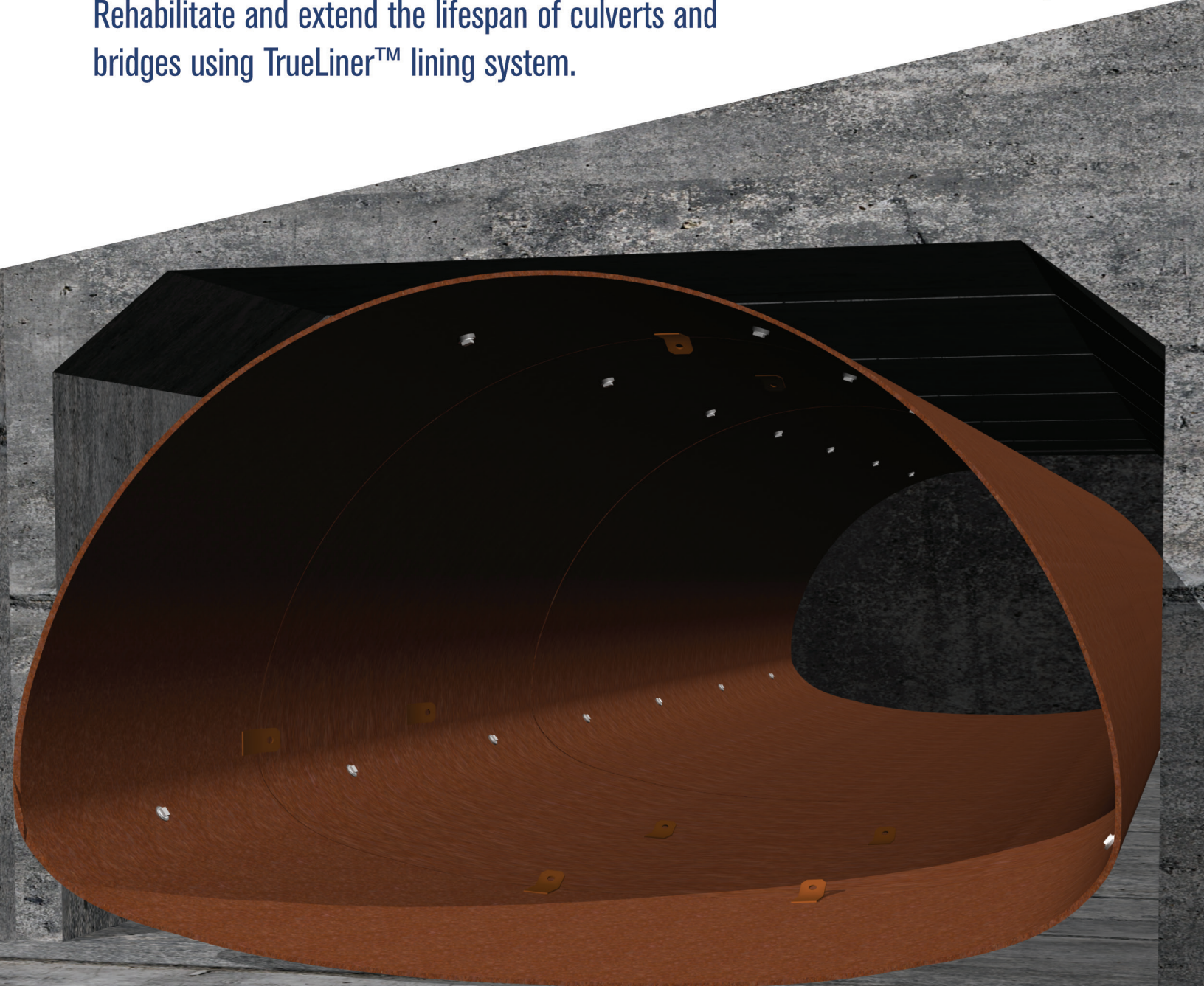# TrueLiner™

Rehabilitate and extend the lifespan of culverts and bridges using TrueLiner™ lining system.


Extend.
Restore.
Rehabilitate.

TrueNorth Steel®

ABOUT TRUELINER™

As America's infrastructure ages, owners, contractors and engineers are challenged to determine effective methods to keep roads and bridges functional and safe for users. The most common structures, and in many cases the oldest structures, are culverts and small bridges. These critical structures are often in either high traffic areas or they are in remote areas and either condition makes removal and replacement costly and disruptive. Rehabilitation is usually the lower total cost alternative to removal and replacement and TrueNorth Steel's® TrueLiner™ is a highly effective way to repair and upgrade culverts and small bridges.

