Generated Output

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Project Summary

General:	CHPE HDD 32
	P3
	Start Date: 12-10-2021
	End Date: 12-10-2021
Project Owner:	TDI
Project Contractor:	Kiewit
Project Consultant:	CHA/BCE
Designer:	AB
	CHA
Description:	HDD 32 10-inch DR 9

Input Summary

Start Coordinate	(0.00, 0.00, 305.13) ft
End Coordinate	(872.00, 0.00, 306.14) ft
Project Length	872.00 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

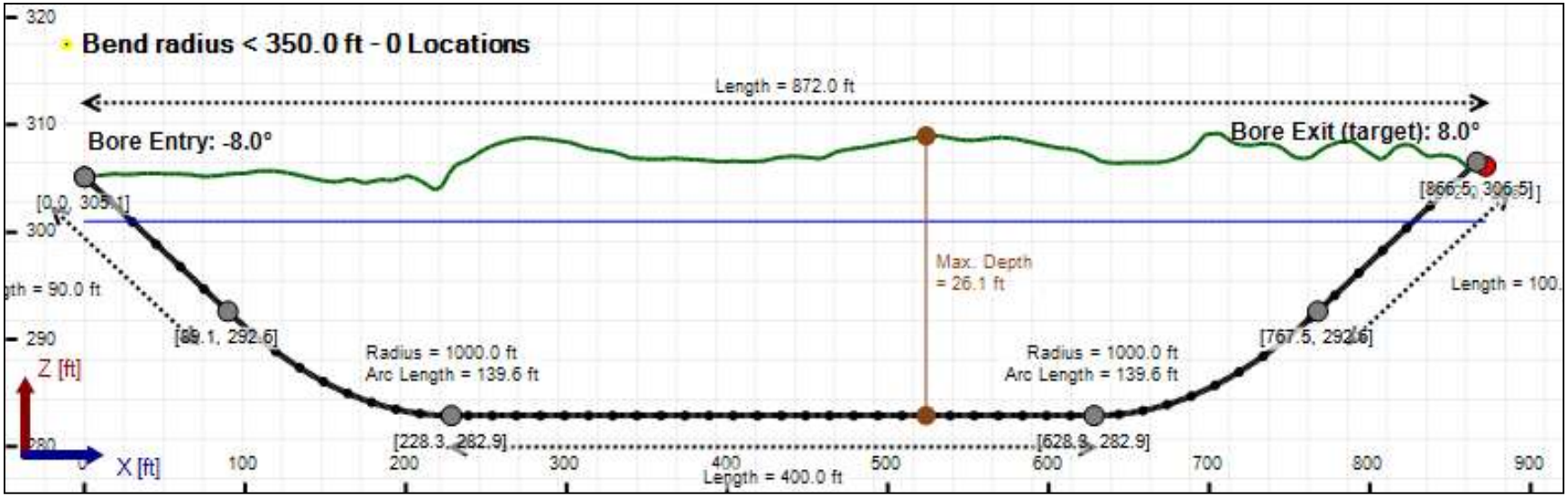
Number of Layers: 3

Soil Layer #1 USCS, Sand (S), SW
Depth: 2.00 ft
Unit Weight: 110.0000 (dry), 125.0000 (sat) [lb/ft3]
Phi: 34.00, S.M.: 145.00, Coh: 0.00 [psi]

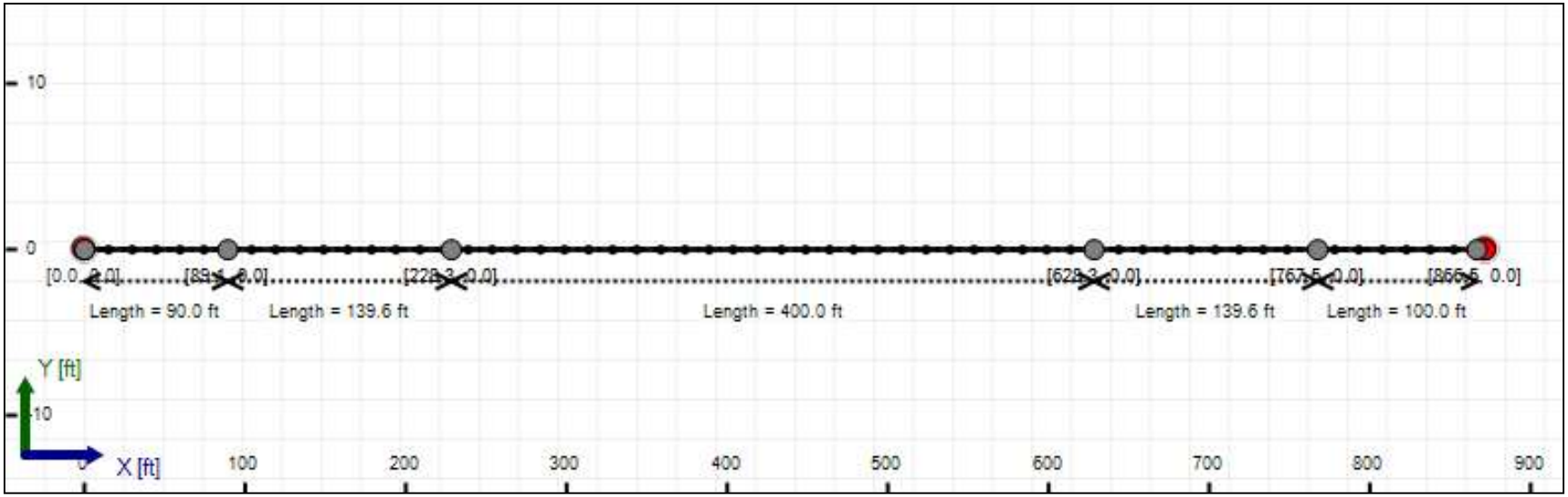
Soil Layer #2 USCS, Sand (S), SM
Depth: 13.00 ft
Unit Weight: 105.0000 (dry), 115.0000 (sat) [lb/ft3]
Phi: 30.00, S.M.: 145.00, Coh: 0.00 [psi]

Soil Layer #3 USCS, Sand (S), SM
Depth: 23.00 ft
Unit Weight: 110.0000 (dry), 125.0000 (sat) [lb/ft3]
Phi: 34.00, S.M.: 145.00, 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: 870.00 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	3.7	13.1
Water Pressure	7.9	7.9
Surface Surcharge	0.0	0.0
Internal Pressure	0.0	0.0
Net Pressure	11.6	21.0
Deflection		
Earth Load Deflection	1.017	3.576
Buoyant Deflection	0.132	0.132
Reissner Effect	0	0
Net Deflection	1.149	3.708
Compressive Stress [psi]		
Compressive Wall Stress	52.1	94.5

Installation Load Summary:

Forces/Stresses	@Maximum Force	Absolute Maximum
Pullback Force [lb]	13804.1	13804.1
Pullback Stress [psi]	385.0	385.0
Pullback Strain	6.695E-3	6.695E-3
Bending Stress [psi]	0.0	25.8
Bending Strain	0	4.479E-4
Tensile Stress [psi]	385.0	406.9
Tensile Strain	6.695E-3	7.524E-3

Net External Pressure = 17.8 [psi]

Buoyant Deflection = 0.1

Hydrokinetic Force = 567.6 lb

In-service Analysis

	Calculated	Allowable	Factor of Safety	Check
Deflection [%]	1.149	7.5	6.5	OK
Unconstrained Collapse [psi]	15.4	124.6	8.1	OK
Compressive Wall Stress [psi]	52.1	1150.0	22.1	OK

Installation Analysis

	Calculated	Allowable	Factor of Safety	Check
Deflection [%]	0.065	7.5	115.8	OK
Unconstrained Collapse [psi]	25.4	232.6	9.1	OK
Tensile Stress [psi]	406.9	1200.0	2.9	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	8.00 in	65.228 psi	67.382 psi
1	8.00 in	12.00 in	65.041 psi	67.191 psi
2	12.00 in	16.13 in	64.773 psi	66.918 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

