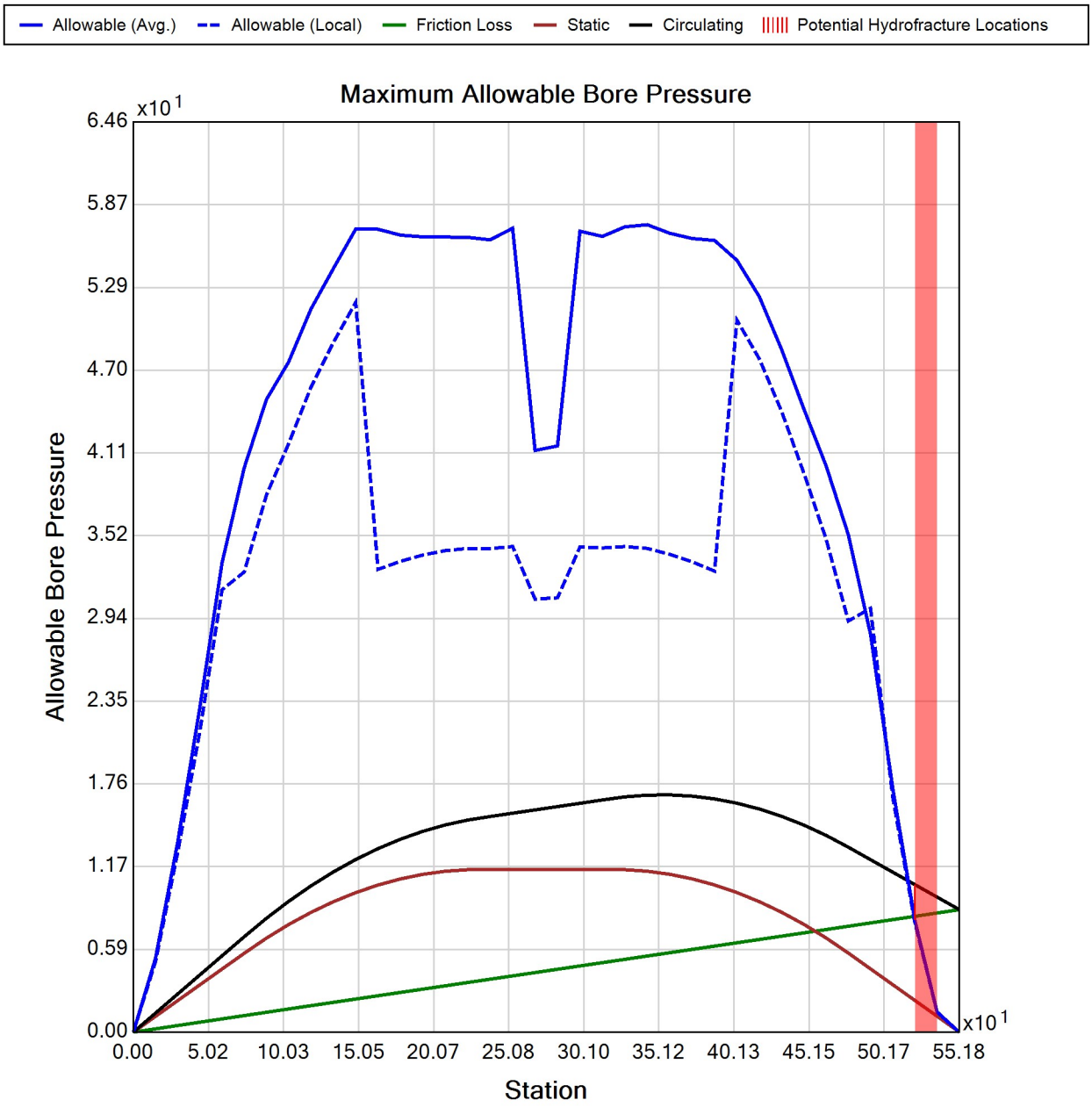

Generated Output

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Input Summary

Start Coordinate	(0.00, 0.00, 127.18) ft
End Coordinate	(546.00, 0.00, 125.88) ft
Project Length	546.00 ft
Pipe Type	HDPE
OD Classification	IPS
Pipe OD	2.375 in
Pipe DR	9.0
Pipe Thickness	0.26 in
Rod Length	15.00 ft
Rod Diameter	3.5 in
Drill Rig Location	(0.00, 0.00, 0.00) ft

Load Verifier Input Summary:

Pipe Application: Electrical Cable
Pipe Type: HDPE
Classification: IPS
Pipe OD: 2" (2.375")
Pipe DR: 9
Pipe Length: 555.00 ft
Internal Pressure: 0 psi
Borehole Diameter: 0.531000018119812 ft
Silo Width: 0.531000018119812 ft
Surface Surcharge: 0 psi
Short Term Modulus: 57500 psi
Long Term Modulus: 28200 psi
Short Term Poisson Ratio: 0.35
Long Term Poisson Ratio: 0.45
Pipe Unit Weight: 59.30500 lb/ft3
Allowable Tensile Stress (Short Term): 1200 psi
Allowable Tensile Stress (Long Term): 1100 psi
Allowable Compressive Stress (Short Term): 1150 psi
Allowable Compressive Stress (Long Term): 1150 psi
Surface-pipe friction coefficient at entrance: 0.5
Surface-pipe friction coefficient in borehole: 0.3
Pipe-soil friction angle: 30
Slurry Unit Weight: 93.64118 lb/ft3
Hydrokinetic Pressure: 10 psi
Ballast Unit Weight: 62.42746 lb/ft3

In-service Load Summary:

Pressure [psi]	Deformed	Collapsed
Earth Pressure	1.1	8.9
Water Pressure	10.0	10.0
Surface Surcharge	0.0	0.0
Internal Pressure	0.0	0.0
Net Pressure	11.1	18.9
Deflection		
Earth Load Deflection	0.381	2.435
Buoyant Deflection	0.029	0.029
Reissner Effect	0	0
Net Deflection	0.410	2.464
Compressive Stress [psi]		
Compressive Wall Stress	50.0	85.1

Installation Load Summary:

Forces/Stresses	@Maximum Force	Absolute Maximum
Pullback Force [lb]	560.1	560.1
Pullback Stress [psi]	320.0	320.0
Pullback Strain	5.566E-3	5.566E-3
Bending Stress [psi]	0.0	5.7
Bending Strain	0	9.896E-5
Tensile Stress [psi]	320.0	324.5
Tensile Strain	5.566E-3	5.742E-3

Net External Pressure = 17.6 [psi]

Buoyant Deflection = 0.0

Hydrokinetic Force = 137.3 lb

In-service Analysis

	Calculated	Allowable	Factor of Safety	Check
Deflection [%]	0.410	7.5	18.3	OK
Unconstrained Collapse [psi]	15.7	134.0	8.5	OK
Compressive Wall Stress [psi]	50.0	1150.0	23.0	OK

Installation Analysis

	Calculated	Allowable	Factor of Safety	Check
Deflection [%]	0.014	7.5	524.3	OK
Unconstrained Collapse [psi]	25.7	238.5	9.3	OK
Tensile Stress [psi]	324.5	1200.0	3.7	OK

Generated Output

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Project Summary

General:	HDD #10 - Conduit 1 Start Date: 09-22-2022 End Date: 09-22-2022
Project Owner:	TDI
Project Contractor:	KIEWIT
Project Consultant:	CHA
Designer:	Amherst, Massachusetts
Description:	North to South 10" DR 9 8" bit

Input Summary

Start Coordinate	(0.00, 0.00, 129.14) ft
End Coordinate	(1210.00, 0.00, 136.00) ft
Project Length	1210.00 ft
Pipe Type	HDPE
OD Classification	IPS
Pipe OD	10.750 in
Pipe DR	9.0
Pipe Thickness	1.19 in
Rod Length	15.00 ft
Rod Diameter	3.5 in
Drill Rig Location	(0.00, 0.00, 0.00) ft

Soil Summary

Number of Layers: 4

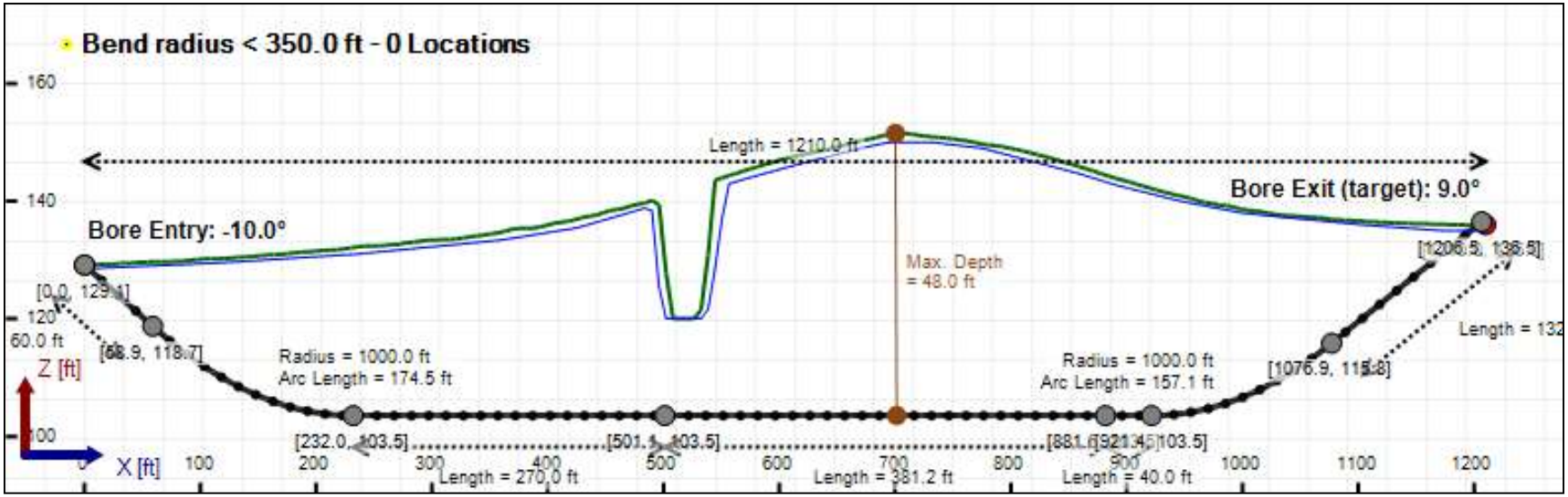
Soil Layer #1 USCS, Sand (S), SM
From Assistant
Unit Weight: 110.0000 (dry), 125.0000 (sat) [lb/ft3]
Phi: 34.00, S.M.: 500.00, Coh: 0.00 [psi]

Soil Layer #2 USCS, Clay (C), CL
From Assistant
Unit Weight: 80.0000 (dry), 110.0000 (sat) [lb/ft3]
Phi: 0.00, S.M.: 300.00, Coh: 5.50 [psi]

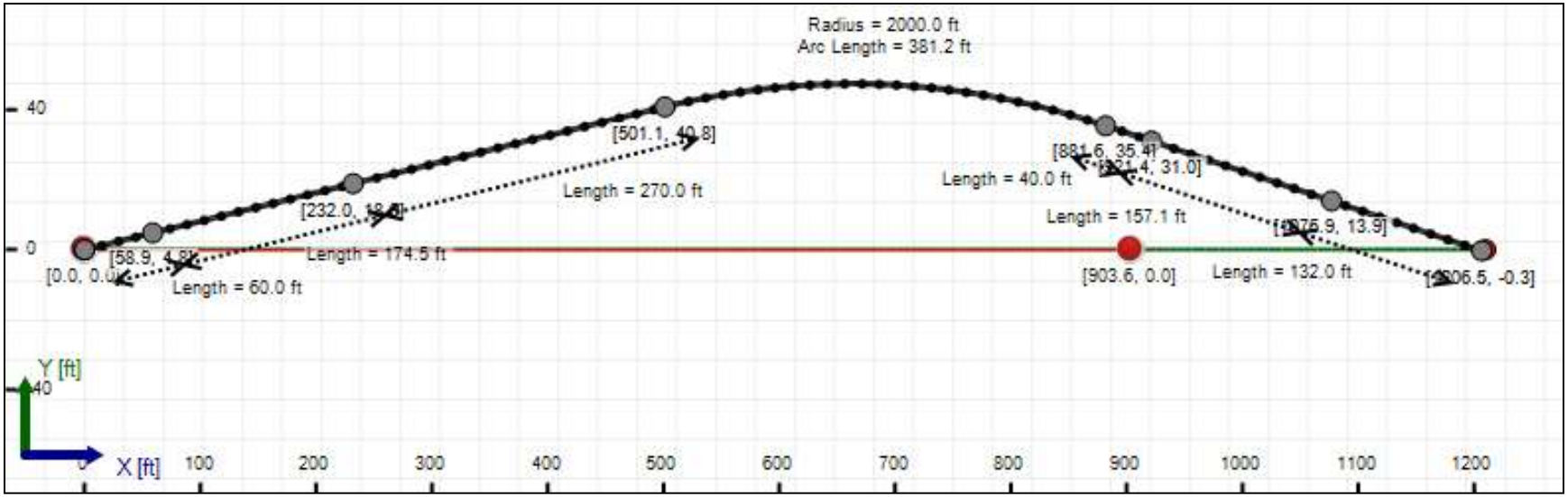
Soil Layer #3 USCS, Clay (C), CL
From Assistant
Unit Weight: 70.0000 (dry), 100.0000 (sat) [lb/ft3]
Phi: 0.00, S.M.: 200.00, Coh: 3.13 [psi]

Soil Layer #4 USCS, Sand (S), SW
From Assistant
Unit Weight: 110.0000 (dry), 125.0000 (sat) [lb/ft3]
Phi: 34.00, S.M.: 500.00, Coh: 0.00 [psi]

Bore Cross-Section View



Bore Plan View



Load Verifier Input Summary:

Pipe Application: Electrical Cable
Pipe Type: HDPE
Classification: IPS
Pipe OD: 10" (10.75")
Pipe DR: 9
Pipe Length: 1215.00 ft
Internal Pressure: 0 psi
Borehole Diameter: 1.34400002161662 ft
Silo Width: 1.34400002161662 ft
Surface Surcharge: 0 psi
Short Term Modulus: 57500 psi
Long Term Modulus: 28200 psi
Short Term Poisson Ratio: 0.35
Long Term Poisson Ratio: 0.45
Pipe Unit Weight: 59.30500 lb/ft3
Allowable Tensile Stress (Short Term): 1200 psi
Allowable Tensile Stress (Long Term): 1100 psi
Allowable Compressive Stress (Short Term): 1150 psi
Allowable Compressive Stress (Long Term): 1150 psi
Surface-pipe friction coefficient at entrance: 0.5
Surface-pipe friction coefficient in borehole: 0.3
Pipe-soil friction angle: 30
Slurry Unit Weight: 93.64118 lb/ft3
Hydrokinetic Pressure: 10 psi
Ballast Unit Weight: 62.42746 lb/ft3

In-service Load Summary:

Pressure [psi]	Deformed	Collapsed
Earth Pressure	3.1	19.0
Water Pressure	20.1	20.1
Surface Surcharge	0.0	0.0
Internal Pressure	0.0	0.0
Net Pressure	23.2	39.2
Deflection		
Earth Load Deflection	1.221	5.178
Buoyant Deflection	0.132	0.132
Reissner Effect	0	0
Net Deflection	1.353	5.310
Compressive Stress [psi]		
Compressive Wall Stress	104.5	176.2

Installation Load Summary:

Forces/Stresses	@Maximum Force	Absolute Maximum
Pullback Force [lb]	20515.2	20515.2
Pullback Stress [psi]	572.1	572.1
Pullback Strain	9.950E-3	9.950E-3
Bending Stress [psi]	0.0	25.8
Bending Strain	0	4.479E-4
Tensile Stress [psi]	572.1	593.4
Tensile Strain	9.950E-3	1.077E-2

Net External Pressure = 19.9 [psi]

Buoyant Deflection = 0.1

Hydrokinetic Force = 567.6 lb

In-service Analysis

	Calculated	Allowable	Factor of Safety	Check
Deflection [%]	1.353	7.5	5.5	OK
Unconstrained Collapse [psi]	23.2	126.6	5.5	OK
Compressive Wall Stress [psi]	104.5	1150.0	11.0	OK

Installation Analysis

	Calculated	Allowable	Factor of Safety	Check
Deflection [%]	0.065	7.5	115.8	OK
Unconstrained Collapse [psi]	31.4	221.0	7.0	OK
Tensile Stress [psi]	593.4	1200.0	2.0	OK

Maximum Allowable Bore Pressure Summary

Ream Number	Initial Diameter	Final Diameter	Estimated Maximum Pressure (Avg.)	Estimated Maximum Pressure (Local)
Pilot Bore	0.00 in	8.00 in	103.571 psi	60.486 psi
1	8.00 in	12.00 in	103.423 psi	57.148 psi
2	12.00 in	16.13 in	103.210 psi	55.148 psi

Note: The maximum bore pressures presented in this table are the maximum values along the length of the bore and not the maximum allowable at any point. The estimated maximum pressures should be compared to the estimated circulating pressures along the bore to determine potential locations of inadvertant returns.

Estimated Circulating Pressure Summary

Active	Shear Rate [rpm]	Shear Stress [Fann Degrees]
No	600	37
No	300	32
No	200	29
Yes	100	25
Yes	6	17
No	3	15

Flow Rate (Q): 40.00 US (liquid) gallon/min

Drill Fluid Density: 68.700 lb/ft3

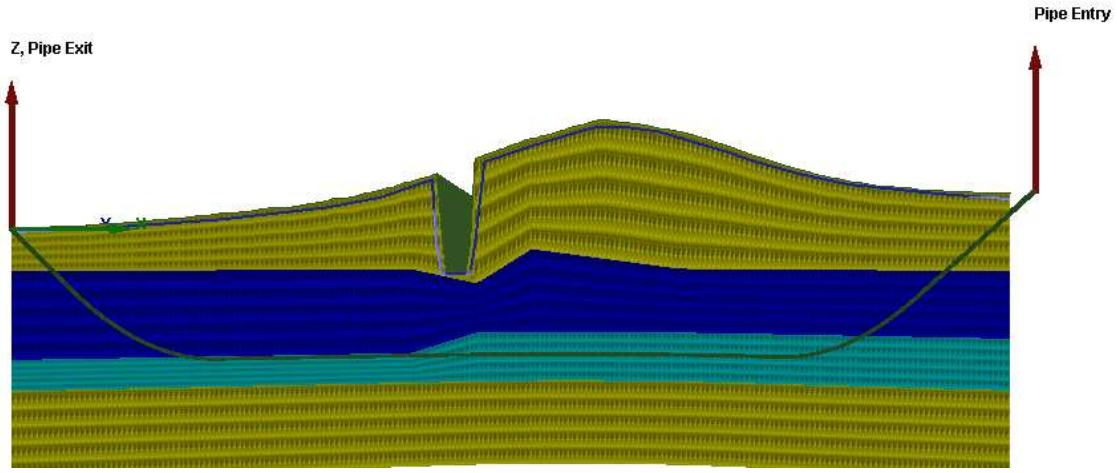
Rheological model: Power-Law

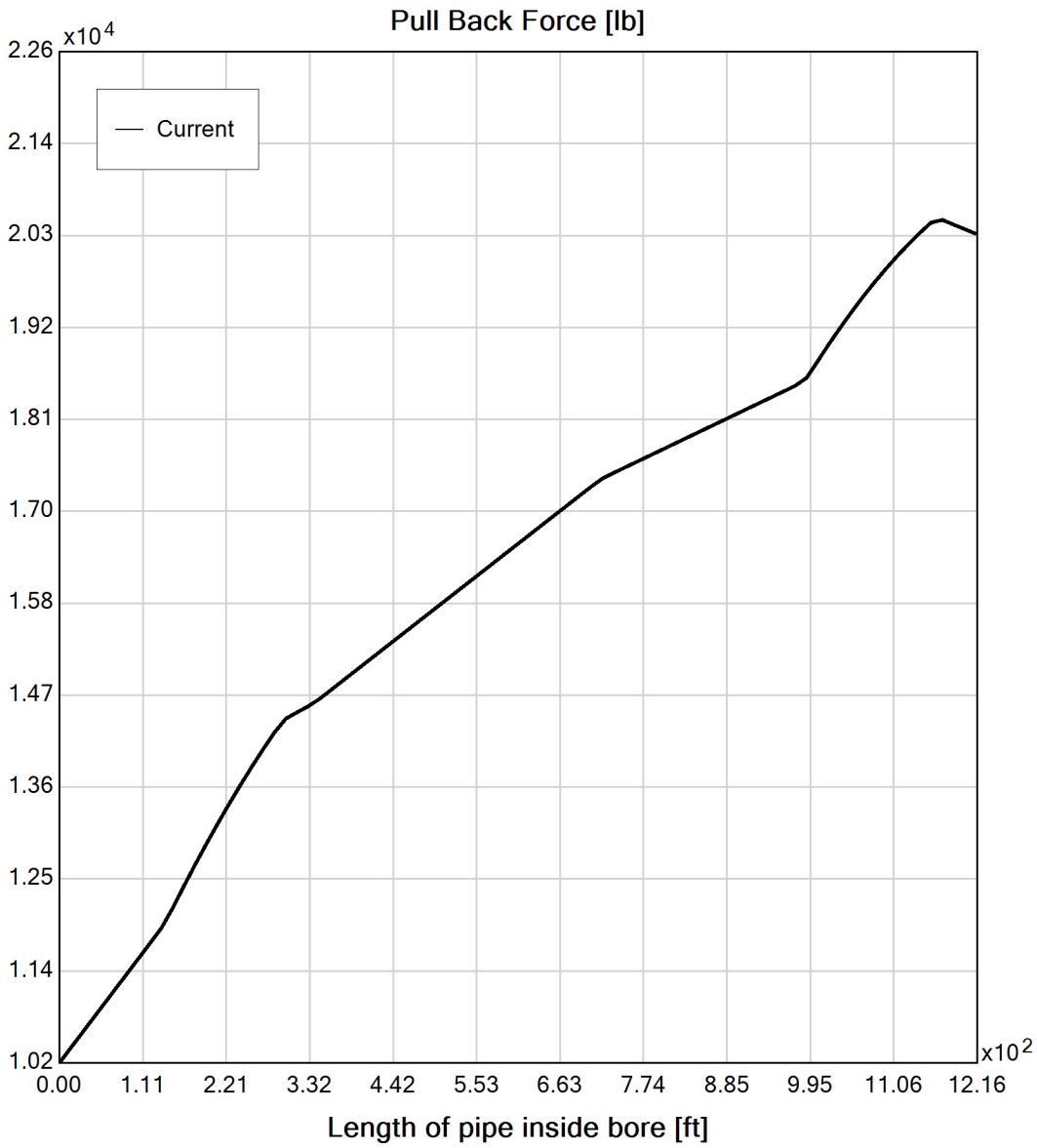
Fluid Consistency Index (K): 63.17

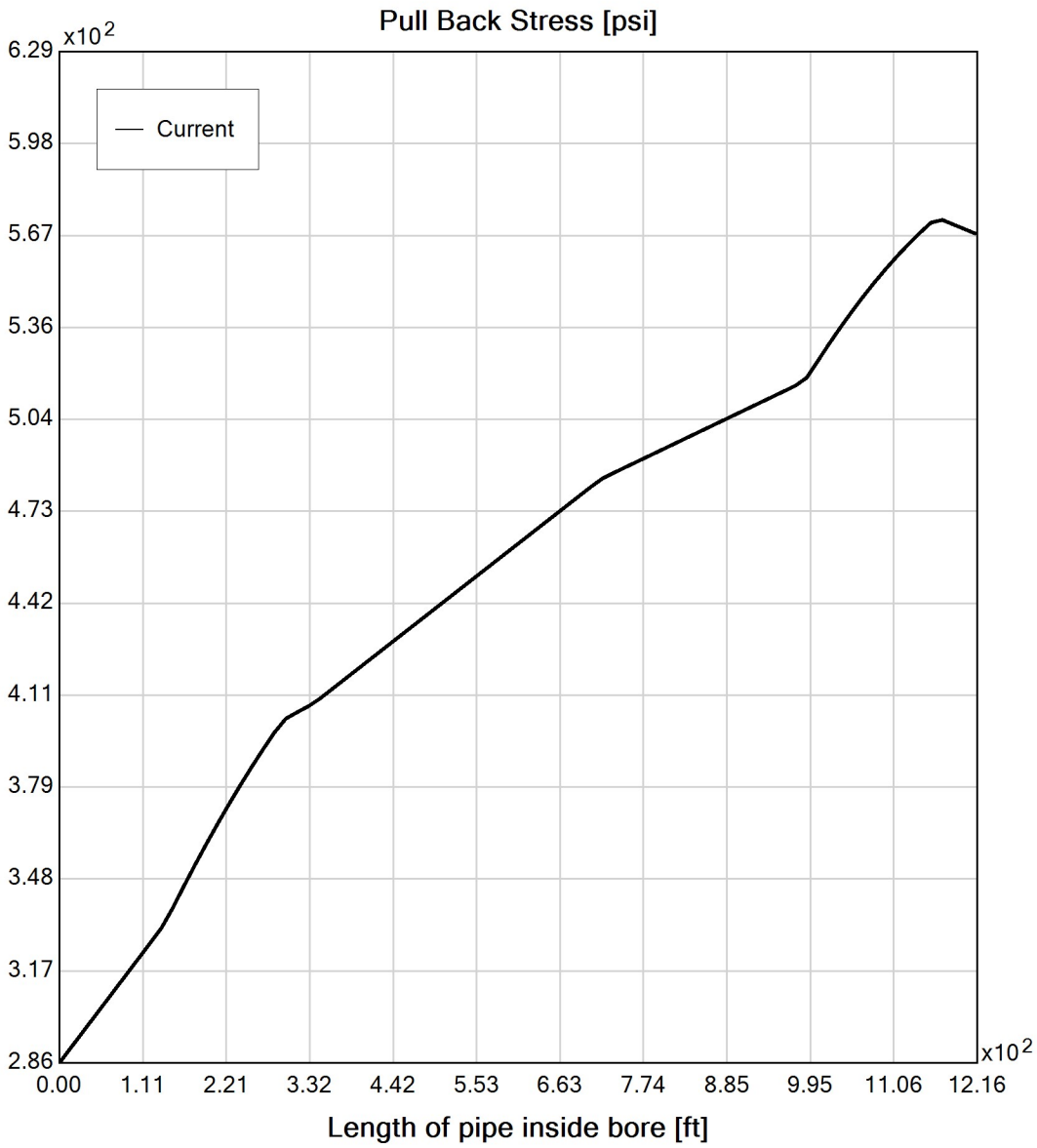
Power Law Exponent (n): 0.14

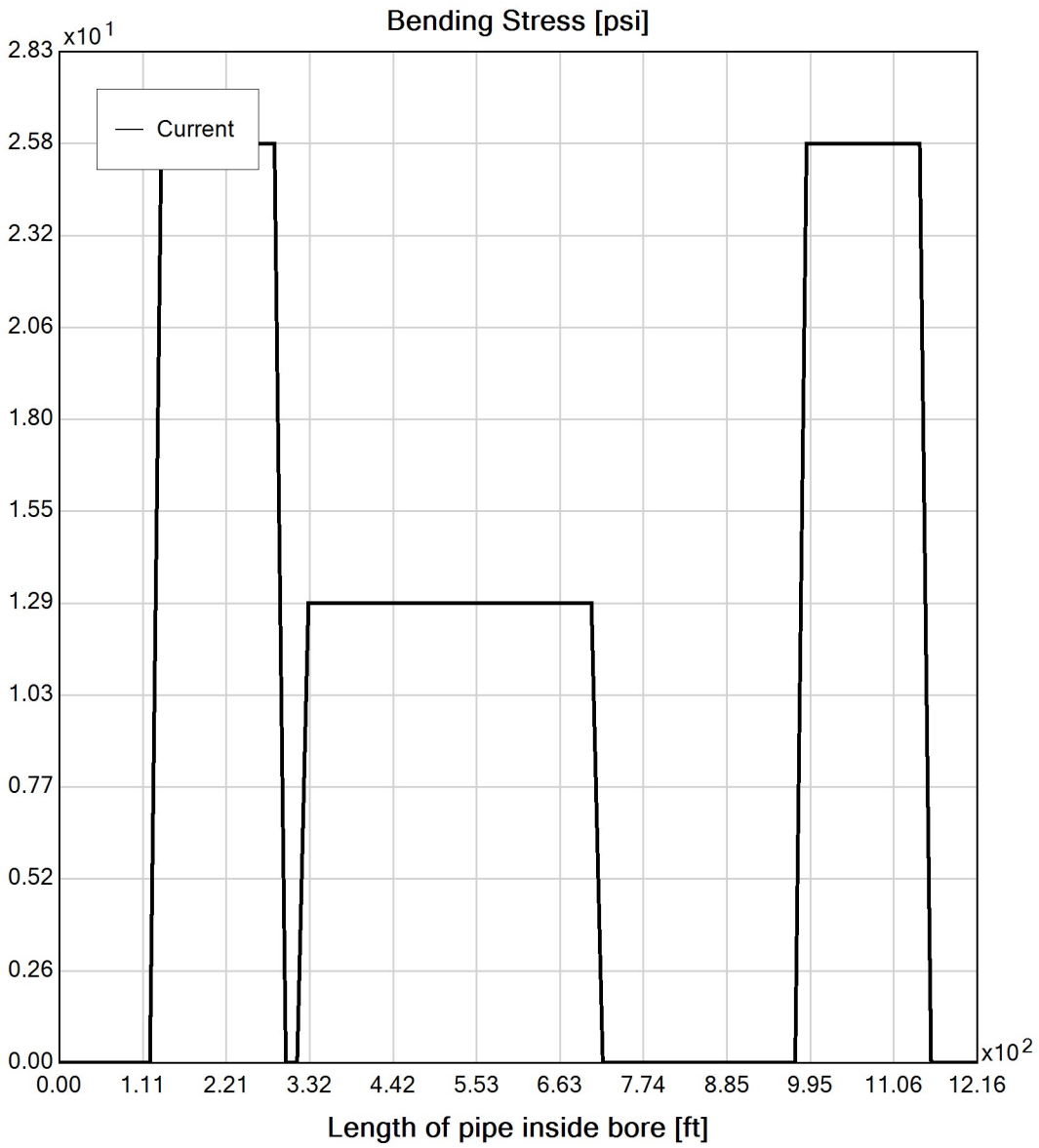
Effective Viscosity (cP): 859.3

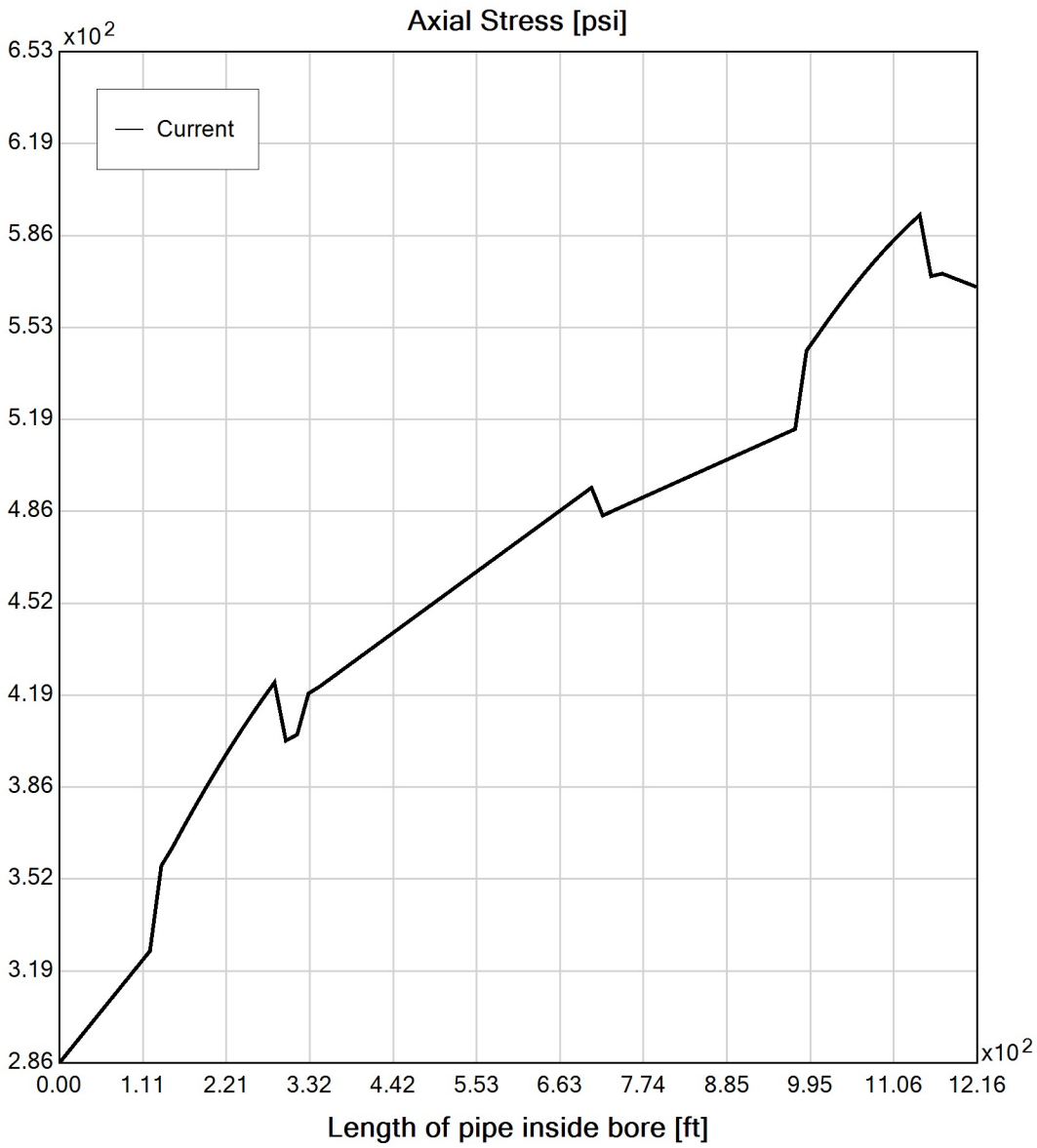
Virtual Site

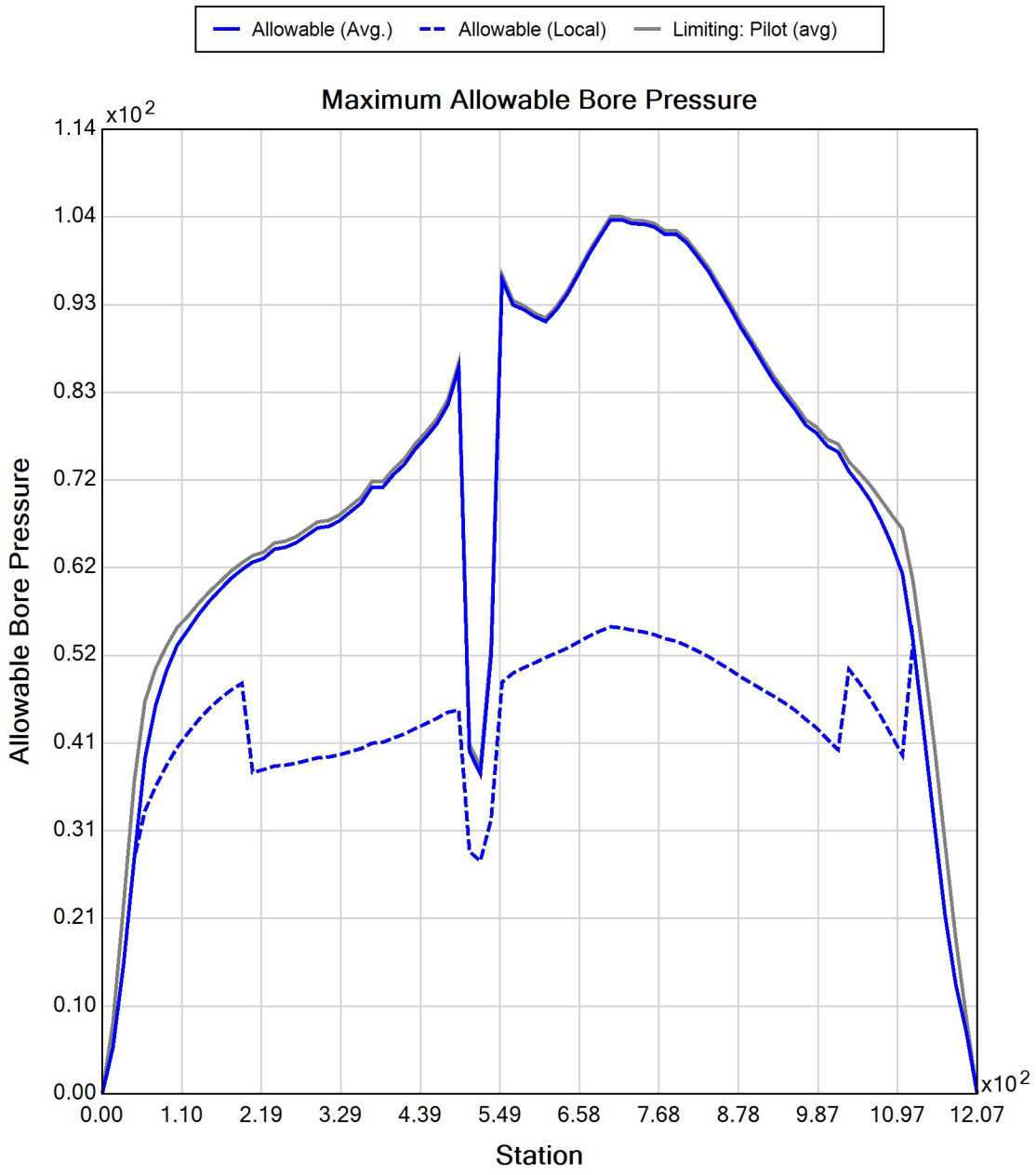


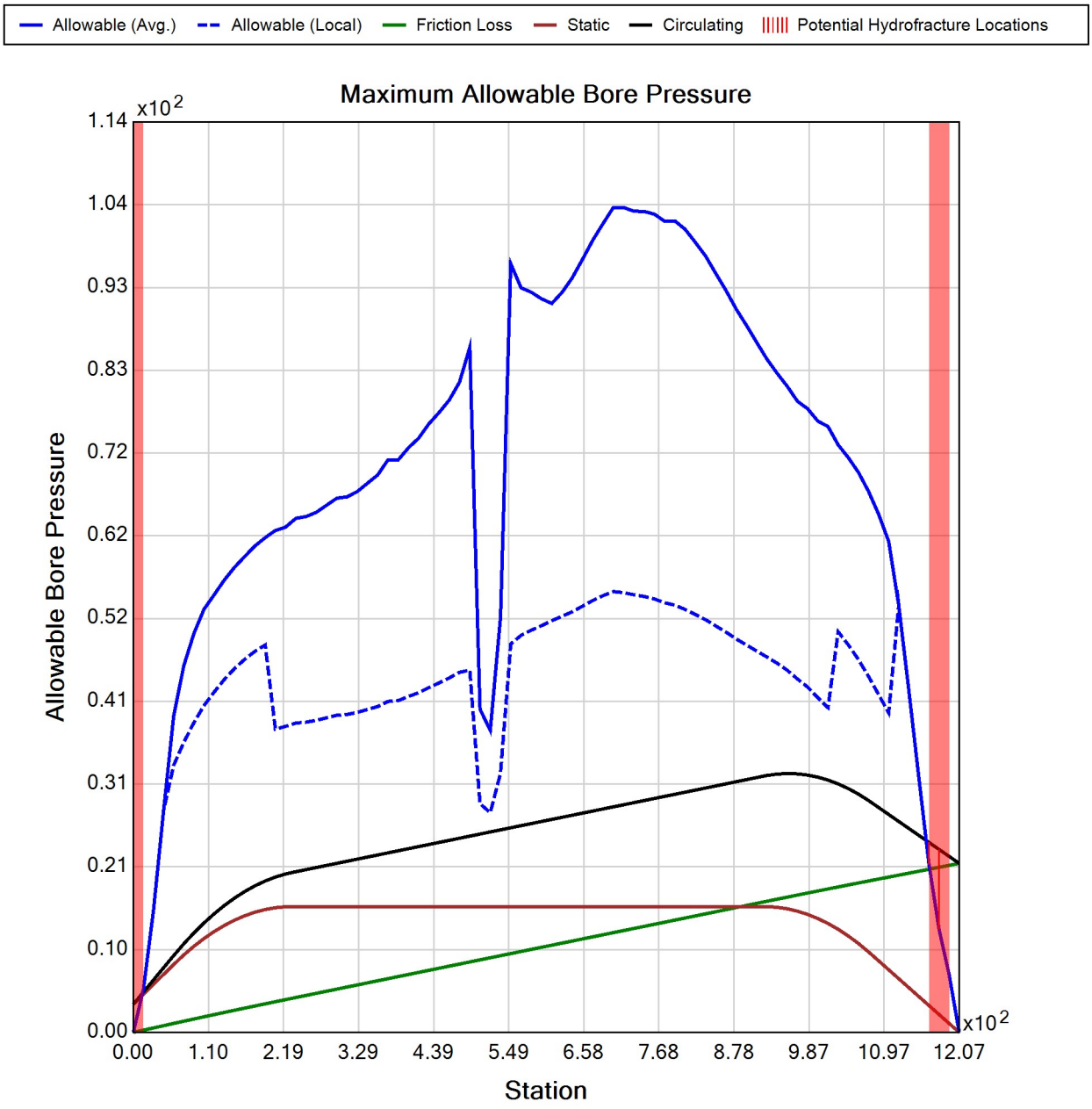












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Input Summary

Start Coordinate	(0.00, 0.00, 129.14) ft
End Coordinate	(1210.00, 0.00, 136.00) ft
Project Length	1210.00 ft
Pipe Type	HDPE
OD Classification	IPS
Pipe OD	2.375 in
Pipe DR	9.0
Pipe Thickness	0.26 in
Rod Length	15.00 ft
Rod Diameter	3.5 in
Drill Rig Location	(0.00, 0.00, 0.00) ft

