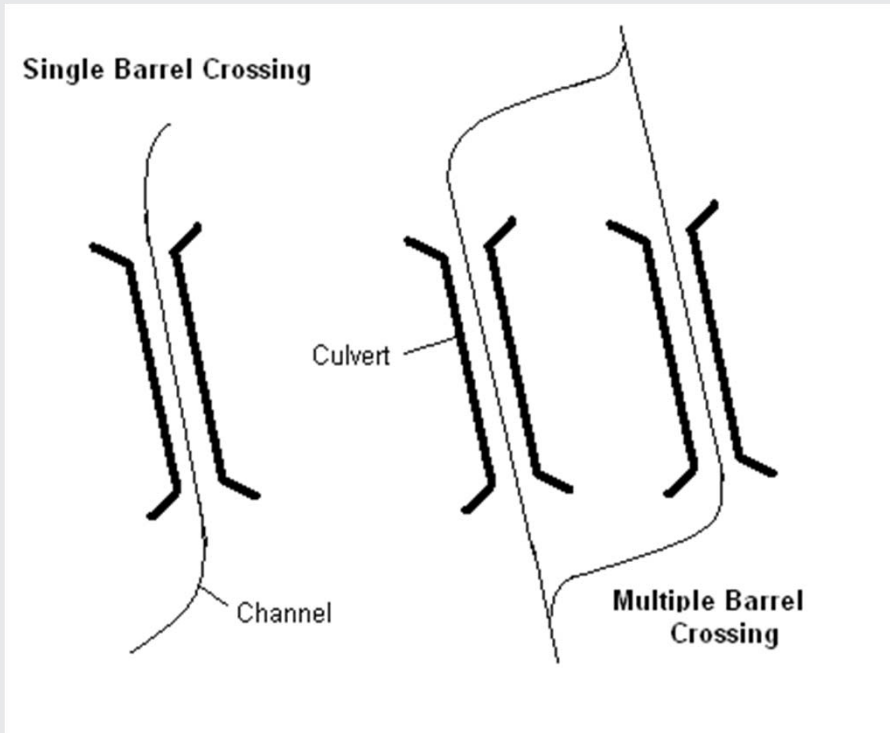




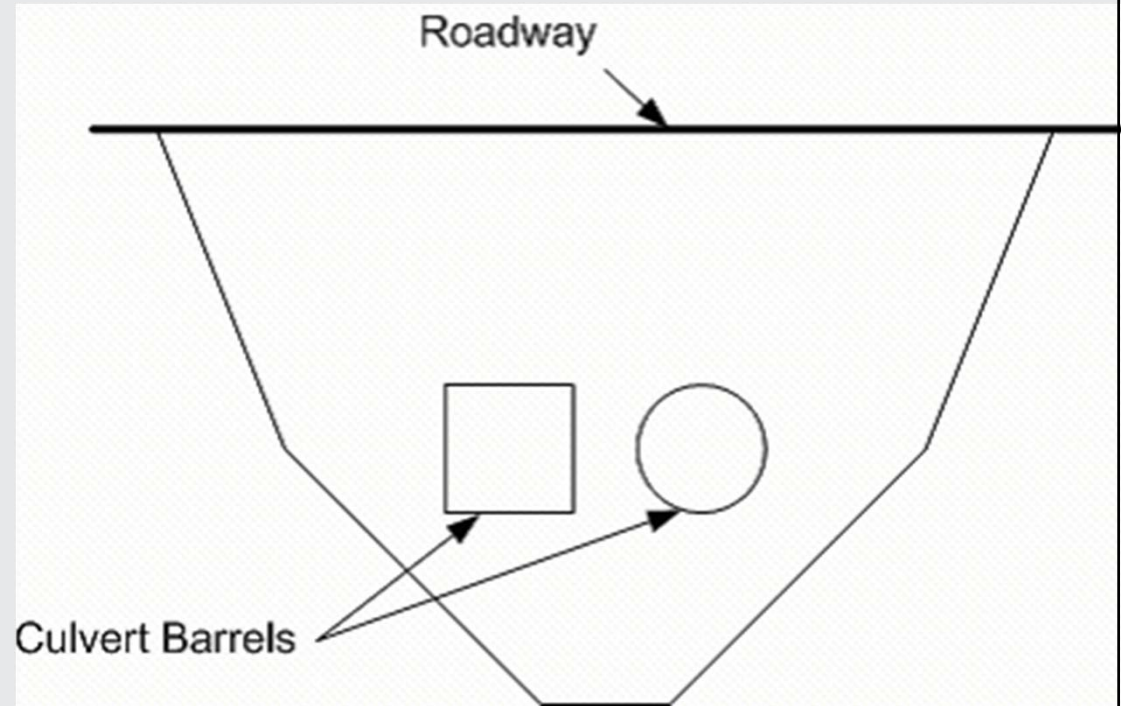
HY-8 culvert design tool

Darren Lumbroso, HR Wallingford

Single barrel or multiple barrel crossing



Plan view



Cross-section

Minimum discharge

Lower limit used for the culvert performance curve. Can be edited to a number greater than '0'.

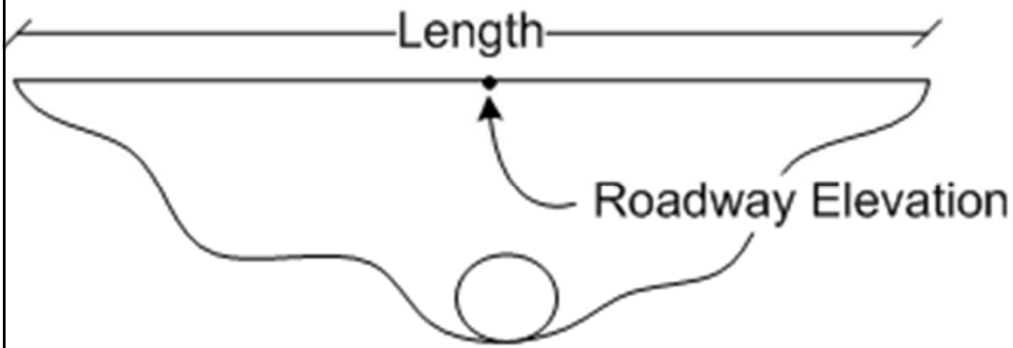
Design discharge

Discharge for which the culvert will be designed. Always included as one of the points on the performance curve.

