Culvert Calculator Report
Pics 01-04

Comments: Pics 1-4

Solve For: Discharge

Culvert Summary			
Allowable HW Elevation	20.00 ft	Headwater Depth/Height	1.25
Computed Headwater Elevation	20.00 ft	Discharge	774.81 cfs
Inlet Control HW Elev.	19.04 ft	Tailwater Elevation	0.00 ft
Outlet Control HW Elev.	20.00 ft	Control Type	Entrance Control

Grades			
Upstream Invert	10.00 ft	Downstream Invert	9.00 ft
Length	100.00 ft	Constructed Slope	1.0000 %

Hydraulic Profile			
Profile	S2	Depth, Downstream	4.61 ft
Slope Type	Steep	Normal Depth	3.99 ft
Flow Regime	Supercritical	Critical Depth	5.71 ft
Velocity Downstream	16.81 ft/s	Critical Slope	0.3805 %

Section			
Section Shape	Box	Mannings Coefficient	0.013
Section Material	Concrete	Span	10.00 ft
Section Size	10 x 8 ft	Rise	8.00 ft
Number Sections	1		

Outlet Control Properties			
Outlet Control HW Elev.	20.00 ft	Upstream Velocity Head	2.86 ft
Ke	0.50	Entrance Loss	1.43 ft

Inlet Control Properties			
Inlet Control HW Elev.	19.04 ft	Flow Control	N/A
Inlet Type	45° non-offset wingwall flares	Area Full	80.0 ft²
K	0.49700	HDS 5 Chart	12
M	0.66700	HDS 5 Scale	1
C	0.03390	Equation Form	2
Y	0.80300		

Rating Table Report
Pics 01-04

Range Data:				
	Minimum	Maximum	Increment	
Allowable HW E	10.00	20.00	1.00	ft

HW Elev. (ft)	Discharge (cfs)
10.00	0.00
11.00	24.50
12.00	69.30
13.00	127.31
14.00	196.01
15.00	273.94
16.00	360.10
17.00	453.78
18.00	554.41
19.00	661.54
20.00	774.81

Culvert Calculator Report
Pics 05-06

Comments: Pics 5-6

Solve For: Discharge

Culvert Summary			
Allowable HW Elevation	16.00 ft	Headwater Depth/Height	1.50
Computed Headwater Elevation	16.00 ft	Discharge	576.16 cfs
Inlet Control HW Elev.	15.94 ft	Tailwater Elevation	0.00 ft
Outlet Control HW Elev.	16.00 ft	Control Type	Entrance Control

Grades			
Upstream Invert	10.00 ft	Downstream Invert	9.00 ft
Length	100.00 ft	Constructed Slope	1.0000 %

Hydraulic Profile			
Profile	S2	Depth, Downstream	2.65 ft
Slope Type	Steep	Normal Depth	2.40 ft
Flow Regime	Supercritical	Critical Depth	3.43 ft
Velocity Downstream	13.58 ft/s	Critical Slope	0.3728 %

Section			
Section Shape	Box	Mannings Coefficient	0.013
Section Material	Concrete	Span	8.00 ft
Section Size	8 x 4 ft	Rise	4.00 ft
Number Sections	2		

Outlet Control Properties			
Outlet Control HW Elev.	16.00 ft	Upstream Velocity Head	1.71 ft
Ke	0.50	Entrance Loss	0.86 ft

Inlet Control Properties			
Inlet Control HW Elev.	15.94 ft	Flow Control	N/A
Inlet Type	45° non-offset wingwall flares	Area Full	64.0 ft²
K	0.49700	HDS 5 Chart	12
M	0.66700	HDS 5 Scale	1
C	0.03390	Equation Form	2
Y	0.80300		

Rating Table Report
Pics 05-06

Range Data:				
	Minimum	Maximum	Increment	
Allowable HW E	10.00	16.00	1.00	ft

HW Elev. (ft)	Discharge (cfs)
10.00	0.00
11.00	39.20
12.00	110.88
13.00	203.70
14.00	313.62
15.00	438.30
16.00	576.16

Culvert Calculator Report
Pics 07-08

Comments: Pics 7-8

Solve For: Discharge

Culvert Summary			
Allowable HW Elevation	13.00 ft	Headwater Depth/Height	1.50
Computed Headwater Elevation	13.00 ft	Discharge	16.88 cfs
Inlet Control HW Elev.	12.71 ft	Tailwater Elevation	0.00 ft
Outlet Control HW Elev.	13.00 ft	Control Type	Outlet Control

Grades			
Upstream Invert	10.00 ft	Downstream Invert	9.50 ft
Length	50.00 ft	Constructed Slope	1.0000 %

Hydraulic Profile			
Profile	CompositeM2PressureProfile	Depth, Downstream	1.48 ft
Slope Type	Mild	Normal Depth	N/A ft
Flow Regime	Subcritical	Critical Depth	1.48 ft
Velocity Downstream	6.77 ft/s	Critical Slope	2.3522 %

Section			
Section Shape	Circular	Mannings Coefficient	0.024
Section Material	CMP	Span	2.00 ft
Section Size	24 inch	Rise	2.00 ft
Number Sections	1		

Outlet Control Properties			
Outlet Control HW Elev.	13.00 ft	Upstream Velocity Head	0.45 ft
Ke	0.90	Entrance Loss	0.40 ft

Inlet Control Properties			
Inlet Control HW Elev.	12.71 ft	Flow Control	N/A
Inlet Type	Projecting	Area Full	3.1 ft²
K	0.03400	HDS 5 Chart	2
M	1.50000	HDS 5 Scale	3
C	0.05530	Equation Form	1
Y	0.54000		

Rating Table Report
Pics 07-08

Range Data:			
	Minimum	Maximum	Increment
Allowable HW E	10.00	13.00	0.50 ft

HW Elev. (ft)	Discharge (cfs)
10.00	0.00
10.50	0.83
11.00	3.11
11.50	6.51
12.00	10.58
12.50	14.46
13.00	16.88

Culvert Calculator Report
Pics 09-10

Comments: Pics 9-10

Solve For: Discharge

Culvert Summary			
Allowable HW Elevation	14.00 ft	Headwater Depth/Height	1.33
Computed Headwater Elevation	14.00 ft	Discharge	44.24 cfs
Inlet Control HW Elev.	13.88 ft	Tailwater Elevation	0.00 ft
Outlet Control HW Elev.	14.00 ft	Control Type	Outlet Control

Grades			
Upstream Invert	10.00 ft	Downstream Invert	9.50 ft
Length	50.00 ft	Constructed Slope	1.0000 %

Hydraulic Profile			
Profile	M2	Depth, Downstream	2.17 ft
Slope Type	Mild	Normal Depth	N/A ft
Flow Regime	Subcritical	Critical Depth	2.17 ft
Velocity Downstream	8.09 ft/s	Critical Slope	1.9743 %

Section			
Section Shape	Circular	Mannings Coefficient	0.024
Section Material	CMP	Span	3.00 ft
Section Size	36 inch	Rise	3.00 ft
Number Sections	1		

Outlet Control Properties			
Outlet Control HW Elev.	14.00 ft	Upstream Velocity Head	0.66 ft
Ke	0.90	Entrance Loss	0.60 ft

Inlet Control Properties			
Inlet Control HW Elev.	13.88 ft	Flow Control	N/A
Inlet Type	Projecting	Area Full	7.1 ft²
K	0.03400	HDS 5 Chart	2
M	1.50000	HDS 5 Scale	3
C	0.05530	Equation Form	1
Y	0.54000		

Rating Table Report
Pics 09-10

Range Data:			
	Minimum	Maximum	Increment
Allowable HW E	10.00	14.00	1.00 ft

HW Elev. (ft)	Discharge (cfs)
10.00	0.00
11.00	3.93
12.00	14.36
13.00	29.16
14.00	44.24