Load Verifier Input Summary:

Pipe Application: Electrical Cable
Pipe Type: HDPE
Classification: IPS
Pipe OD: 2" (2.375")
Pipe DR: 9
Pipe Length: 1215.00 ft
Internal Pressure: 0 psi
Borehole Diameter: 0.531000018119812 ft
Silo Width: 0.531000018119812 ft
Surface Surcharge: 0 psi
Short Term Modulus: 57500 psi
Long Term Modulus: 28200 psi
Short Term Poisson Ratio: 0.35
Long Term Poisson Ratio: 0.45
Pipe Unit Weight: 59.30500 lb/ft3
Allowable Tensile Stress (Short Term): 1200 psi
Allowable Tensile Stress (Long Term): 1100 psi
Allowable Compressive Stress (Short Term): 1150 psi
Allowable Compressive Stress (Long Term): 1150 psi
Surface-pipe friction coefficient at entrance: 0.5
Surface-pipe friction coefficient in borehole: 0.3
Pipe-soil friction angle: 30
Slurry Unit Weight: 93.64118 lb/ft3
Hydrokinetic Pressure: 10 psi
Ballast Unit Weight: 62.42746 lb/ft3

In-service Load Summary:

Pressure [psi]	Deformed	Collapsed
Earth Pressure	1.2	19.0
Water Pressure	20.1	20.1
Surface Surcharge	0.0	0.0
Internal Pressure	0.0	0.0
Net Pressure	21.4	39.2
Deflection		
Earth Load Deflection	0.858	5.178
Buoyant Deflection	0.029	0.029
Reissner Effect	0	0
Net Deflection	0.887	5.207
Compressive Stress [psi]		
Compressive Wall Stress	96.1	176.2

Installation Load Summary:

Forces/Stresses	@Maximum Force	Absolute Maximum
Pullback Force [lb]	1110.9	1110.9
Pullback Stress [psi]	634.8	634.8
Pullback Strain	1.104E-2	1.104E-2
Bending Stress [psi]	0.0	5.7
Bending Strain	0	9.896E-5
Tensile Stress [psi]	634.8	636.0
Tensile Strain	1.104E-2	1.116E-2

Net External Pressure = 19.9 [psi]

Buoyant Deflection = 0.0

Hydrokinetic Force = 137.3 lb

In-service Analysis

	Calculated	Allowable	Factor of Safety	Check
Deflection [%]	0.887	7.5	8.5	OK
Unconstrained Collapse [psi]	21.5	127.5	5.9	OK
Compressive Wall Stress [psi]	96.1	1150.0	12.0	OK

Installation Analysis

	Calculated	Allowable	Factor of Safety	Check
Deflection [%]	0.014	7.5	524.3	OK
Unconstrained Collapse [psi]	31.4	219.0	7.0	OK
Tensile Stress [psi]	636.0	1200.0	1.9	OK

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Project Summary

General:	HDD #10 - Conduit 2 Start Date: 09-22-2022 End Date: 09-22-2022
Project Owner:	TDI
Project Contractor:	KIEWIT
Project Consultant:	CHA
Designer:	Amherst, Massachusetts
Description:	North to South 10" DR 9 8" bit

Input Summary

Start Coordinate	(0.00, 0.00, 129.14) ft
End Coordinate	(1240.00, 0.00, 136.00) ft
Project Length	1240.00 ft
Pipe Type	HDPE
OD Classification	IPS
Pipe OD	10.750 in
Pipe DR	9.0
Pipe Thickness	1.19 in
Rod Length	15.00 ft
Rod Diameter	3.5 in
Drill Rig Location	(0.00, 0.00, 0.00) ft

Soil Summary

Number of Layers: 4

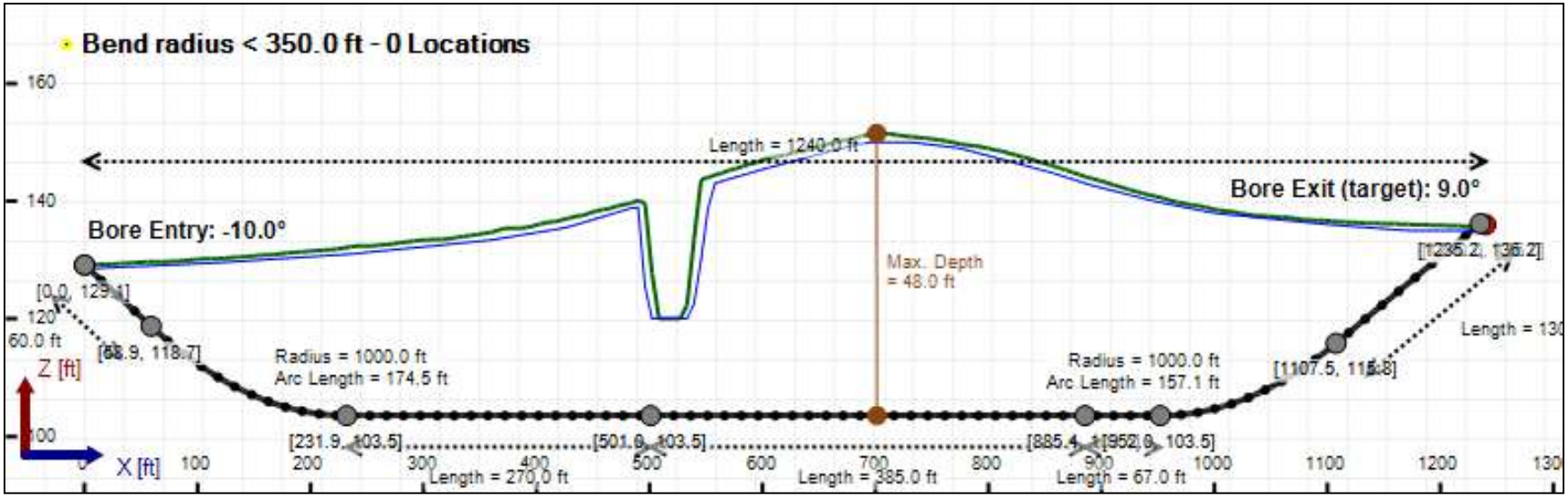
Soil Layer #1 USCS, Sand (S), SM
From Assistant
Unit Weight: 110.0000 (dry), 125.0000 (sat) [lb/ft3]
Phi: 34.00, S.M.: 500.00, Coh: 0.00 [psi]

Soil Layer #2 USCS, Clay (C), CL
From Assistant
Unit Weight: 80.0000 (dry), 110.0000 (sat) [lb/ft3]
Phi: 0.00, S.M.: 300.00, Coh: 5.50 [psi]

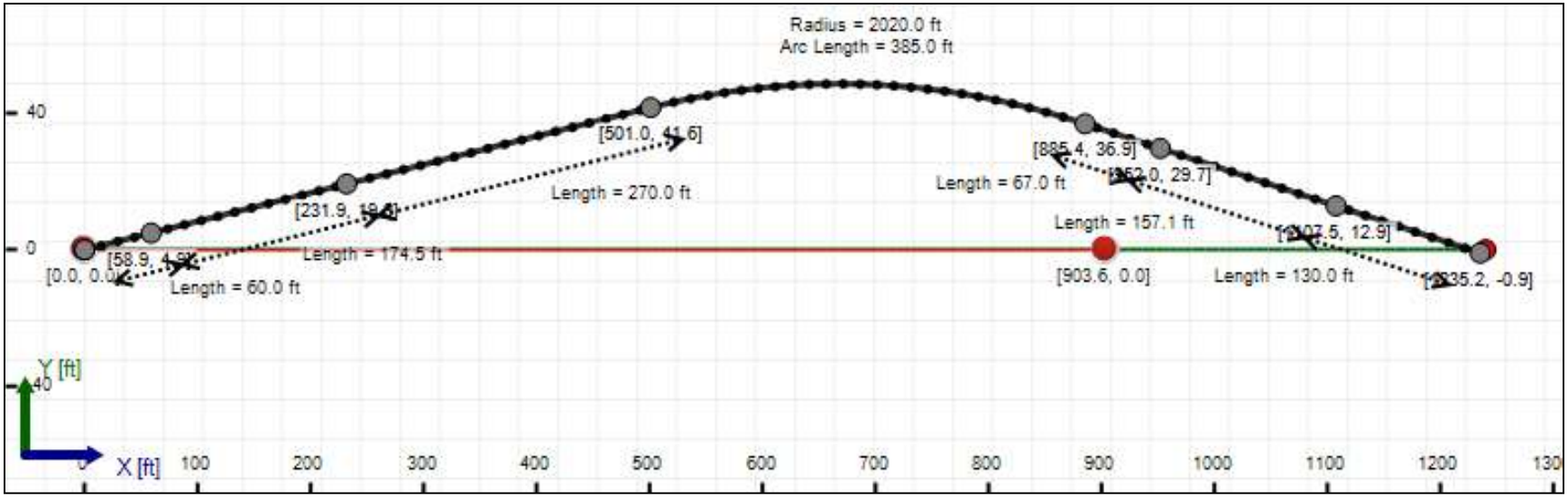
Soil Layer #3 USCS, Clay (C), CL
From Assistant
Unit Weight: 70.0000 (dry), 100.0000 (sat) [lb/ft3]
Phi: 0.00, S.M.: 200.00, Coh: 3.13 [psi]

Soil Layer #4 USCS, Sand (S), SW
From Assistant
Unit Weight: 110.0000 (dry), 125.0000 (sat) [lb/ft3]
Phi: 34.00, S.M.: 500.00, Coh: 0.00 [psi]

Bore Cross-Section View



Bore Plan View



Load Verifier Input Summary:

Pipe Application: Electrical Cable
Pipe Type: HDPE
Classification: IPS
Pipe OD: 10" (10.75")
Pipe DR: 9
Pipe Length: 1245.00 ft
Internal Pressure: 0 psi
Borehole Diameter: 1.34400002161662 ft
Silo Width: 1.34400002161662 ft
Surface Surcharge: 0 psi
Short Term Modulus: 57500 psi
Long Term Modulus: 28200 psi
Short Term Poisson Ratio: 0.35
Long Term Poisson Ratio: 0.45
Pipe Unit Weight: 59.30500 lb/ft3
Allowable Tensile Stress (Short Term): 1200 psi
Allowable Tensile Stress (Long Term): 1100 psi
Allowable Compressive Stress (Short Term): 1150 psi
Allowable Compressive Stress (Long Term): 1150 psi
Surface-pipe friction coefficient at entrance: 0.5
Surface-pipe friction coefficient in borehole: 0.3
Pipe-soil friction angle: 30
Slurry Unit Weight: 93.64118 lb/ft3
Hydrokinetic Pressure: 10 psi
Ballast Unit Weight: 62.42746 lb/ft3

In-service Load Summary:

Pressure [psi]	Deformed	Collapsed
Earth Pressure	3.1	19.0
Water Pressure	20.1	20.1
Surface Surcharge	0.0	0.0
Internal Pressure	0.0	0.0
Net Pressure	23.2	39.2
Deflection		
Earth Load Deflection	1.217	5.178
Buoyant Deflection	0.132	0.132
Reissner Effect	0	0
Net Deflection	1.349	5.310
Compressive Stress [psi]		
Compressive Wall Stress	104.5	176.2

Installation Load Summary:

Forces/Stresses	@Maximum Force	Absolute Maximum
Pullback Force [lb]	20991.8	20991.8
Pullback Stress [psi]	585.4	585.4
Pullback Strain	1.018E-2	1.018E-2
Bending Stress [psi]	0.0	25.8
Bending Strain	0	4.479E-4
Tensile Stress [psi]	585.4	606.5
Tensile Strain	1.018E-2	1.100E-2

Net External Pressure = 19.8 [psi]

Buoyant Deflection = 0.1

Hydrokinetic Force = 567.6 lb

In-service Analysis

	Calculated	Allowable	Factor of Safety	Check
Deflection [%]	1.349	7.5	5.6	OK
Unconstrained Collapse [psi]	23.2	126.6	5.5	OK
Compressive Wall Stress [psi]	104.5	1150.0	11.0	OK

Installation Analysis

	Calculated	Allowable	Factor of Safety	Check
Deflection [%]	0.065	7.5	115.8	OK
Unconstrained Collapse [psi]	31.3	220.2	7.0	OK
Tensile Stress [psi]	606.5	1200.0	2.0	OK

Maximum Allowable Bore Pressure Summary

Ream Number	Initial Diameter	Final Diameter	Estimated Maximum Pressure (Avg.)	Estimated Maximum Pressure (Local)
Pilot Bore	0.00 in	8.00 in	103.573 psi	60.356 psi
1	8.00 in	12.00 in	103.422 psi	56.979 psi
2	12.00 in	16.13 in	103.205 psi	55.146 psi

Note: The maximum bore pressures presented in this table are the maximum values along the length of the bore and not the maximum allowable at any point. The estimated maximum pressures should be compared to the estimated circulating pressures along the bore to determine potential locations of inadvertant returns.

Estimated Circulating Pressure Summary

Active	Shear Rate [rpm]	Shear Stress [Fann Degrees]
No	600	37
No	300	32
No	200	29
Yes	100	25
Yes	6	17
No	3	15

Flow Rate (Q): 40.00 US (liquid) gallon/min

Drill Fluid Density: 68.700 lb/ft3

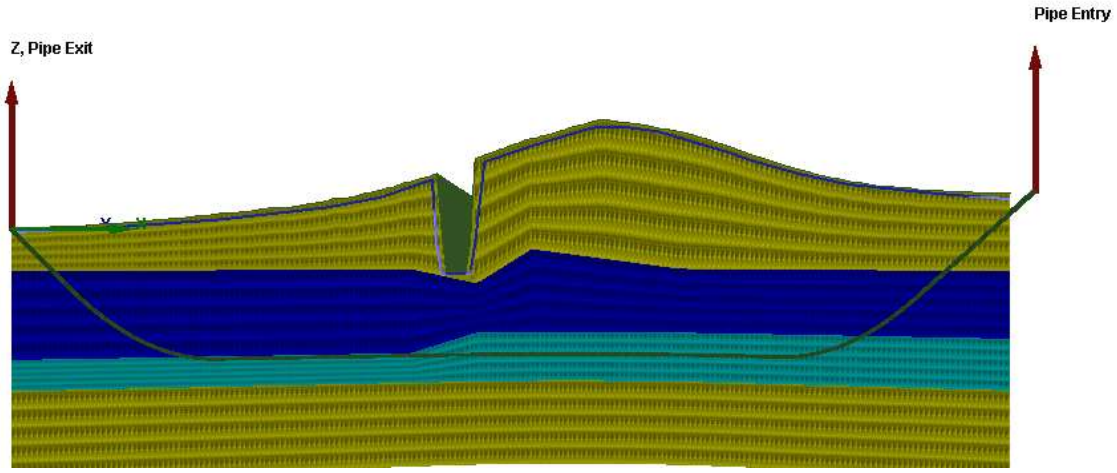
Rheological model: Power-Law

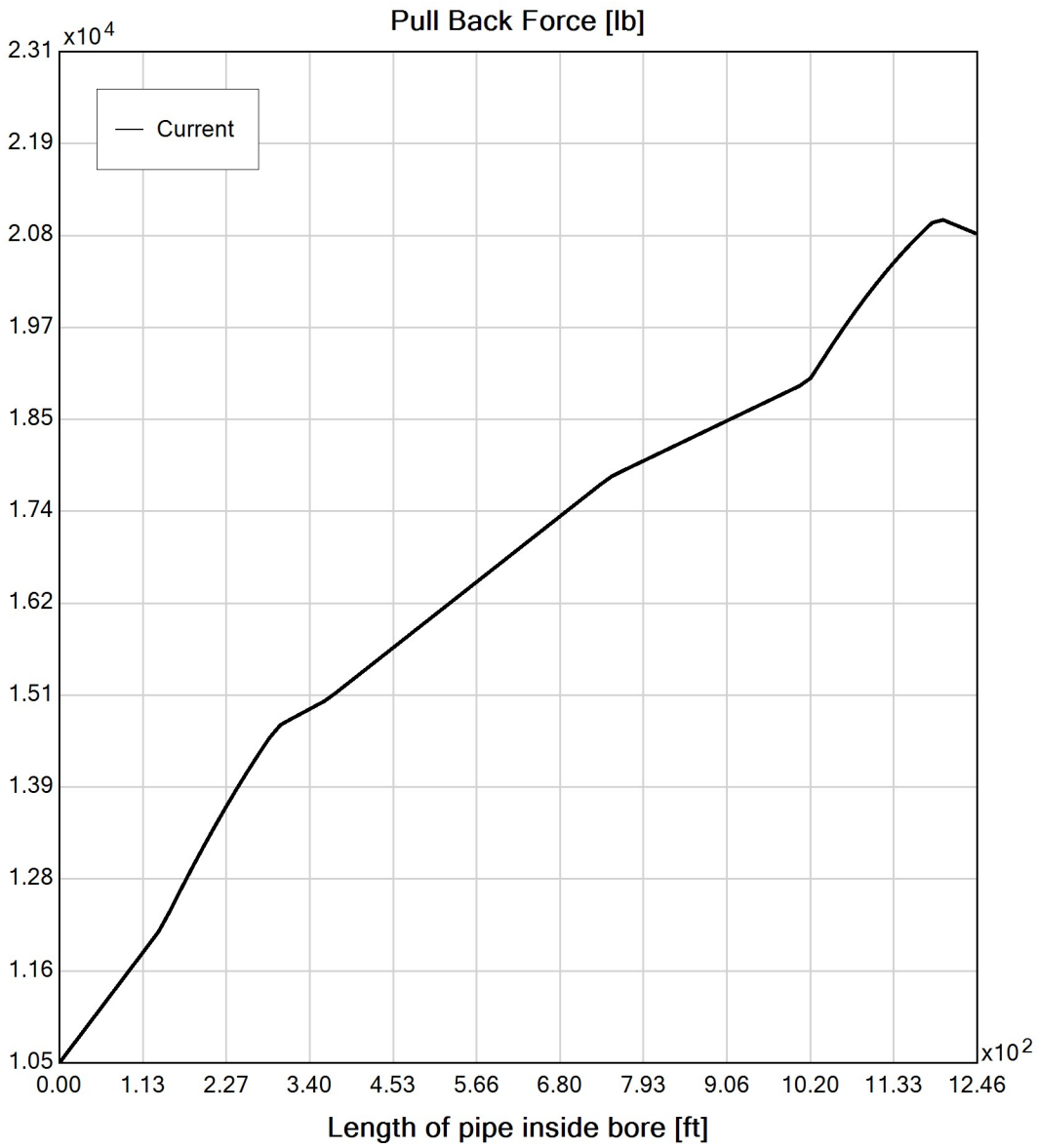
Fluid Consistency Index (K): 63.17

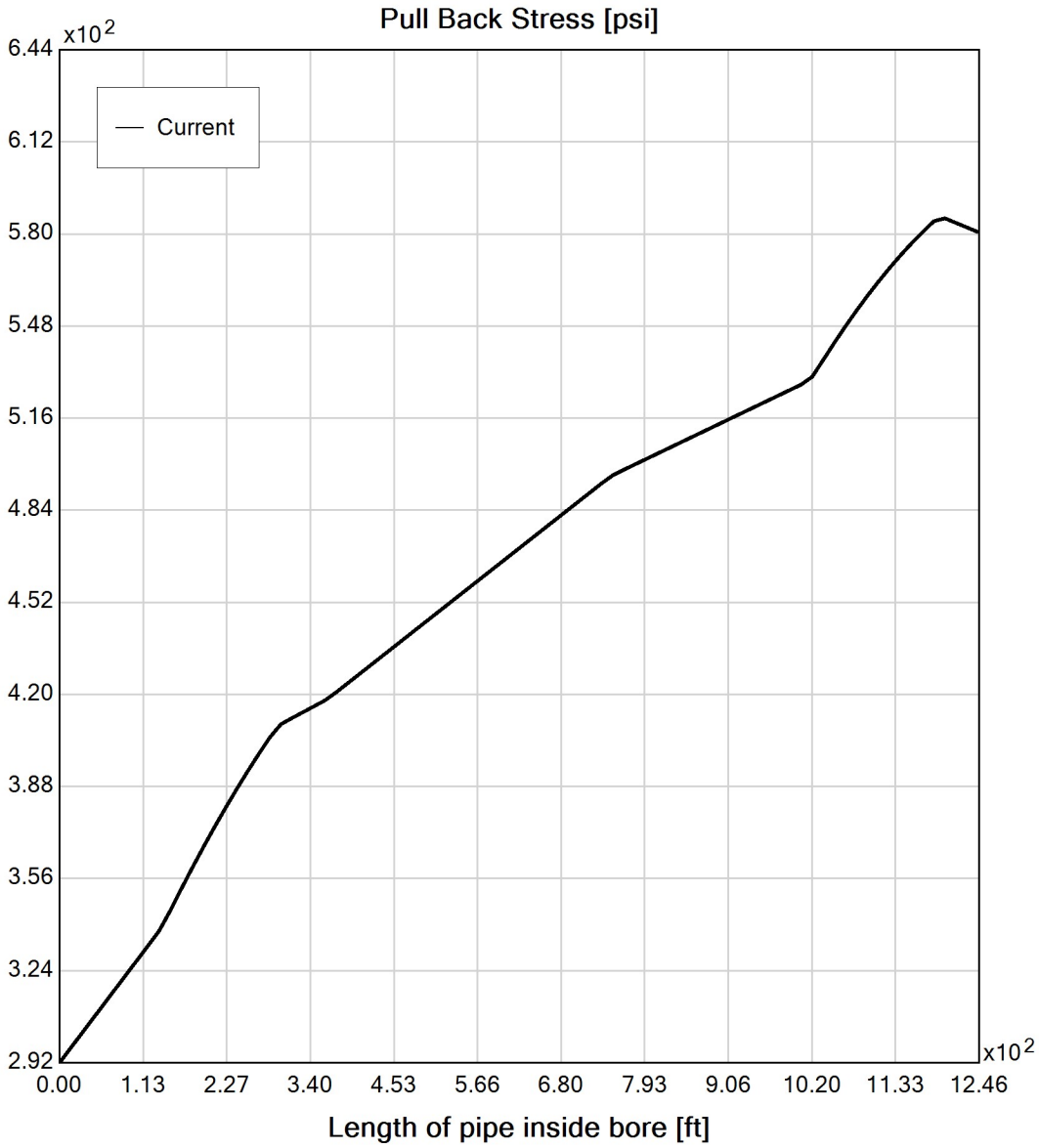
Power Law Exponent (n): 0.14

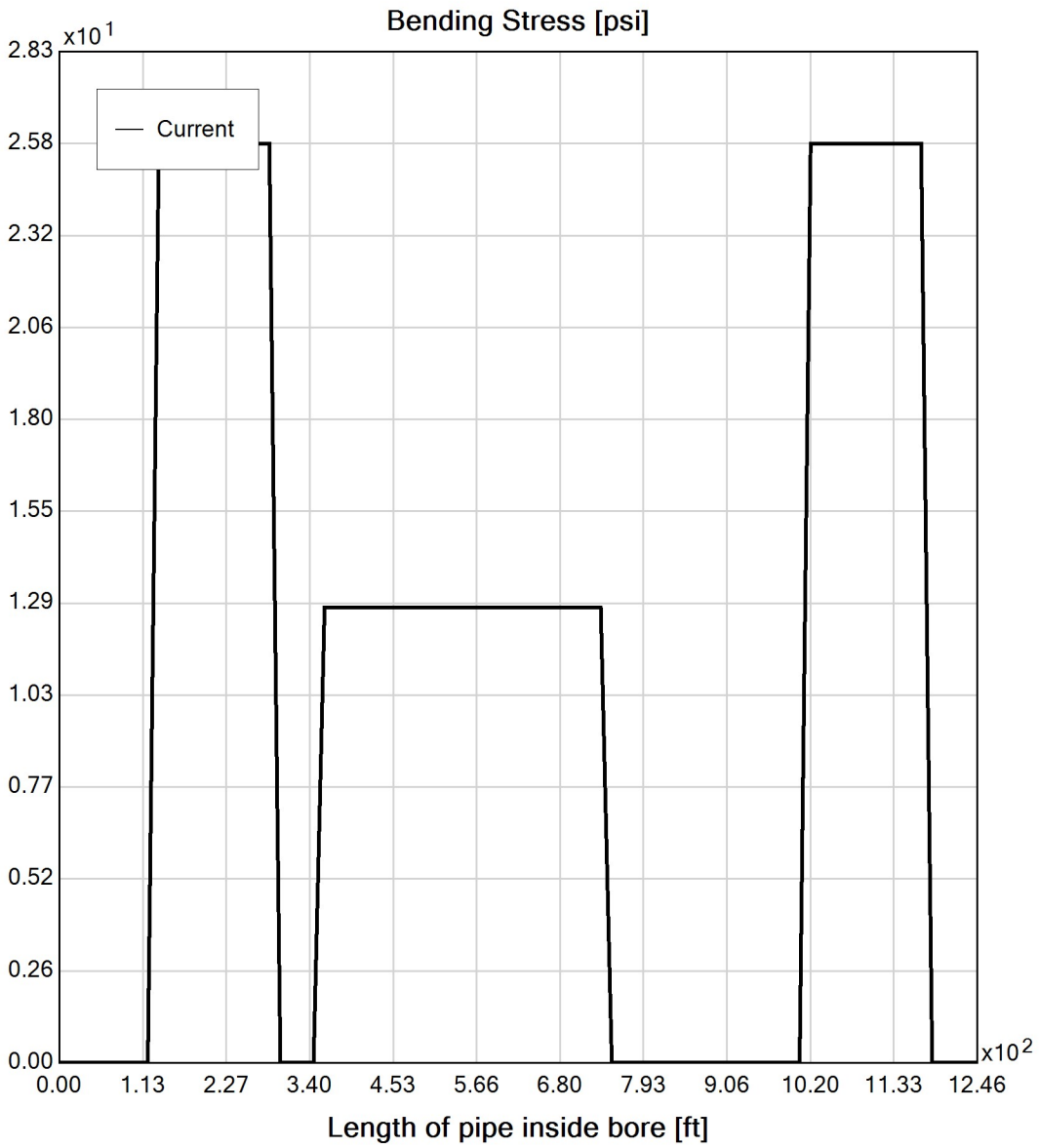
Effective Viscosity (cP): 859.3

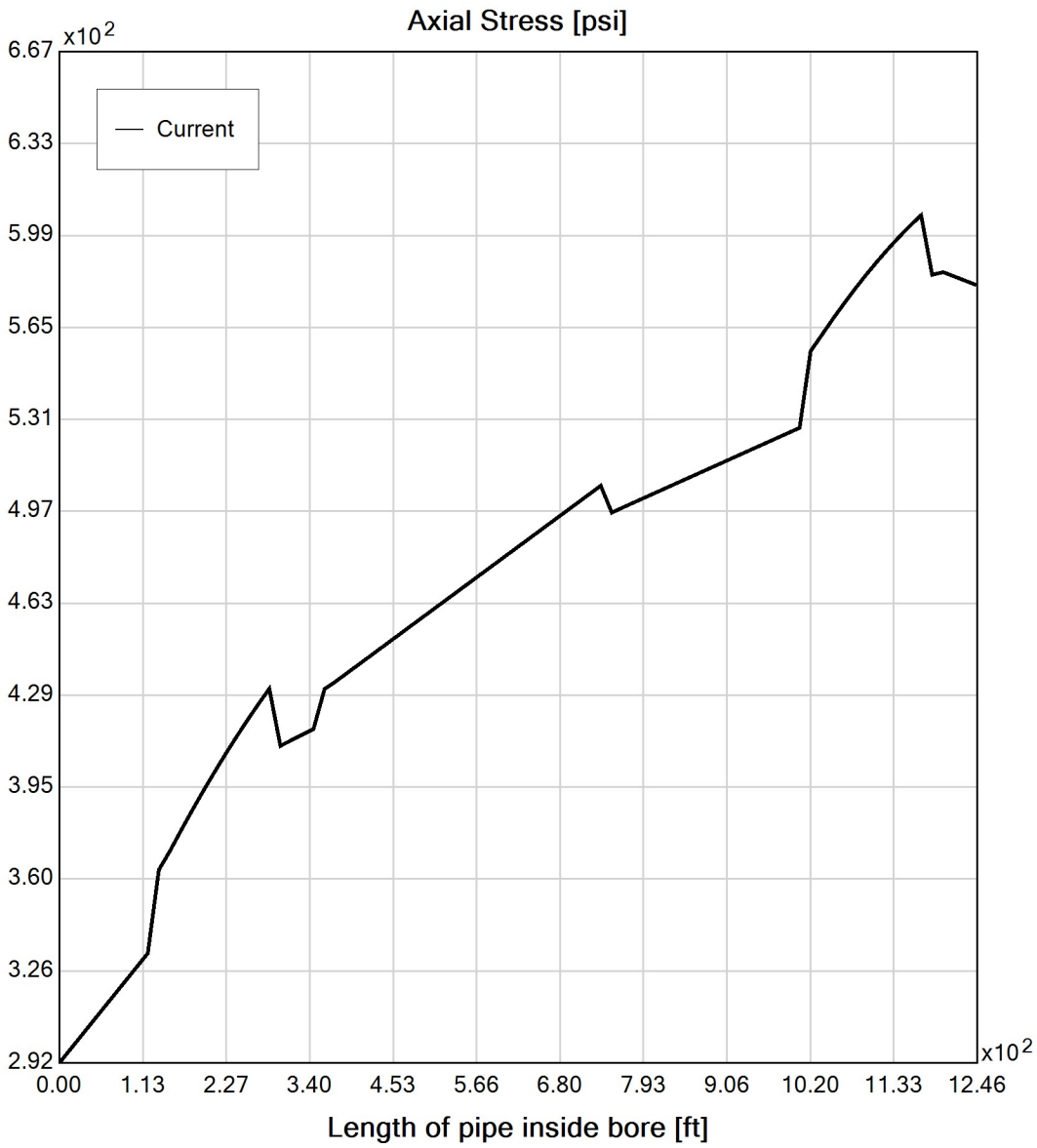
Virtual Site

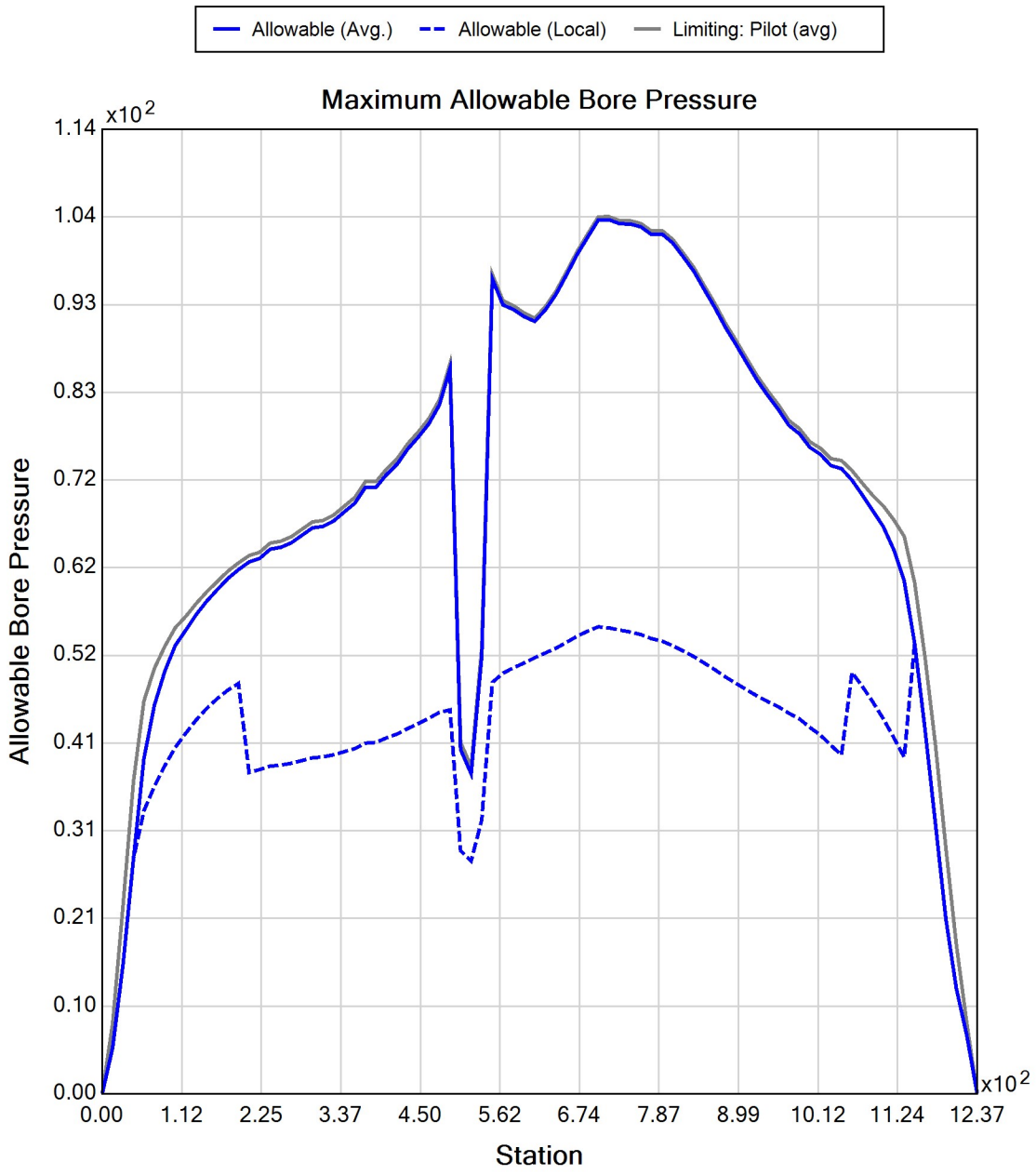


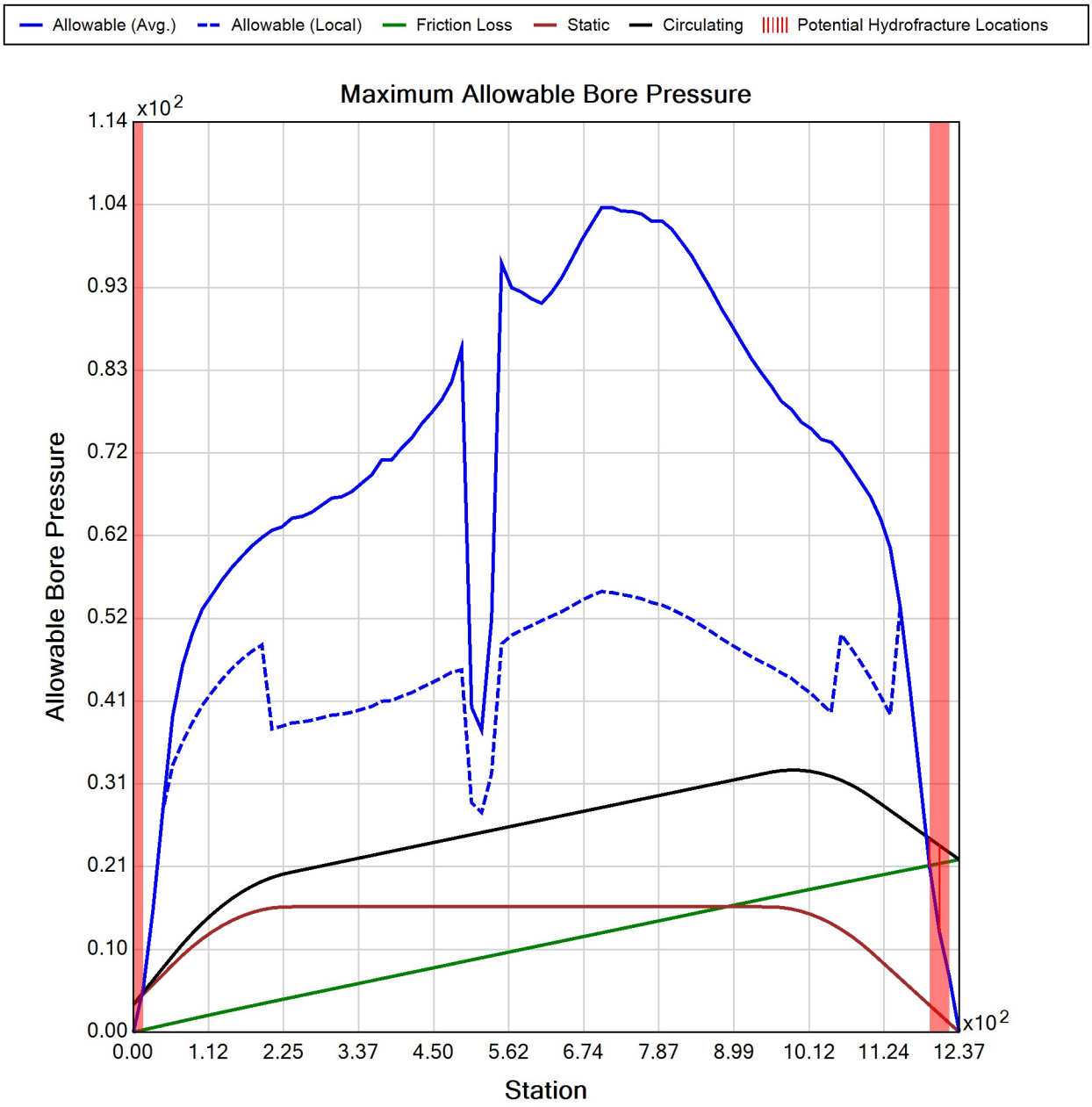












Generated Output

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Input Summary

Start Coordinate	(0.00, 0.00, 129.14) ft
End Coordinate	(1240.00, 0.00, 136.00) ft
Project Length	1240.00 ft
Pipe Type	HDPE
OD Classification	IPS
Pipe OD	2.375 in
Pipe DR	9.0
Pipe Thickness	0.26 in
Rod Length	15.00 ft
Rod Diameter	3.5 in
Drill Rig Location	(0.00, 0.00, 0.00) ft