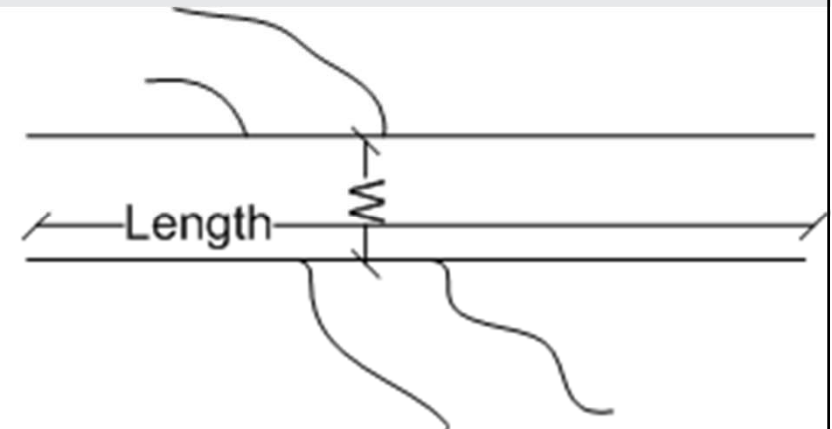
Maximum discharge

Upper limit used for the culvert performance curve.

Defining the roadway profile

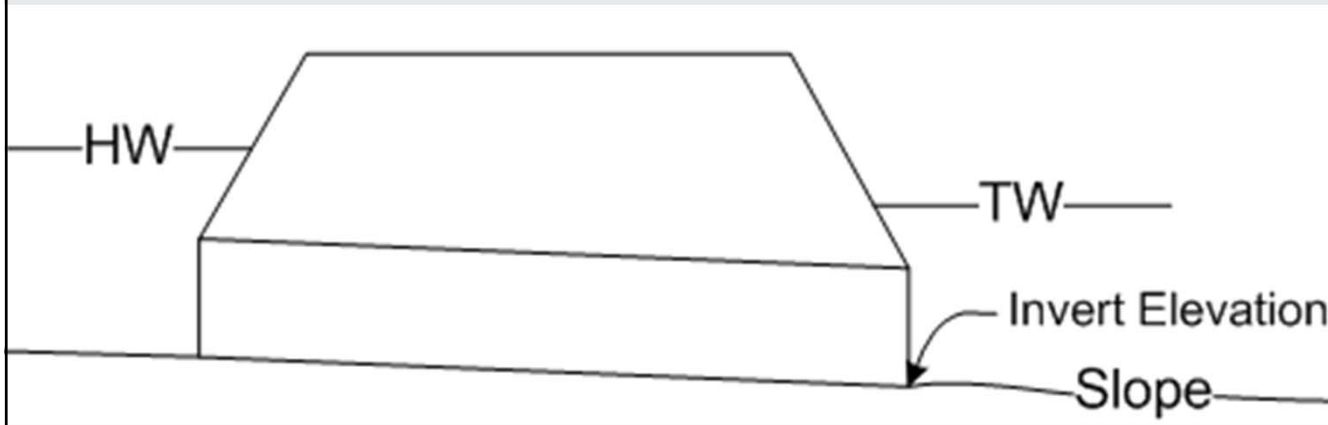


Cross-section

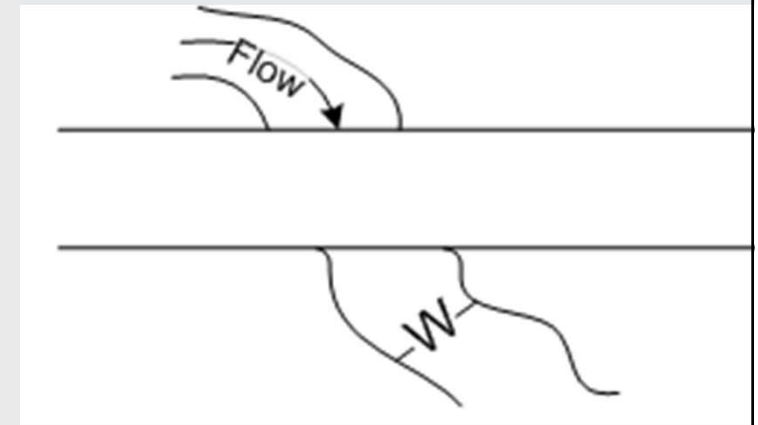


Plan view

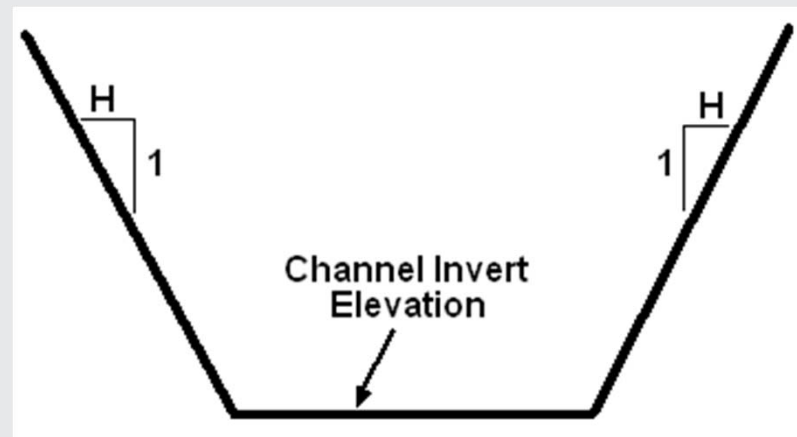
Channel and culvert shape



Longitudinal section

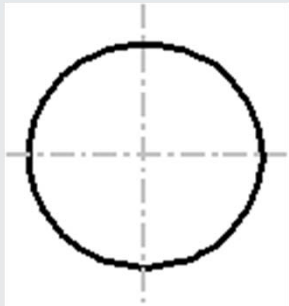


Plan view

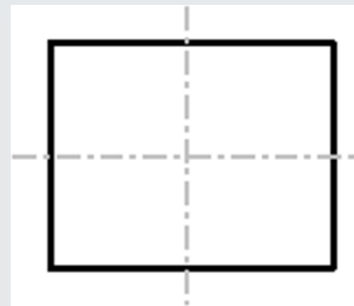


Culvert cross-section

Culvert shapes



Circular



Box



Pipe arch



Elliptical



Arch

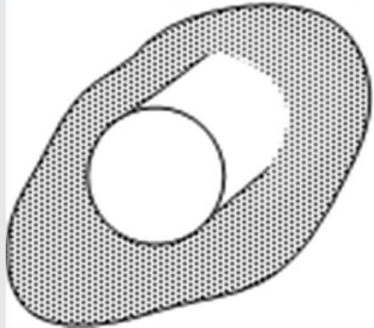


Metal box

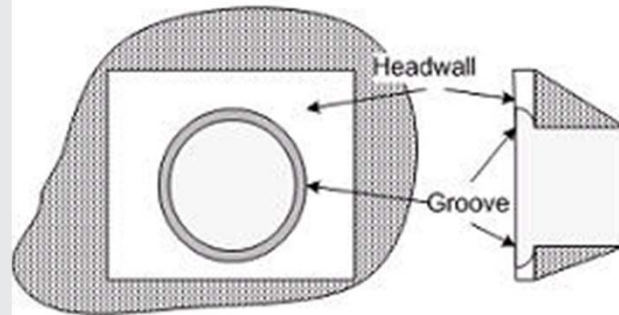
- > Corrugated steel
- > Steel structural plate
- > Corrugated aluminium
- > Aluminium structural plate
- > Reinforced concrete
- > PVC
- > Smooth HDPE
- > Corrugated PE