TrueLiner™ is a slip lining method that utilizes sections of weathering steel liner sections manufactured specifically for each project to provide the optimal shape and size required to maintain hydraulic capacity and or passage of vehicles and pedestrians.
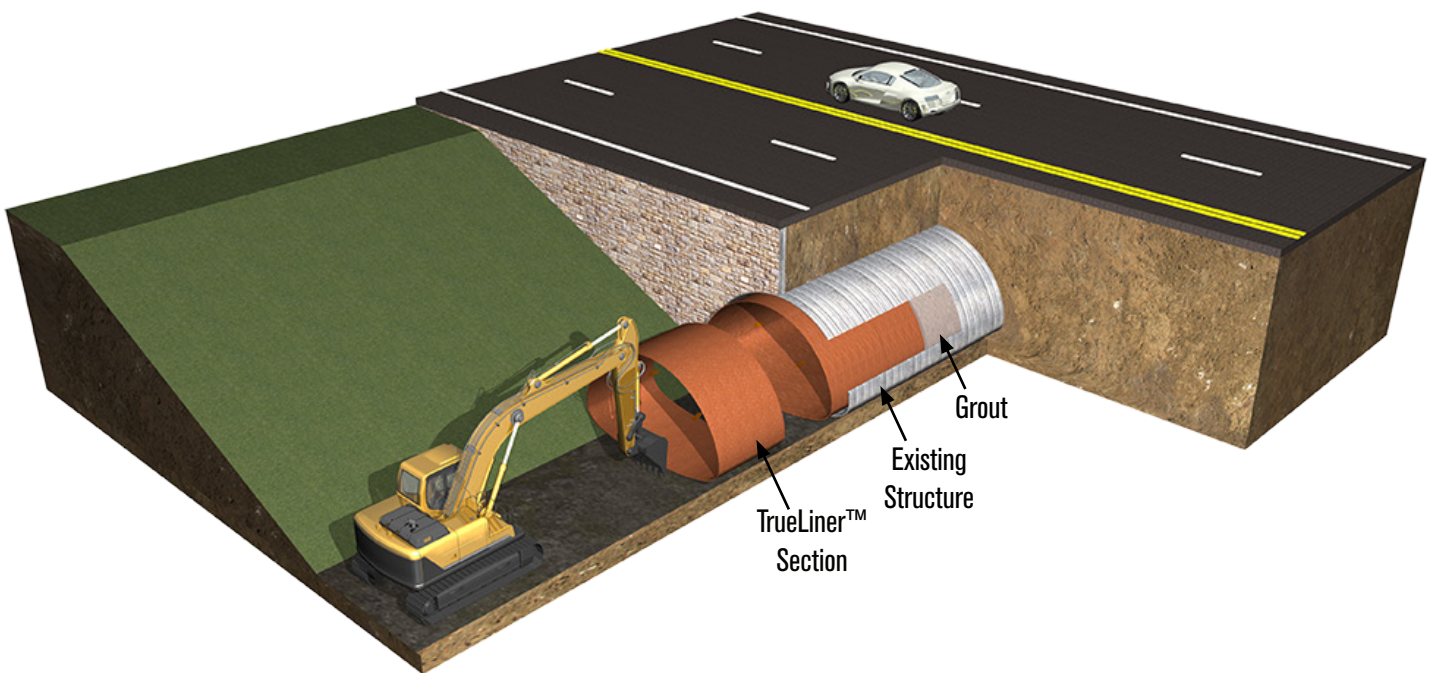
TrueLiner™ Slip Lining of an Existing Culvert

TrueLiner™ utilizes weathering steel in thicknesses sufficient to carry earth and vehicle loads, so upon completion of the reline process, the TrueLiner™ structure will match or exceed the requirements of the original structure. TrueLiner™ features a smooth interior surface which allows for relining of existing corrugated pipes often with no loss of hydraulic capacity and in some cases an improved hydraulic capacity.
TrueLiner's™ weathering steel material utilizes material thicknesses that resist corrosive and abrasive conditions and extends the structure service life. Material thickness ranges from 0.50" to 1.00" thick so achieving the desired lifespan is usually achievable.

Every reline project is unique and the ability to manufacture materials in box culvert, round, pipe arch, arch, ellipse, and other special shapes means TrueLiner™ can be configured to meet almost any application. TrueLiner™ excels when it comes to slip lining aging corrugated structural plate pipe and can be manufactured to match the shapes of pipe arches and arches.

TRUELINER™ INSTALLATION

Installation of TrueLiner™ can be accomplished in a very short time by utilizing commonly available equipment. Once the completed TrueLiner™ is installed, grout is pumped in through ports in the steel liner or directly into the void between the existing structure and the new liner, thus creating a strong composite of the old and new.