Load Verifier Input Summary:

Pipe Application: Electrical Cable
Pipe Type: HDPE
Classification: IPS
Pipe OD: 2" (2.375")
Pipe DR: 9
Pipe Length: 1245.00 ft
Internal Pressure: 0 psi
Borehole Diameter: 0.531000018119812 ft
Silo Width: 0.531000018119812 ft
Surface Surcharge: 0 psi
Short Term Modulus: 57500 psi
Long Term Modulus: 28200 psi
Short Term Poisson Ratio: 0.35
Long Term Poisson Ratio: 0.45
Pipe Unit Weight: 59.30500 lb/ft3
Allowable Tensile Stress (Short Term): 1200 psi
Allowable Tensile Stress (Long Term): 1100 psi
Allowable Compressive Stress (Short Term): 1150 psi
Allowable Compressive Stress (Long Term): 1150 psi
Surface-pipe friction coefficient at entrance: 0.5
Surface-pipe friction coefficient in borehole: 0.3
Pipe-soil friction angle: 30
Slurry Unit Weight: 93.64118 lb/ft3
Hydrokinetic Pressure: 10 psi
Ballast Unit Weight: 62.42746 lb/ft3

In-service Load Summary:

Pressure [psi]	Deformed	Collapsed
Earth Pressure	1.2	19.0
Water Pressure	20.1	20.1
Surface Surcharge	0.0	0.0
Internal Pressure	0.0	0.0
Net Pressure	21.4	39.2
Deflection		
Earth Load Deflection	0.859	5.178
Buoyant Deflection	0.029	0.029
Reissner Effect	0	0
Net Deflection	0.888	5.207
Compressive Stress [psi]		
Compressive Wall Stress	96.1	176.2

Installation Load Summary:

Forces/Stresses	@Maximum Force	Absolute Maximum
Pullback Force [lb]	1134.2	1134.2
Pullback Stress [psi]	648.0	648.0
Pullback Strain	1.127E-2	1.127E-2
Bending Stress [psi]	0.0	5.7
Bending Strain	0	9.896E-5
Tensile Stress [psi]	648.0	649.1
Tensile Strain	1.127E-2	1.139E-2

Net External Pressure = 19.8 [psi]

Buoyant Deflection = 0.0

Hydrokinetic Force = 137.3 lb

In-service Analysis

	Calculated	Allowable	Factor of Safety	Check
Deflection [%]	0.888	7.5	8.4	OK
Unconstrained Collapse [psi]	21.4	127.5	6.0	OK
Compressive Wall Stress [psi]	96.1	1150.0	12.0	OK

Installation Analysis

	Calculated	Allowable	Factor of Safety	Check
Deflection [%]	0.014	7.5	524.3	OK
Unconstrained Collapse [psi]	31.3	218.1	7.0	OK
Tensile Stress [psi]	649.1	1200.0	1.8	OK

Generated Output

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Project Summary

General:	HDD #11 - Conduit 1 Ref: Fort Ann, NY Washington cty J2105 Start Date: 06-24-2022 End Date: 06-24-2022
Project Owner:	TDI
Project Contractor:	Kiewit
Project Consultant:	CHA-BCE
Designer:	MDB BCE Amherst, MA
Description:	West Alignment Running South to North 10" DR9

Input Summary

Start Coordinate	(0.00, 0.00, 129.00) ft
End Coordinate	(1250.00, 0.00, 129.00) ft
Project Length	1250.00 ft
Pipe Type	HDPE
OD Classification	IPS
Pipe OD	10.750 in
Pipe DR	9.0
Pipe Thickness	1.19 in
Rod Length	15.00 ft
Rod Diameter	3.5 in
Drill Rig Location	(0.00, 0.00, 0.00) ft

Soil Summary

Number of Layers: 5

Soil Layer #1 USCS, Sand (S), SW
From Assistant
Unit Weight: 110.0000 (dry), 125.0000 (sat) [lb/ft3]
Phi: 34.00, S.M.: 500.00, Coh: 0.00 [psi]

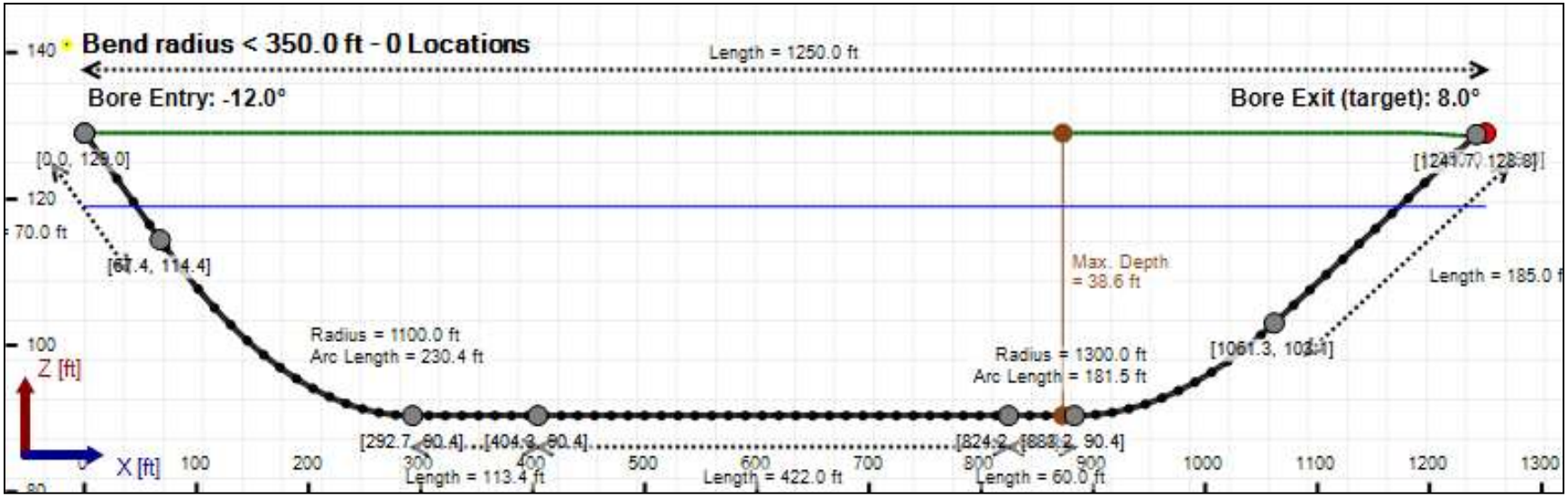
Soil Layer #2 USCS, Silt (M), MH
From Assistant
Unit Weight: 80.0000 (dry), 100.0000 (sat) [lb/ft3]
Phi: 28.00, S.M.: 50.00, Coh: 0.00 [psi]

Soil Layer #3 USCS, Clay (C), CL
From Assistant
Unit Weight: 100.0000 (dry), 120.0000 (sat) [lb/ft3]
Phi: 0.00, S.M.: 145.00, Coh: 8.30 [psi]

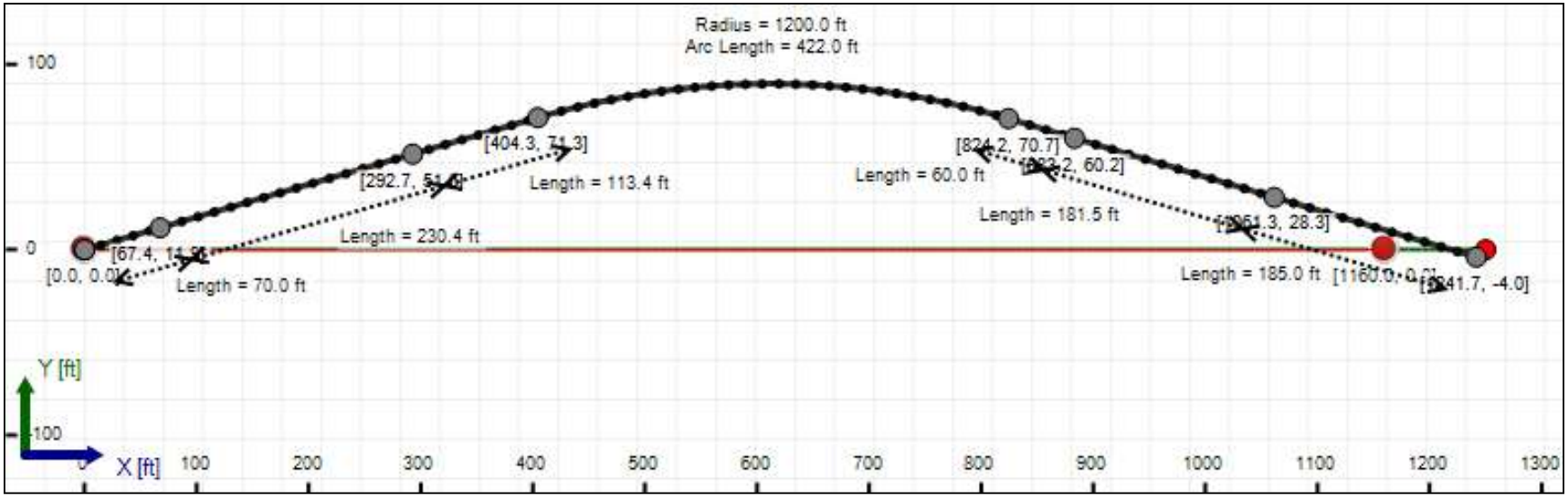
Soil Layer #4 USCS, Sand (S), SW
From Assistant
Unit Weight: 110.0000 (dry), 125.0000 (sat) [lb/ft3]
Phi: 34.00, S.M.: 500.00, Coh: 0.00 [psi]

Soil Layer #5 Rock, Geological Classification, Sedimentary Rocks
From Assistant
Unit Weight: 107.8272 (dry), 177.6384 (sat) [lb/ft3]
Phi: 35.00, S.M.: 1450.40, Coh: 2900.80 [psi]

Bore Cross-Section View



Bore Plan View



Load Verifier Input Summary:

Pipe Application: Electrical Cable
Pipe Type: HDPE
Classification: IPS
Pipe OD: 10" (10.75")
Pipe DR: 9
Pipe Length: 1274.99 ft
Internal Pressure: 0 psi
Borehole Diameter: 1.34400002161662 ft
Silo Width: 1.34400002161662 ft
Surface Surcharge: 0 psi
Short Term Modulus: 57500 psi
Long Term Modulus: 28200 psi
Short Term Poisson Ratio: 0.35
Long Term Poisson Ratio: 0.45
Pipe Unit Weight: 59.30500 lb/ft3
Allowable Tensile Stress (Short Term): 1200 psi
Allowable Tensile Stress (Long Term): 1100 psi
Allowable Compressive Stress (Short Term): 1150 psi
Allowable Compressive Stress (Long Term): 1150 psi
Surface-pipe friction coefficient at entrance: 0.5
Surface-pipe friction coefficient in borehole: 0.3
Pipe-soil friction angle: 30
Slurry Unit Weight: 93.64118 lb/ft3
Hydrokinetic Pressure: 10 psi
Ballast Unit Weight: 62.42746 lb/ft3

In-service Load Summary:

Pressure [psi]	Deformed	Collapsed
Earth Pressure	3.9	19.6
Water Pressure	12.4	12.4
Surface Surcharge	0.0	0.0
Internal Pressure	0.0	0.0
Net Pressure	16.3	32.0
Deflection		
Earth Load Deflection	1.162	5.344
Buoyant Deflection	0.132	0.132
Reissner Effect	0	0
Net Deflection	1.294	5.476
Compressive Stress [psi]		
Compressive Wall Stress	73.2	144.1

Installation Load Summary:

Forces/Stresses	@Maximum Force	Absolute Maximum
Pullback Force [lb]	22775.1	22775.1
Pullback Stress [psi]	635.2	635.2
Pullback Strain	1.105E-2	1.105E-2
Bending Stress [psi]	0.0	23.4
Bending Strain	0	4.072E-4
Tensile Stress [psi]	635.2	657.0
Tensile Strain	1.105E-2	1.183E-2

Net External Pressure = 19.1 [psi]

Buoyant Deflection = 0.1

Hydrokinetic Force = 567.6 lb

In-service Analysis

	Calculated	Allowable	Factor of Safety	Check
Deflection [%]	1.294	7.5	5.8	OK
Unconstrained Collapse [psi]	26.1	124.2	4.8	OK
Compressive Wall Stress [psi]	73.2	1150.0	15.7	OK

Installation Analysis

	Calculated	Allowable	Factor of Safety	Check
Deflection [%]	0.065	7.5	115.8	OK
Unconstrained Collapse [psi]	36.1	217.6	6.0	OK
Tensile Stress [psi]	657.0	1200.0	1.8	OK

Maximum Allowable Bore Pressure Summary

Ream Number	Initial Diameter	Final Diameter	Estimated Maximum Pressure (Avg.)	Estimated Maximum Pressure (Local)
Pilot Bore	0.00 in	6.50 in	105.909 psi	132.552 psi
1	6.50 in	12.00 in	105.629 psi	132.035 psi
2	12.00 in	16.13 in	105.314 psi	131.455 psi

Note: The maximum bore pressures presented in this table are the maximum values along the length of the bore and not the maximum allowable at any point. The estimated maximum pressures should be compared to the estimated circulating pressures along the bore to determine potential locations of inadvertant returns.

Estimated Circulating Pressure Summary

Active	Shear Rate [rpm]	Shear Stress [Fann Degrees]
No	600	37
No	300	32
No	200	29
Yes	100	25
Yes	6	17
No	3	15

Flow Rate (Q): 40.00 US (liquid) gallon/min

Drill Fluid Density: 68.700 lb/ft3

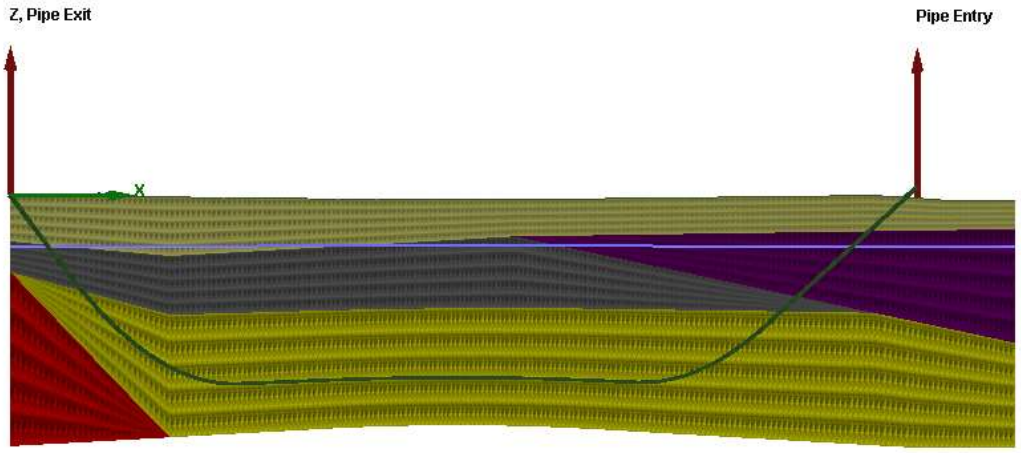
Rheological model: Power-Law

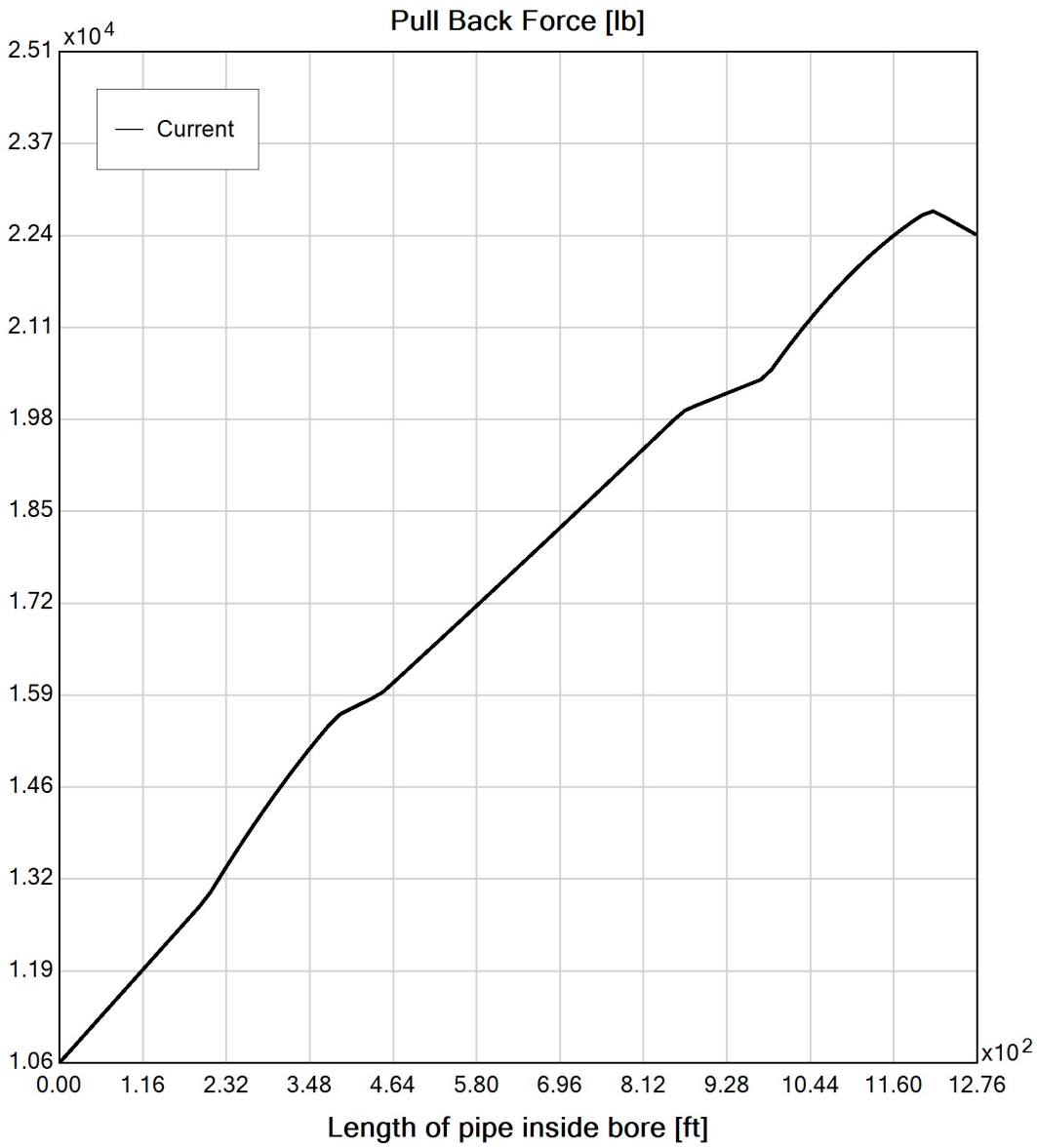
Fluid Consistency Index (K): 63.17

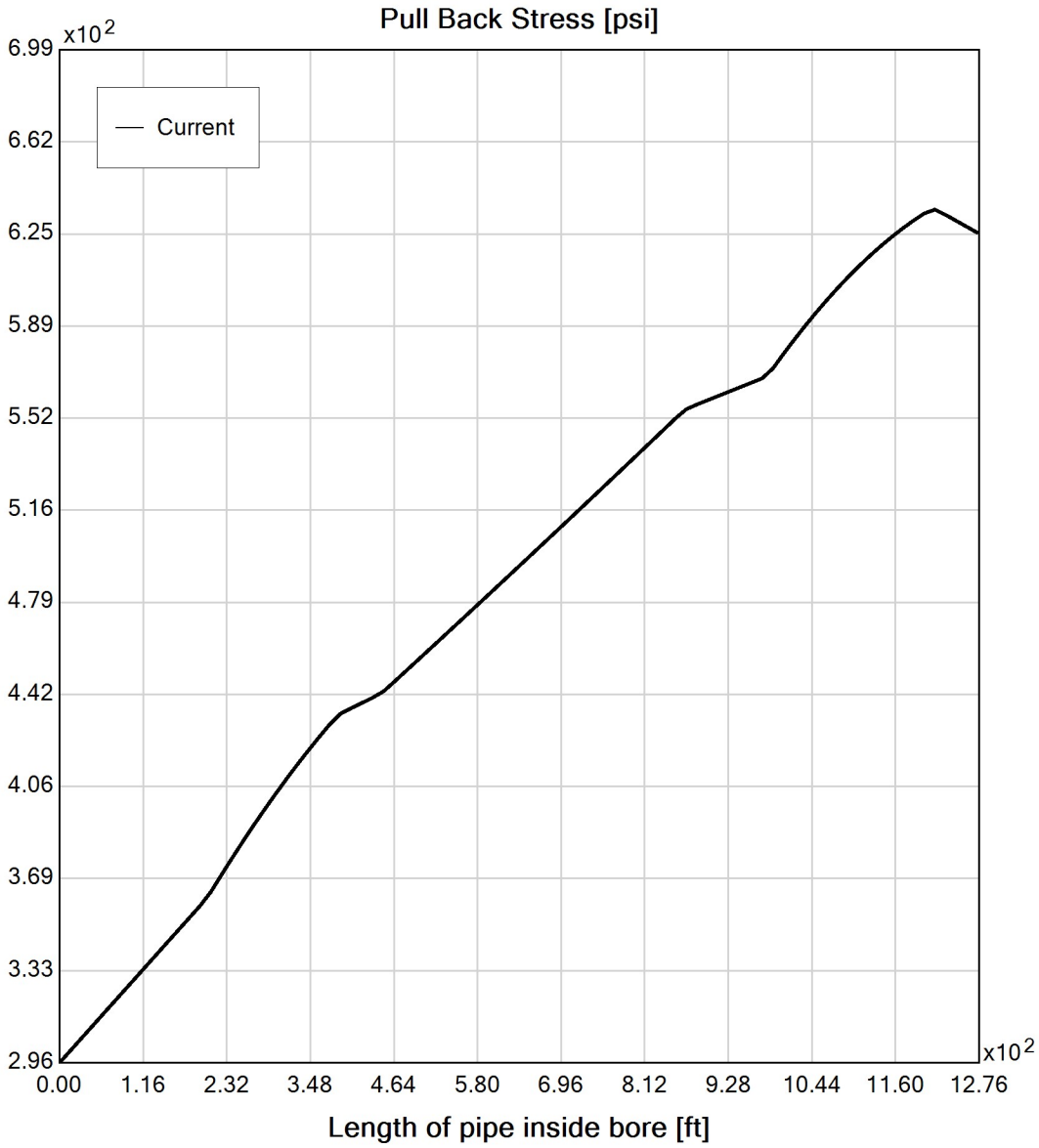
Power Law Exponent (n): 0.14

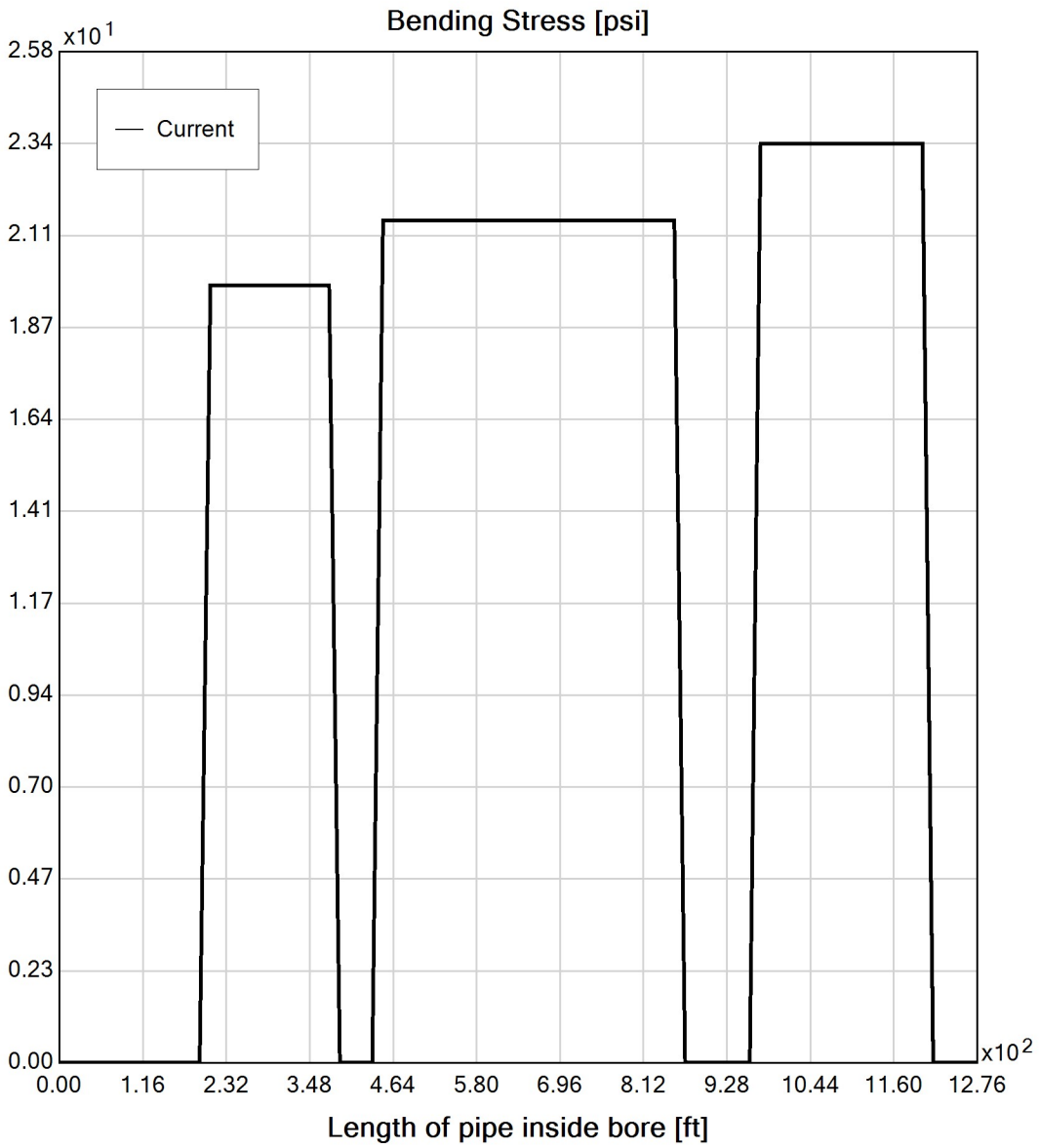
Effective Viscosity (cP): 378.3

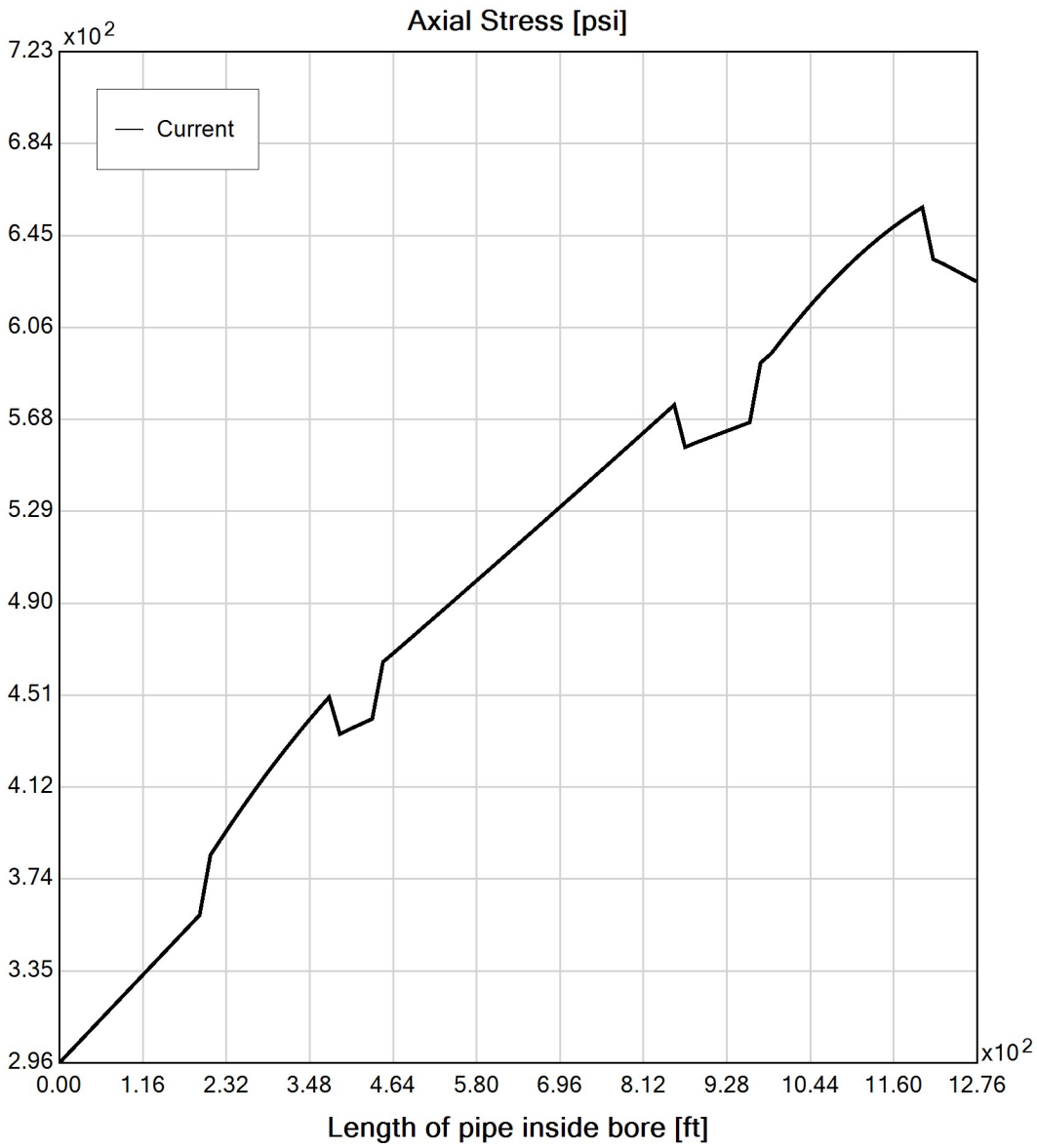
Virtual Site

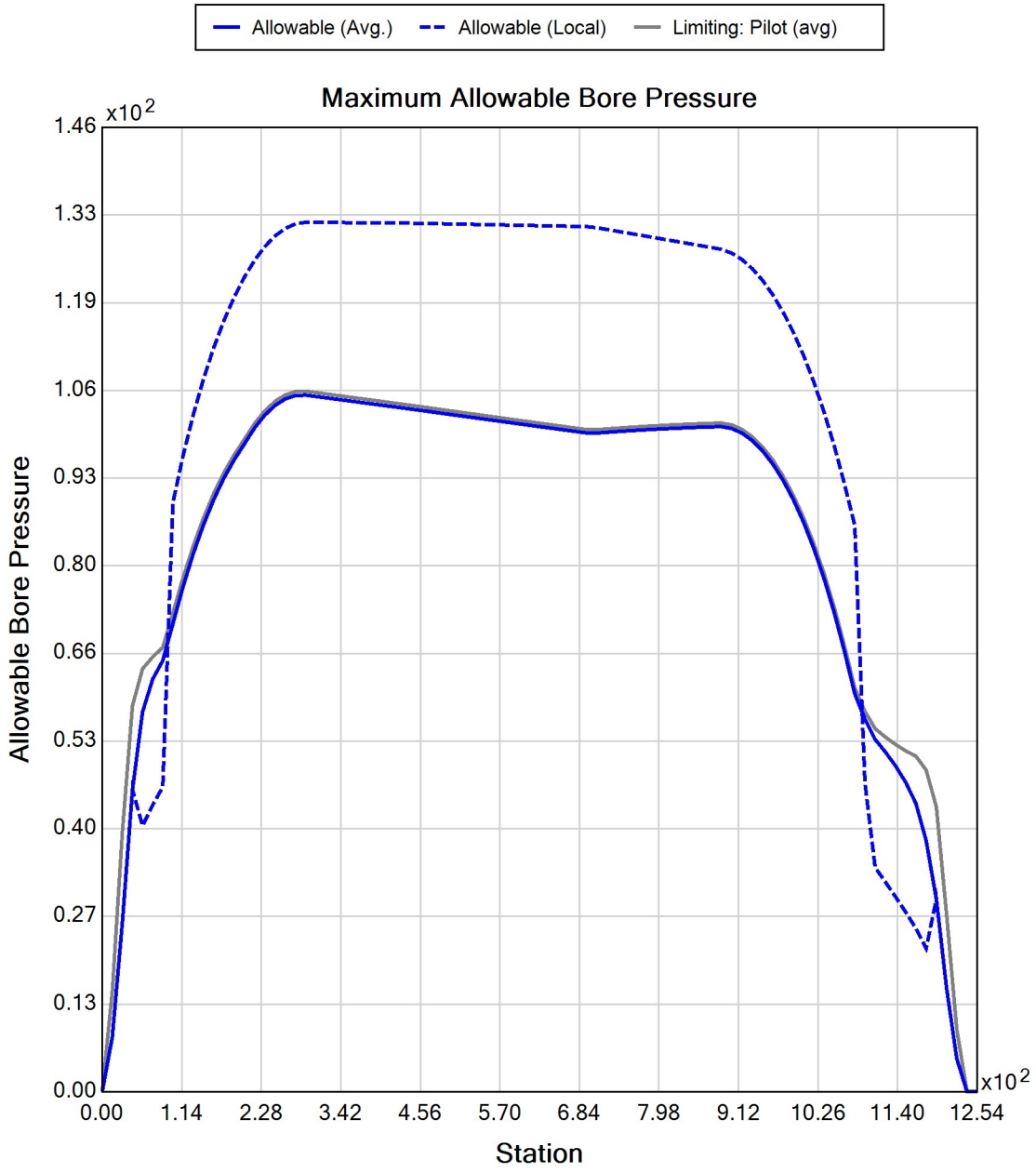


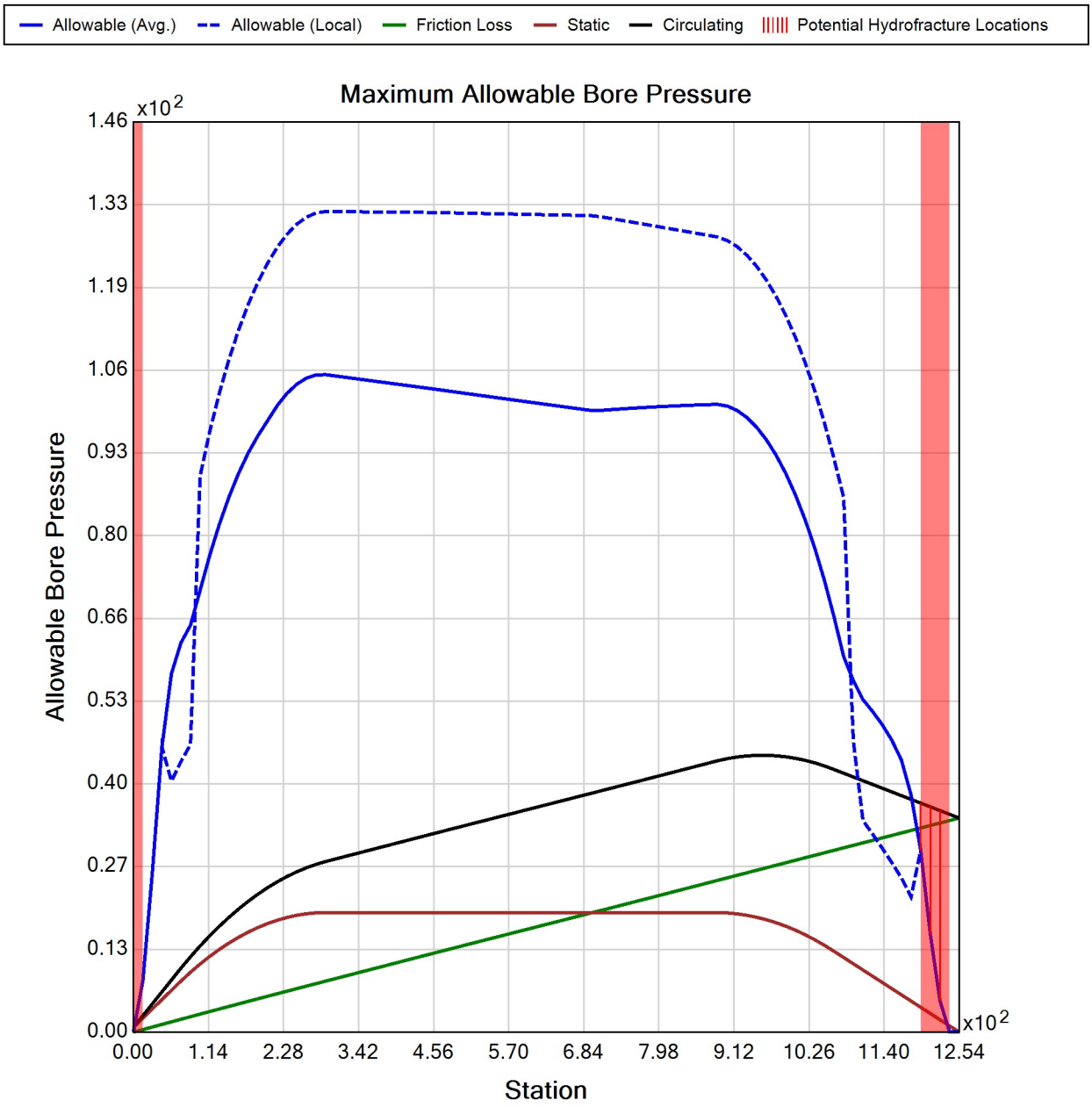












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Input Summary

Start Coordinate	(0.00, 0.00, 129.00) ft
End Coordinate	(1250.00, 0.00, 129.00) ft
Project Length	1250.00 ft
Pipe Type	HDPE
OD Classification	IPS
Pipe OD	2.375 in
Pipe DR	9.0
Pipe Thickness	0.26 in
Rod Length	15.00 ft
Rod Diameter	3.5 in
Drill Rig Location	(0.00, 0.00, 0.00) ft

Load Verifier Input Summary:

Pipe Application: Electrical Cable
Pipe Type: HDPE
Classification: IPS
Pipe OD: 2" (2.375")
Pipe DR: 9
Pipe Length: 1274.99 ft
Internal Pressure: 0 psi
Borehole Diameter: 0.531000018119812 ft
Silo Width: 0.531000018119812 ft
Surface Surcharge: 0 psi
Short Term Modulus: 57500 psi
Long Term Modulus: 28200 psi
Short Term Poisson Ratio: 0.35
Long Term Poisson Ratio: 0.45
Pipe Unit Weight: 59.30500 lb/ft3
Allowable Tensile Stress (Short Term): 1200 psi
Allowable Tensile Stress (Long Term): 1100 psi
Allowable Compressive Stress (Short Term): 1150 psi
Allowable Compressive Stress (Long Term): 1150 psi
Surface-pipe friction coefficient at entrance: 0.5
Surface-pipe friction coefficient in borehole: 0.3
Pipe-soil friction angle: 30
Slurry Unit Weight: 93.64118 lb/ft3
Hydrokinetic Pressure: 10 psi
Ballast Unit Weight: 62.42746 lb/ft3

In-service Load Summary:

Pressure [psi]	Deformed	Collapsed
Earth Pressure	1.5	19.6
Water Pressure	12.4	12.4
Surface Surcharge	0.0	0.0
Internal Pressure	0.0	0.0
Net Pressure	13.9	32.0
Deflection		
Earth Load Deflection	0.609	5.344
Buoyant Deflection	0.029	0.029
Reissner Effect	0	0
Net Deflection	0.638	5.373
Compressive Stress [psi]		
Compressive Wall Stress	62.7	144.1