Culvert Calculator Report
Pic 16

Comments: Pic 16

Solve For: Discharge

Culvert Summary			
Allowable HW Elevation	12.50 ft	Headwater Depth/Height	1.67
Computed Headwater Elevation	12.50 ft	Discharge	9.35 cfs
Inlet Control HW Elev.	12.35 ft	Tailwater Elevation	0.00 ft
Outlet Control HW Elev.	12.50 ft	Control Type	Outlet Control

Grades			
Upstream Invert	10.00 ft	Downstream Invert	9.80 ft
Length	20.00 ft	Constructed Slope	1.0000 %

Hydraulic Profile			
Profile	CompositeM2PressureProfile	Depth, Downstream	1.18 ft
Slope Type	Mild	Normal Depth	N/A ft
Flow Regime	Subcritical	Critical Depth	1.18 ft
Velocity Downstream	6.26 ft/s	Critical Slope	2.9151 %

Section			
Section Shape	Circular	Mannings Coefficient	0.024
Section Material	CMP	Span	1.50 ft
Section Size	18 inch	Rise	1.50 ft
Number Sections	1		

Outlet Control Properties			
Outlet Control HW Elev.	12.50 ft	Upstream Velocity Head	0.44 ft
Ke	0.90	Entrance Loss	0.39 ft

Inlet Control Properties			
Inlet Control HW Elev.	12.35 ft	Flow Control	N/A
Inlet Type	Projecting	Area Full	1.8 ft²
K	0.03400	HDS 5 Chart	2
M	1.50000	HDS 5 Scale	3
C	0.05530	Equation Form	1
Y	0.54000		

Rating Table Report
Pic 16

Range Data:				
	Minimum	Maximum	Increment	
Allowable HW E	10.00	12.50	0.50	ft

HW Elev. (ft)	Discharge (cfs)
10.00	0.00
10.50	0.71
11.00	2.58
11.50	5.15
12.00	7.70
12.50	9.35

Culvert Calculator Report
Pics 17-18

Comments: Pics 17-18

Solve For: Discharge

Culvert Summary			
Allowable HW Elevation	12.50 ft	Headwater Depth/Height	1.67
Computed Headwater Elevation	12.50 ft	Discharge	8.31 cfs
Inlet Control HW Elev.	12.05 ft	Tailwater Elevation	0.00 ft
Outlet Control HW Elev.	12.50 ft	Control Type	Outlet Control

Grades			
Upstream Invert	10.00 ft	Downstream Invert	9.50 ft
Length	50.00 ft	Constructed Slope	1.0000 %

Hydraulic Profile			
Profile	CompositeM2PressureProfile	Depth, Downstream	1.12 ft
Slope Type	Mild	Normal Depth	N/A ft
Flow Regime	Subcritical	Critical Depth	1.12 ft
Velocity Downstream	5.89 ft/s	Critical Slope	2.6084 %

Section			
Section Shape	Circular	Mannings Coefficient	0.024
Section Material	CMP	Span	1.50 ft
Section Size	18 inch	Rise	1.50 ft
Number Sections	1		

Outlet Control Properties			
Outlet Control HW Elev.	12.50 ft	Upstream Velocity Head	0.34 ft
Ke	0.90	Entrance Loss	0.31 ft

Inlet Control Properties			
Inlet Control HW Elev.	12.05 ft	Flow Control	N/A
Inlet Type	Projecting	Area Full	1.8 ft²
K	0.03400	HDS 5 Chart	2
M	1.50000	HDS 5 Scale	3
C	0.05530	Equation Form	1
Y	0.54000		

Rating Table Report
Pics 17-18

Range Data:

	Minimum	Maximum	Increment	
Allowable HW E	10.00	12.50	0.50	ft

HW Elev. (ft)	Discharge (cfs)
10.00	0.00
10.50	0.71
11.00	2.58
11.50	5.11
12.00	7.19
12.50	8.31

Culvert Calculator Report
Pics 19-20

Comments: Pics 19-20

Solve For: Discharge

Culvert Summary			
Allowable HW Elevation	16.00 ft	Headwater Depth/Height	1.50
Computed Headwater Elevation	16.00 ft	Discharge	216.06 cfs
Inlet Control HW Elev.	15.94 ft	Tailwater Elevation	0.00 ft
Outlet Control HW Elev.	16.00 ft	Control Type	Entrance Control

Grades			
Upstream Invert	10.00 ft	Downstream Invert	9.00 ft
Length	100.00 ft	Constructed Slope	1.0000 %

Hydraulic Profile			
Profile	S2	Depth, Downstream	2.73 ft
Slope Type	Steep	Normal Depth	2.55 ft
Flow Regime	Supercritical	Critical Depth	3.43 ft
Velocity Downstream	13.20 ft/s	Critical Slope	0.4512 %

Section			
Section Shape	Box	Mannings Coefficient	0.013
Section Material	Concrete	Span	6.00 ft
Section Size	6 x 4 ft	Rise	4.00 ft
Number Sections	1		

Outlet Control Properties			
Outlet Control HW Elev.	16.00 ft	Upstream Velocity Head	1.71 ft
Ke	0.50	Entrance Loss	0.86 ft

Inlet Control Properties			
Inlet Control HW Elev.	15.94 ft	Flow Control	N/A
Inlet Type	45° non-offset wingwall flares	Area Full	24.0 ft²
K	0.49700	HDS 5 Chart	12
M	0.66700	HDS 5 Scale	1
C	0.03390	Equation Form	2
Y	0.80300		

Rating Table Report
Pics 19-20

Range Data:			
	Minimum	Maximum	Increment
Allowable HW E	10.00	16.00	1.00 ft

HW Elev. (ft)	Discharge (cfs)
10.00	0.00
11.00	14.70
12.00	41.58
13.00	76.39
14.00	117.61
15.00	164.36
16.00	216.06

Culvert Calculator Report
Pics 21-22

Comments: Pics 21-22

Solve For: Discharge

Culvert Summary			
Allowable HW Elevation	12.50 ft	Headwater Depth/Height	1.67
Computed Headwater Elevation	12.50 ft	Discharge	8.31 cfs
Inlet Control HW Elev.	12.05 ft	Tailwater Elevation	0.00 ft
Outlet Control HW Elev.	12.50 ft	Control Type	Outlet Control

Grades			
Upstream Invert	10.00 ft	Downstream Invert	9.50 ft
Length	50.00 ft	Constructed Slope	1.0000 %

Hydraulic Profile			
Profile	CompositeM2PressureProfile	Depth, Downstream	1.12 ft
Slope Type	Mild	Normal Depth	N/A ft
Flow Regime	Subcritical	Critical Depth	1.12 ft
Velocity Downstream	5.89 ft/s	Critical Slope	2.6084 %

Section			
Section Shape	Circular	Mannings Coefficient	0.024
Section Material	CMP	Span	1.50 ft
Section Size	18 inch	Rise	1.50 ft
Number Sections	1		

Outlet Control Properties			
Outlet Control HW Elev.	12.50 ft	Upstream Velocity Head	0.34 ft
Ke	0.90	Entrance Loss	0.31 ft

Inlet Control Properties			
Inlet Control HW Elev.	12.05 ft	Flow Control	N/A
Inlet Type	Projecting	Area Full	1.8 ft²
K	0.03400	HDS 5 Chart	2
M	1.50000	HDS 5 Scale	3
C	0.05530	Equation Form	1
Y	0.54000		

Rating Table Report
Pics 21-22

Range Data:			
	Minimum	Maximum	Increment
Allowable HW E	10.00	12.50	0.50 ft

HW Elev. (ft)	Discharge (cfs)
10.00	0.00
10.50	0.71
11.00	2.58
11.50	5.11
12.00	7.19
12.50	8.31