TrueLiner™ Section

Grout Port

Pull Lugs

Optional
Skid Railing
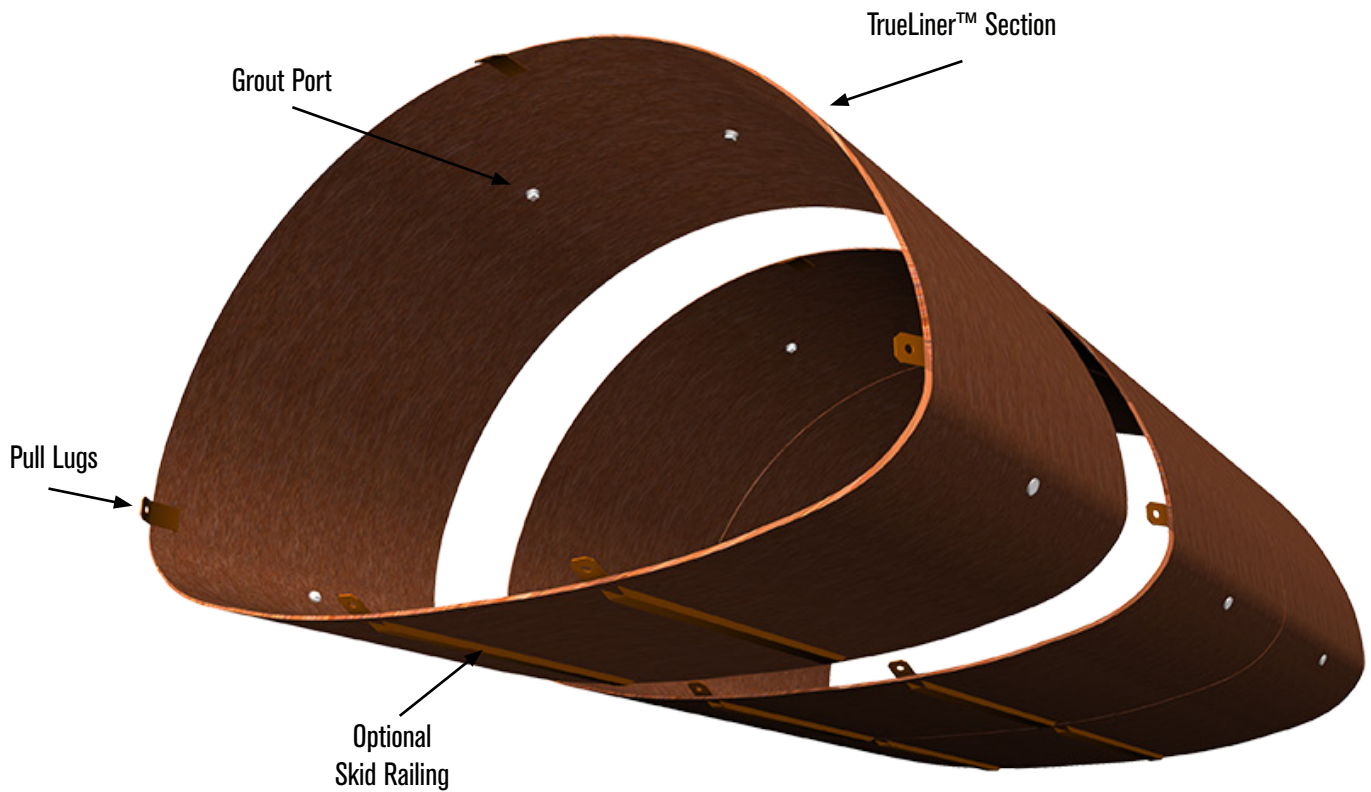
Installation is a simple process but site conditions, the condition of the existing structure, and available equipment will dictate specific installation details. TrueNorth Steel® will work with you to create specifications, installation, and construction drawings for your project.

In addition to TrueLiner™, TrueNorth Steel® offers several other solutions to rehabilitating and sliplining structures. Visit our website for additional information, or find your local contact at www.TrueNorthSteel.com.

TYPICAL INSTALLATION

Existing Structure

TrueLiner™
Segment #1

1. Insert first TrueLiner™ section into existing structure leaving the trailing end exposed for attachment to the second section of TrueLiner™.

TrueLiner™
Segment #2

TrueLiner™
Segment #1

2. Align the leading end of the second section of TrueLiner™ with the trailing end of the first section of TrueLiner™. Connect the two sections using methods described in the TrueLiner™ installation details.

TrueLiner™
Segment #3

TrueLiner™
Segment #2

TrueLiner™
Segment #1

3. Push or pull sections one and two into the existing structure leaving the trailing end of section two exposed for connection to section number three

TrueLiner™
Segment #4

TrueLiner™
Segment #3

TrueLiner™
Segment #2

TrueLiner™
Segment #1

4. Repeat this process until the final section of TrueLiner™ has been placed. The structure is now ready to be grouted into place. Consult with TrueNorth Steel® for assistance with installation processes and grouting the annulus between the existing structure and TrueLiner™.

TYPICAL RELINE OF ARCH TOP BOX CULVERT

Sheet 1 of 2

QC	LAYOUT	DIM. INSP.:	WELDER:	WELD INSP.:	COATING:	COAT. INSP.:	COMP. DATE:	HEAT #:

BILL OF MATERIAL

SL ITEM#	SHOP MARK	ITEM QTY	DESCRIPTION	REMARKS	WEIGHT/LBS.
3000-4721	1	5	Liner,STR PL,Box,46x29.5x39.5 Side,10'		1197.92

CONCRETE BOX CULVERT TO BE LINED

LINER SECTIONS

¼ A588 PL

CONCRETE BOX CULVERT TO BE LINED

SECTION B-B
ELEVATION

NOTES:
1. PULL LUGS, SKIDS, GROUT PORTS, AND OTHER PLATE WELDMENTS TBD

THIS DESIGN IS PROPERTY OF TRUENORTH STEEL DUPLICATION WITHOUT WRITTEN PERMISSIONS IS STRICTLY PROHIBITED

TrueNorth Steel

DESCRIPTION: W. Riverview Box Culvert Pl Liner 52x37.5-50'
DRAWN BY: DMA   PART#: 1606-0324
DATE: 7/25/2019   WEIGHT: 5989.621 lbmass
CHECKED: JLK   MATERIAL:
CHK DATE: 7/25/2019   JOB#:   QTY: SHEET NO: 1 OF 2

DR 1504	A	7/25/2019	CONCEPTUAL ONLY		DMA
JOB#	REV	DATE	DESCRIPTION		BY

REVISIONS

DRAWING IS NOT TO SCALE
ALL DIMENSIONS ARE IN INCHES UNLESS OTHERWISE NOTED
ALL WELDS MUST REPAIRED AFTER FABRICATION (PER ASTM 760)
PIPE LENGTHS HAVE A TOLERANCE OF ± 2"
PIPE DIAMETERS HAVE A TOLERANCE OF THE GREATER OF ± 1/2" or 1%
ALL ANGLES HAVE A TOLERANCE OF ± 3°