Installation Load Summary:

Forces/Stresses	@Maximum Force	Absolute Maximum
Pullback Force [lb]	1221.2	1221.2
Pullback Stress [psi]	697.8	697.8
Pullback Strain	1.214E-2	1.214E-2
Bending Stress [psi]	0.0	5.2
Bending Strain	0	8.996E-5
Tensile Stress [psi]	697.8	701.4
Tensile Strain	1.214E-2	1.229E-2

Net External Pressure = 19.1 [psi]

Buoyant Deflection = 0.0

Hydrokinetic Force = 137.3 lb

In-service Analysis

	Calculated	Allowable	Factor of Safety	Check
Deflection [%]	0.638	7.5	11.8	OK
Unconstrained Collapse [psi]	26.1	132.7	5.1	OK
Compressive Wall Stress [psi]	62.7	1150.0	18.3	OK

Installation Analysis

	Calculated	Allowable	Factor of Safety	Check
Deflection [%]	0.014	7.5	524.3	OK
Unconstrained Collapse [psi]	36.1	215.3	6.0	OK
Tensile Stress [psi]	701.4	1200.0	1.7	OK

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Project Summary

General:	HDD #11 - Conduit 2 Ref: Fort Ann, NY Washington cty J2105 Start Date: 06-29-2022 End Date: 06-29-2022
Project Owner:	TDI
Project Contractor:	Kiewit
Project Consultant:	CHA-BCE
Designer:	MDB BCE Amherst, MA
Description:	East Alignment Running South to North 10" DR9

Input Summary

Start Coordinate	(0.00, 0.00, 129.00) ft
End Coordinate	(1200.00, 0.00, 129.00) ft
Project Length	1200.00 ft
Pipe Type	HDPE
OD Classification	IPS
Pipe OD	10.750 in
Pipe DR	9.0
Pipe Thickness	1.19 in
Rod Length	15.00 ft
Rod Diameter	3.5 in
Drill Rig Location	(0.00, 0.00, 0.00) ft

Soil Summary

Number of Layers: 5

Soil Layer #1 USCS, Sand (S), SW
From Assistant
Unit Weight: 110.0000 (dry), 125.0000 (sat) [lb/ft3]
Phi: 34.00, S.M.: 500.00, Coh: 0.00 [psi]

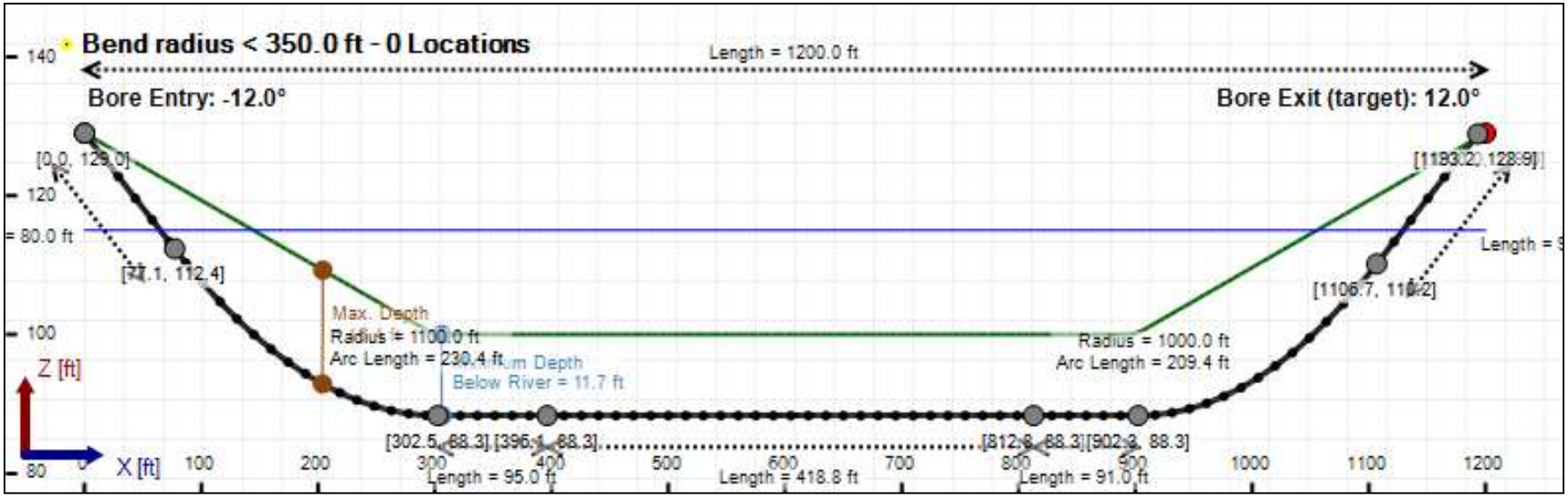
Soil Layer #2 USCS, Silt (M), MH
From Assistant
Unit Weight: 80.0000 (dry), 100.0000 (sat) [lb/ft3]
Phi: 28.00, S.M.: 50.00, Coh: 0.00 [psi]

Soil Layer #3 USCS, Clay (C), CL
From Assistant
Unit Weight: 100.0000 (dry), 120.0000 (sat) [lb/ft3]
Phi: 0.00, S.M.: 300.00, Coh: 5.50 [psi]

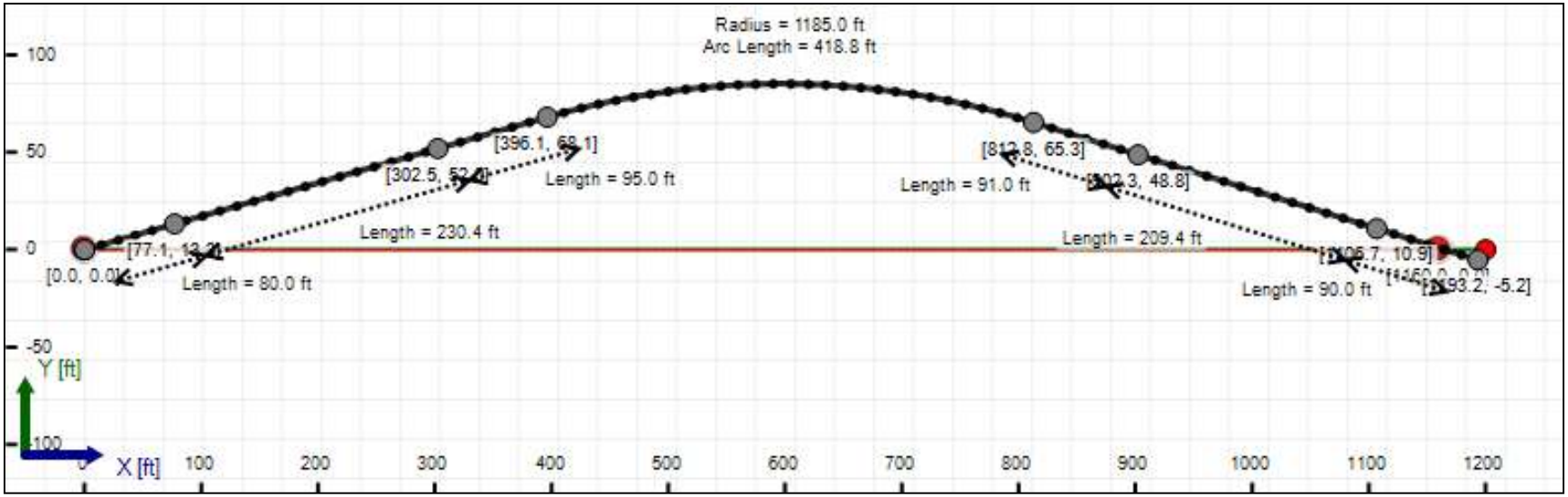
Soil Layer #4 USCS, Sand (S), SW
From Assistant
Unit Weight: 110.0000 (dry), 125.0000 (sat) [lb/ft3]
Phi: 34.00, S.M.: 500.00, Coh: 0.00 [psi]

Soil Layer #5 Rock, Geological Classification, Sedimentary Rocks
From Assistant
Unit Weight: 107.8272 (dry), 177.6384 (sat) [lb/ft3]
Phi: 35.00, S.M.: 1450.40, Coh: 2900.80 [psi]

Bore Cross-Section View



Bore Plan View



Load Verifier Input Summary:

Pipe Application: Electrical Cable
Pipe Type: HDPE
Classification: IPS
Pipe OD: 10" (10.75")
Pipe DR: 9
Pipe Length: 1214.99 ft
Internal Pressure: 0 psi
Borehole Diameter: 1.34400002161662 ft
Silo Width: 1.34400002161662 ft
Surface Surcharge: 0 psi
Short Term Modulus: 57500 psi
Long Term Modulus: 28200 psi
Short Term Poisson Ratio: 0.35
Long Term Poisson Ratio: 0.45
Pipe Unit Weight: 59.30500 lb/ft3
Allowable Tensile Stress (Short Term): 1200 psi
Allowable Tensile Stress (Long Term): 1100 psi
Allowable Compressive Stress (Short Term): 1150 psi
Allowable Compressive Stress (Long Term): 1150 psi
Surface-pipe friction coefficient at entrance: 0.5
Surface-pipe friction coefficient in borehole: 0.3
Pipe-soil friction angle: 30
Slurry Unit Weight: 93.64118 lb/ft3
Hydrokinetic Pressure: 10 psi
Ballast Unit Weight: 62.42746 lb/ft3

In-service Load Summary:

Pressure [psi]	Deformed	Collapsed
Earth Pressure	2.8	6.6
Water Pressure	11.5	11.1
Surface Surcharge	0.0	0.0
Internal Pressure	0.0	0.0
Net Pressure	14.3	17.7
Deflection		
Earth Load Deflection	1.166	1.911
Buoyant Deflection	0.132	0.132
Reissner Effect	0	0
Net Deflection	1.298	2.043
Compressive Stress [psi]		
Compressive Wall Stress	64.2	79.7

Installation Load Summary:

Forces/Stresses	@Maximum Force	Absolute Maximum
Pullback Force [lb]	22180.9	22180.9
Pullback Stress [psi]	618.6	618.6
Pullback Strain	1.076E-2	1.076E-2
Bending Stress [psi]	0.0	25.8
Bending Strain	0	4.479E-4
Tensile Stress [psi]	618.6	639.9
Tensile Strain	1.076E-2	1.154E-2

Net External Pressure = 20.1 [psi]

Buoyant Deflection = 0.1

Hydrokinetic Force = 567.6 lb

In-service Analysis

	Calculated	Allowable	Factor of Safety	Check
Deflection [%]	1.298	7.5	5.8	OK
Unconstrained Collapse [psi]	26.4	127.9	4.8	OK
Compressive Wall Stress [psi]	64.2	1150.0	17.9	OK

Installation Analysis

	Calculated	Allowable	Factor of Safety	Check
Deflection [%]	0.065	7.5	115.8	OK
Unconstrained Collapse [psi]	36.4	218.3	6.0	OK
Tensile Stress [psi]	639.9	1200.0	1.9	OK

Maximum Allowable Bore Pressure Summary

Ream Number	Initial Diameter	Final Diameter	Estimated Maximum Pressure (Avg.)	Estimated Maximum Pressure (Local)
Pilot Bore	0.00 in	6.50 in	69.919 psi	70.704 psi
1	6.50 in	12.00 in	66.362 psi	67.233 psi
2	12.00 in	16.13 in	63.140 psi	64.058 psi

Note: The maximum bore pressures presented in this table are the maximum values along the length of the bore and not the maximum allowable at any point. The estimated maximum pressures should be compared to the estimated circulating pressures along the bore to determine potential locations of inadvertant returns.

Estimated Circulating Pressure Summary

Active	Shear Rate [rpm]	Shear Stress [Fann Degrees]
No	600	37
No	300	32
No	200	29
Yes	100	25
Yes	6	17
No	3	15

Flow Rate (Q): 40.00 US (liquid) gallon/min

Drill Fluid Density: 68.700 lb/ft3

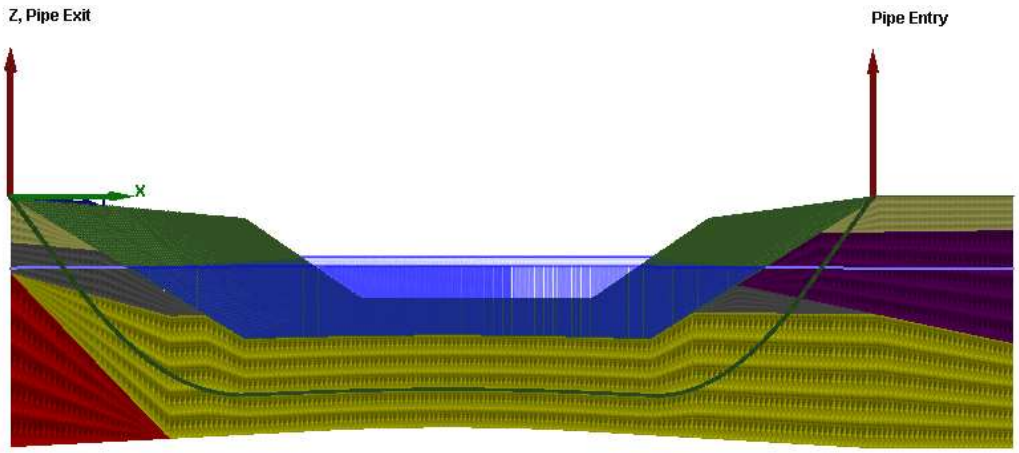
Rheological model: Power-Law

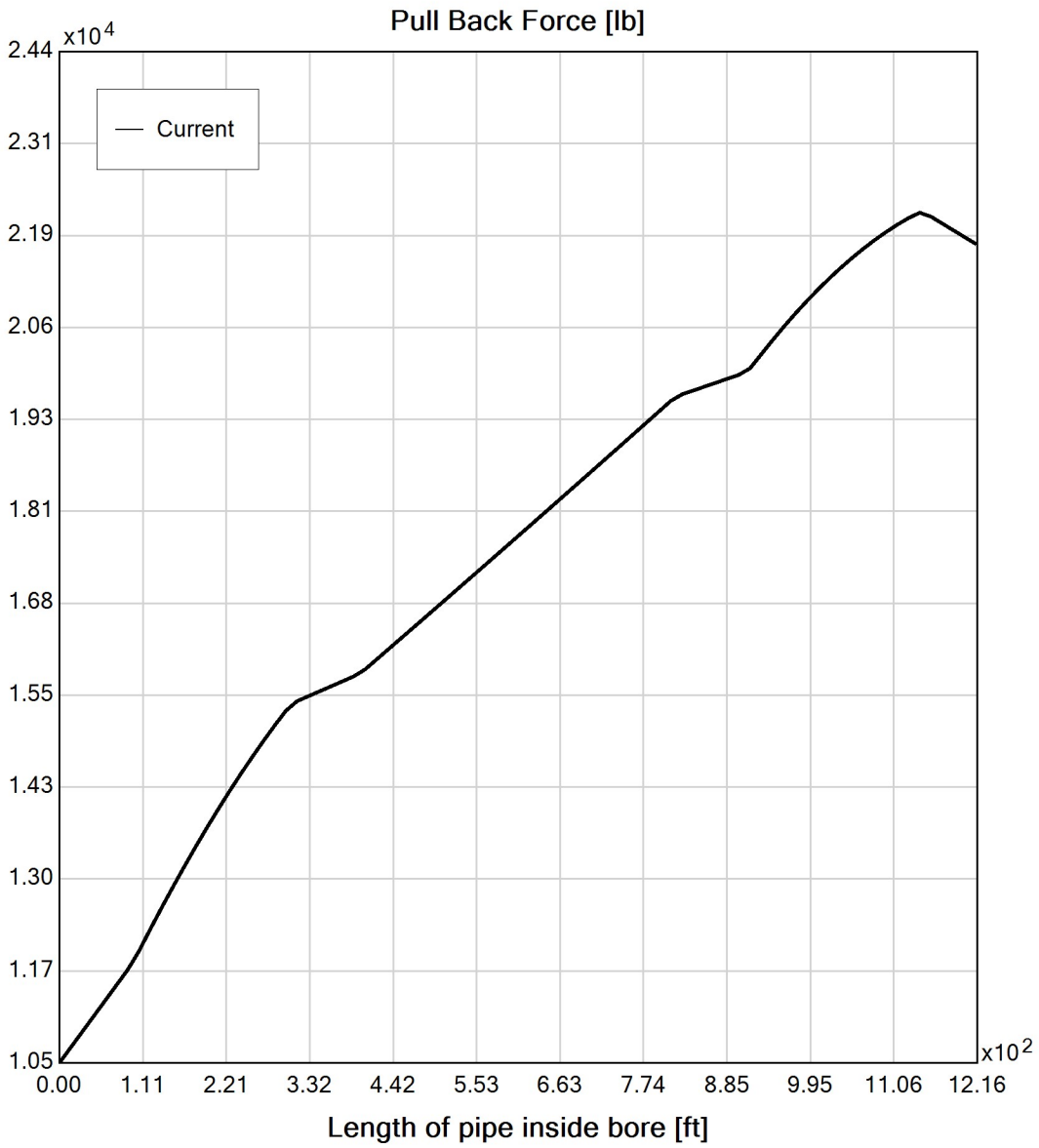
Fluid Consistency Index (K): 63.17

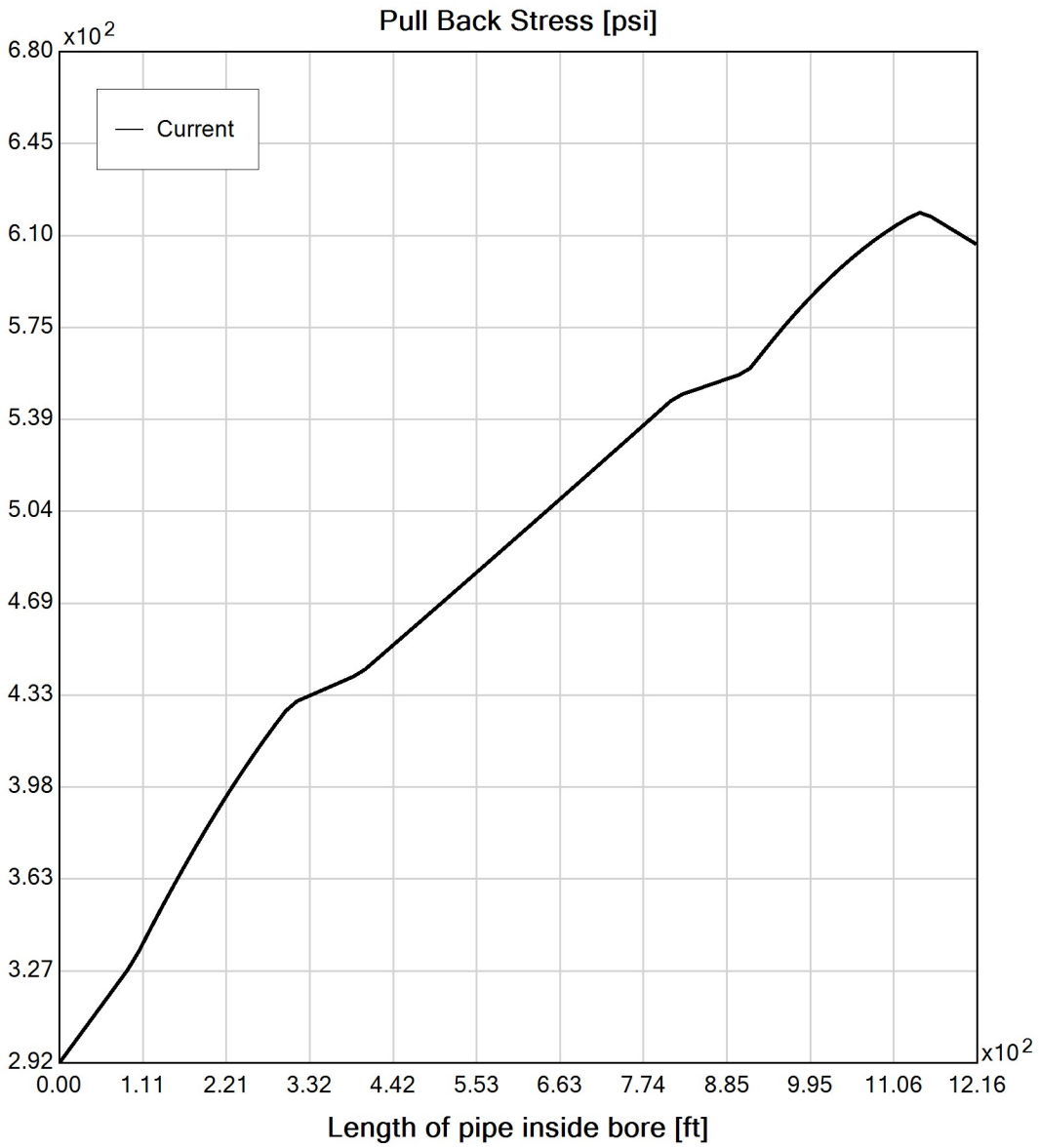
Power Law Exponent (n): 0.14

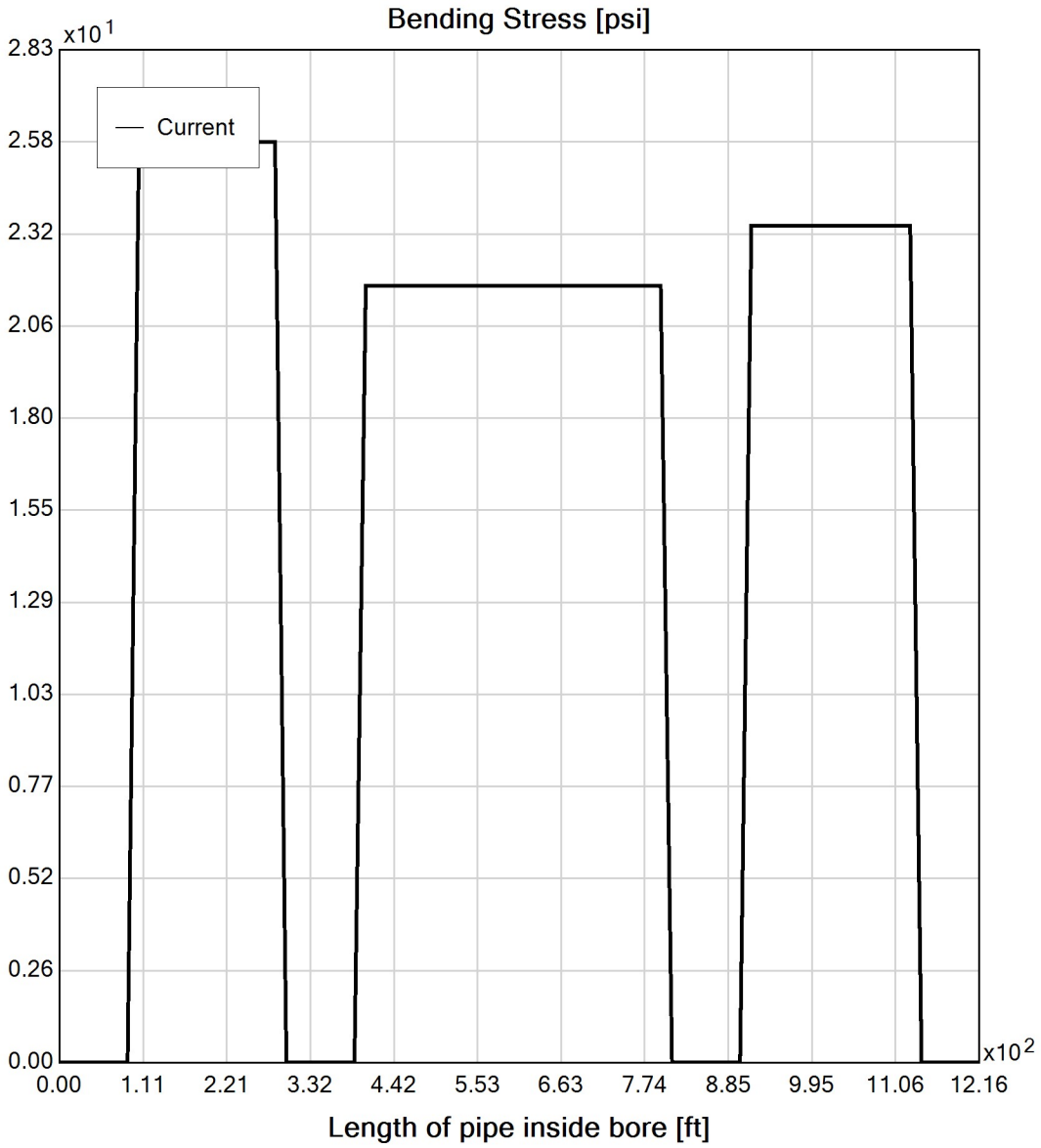
Effective Viscosity (cP): 378.3

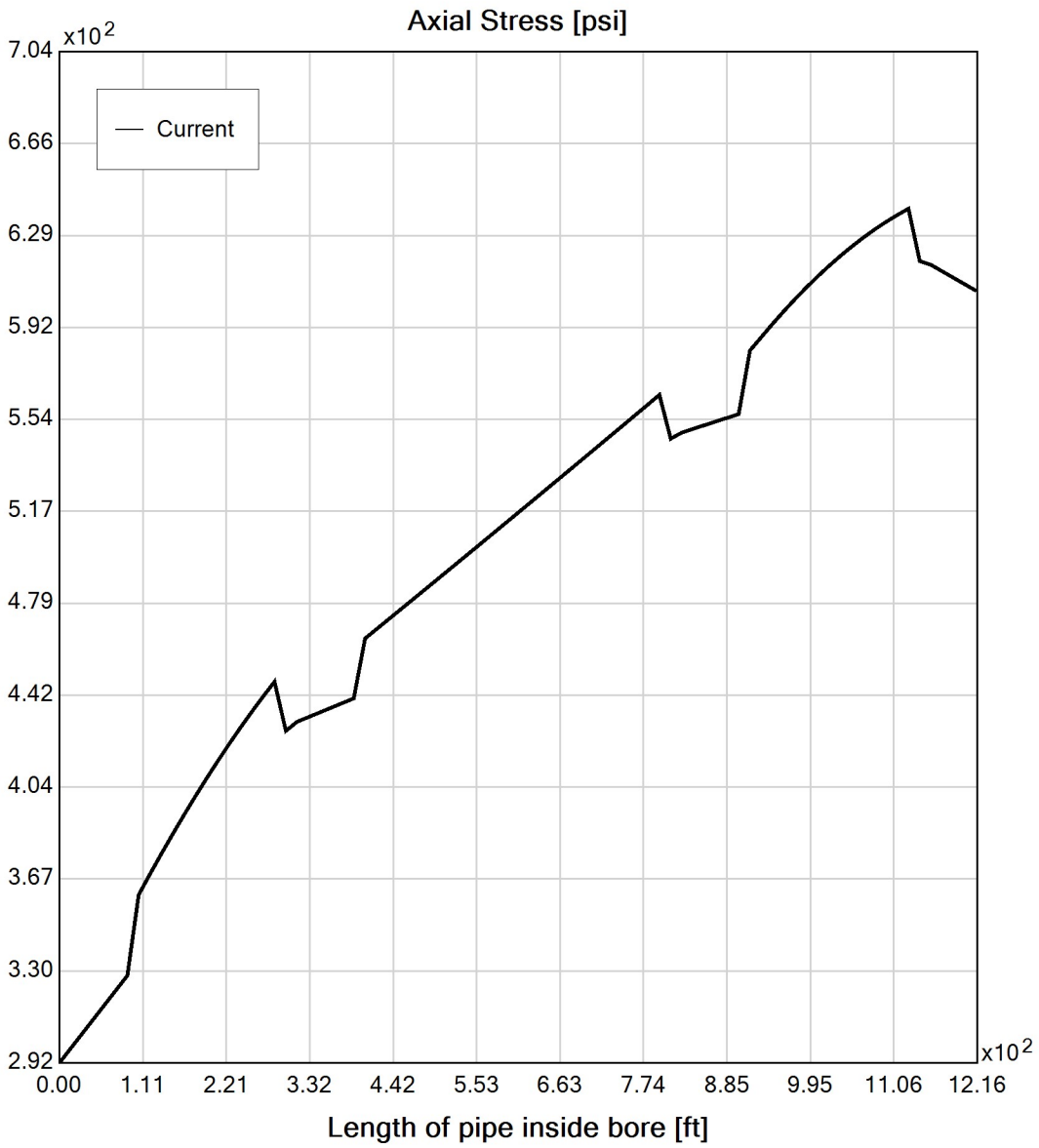
Virtual Site

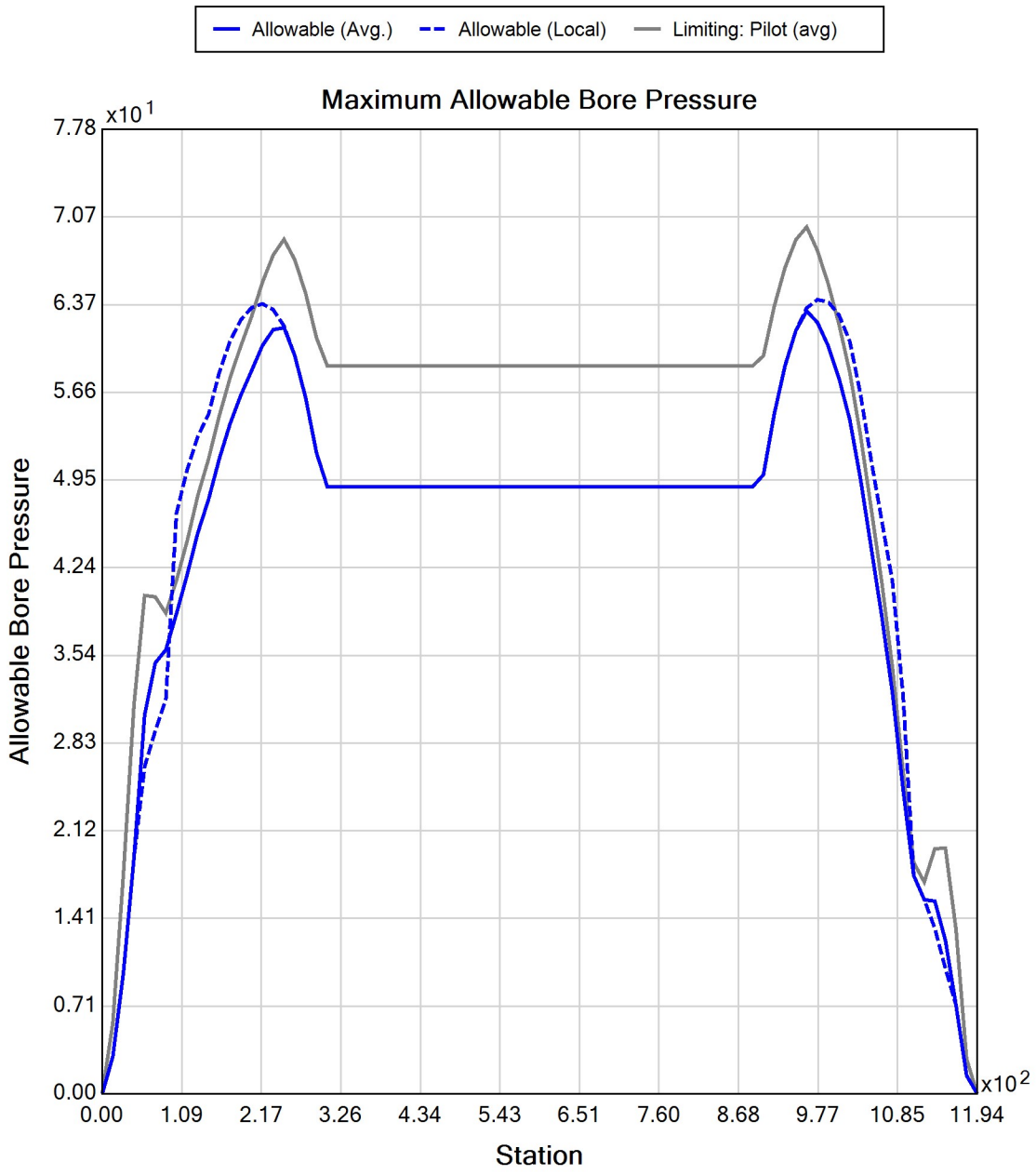


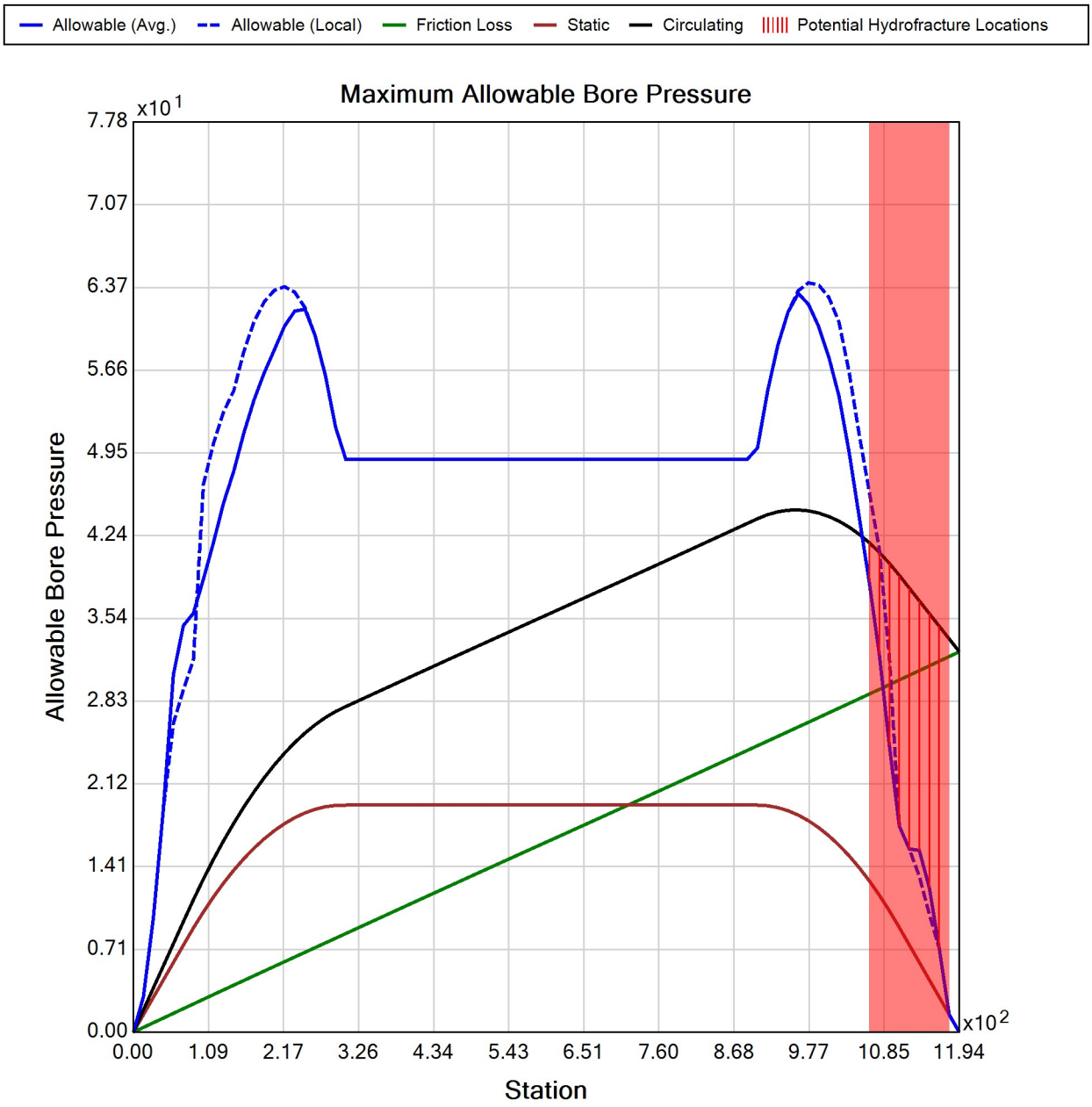












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Input Summary

Start Coordinate	(0.00, 0.00, 129.00) ft
End Coordinate	(1200.00, 0.00, 129.00) ft
Project Length	1200.00 ft
Pipe Type	HDPE
OD Classification	IPS
Pipe OD	10.750 in
Pipe DR	9.0
Pipe Thickness	1.19 in
Rod Length	15.00 ft
Rod Diameter	3.5 in
Drill Rig Location	(0.00, 0.00, 0.00) ft

Load Verifier Input Summary:

Pipe Application: Electrical Cable
Pipe Type: HDPE
Classification: IPS
Pipe OD: 10" (10.75")
Pipe DR: 9
Pipe Length: 1214.99 ft
Internal Pressure: 0 psi
Borehole Diameter: 1.34400002161662 ft
Silo Width: 1.34400002161662 ft
Surface Surcharge: 0 psi
Short Term Modulus: 57500 psi
Long Term Modulus: 28200 psi
Short Term Poisson Ratio: 0.35
Long Term Poisson Ratio: 0.45
Pipe Unit Weight: 59.30500 lb/ft3
Allowable Tensile Stress (Short Term): 1200 psi
Allowable Tensile Stress (Long Term): 1100 psi
Allowable Compressive Stress (Short Term): 1150 psi
Allowable Compressive Stress (Long Term): 1150 psi
Surface-pipe friction coefficient at entrance: 0.5
Surface-pipe friction coefficient in borehole: 0.3
Pipe-soil friction angle: 30
Slurry Unit Weight: 93.64118 lb/ft3
Hydrokinetic Pressure: 10 psi
Ballast Unit Weight: 62.42746 lb/ft3

In-service Load Summary:

Pressure [psi]	Deformed	Collapsed
Earth Pressure	2.8	6.6
Water Pressure	11.5	11.1
Surface Surcharge	0.0	0.0
Internal Pressure	0.0	0.0
Net Pressure	14.3	17.7
Deflection		
Earth Load Deflection	1.166	1.911
Buoyant Deflection	0.132	0.132
Reissner Effect	0	0
Net Deflection	1.298	2.043
Compressive Stress [psi]		
Compressive Wall Stress	64.2	79.7

Installation Load Summary:

Forces/Stresses	@Maximum Force	Absolute Maximum
Pullback Force [lb]	22180.9	22180.9
Pullback Stress [psi]	618.6	618.6
Pullback Strain	1.076E-2	1.076E-2
Bending Stress [psi]	0.0	25.8
Bending Strain	0	4.479E-4
Tensile Stress [psi]	618.6	639.9
Tensile Strain	1.076E-2	1.154E-2

Net External Pressure = 20.1 [psi]

Buoyant Deflection = 0.1

Hydrokinetic Force = 567.6 lb

In-service Analysis

	Calculated	Allowable	Factor of Safety	Check
Deflection [%]	1.298	7.5	5.8	OK
Unconstrained Collapse [psi]	26.4	127.9	4.8	OK
Compressive Wall Stress [psi]	64.2	1150.0	17.9	OK

Installation Analysis

	Calculated	Allowable	Factor of Safety	Check
Deflection [%]	0.065	7.5	115.8	OK
Unconstrained Collapse [psi]	36.4	218.3	6.0	OK
Tensile Stress [psi]	639.9	1200.0	1.9	OK

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Project Summary

General:	HDD #12 - Conduit 1
	Start Date: 06-21-2022
	End Date: 06-21-2022
Project Owner:	TDI
Project Contractor:	KIEWIT
Project Consultant:	CHA
Designer:	MCS
	CHA

Description:

Input Summary

Start Coordinate	(0.00, 0.00, 131.80) ft
End Coordinate	(705.20, 0.00, 140.75) ft
Project Length	705.20 ft
Pipe Type	HDPE
OD Classification	IPS
Pipe OD	10.750 in
Pipe DR	9.0
Pipe Thickness	1.19 in
Rod Length	15.00 ft
Rod Diameter	3.5 in
Drill Rig Location	(0.00, 0.00, 0.00) ft

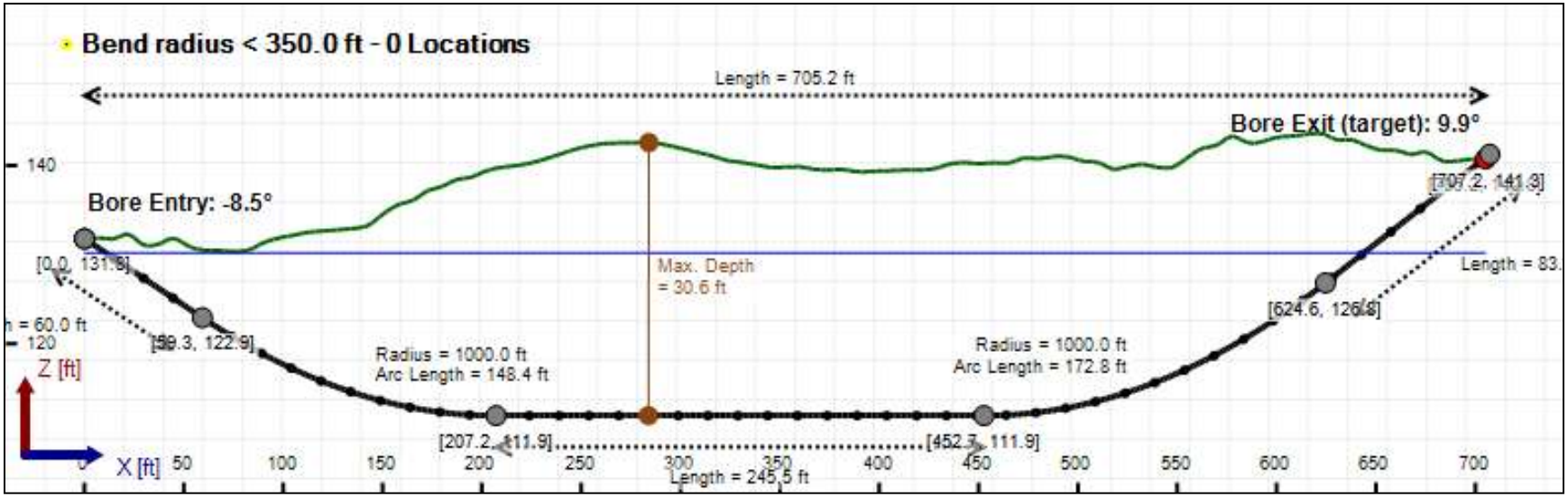
Soil Summary

Number of Layers: 2

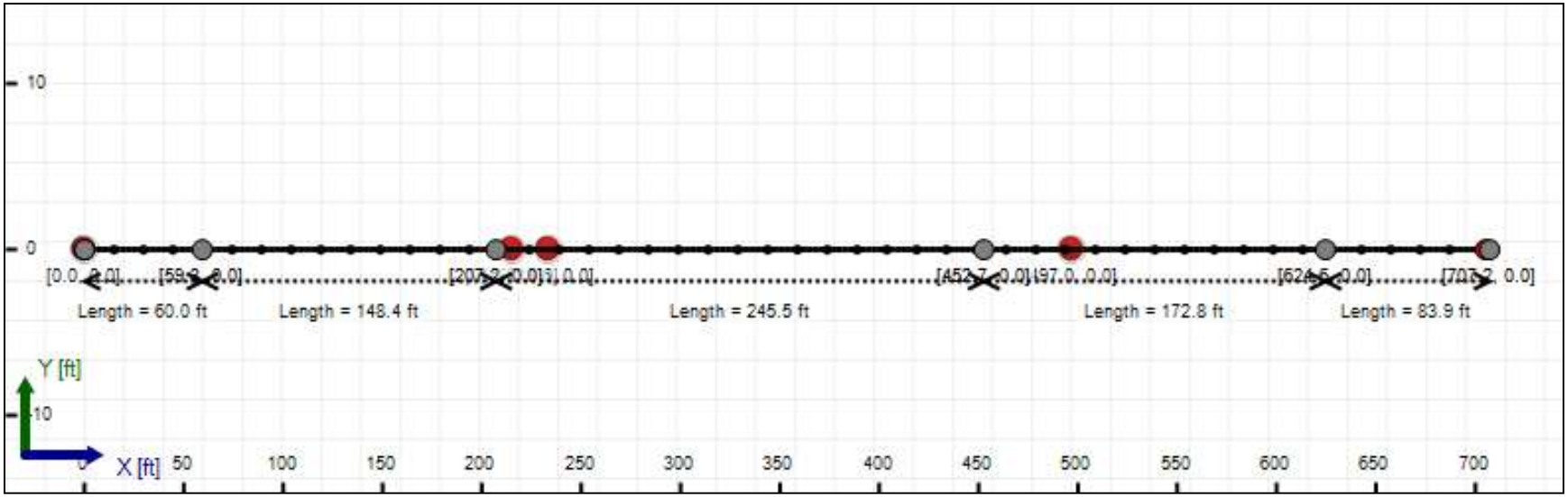
Soil Layer #1 USCS, Sand (S), SM
Depth: 1.00 ft
Unit Weight: 105.0000 (dry), 115.0000 (sat) [lb/ft3]
Phi: 30.00, S.M.: 145.00, Coh: 0.00 [psi]

Soil Layer #2 Rock, Geological Classification, Sedimentary Rocks
Depth: 25.00 ft
Unit Weight: 107.8272 (dry), 177.6384 (sat) [lb/ft3]
Phi: 35.00, S.M.: 1450.40, Coh: 2900.80 [psi]

Bore Cross-Section View



Bore Plan View



Load Verifier Input Summary:

Pipe Application: Electrical Cable
Pipe Type: HDPE
Classification: IPS
Pipe OD: 10" (10.75")
Pipe DR: 9
Pipe Length: 720.00 ft
Internal Pressure: 0 psi
Borehole Diameter: 1.34400002161662 ft
Silo Width: 1.34400002161662 ft
Surface Surcharge: 0 psi
Short Term Modulus: 57500 psi
Long Term Modulus: 28200 psi
Short Term Poisson Ratio: 0.35
Long Term Poisson Ratio: 0.45
Pipe Unit Weight: 59.30500 lb/ft3
Allowable Tensile Stress (Short Term): 1200 psi
Allowable Tensile Stress (Long Term): 1100 psi
Allowable Compressive Stress (Short Term): 1150 psi
Allowable Compressive Stress (Long Term): 1150 psi
Surface-pipe friction coefficient at entrance: 0.5
Surface-pipe friction coefficient in borehole: 0.3
Pipe-soil friction angle: 30
Slurry Unit Weight: 93.64118 lb/ft3
Hydrokinetic Pressure: 10 psi
Ballast Unit Weight: 62.42746 lb/ft3

In-service Load Summary:

Pressure [psi]	Deformed	Collapsed
Earth Pressure	5.8	23.7
Water Pressure	7.9	7.9
Surface Surcharge	0.0	0.0
Internal Pressure	0.0	0.0
Net Pressure	13.7	31.6
Deflection		
Earth Load Deflection	1.589	6.444
Buoyant Deflection	0.132	0.132
Reissner Effect	0	0
Net Deflection	1.721	6.576
Compressive Stress [psi]		
Compressive Wall Stress	61.9	142.1

Installation Load Summary:

Forces/Stresses	@Maximum Force	Absolute Maximum
Pullback Force [lb]	12257.2	12257.2
Pullback Stress [psi]	341.8	341.8
Pullback Strain	5.945E-3	5.945E-3
Bending Stress [psi]	0.0	25.8
Bending Strain	0	4.479E-4
Tensile Stress [psi]	341.8	364.9
Tensile Strain	5.945E-3	6.793E-3

Net External Pressure = 21.5 [psi]

Buoyant Deflection = 0.1

Hydrokinetic Force = 567.6 lb

In-service Analysis

	Calculated	Allowable	Factor of Safety	Check
Deflection [%]	1.721	7.5	4.4	OK
Unconstrained Collapse [psi]	20.1	118.4	5.9	OK
Compressive Wall Stress [psi]	61.9	1150.0	18.6	OK

Installation Analysis

	Calculated	Allowable	Factor of Safety	Check
Deflection [%]	0.065	7.5	115.8	OK
Unconstrained Collapse [psi]	30.1	235.1	7.8	OK
Tensile Stress [psi]	364.9	1200.0	3.3	OK

Maximum Allowable Bore Pressure Summary

Ream Number	Initial Diameter	Final Diameter	Estimated Maximum Pressure (Avg.)	Estimated Maximum Pressure (Local)
Pilot Bore	0.00 in	8.00 in	1309.762 psi	1329.978 psi
1	8.00 in	12.00 in	1305.627 psi	1329.576 psi
2	12.00 in	16.13 in	1299.646 psi	1328.993 psi

Note: The maximum bore pressures presented in this table are the maximum values along the length of the bore and not the maximum allowable at any point. The estimated maximum pressures should be compared to the estimated circulating pressures along the bore to determine potential locations of inadvertant returns.

Estimated Circulating Pressure Summary

Active	Shear Rate [rpm]	Shear Stress [Fann Degrees]
No	600	37
No	300	32
No	200	29
Yes	100	25
Yes	6	17
No	3	15

Flow Rate (Q): 40.00 US (liquid) gallon/min

Drill Fluid Density: 68.700 lb/ft3

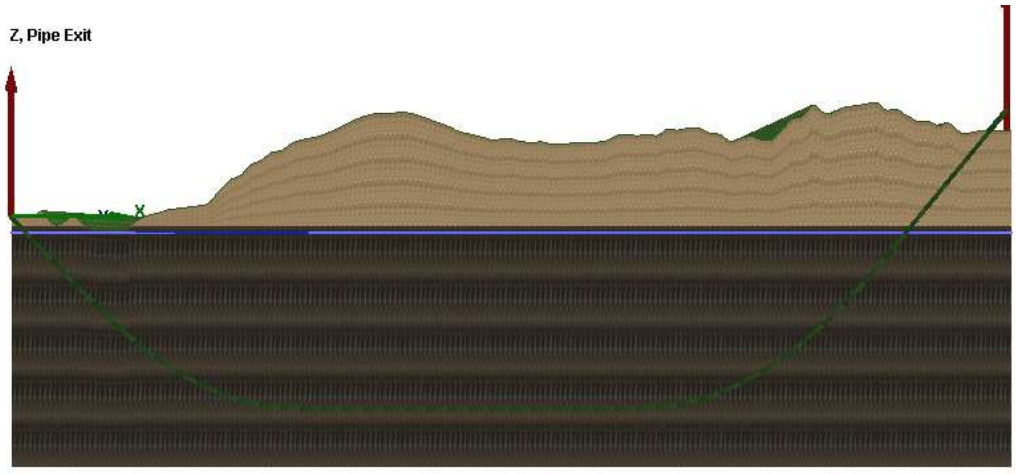
Rheological model: Bingham-Plastic

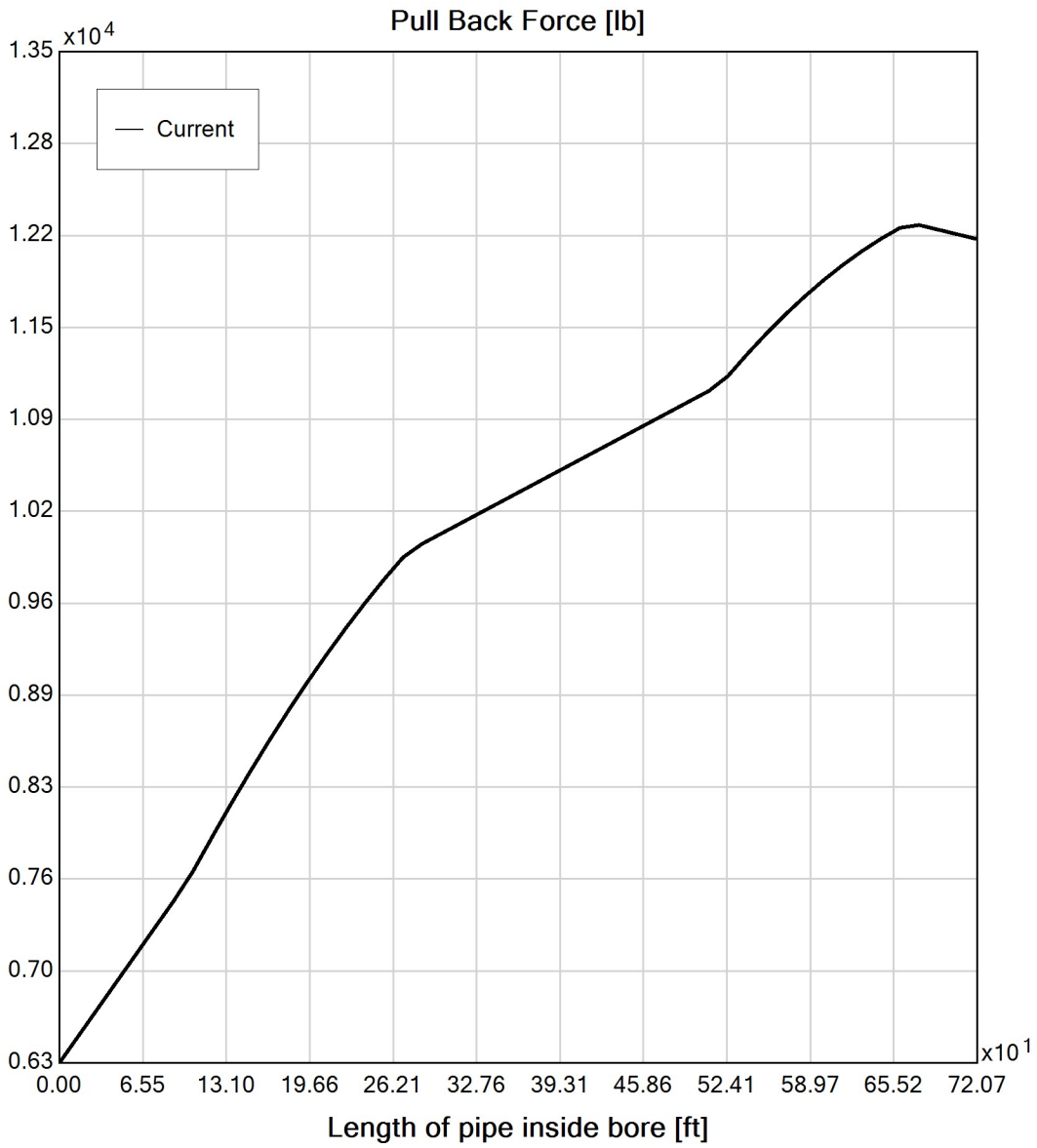
Plastic Viscosity (PV): 25.53

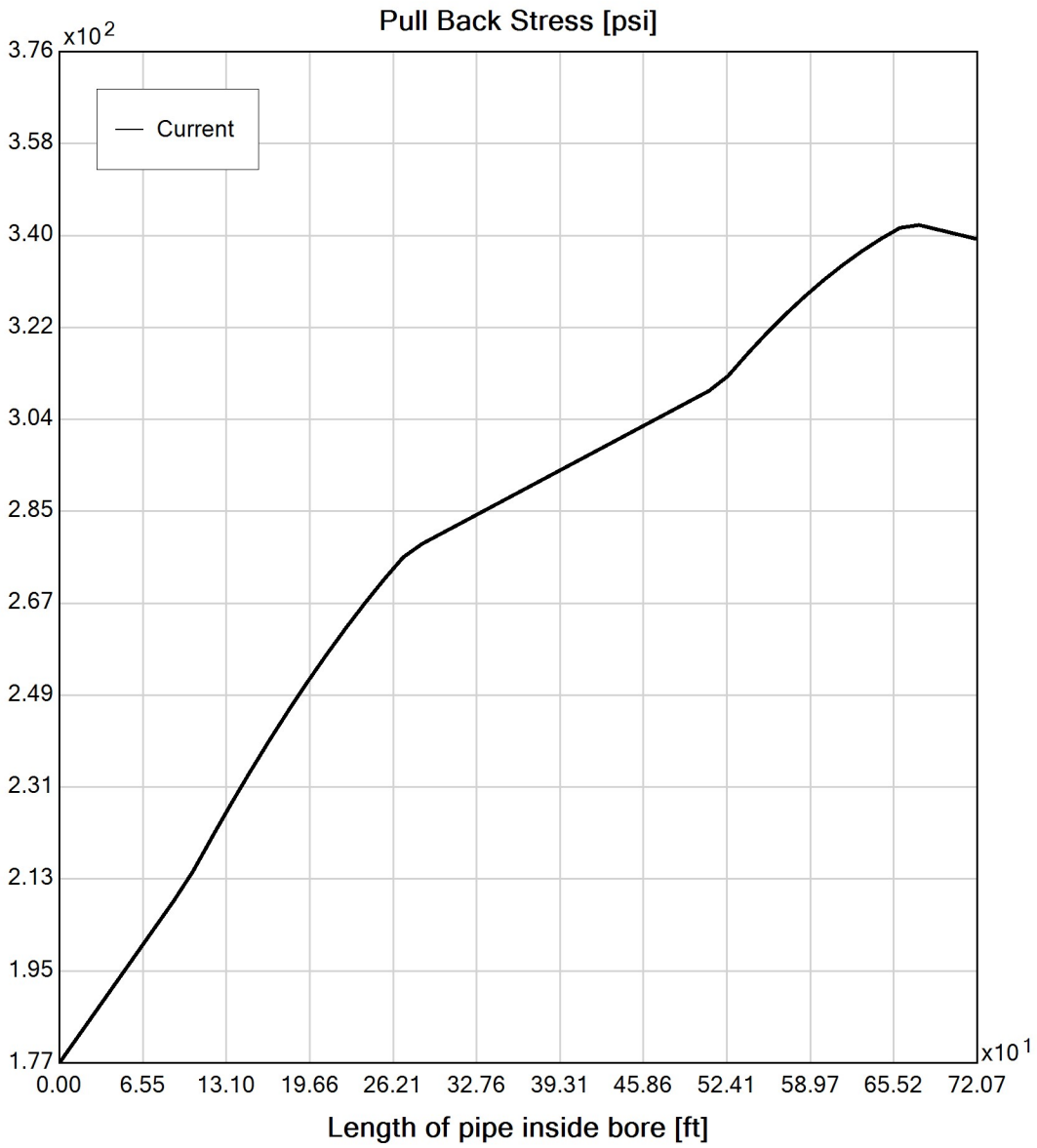
Yield Point (YP): 16.49

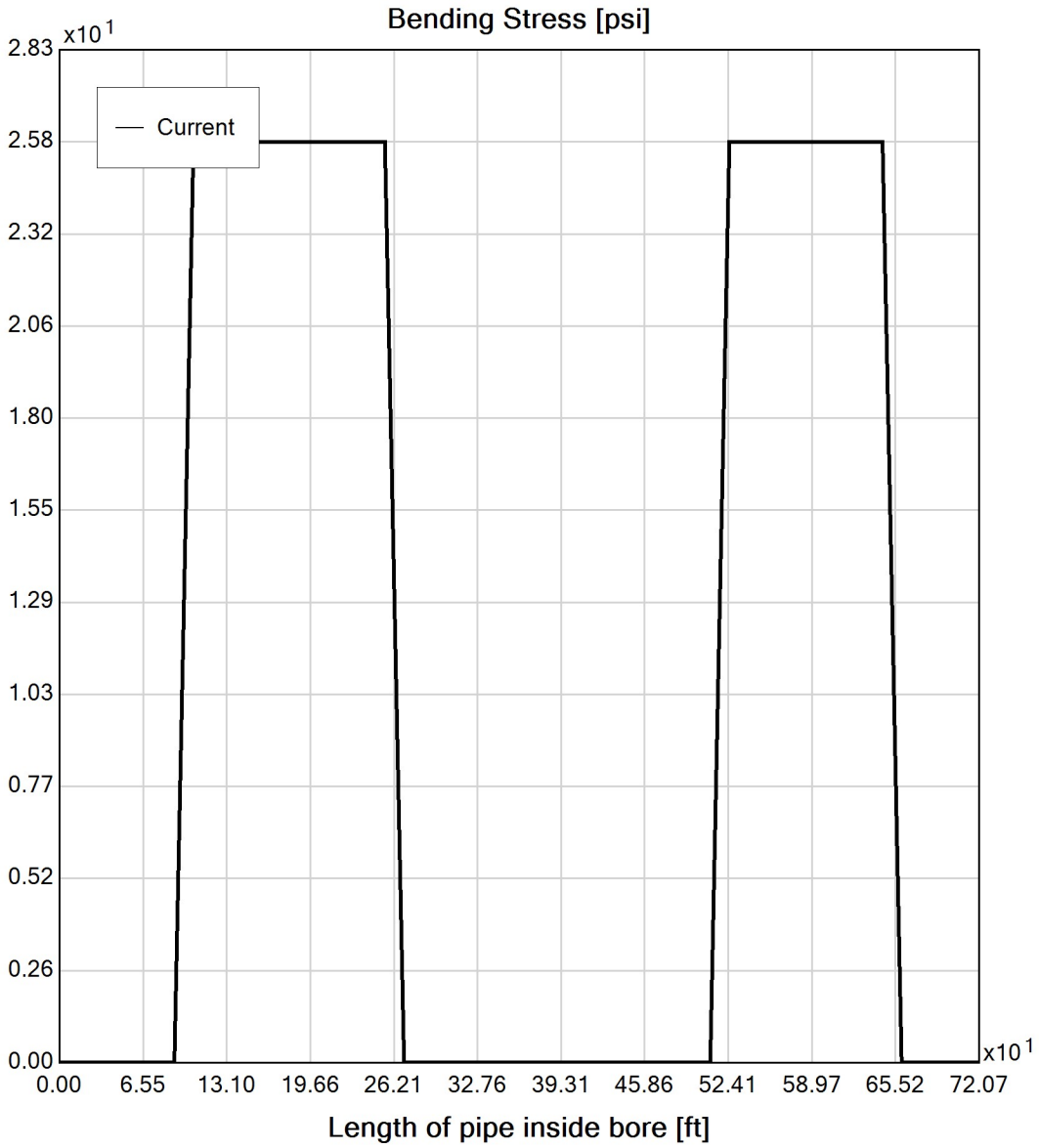
Effective Viscosity (cP): 1202.0

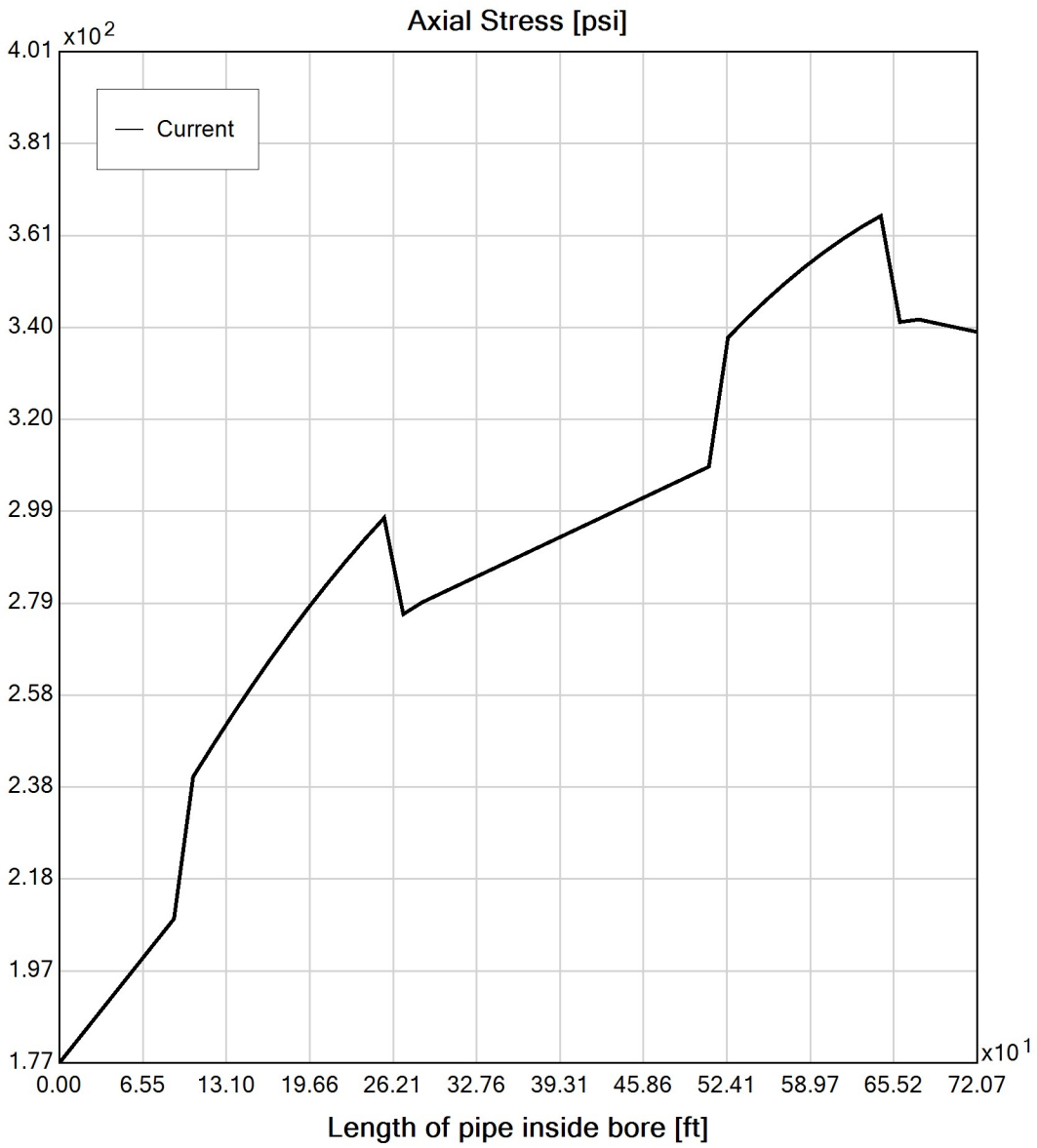
Virtual Site

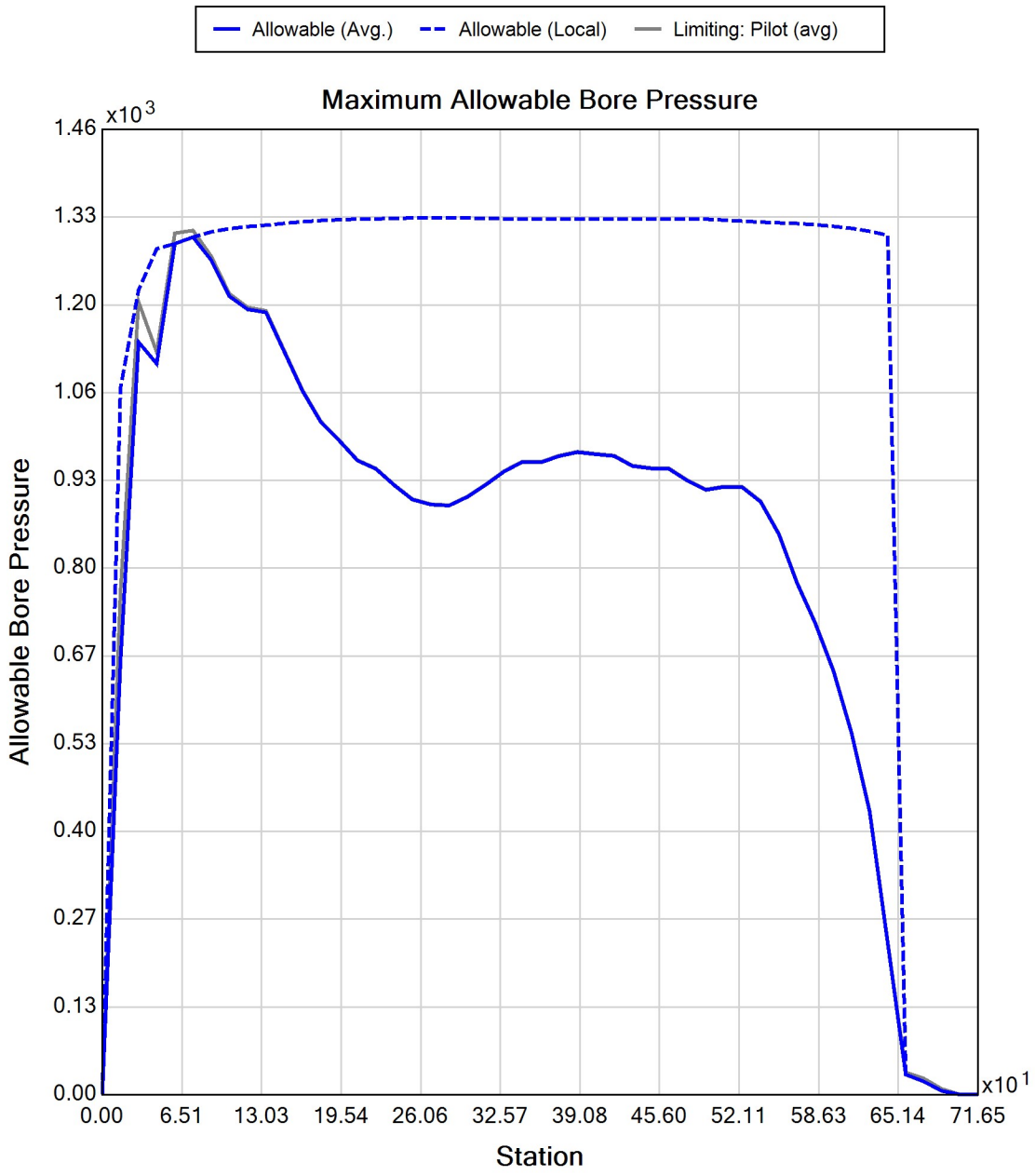


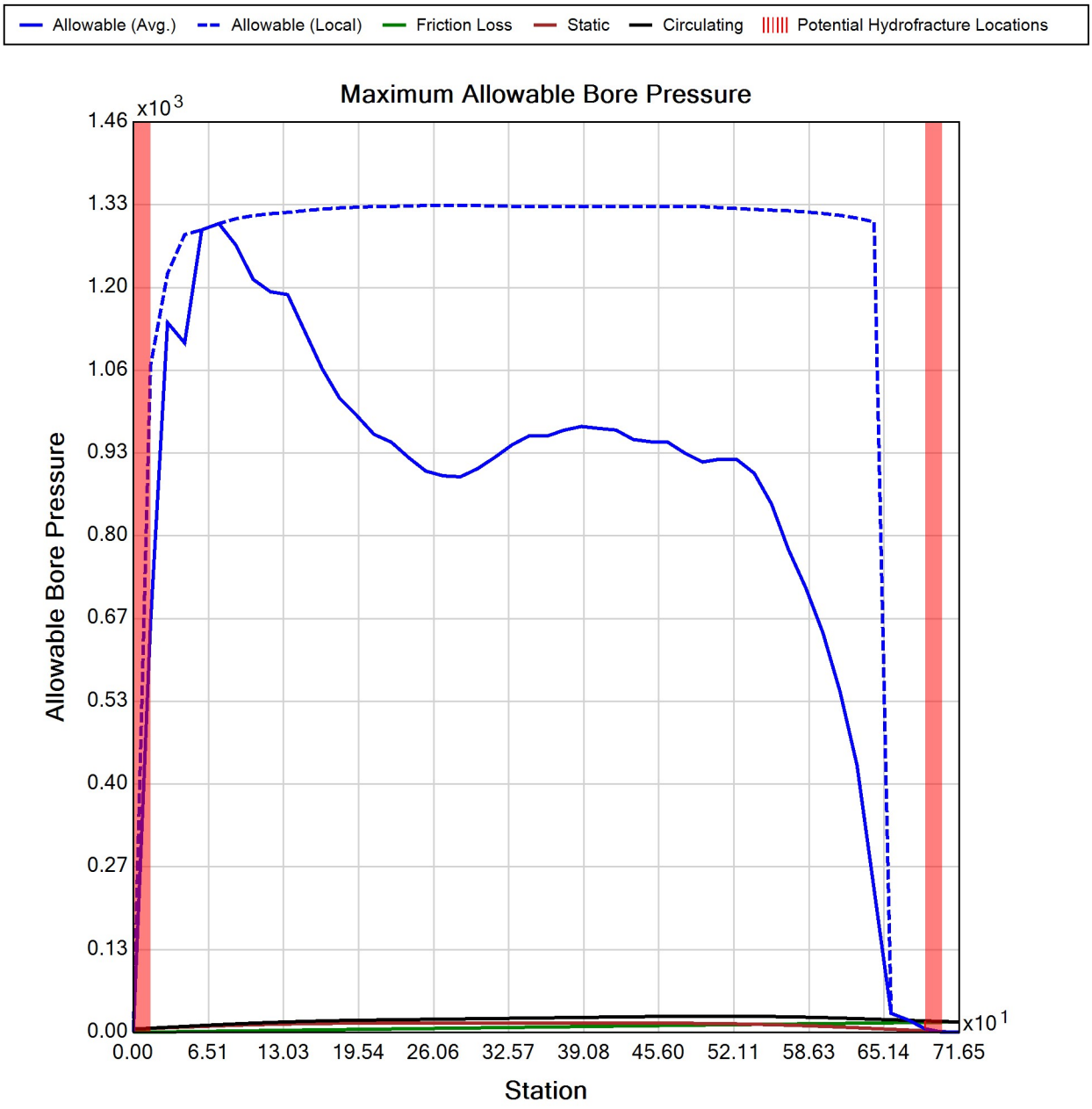












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Input Summary

Start Coordinate	(0.00, 0.00, 131.80) ft
End Coordinate	(705.20, 0.00, 140.75) ft
Project Length	705.20 ft
Pipe Type	HDPE
OD Classification	IPS
Pipe OD	2.375 in
Pipe DR	9.0
Pipe Thickness	0.26 in
Rod Length	15.00 ft
Rod Diameter	3.5 in
Drill Rig Location	(0.00, 0.00, 0.00) ft

Load Verifier Input Summary:

Pipe Application: Electrical Cable
Pipe Type: HDPE
Classification: IPS
Pipe OD: 2" (2.375")
Pipe DR: 9
Pipe Length: 720.00 ft
Internal Pressure: 0 psi
Borehole Diameter: 0.531000018119812 ft
Silo Width: 0.531000018119812 ft
Surface Surcharge: 0 psi
Short Term Modulus: 57500 psi
Long Term Modulus: 28200 psi
Short Term Poisson Ratio: 0.35
Long Term Poisson Ratio: 0.45
Pipe Unit Weight: 59.30500 lb/ft3
Allowable Tensile Stress (Short Term): 1200 psi
Allowable Tensile Stress (Long Term): 1100 psi
Allowable Compressive Stress (Short Term): 1150 psi
Allowable Compressive Stress (Long Term): 1150 psi
Surface-pipe friction coefficient at entrance: 0.5
Surface-pipe friction coefficient in borehole: 0.3
Pipe-soil friction angle: 30
Slurry Unit Weight: 93.64118 lb/ft3
Hydrokinetic Pressure: 10 psi
Ballast Unit Weight: 62.42746 lb/ft3

In-service Load Summary:

Pressure [psi]	Deformed	Collapsed
Earth Pressure	2.4	23.7
Water Pressure	7.9	7.9
Surface Surcharge	0.0	0.0
Internal Pressure	0.0	0.0
Net Pressure	10.3	31.6
Deflection		
Earth Load Deflection	0.662	6.444
Buoyant Deflection	0.029	0.029
Reissner Effect	0	0
Net Deflection	0.692	6.473
Compressive Stress [psi]		
Compressive Wall Stress	46.3	142.1

Installation Load Summary:

Forces/Stresses	@Maximum Force	Absolute Maximum
Pullback Force [lb]	707.9	707.9
Pullback Stress [psi]	404.5	404.5
Pullback Strain	7.034E-3	7.034E-3
Bending Stress [psi]	0.0	5.7
Bending Strain	0	9.896E-5
Tensile Stress [psi]	404.5	407.4
Tensile Strain	7.034E-3	7.184E-3

Net External Pressure = 21.5 [psi]

Buoyant Deflection = 0.0

Hydrokinetic Force = 137.3 lb

In-service Analysis

	Calculated	Allowable	Factor of Safety	Check
Deflection [%]	0.692	7.5	10.8	OK
Unconstrained Collapse [psi]	20.1	130.0	6.5	OK
Compressive Wall Stress [psi]	46.3	1150.0	24.8	OK

Installation Analysis

	Calculated	Allowable	Factor of Safety	Check
Deflection [%]	0.014	7.5	524.3	OK
Unconstrained Collapse [psi]	30.1	233.3	7.8	OK
Tensile Stress [psi]	407.4	1200.0	2.9	OK

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Project Summary

General:	HDD #12 - Conduit 2
	Start Date: 06-21-2022
	End Date: 06-21-2022
Project Owner:	TDI
Project Contractor:	KIEWIT
Project Consultant:	CHA
Designer:	MCS
	CHA

Description:

Input Summary

Start Coordinate	(0.00, 0.00, 131.07) ft
End Coordinate	(920.00, 0.00, 142.07) ft
Project Length	920.00 ft
Pipe Type	HDPE
OD Classification	IPS
Pipe OD	10.750 in
Pipe DR	9.0
Pipe Thickness	1.19 in
Rod Length	15.00 ft
Rod Diameter	3.5 in
Drill Rig Location	(0.00, 0.00, 0.00) ft