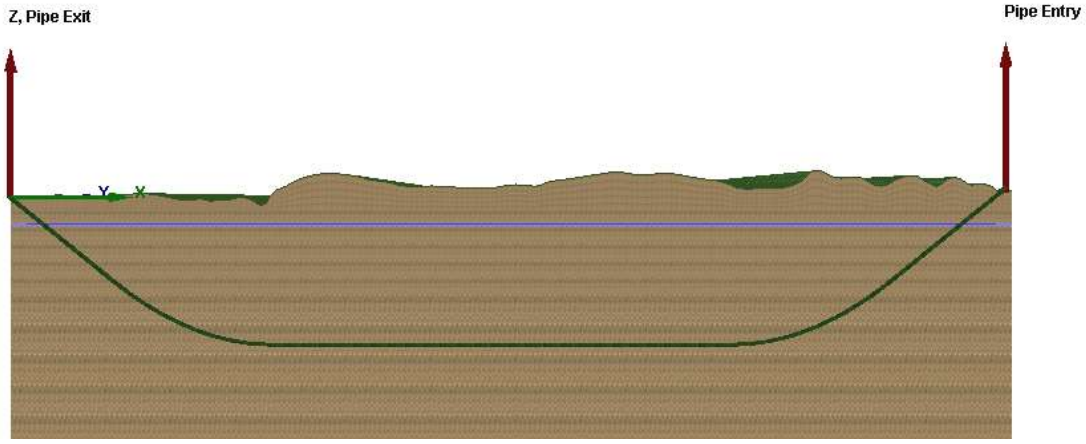
Rheological model: Bingham-Plastic

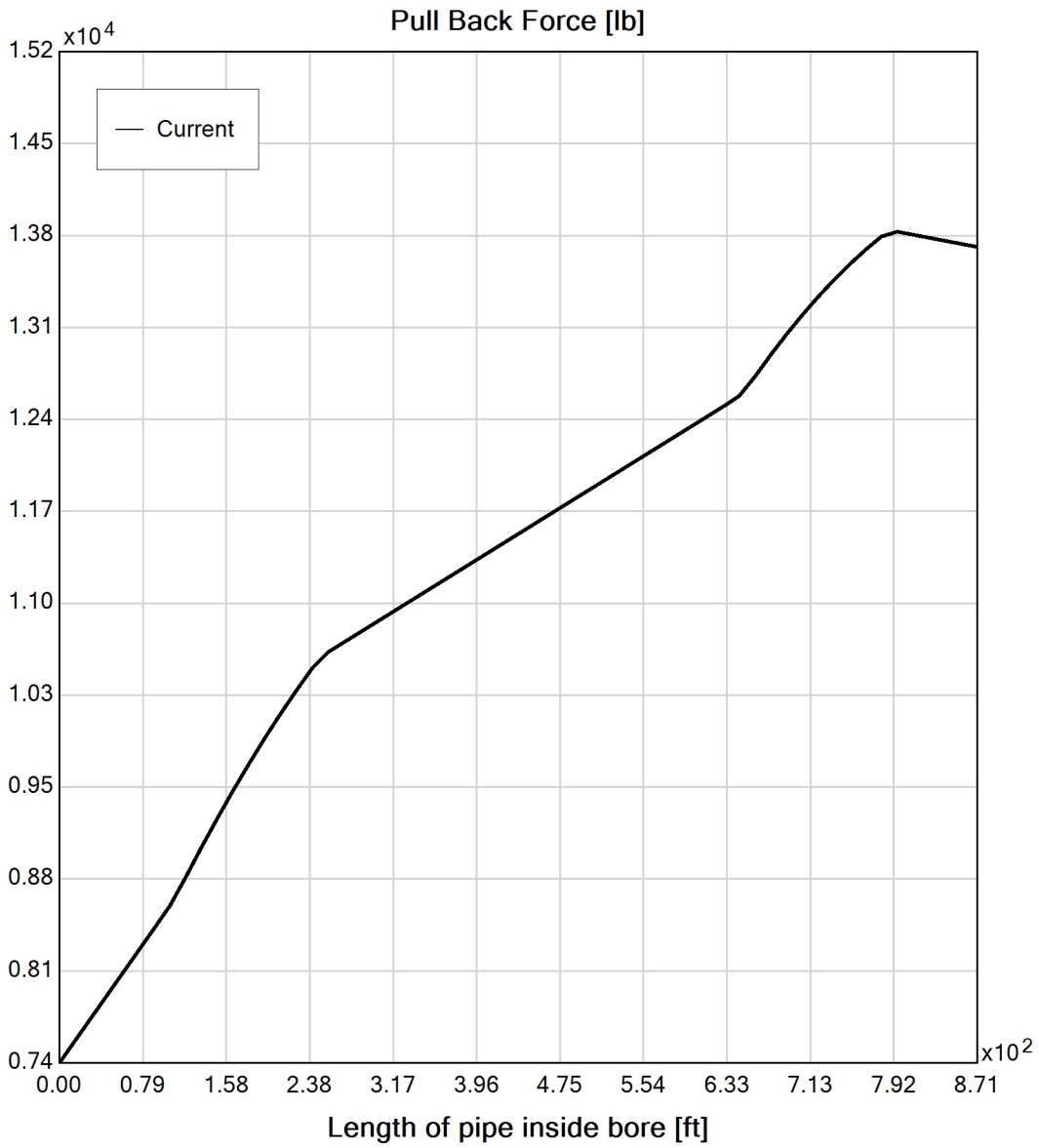
Plastic Viscosity (PV): 25.53

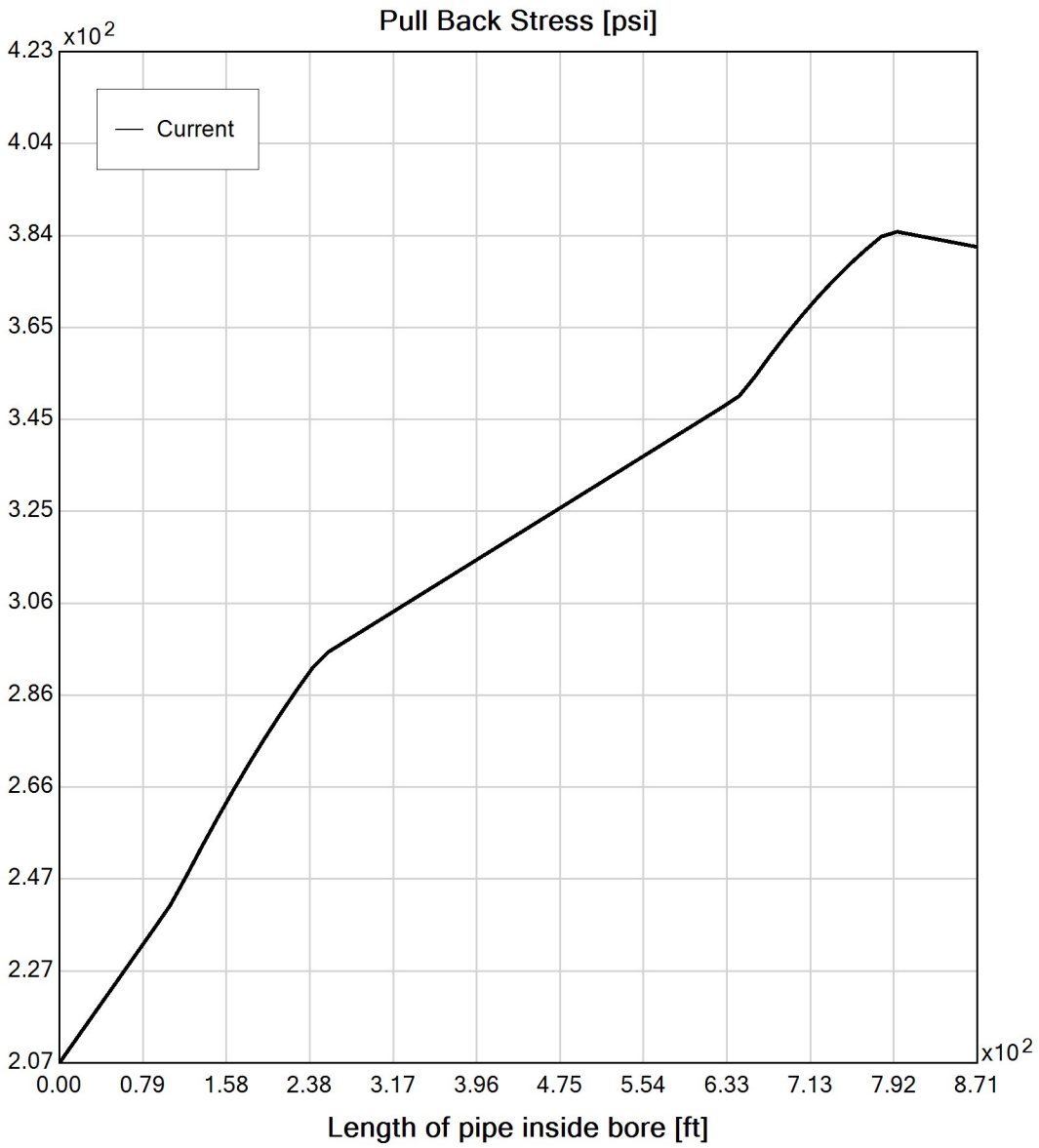
Yield Point (YP): 16.49

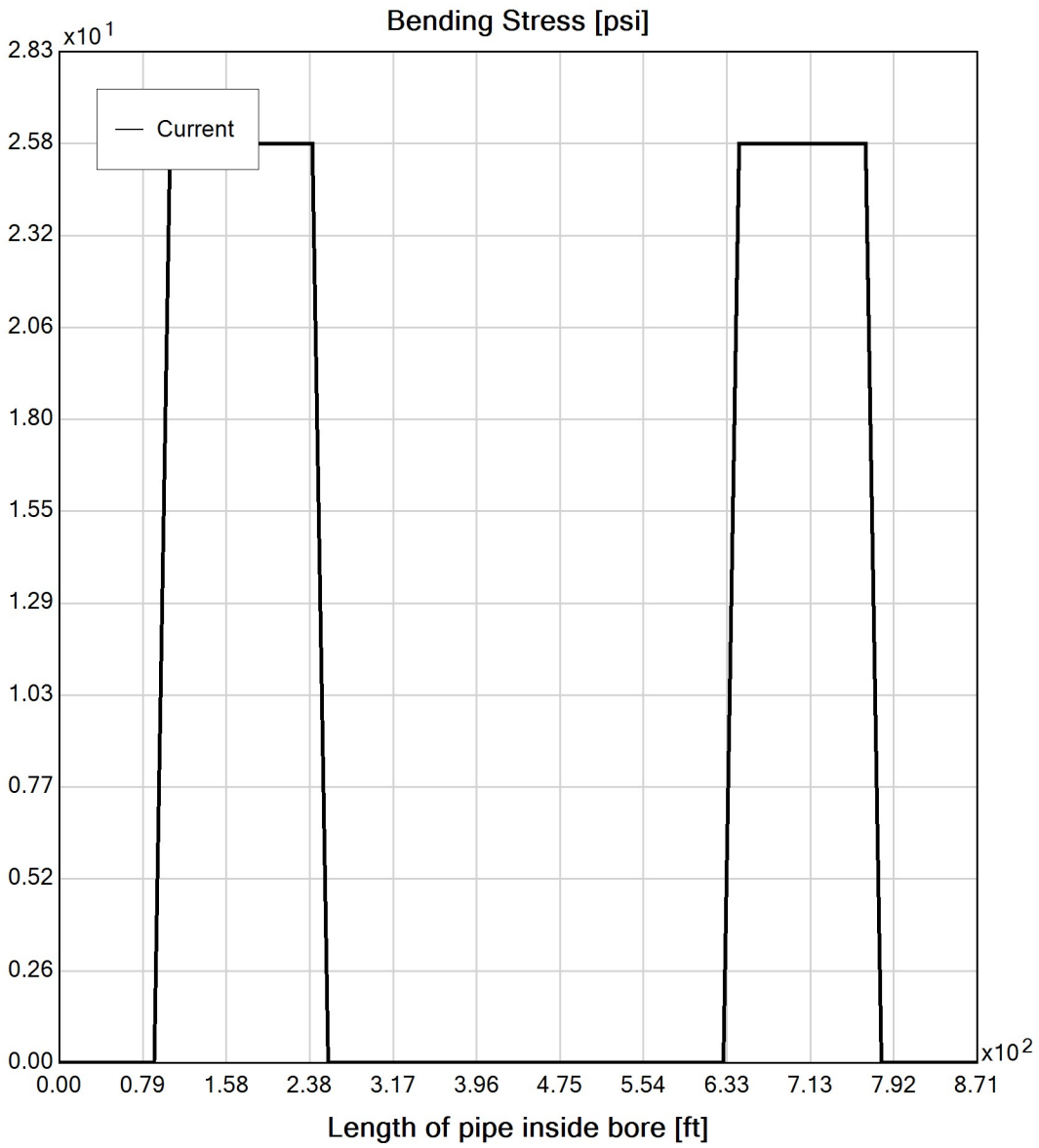
Effective Viscosity (cP): 1202.0

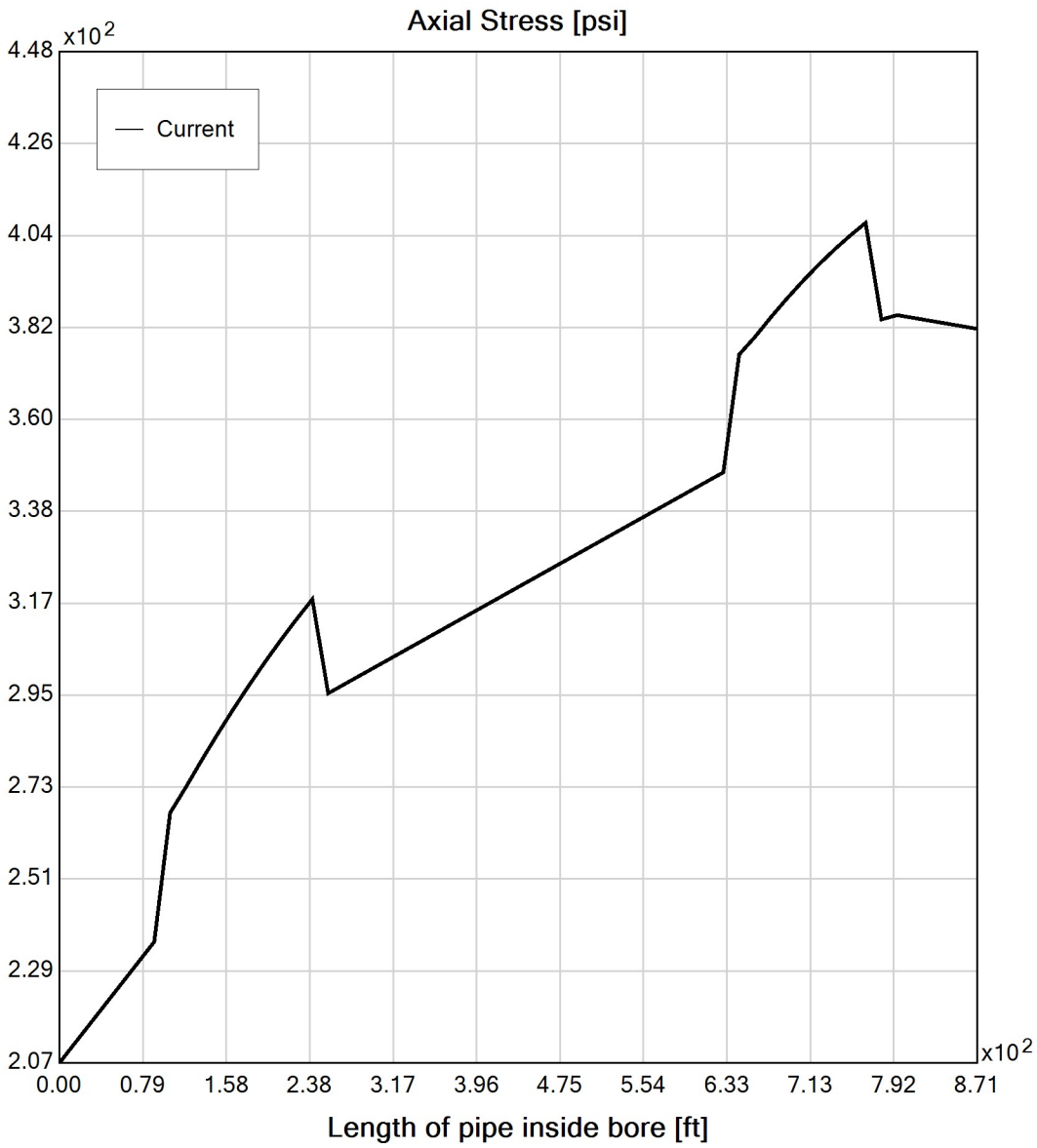
Virtual Site

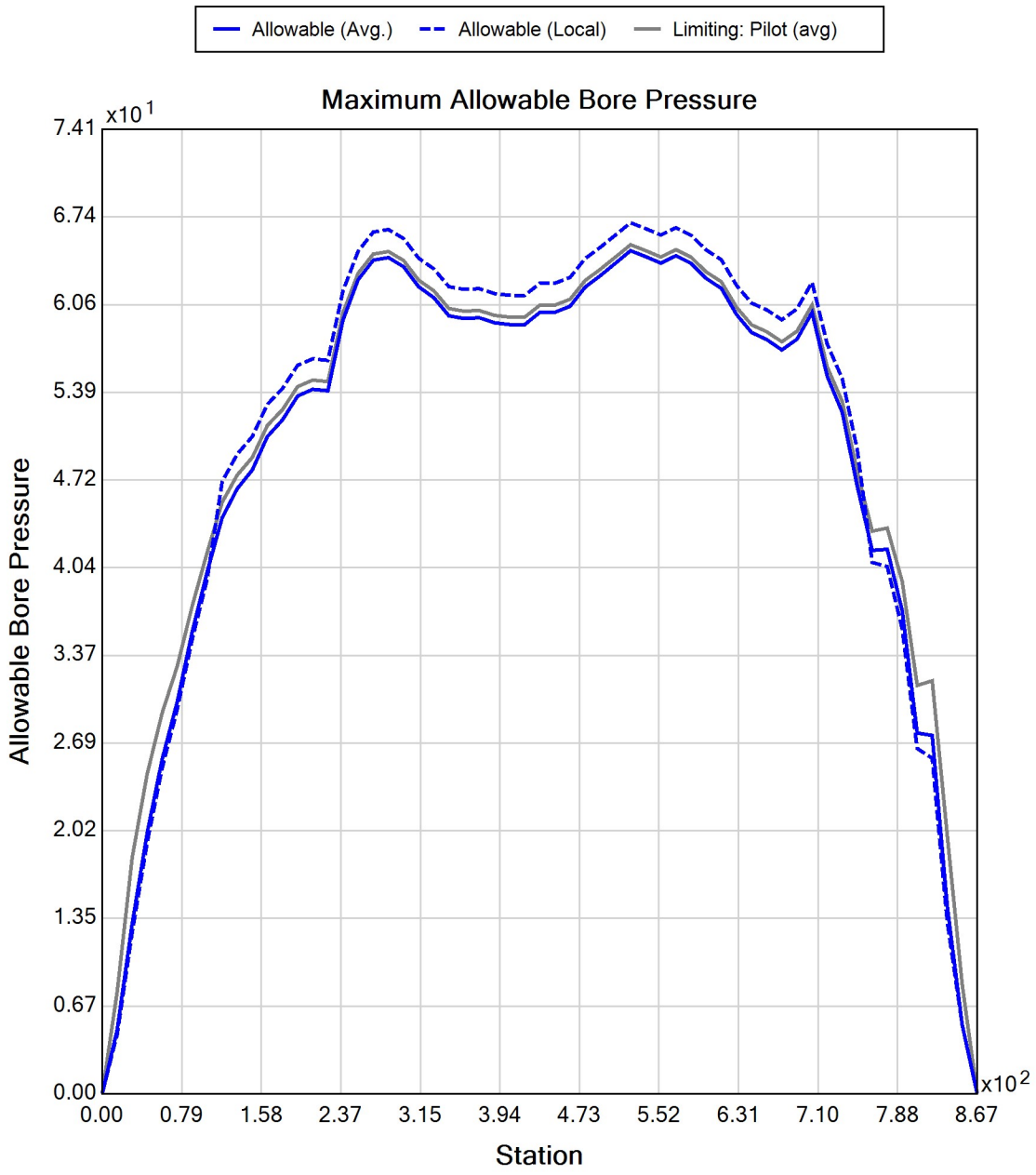


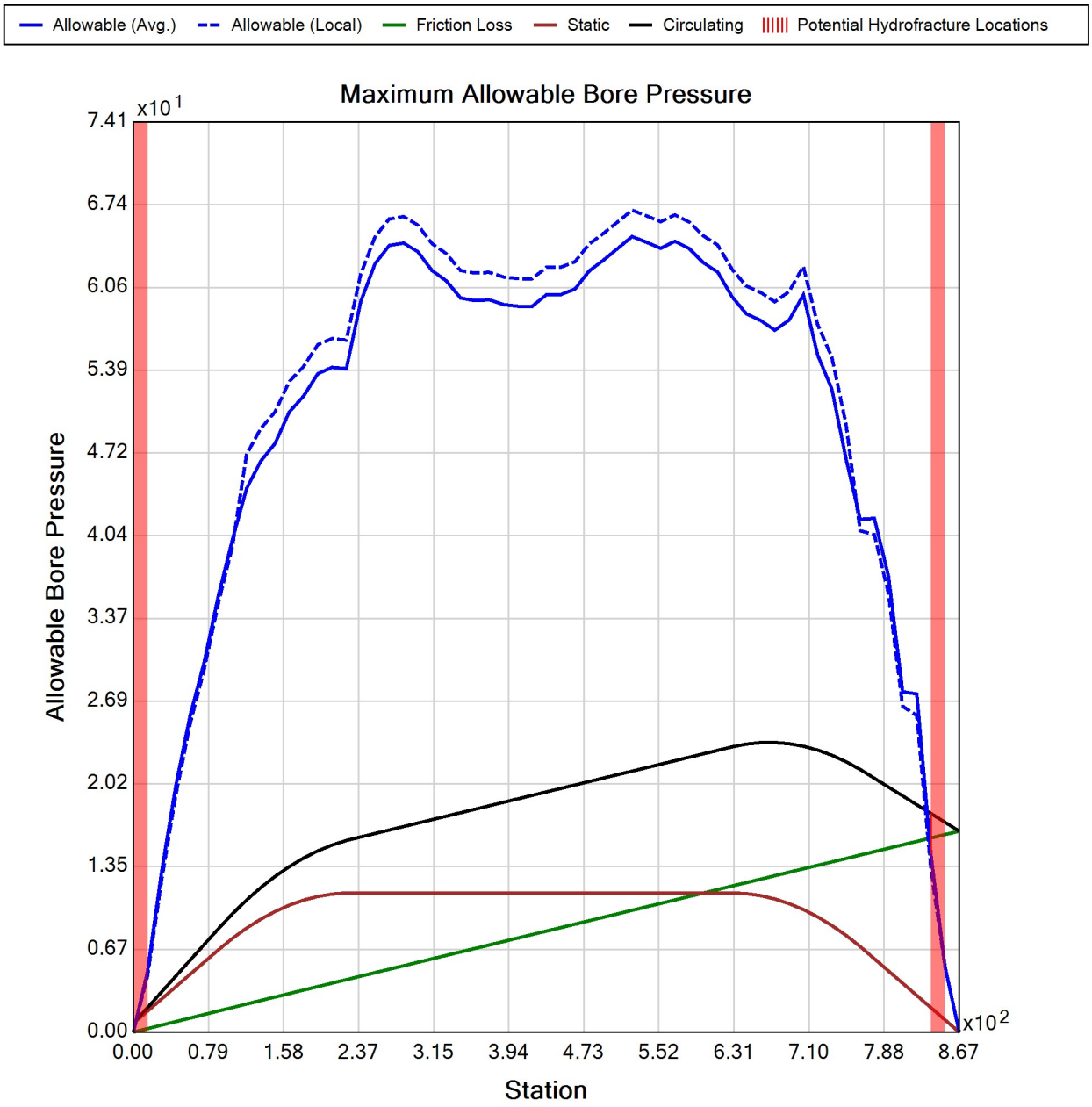












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Input Summary

Start Coordinate	(0.00, 0.00, 305.13) ft
End Coordinate	(872.00, 0.00, 306.14) ft
Project Length	872.00 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: 870.00 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	1.5	13.1
Water Pressure	7.9	7.9
Surface Surcharge	0.0	0.0
Internal Pressure	0.0	0.0
Net Pressure	9.4	21.0
Deflection		
Earth Load Deflection	0.550	3.576
Buoyant Deflection	0.029	0.029
Reissner Effect	0	0
Net Deflection	0.579	3.605
Compressive Stress [psi]		
Compressive Wall Stress	42.2	94.5

Installation Load Summary:

Forces/Stresses	@Maximum Force	Absolute Maximum
Pullback Force [lb]	783.4	783.4