TOLERANCES: ± 1/4" UNLESS OTHERWISE NOTED
CUSTOMER APPROVAL SIGNATURE   DATE

Sheet 2 of 2

QC	LAYOUT	DIM. INSP.:	WELDER:	WELD INSP.:	COATING:	COAT. INSP.:	COMP. DATE:	HEAT #:

BILL OF MATERIAL

SL ITEM#	SHOP MARK	ITEM QTY	DESCRIPTION	REMARKS	WEIGHT/LBS.
TBD	1	1	TBD		1197.92

R20

45½ ID

39½

46

29 ID

¼

¼

29½

10'-0"

NOTES:
1. PULL LUGS, SKIDS, GROUT PORTS, AND OTHER PLATE WELDMENTS TBD

THIS DESIGN IS PROPERTY OF TRUENORTH STEEL DUPLICATION WITHOUT WRITTEN PERMISSIONS IS STRICTLY PROHIBITED

TrueNorth Steel

DESCRIPTION: Liner,STR PL,Box,46x29.5x39.5 Side,10'
DRAWN BY: DMA   PART#: 3000-4721
DATE: 7/24/2019   WEIGHT: 1197.924 lbmass
CHECKED: JLK   MATERIAL: STEEL ASTM A588
CHK DATE: 7/25/2019   JOB#:   QTY: SHEET NO: 2 OF 2

DR 1504	A	7/25/2019	CONCEPTUAL ONLY		DMA
ECN #/JPS#	REV	DATE	DESCRIPTION		BY

REVISIONS

DRAWING IS NOT TO SCALE
ALL DIMENSIONS ARE IN INCHES UNLESS OTHERWISE NOTED
ALL WELDS MUST REPAIRED AFTER FABRICATION (PER ASTM 760)
PIPE LENGTHS HAVE A TOLERANCE OF ± 2"
PIPE DIAMETERS HAVE A TOLERANCE OF THE GREATER OF ± 1/2" or 1%
ALL ANGLES HAVE A TOLERANCE OF ± 3°

TOLERANCES: ± 1/4" UNLESS OTHERWISE NOTED
CUSTOMER APPROVAL SIGNATURE   DATE

ROUND CULVERT LINER SHAPES

Diam (in.)	Flow Area (sq ft)	Wt/Ft (lbs)
36	6.68	190
38	7.47	200
40	8.3	211
42	9.17	222
44	10.08	233
46	11.04	243
48	12.05	254
50	13.1	265
52	14.19	275
54	15.32	286
56	16.5	297
58	17.72	307
60	18.99	318
62	20.29	329
64	21.65	339
66	23.04	350
68	24.48	361
70	25.97	372
72	27.49	382
74	29.07	393
76	30.68	404
78	32.34	414
80	34.04	425
82	35.78	436
84	37.57	446
86	39.41	457
88	41.28	468
90	43.2	478
92	45.17	489
94	47.17	500
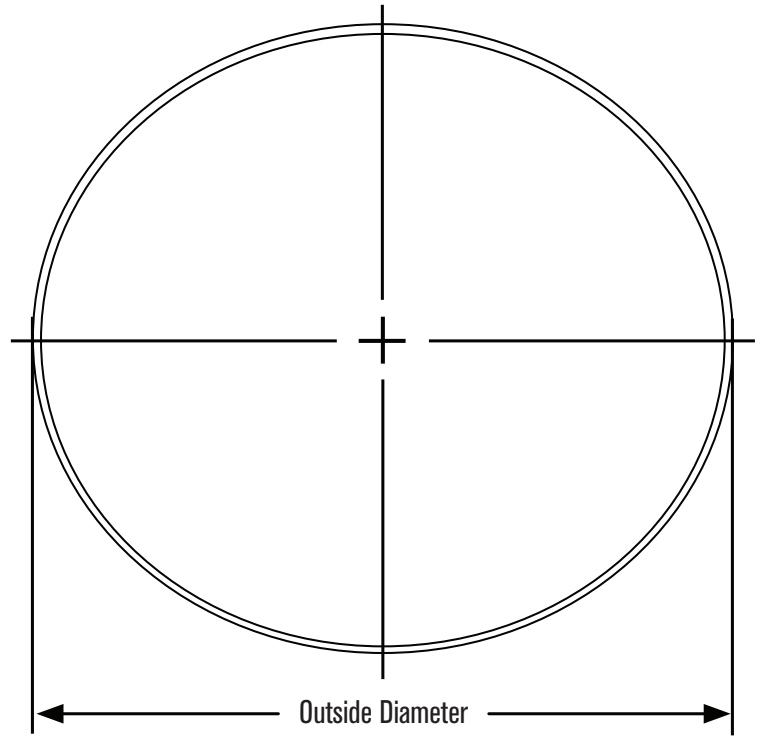
Outside Diameter

Note: These are standard shapes and sizes. Each project requires careful measurement of the existing structure and selection of a shape and size specific to the project requirements. Custom sizes are available. Weights are based upon 0.500" thickness.

