	Left	1.0	0.069	2,994	2,994	1.0	0.9	3,8761	4	
	Right	1.0	0.307	13,381	13,381	1.0	0.9	17,3234	20	
183+00	Left	1.0	0.068	2,973	2,973	1.0	0.9	3,8489	4	
	Right	1.0	0.293	12,781	12,781	1.0	0.9	16,5467	20	
185+00	Left	1.0	0.044	1,916	1,916	1.0	0.9	2,4805	4	
	Right	1.0	0.175	7,637	7,637	1.0	0.9	9,8871	12	
186+32.39 (low point)	Left	1.0	0.026	1,122	1,122	1.0	0.9	1,4526		
	Right	1.0	0.108	4,720	4,720	1.0	0.9	6,1107		Sump inlet area less than 0.25 acres, no EXT needed
187+00	Left	1.0	0.017	744	744	1.0	0.9	0,9628		
	Right	1.0	0.017	744	744	1.0	0.9	0,9628		
189+00	Left	1.0	0.051	2,200	2,200	1.0	0.9	2,8482	4	
	Right	1.0	0.051	2,200	2,200	1.0	0.9	2,8482	4	
199+00	Left	1.0	0.126	5,500	5,500	1.0	0.9	7,1205	8	
	Right	1.0	0.154	6,689	6,689	1.0	0.9	8,6500	12	
204+00	Left	1.0	0.126	5,500	5,500	1.0	0.9	7,1205	8	
	Right	1.0	0.402	17,500	17,500	1.0	0.9	22,6560	24	
209+00	Left	1.0	0.126	5,500	5,500	1.0	0.9	7,1205	8	
	Right	1.0	0.402	17,500	17,500	1.0	0.9	22,6560	24	
214+00	Left	1.0	0.126	5,500	5,500	1.0	0.9	7,1205	8	
	Right	1.0	0.402	17,500	17,500	1.0	0.9	22,6560	24	
219+00	Left	1.0	0.126	5,500	5,500	1.0	0.9	7,1205	8	
	Right	1.0	0.402	17,500	17,500	1.0	0.9	22,6560	24	
224+00	Left	1.0	0.126	5,500	5,500	1.0	0.9	7,1205	8	
	Right	1.0	0.402	17,500	17,500	1.0	0.9	22,6560	24	
229+00	Left	1.0	0.152	6,600	6,600	1.0	0.9	8,5446	12	
	Right	1.0	0.482	21,000	21,000	1.0	0.9	27,1872	28	
235+00	Left	1.0	0.202	8,800	8,800	1.0	0.9	11,3927	12	
	Right	1.0	0.643	28,000	28,000	1.0	0.9	36,2496	40	
243+00	Left	1.0	0.253	11,041	11,041	1.0	0.9	14,2936	16	
	Right	1.0	0.313	13,645	13,645	1.0	0.9	17,6658	20	



Made By: MHT Date: 1/30/2007
 Checked: DL RN Date: 3/13/2007
 Job No.: PID 77366 Sheet No.: 5 of 5

Descriptio Exfiltration Trench (ExT) at Median for SR823 - Phase 3 (SCI-823-0.00)

Calculation to Determine Length of Exfiltration Trench - Lt for the equation $Lt = T(A^*Cq)/689$ (where $Cq = 0.858i^3 - 0.78i^2 + 0.774i + 0.04$ and $i =$ impervious area divided by the total area)

* Area values are from Phase 3 median inlet spacing calculations.