Inlet edge conditions

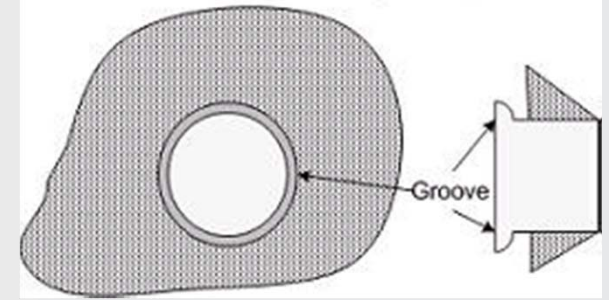
Projecting



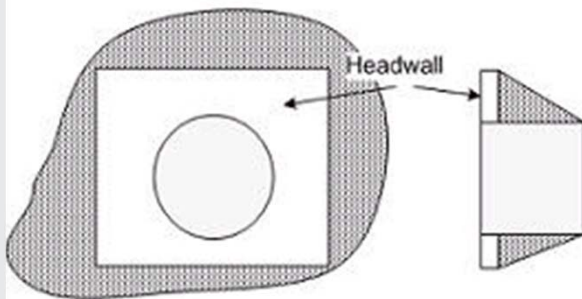
Grooved Pipe with Headwalls



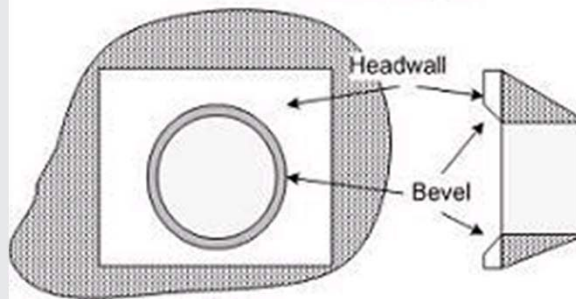
Grooved Pipe Projecting



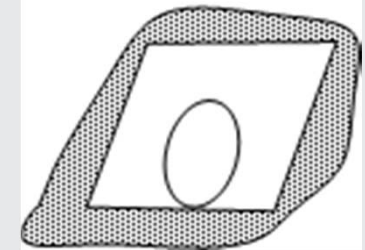
Square Edge with Headwalls