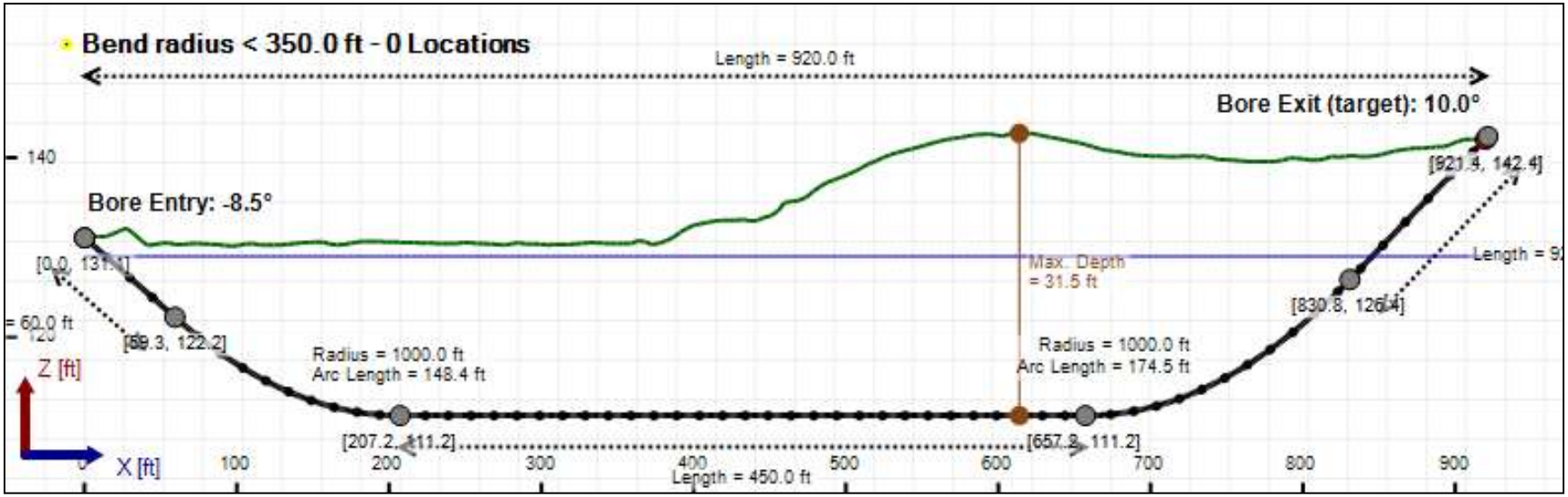
Soil Summary

Number of Layers: 2

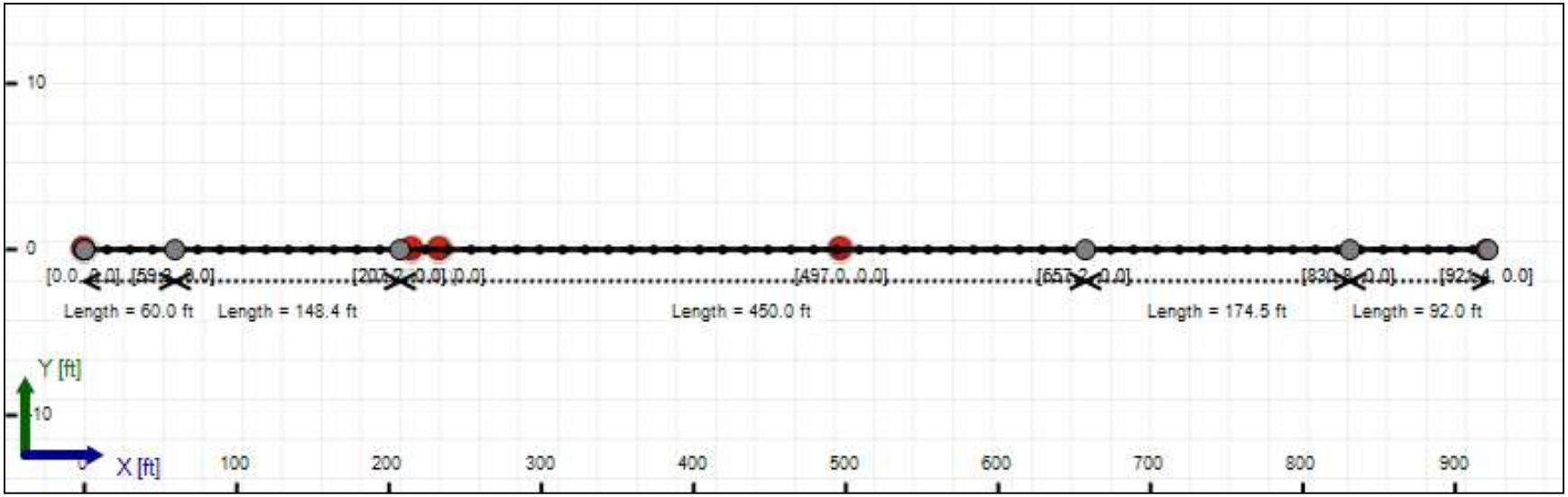
Soil Layer #1 USCS, Sand (S), SP
Depth: 4.00 ft
Unit Weight: 105.0000 (dry), 115.0000 (sat) [lb/ft3]
Phi: 30.00, S.M.: 1.39, Coh: 0.00 [psi]

Soil Layer #2 Rock, Geological Classification, Sedimentary Rocks
Depth: 40.00 ft
Unit Weight: 120.0000 (dry), 140.0000 (sat) [lb/ft3]
Phi: 37.00, S.M.: 10000.00, Coh: 0.00 [psi]

Bore Cross-Section View



Bore Plan View



Load Verifier Input Summary:

Pipe Application: Electrical Cable
Pipe Type: HDPE
Classification: IPS
Pipe OD: 10" (10.75")
Pipe DR: 9
Pipe Length: 930.00 ft
Internal Pressure: 0 psi
Borehole Diameter: 1.34400002161662 ft
Silo Width: 1.34400002161662 ft
Surface Surcharge: 0 psi
Short Term Modulus: 57500 psi
Long Term Modulus: 28200 psi
Short Term Poisson Ratio: 0.35
Long Term Poisson Ratio: 0.45
Pipe Unit Weight: 59.30500 lb/ft3
Allowable Tensile Stress (Short Term): 1200 psi
Allowable Tensile Stress (Long Term): 1100 psi
Allowable Compressive Stress (Short Term): 1150 psi
Allowable Compressive Stress (Long Term): 1150 psi
Surface-pipe friction coefficient at entrance: 0.5
Surface-pipe friction coefficient in borehole: 0.3
Pipe-soil friction angle: 30
Slurry Unit Weight: 93.64118 lb/ft3
Hydrokinetic Pressure: 10 psi
Ballast Unit Weight: 62.42746 lb/ft3

In-service Load Summary:

Pressure [psi]	Deformed	Collapsed
Earth Pressure	4.6	19.3
Water Pressure	7.7	7.7
Surface Surcharge	0.0	0.0
Internal Pressure	0.0	0.0
Net Pressure	12.4	27.0
Deflection		
Earth Load Deflection	1.265	5.245
Buoyant Deflection	0.132	0.132
Reissner Effect	0	0
Net Deflection	1.397	5.377
Compressive Stress [psi]		
Compressive Wall Stress	55.6	121.4

Installation Load Summary:

Forces/Stresses	@Maximum Force	Absolute Maximum
Pullback Force [lb]	15479.9	15479.9
Pullback Stress [psi]	431.7	431.7
Pullback Strain	7.508E-3	7.508E-3
Bending Stress [psi]	0.0	25.8
Bending Strain	0	4.479E-4
Tensile Stress [psi]	431.7	453.5
Tensile Strain	7.508E-3	8.336E-3

Net External Pressure = 22.3 [psi]

Buoyant Deflection = 0.1

Hydrokinetic Force = 567.6 lb

In-service Analysis

	Calculated	Allowable	Factor of Safety	Check
Deflection [%]	1.397	7.5	5.4	OK
Unconstrained Collapse [psi]	20.8	121.8	5.8	OK
Compressive Wall Stress [psi]	55.6	1150.0	20.7	OK

Installation Analysis

	Calculated	Allowable	Factor of Safety	Check
Deflection [%]	0.065	7.5	115.8	OK
Unconstrained Collapse [psi]	30.8	229.6	7.5	OK
Tensile Stress [psi]	453.5	1200.0	2.6	OK

Maximum Allowable Bore Pressure Summary

Ream Number	Initial Diameter	Final Diameter	Estimated Maximum Pressure (Avg.)	Estimated Maximum Pressure (Local)
Pilot Bore	0.00 in	8.00 in	264.655 psi	370.953 psi
1	8.00 in	12.00 in	253.489 psi	344.489 psi
2	12.00 in	16.13 in	240.110 psi	316.049 psi

Note: The maximum bore pressures presented in this table are the maximum values along the length of the bore and not the maximum allowable at any point. The estimated maximum pressures should be compared to the estimated circulating pressures along the bore to determine potential locations of inadvertant returns.

Estimated Circulating Pressure Summary

Active	Shear Rate [rpm]	Shear Stress [Fann Degrees]
No	600	37
No	300	32
No	200	29
Yes	100	25
Yes	6	17
No	3	15

Flow Rate (Q): 40.00 US (liquid) gallon/min

Drill Fluid Density: 68.700 lb/ft3

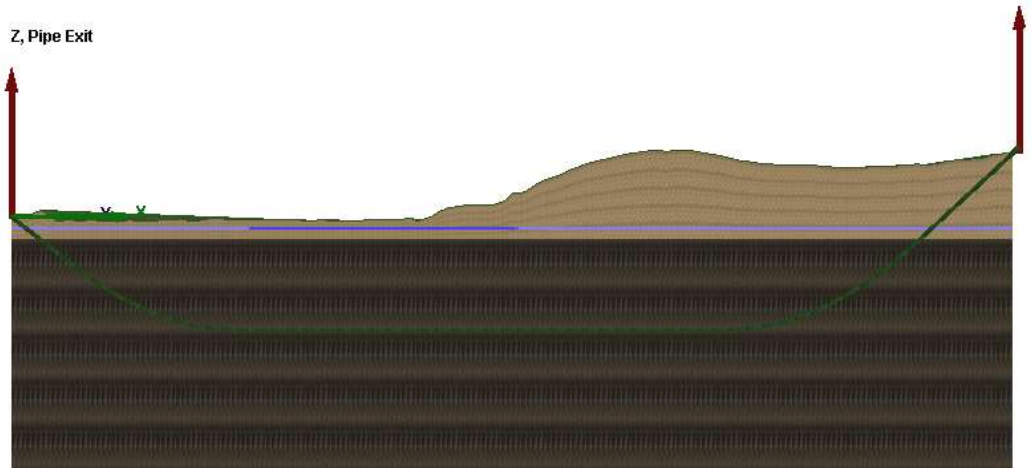
Rheological model: Bingham-Plastic

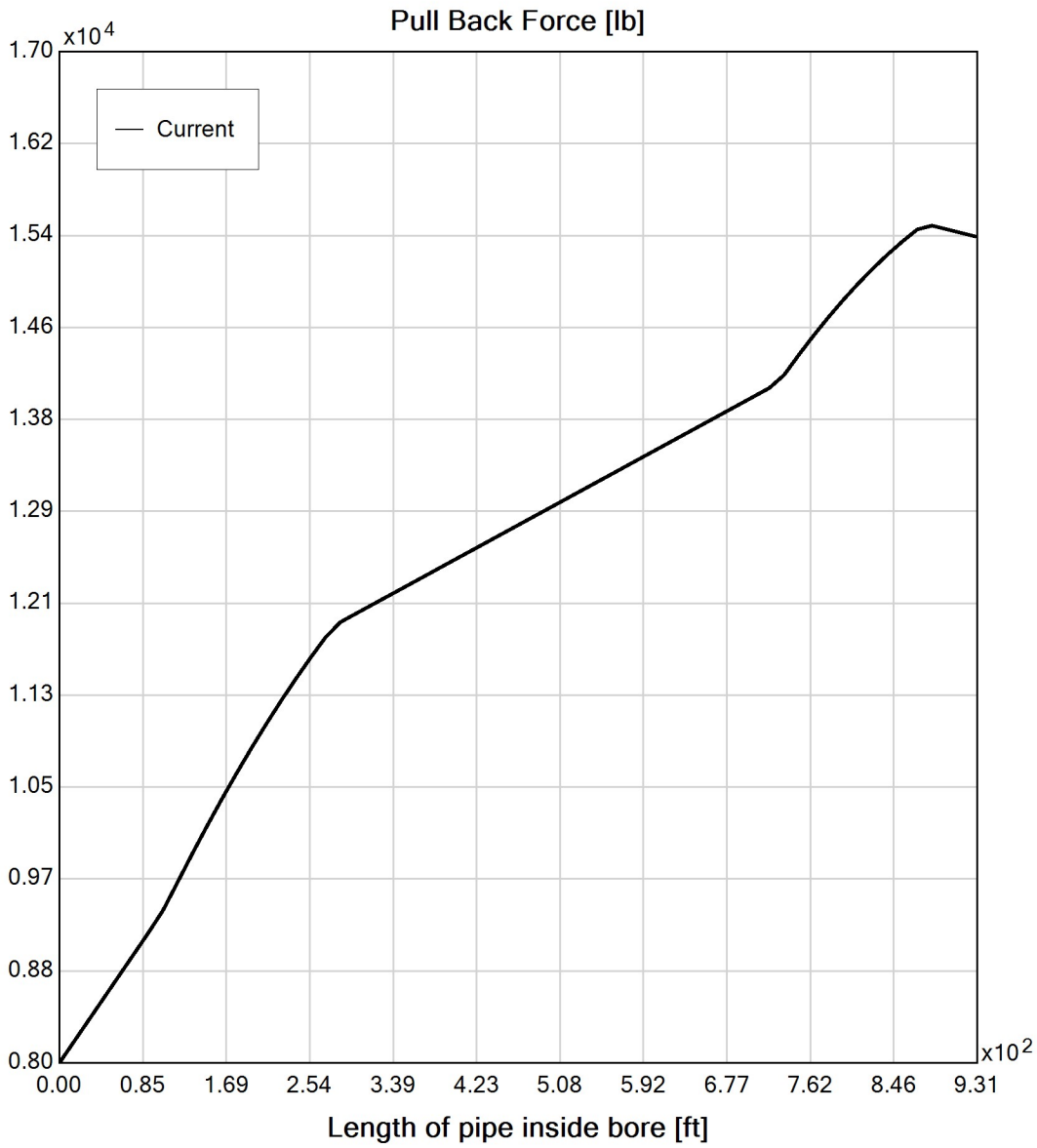
Plastic Viscosity (PV): 25.53

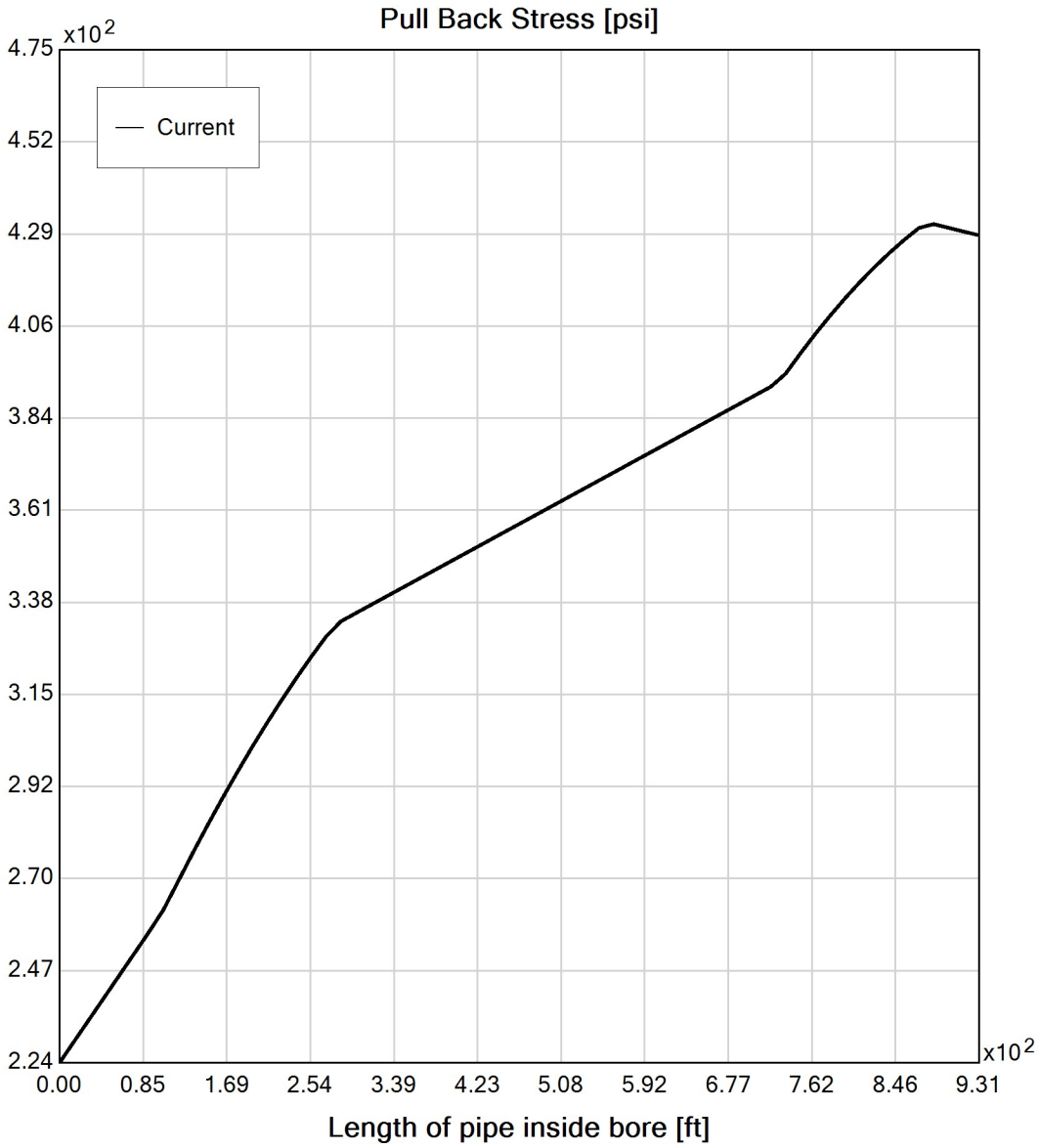
Yield Point (YP): 16.49

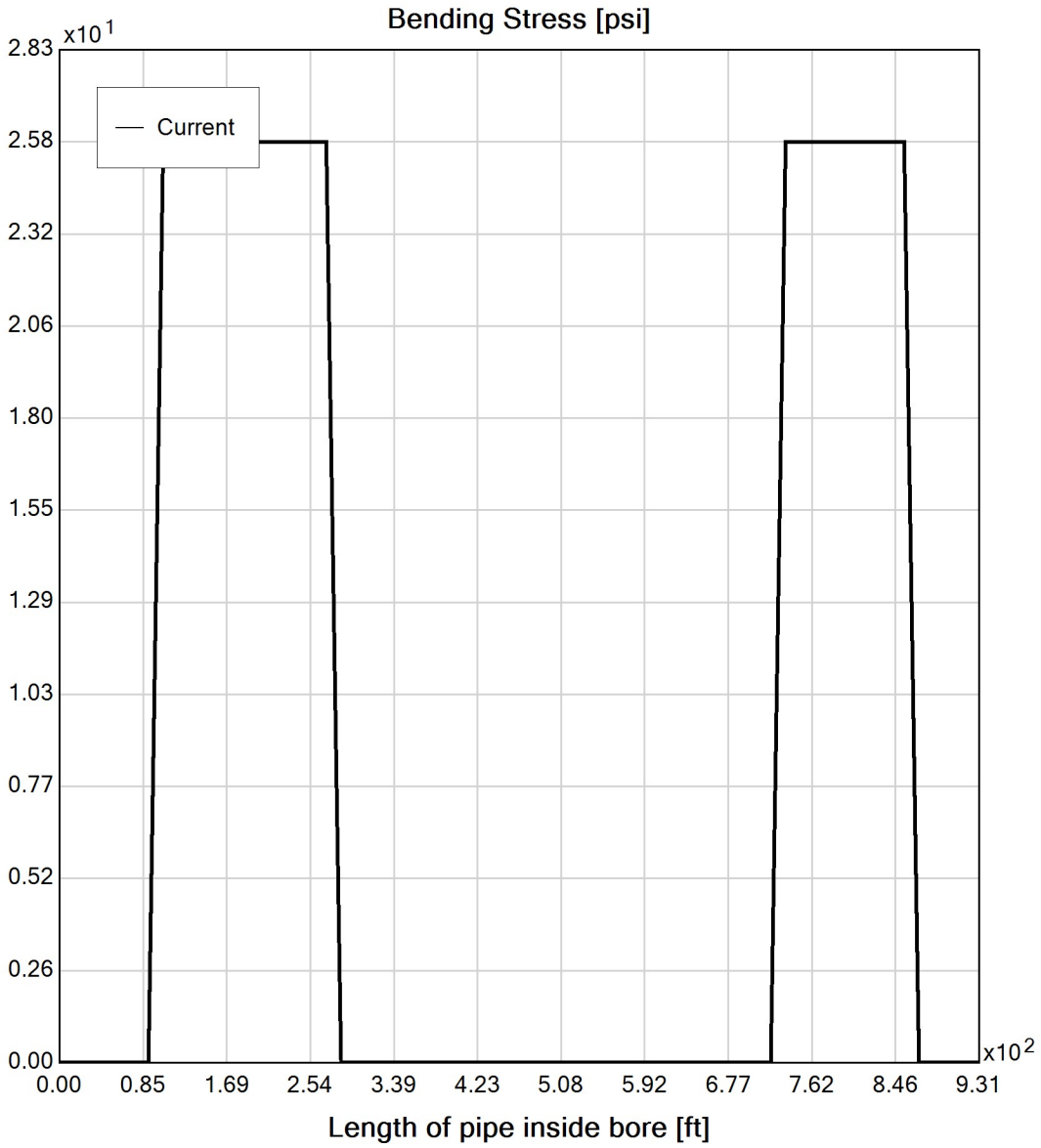
Effective Viscosity (cP): 1202.0

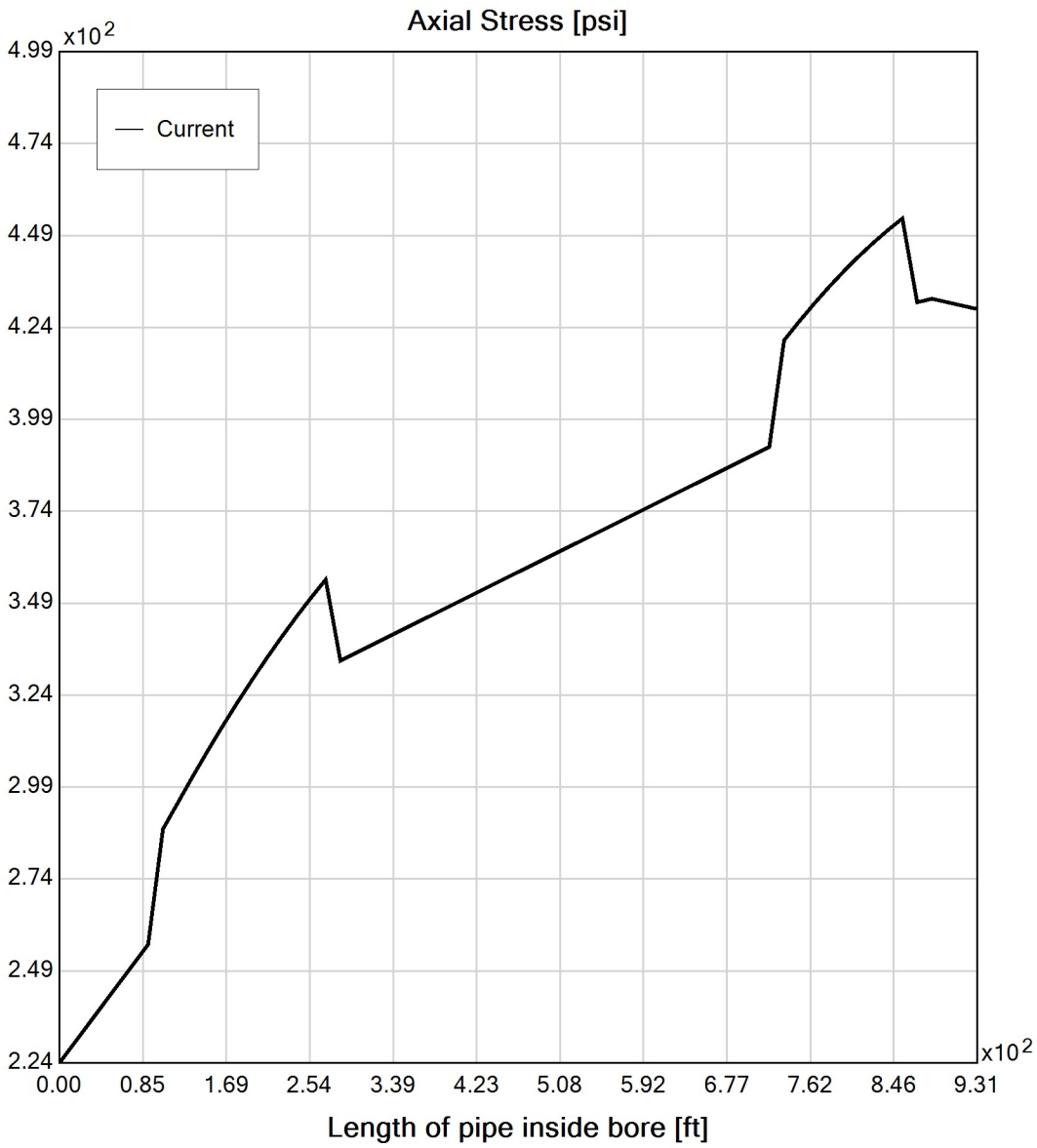
Virtual Site

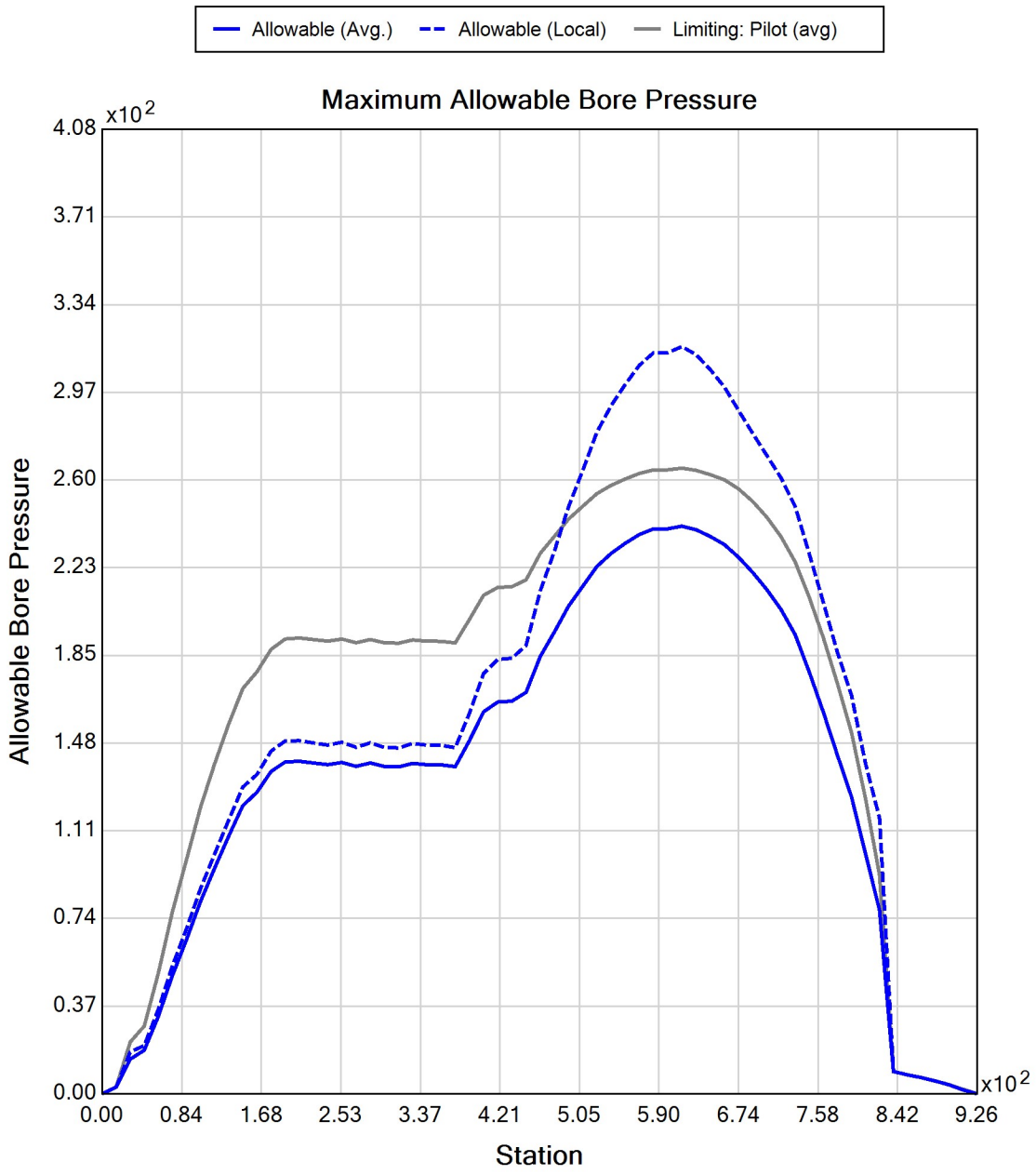


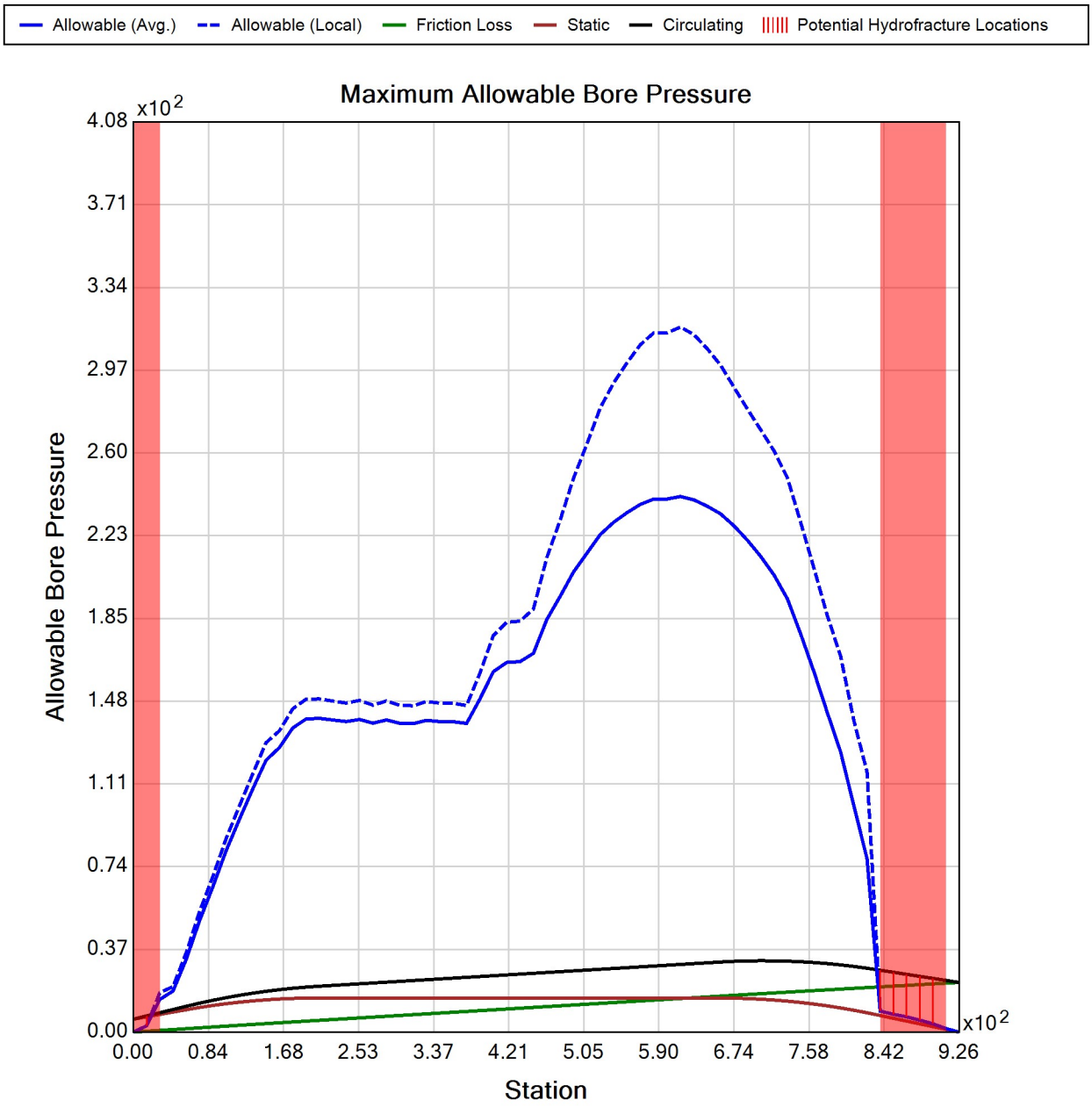












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Input Summary

Start Coordinate	(0.00, 0.00, 131.07) ft
End Coordinate	(920.00, 0.00, 142.07) ft
Project Length	920.00 ft
Pipe Type	HDPE
OD Classification	IPS
Pipe OD	2.375 in
Pipe DR	9.0
Pipe Thickness	0.26 in
Rod Length	15.00 ft
Rod Diameter	3.5 in
Drill Rig Location	(0.00, 0.00, 0.00) ft

Load Verifier Input Summary:

Pipe Application: Electrical Cable
Pipe Type: HDPE
Classification: IPS
Pipe OD: 2" (2.375")
Pipe DR: 9
Pipe Length: 930.00 ft
Internal Pressure: 0 psi
Borehole Diameter: 0.531000018119812 ft
Silo Width: 0.531000018119812 ft
Surface Surcharge: 0 psi
Short Term Modulus: 57500 psi
Long Term Modulus: 28200 psi
Short Term Poisson Ratio: 0.35
Long Term Poisson Ratio: 0.45
Pipe Unit Weight: 59.30500 lb/ft3
Allowable Tensile Stress (Short Term): 1200 psi
Allowable Tensile Stress (Long Term): 1100 psi
Allowable Compressive Stress (Short Term): 1150 psi
Allowable Compressive Stress (Long Term): 1150 psi
Surface-pipe friction coefficient at entrance: 0.5
Surface-pipe friction coefficient in borehole: 0.3
Pipe-soil friction angle: 30
Slurry Unit Weight: 93.64118 lb/ft3
Hydrokinetic Pressure: 10 psi
Ballast Unit Weight: 62.42746 lb/ft3

In-service Load Summary:

Pressure [psi]	Deformed	Collapsed
Earth Pressure	1.9	19.3
Water Pressure	7.7	7.7
Surface Surcharge	0.0	0.0
Internal Pressure	0.0	0.0
Net Pressure	9.6	27.0
Deflection		
Earth Load Deflection	0.571	5.245
Buoyant Deflection	0.029	0.029
Reissner Effect	0	0
Net Deflection	0.600	5.274
Compressive Stress [psi]		
Compressive Wall Stress	43.1	121.4

Installation Load Summary:

Forces/Stresses	@Maximum Force	Absolute Maximum
Pullback Force [lb]	865.2	865.2
Pullback Stress [psi]	494.3	494.3
Pullback Strain	8.597E-3	8.597E-3
Bending Stress [psi]	0.0	5.7
Bending Strain	0	9.896E-5
Tensile Stress [psi]	494.3	496.1
Tensile Strain	8.597E-3	8.727E-3

Net External Pressure = 22.3 [psi]

Buoyant Deflection = 0.0

Hydrokinetic Force = 137.3 lb

In-service Analysis

	Calculated	Allowable	Factor of Safety	Check
Deflection [%]	0.600	7.5	12.5	OK
Unconstrained Collapse [psi]	20.8	131.6	6.3	OK
Compressive Wall Stress [psi]	43.1	1150.0	26.7	OK

Installation Analysis

	Calculated	Allowable	Factor of Safety	Check
Deflection [%]	0.014	7.5	524.3	OK
Unconstrained Collapse [psi]	30.8	227.8	7.4	OK
Tensile Stress [psi]	496.1	1200.0	2.4	OK

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Project Summary

General:	HDD #12A - Conduit 1
	Start Date: 06-21-2022
	End Date: 06-21-2022
Project Owner:	TDI
Project Contractor:	KIEWIT
Project Consultant:	CHA
Designer:	MCS
	CHA

Description:

Input Summary

Start Coordinate	(0.00, 0.00, 137.09) ft
End Coordinate	(1490.00, 0.00, 143.80) ft
Project Length	1490.00 ft
Pipe Type	HDPE
OD Classification	IPS
Pipe OD	10.750 in
Pipe DR	9.0
Pipe Thickness	1.19 in
Rod Length	15.00 ft
Rod Diameter	3.5 in
Drill Rig Location	(0.00, 0.00, 0.00) ft

Soil Summary

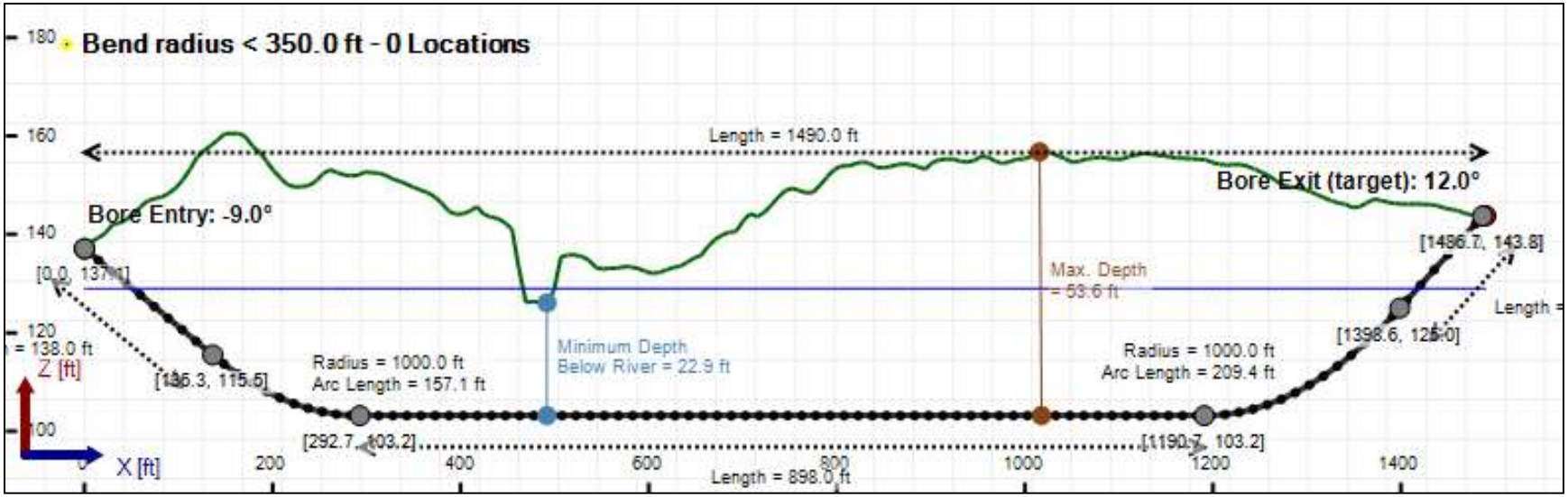
Number of Layers: 3

Soil Layer #1 USCS, Sand (S), SP
Depth: 4.00 ft
Unit Weight: 105.0000 (dry), 115.0000 (sat) [lb/ft3]
Phi: 30.00, S.M.: 1.39, Coh: 0.00 [psi]

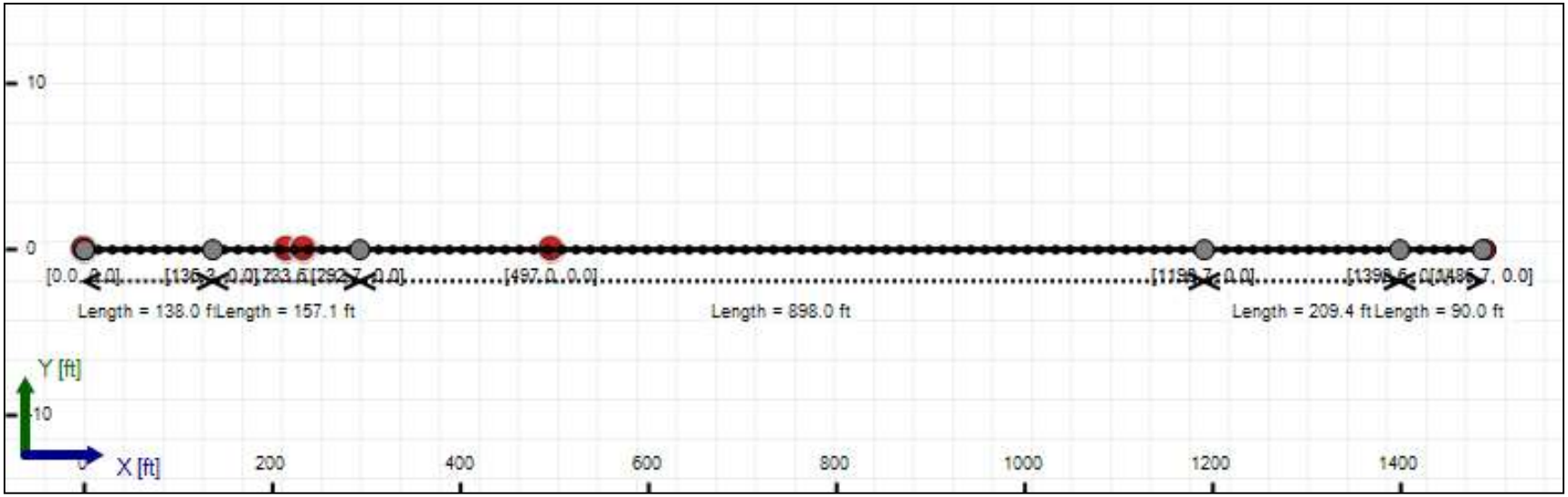
Soil Layer #2 Rock, Geological Classification, Sedimentary Rocks
Depth: 40.00 ft
Unit Weight: 120.0000 (dry), 140.0000 (sat) [lb/ft3]
Phi: 37.00, S.M.: 1000.00, Coh: 0.00 [psi]

Soil Layer #3 Rock, Geological Classification, Sedimentary Rocks
Depth: 20.00 ft
Unit Weight: 120.0000 (dry), 140.0000 (sat) [lb/ft3]
Phi: 37.00, S.M.: 1000.00, Coh: 0.00 [psi]

Bore Cross-Section View



Bore Plan View



Load Verifier Input Summary:

Pipe Application: Electrical Cable
Pipe Type: HDPE
Classification: IPS
Pipe OD: 10" (10.75")
Pipe DR: 9
Pipe Length: 1500.00 ft
Internal Pressure: 0 psi
Borehole Diameter: 1.34400002161662 ft
Silo Width: 1.34400002161662 ft
Surface Surcharge: 0 psi
Short Term Modulus: 57500 psi
Long Term Modulus: 28200 psi
Short Term Poisson Ratio: 0.35
Long Term Poisson Ratio: 0.45
Pipe Unit Weight: 59.30500 lb/ft3
Allowable Tensile Stress (Short Term): 1200 psi
Allowable Tensile Stress (Long Term): 1100 psi
Allowable Compressive Stress (Short Term): 1150 psi
Allowable Compressive Stress (Long Term): 1150 psi
Surface-pipe friction coefficient at entrance: 0.5
Surface-pipe friction coefficient in borehole: 0.3
Pipe-soil friction angle: 30
Slurry Unit Weight: 93.64118 lb/ft3
Hydrokinetic Pressure: 10 psi
Ballast Unit Weight: 62.42746 lb/ft3

In-service Load Summary:

Pressure [psi]	Deformed	Collapsed
Earth Pressure	5.0	34.7
Water Pressure	11.2	11.2
Surface Surcharge	0.0	0.0
Internal Pressure	0.0	0.0
Net Pressure	16.2	45.8
Deflection		
Earth Load Deflection	1.423	9.437
Buoyant Deflection	0.132	0.132
Reissner Effect	0	0
Net Deflection	1.555	9.569
Compressive Stress [psi]		
Compressive Wall Stress	72.9	206.3

Installation Load Summary:

Forces/Stresses	@Maximum Force	Absolute Maximum
Pullback Force [lb]	24484.2	24484.2
Pullback Stress [psi]	682.8	682.8
Pullback Strain	1.188E-2	1.188E-2
Bending Stress [psi]	0.0	25.8
Bending Strain	0	4.479E-4
Tensile Stress [psi]	682.8	703.1
Tensile Strain	1.188E-2	1.268E-2

Net External Pressure = 27.6 [psi]

Buoyant Deflection = 0.1

Hydrokinetic Force = 567.6 lb

In-service Analysis

	Calculated	Allowable	Factor of Safety	Check
Deflection [%]	1.555	7.5	4.8	OK
Unconstrained Collapse [psi]	27.4	120.8	4.4	OK
Compressive Wall Stress [psi]	72.9	1150.0	15.8	OK

Installation Analysis

	Calculated	Allowable	Factor of Safety	Check
Deflection [%]	0.065	7.5	115.8	OK
Unconstrained Collapse [psi]	37.4	213.4	5.7	OK
Tensile Stress [psi]	703.1	1200.0	1.7	OK

Maximum Allowable Bore Pressure Summary

Ream Number	Initial Diameter	Final Diameter	Estimated Maximum Pressure (Avg.)	Estimated Maximum Pressure (Local)
Pilot Bore	0.00 in	8.00 in	190.926 psi	248.409 psi
1	8.00 in	12.00 in	190.725 psi	247.950 psi
2	12.00 in	16.13 in	190.436 psi	247.288 psi

Note: The maximum bore pressures presented in this table are the maximum values along the length of the bore and not the maximum allowable at any point. The estimated maximum pressures should be compared to the estimated circulating pressures along the bore to determine potential locations of inadvertant returns.