Culvert Calculator Report
Pics 23-24

Comments: Pics 23-24

Solve For: Discharge

Culvert Summary			
Allowable HW Elevation	15.00 ft	Headwater Depth/Height	1.67
Computed Headwater Elevation	15.00 ft	Discharge	1,052.13 cfs
Inlet Control HW Elev.	15.00 ft	Tailwater Elevation	0.00 ft
Outlet Control HW Elev.	14.87 ft	Control Type	Inlet Control

Grades			
Upstream Invert	10.00 ft	Downstream Invert	9.00 ft
Length	100.00 ft	Constructed Slope	1.0000 %

Hydraulic Profile			
Profile	S2	Depth, Downstream	2.07 ft
Slope Type	Steep	Normal Depth	1.87 ft
Flow Regime	Supercritical	Critical Depth	2.78 ft
Velocity Downstream	12.70 ft/s	Critical Slope	0.3158 %

Section			
Section Shape	Box	Mannings Coefficient	0.013
Section Material	Concrete	Span	10.00 ft
Section Size	10 x 3 ft	Rise	3.00 ft
Number Sections	4		

Outlet Control Properties			
Outlet Control HW Elev.	14.87 ft	Upstream Velocity Head	1.39 ft
Ke	0.50	Entrance Loss	0.70 ft

Inlet Control Properties			
Inlet Control HW Elev.	15.00 ft	Flow Control	N/A
Inlet Type	45° non-offset wingwall flares	Area Full	120.0 ft²
K	0.49700	HDS 5 Chart	12
M	0.66700	HDS 5 Scale	1
C	0.03390	Equation Form	2
Y	0.80300		

Rating Table Report
Pics 23-24

Range Data:			
	Minimum	Maximum	Increment
Allowable HW E	10.00	15.00	1.00 ft

HW Elev. (ft)	Discharge (cfs)
10.00	0.00
11.00	98.01
12.00	277.20
13.00	509.26
14.00	784.05
15.00	1,052.13

Culvert Calculator Report
Pics 25-26

Comments: Pics 25-26

Solve For: Discharge

Culvert Summary			
Allowable HW Elevation	14.00 ft	Headwater Depth/Height	2.00
Computed Headwater Elevation	14.00 ft	Discharge	108.18 cfs
Inlet Control HW Elev.	13.17 ft	Tailwater Elevation	0.00 ft
Outlet Control HW Elev.	14.00 ft	Control Type	Outlet Control

Grades			
Upstream Invert	10.00 ft	Downstream Invert	9.50 ft
Length	50.00 ft	Constructed Slope	1.0000 %

Hydraulic Profile			
Profile	CompositeM2PressureProfile	Depth, Downstream	1.66 ft
Slope Type	Mild	Normal Depth	N/A ft
Flow Regime	Subcritical	Critical Depth	1.66 ft
Velocity Downstream	7.75 ft/s	Critical Slope	3.0401 %

Section			
Section Shape	Circular	Mannings Coefficient	0.024
Section Material	CMP	Span	2.00 ft
Section Size	24 inch	Rise	2.00 ft
Number Sections	5		

Outlet Control Properties			
Outlet Control HW Elev.	14.00 ft	Upstream Velocity Head	0.74 ft
Ke	0.50	Entrance Loss	0.37 ft

Inlet Control Properties			
Inlet Control HW Elev.	13.17 ft	Flow Control	N/A
Inlet Type	Headwall	Area Full	15.7 ft²
K	0.00780	HDS 5 Chart	2
M	2.00000	HDS 5 Scale	1
C	0.03790	Equation Form	1
Y	0.69000		

Rating Table Report
Pics 25-26

Range Data:			
	Minimum	Maximum	Increment
Allowable HW E	10.00	14.00	1.00 ft

HW Elev. (ft)	Discharge (cfs)
10.00	0.00
11.00	17.65
12.00	58.20
13.00	88.28
14.00	108.18

Culvert Calculator Report
Pics 27-28

Comments: Pics 27-28

Solve For: Discharge

Culvert Summary			
Allowable HW Elevation	14.50 ft	Headwater Depth/Height	1.80
Computed Headwater Elevation	14.50 ft	Discharge	70.16 cfs
Inlet Control HW Elev.	14.16 ft	Tailwater Elevation	0.00 ft
Outlet Control HW Elev.	14.50 ft	Control Type	Outlet Control

Grades			
Upstream Invert	10.00 ft	Downstream Invert	9.50 ft
Length	50.00 ft	Constructed Slope	1.0000 %

Hydraulic Profile			
Profile	CompositeM2PressureProfile	Depth, Downstream	2.01 ft
Slope Type	Mild	Normal Depth	N/A ft
Flow Regime	Subcritical	Critical Depth	2.01 ft
Velocity Downstream	8.29 ft/s	Critical Slope	2.5805 %

Section			
Section Shape	Circular	Mannings Coefficient	0.024
Section Material	CMP	Span	2.50 ft
Section Size	30 inch	Rise	2.50 ft
Number Sections	2		

Outlet Control Properties			
Outlet Control HW Elev.	14.50 ft	Upstream Velocity Head	0.79 ft
Ke	0.90	Entrance Loss	0.71 ft

Inlet Control Properties			
Inlet Control HW Elev.	14.16 ft	Flow Control	N/A
Inlet Type	Projecting	Area Full	9.8 ft²
K	0.03400	HDS 5 Chart	2
M	1.50000	HDS 5 Scale	3
C	0.05530	Equation Form	1
Y	0.54000		

Rating Table Report
Pics 27-28

Range Data:				
	Minimum	Maximum	Increment	
Allowable HW E	10.00	14.50	0.50	ft

HW Elev. (ft)	Discharge (cfs)
10.00	0.00
10.50	1.88
11.00	7.10
11.50	15.12
12.00	25.39
12.50	37.02
13.00	48.59
13.50	58.22
14.00	64.33
14.50	70.16

Culvert Calculator Report
Pics 29-30

Comments: Pics 29-30

Solve For: Discharge

Culvert Summary			
Allowable HW Elevation	12.67 ft	Headwater Depth/Height	1.60
Computed Headwater Elevation	12.67 ft	Discharge	15.48 cfs
Inlet Control HW Elev.	12.35 ft	Tailwater Elevation	0.00 ft
Outlet Control HW Elev.	12.67 ft	Control Type	Outlet Control

Grades			
Upstream Invert	10.00 ft	Downstream Invert	9.50 ft
Length	50.00 ft	Constructed Slope	1.0000 %

Hydraulic Profile			
Profile	CompositeM2PressureProfile	Depth, Downstream	1.16 ft
Slope Type	Mild	Normal Depth	N/A ft
Flow Regime	Subcritical	Critical Depth	1.16 ft
Velocity Downstream	6.38 ft/s	Critical Slope	2.3916 %

Section			
Section Shape	Arch	Mannings Coefficient	0.025
Section Material	Steel and Aluminum Var CR	Span	2.33 ft
Section Size	28 x 20 inch	Rise	1.67 ft
Number Sections	1		

Outlet Control Properties			
Outlet Control HW Elev.	12.67 ft	Upstream Velocity Head	0.44 ft
Ke	0.90	Entrance Loss	0.40 ft

Inlet Control Properties			
Inlet Control HW Elev.	12.35 ft	Flow Control	N/A
Inlet Type	Thin wall projecting	Area Full	2.9 ft²
K	0.03400	HDS 5 Chart	34
M	1.50000	HDS 5 Scale	3
C	0.04960	Equation Form	1
Y	0.57000		

Rating Table Report
Pics 29-30

Range Data:				
	Minimum	Maximum	Increment	
Allowable HW E	10.00	12.50	0.50	ft

HW Elev. (ft)	Discharge (cfs)
10.00	0.00
10.50	1.40
11.00	4.55
11.50	8.62
12.00	12.70
12.50	14.97
12.67	15.48

Doesn't start flowing until ~2' deep in pond.