Inlet Station	Side	Treatment Percent	T		A		i	Cq	Lt	Lt Rounded	Notes
			Impervious Area (acres)*	Impervious Area (SF)*	Total Area (SF)*						
263+00	Left	1.0	0.435	18,931	18,931	1.0	0.9	24,5080	28		
	Right	1.0	0.244	10,632	10,632	1.0	0.9	13,7643	16		
273+00	Left	1.0	0.861	37,500	37,500	1.0	0.9	48,5486	52		
	Right	1.0	0.195	8,500	8,500	1.0	0.9	11,0044	12		
283+00	Left	1.0	0.861	37,500	37,500	1.0	0.9	48,5486	52		
	Right	1.0	0.195	8,500	8,500	1.0	0.9	11,0044	12		
293+00	Left	1.0	0.622	27,106	27,106	1.0	0.9	35,0918	36		
	Right	1.0	0.225	9,791	9,791	1.0	0.9	12,6758	16		
303+00	Left	1.0	0.253	11,000	11,000	1.0	0.9	14,2409	16		
	Right	1.0	0.253	11,000	11,000	1.0	0.9	14,2409	16		
313+00	Left	1.0	0.253	11,000	11,000	1.0	0.9	14,2409	16		
	Right	1.0	0.253	11,000	11,000	1.0	0.9	14,2409	16		
323+00	Left	1.0	0.253	11,000	11,000	1.0	0.9	14,2409	16		
	Right	1.0	0.700	30,478	30,478	1.0	0.9	39,4576	40		
333+00	Left	1.0	0.253	11,000	11,000	1.0	0.9	14,2409	16		
	Right	1.0	0.803	35,000	35,000	1.0	0.9	45,3120	48		
340+00	Left	1.0	0.177	7,700	7,700	1.0	0.9	9,9687	12		
	Right	1.0	0.562	24,500	24,500	1.0	0.9	31,7184	32		
346+00	Left	1.0	0.152	6,600	6,600	1.0	0.9	8,5446	12		
	Right	1.0	0.482	21,000	21,000	1.0	0.9	27,1872	28		
349+00	Left	1.0	0.076	3,300	3,300	1.0	0.9	4,2723	8		
	Right	1.0	0.241	10,500	10,500	1.0	0.9	13,5936	16		
350+00	Left	1.0	0.025	1,100	1,100	1.0	0.9	1,4241	4		
	Right	1.0	0.080	3,500	3,500	1.0	0.9	4,5312	8		
350+59.68 (low point)	Left	1.0	0.015	657	657	1.0	0.9	0,8499			Sump inlet area less
	Right	1.0	0.048	2,089	2,089	1.0	0.9	2,7042			than 0.25 acres, no
351+50	Left	1.0	0.023	994	994	1.0	0.9	1,2862			EXT needed
	Right	1.0	0.073	3,161	3,161	1.0	0.9	4,0926			
	Left	1.0	0.088	3,850	3,850	1.0	0.9	4,9843	8		
	Right	1.0	0.281	12,250	12,250	1.0	0.9	15,8592	16		

SCI 823-0.00 PID 77366 PHASE 3

BMP CALS FOR DITCHES - SR823, RIGHT HAND SIDE
VEGETATED DITCH DESIGN - 1118.3.1, L & D VOL-2

DATE: 07/12/07 DONE BY: MDC CHECKED BY: RN

EBW = ENCHANCED BANKFULL WIDTH - (5.4'A^{0.565}) FT
AREA (A) = TOTAL DRAINAGE AREA TO THE DITCH IN ACRES

STATION FROM	STATION TO	DITCH WIDTH PROVIDED (FT)	AREA (AC)	EBW (FT)	DITCH WIDTH REQUIRED > 10FT	COMMENTS
044+50	040+00	10	1.11	5.606		US52 A
044+50	061+00	10	6.81	10.693	10.693	US52 A, Cut Section, Use 10' maximum ditch width
061+00	062+50	10	0.34	3.689		SR823
068+50	064+00	10	1.58	6.349		SR140 A
068+50	069+00	10	0.12	2.554		SR140 A
096+00	076+00	10	11.34	12.817	12.817	Cut Section, Use 10' maximum ditch width
076+00	069+50	10	3.90	8.765		
096+00	105+00	10	3.06	8.037		
105+50	106+00	10	13.27	13.556	13.556	Fill Section, coordinate with ODOT and establish the ditch width in Stage 2
106+00	107+00	10	0.99	5.375		
118+50	120+50	10	0.93	5.260		
124+50	127+50	10	1.59	6.372		
127+50	128+50	15	0.68	4.702		
131+50	130+00	10	0.63	4.581		
130+00	129+50	10	0.31	3.551		
129+50	129+00	15	0.40	3.897		
166+00	161+00	10	2.14	7.076		
161+00	159+00	10	2.04	6.965		
155+00	150+00	10	2.46	7.435		
150+00	148+00	10	2.09	7.023		
146+00	143+00	10	0.81	5.016		
143+00	142+00	10	4.36	9.122		
142+00	141+00	10	0.53	4.299		
141+00	140+00	10	0.70	4.763		