Pullback Stress [psi]	447.6	447.6
Pullback Strain	7.784E-3	7.784E-3
Bending Stress [psi]	0.0	5.7
Bending Strain	0	9.896E-5
Tensile Stress [psi]	447.6	449.4
Tensile Strain	7.784E-3	7.915E-3

Net External Pressure = 17.8 [psi]

Buoyant Deflection = 0.0

Hydrokinetic Force = 137.3 lb

In-service Analysis

	Calculated	Allowable	Factor of Safety	Check
Deflection [%]	0.579	7.5	13.0	OK
Unconstrained Collapse [psi]	15.4	132.7	8.6	OK
Compressive Wall Stress [psi]	42.2	1150.0	27.3	OK

Installation Analysis

	Calculated	Allowable	Factor of Safety	Check
Deflection [%]	0.014	7.5	524.3	OK
Unconstrained Collapse [psi]	25.4	230.8	9.1	OK
Tensile Stress [psi]	449.4	1200.0	2.7	OK

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Project Summary

General:	CHPE HDD 32A
	P3
	Start Date: 12-10-2021
	End Date: 12-10-2021
Project Owner:	TDI
Project Contractor:	Kiewit
Project Consultant:	CHA/BCE
Designer:	AB
	CHA
Description:	HDD 32A 10-inch DR 9

Input Summary

Start Coordinate	(0.00, 0.00, 305.50) ft
End Coordinate	(633.00, 0.00, 301.50) ft
Project Length	633.00 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