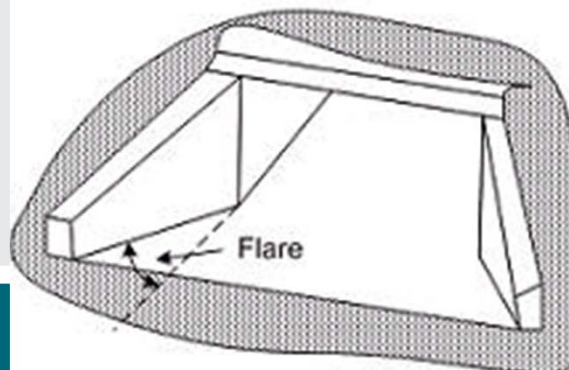
Beveled Edge with Headwalls



Mitered

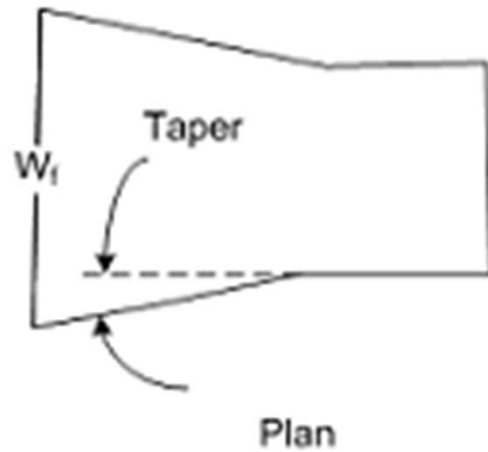
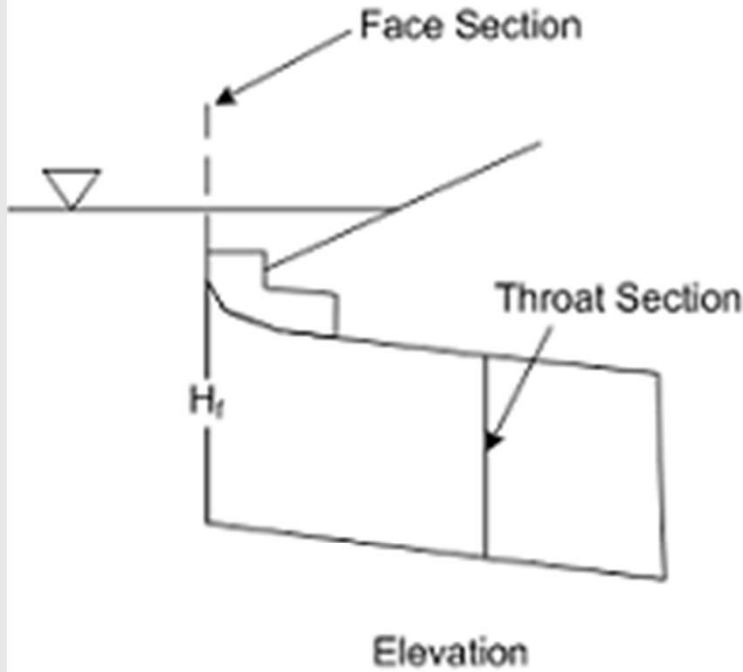


Wingwalls

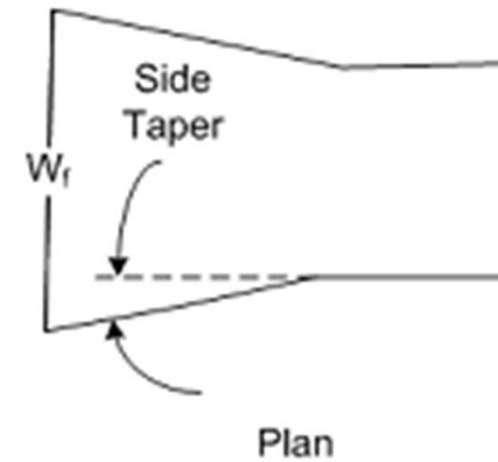
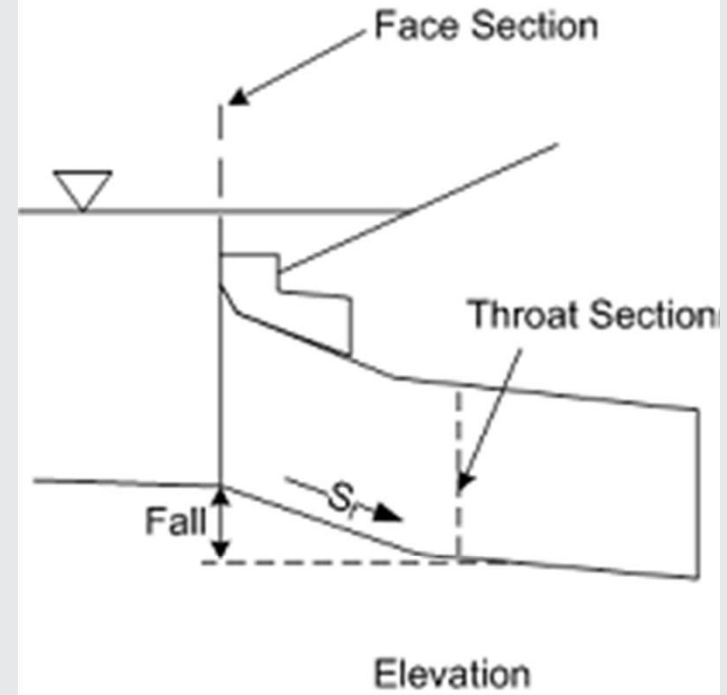