Culvert Calculator Report
Pics 31-32

Comments: Pics 31-32

Solve For: Discharge

Culvert Summary			
Allowable HW Elevation	12.00 ft	Headwater Depth/Height	2.18
Computed Headwater Elevation	12.00 ft	Discharge	4.67 cfs
Inlet Control HW Elev.	11.42 ft	Tailwater Elevation	0.00 ft
Outlet Control HW Elev.	12.00 ft	Control Type	Outlet Control

Grades			
Upstream Invert	10.00 ft	Downstream Invert	9.50 ft
Length	50.00 ft	Constructed Slope	1.0000 %

Hydraulic Profile			
Profile	CompositeM2PressureProfile	Depth, Downstream	0.66 ft
Slope Type	Mild	Normal Depth	N/A ft
Flow Regime	Subcritical	Critical Depth	0.66 ft
Velocity Downstream	4.93 ft/s	Critical Slope	2.2906 %

Section			
Section Shape	Arch	Mannings Coefficient	0.025
Section Material	Steel and Aluminum Var CR	Span	1.50 ft
Section Size	18.0 x 11.0 inch	Rise	0.92 ft
Number Sections	1		

Outlet Control Properties			
Outlet Control HW Elev.	12.00 ft	Upstream Velocity Head	0.28 ft
Ke	0.90	Entrance Loss	0.26 ft

Inlet Control Properties			
Inlet Control HW Elev.	11.42 ft	Flow Control	N/A
Inlet Type	Thin wall projecting	Area Full	1.1 ft²
K	0.03400	HDS 5 Chart	34
M	1.50000	HDS 5 Scale	3
C	0.04960	Equation Form	1
Y	0.57000		

Rating Table Report
Pics 31-32

Range Data:			
	Minimum	Maximum	Increment
Allowable HW E	10.00	12.00	0.50 ft

HW Elev. (ft)	Discharge (cfs)
10.00	0.00
10.50	1.08
11.00	3.21
11.50	4.13
12.00	4.67

Culvert Calculator Report
Pics 33-36

Comments: Pics 33-36

Solve For: Discharge

Culvert Summary			
Allowable HW Elevation	16.00 ft	Headwater Depth/Height	1.50
Computed Headwater Elevation	16.00 ft	Discharge	1,836.51 cfs
Inlet Control HW Elev.	15.94 ft	Tailwater Elevation	0.00 ft
Outlet Control HW Elev.	16.00 ft	Control Type	Entrance Control

Grades			
Upstream Invert	10.00 ft	Downstream Invert	9.50 ft
Length	50.00 ft	Constructed Slope	1.0000 %

Hydraulic Profile			
Profile	S2	Depth, Downstream	2.73 ft
Slope Type	Steep	Normal Depth	2.18 ft
Flow Regime	Supercritical	Critical Depth	3.43 ft
Velocity Downstream	13.20 ft/s	Critical Slope	0.2566 %

Section			
Section Shape	Box	Mannings Coefficient	0.013
Section Material	Concrete	Span	17.00 ft
Section Size	17 x 4 ft	Rise	4.00 ft
Number Sections	3		

Outlet Control Properties			
Outlet Control HW Elev.	16.00 ft	Upstream Velocity Head	1.71 ft
Ke	0.50	Entrance Loss	0.86 ft

Inlet Control Properties			
Inlet Control HW Elev.	15.94 ft	Flow Control	N/A
Inlet Type	45° non-offset wingwall flares	Area Full	204.0 ft²
K	0.49700	HDS 5 Chart	12
M	0.66700	HDS 5 Scale	1
C	0.03390	Equation Form	2
Y	0.80300		

Rating Table Report
Pics 33-36

Range Data:			
	Minimum	Maximum	Increment
Allowable HW E	10.00	16.00	1.00 ft

HW Elev. (ft)	Discharge (cfs)
10.00	0.00
11.00	124.96
12.00	353.44
13.00	649.30
14.00	999.67
15.00	1,397.08
16.00	1,836.51

Culvert Calculator Report
Pics 37-38

Comments: Pics 37-38

Solve For: Discharge

Culvert Summary			
Allowable HW Elevation	15.17 ft	Headwater Depth/Height	1.63
Computed Headwater Elevation	15.17 ft	Discharge	95.00 cfs
Inlet Control HW Elev.	15.12 ft	Tailwater Elevation	0.00 ft
Outlet Control HW Elev.	15.17 ft	Control Type	Outlet Control

Grades			
Upstream Invert	10.00 ft	Downstream Invert	9.50 ft
Length	50.00 ft	Constructed Slope	1.0000 %

Hydraulic Profile			
Profile	CompositeM2PressureProfile	Depth, Downstream	2.39 ft
Slope Type	Mild	Normal Depth	N/A ft
Flow Regime	Subcritical	Critical Depth	2.39 ft
Velocity Downstream	9.54 ft/s	Critical Slope	2.1653 %

Section			
Section Shape	Arch	Mannings Coefficient	0.025
Section Material	Steel and Aluminum Var CR	Span	4.75 ft
Section Size	57 x 38 inch	Rise	3.17 ft
Number Sections	1		

Outlet Control Properties			
Outlet Control HW Elev.	15.17 ft	Upstream Velocity Head	1.04 ft
Ke	0.90	Entrance Loss	0.94 ft

Inlet Control Properties			
Inlet Control HW Elev.	15.12 ft	Flow Control	N/A
Inlet Type	Thin wall projecting	Area Full	11.6 ft²
K	0.03400	HDS 5 Chart	34
M	1.50000	HDS 5 Scale	3
C	0.04960	Equation Form	1
Y	0.57000		

Rating Table Report
Pics 37-38

Range Data:			
	Minimum	Maximum	Increment
Allowable HW E	10.00	15.00	1.00 ft

HW Elev. (ft)	Discharge (cfs)
10.00	0.00
11.00	7.88
12.00	25.55
13.00	48.94
14.00	73.51
15.00	93.33

15.17 95.00

Culvert Calculator Report
Pics 39-40

Comments: Pics 39-40

Solve For: Discharge

Culvert Summary			
Allowable HW Elevation	18.00 ft	Headwater Depth/Height	2.00
Computed Headwater Elevation	18.00 ft	Discharge	129.36 cfs
Inlet Control HW Elev.	18.00 ft	Tailwater Elevation	0.00 ft
Outlet Control HW Elev.	17.73 ft	Control Type	Inlet Control

Grades			
Upstream Invert	10.00 ft	Downstream Invert	9.50 ft
Length	50.00 ft	Constructed Slope	1.0000 %

Hydraulic Profile			
Profile	CompositeM2PressureProfile	Depth, Downstream	3.40 ft
Slope Type	Mild	Normal Depth	N/A ft
Flow Regime	Subcritical	Critical Depth	3.40 ft
Velocity Downstream	11.35 ft/s	Critical Slope	2.5980 %

Section			
Section Shape	Circular	Mannings Coefficient	0.024
Section Material	CMP	Span	4.00 ft
Section Size	48 inch	Rise	4.00 ft
Number Sections	1		

Outlet Control Properties			
Outlet Control HW Elev.	17.73 ft	Upstream Velocity Head	1.65 ft
Ke	0.90	Entrance Loss	1.48 ft

Inlet Control Properties			
Inlet Control HW Elev.	18.00 ft	Flow Control	N/A
Inlet Type	Projecting	Area Full	12.6 ft²
K	0.03400	HDS 5 Chart	2
M	1.50000	HDS 5 Scale	3
C	0.05530	Equation Form	1
Y	0.54000		

Rating Table Report
Pics 39-40

Range Data:			
	Minimum	Maximum	Increment
Allowable HW E	10.00	18.00	1.00 ft

HW Elev. (ft)	Discharge (cfs)
10.00	0.00
11.00	4.60
12.00	17.07
13.00	36.00
14.00	59.52
15.00	84.15
16.00	104.99
17.00	117.81
18.00	129.36