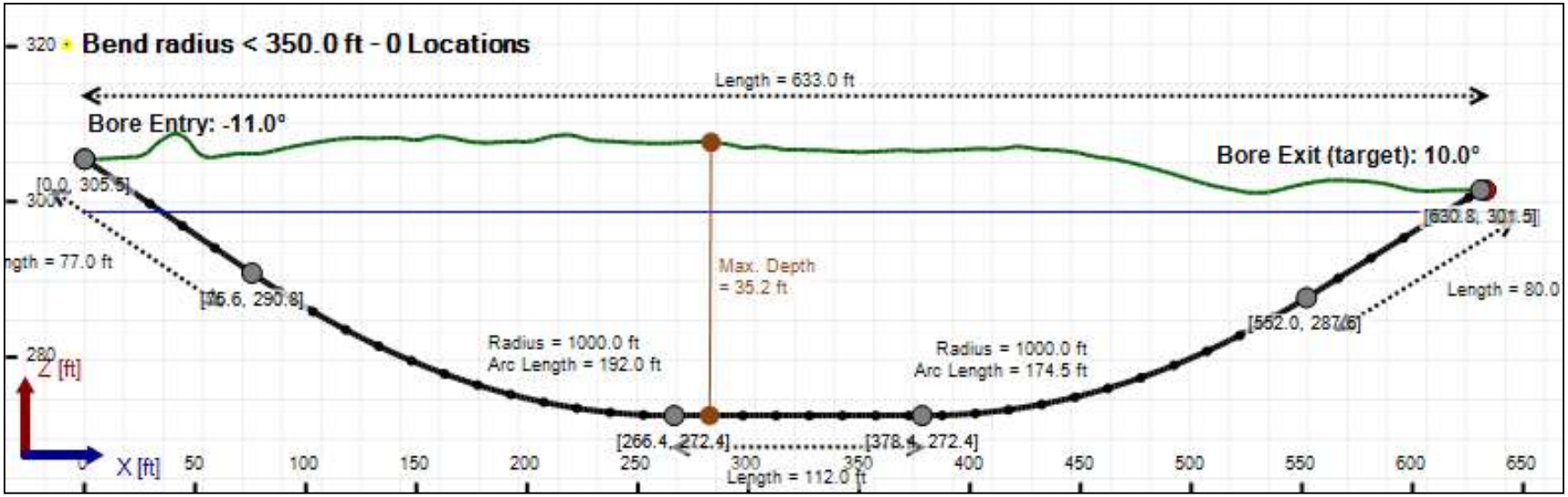
Soil Summary

Number of Layers: 2

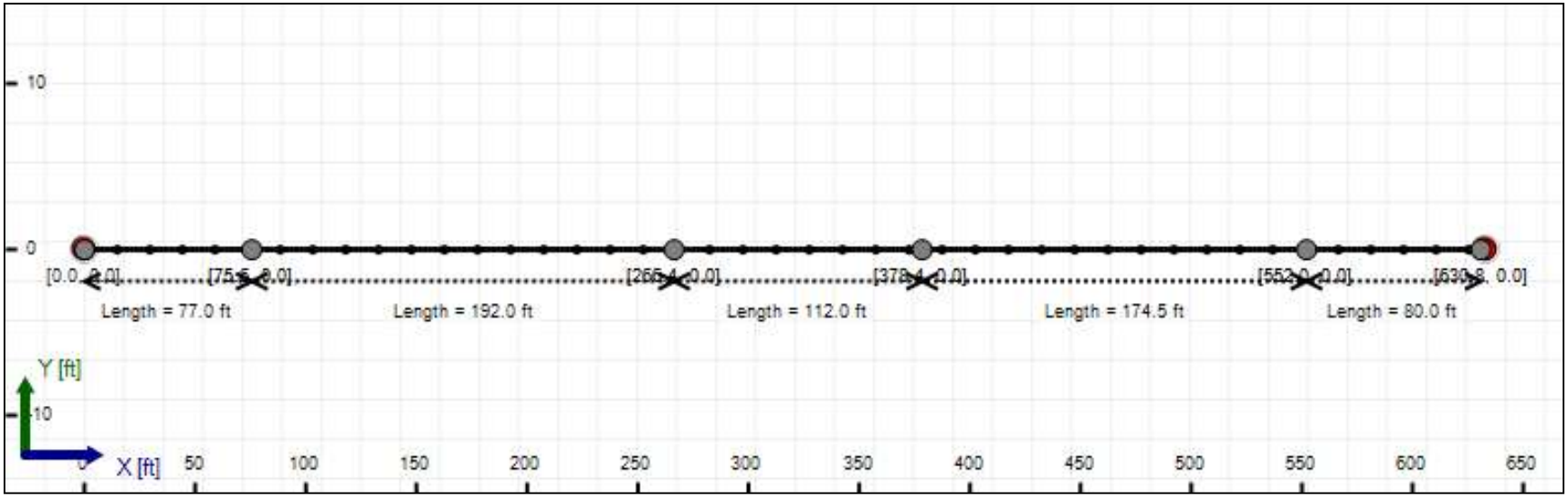
Soil Layer #1 USCS, Sand (S), SP
Depth: 2.70 ft
Unit Weight: 110.0000 (dry), 125.0000 (sat) [lb/ft3]
Phi: 34.00, S.M.: 145.00, Coh: 0.00 [psi]

Soil Layer #2 USCS, Sand (S), SM
Depth: 35.00 ft
Unit Weight: 105.0000 (dry), 115.0000 (sat) [lb/ft3]
Phi: 30.00, S.M.: 145.00, 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: 645.00 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	3.5	16.3
Water Pressure	11.4	11.4
Surface Surcharge	0.0	0.0
Internal Pressure	0.0	0.0
Net Pressure	14.8	27.7
Deflection		
Earth Load Deflection	1.122	4.499
Buoyant Deflection	0.132	0.132
Reissner Effect	0	0
Net Deflection	1.254	4.631
Compressive Stress [psi]		
Compressive Wall Stress	66.8	124.6

Installation Load Summary:

Forces/Stresses	@Maximum Force	Absolute Maximum
Pullback Force [lb]	10914.1	10914.1
Pullback Stress [psi]	304.4	304.4
Pullback Strain	5.294E-3	5.294E-3
Bending Stress [psi]	0.0	25.8
Bending Strain	0	4.479E-4
Tensile Stress [psi]	304.4	329.2
Tensile Strain	5.294E-3	6.173E-3

Net External Pressure = 19.3 [psi]

Buoyant Deflection = 0.1

Hydrokinetic Force = 567.6 lb

In-service Analysis

	Calculated	Allowable	Factor of Safety	Check
Deflection [%]	1.254	7.5	6.0	OK
Unconstrained Collapse [psi]	21.5	125.4	5.8	OK
Compressive Wall Stress [psi]	66.8	1150.0	17.2	OK

Installation Analysis

	Calculated	Allowable	Factor of Safety	Check
Deflection [%]	0.065	7.5	115.8	OK
Unconstrained Collapse [psi]	31.4	237.5	7.6	OK
Tensile Stress [psi]	329.2	1200.0	3.6	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	76.085 psi	75.295 psi
1	8.00 in	12.00 in	75.990 psi	75.200 psi
2	12.00 in	16.13 in	75.851 psi	75.063 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