SCI 823-0.00 PID 77366 PHASE 3

BMP CALS FOR DITCHES - SR823, RIGHT HAND SIDE
VEGETATED DITCH DESIGN - 1118.3.1, L & D VOL-2

DATE: 07/12/07 DONE BY: MDC CHECKED BY: RN

EBW = ENCHANCED BANKFULL WIDTH - (5.4'A^{0.355}) FT
AREA (A) = TOTAL DRAINAGE AREA TO THE DITCH IN ACRES

STATION FROM	STATION TO	DITCH WIDTH PROVIDED (FT)	AREA (AC)	EBW (FT)	DITCH WIDTH REQUIRED > 10FT	COMMENTS
166+00	166+50	10	0.29	3.454		
166+50	168+50	10	1.24	5.831		
169+50	173+00	10	0.78	4.938		
177+00	179+00	10	2.36	7.327		
179+00	182+00	10	3.45	8.388		
207+00	186+50	10	20.50	15.826	15.826	Cut Section, Use 10' maximum ditch width, Fill Section, coordinate with ODOT and establish the ditch width in Stage 2
186+50	185+00	10	0.82	5.034		
185+00	183+50	10	1.06	5.508		
183+50	182+00	10	16.30	14.585	14.585	Fill Section, coordinate with ODOT and establish the ditch width in Stage 2
207+00	209+00	10	13.69	13.708	13.708	Fill Section, coordinate with ODOT and establish the ditch width in Stage 2
209+00	209+50	10	0.30	3.518		
209+50	210+00	15	0.30	3.518		
229+00	212+50	10	3.89	8.757		
212+50	211+00	10	0.78	4.952		
211+00	210+50	15	0.34	3.682		
258+00	244+50	10	10.90	12.638	12.638	Fill Section, coordinate with ODOT and establish the ditch width in Stage 2
244+50	240+00	10	4.44	14.273	14.273	Fill Section, coordinate with ODOT and establish the ditch width in Stage 2
244+50	239+00	15	1.12	5.628		
264+00	268+50	10	1.12	5.615		
268+50	270+50	15	1.18	5.735		
270+50	271+50	15	0.75	4.872		
274+00	283+00	10	2.83	7.821		
283+00	290+00	10	3.08	8.059		
290+00	291+00	10	1.68	6.501		
291+00	293+00	10	3.70	8.602		
293+00	297+00	10	4.99	9.570		
297+00	299+50	10	3.87	8.740		
299+50	301+50	10	2.68	7.671		