ROUND CULVERT LINER SHAPES

| Diam (in.)	Flow Area (sq ft)	Wt/Ft (lbs)
96	49.22	511
98	51.32	521
100	53.46	532
102	55.64	543
104	57.86	553
106	60.13	564
108	62.44	575
110	64.8	585
112	67.2	596
114	69.64	607
116	72.13	617
118	74.66	628
120	77.24	639
122	79.85	650
124	82.52	660
126	85.22	671
128	87.97	682
130	90.76	692
132	93.6	703
134	96.48	714
136	99.4	724
138	102.37	735
140	105.38	746
142	108.43	756
144	111.53	767
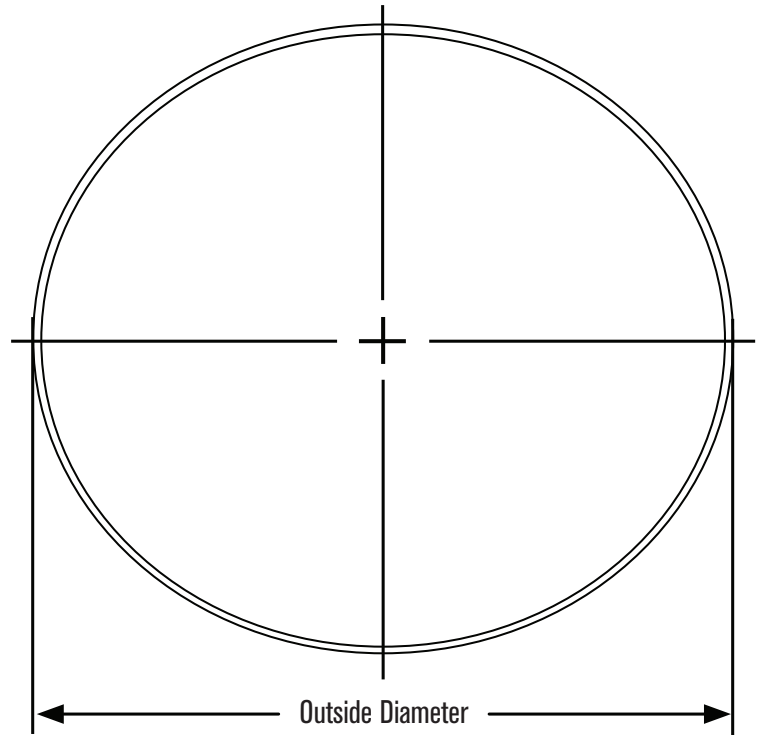
Outside Diameter

Note: These are standard shapes and sizes. Each project requires careful measurement of the existing structure and selection of a shape and size specific to the project requirements. Custom sizes are available. Weights are based upon 0.500" thickness.

PIPE ARCH LINER SHAPES & SIZES: CORNER RADIUS 18"

| Span (in.)	Rise (in.)	Flow Area (sq ft)	Wt/Ft (lbs)
72	52	19.78	333
74	53	20.73	341
76	54	21.71	350
78	56	23.13	360
80	57	24.16	369
82	58	25.21	377
84	59	26.27	386
86	61	27.86	397
88	62	28.98	405
90	63	30.13	413
92	64	31.29	422
94	66	33.03	433
96	67	34.25	441
98	68	35.49	450
100	69	36.75	458
102	70	38.03	466
103	71	38.99	472
104	72	39.96	477
106	73	41.29	486
108	57	32.8	454
108	74	42.65	494
110	75	44.03	503
112	76	45.42	511
114	77	46.84	519
116	79	48.99	530
118	80	50.46	539
120	81	51.95	547
122	82	53.47	556
124	83	55	564
126	84	56.55	572
128	85	58.13	581
130	86	59.73	589
131	81	56.21	578
132	87	61.34	597
134	89	63.81	609
136	90	65.48	617
138	91	67.17	625
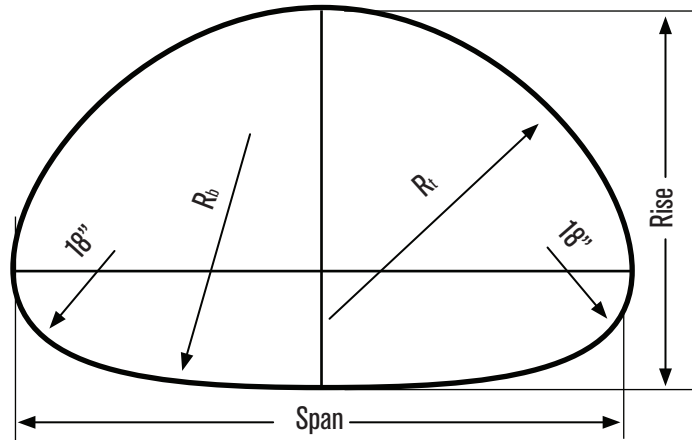
Note: These are standard shapes and sizes. Each project requires careful measurement of the existing structure and selection of a shape and size specific to the project requirements. Custom sizes are available. Weights are based upon 0.500" thickness.