Culvert Calculator Report
Pics 41-42

Comments: Pics 41-42

Solve For: Discharge

Culvert Summary			
Allowable HW Elevation	16.50 ft	Headwater Depth/Height	2.69
Computed Headwater Elevation	16.50 ft	Discharge	62.16 cfs
Inlet Control HW Elev.	15.90 ft	Tailwater Elevation	0.00 ft
Outlet Control HW Elev.	16.50 ft	Control Type	Outlet Control

Grades			
Upstream Invert	10.00 ft	Downstream Invert	9.50 ft
Length	50.00 ft	Constructed Slope	1.0000 %

Hydraulic Profile			
Profile	CompositeM2PressureProfile	Depth, Downstream	2.08 ft
Slope Type	Mild	Normal Depth	N/A ft
Flow Regime	Subcritical	Critical Depth	2.08 ft
Velocity Downstream	9.87 ft/s	Critical Slope	3.4263 %

Section			
Section Shape	Arch	Mannings Coefficient	0.025
Section Material	Steel and Aluminum Var CR	Span	3.50 ft
Section Size	42 x 29 inch	Rise	2.42 ft
Number Sections	1		

Outlet Control Properties			
Outlet Control HW Elev.	16.50 ft	Upstream Velocity Head	1.42 ft
Ke	0.90	Entrance Loss	1.28 ft

Inlet Control Properties			
Inlet Control HW Elev.	15.90 ft	Flow Control	N/A
Inlet Type	Thin wall projecting	Area Full	6.5 ft²
K	0.03400	HDS 5 Chart	34
M	1.50000	HDS 5 Scale	3
C	0.04960	Equation Form	1
Y	0.57000		

Rating Table Report
Pics 41-42

Range Data:				
	Minimum	Maximum	Increment	
Allowable HW E	10.00	16.50	0.50	ft

HW Elev. (ft)	Discharge (cfs)
10.00	0.00
10.50	1.87
11.00	6.28
11.50	12.43
12.00	19.84
12.50	27.82
13.00	35.52
13.50	41.96
14.00	45.34
14.50	48.93
15.00	52.42
15.50	55.79
16.00	59.04
16.50	62.16

Culvert Calculator Report
Pics 43-44

Comments: Pics 43-44

Solve For: Discharge

Culvert Summary			
Allowable HW Elevation	18.00 ft	Headwater Depth/Height	1.33
Computed Headwater Elevation	18.00 ft	Discharge	507.54 cfs
Inlet Control HW Elev.	17.87 ft	Tailwater Elevation	0.00 ft
Outlet Control HW Elev.	18.00 ft	Control Type	Outlet Control

Grades			
Upstream Invert	10.00 ft	Downstream Invert	9.50 ft
Length	50.00 ft	Constructed Slope	1.0000 %

Hydraulic Profile			
Profile	M2	Depth, Downstream	4.36 ft
Slope Type	Mild	Normal Depth	N/A ft
Flow Regime	Subcritical	Critical Depth	4.36 ft
Velocity Downstream	11.52 ft/s	Critical Slope	1.5837 %

Section			
Section Shape	Circular	Mannings Coefficient	0.024
Section Material	CMP	Span	6.00 ft
Section Size	72 inch	Rise	6.00 ft
Number Sections	2		

Outlet Control Properties			
Outlet Control HW Elev.	18.00 ft	Upstream Velocity Head	1.58 ft
Ke	0.90	Entrance Loss	1.42 ft

Inlet Control Properties			
Inlet Control HW Elev.	17.87 ft	Flow Control	N/A
Inlet Type	Projecting	Area Full	56.5 ft²
K	0.03400	HDS 5 Chart	2
M	1.50000	HDS 5 Scale	3
C	0.05530	Equation Form	1
Y	0.54000		

Rating Table Report
Pics 43-44

Range Data:			
	Minimum	Maximum	Increment
Allowable HW E	10.00	18.00	1.00 ft

HW Elev. (ft)	Discharge (cfs)
10.00	0.00
11.00	11.42
12.00	42.75
13.00	91.50
14.00	155.90
15.00	234.14
16.00	322.90
17.00	416.17
18.00	507.54

Culvert Calculator Report
Pic 45

Comments: Pic 45

Solve For: Discharge

Culvert Summary			
Allowable HW Elevation	18.00 ft	Headwater Depth/Height	4.00
Computed Headwater Elevation	18.00 ft	Discharge	38.08 cfs
Inlet Control HW Elev.	16.94 ft	Tailwater Elevation	0.00 ft
Outlet Control HW Elev.	18.00 ft	Control Type	Outlet Control

Grades			
Upstream Invert	10.00 ft	Downstream Invert	9.70 ft
Length	30.00 ft	Constructed Slope	1.0000 %

Hydraulic Profile			
Profile	CompositeM2PressureProfile	Depth, Downstream	1.94 ft
Slope Type	Mild	Normal Depth	N/A ft
Flow Regime	Subcritical	Critical Depth	1.94 ft
Velocity Downstream	12.22 ft/s	Critical Slope	8.5124 %

Section			
Section Shape	Circular	Mannings Coefficient	0.024
Section Material	CMP	Span	2.00 ft
Section Size	24 inch	Rise	2.00 ft
Number Sections	1		

Outlet Control Properties			
Outlet Control HW Elev.	18.00 ft	Upstream Velocity Head	2.28 ft
Ke	0.50	Entrance Loss	1.14 ft

Inlet Control Properties			
Inlet Control HW Elev.	16.94 ft	Flow Control	N/A
Inlet Type	Headwall	Area Full	3.1 ft²
K	0.00780	HDS 5 Chart	2
M	2.00000	HDS 5 Scale	1
C	0.03790	Equation Form	1
Y	0.69000		

Rating Table Report
Pic 45

Range Data:				
	Minimum	Maximum	Increment	
Allowable HW E	10.00	18.00	1.00	ft

HW Elev. (ft)	Discharge (cfs)
10.00	0.00
11.00	3.53
12.00	11.73
13.00	18.78
14.00	23.59
15.00	27.81
16.00	31.57
17.00	34.96
18.00	38.08

Culvert Calculator Report
Pics 47-48

Comments: Pics 47-48

Solve For: Discharge

Culvert Summary			
Allowable HW Elevation	16.00 ft	Headwater Depth/Height	1.50
Computed Headwater Elevation	16.00 ft	Discharge	450.97 cfs
Inlet Control HW Elev.	15.79 ft	Tailwater Elevation	0.00 ft
Outlet Control HW Elev.	16.00 ft	Control Type	Outlet Control

Grades			
Upstream Invert	10.00 ft	Downstream Invert	9.50 ft
Length	50.00 ft	Constructed Slope	1.0000 %

Hydraulic Profile			
Profile	CompositeM2PressureProfile	Depth, Downstream	3.21 ft
Slope Type	Mild	Normal Depth	N/A ft
Flow Regime	Subcritical	Critical Depth	3.21 ft
Velocity Downstream	10.44 ft/s	Critical Slope	2.1881 %

Section			
Section Shape	Circular	Mannings Coefficient	0.024
Section Material	CMP	Span	4.00 ft
Section Size	48 inch	Rise	4.00 ft
Number Sections	4		

Outlet Control Properties			
Outlet Control HW Elev.	16.00 ft	Upstream Velocity Head	1.25 ft
Ke	0.50	Entrance Loss	0.63 ft

Inlet Control Properties			
Inlet Control HW Elev.	15.79 ft	Flow Control	N/A
Inlet Type	Headwall	Area Full	50.3 ft²
K	0.00780	HDS 5 Chart	2
M	2.00000	HDS 5 Scale	1
C	0.03790	Equation Form	1
Y	0.69000		

Rating Table Report
Pics 47-48

Range Data:				
	Minimum	Maximum	Increment	
Allowable HW E	10.00	16.00	1.00	ft

HW Elev. (ft)	Discharge (cfs)
10.00	0.00
11.00	21.26
12.00	79.23
13.00	165.90
14.00	269.51
15.00	372.25
16.00	450.97