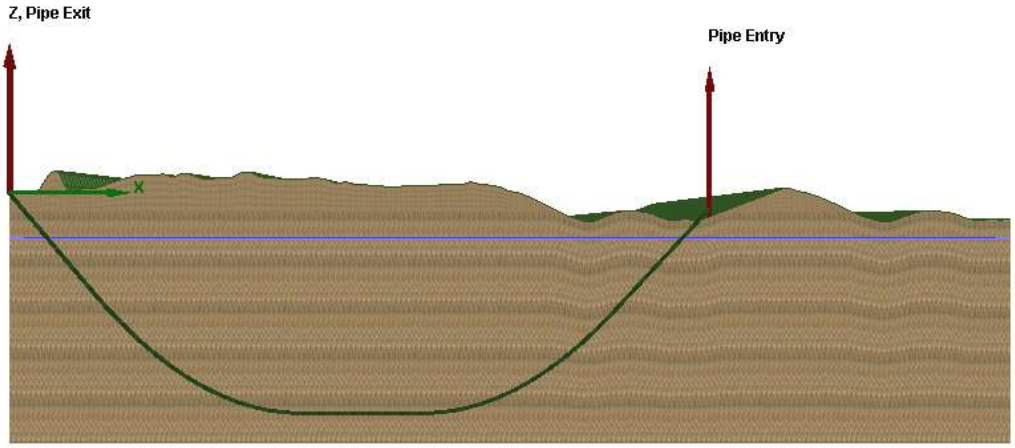
Rheological model: Bingham-Plastic

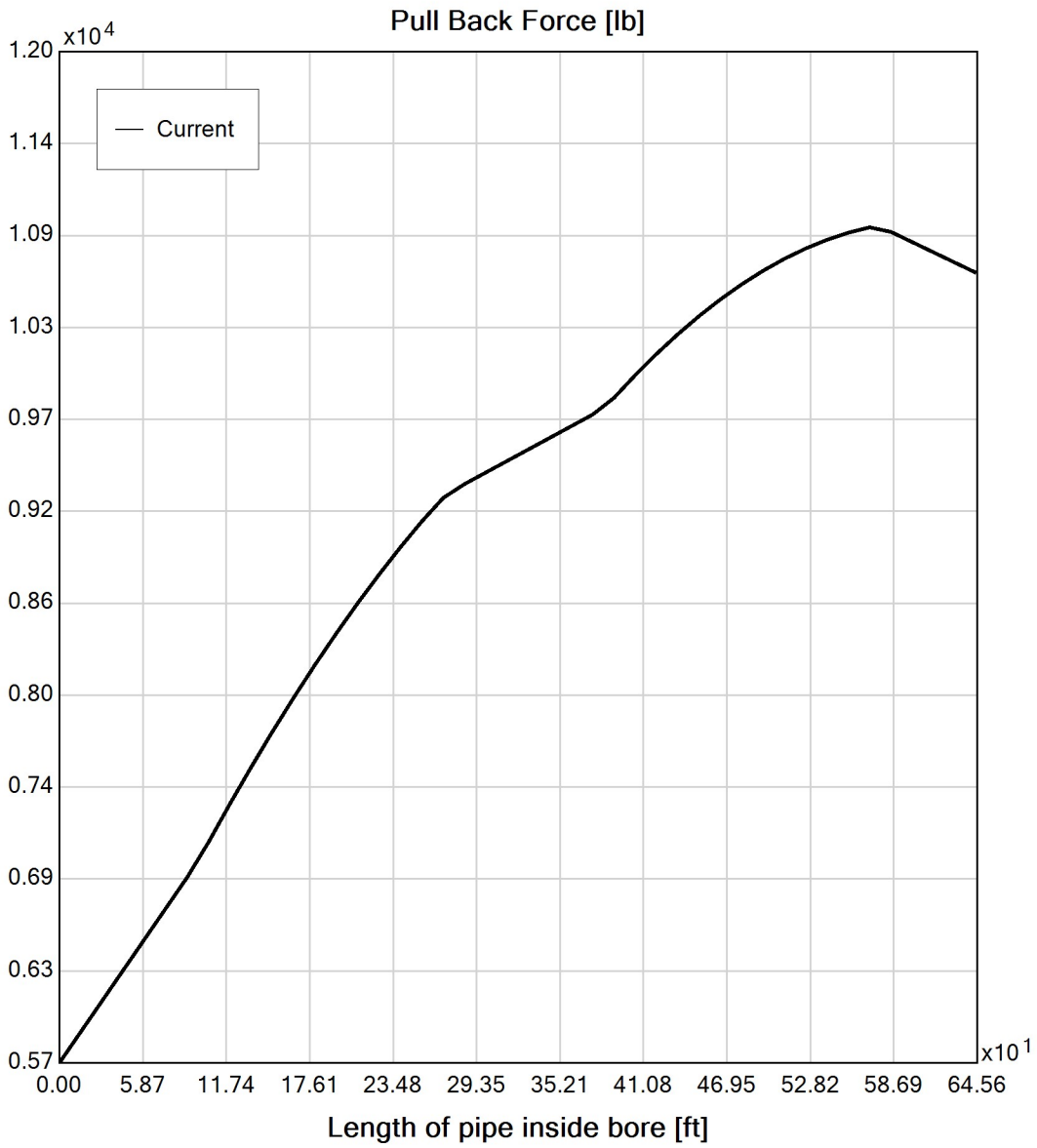
Plastic Viscosity (PV): 25.53

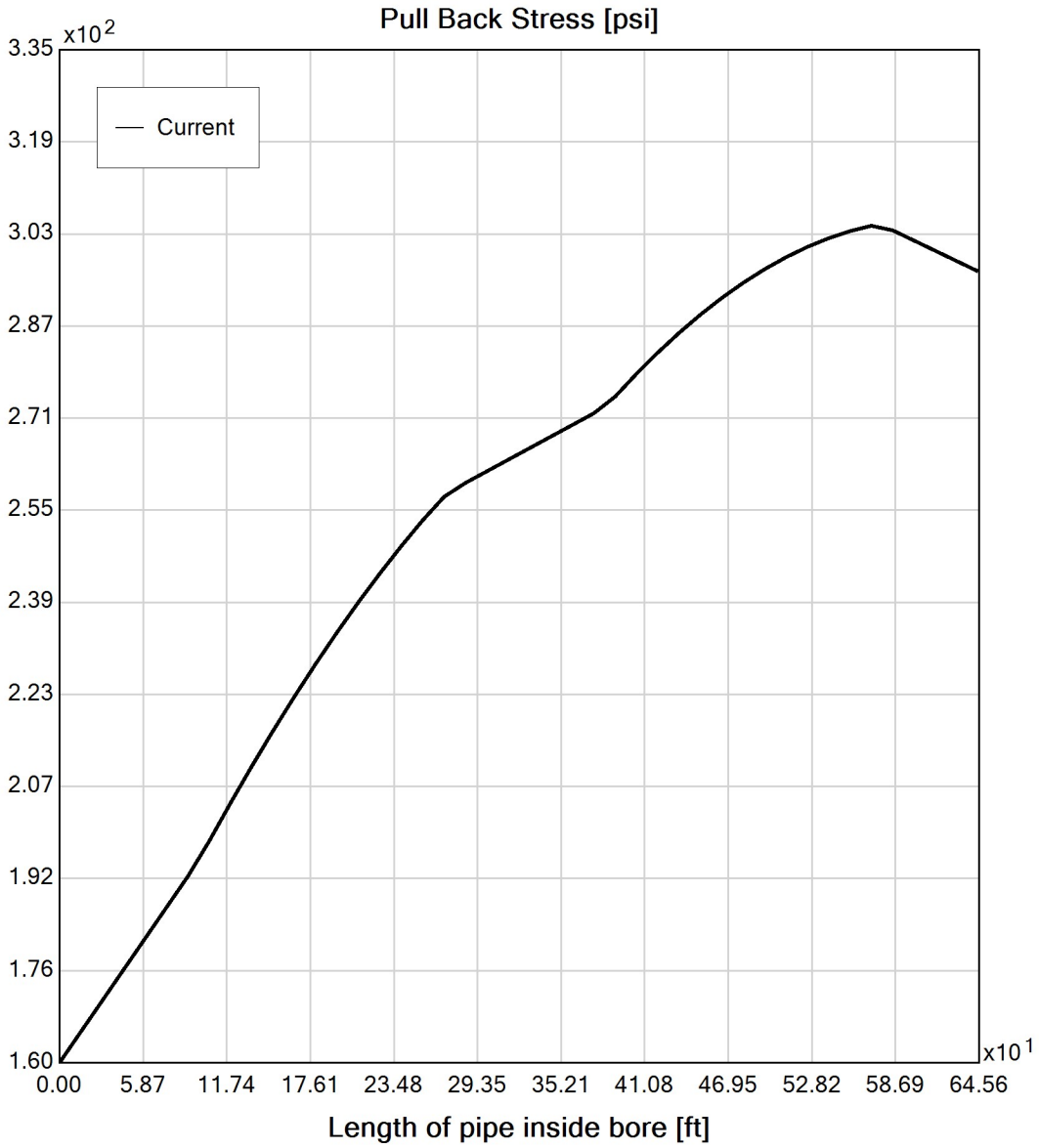
Yield Point (YP): 16.49

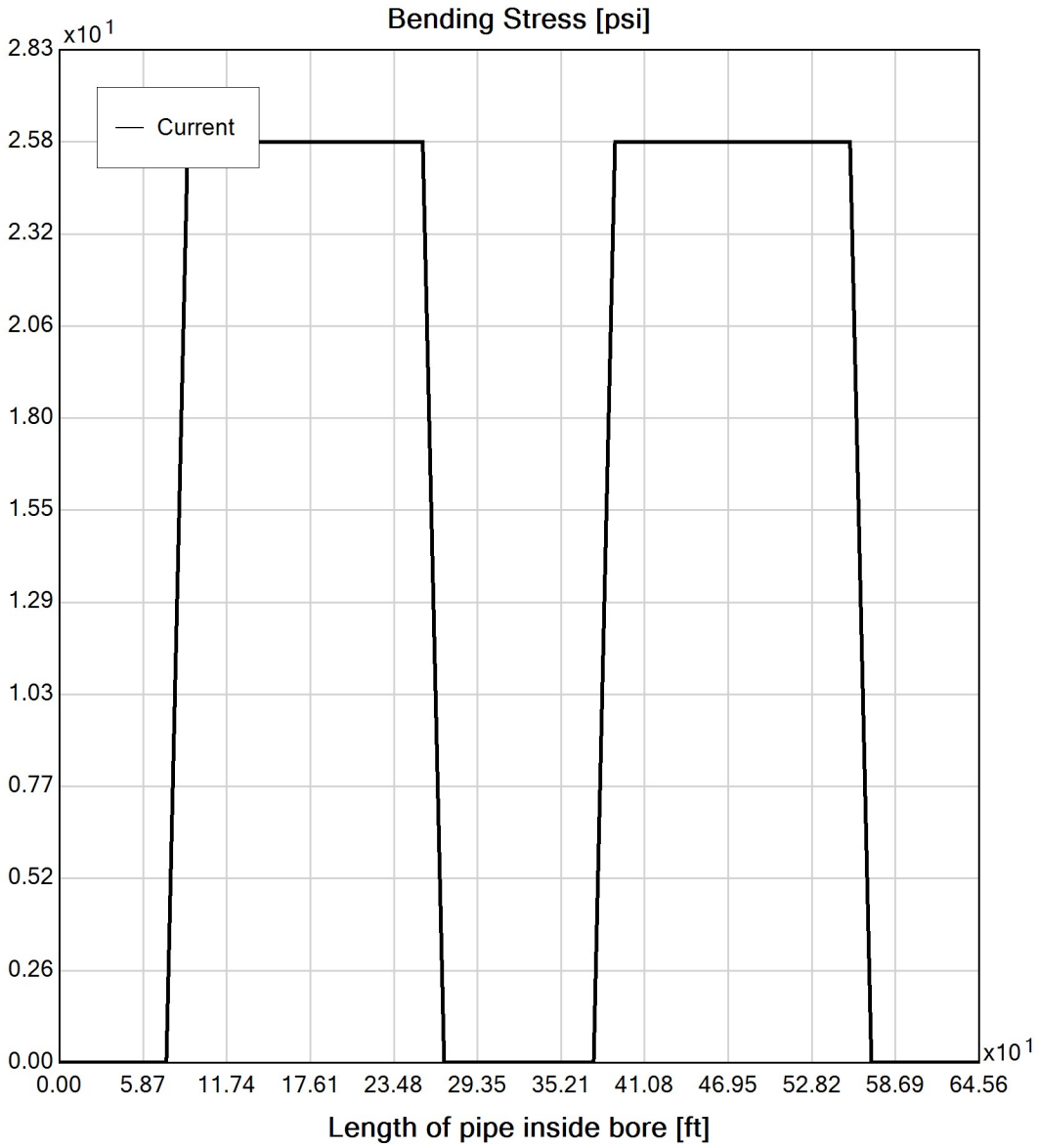
Effective Viscosity (cP): 1202.0

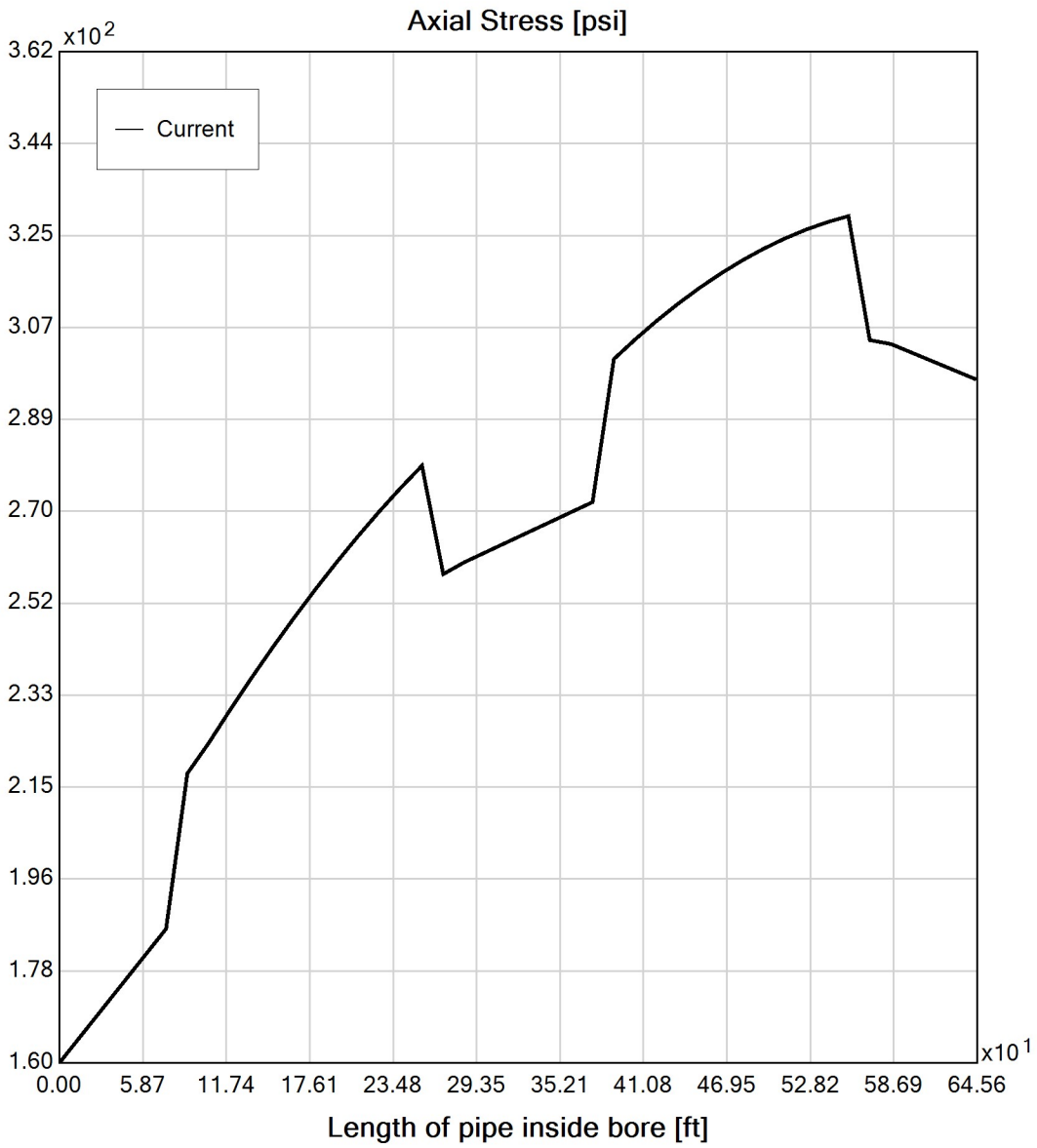
Virtual Site

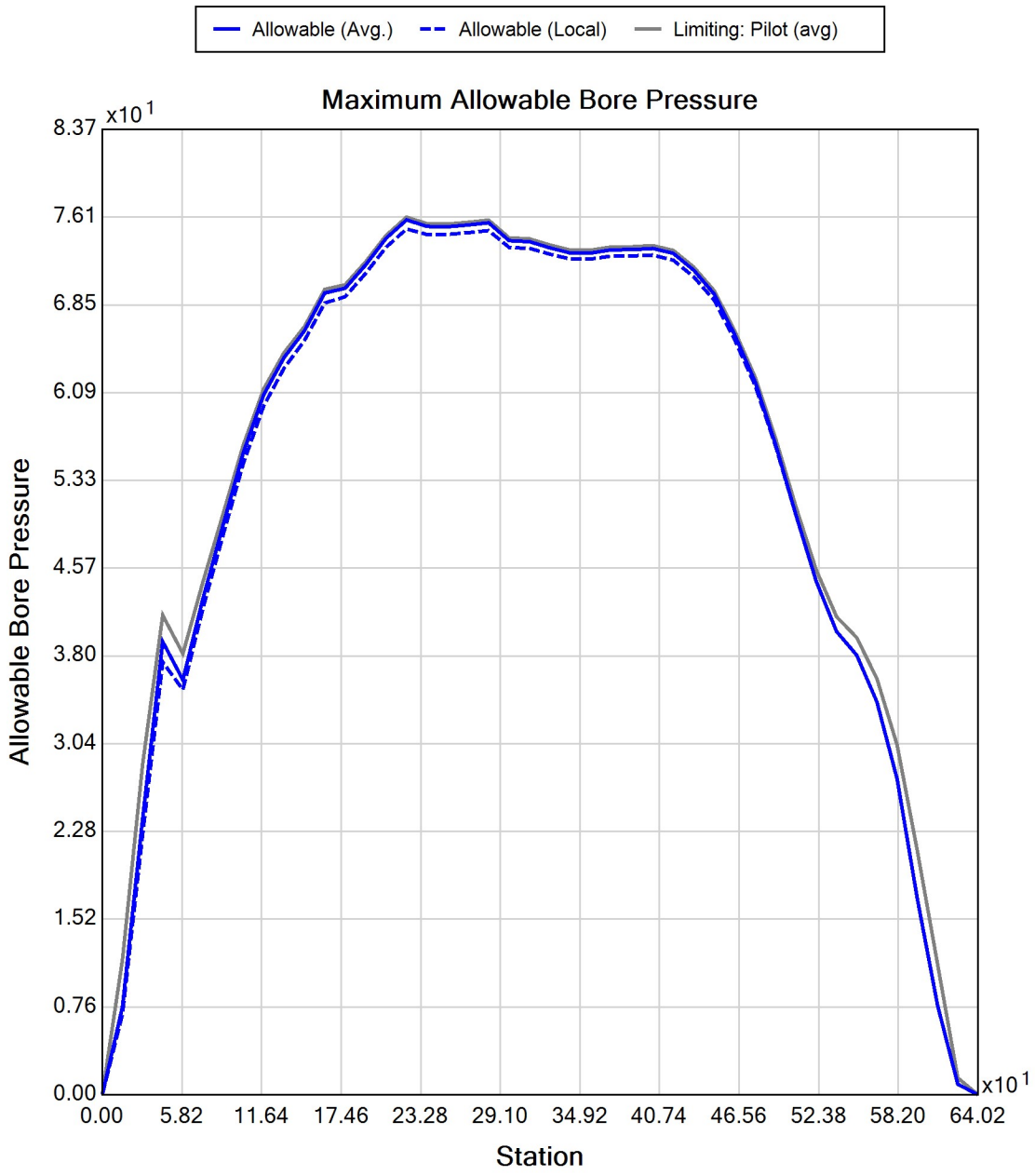


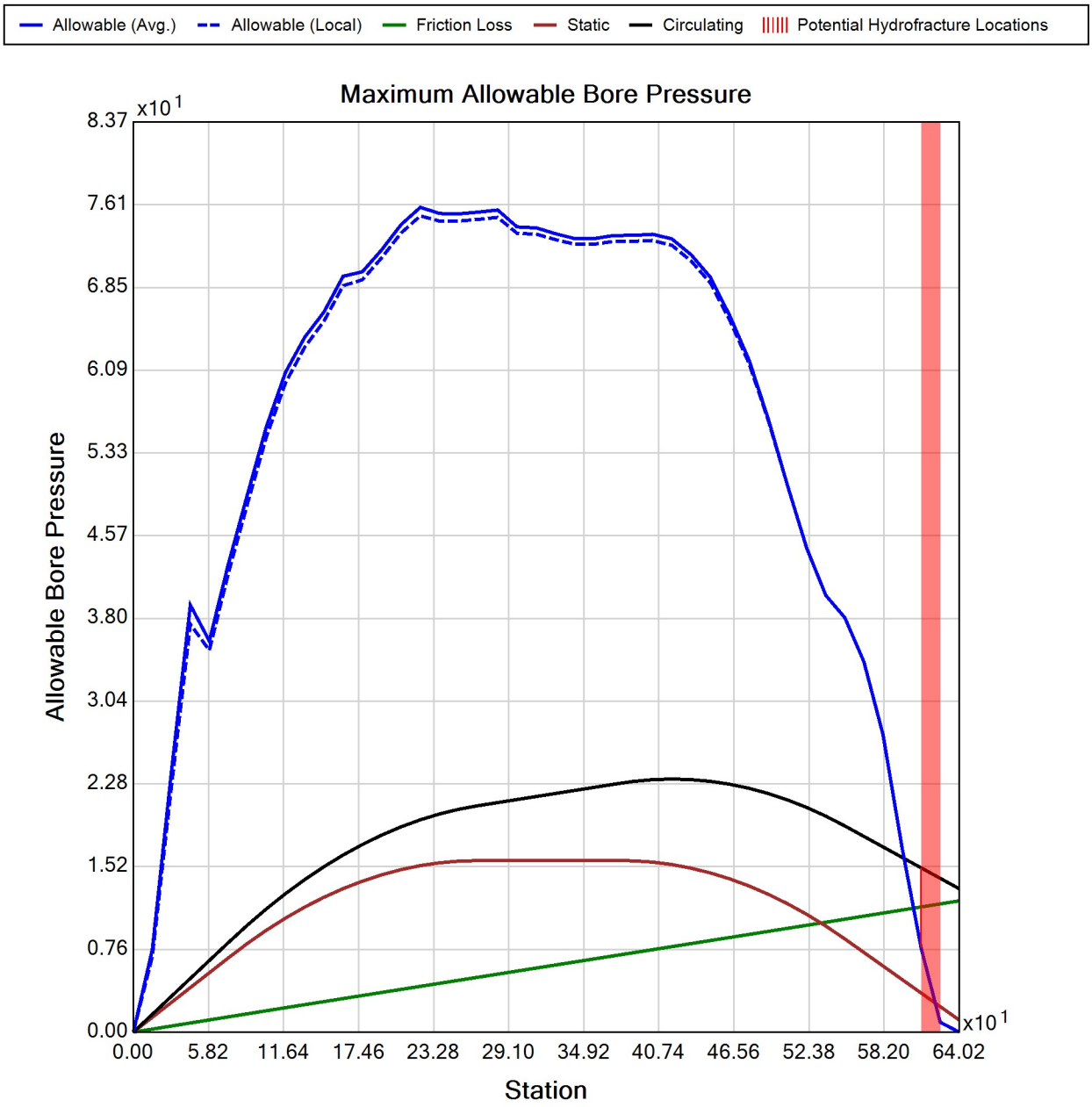












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Input Summary

Start Coordinate	(0.00, 0.00, 305.50) ft
End Coordinate	(633.00, 0.00, 301.50) ft
Project Length	633.00 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: 645.00 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	1.4	16.3
Water Pressure	11.4	11.4
Surface Surcharge	0.0	0.0
Internal Pressure	0.0	0.0
Net Pressure	12.8	27.7
Deflection		
Earth Load Deflection	0.555	4.499
Buoyant Deflection	0.029	0.029
Reissner Effect	0	0
Net Deflection	0.584	4.529
Compressive Stress [psi]		
Compressive Wall Stress	57.4	124.6

Installation Load Summary:

Forces/Stresses	@Maximum Force	Absolute Maximum
Pullback Force [lb]	642.3	642.3