PIPE ARCH LINER SHAPES & SIZES: CORNER RADIUS 36

| Span (in.)	Rise (in.)	Flow Area (sq ft)	Wt/Ft (lbs)
140	92	68.88	634
142	93	70.62	642
144	89	67.99	636
144	94	72.37	650
146	95	74.15	659
148	96	75.94	667
150	97	77.76	675
152	98	79.59	684
154	99	81.45	692
156	100	83.33	701
158	101	85.23	709
160	102	87.15	717
162	90	76.64	691
162	99	85.12	714
162	103	89.09	726
164	104	91.05	734
166	105	93.03	742
168	106	95.03	751
170	107	97.06	759
172	108	99.1	767
174	109	101.17	776
176	110	103.25	784
178	111	105.36	793
180	111	106.37	798
182	112	108.51	806
184	113	110.66	815
186	114	112.84	823
188	115	115.04	831
190	116	117.26	840
192	117	119.5	848
194	118	121.76	857
196	119	124.04	865
198	119	125.12	870
200	120	127.43	879
202	121	129.76	887
204	122	132.11	895
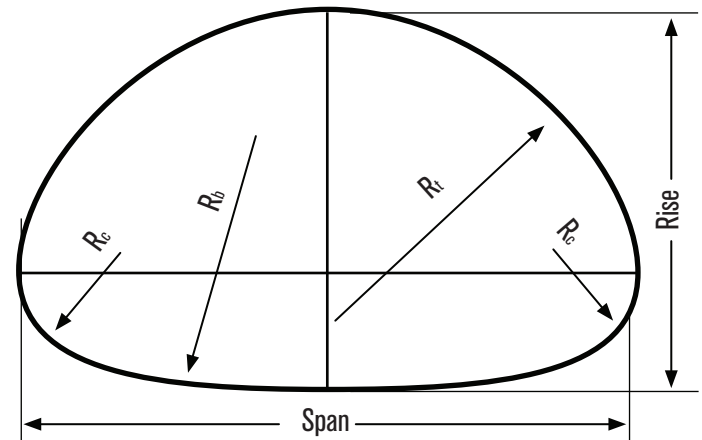
Note: These are standard shapes and sizes. Each project requires careful measurement of the existing structure and selection of a shape and size specific to the project requirements. Custom sizes are available. Weights are based upon 0.500" thickness.

ELLIPTICAL LINER SHAPES

Span (in.)	Rise (in.)	Flow Area (sq ft)	Wt/Ft (lbs)
120	81	52.05	543
122	83	54.23	553
124	84	55.79	561
126	86	58.04	572
128	87	59.66	580
130	88	61.3	588
132	90	63.66	599
134	91	65.36	607
136	92	67.07	615
138	94	69.54	626
140	95	71.31	634
142	96	73.11	642
144	98	75.68	652
146	99	77.53	661
148	100	79.4	669
150	102	82.08	679
152	103	84	688
154	105	86.76	698
156	106	88.74	706
158	107	90.74	715
160	109	93.61	725
162	110	95.66	733
164	111	97.74	741
166	113	100.71	752
168	114	102.85	760
170	115	105	768
172	117	108.08	779
174	118	110.29	787
176	120	113.44	798
178	121	115.71	806
180	122	118	814
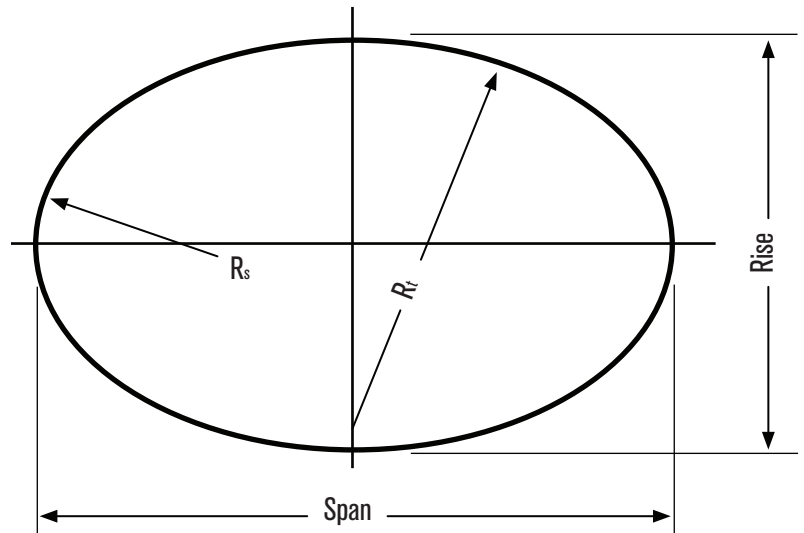
Note: These are standard shapes and sizes. Each project requires careful measurement of the existing structure and selection of a shape and size specific to the project requirements. Custom sizes are available. Weights are based upon 0.500" thickness.

ELLIPTICAL LINER SHAPES

Span (in.)	Rise (in.)	Flow Area (sq ft)	Wt/Ft (lbs)
60	41	13.15	275
62	42	13.92	283
64	43	14.7	291
66	45	15.87	299
68	46	16.71	310
70	48	17.95	320
72	49	18.85	329
74	50	19.77	337
76	52	21.11	347
78	53	22.09	355
80	54	23.08	363
82	56	24.54	374
84	57	25.59	382
86	58	26.66	390
88	60	28.22	401
90	61	29.34	409
92	62	30.49	417
94	64	32.16	427
96	65	33.36	436
98	67	35.11	446
100	68	36.37	454
102	69	37.64	462
104	71	39.5	473
106	72	40.83	481
108	73	42.19	489
110	75	43.56	500
112	76	45.56	508
114	77	46.99	516
116	79	49.06	526
118	80	50.54	535
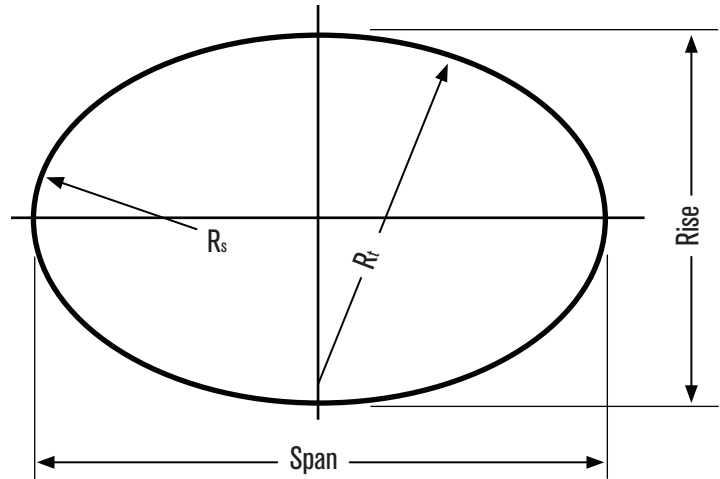
R_s R_t Rise Span

Note: These are standard shapes and sizes. Each project requires careful measurement of the existing structure and selection of a shape and size specific to the project requirements. Custom sizes are available. Weights are based upon 0.500" thickness.