Culvert Calculator Report
Pics 49-51

Comments: Pics 49-51

Solve For: Discharge

Culvert Summary			
Allowable HW Elevation	21.00 ft	Headwater Depth/Height	2.75
Computed Headwater Elevation	21.00 ft	Discharge	324.65 cfs
Inlet Control HW Elev.	21.00 ft	Tailwater Elevation	0.00 ft
Outlet Control HW Elev.	18.88 ft	Control Type	Inlet Control

Grades			
Upstream Invert	10.00 ft	Downstream Invert	9.50 ft
Length	50.00 ft	Constructed Slope	1.0000 %

Hydraulic Profile			
Profile	PressureProfile	Depth, Downstream	4.00 ft
Slope Type	N/A	Normal Depth	N/A ft
Flow Regime	N/A	Critical Depth	4.00 ft
Velocity Downstream	13.53 ft/s	Critical Slope	1.0983 %

Section			
Section Shape	Box	Mannings Coefficient	0.013
Section Material	Concrete	Span	6.00 ft
Section Size	6 x 4 ft	Rise	4.00 ft
Number Sections	1		

Outlet Control Properties			
Outlet Control HW Elev.	18.88 ft	Upstream Velocity Head	2.84 ft
Ke	0.70	Entrance Loss	1.99 ft

Inlet Control Properties			
Inlet Control HW Elev.	21.00 ft	Flow Control	N/A
Inlet Type	0° wingwall flares	Area Full	24.0 ft²
K	0.06100	HDS 5 Chart	8
M	0.75000	HDS 5 Scale	3
C	0.04230	Equation Form	1
Y	0.82000		

Rating Table Report
Pics 49-51

Range Data:				
	Minimum	Maximum	Increment	
Allowable HW E	10.00	21.00	1.00	ft

HW Elev. (ft)	Discharge (cfs)
10.00	0.00
11.00	13.53
12.00	38.26
13.00	70.28
14.00	108.20
15.00	151.22
16.00	193.16
17.00	225.67
18.00	254.06
19.00	279.57
20.00	302.95
21.00	324.65

Culvert Calculator Report
Pics 55&57

Comments: Pics 55&57

Solve For: Discharge

Culvert Summary			
Allowable HW Elevation	15.17 ft	Headwater Depth/Height	3.10
Computed Headwater Elevation	15.17 ft	Discharge	58.95 cfs
Inlet Control HW Elev.	12.88 ft	Tailwater Elevation	0.00 ft
Outlet Control HW Elev.	15.17 ft	Control Type	Outlet Control

Grades			
Upstream Invert	10.00 ft	Downstream Invert	9.00 ft
Length	100.00 ft	Constructed Slope	1.0000 %

Hydraulic Profile			
Profile	CompositeM2PressureProfile	Depth, Downstream	1.32 ft
Slope Type	Mild	Normal Depth	N/A ft
Flow Regime	Subcritical	Critical Depth	1.32 ft
Velocity Downstream	7.25 ft/s	Critical Slope	3.0226 %

Section			
Section Shape	Arch	Mannings Coefficient	0.025
Section Material	Steel and Aluminum Var CR	Span	2.33 ft
Section Size	28 x 20 inch	Rise	1.67 ft
Number Sections	3		

Outlet Control Properties			
Outlet Control HW Elev.	15.17 ft	Upstream Velocity Head	0.71 ft
Ke	0.50	Entrance Loss	0.36 ft

Inlet Control Properties			
Inlet Control HW Elev.	12.88 ft	Flow Control	N/A
Inlet Type	90° headwall	Area Full	8.7 ft²
K	0.00830	HDS 5 Chart	34
M	2.00000	HDS 5 Scale	1
C	0.03790	Equation Form	1
Y	0.69000		

Rating Table Report
Pics 55&57

Range Data:			
	Minimum	Maximum	Increment
Allowable HW E	10.00	15.00	1.00 ft

HW Elev. (ft)	Discharge (cfs)
10.00	0.00
11.00	15.38
12.00	39.29
13.00	45.37
14.00	51.87
15.00	57.98

15.17 58.95

Culvert Calculator Report
Pics 56-57

Comments: Pics 56-57

Solve For: Discharge

Culvert Summary			
Allowable HW Elevation	13.75 ft	Headwater Depth/Height	3.00
Computed Headwater Elevation	13.75 ft	Discharge	9.93 cfs
Inlet Control HW Elev.	12.32 ft	Tailwater Elevation	0.00 ft
Outlet Control HW Elev.	13.75 ft	Control Type	Outlet Control

Grades			
Upstream Invert	10.00 ft	Downstream Invert	9.50 ft
Length	50.00 ft	Constructed Slope	1.0000 %

Hydraulic Profile			
Profile	CompositeM2PressureProfile	Depth, Downstream	1.00 ft
Slope Type	Mild	Normal Depth	N/A ft
Flow Regime	Subcritical	Critical Depth	1.00 ft
Velocity Downstream	6.37 ft/s	Critical Slope	3.4266 %

Section			
Section Shape	Arch	Mannings Coefficient	0.025
Section Material	Steel and Aluminum Var CR	Span	1.75 ft
Section Size	21 x 15 inch	Rise	1.25 ft
Number Sections	1		

Outlet Control Properties			
Outlet Control HW Elev.	13.75 ft	Upstream Velocity Head	0.60 ft
Ke	0.50	Entrance Loss	0.30 ft

Inlet Control Properties			
Inlet Control HW Elev.	12.32 ft	Flow Control	N/A
Inlet Type	90° headwall	Area Full	1.6 ft²
K	0.00830	HDS 5 Chart	34
M	2.00000	HDS 5 Scale	1
C	0.03790	Equation Form	1
Y	0.69000		

Rating Table Report
Pics 56-57

Range Data:			
	Minimum	Maximum	Increment
Allowable HW E	10.00	13.50	0.50 ft

HW Elev. (ft)	Discharge (cfs)
10.00	0.00
10.50	1.27
11.00	3.90
11.50	6.44
12.00	7.20
12.50	8.01
13.00	8.81
13.50	9.56
13.75	9.93

Culvert Calculator Report
Pics 58-59

Comments: Pics 58-59

Solve For: Discharge

Culvert Summary			
Allowable HW Elevation	14.50 ft	Headwater Depth/Height	3.00
Computed Headwater Elevation	14.50 ft	Discharge	12.49 cfs
Inlet Control HW Elev.	12.92 ft	Tailwater Elevation	0.00 ft
Outlet Control HW Elev.	14.50 ft	Control Type	Outlet Control

Grades			
Upstream Invert	10.00 ft	Downstream Invert	9.50 ft
Length	50.00 ft	Constructed Slope	1.0000 %

Hydraulic Profile			
Profile	CompositeM2PressureProfile	Depth, Downstream	1.33 ft
Slope Type	Mild	Normal Depth	N/A ft
Flow Regime	Subcritical	Critical Depth	1.33 ft
Velocity Downstream	7.52 ft/s	Critical Slope	4.2894 %

Section			
Section Shape	Circular	Mannings Coefficient	0.024
Section Material	CMP	Span	1.50 ft
Section Size	18 inch	Rise	1.50 ft
Number Sections	1		

Outlet Control Properties			
Outlet Control HW Elev.	14.50 ft	Upstream Velocity Head	0.78 ft
Ke	0.50	Entrance Loss	0.39 ft

Inlet Control Properties			
Inlet Control HW Elev.	12.92 ft	Flow Control	N/A
Inlet Type	Headwall	Area Full	1.8 ft²
K	0.00780	HDS 5 Chart	2
M	2.00000	HDS 5 Scale	1
C	0.03790	Equation Form	1
Y	0.69000		