SCI 823-0.00 PID 77366 PHASE 3

BMP CALS FOR DITCHES - SR823, RIGHT HAND SIDE
 VEGETATED DITCH DESIGN - 1118.3.1, L & D VOL-2

DATE: 07/12/07 DONE BY: MDC CHECKED BY: RN

EBW = ENCHANCED BANKFULL WIDTH - (5.4'A^{0.85}) FT
 AREA (A) = TOTAL DRAINAGE AREA TO THE DITCH IN ACRES

STATION FROM	STATION TO	DITCH WIDTH PROVIDED (FT)	AREA (AC)	EBW (FT)	DITCH WIDTH REQUIRED > 10FT	COMMENTS
314+50	313+00	10	1.77	6.615		
313+00	311+50	10	2.18	7.124		
311+50	311+00	10	0.53	4.308		
314+50	319+00	10	2.87	7.855		
319+00	321+50	10	3.23	8.197		
321+50	322+00	15	0.42	3.965		
325+00	327+50	10	0.46	4.096		
327+50	328+00	10	0.12	2.561		
328+00	328+50	10	0.16	2.812		
328+50	329+00	10	0.19	2.967		
330+50	333+50	10	0.59	4.473		
334+00	343+00	10	2.08	7.004		
343+00	344+50	15	1.37	6.036		
348+00	346+00	10	1.03	5.459		
348+00	352+00	10	0.69	4.724		

SCI 823-0.00 PID 77366 PHASE 3

BMP CALS FOR DITCHES - SR823, LEFT HAND SIDE
 VEGETATED DITCH DESIGN - 1118.3.1, L & D VOL-2

DATE: 07/12/07 DONE BY: MDC CHECKED BY: RN

EBW = ENCHANCED BANKFULL WIDTH - (5.4*A^{0.85}) FT

AREA (A) = TOTAL DRAINAGE AREA TO THE DITCH IN ACRES

STATION FROM	STATION TO	DITCH WIDTH PROVIDED (FT)	AREA (AC)	EBW (FT)	DITCH WIDTH REQUIRED > 10FT	COMMENTS
044+00	044+50	10	1.14	5.653		US52 B
045+00	044+50	10	0.80	4.992		US52 B
045+00	047+00	10	0.50	4.210		US52 B
047+00	056+00	10	3.54	8.472		US52 B
056+00	059+50	10	0.87	5.147		SR823
059+50	060+00	10	0.08	2.188		SR823
060+00	060+50	10	0.10	2.396		SR823
068+00	061+00	10	3.94	8.794		SR140 B
068+00	068+50	10	0.13	2.633		SR140 B
096+00	086+00	10	2.93	7.915		SR823
086+00	075+00	10	4.13	8.944		SR823
075+00	074+50	10	0.09	2.291		SR140 B
074+50	073+50	15	0.20	3.030		SR140 B
073+00	073+50	15	0.29	3.488		
073+00	068+50	10	1.29	5.909		
096+00	106+00	10	4.82	9.453		
106+00	108+50	10	2.80	7.794		
108+50	109+50	10	0.85	5.096		
109+50	110+00	15	0.50	4.231		
110+00	110+50	15	0.55	4.359		
111+50	110+50	15	0.87	5.130		
118+00	119+00	10	0.69	4.739		

SCI 823-0.00 PID 77366 PHASE 3

BMP CALS FOR DITCHES - SR823, LEFT HAND SIDE
 VEGETATED DITCH DESIGN - 1118.3.1, L & D VOL-2

DATE: 07/12/07 DONE BY: MDC CHECKED BY: RN

EBW = ENCHANCED BANKFULL WIDTH - (5.4*A^{0.365}) FT

AREA (A) = TOTAL DRAINAGE AREA TO THE DITCH IN ACRES

STATION FROM	STATION TO	DITCH WIDTH PROVIDED (FT)	AREA (AC)	EBW (FT)	DITCH WIDTH REQUIRED > 10FT	COMMENTS
125+50	125+00	10	0.31	3.567		
125+50	126+00	10	0.21	3.077		
126+00	128+00	10	1.23	5.810		
128+00	128+50	10	0.36	3.739		
128+50	129+00	15	0.37	3.790		
166+00	142+00	10	11.61	12.926	12.9	Cut Section, Use 10' maximum ditch width
142+00	141+00	10	0.95	5.298		
141+00	139+50	10	1.40	6.083		
166+00	166+50	10	0.87	5.141		
167+50	173+50	10	2.74	7.735		
173+50	174+50	10	2.77	7.761		
174+50	175+00	15	0.30	3.522		
178+00	177+50	10	0.13	2.583		
177+50	177+00	10	0.98	5.355		
177+00	176+00	10	1.17	5.705		
176+00	175+50	15	1.49	6.228		
178+00	182+50	10	2.71	7.700		
182+50	184+50	10	1.44	6.152		
184+50	185+00	15	0.26	3.334		
207+00	204+00	10	0.88	5.168		
204+00	189+00	10	9.54	12.053	12.1	Cut Section, Use 10' maximum ditch width
189+00	187+00	10	0.88	5.151		
187+00	186+00	10	0.78	4.952		
186+00	185+50	15	0.27	3.393		