ARCH TOP BOX CULVERT LINER SHAPE

Span (in.)	Rise (in.)	Flow Area (sq ft)	Wt/Ft (lbs)
32	20	3.91	165
32	32	6.5	205
44	20	5.33	202
44	32	8.91	243
44	44	12.5	284
54	43	14.83	312
56	32	11.27	281
56	44	15.86	322
56	56	2044	363
68	32	13.58	319
68	44	19.16	360
68	56	24.75	401
68	68	30.33	441
80	44	22.41	398
80	56	29	438
80	68	35.58	479
80	80	42.16	520
92	44	25.61	435
92	56	33.19	476
92	68	40.78	517
92	80	48.36	558
92	92	55.94	599

Note: These are standard shapes and sizes. Each project requires careful measurement of the existing structure and selection of a shape and size specific to the project requirements. Custom sizes are available. Weights are based upon 0.500" thickness.

ARCH TOP BOX CULVERT LINER SHAPE

Span (in.)	Rise (in.)	Flow Area (sq ft)	Wt/Ft (lbs)
104	56	37.33	514
104	68	45.92	555
104	80	54.5	596
104	92	63.08	637
104	104	71.67	677
116	56	41.42	552
116	68	51	593
116	80	60.59	633
116	92	70.17	674
116	104	79.75	715
116	116	89.34	756
128	44	34.87	549
128	68	56.04	630
128	92	77.2	712
128	116	98.37	794
128	128	108.95	835
140	44	37.84	587
140	68	61.01	668
140	92	84.18	750
140	116	107.34	832
140	140	130.51	913

Note: These are standard shapes and sizes. Each project requires careful measurement of the existing structure and selection of a shape and size specific to the project requirements. Custom sizes are available. Weights are based upon 0.500" thickness.

ARCH CULVERT LINER SHAPE

Span	Rise
60"	21"
	26"
	31"
	36"
72"	21"
	27"
	38"
	42"
84"	28"
	34"
	44"
	49"
	53"
96"	35"
	40"
	50"
	54"
	59"
108"	35"
	46"
	56"
	61"
	66"
120"	41"
	53"
	63"
	67"
	72"
	76"
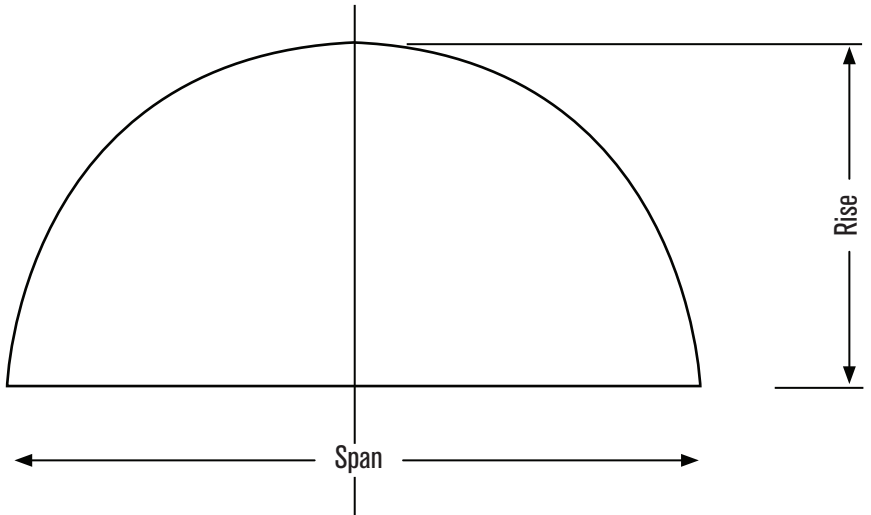
Additional spans available up to 216" in various rises

Rise

Span

Note: These are standard shapes and sizes. Each project requires careful measurement of the existing structure and selection of a shape and size specific to the project requirements. Custom sizes are available. Weights are based upon 0.500" thickness.

TRUELINER™ TYPICAL INSTALLATION DETAILS

a. Always adhere to all applicable state and local safety regulations.

b. Review shop drawings and confirm that materials are appropriate for installation.

c. Clean and clear the existing structure of all sediment and debris.

d. Make final measurements or use a template to ensure the new structure will pass freely into the new structure.

e. Repair any damaged areas of the existing structure including loss of backfill material under or around the structure.

f. Prepare grouting plan to accommodate buoyant forces.

g. Lift steel liner sections using the preplaced lifting lugs or other safe methods determined by the installer including chains or nylon straps.

h. Place the first section of the reline system by sliding into the existing structure on rails or skids attached to the reline system.

i. Lift, place, align and attach the second section of the steel liner system to the first section. Attach by one of the following methods.

     i. Weld the two sections together by fully welding the circumferential joint. Tack welding will facilitate the full perimeter welding process. Welds shall be placed on the outside or inside or both sides of the liner system.

          OR

     ii. Slide the second section onto the trailing end of the first section using the provided alignment tabs to provide alignment. Tack weld the two sections together. Wrap the exterior of the joint using 12" wide mastic wrap.

     iii. Repeat process until all sections are placed.