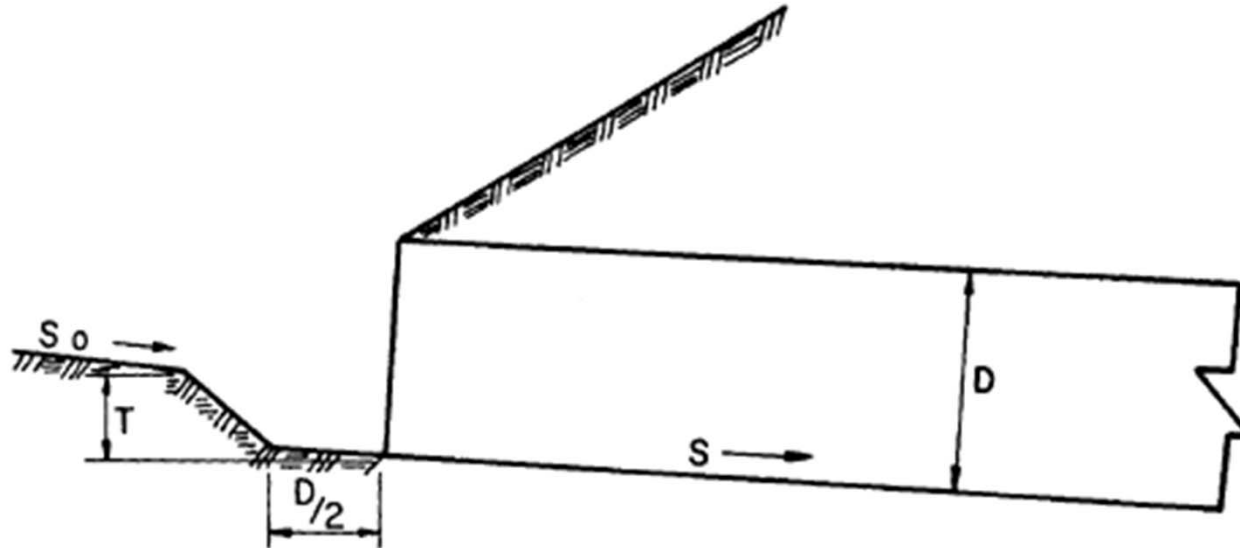
Channel and culvert shape

Side Tapered

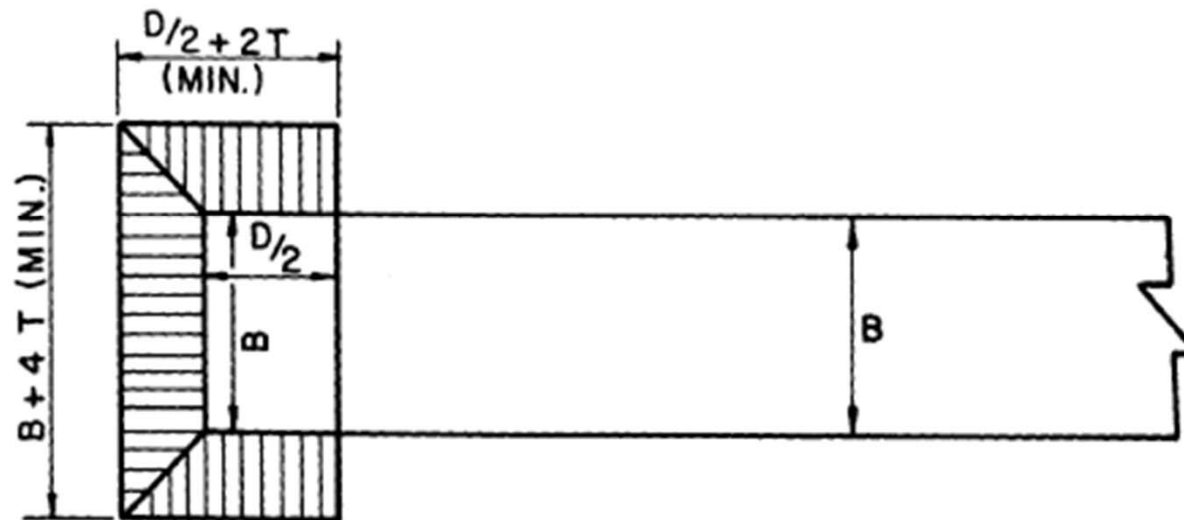


Slope Tapered

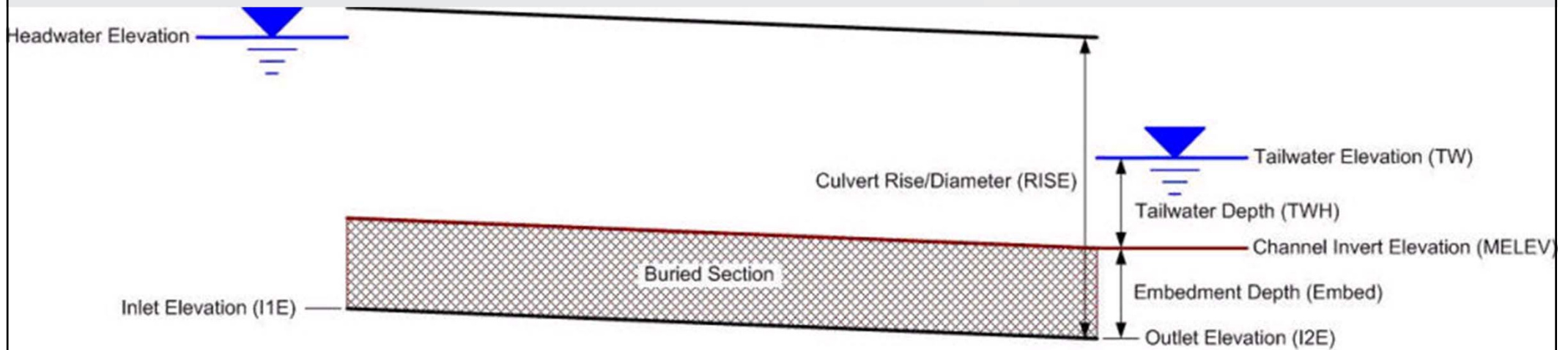




ELEVATION

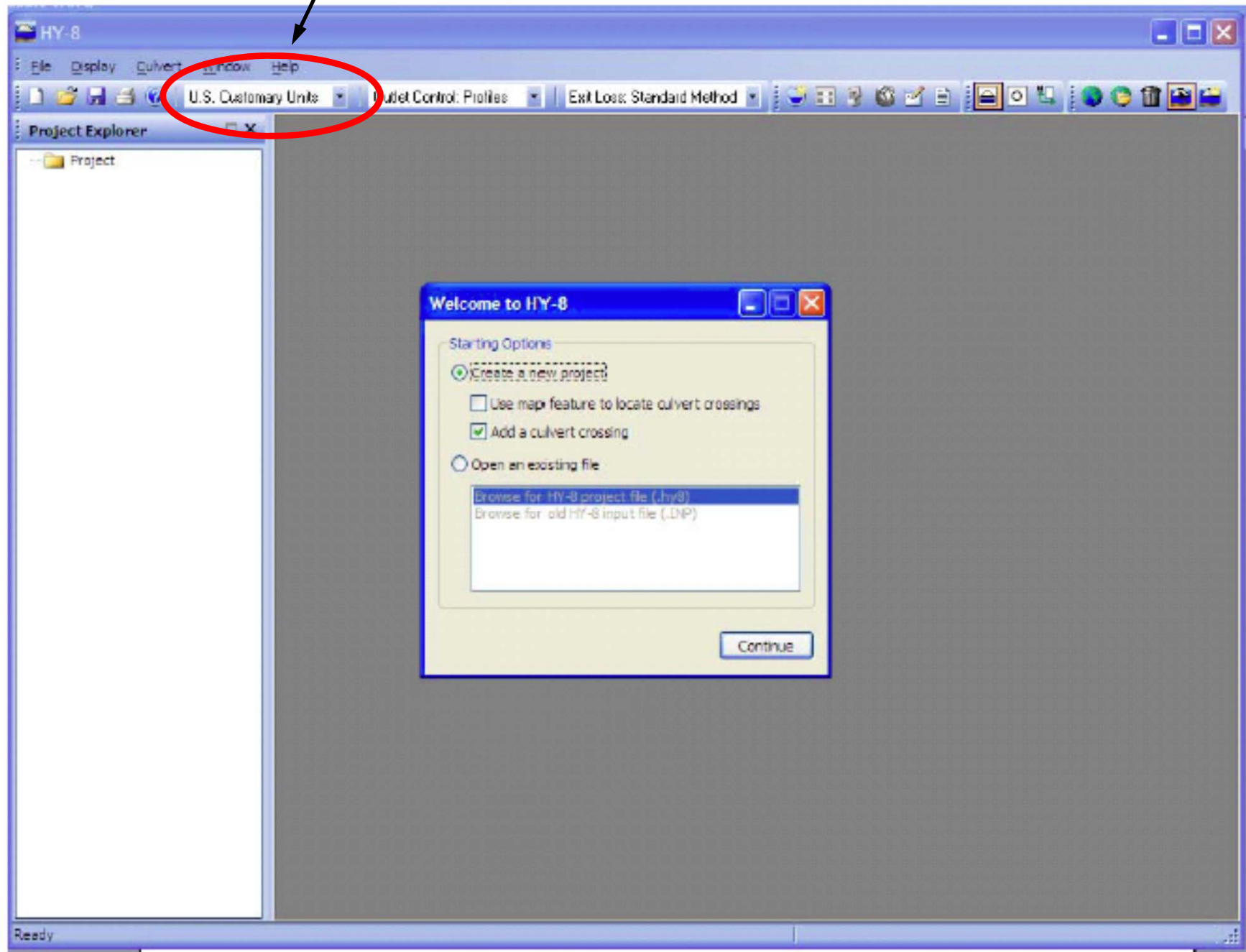


PLAN



Change to metric units

Open software



Select culvert – new culvert crossing

Crossing Data - Crossing 1

Crossing Properties

Name:

Parameter	Value	Units
DISCHARGE DATA		
Minimum Flow	0.00	cfs
Design Flow	0.00	cfs
Maximum Flow	0.00	cfs
TAILWATER DATA		
Channel Type	Rectangular Channel	
Bottom Width	0.00	ft
Channel Slope	0.0000	ft/ft
Manning's n (channel)	0.0000	
Channel Invert Elevation	0.00	ft
Rating Curve	view...	
ROADWAY DATA		
Roadway Profile Shape	Constant Roadway Elevation	
First Roadway Station	0.00	ft
Crest Length	0.00	ft
Crest Elevation	0.00	ft
Roadway Surface	Paved	
Top Width	0.00	ft

Culvert Properties


Culvert 1

Add Culvert

Duplicate Culvert

Delete Culvert

Parameter	Value	Units
CULVERT DATA		
Name	Culvert 1	
Shape	Circular	
Material	Concrete	
Diameter	0.00	ft
Embedment Depth	0.00	in
Manning's n	0.0120	
Inlet Type	Conventional	
Inlet Edge Condition	Square Edge with Headwall	
Inlet Depression?	No	
SITE DATA		
Site Data Input Option	Culvert Invert Data	
Inlet Station	0.00	ft
Inlet Elevation	0.00	ft
Outlet Station	0.00	ft
Outlet Elevation	0.00	ft

Help Click on any  icon for help on a specific topic

Energy Dissipation Analyze Crossing OK Cancel

Discharge data