Pullback Stress [psi]	367.0	367.0
Pullback Strain	6.383E-3	6.383E-3
Bending Stress [psi]	0.0	5.7
Bending Strain	0	9.896E-5
Tensile Stress [psi]	367.0	371.8
Tensile Strain	6.383E-3	6.564E-3

Net External Pressure = 19.3 [psi]

Buoyant Deflection = 0.0

Hydrokinetic Force = 137.3 lb

In-service Analysis

	Calculated	Allowable	Factor of Safety	Check
Deflection [%]	0.584	7.5	12.8	OK
Unconstrained Collapse [psi]	21.5	133.2	6.2	OK
Compressive Wall Stress [psi]	57.4	1150.0	20.0	OK

Installation Analysis

	Calculated	Allowable	Factor of Safety	Check
Deflection [%]	0.014	7.5	524.3	OK
Unconstrained Collapse [psi]	31.4	235.8	7.5	OK
Tensile Stress [psi]	371.8	1200.0	3.2	OK

Generated Output

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Project Summary

General:	CHPE HDD 33 Conduit 1
	P3
	Start Date: 11-04-2022
	End Date: 11-04-2022
Project Owner:	TDI
Project Contractor:	Kiewit
Project Consultant:	CHA/BCE
Designer:	MB
	BCE
Description:	HDD 33 Conduit 1 10-inch DR 9

Input Summary

Start Coordinate	(0.00, 0.00, 318.00) ft
End Coordinate	(1843.00, 0.00, 313.00) ft
Project Length	1843.00 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