Rating Table Report
Pics 58-59

Range Data:			
	Minimum	Maximum	Increment
Allowable HW E	10.00	14.50	0.50 ft

HW Elev. (ft)	Discharge (cfs)
10.00	0.00
10.50	0.80
11.00	2.89
11.50	5.56
12.00	7.44
12.50	8.62
13.00	9.70
13.50	10.69
14.00	11.62
14.50	12.49

Culvert Calculator Report
Pics 60-61

Comments: Pics 60-61

Solve For: Discharge

Culvert Summary			
Allowable HW Elevation	12.50 ft	Headwater Depth/Height	1.67
Computed Headwater Elevation	12.50 ft	Discharge	8.46 cfs
Inlet Control HW Elev.	12.15 ft	Tailwater Elevation	0.00 ft
Outlet Control HW Elev.	12.50 ft	Control Type	Outlet Control

Grades			
Upstream Invert	10.00 ft	Downstream Invert	9.50 ft
Length	50.00 ft	Constructed Slope	1.0000 %

Hydraulic Profile			
Profile	CompositeM2PressureProfile	Depth, Downstream	1.13 ft
Slope Type	Mild	Normal Depth	N/A ft
Flow Regime	Subcritical	Critical Depth	1.13 ft
Velocity Downstream	5.94 ft/s	Critical Slope	2.6492 %

Section			
Section Shape	Circular	Mannings Coefficient	0.024
Section Material	CMP	Span	1.50 ft
Section Size	18 inch	Rise	1.50 ft
Number Sections	1		

Outlet Control Properties			
Outlet Control HW Elev.	12.50 ft	Upstream Velocity Head	0.36 ft
Ke	0.70	Entrance Loss	0.25 ft

Inlet Control Properties			
Inlet Control HW Elev.	12.15 ft	Flow Control	N/A
Inlet Type	Mitered to slope	Area Full	1.8 ft²
K	0.02100	HDS 5 Chart	2
M	1.33000	HDS 5 Scale	2
C	0.04630	Equation Form	1
Y	0.75000		

Rating Table Report
Pics 60-61

Range Data:			
	Minimum	Maximum	Increment
Allowable HW E	10.00	12.50	0.50 ft

HW Elev. (ft)	Discharge (cfs)
10.00	0.00
10.50	0.75
11.00	2.73
11.50	5.33
12.00	7.31
12.50	8.46

Culvert Calculator Report
Pic 62

Comments: Pic 62

Solve For: Discharge

Culvert Summary			
Allowable HW Elevation	13.00 ft	Headwater Depth/Height	1.50
Computed Headwater Elevation	13.00 ft	Discharge	33.77 cfs
Inlet Control HW Elev.	12.71 ft	Tailwater Elevation	0.00 ft
Outlet Control HW Elev.	13.00 ft	Control Type	Outlet Control

Grades			
Upstream Invert	10.00 ft	Downstream Invert	9.50 ft
Length	50.00 ft	Constructed Slope	1.0000 %

Hydraulic Profile			
Profile	CompositeM2PressureProfile	Depth, Downstream	1.48 ft
Slope Type	Mild	Normal Depth	N/A ft
Flow Regime	Subcritical	Critical Depth	1.48 ft
Velocity Downstream	6.77 ft/s	Critical Slope	2.3513 %

Section			
Section Shape	Circular	Mannings Coefficient	0.024
Section Material	CMP	Span	2.00 ft
Section Size	24 inch	Rise	2.00 ft
Number Sections	2		

Outlet Control Properties			
Outlet Control HW Elev.	13.00 ft	Upstream Velocity Head	0.45 ft
Ke	0.90	Entrance Loss	0.40 ft

Inlet Control Properties			
Inlet Control HW Elev.	12.71 ft	Flow Control	N/A
Inlet Type	Projecting	Area Full	6.3 ft²
K	0.03400	HDS 5 Chart	2
M	1.50000	HDS 5 Scale	3
C	0.05530	Equation Form	1
Y	0.54000		

Rating Table Report
Pic 62

Range Data:			
	Minimum	Maximum	Increment
Allowable HW E	10.00	13.00	1.00 ft

HW Elev. (ft)	Discharge (cfs)
10.00	0.00
11.00	6.22
12.00	21.15
13.00	33.77

Culvert Calculator Report
Pics 66-67

Comments: Pics 66-67

Solve For: Discharge

Culvert Summary			
Allowable HW Elevation	12.50 ft	Headwater Depth/Height	1.67
Computed Headwater Elevation	12.50 ft	Discharge	8.31 cfs
Inlet Control HW Elev.	12.05 ft	Tailwater Elevation	0.00 ft
Outlet Control HW Elev.	12.50 ft	Control Type	Outlet Control

Grades			
Upstream Invert	10.00 ft	Downstream Invert	9.50 ft
Length	50.00 ft	Constructed Slope	1.0000 %

Hydraulic Profile			
Profile	CompositeM2PressureProfile	Depth, Downstream	1.12 ft
Slope Type	Mild	Normal Depth	N/A ft
Flow Regime	Subcritical	Critical Depth	1.12 ft
Velocity Downstream	5.89 ft/s	Critical Slope	2.6084 %

Section			
Section Shape	Circular	Mannings Coefficient	0.024
Section Material	CMP	Span	1.50 ft
Section Size	18 inch	Rise	1.50 ft
Number Sections	1		

Outlet Control Properties			
Outlet Control HW Elev.	12.50 ft	Upstream Velocity Head	0.34 ft
Ke	0.90	Entrance Loss	0.31 ft

Inlet Control Properties			
Inlet Control HW Elev.	12.05 ft	Flow Control	N/A
Inlet Type	Projecting	Area Full	1.8 ft²
K	0.03400	HDS 5 Chart	2
M	1.50000	HDS 5 Scale	3
C	0.05530	Equation Form	1
Y	0.54000		

Rating Table Report
Pics 66-67

Range Data:			
	Minimum	Maximum	Increment
Allowable HW E	10.00	12.50	0.50 ft

HW Elev. (ft)	Discharge (cfs)
10.00	0.00
10.50	0.71
11.00	2.58
11.50	5.11
12.00	7.19
12.50	8.31

Culvert Calculator Report
Pics 68-69

Comments: Pics 68-69

Solve For: Discharge

Culvert Summary			
Allowable HW Elevation	13.50 ft	Headwater Depth/Height	1.40
Computed Headwater Elevation	13.50 ft	Discharge	29.11 cfs
Inlet Control HW Elev.	13.35 ft	Tailwater Elevation	0.00 ft
Outlet Control HW Elev.	13.50 ft	Control Type	Outlet Control

Grades			
Upstream Invert	10.00 ft	Downstream Invert	9.50 ft
Length	50.00 ft	Constructed Slope	1.0000 %

Hydraulic Profile			
Profile	M2	Depth, Downstream	1.84 ft
Slope Type	Mild	Normal Depth	N/A ft
Flow Regime	Subcritical	Critical Depth	1.84 ft
Velocity Downstream	7.52 ft/s	Critical Slope	2.1599 %

Section			
Section Shape	Circular	Mannings Coefficient	0.024
Section Material	CMP	Span	2.50 ft
Section Size	30 inch	Rise	2.50 ft
Number Sections	1		

Outlet Control Properties			
Outlet Control HW Elev.	13.50 ft	Upstream Velocity Head	0.55 ft
Ke	0.90	Entrance Loss	0.50 ft

Inlet Control Properties			
Inlet Control HW Elev.	13.35 ft	Flow Control	N/A
Inlet Type	Projecting	Area Full	4.9 ft²
K	0.03400	HDS 5 Chart	2
M	1.50000	HDS 5 Scale	3
C	0.05530	Equation Form	1
Y	0.54000		

Rating Table Report
Pics 68-69

Range Data:				
	Minimum	Maximum	Increment	
Allowable HW E	10.00	13.50	0.50	ft

HW Elev. (ft)	Discharge (cfs)
10.00	0.00
10.50	0.94
11.00	3.55
11.50	7.56
12.00	12.70
12.50	18.51
13.00	24.29
13.50	29.11