Minimum flow:	0 m ³ /s
Design flow:	15 m ³ /s
Maximum flow:	18 m ³ /s

Tailwater data

Channel type:	Trapezoidal channel
Bottom width:	2.5 m
Side slope:	2
Channel slope:	0.0095 m/m
Manning's n channel:	0.032
Channel invert elevation:	29.7 m

View rating curve

Crossing Data - Crossing 1

Crossing Properties


Name:

Parameter	Value	Units
DISCHARGE DATA		
Minimum Flow	0.00	cfs
Design Flow	400.00	cfs
Maximum Flow	500.00	cfs
TAIL WATER DATA		
Channel Type	Trapezoidal Channel	
Bottom Width	8.00	ft
Side Slope (H:V)	2.00	:1
Channel Slope	0.0400	ft/ft
Manning's n (channel)	0.0320	
Channel Invert Elevation	89.20	ft
Rating Curve	View...	
ROADWAY DATA		
Roadway Profile Shape	Constant Roadway Elevation	
First Roadway Station	0.00	ft
Crest Length	0.00	ft
Crest Elevation	0.00	ft
Roadway Surface	Paved	
Top Width	0.00	ft

Culvert Properties

Culvert 1

Parameter	Value	Units
CULVERT DATA		
Name	Culvert 1	
Shape	Circular	
Material	Concrete	
Diameter	0.00	ft
Embedment Depth	0.00	in
Manning's n	0.0120	
Inlet Type	Conventional	
Inlet Edge Condition	Square Edge with Headwall	
Inlet Depression?	No	
SITE DATA		
Site Data Input Option	Culvert Invert Data	
Inlet Station	0.00	ft
Inlet Elevation	0.00	ft
Outlet Station	0.00	ft
Outlet Elevation	0.00	ft

Click on any  icon for help on a specific topic

Roadway data

Roadway profile shape:	Constant roadway elevation
First roadway station:	0 m
Crest length:	33 m
Crest elevation:	36.7 m
Road surface:	Paved
Top width:	50 m