Estimated Circulating Pressure Summary

Active	Shear Rate [rpm]	Shear Stress [Fann Degrees]
No	600	37
No	300	32
No	200	29
Yes	100	25
Yes	6	17
No	3	15

Flow Rate (Q): 40.00 US (liquid) gallon/min

Drill Fluid Density: 68.700 lb/ft3

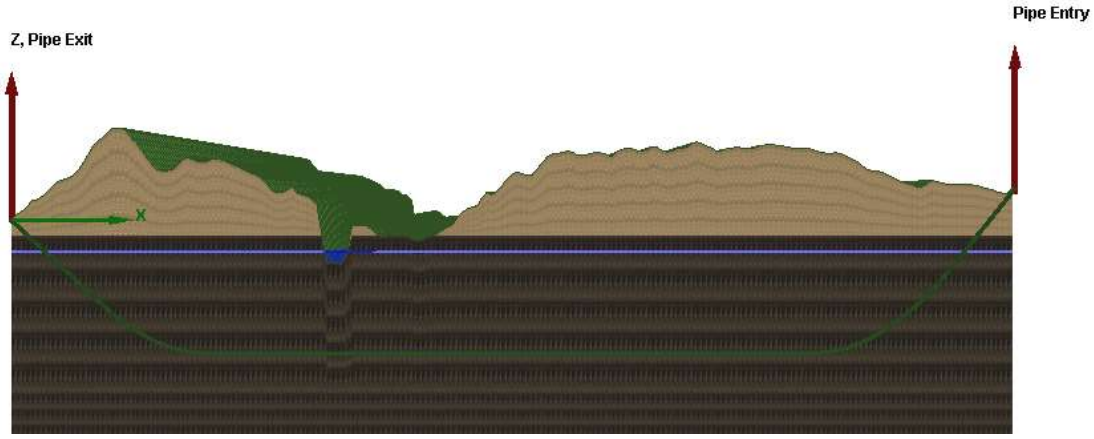
Rheological model: Bingham-Plastic

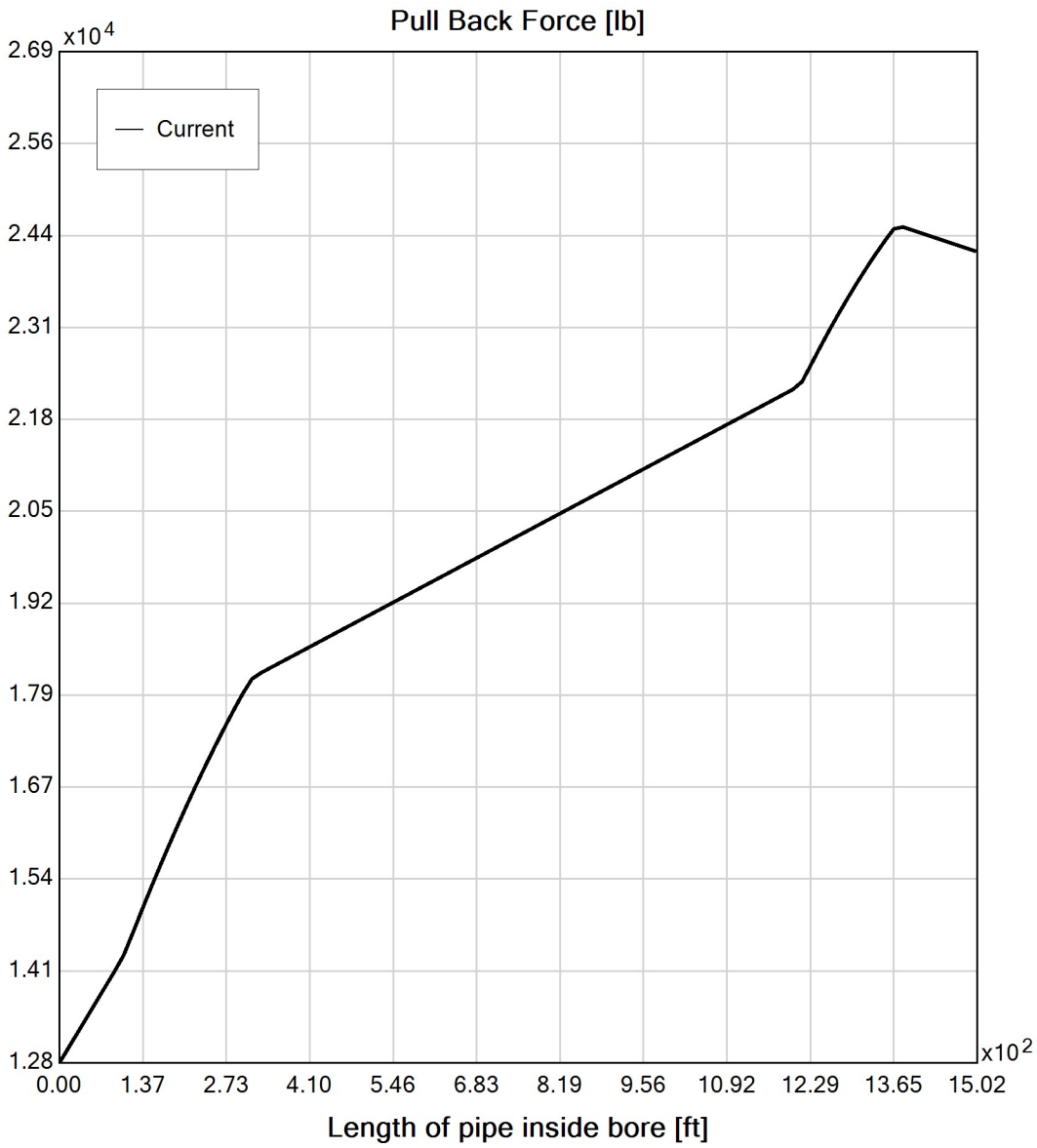
Plastic Viscosity (PV): 25.53

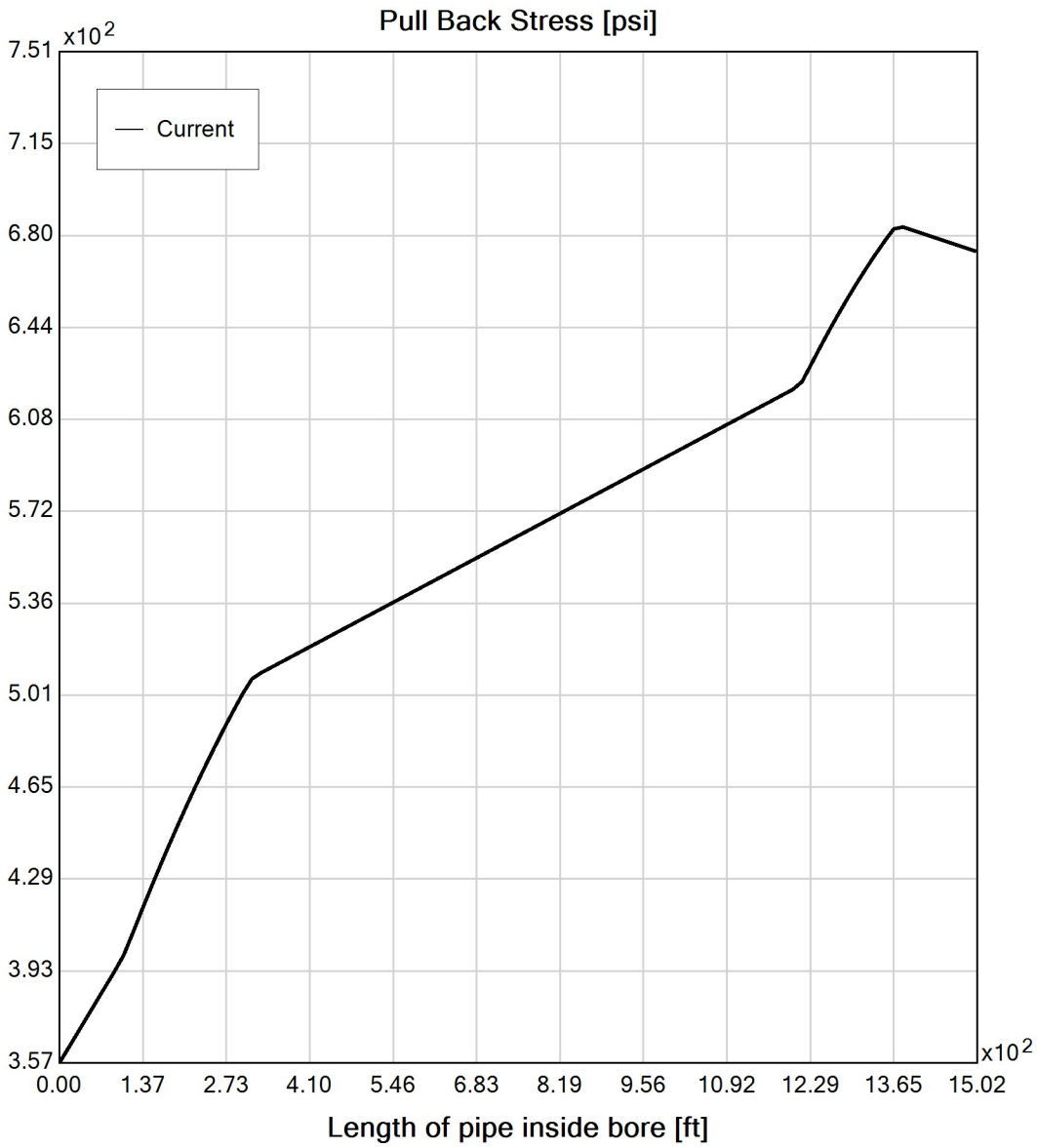
Yield Point (YP): 16.49

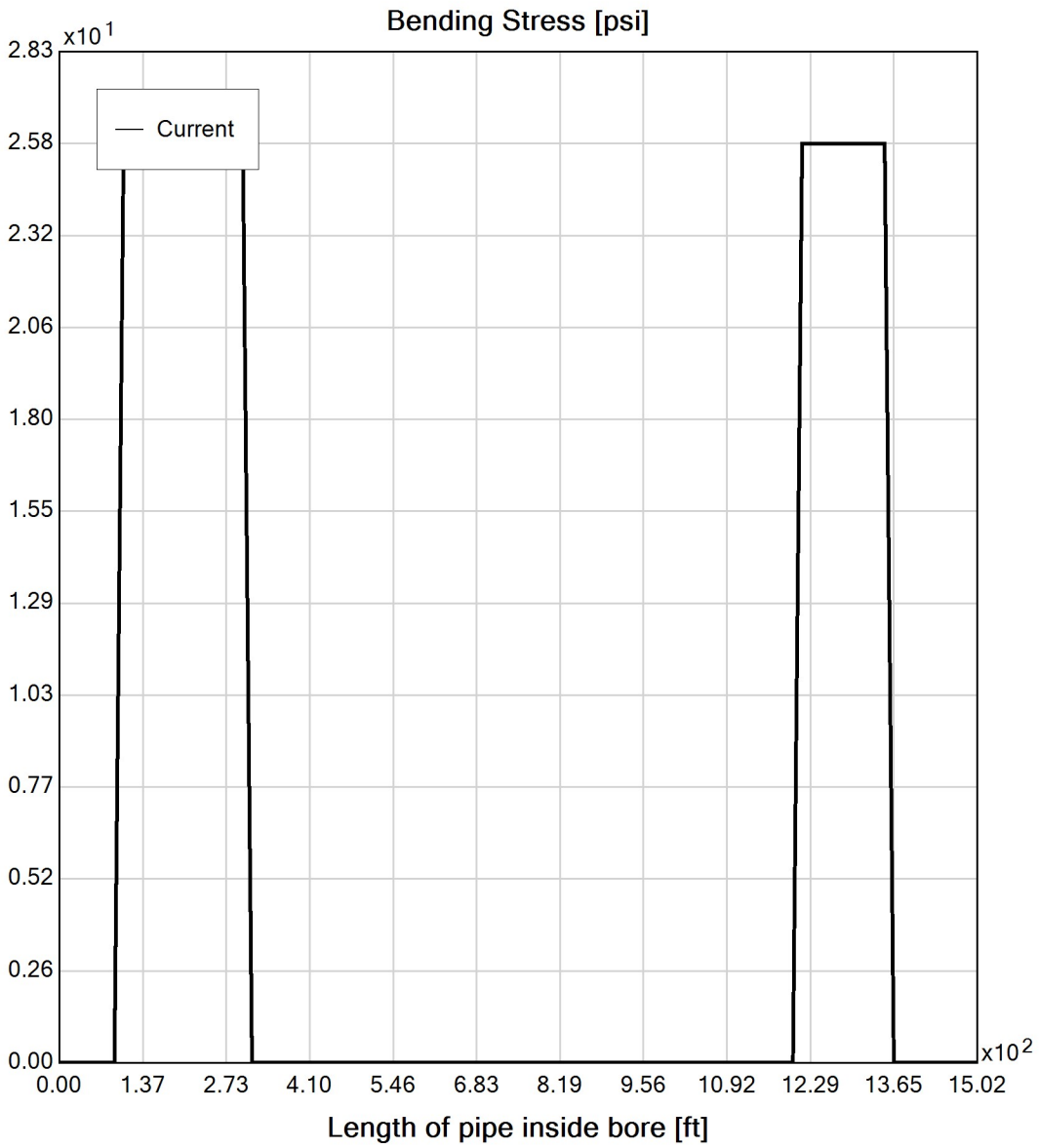
Effective Viscosity (cP): 1202.0

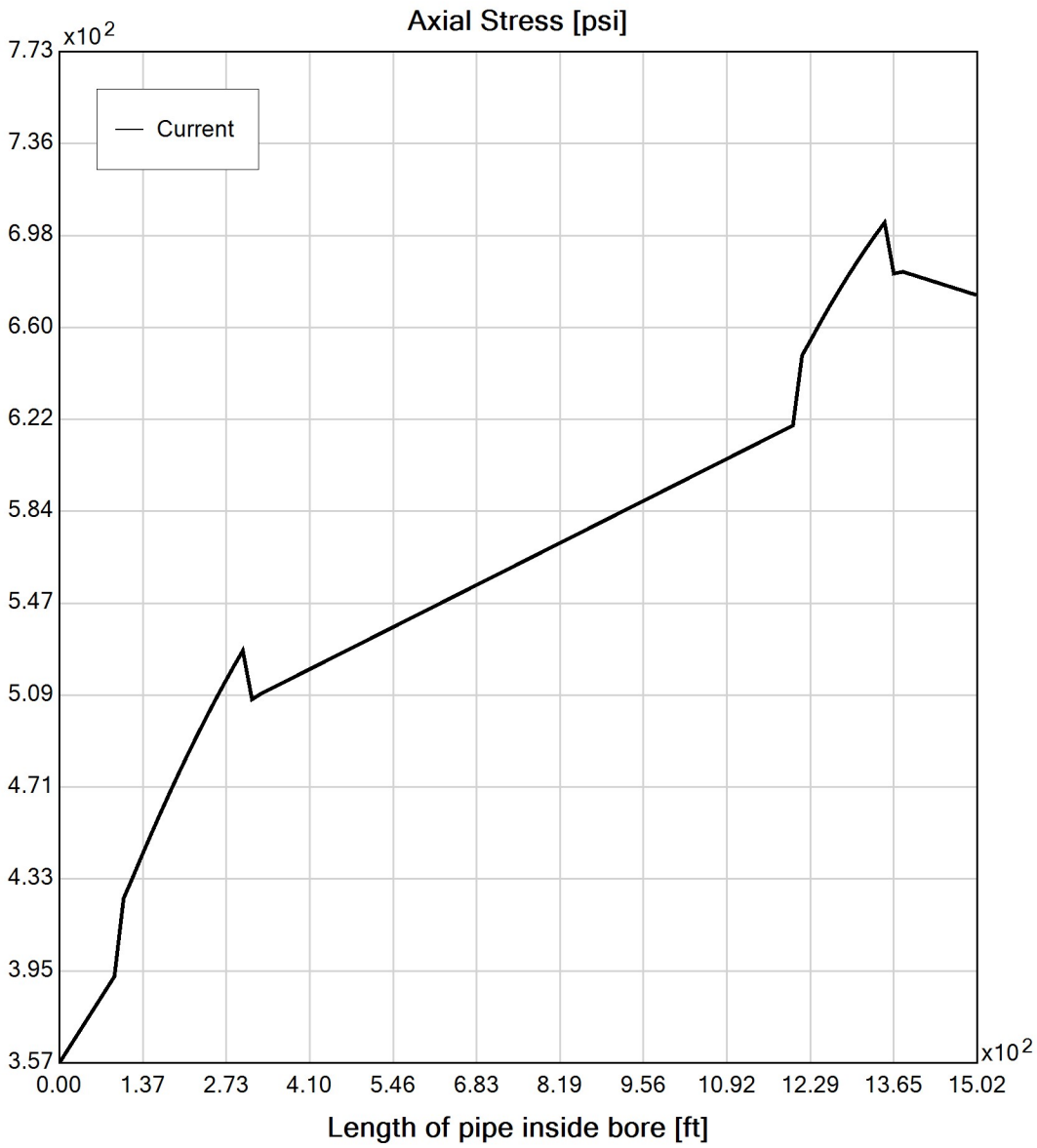
Virtual Site

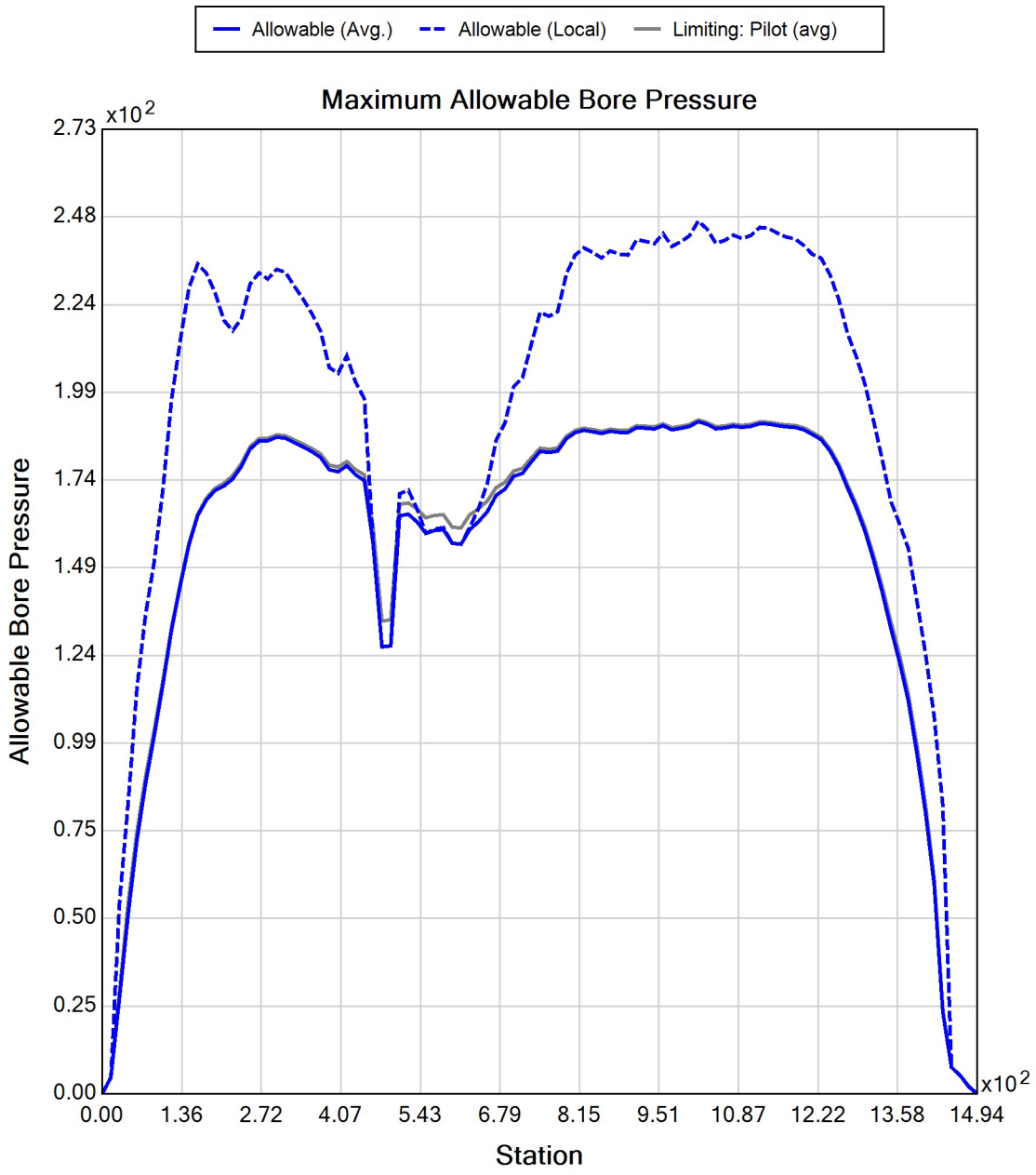


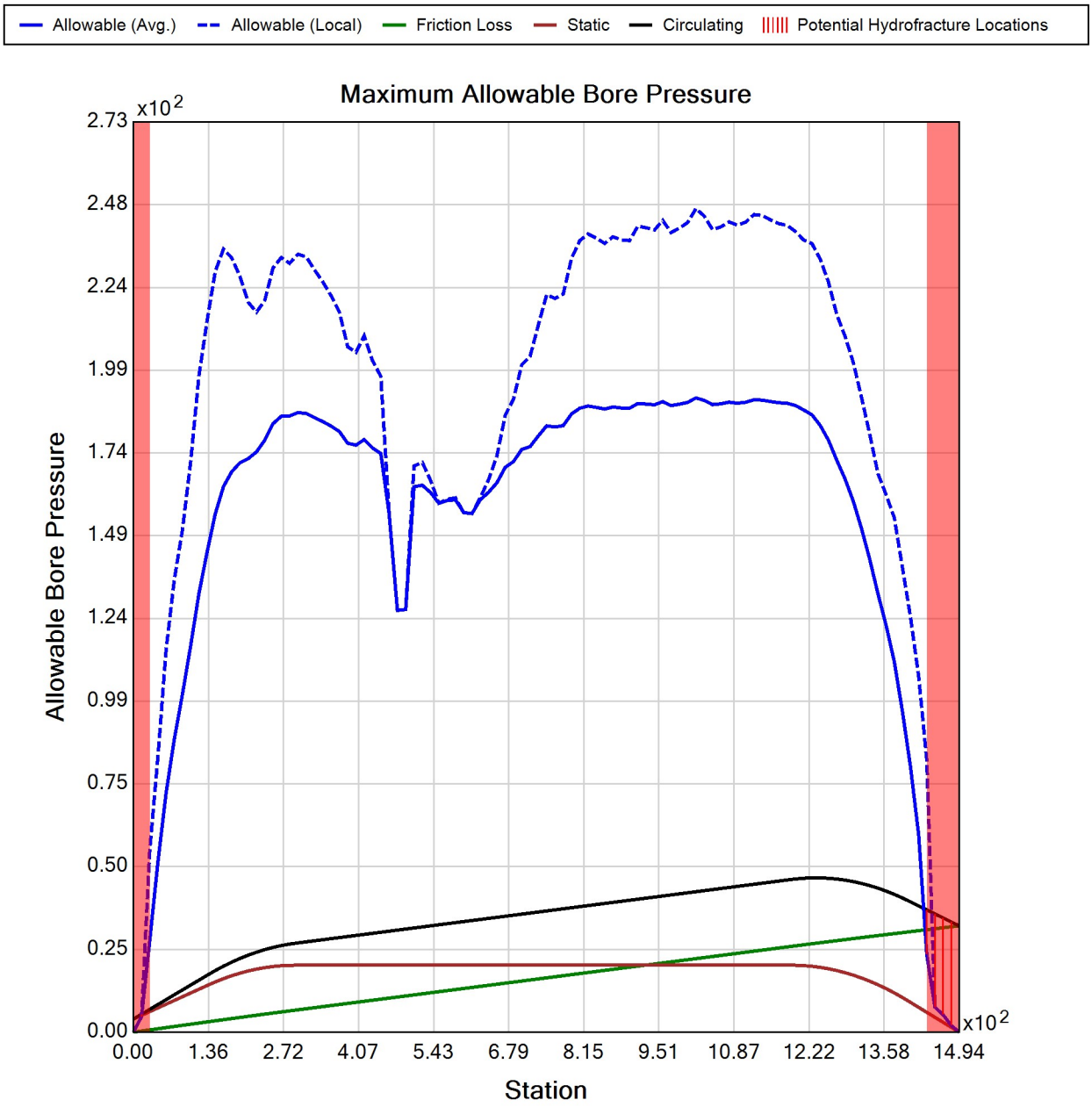












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Input Summary

Start Coordinate	(0.00, 0.00, 137.09) ft
End Coordinate	(1490.00, 0.00, 143.80) ft
Project Length	1490.00 ft
Pipe Type	HDPE
OD Classification	IPS
Pipe OD	2.375 in
Pipe DR	9.0
Pipe Thickness	0.26 in
Rod Length	15.00 ft
Rod Diameter	3.5 in
Drill Rig Location	(0.00, 0.00, 0.00) ft

Load Verifier Input Summary:

Pipe Application: Electrical Cable
Pipe Type: HDPE
Classification: IPS
Pipe OD: 2" (2.375")
Pipe DR: 9
Pipe Length: 1500.00 ft
Internal Pressure: 0 psi
Borehole Diameter: 0.531000018119812 ft
Silo Width: 0.531000018119812 ft
Surface Surcharge: 0 psi
Short Term Modulus: 57500 psi
Long Term Modulus: 28200 psi
Short Term Poisson Ratio: 0.35
Long Term Poisson Ratio: 0.45
Pipe Unit Weight: 59.30500 lb/ft3
Allowable Tensile Stress (Short Term): 1200 psi
Allowable Tensile Stress (Long Term): 1100 psi
Allowable Compressive Stress (Short Term): 1150 psi
Allowable Compressive Stress (Long Term): 1150 psi
Surface-pipe friction coefficient at entrance: 0.5
Surface-pipe friction coefficient in borehole: 0.3
Pipe-soil friction angle: 30
Slurry Unit Weight: 93.64118 lb/ft3
Hydrokinetic Pressure: 10 psi
Ballast Unit Weight: 62.42746 lb/ft3

In-service Load Summary:

Pressure [psi]	Deformed	Collapsed
Earth Pressure	2.0	34.7
Water Pressure	11.2	11.2
Surface Surcharge	0.0	0.0
Internal Pressure	0.0	0.0
Net Pressure	13.2	45.8
Deflection		
Earth Load Deflection	0.611	9.437
Buoyant Deflection	0.029	0.029
Reissner Effect	0	0
Net Deflection	0.640	9.466
Compressive Stress [psi]		
Compressive Wall Stress	59.3	206.3

Installation Load Summary:

Forces/Stresses	@Maximum Force	Absolute Maximum
Pullback Force [lb]	1304.7	1304.7
Pullback Stress [psi]	745.4	745.4
Pullback Strain	1.296E-2	1.296E-2
Bending Stress [psi]	0.0	5.7
Bending Strain	0	9.896E-5
Tensile Stress [psi]	745.4	745.6
Tensile Strain	1.296E-2	1.307E-2

Net External Pressure = 27.6 [psi]

Buoyant Deflection = 0.0

Hydrokinetic Force = 137.3 lb

In-service Analysis

	Calculated	Allowable	Factor of Safety	Check
Deflection [%]	0.640	7.5	11.7	OK
Unconstrained Collapse [psi]	27.4	131.2	4.8	OK
Compressive Wall Stress [psi]	59.3	1150.0	19.4	OK

Installation Analysis

	Calculated	Allowable	Factor of Safety	Check
Deflection [%]	0.014	7.5	524.3	OK
Unconstrained Collapse [psi]	37.4	211.2	5.7	OK
Tensile Stress [psi]	745.6	1200.0	1.6	OK

Generated Output

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OSHA CFR 29 1926.651 requires that the estimated location of underground utilities be determined before beginning the excavation or underground drilling operation. When the actual excavation or bore approaches an estimated utility location, the exact location of the underground installation must be determined by a safe, acceptable and dependable method. If the utility cannot be precisely located, it must be shut off by the utility company.

Project Summary

General:	HDD #12A - Conduit 2
	Start Date: 06-21-2022
	End Date: 06-21-2022
Project Owner:	TDI
Project Contractor:	KIEWIT
Project Consultant:	CHA
Designer:	MCS
	CHA

Description:

Input Summary

Start Coordinate	(0.00, 0.00, 141.40) ft
End Coordinate	(1490.00, 0.00, 141.40) ft
Project Length	1490.00 ft
Pipe Type	HDPE
OD Classification	IPS
Pipe OD	10.750 in
Pipe DR	9.0
Pipe Thickness	1.19 in
Rod Length	15.00 ft
Rod Diameter	3.5 in
Drill Rig Location	(0.00, 0.00, 0.00) ft

Soil Summary

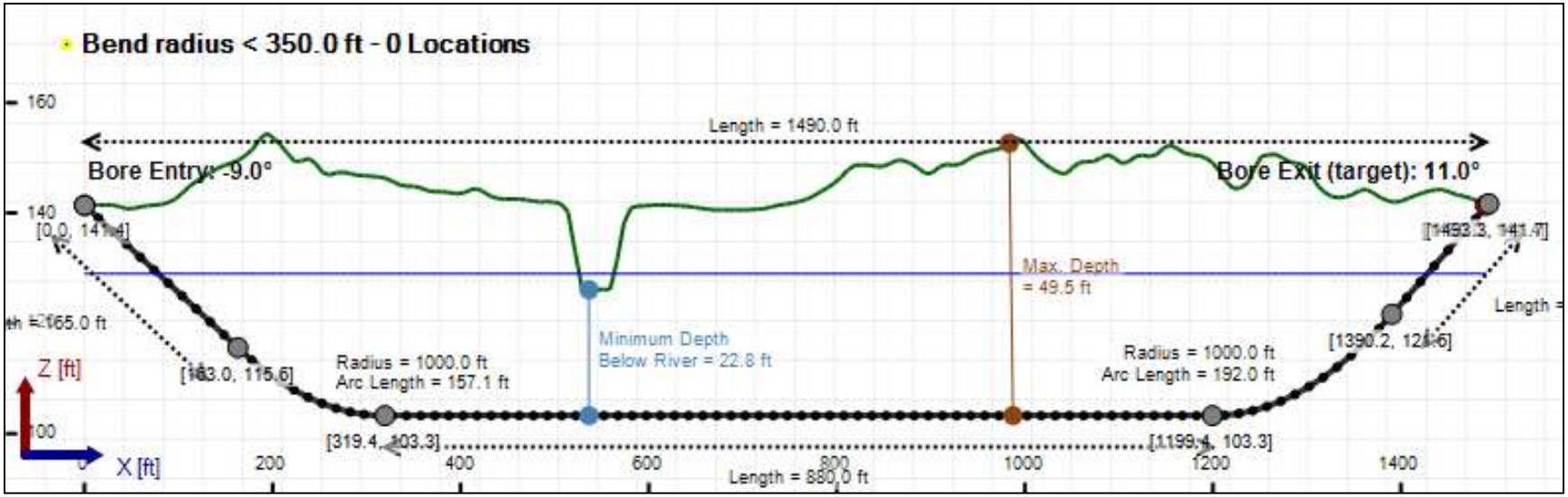
Number of Layers: 3

Soil Layer #1 USCS, Sand (S), SP
Depth: 4.00 ft
Unit Weight: 105.0000 (dry), 115.0000 (sat) [lb/ft3]
Phi: 30.00, S.M.: 1.39, Coh: 0.00 [psi]

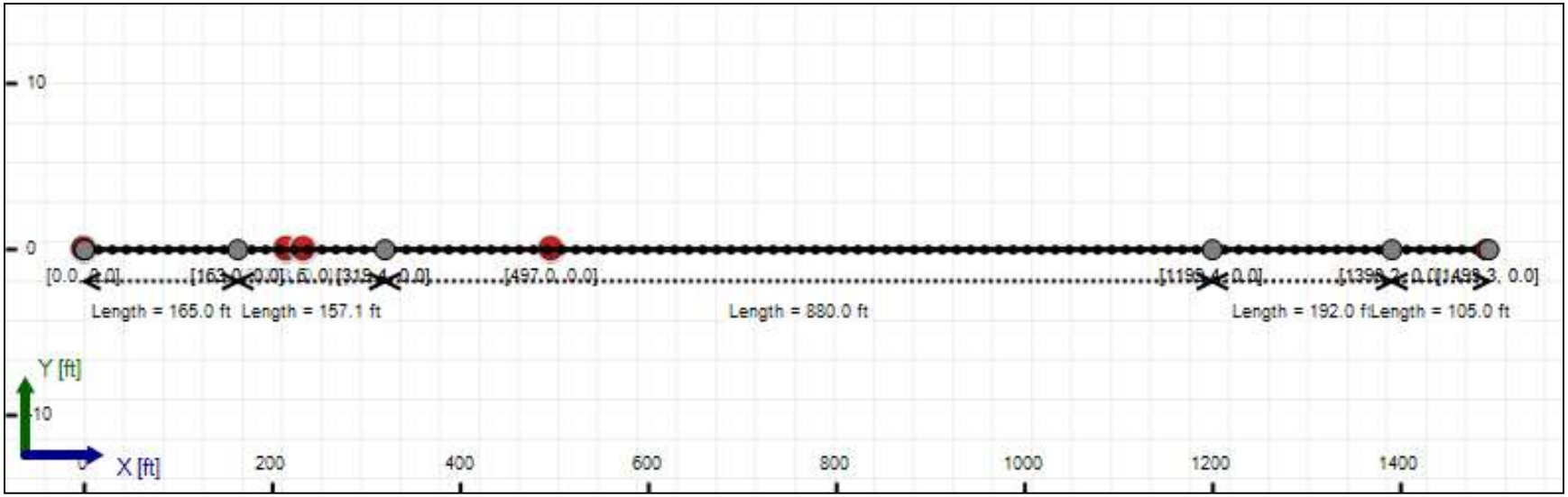
Soil Layer #2 Rock, Geological Classification, Sedimentary Rocks
Depth: 40.00 ft
Unit Weight: 120.0000 (dry), 140.0000 (sat) [lb/ft3]
Phi: 37.00, S.M.: 1000.00, Coh: 0.00 [psi]

Soil Layer #3 Rock, Geological Classification, Sedimentary Rocks
Depth: 20.00 ft
Unit Weight: 120.0000 (dry), 140.0000 (sat) [lb/ft3]
Phi: 37.00, S.M.: 1000.00, Coh: 0.00 [psi]

Bore Cross-Section View



Bore Plan View



Load Verifier Input Summary:

Pipe Application: Electrical Cable
Pipe Type: HDPE
Classification: IPS
Pipe OD: 10" (10.75")
Pipe DR: 9
Pipe Length: 1500.00 ft
Internal Pressure: 0 psi
Borehole Diameter: 1.34400002161662 ft
Silo Width: 1.34400002161662 ft
Surface Surcharge: 0 psi
Short Term Modulus: 57500 psi
Long Term Modulus: 28200 psi
Short Term Poisson Ratio: 0.35
Long Term Poisson Ratio: 0.45
Pipe Unit Weight: 59.30500 lb/ft3
Allowable Tensile Stress (Short Term): 1200 psi
Allowable Tensile Stress (Long Term): 1100 psi
Allowable Compressive Stress (Short Term): 1150 psi
Allowable Compressive Stress (Long Term): 1150 psi
Surface-pipe friction coefficient at entrance: 0.5
Surface-pipe friction coefficient in borehole: 0.3
Pipe-soil friction angle: 30
Slurry Unit Weight: 93.64118 lb/ft3
Hydrokinetic Pressure: 10 psi
Ballast Unit Weight: 62.42746 lb/ft3

In-service Load Summary:

Pressure [psi]	Deformed	Collapsed
Earth Pressure	5.1	32.4
Water Pressure	11.2	11.2
Surface Surcharge	0.0	0.0
Internal Pressure	0.0	0.0
Net Pressure	16.2	43.5
Deflection		
Earth Load Deflection	1.442	8.823
Buoyant Deflection	0.132	0.132
Reissner Effect	0	0
Net Deflection	1.574	8.955
Compressive Stress [psi]		
Compressive Wall Stress	73.0	196.0

Installation Load Summary:

Forces/Stresses	@Maximum Force	Absolute Maximum
Pullback Force [lb]	24022.6	24022.6
Pullback Stress [psi]	670.0	670.0
Pullback Strain	1.165E-2	1.165E-2
Bending Stress [psi]	0.0	25.8
Bending Strain	0	4.479E-4
Tensile Stress [psi]	670.0	689.0
Tensile Strain	1.165E-2	1.243E-2

Net External Pressure = 25.6 [psi]

Buoyant Deflection = 0.1

Hydrokinetic Force = 567.6 lb

In-service Analysis

	Calculated	Allowable	Factor of Safety	Check
Deflection [%]	1.574	7.5	4.8	OK
Unconstrained Collapse [psi]	25.1	120.6	4.8	OK
Compressive Wall Stress [psi]	73.0	1150.0	15.7	OK

Installation Analysis

	Calculated	Allowable	Factor of Safety	Check
Deflection [%]	0.065	7.5	115.8	OK
Unconstrained Collapse [psi]	35.1	214.4	6.1	OK
Tensile Stress [psi]	689.0	1200.0	1.7	OK

Maximum Allowable Bore Pressure Summary

Ream Number	Initial Diameter	Final Diameter	Estimated Maximum Pressure (Avg.)	Estimated Maximum Pressure (Local)
Pilot Bore	0.00 in	8.00 in	199.753 psi	238.537 psi
1	8.00 in	12.00 in	199.438 psi	237.994 psi
2	12.00 in	16.13 in	198.984 psi	237.213 psi

Note: The maximum bore pressures presented in this table are the maximum values along the length of the bore and not the maximum allowable at any point. The estimated maximum pressures should be compared to the estimated circulating pressures along the bore to determine potential locations of inadvertant returns.