Culvert Calculator Report
Pics 70-71

Comments: Pics 70-71

Solve For: Discharge

Culvert Summary			
Allowable HW Elevation	14.00 ft	Headwater Depth/Height	2.00
Computed Headwater Elevation	14.00 ft	Discharge	41.24 cfs
Inlet Control HW Elev.	13.45 ft	Tailwater Elevation	0.00 ft
Outlet Control HW Elev.	14.00 ft	Control Type	Outlet Control

Grades			
Upstream Invert	10.00 ft	Downstream Invert	9.50 ft
Length	50.00 ft	Constructed Slope	1.0000 %

Hydraulic Profile			
Profile	CompositeM2PressureProfile	Depth, Downstream	1.63 ft
Slope Type	Mild	Normal Depth	N/A ft
Flow Regime	Subcritical	Critical Depth	1.63 ft
Velocity Downstream	7.53 ft/s	Critical Slope	2.8658 %

Section			
Section Shape	Circular	Mannings Coefficient	0.024
Section Material	CMP	Span	2.00 ft
Section Size	24 inch	Rise	2.00 ft
Number Sections	2		

Outlet Control Properties			
Outlet Control HW Elev.	14.00 ft	Upstream Velocity Head	0.67 ft
Ke	0.90	Entrance Loss	0.60 ft

Inlet Control Properties			
Inlet Control HW Elev.	13.45 ft	Flow Control	N/A
Inlet Type	Projecting	Area Full	6.3 ft²
K	0.03400	HDS 5 Chart	2
M	1.50000	HDS 5 Scale	3
C	0.05530	Equation Form	1
Y	0.54000		

Rating Table Report
Pics 70-71

Range Data:			
	Minimum	Maximum	Increment
Allowable HW E	10.00	14.00	1.00 ft

HW Elev. (ft)	Discharge (cfs)
10.00	0.00
11.00	6.22
12.00	21.15
13.00	33.77
14.00	41.24

Culvert Calculator Report
Pics 73-74

Comments: Pics 73-74

Solve For: Discharge

Culvert Summary			
Allowable HW Elevation	13.00 ft	Headwater Depth/Height	1.50
Computed Headwater Elevation	13.00 ft	Discharge	33.77 cfs
Inlet Control HW Elev.	12.71 ft	Tailwater Elevation	0.00 ft
Outlet Control HW Elev.	13.00 ft	Control Type	Outlet Control

Grades			
Upstream Invert	10.00 ft	Downstream Invert	9.50 ft
Length	50.00 ft	Constructed Slope	1.0000 %

Hydraulic Profile			
Profile	CompositeM2PressureProfile	Depth, Downstream	1.48 ft
Slope Type	Mild	Normal Depth	N/A ft
Flow Regime	Subcritical	Critical Depth	1.48 ft
Velocity Downstream	6.77 ft/s	Critical Slope	2.3513 %

Section			
Section Shape	Circular	Mannings Coefficient	0.024
Section Material	CMP	Span	2.00 ft
Section Size	24 inch	Rise	2.00 ft
Number Sections	2		

Outlet Control Properties			
Outlet Control HW Elev.	13.00 ft	Upstream Velocity Head	0.45 ft
Ke	0.90	Entrance Loss	0.40 ft

Inlet Control Properties			
Inlet Control HW Elev.	12.71 ft	Flow Control	N/A
Inlet Type	Projecting	Area Full	6.3 ft²
K	0.03400	HDS 5 Chart	2
M	1.50000	HDS 5 Scale	3
C	0.05530	Equation Form	1
Y	0.54000		

Rating Table Report
Pics 73-74

Range Data:			
	Minimum	Maximum	Increment
Allowable HW E	10.00	13.00	0.50 ft

HW Elev. (ft)	Discharge (cfs)
10.00	0.00
10.50	1.67
11.00	6.22
11.50	13.03
12.00	21.15
12.50	28.92
13.00	33.77

Culvert Calculator Report
Pics 75-77

Comments: Pics 75-77

Solve For: Discharge

Culvert Summary			
Allowable HW Elevation	12.25 ft	Headwater Depth/Height	1.80
Computed Headwater Elevation	12.25 ft	Discharge	14.77 cfs
Inlet Control HW Elev.	11.76 ft	Tailwater Elevation	0.00 ft
Outlet Control HW Elev.	12.25 ft	Control Type	Outlet Control

Grades			
Upstream Invert	10.00 ft	Downstream Invert	9.50 ft
Length	50.00 ft	Constructed Slope	1.0000 %

Hydraulic Profile			
Profile	CompositeM2PressureProfile	Depth, Downstream	0.86 ft
Slope Type	Mild	Normal Depth	N/A ft
Flow Regime	Subcritical	Critical Depth	0.86 ft
Velocity Downstream	5.44 ft/s	Critical Slope	2.5652 %

Section			
Section Shape	Arch	Mannings Coefficient	0.025
Section Material	Steel and Aluminum Var CR	Span	1.75 ft
Section Size	21 x 15 inch	Rise	1.25 ft
Number Sections	2		

Outlet Control Properties			
Outlet Control HW Elev.	12.25 ft	Upstream Velocity Head	0.33 ft
Ke	0.90	Entrance Loss	0.30 ft

Inlet Control Properties			
Inlet Control HW Elev.	11.76 ft	Flow Control	N/A
Inlet Type	Thin wall projecting	Area Full	3.2 ft²
K	0.03400	HDS 5 Chart	34
M	1.50000	HDS 5 Scale	3
C	0.04960	Equation Form	1
Y	0.57000		

Rating Table Report
Pics 75-77

Range Data:			
	Minimum	Maximum	Increment
Allowable HW E	10.00	12.25	0.25 ft

HW Elev. (ft)	Discharge (cfs)
10.00	0.00
10.25	0.67
10.50	2.26
10.75	4.47
11.00	7.08
11.25	9.78
11.50	12.20
11.75	13.32
12.00	14.01
12.25	14.77

Culvert Calculator Report
Highway 89 at Road 3.5 North

Solve For: Discharge

Culvert Summary			
Allowable HW Elevation	16.00 ft	Headwater Depth/Height	1.50
Computed Headwater Elev	16.00 ft	Discharge	288.08 cfs
Inlet Control HW Elev.	15.94 ft	Tailwater Elevation	0.00 ft
Outlet Control HW Elev.	16.00 ft	Control Type	Entrance Control

Grades			
Upstream Invert	10.00 ft	Downstream Invert	9.00 ft
Length	100.00 ft	Constructed Slope	1.0000 %

Hydraulic Profile			
Profile	S2	Depth, Downstream	2.65 ft
Slope Type	Steep	Normal Depth	2.40 ft
Flow Regime	Supercritical	Critical Depth	3.43 ft
Velocity Downstream	13.58 ft/s	Critical Slope	0.3728 %

Section			
Section Shape	Box	Mannings Coefficient	0.013
Section Material	Concrete	Span	8.00 ft
Section Size	8 x 4 ft	Rise	4.00 ft
Number Sections	1		

Outlet Control Properties			
Outlet Control HW Elev.	16.00 ft	Upstream Velocity Head	1.71 ft
Ke	0.50	Entrance Loss	0.86 ft

Inlet Control Properties			
Inlet Control HW Elev.	15.94 ft	Flow Control	N/A
Inlet Type	45° non-offset wingwall flares	Area Full	32.0 ft²
K	0.49700	HDS 5 Chart	12
M	0.66700	HDS 5 Scale	1
C	0.03390	Equation Form	2
Y	0.80300		

Rating Table Report
Highway 89 at Road 3.5 North

Range Data:			
	Minimum	Maximum	Increment
Allowable HW E	10.00	16.00	1.00 ft

HW Elev. (ft)	Discharge (cfs)
10.00	0.00
11.00	19.60
12.00	55.44
13.00	101.85
14.00	156.81
15.00	219.15
16.00	288.08