          1. Sections can be placed using either pushing or pulling method.

j. Grout annulus.

     i. Grout plan should be submitted to the engineer of record a minimum of (5) five working days in advance of grouting.

     ii. Brace new liner system to ensure alignment and that system will not move during the grouting process.

     iii. End dams may be used to contain grout.

     iv. Prepare grout lift thickness plan to avoid excessive buoyant/flotation forces.

     v. Limit grout pressure to 5 psi or less.

     vi. Grout from roadway surface by drilling an access hole to the annulus.

          OR

     vii. Grout from one end or both ends.

          OR

     viii. Grout through preplaced grout ports in the wall of the liner.

k. Ensure annulus is completely filled and that there are no voids.

l. Remove any internal bracing after 24 hours.

Use of "foamed grout" similar in nature to the material specified by WYDOT (see below) are recommended although "sand" based grouts work as well

Typical Grout Specifications			
Property	**Specifications**	**Unit**	**Nominal Value**
Finished Density		LBS/FT³	20 - 60
Compressive Strength			
1. 24-Hours		LBS/IN²	>20
2. 28-Day	ASTMC 939	LBS/IN²	>300
Viscosity Per Length of Pipe Injected			
1. <300 FT		SECONDS	<35
2. 300 FT - 500 FT		SECONDS	<25
3. >500 FT		SECONDS	<18

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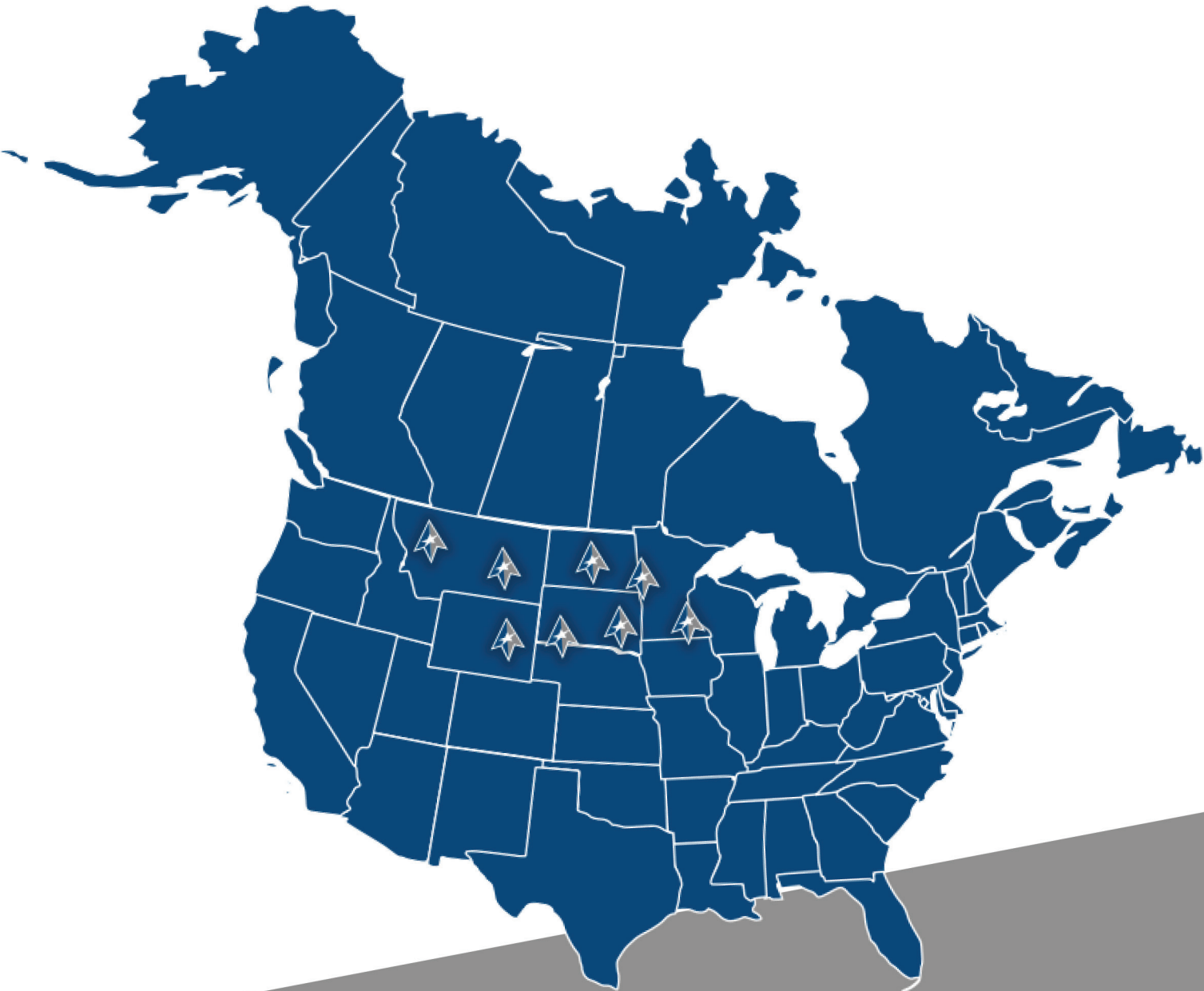
TrueNorth Steel®   702 13th Ave E, West Fargo, ND 58078 / TrueNorthSteel.com / 701-373-7781 / drainage@truenorthsteel.com

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