Estimated Circulating Pressure Summary

Active	Shear Rate [rpm]	Shear Stress [Fann Degrees]
No	600	37
No	300	32
No	200	29
Yes	100	25
Yes	6	17
No	3	15

Flow Rate (Q): 40.00 US (liquid) gallon/min

Drill Fluid Density: 68.700 lb/ft3

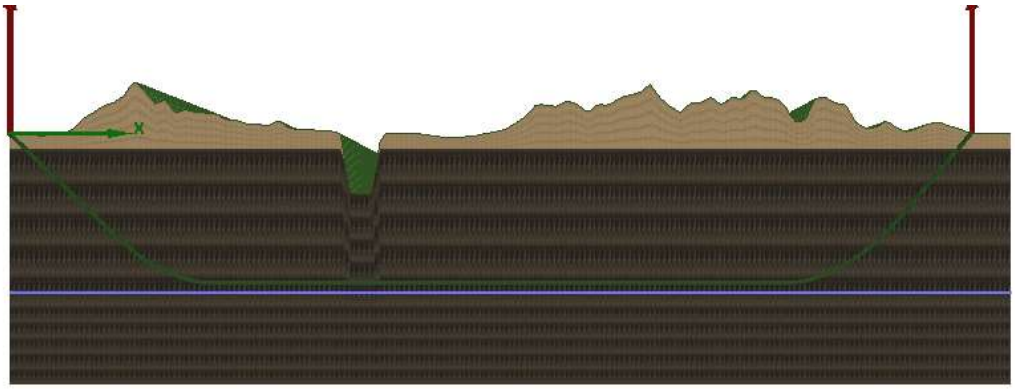
Rheological model: Bingham-Plastic

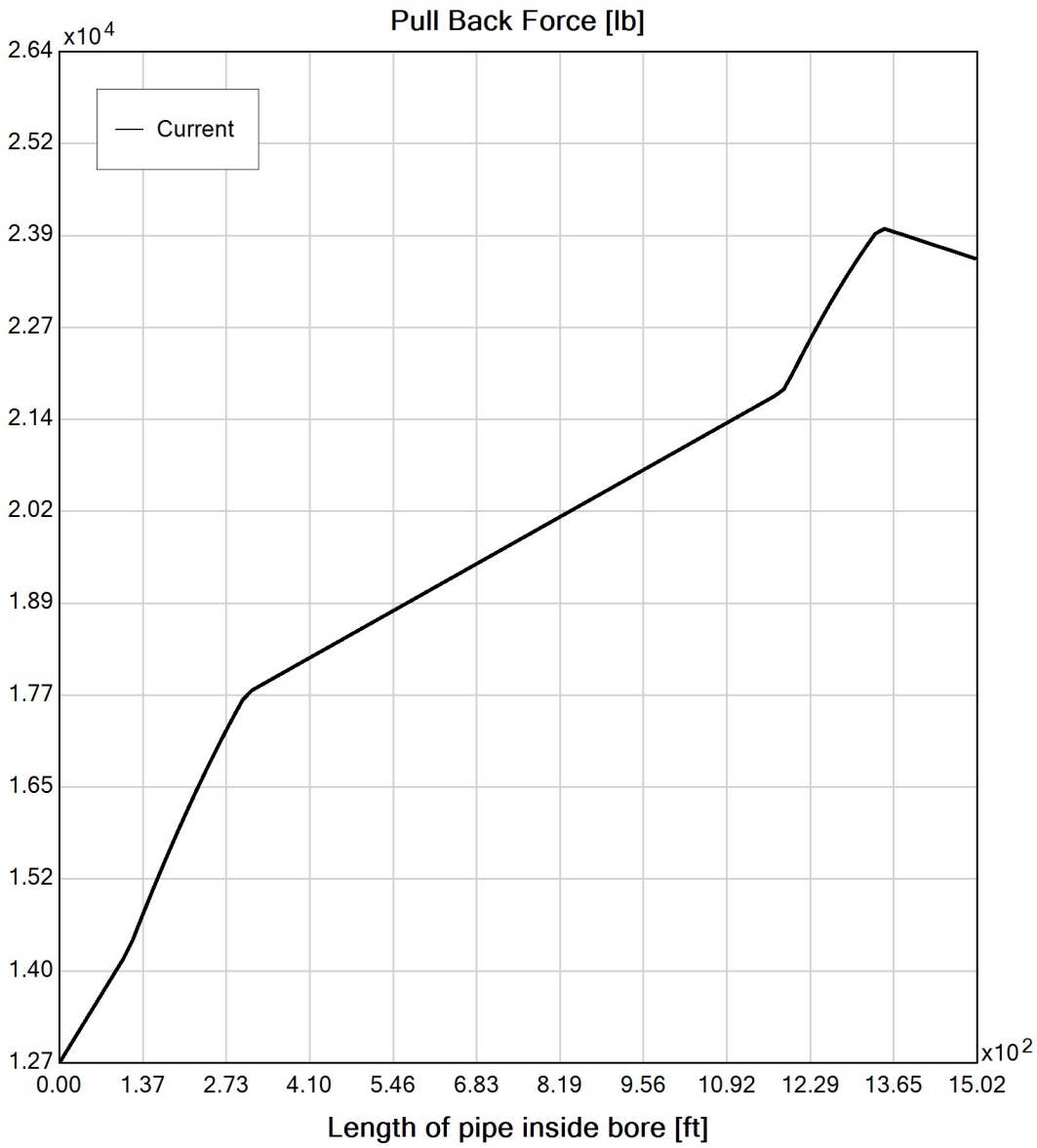
Plastic Viscosity (PV): 25.53

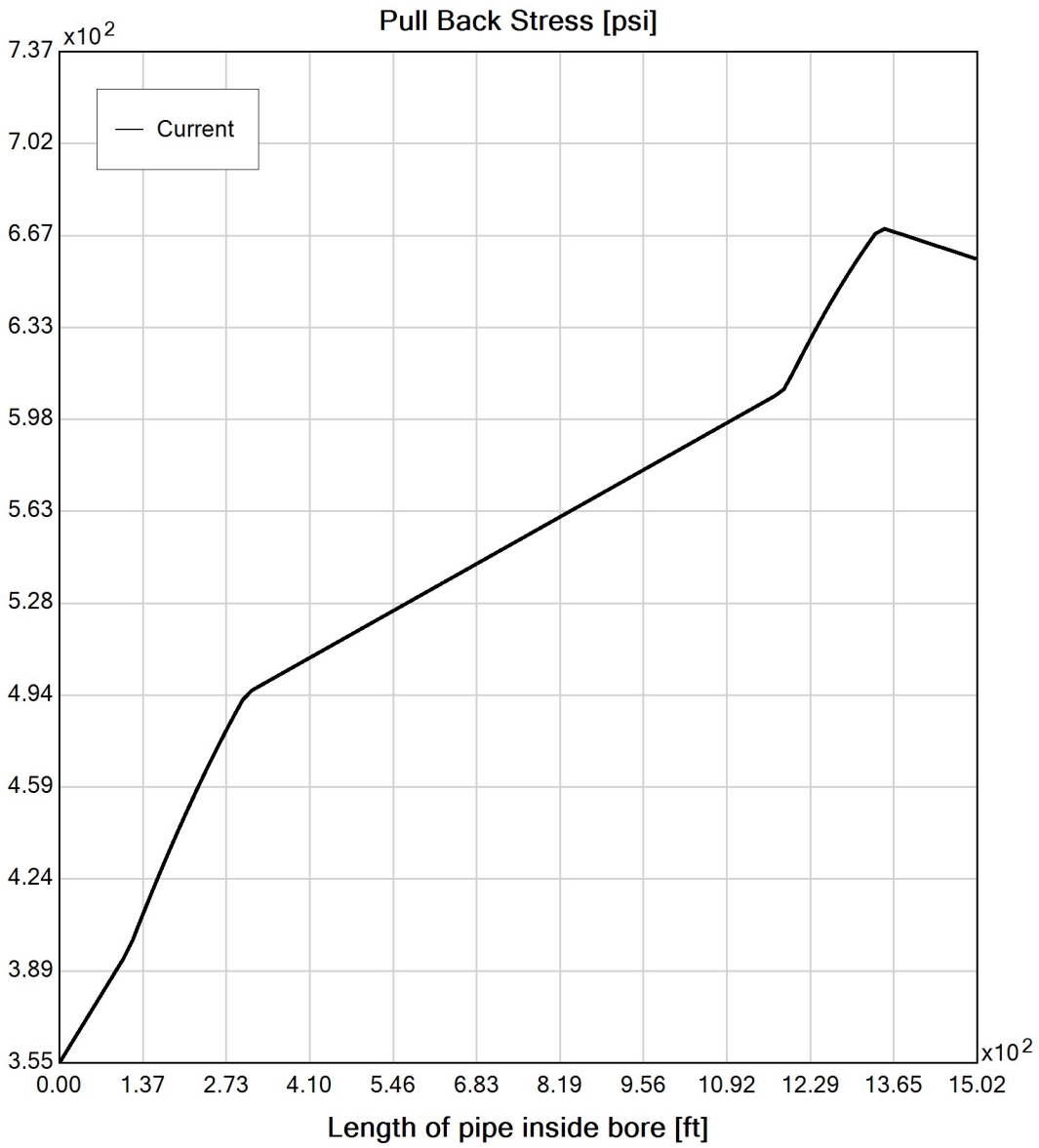
Yield Point (YP): 16.49

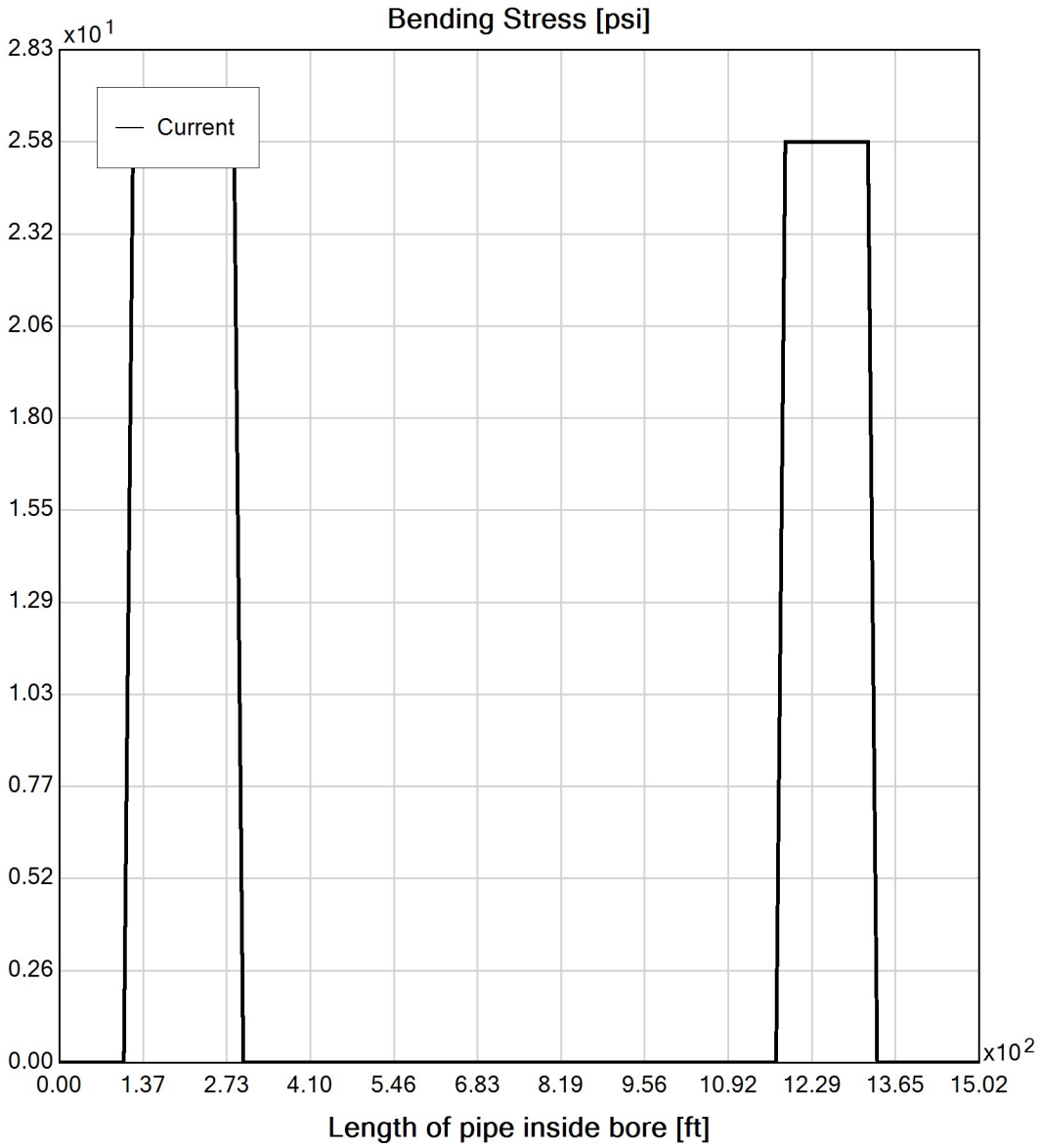
Effective Viscosity (cP): 1202.0

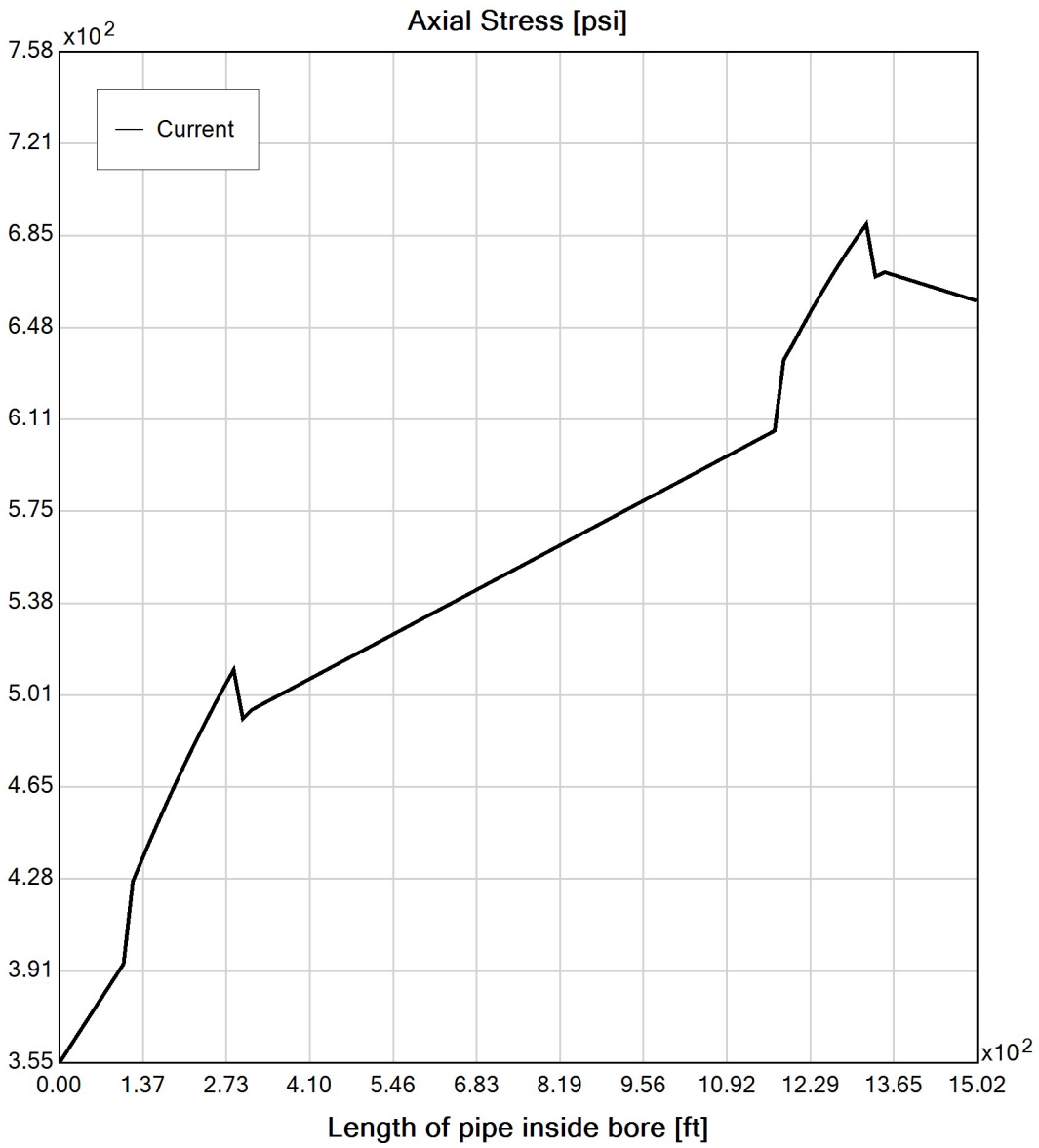
Virtual Site

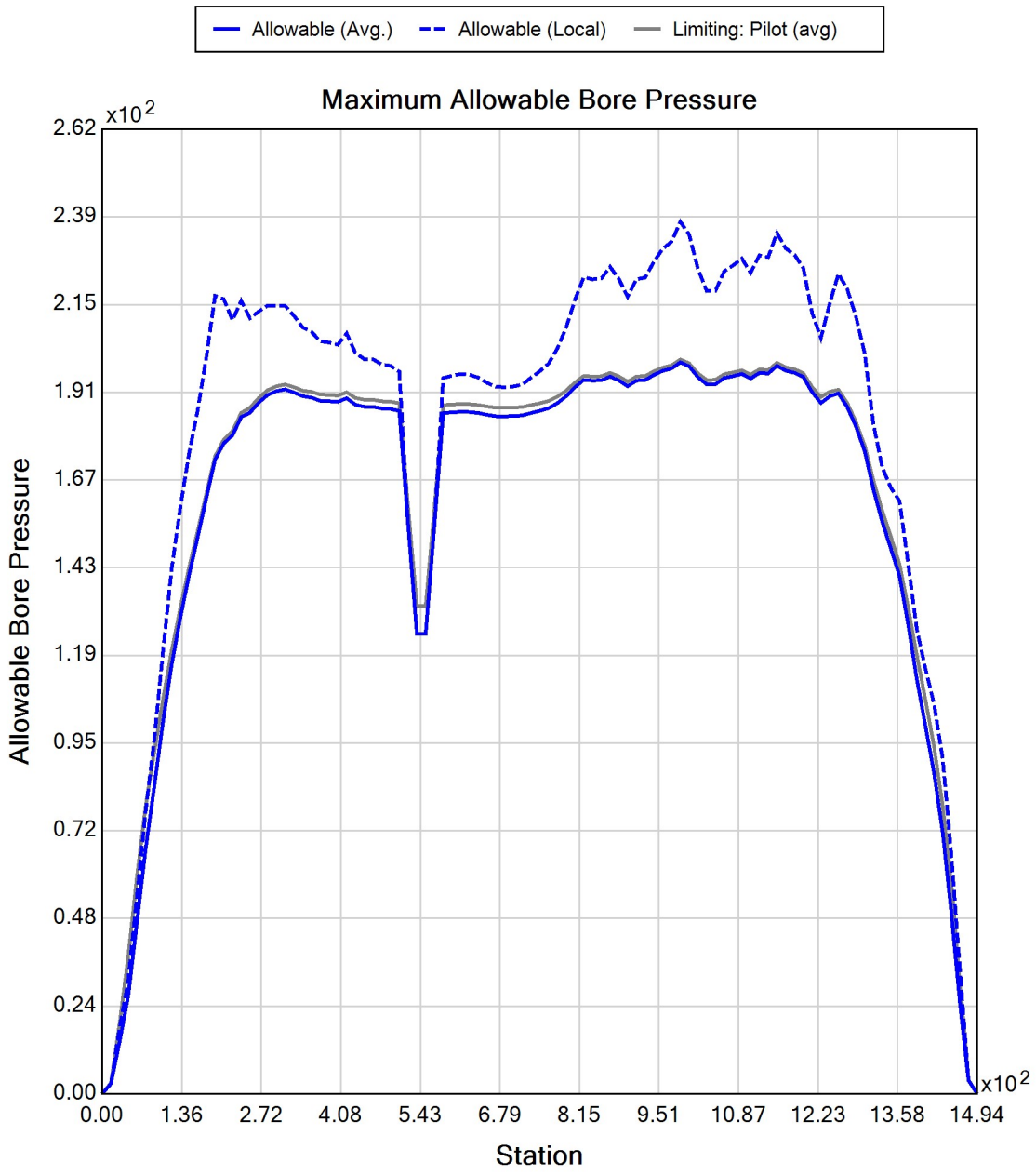


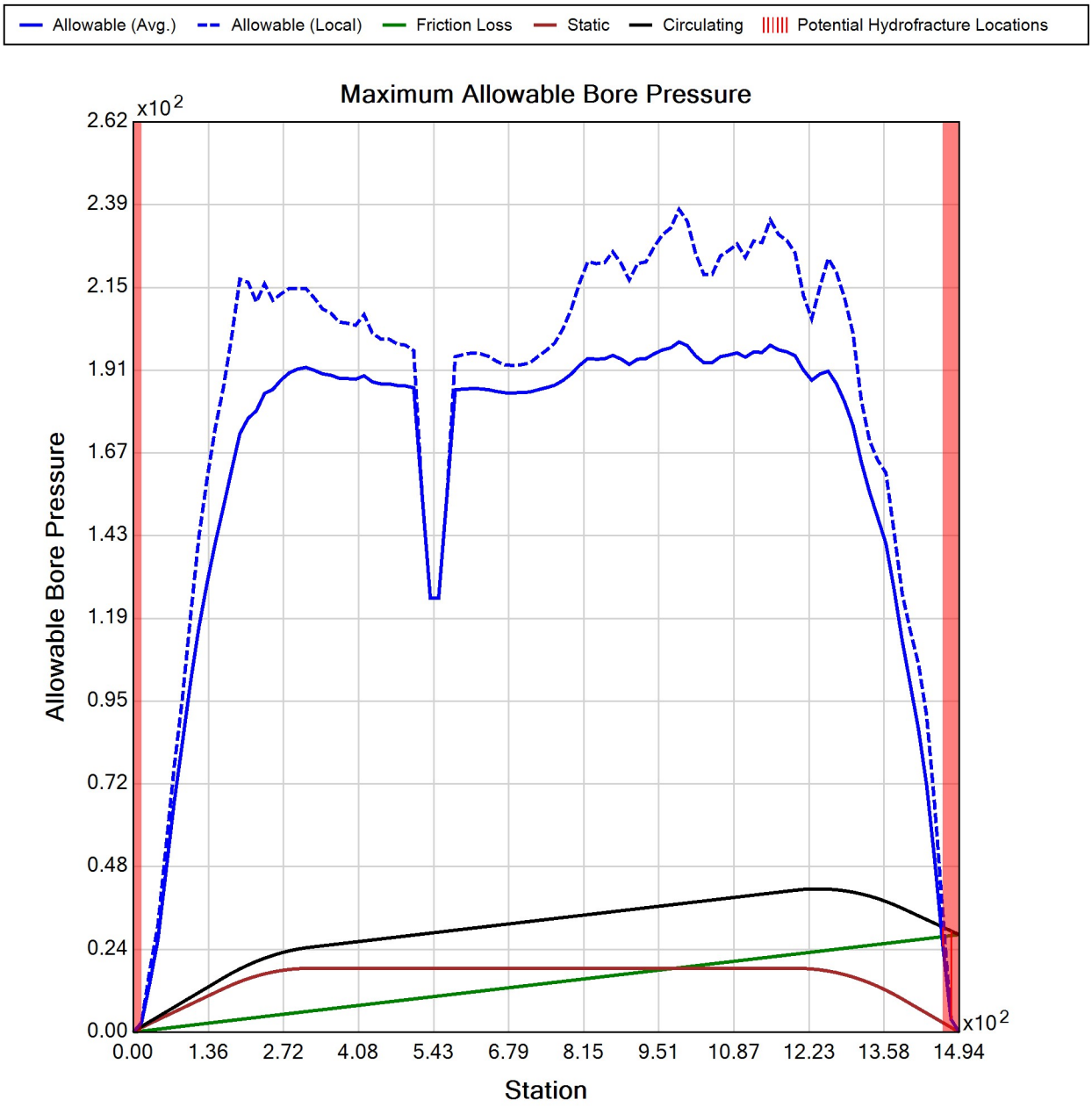












Generated Output

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Input Summary

Start Coordinate	(0.00, 0.00, 141.40) ft
End Coordinate	(1490.00, 0.00, 141.40) ft
Project Length	1490.00 ft
Pipe Type	HDPE
OD Classification	IPS
Pipe OD	2.375 in
Pipe DR	9.0
Pipe Thickness	0.26 in
Rod Length	15.00 ft
Rod Diameter	3.5 in
Drill Rig Location	(0.00, 0.00, 0.00) ft

Load Verifier Input Summary:

Pipe Application: Electrical Cable
Pipe Type: HDPE
Classification: IPS
Pipe OD: 2" (2.375")
Pipe DR: 9
Pipe Length: 1500.00 ft
Internal Pressure: 0 psi
Borehole Diameter: 0.531000018119812 ft
Silo Width: 0.531000018119812 ft
Surface Surcharge: 0 psi
Short Term Modulus: 57500 psi
Long Term Modulus: 28200 psi
Short Term Poisson Ratio: 0.35
Long Term Poisson Ratio: 0.45
Pipe Unit Weight: 59.30500 lb/ft3
Allowable Tensile Stress (Short Term): 1200 psi
Allowable Tensile Stress (Long Term): 1100 psi
Allowable Compressive Stress (Short Term): 1150 psi
Allowable Compressive Stress (Long Term): 1150 psi
Surface-pipe friction coefficient at entrance: 0.5
Surface-pipe friction coefficient in borehole: 0.3
Pipe-soil friction angle: 30
Slurry Unit Weight: 93.64118 lb/ft3
Hydrokinetic Pressure: 10 psi
Ballast Unit Weight: 62.42746 lb/ft3

In-service Load Summary:

Pressure [psi]	Deformed	Collapsed
Earth Pressure	2.0	32.4
Water Pressure	11.2	11.2
Surface Surcharge	0.0	0.0
Internal Pressure	0.0	0.0
Net Pressure	13.2	43.5
Deflection		
Earth Load Deflection	0.657	8.823
Buoyant Deflection	0.029	0.029
Reissner Effect	0	0
Net Deflection	0.686	8.852
Compressive Stress [psi]		
Compressive Wall Stress	59.2	196.0

Installation Load Summary:

Forces/Stresses	@Maximum Force	Absolute Maximum
Pullback Force [lb]	1282.1	1282.1
Pullback Stress [psi]	732.6	732.6
Pullback Strain	1.274E-2	1.274E-2
Bending Stress [psi]	0.0	5.7
Bending Strain	0	9.896E-5
Tensile Stress [psi]	732.6	732.6
Tensile Strain	1.274E-2	1.282E-2

Net External Pressure = 25.6 [psi]

Buoyant Deflection = 0.0

Hydrokinetic Force = 137.3 lb

In-service Analysis

	Calculated	Allowable	Factor of Safety	Check
Deflection [%]	0.686	7.5	10.9	OK
Unconstrained Collapse [psi]	25.1	131.1	5.2	OK
Compressive Wall Stress [psi]	59.2	1150.0	19.4	OK

Installation Analysis

	Calculated	Allowable	Factor of Safety	Check
Deflection [%]	0.014	7.5	524.3	OK
Unconstrained Collapse [psi]	35.1	212.2	6.1	OK
Tensile Stress [psi]	732.6	1200.0	1.6	OK

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Project Summary

General:	HDD #13 - Conduit 1
	Start Date: 06-21-2022
	End Date: 06-21-2022
Project Owner:	TDI
Project Contractor:	KIEWIT
Project Consultant:	CHA
Designer:	MCS/MDB
	CHA/BCE

Description:

Input Summary

Start Coordinate	(0.00, 0.00, 134.00) ft
End Coordinate	(1478.00, 0.00, 132.00) ft
Project Length	1478.00 ft
Pipe Type	HDPE
OD Classification	IPS
Pipe OD	10.750 in
Pipe DR	9.0
Pipe Thickness	1.19 in
Rod Length	15.00 ft
Rod Diameter	3.5 in
Drill Rig Location	(0.00, 0.00, 0.00) ft

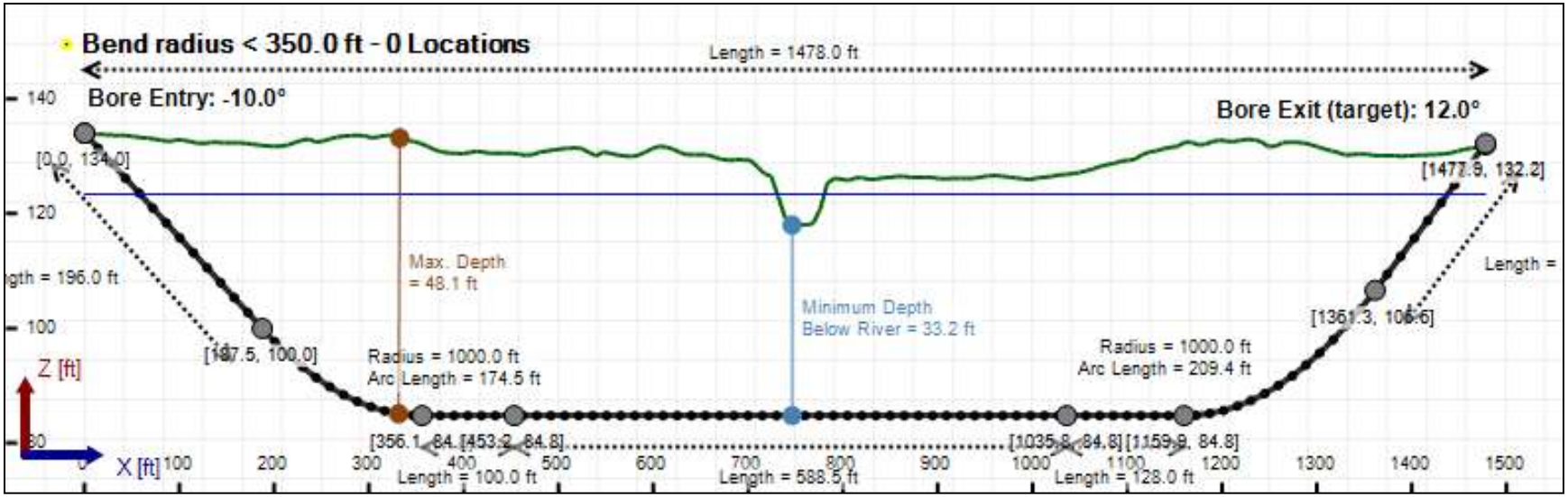
Soil Summary

Number of Layers: 2

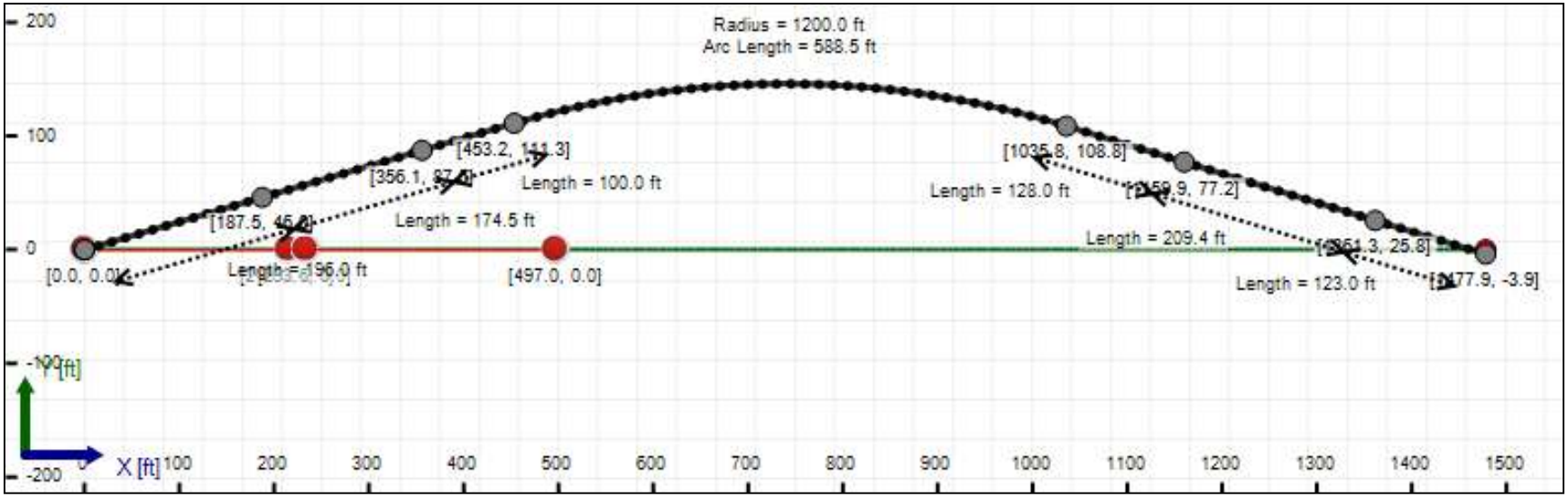
Soil Layer #1 USCS, Sand (S), SM
From Assistant
Unit Weight: 105.0000 (dry), 115.0000 (sat) [lb/ft3]
Phi: 30.00, S.M.: 200.00, Coh: 0.00 [psi]

Soil Layer #2 USCS, Sand (S), SP
From Assistant
Unit Weight: 109.5552 (dry), 126.6624 (sat) [lb/ft3]
Phi: 30.00, S.M.: 300.00, Coh: 0.00 [psi]

Bore Cross-Section View



Bore Plan View



Load Verifier Input Summary:

Pipe Application: Electrical Cable
Pipe Type: HDPE
Classification: IPS
Pipe OD: 10" (10.75")
Pipe DR: 9
Pipe Length: 1529.99 ft
Internal Pressure: 0 psi
Borehole Diameter: 1.34400002161662 ft
Silo Width: 1.34400002161662 ft
Surface Surcharge: 0 psi
Short Term Modulus: 57500 psi
Long Term Modulus: 28200 psi
Short Term Poisson Ratio: 0.35
Long Term Poisson Ratio: 0.45
Pipe Unit Weight: 59.30500 lb/ft3
Allowable Tensile Stress (Short Term): 1200 psi
Allowable Tensile Stress (Long Term): 1100 psi
Allowable Compressive Stress (Short Term): 1150 psi
Allowable Compressive Stress (Long Term): 1150 psi
Surface-pipe friction coefficient at entrance: 0.5
Surface-pipe friction coefficient in borehole: 0.3
Pipe-soil friction angle: 30
Slurry Unit Weight: 93.64118 lb/ft3
Hydrokinetic Pressure: 10 psi
Ballast Unit Weight: 62.42746 lb/ft3

In-service Load Summary:

Pressure [psi]	Deformed	Collapsed
Earth Pressure	3.7	24.3
Water Pressure	16.7	16.6
Surface Surcharge	0.0	0.0
Internal Pressure	0.0	0.0
Net Pressure	20.5	40.9
Deflection		
Earth Load Deflection	1.109	6.617
Buoyant Deflection	0.132	0.132
Reissner Effect	0	0
Net Deflection	1.241	6.749
Compressive Stress [psi]		
Compressive Wall Stress	92.2	184.0

Installation Load Summary:

Forces/Stresses	@Maximum Force	Absolute Maximum
Pullback Force [lb]	28662.5	28662.5
Pullback Stress [psi]	799.4	799.4
Pullback Strain	1.390E-2	1.390E-2
Bending Stress [psi]	0.0	25.8
Bending Strain	0	4.479E-4
Tensile Stress [psi]	799.4	819.2
Tensile Strain	1.390E-2	1.469E-2

Net External Pressure = 30.6 [psi]

Buoyant Deflection = 0.1

Hydrokinetic Force = 567.6 lb

In-service Analysis

	Calculated	Allowable	Factor of Safety	Check
Deflection [%]	1.241	7.5	6.0	OK
Unconstrained Collapse [psi]	32.3	124.5	3.9	OK
Compressive Wall Stress [psi]	92.2	1150.0	12.5	OK

Installation Analysis

	Calculated	Allowable	Factor of Safety	Check
Deflection [%]	0.065	7.5	115.8	OK
Unconstrained Collapse [psi]	42.2	205.2	4.9	OK
Tensile Stress [psi]	819.2	1200.0	1.5	OK

Maximum Allowable Bore Pressure Summary

Ream Number	Initial Diameter	Final Diameter	Estimated Maximum Pressure (Avg.)	Estimated Maximum Pressure (Local)
Pilot Bore	0.00 in	8.00 in	120.283 psi	122.634 psi
1	8.00 in	12.00 in	120.176 psi	122.517 psi
2	12.00 in	16.13 in	120.022 psi	122.348 psi

Note: The maximum bore pressures presented in this table are the maximum values along the length of the bore and not the maximum allowable at any point. The estimated maximum pressures should be compared to the estimated circulating pressures along the bore to determine potential locations of inadvertant returns.

Estimated Circulating Pressure Summary

Active	Shear Rate [rpm]	Shear Stress [Fann Degrees]
No	600	37
No	300	32
No	200	29
Yes	100	25
Yes	6	17
No	3	15

Flow Rate (Q): 40.00 US (liquid) gallon/min

Drill Fluid Density: 68.700 lb/ft3

Rheological model: Bingham-Plastic

Plastic Viscosity (PV): 25.53

Yield Point (YP): 16.49

Effective Viscosity (cP): 1202.0

Virtual Site