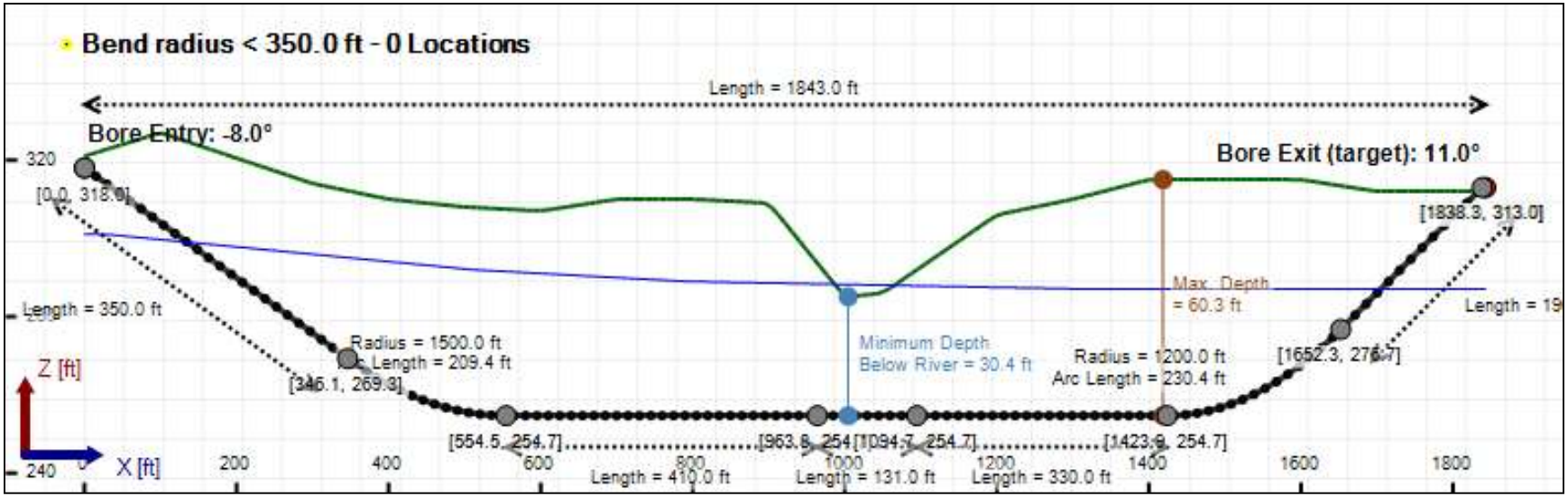
Soil Layer #1 USCS, Gravel (G), GM
From Assistant
Unit Weight: 120.0000 (dry), 140.0000 (sat) [lb/ft3]
Phi: 37.00, S.M.: 1000.00, Coh: 0.00 [psi]

Soil Layer #2 USCS, Sand (S), SP
From Assistant
Unit Weight: 110.0000 (dry), 125.0000 (sat) [lb/ft3]
Phi: 34.00, S.M.: 500.00, Coh: 0.00 [psi]

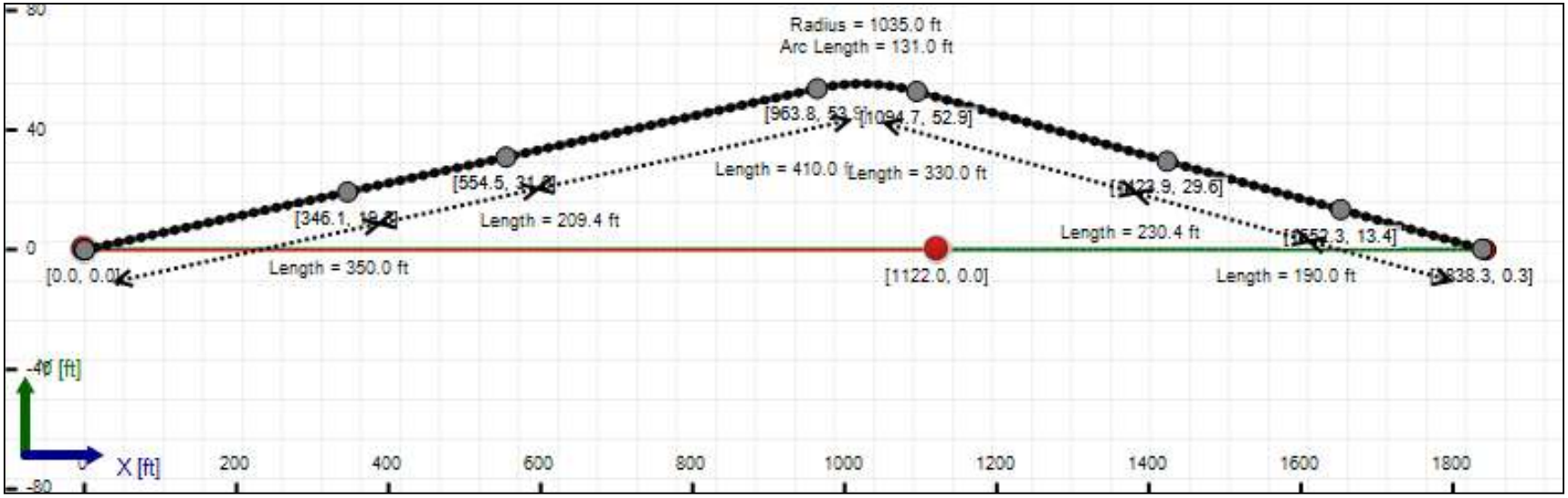
Soil Layer #3 USCS, Sand (S), SP
From Assistant
Unit Weight: 105.0000 (dry), 115.0000 (sat) [lb/ft3]
Phi: 30.00, S.M.: 200.00, Coh: 0.00 [psi]

Soil Layer #4 USCS, Sand (S), SP
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: 1860.00 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	3.9	35.1
Water Pressure	16.0	14.0
Surface Surcharge	0.0	0.0
Internal Pressure	0.0	0.0
Net Pressure	19.9	49.1
Deflection		
Earth Load Deflection	1.681	9.554
Buoyant Deflection	0.132	0.132
Reissner Effect	0	0
Net Deflection	1.813	9.686
Compressive Stress [psi]		
Compressive Wall Stress	89.4	220.9

Installation Load Summary:

Forces/Stresses	@Maximum Force	Absolute Maximum
Pullback Force [lb]	30370.6	30370.6
Pullback Stress [psi]	847.0	847.0
Pullback Strain	1.473E-2	1.473E-2
Bending Stress [psi]	0.0	24.9
Bending Strain	0	4.328E-4
Tensile Stress [psi]	847.0	860.2
Tensile Strain	1.473E-2	1.526E-2

Net External Pressure = 39.9 [psi]

Buoyant Deflection = 0.1

Hydrokinetic Force = 567.6 lb

In-service Analysis

	Calculated	Allowable	Factor of Safety	Check
Deflection [%]	1.813	7.5	4.1	OK
Unconstrained Collapse [psi]	41.2	122.3	3.0	OK
Compressive Wall Stress [psi]	89.4	1150.0	12.9	OK

Installation Analysis

	Calculated	Allowable	Factor of Safety	Check
Deflection [%]	0.065	7.5	115.8	OK
Unconstrained Collapse [psi]	51.1	201.8	4.0	OK
Tensile Stress [psi]	860.2	1200.0	1.4	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	178.654 psi	188.618 psi
1	8.00 in	12.00 in	178.539 psi	188.481 psi
2	12.00 in	16.13 in	178.371 psi	188.283 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