SCI 823-0.00 PID 77366 PHASE 3

**BMP CALS FOR DITCHES - SR823, LEFT HAND SIDE
VEGETATED DITCH DESIGN - 1118.3.1, L & D VOL-2**

DATE: 07/12/07 | DONE BY: MDC | CHECKED BY: RN

**EBW = ENCHANCED BANKFULL WIDTH - (5.4*A^{0.85}) FT
AREA (A) = TOTAL DRAINAGE AREA TO THE DITCH IN ACRES**

STATION FROM	STATION TO	DITCH WIDTH PROVIDED (FT)	AREA (AC)	EBW (FT)	DITCH WIDTH REQUIRED > 10FT	COMMENTS
226+00	224+00	10	0.46	4.093		
224+00	219+00	10	1.50	6.233		
219+00	214+00	10	1.35	6.004		
214+00	213+50	10	0.09	2.264		
213+50	213+00	10	6.42	10.471	10.5	Cut Section, Use 10' maximum ditch width
213+00	209+50	10	3.28	8.241		
209+50	209+00	15	0.33	3.635		
236+50	232+50	10	4.16	8.972		
232+50	230+00	10	4.31	9.081		
258+00	284+00	10	12.73	13.356	13.4	Cut Section, Use 10' maximum ditch width
288+50	291+00	15	5.16	9.684		
295+00	293+00	10	3.82	8.704		
293+00	291+00	10	1.18	5.729		
295+00	297+00	10	2.81	7.805		
297+00	298+00	15	1.22	5.800		
306+00	309+00	10	0.88	5.162		
309+00	312+00	10	3.24	8.207		
312+00	312+50	15	0.44	4.022		
318+50	319+00	10	0.46	4.096		
323+50	320+50	10	3.30	8.259		
323+50	327+50	10	2.18	7.124		
327+50	328+00	10	0.40	3.904		

SCI 823-0.00 PID 77366 PHASE 3

**BMP CALS FOR DITCHES - SR823, LEFT HAND SIDE
VEGETATED DITCH DESIGN - 1118.3.1, L & D VOL-2**

DATE: 07/12/07 DONE BY: MDC CHECKED BY: RN

EBW = ENCHANGED BANKFULL WIDTH - (5.4*A^{0.85}) FT

AREA (A) = TOTAL DRAINAGE AREA TO THE DITCH IN ACRES

STATION FROM	STATION TO	DITCH WIDTH PROVIDED (FT)	AREA (AC)	EBW (FT)	DITCH WIDTH REQUIRED > 10FT	COMMENTS
329+00	328+50	10	0.32	3.607		
329+00	333+00	10	3.01	7.991		
333+00	340+00	10	8.17	11.406	11.4	Cut Section, Use 10' maximum ditch width
340+00	343+50	10	1.40	6.086		
343+50	344+50	10	1.42	6.113		
344+50	345+00	15	0.33	3.619		
349+50	349+00	10	0.30	3.501		
349+00	348+00	10	0.33	3.647		
348+00	346+50	10	2.03	6.950		
346+50	345+50	15	0.70	4.744		
349+50	350+50	10	0.84	5.064		
350+50	352+00	10	0.96	5.318		

APPENDIX G

LD-33 Form

**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