Culvert data

Name:	Example 1
Material:	Concrete box
Span:	2.0 m
Rise :	1.7 m
Embedment depth:	0 m
Manning's n:	0.012
Inlet type:	Conventional
Inlet edge condition:	1:1 Bevel headwall
Inlet depression:	No

Site data

Site data input option:	Culvert input data
Inlet station:	0 m
Inlet elevation:	30 m
Outlet station:	53 m
Outlet elevation:	29.7 m
Number of barrels:	1

Running an analysis

Crossing Data - Crossing 1

Crossing Properties

Name: Crossing 1


Parameter	Value	Units
DISCHARGE DATA		
Minimum Flow	0.00	cfs
Design Flow	400.00	cfs
Maximum Flow	500.00	cfs
TAILWATER DATA		
Channel Type	Trapezoidal Channel	
Bottom Width	8.00	ft
Side Slope (H:V)	2.00	_:1
Channel Slope	0.0400	ft/ft
Manning's n (channel)	0.0320	
Channel Invert Elevation	89.20	ft
Rating Curve	View...	
ROADWAY DATA		
Roadway Profile Shape	Constant Roadway Elevation	
First Roadway Station	0.00	ft
Crest Length	100.00	ft
Crest Elevation	110.00	ft
Roadway Surface	Paved	
Top Width	89.20	ft

Culvert Properties

Example 6

Add Culvert
Duplicate Culvert
Delete Culvert

Parameter	Value	Units
Shape	Concrete Box	
Material	Concrete	
Span	6.00	ft
Rise	5.00	ft
Embedment Depth	0.00	in
Manning's n	0.0120	
Inlet Type	Conventional	
Inlet Edge Condition	1:1 Bevel Headwall	
Inlet Depression?	No	
SITE DATA		
Site Data Input Option	Culvert Invert Data	
Inlet Station	0.00	ft
Inlet Elevation	90.00	ft
Outlet Station	160.00	ft
Outlet Elevation	89.20	ft
Number of Barrels	1	

Help Click on any  icon for help on a specific topic

Energy Dissipation Analyze Crossing OK Cancel

Summary of Flows at Crossing - Crossing 1

Headwater Elevation (ft)	Total Discharge (cfs)	Example 6 Discharge (cfs)	Roadway Discharge (cfs)	Iterations
90.00	0.00	0.00	0.00	1
92.06	50.00	50.00	0.00	1
93.20	100.00	100.00	0.00	1
94.18	150.00	150.00	0.00	1
95.12	200.00	200.00	0.00	1
96.09	250.00	250.00	0.00	1
97.14	300.00	300.00	0.00	1
98.31	350.00	350.00	0.00	1
99.63	400.00	400.00	0.00	1
101.11	450.00	450.00	0.00	1
102.76	500.00	500.00	0.00	1
110.00	662.85	662.85	0.00	Overtopping

Display

- Crossing Summary Table
- Culvert Summary Table Example 6
- Water Surface Profiles
- Improved Inlet Table
- Customized Table Options...

Geometry

Inlet Elevation: 90.00 ft
 Outlet Elevation: 89.20 ft
 Culvert Length: 160.00 ft
 Culvert Slope: 0.0050
 Inlet Crest: 0.00 ft
 Inlet Throat: 0.00 ft

Plot

-
-
-

Outlet Control: Profiles

Culvert summary table

Culvert Summary Table - Example 6

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	90.00	0.00	0.00	0-NF	0.00	0.00	0.00	0.00	0.00	0.00
50.00	50.00	92.06	2.06	0.00	1-S2n	1.09	1.29	1.09	0.76	7.62	6.87
100.00	100.00	93.20	3.20	0.33	1-S2n	1.76	2.06	1.77	1.13	9.44	8.59
150.00	150.00	94.18	4.18	0.62	1-S2n	2.36	2.69	2.37	1.42	10.56	9.73
200.00	200.00	95.12	5.12	0.86	5-S2n	2.92	3.26	2.93	1.66	11.37	10.61
250.00	250.00	96.09	6.09	1.08	5-S2n	3.46	3.79	3.46	1.88	12.03	11.32
300.00	300.00	97.14	7.14	1.27	5-S2n	3.98	4.28	3.99	2.07	12.53	11.93
350.00	350.00	98.31	8.31	1.45	5-S2n	4.49	4.74	4.50	2.25	12.97	12.47
400.00	400.00	99.63	9.63	8.73	5-S2n	5.00	5.00	5.00	2.41	13.33	12.95
450.00	450.00	101.11	11.11	9.94	5-S2n	5.00	5.00	5.00	2.56	15.00	13.37
500.00	500.00	102.76	12.76	11.28	5-S2n	5.00	5.00	5.00	2.71	16.67	13.77

Display

Crossing Summary Table
 Culvert Summary Table: Example 6
 Water Surface Profiles
 Improved Water Table
 Customized Table Options...

Geometry

Inlet Elevation: 90.00 ft
 Outlet Elevation: 89.20 ft
 Culvert Length: 160.00 ft
 Culvert Slope: 0.0050
 Inlet Crest: 0.00 ft
 Inlet Throat: 0.00 ft

Plot

Crossing Rating Curve
Culvert Performance Curve
Selected Water Profile

Outlet Control: Profiles

Help Flow Types... Edit Input Data... Energy Dissipation... Export Report Addbe PDF (*.pdf) Close

Culvert performance curve

Culvert Summary Table - Example 6

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	90.00	0.00	0.00	0-NF	0.00	0.00	0.00	0.00	0.00	0.00
50.00	50.00	92.06	2.06	0.00	1-S2n	1.09	1.29	1.09	0.76	7.63	6.87
100.00	100.00	93.20	3.20	0.33	1-S2n	1.76	2.06	1.76	1.13	9.45	8.59
150.00	150.00	94.18	4.18	0.62	1-S2n	2.36	2.69	2.36	1.42	10.58	9.73
200.00	200.00	95.12	5.12	0.86	5-S2n	2.92	3.26	2.92	1.66	11.40	10.61
250.00	250.00	96.09	6.09	1.08	5-S2n	3.46	3.79	3.46	1.88	12.04	11.32
300.00	300.00	97.14	7.14	1.27	5-S2n	3.98	4.28	3.98	2.07	12.55	11.93
350.00	350.00	98.31	8.31	1.45	5-S2n	4.49	4.74	4.49	2.25	12.98	12.47
400.00	400.00	99.63	9.63	8.73	5-S2n	5.00	5.00	5.00	2.41	13.33	12.95
450.00	450.00	101.11	11.11	9.94	5-S2n	5.00	5.00	5.00	2.56	15.00	13.37
500.00	500.00	102.76	12.76	11.28	5-S2n	5.00	5.00	5.00	2.71	16.67	13.77

Display

Crossing Summary Table
 Culvert Summary Table Example 6
 Water Surface Profiles
 Improved Inlet Table
 Customized Table Options...

Geometry

Inlet Elevation: 90.00 ft
 Outlet Elevation: 89.20 ft
 Culvert Length: 160.00 ft
 Culvert Slope: 0.0050
 Inlet Crest: 0.00 ft
 Inlet Throat: 0.00 ft

Plot

Outlet Control: Profiles

Select water surface profile – 15 m³/s

Water Surface Profile Table - Example 6

Total Discharge (cfs)	Culvert Discharge (cfs)	Headwater Elevation (ft)	Inlet Control Depth(ft)	Outlet Control Depth(ft)	Flow Type	Length Full (ft)	Length Free (ft)	Last Step (ft)	Mean Slope (%)	First Depth (ft)	Last Depth (ft)
0.00	0.00	90.00	0.00	0.00	0-NF	0.00	0.00	0.00	0.00	0.00	0.00
50.00	50.00	92.06	2.06	0.00	1-S2n	0.00	160.00	152.15	0.51	1.29	1.09
100.00	100.00	93.20	3.20	0.33	1-S2n	0.00	160.00	132.80	0.50	2.06	1.77
150.00	150.00	94.18	4.18	0.62	1-S2n	0.00	160.00	211.08	0.50	2.69	2.37
200.00	200.00	95.12	5.12	0.86	5-S2n	0.00	160.00	332.39	0.50	3.26	2.93
250.00	250.00	96.09	6.09	1.08	5-S2n	0.00	160.00	554.37	0.50	3.79	3.46
300.00	300.00	97.14	7.14	1.27	5-S2n	0.00	160.00	8.68	0.50	4.28	3.99
350.00	350.00	98.31	8.31	1.45	5-S2n	0.00	160.00	254.51	0.50	4.74	4.50
400.00	400.00	99.63	9.63	8.73	5-S2n	0.00	160.00	0.00	0.77	5.00	5.00
450.00	450.00	101.11	11.11	9.94	5-S2n	0.00	160.00	0.00	0.97	5.00	5.00
500.00	500.00	102.76	12.76	11.28	5-S2n	0.00	160.00	0.00	1.20	5.00	5.00

Display

Crossing Summary Table

Culvert Summary Table Example 6

Water Surface Profiles

Improved Inlet Table

Customized Table Options...

Geometry

Inlet Elevation: 90.00 ft

Outlet Elevation: 89.20 ft

Culvert Length: 160.00 ft

Culvert Slope: 0.0050

Inlet Crest: 0.00 ft

Inlet Throat: 0.00 ft

Plot

Outlet Control: Profiles

Help
Flow Types...
Edit Input Data...
Energy Dissipation...
Export Report
Adobe PDF (*.pdf)
Close

Select water surface profile – 15 m³/s

Water Surface Profile Table - Example 6

Total Discharge (cfs)	Culvert Discharge (cfs)	Headwater Elevation (ft)	Inlet Control Depth(ft)	Outlet Control Depth(ft)	Flow Type	Length Full (ft)	Length Free (ft)	Last Step (ft)	Mean Slope (%)	First Depth (ft)	Last Depth (ft)
0.00	0.00	90.00	0.00	0.00	0-NF	0.00	0.00	0.00	0.00	0.00	0.00
50.00	50.00	92.06	2.06	0.00	1-S2n	0.00	160.00	152.15	0.51	1.29	1.09
100.00	100.00	93.20	3.20	0.33	1-S2n	0.00	160.00	132.80	0.50	2.06	1.77
150.00	150.00	94.18	4.18	0.62	1-S2n	0.00	160.00	211.08	0.50	2.69	2.37
200.00	200.00	95.12	5.12	0.86	5-S2n	0.00	160.00	332.39	0.50	3.26	2.93
250.00	250.00	96.09	6.09	1.08	5-S2n	0.00	160.00	554.37	0.50	3.79	3.46
300.00	300.00	97.14	7.14	1.27	5-S2n	0.00	160.00	8.68	0.50	4.28	3.99
350.00	350.00	98.31	8.31	1.45	5-S2n	0.00	160.00	254.51	0.50	4.74	4.50
400.00	400.00	99.63	9.63	8.73	5-S2n	0.00	160.00	0.00	0.77	5.00	5.00
450.00	450.00	101.11	11.11	9.94	5-S2n	0.00	160.00	0.00	0.97	5.00	5.00
500.00	500.00	102.76	12.76	11.28	5-S2n	0.00	160.00	0.00	1.20	5.00	5.00

Display

Crossing Summary Table

Culvert Summary Table Example 6

Water Surface Profiles

Improved Inlet Table

Customized Table Options...

Geometry

Inlet Elevation: 90.00 ft

Outlet Elevation: 89.20 ft

Culvert Length: 160.00 ft

Culvert Slope: 0.0050

Inlet Crest: 0.00 ft

Inlet Throat: 0.00 ft

Plot

Outlet Control: Profiles



Any questions?

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