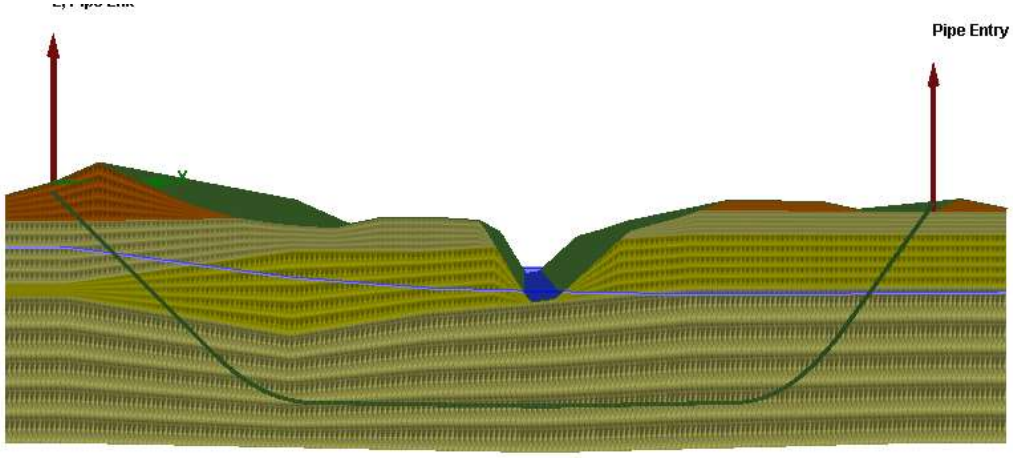
Rheological model: Power-Law

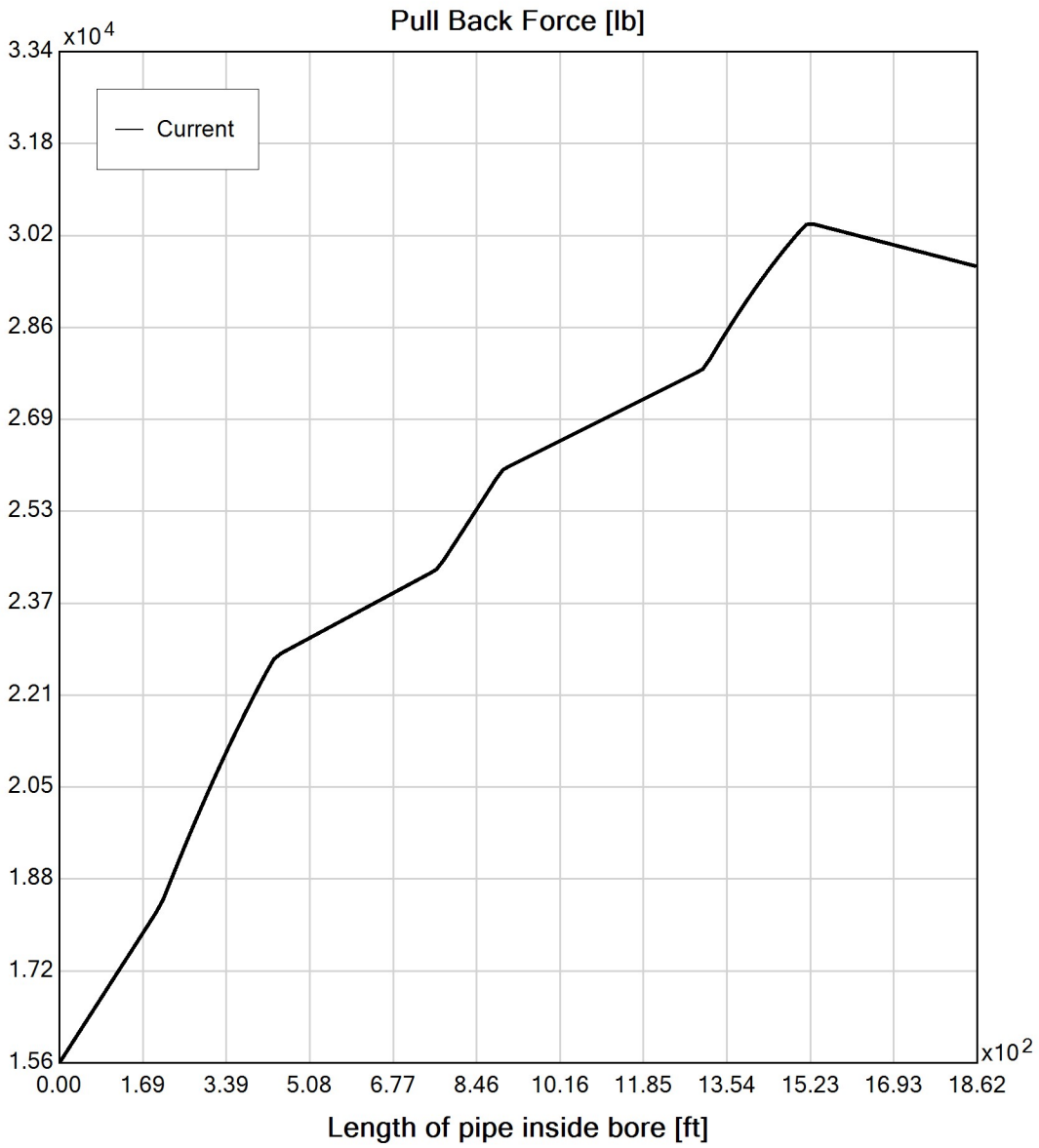
Fluid Consistency Index (K): 63.17

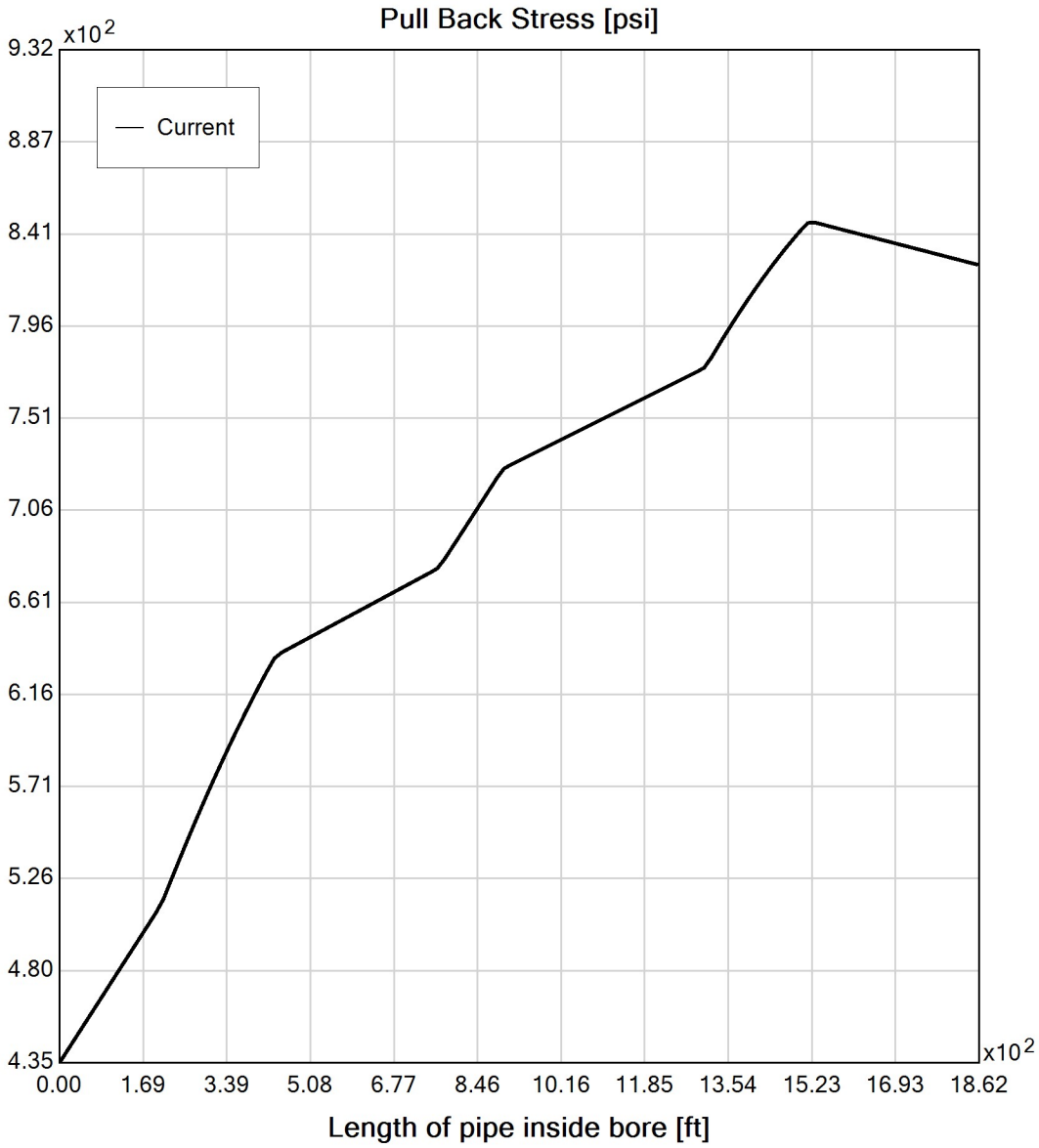
Power Law Exponent (n): 0.14

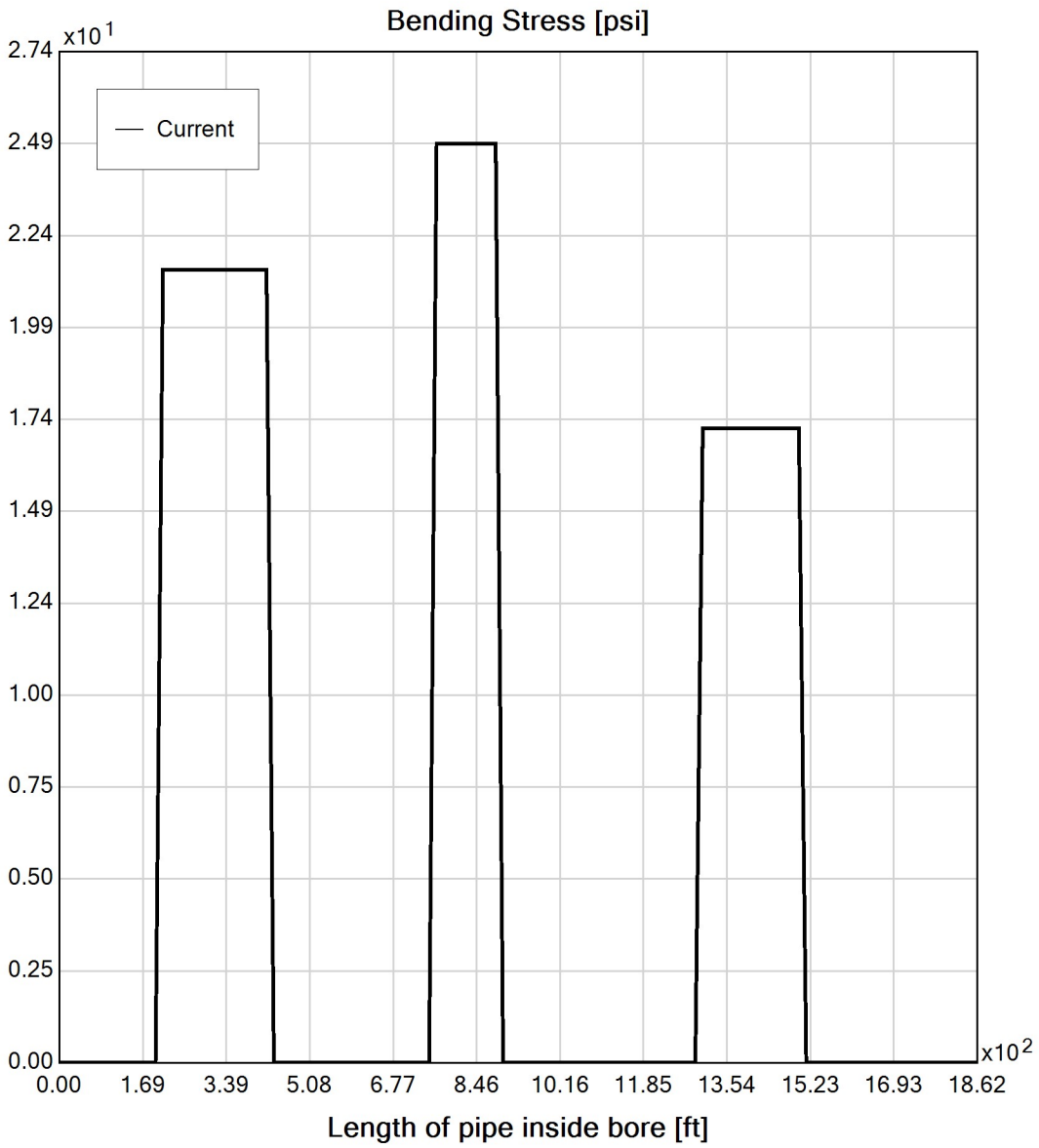
Effective Viscosity (cP): 859.3

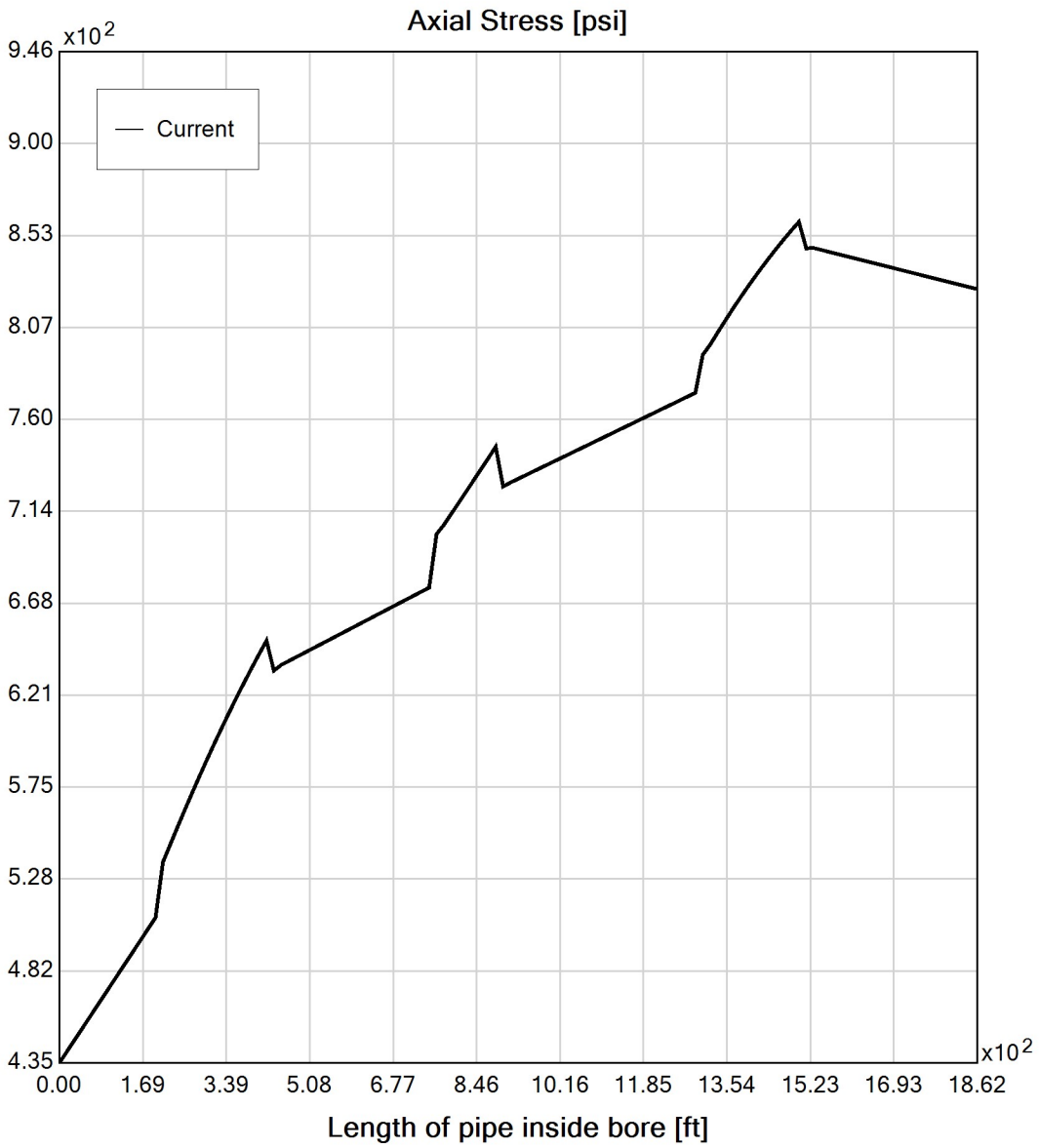
Virtual Site

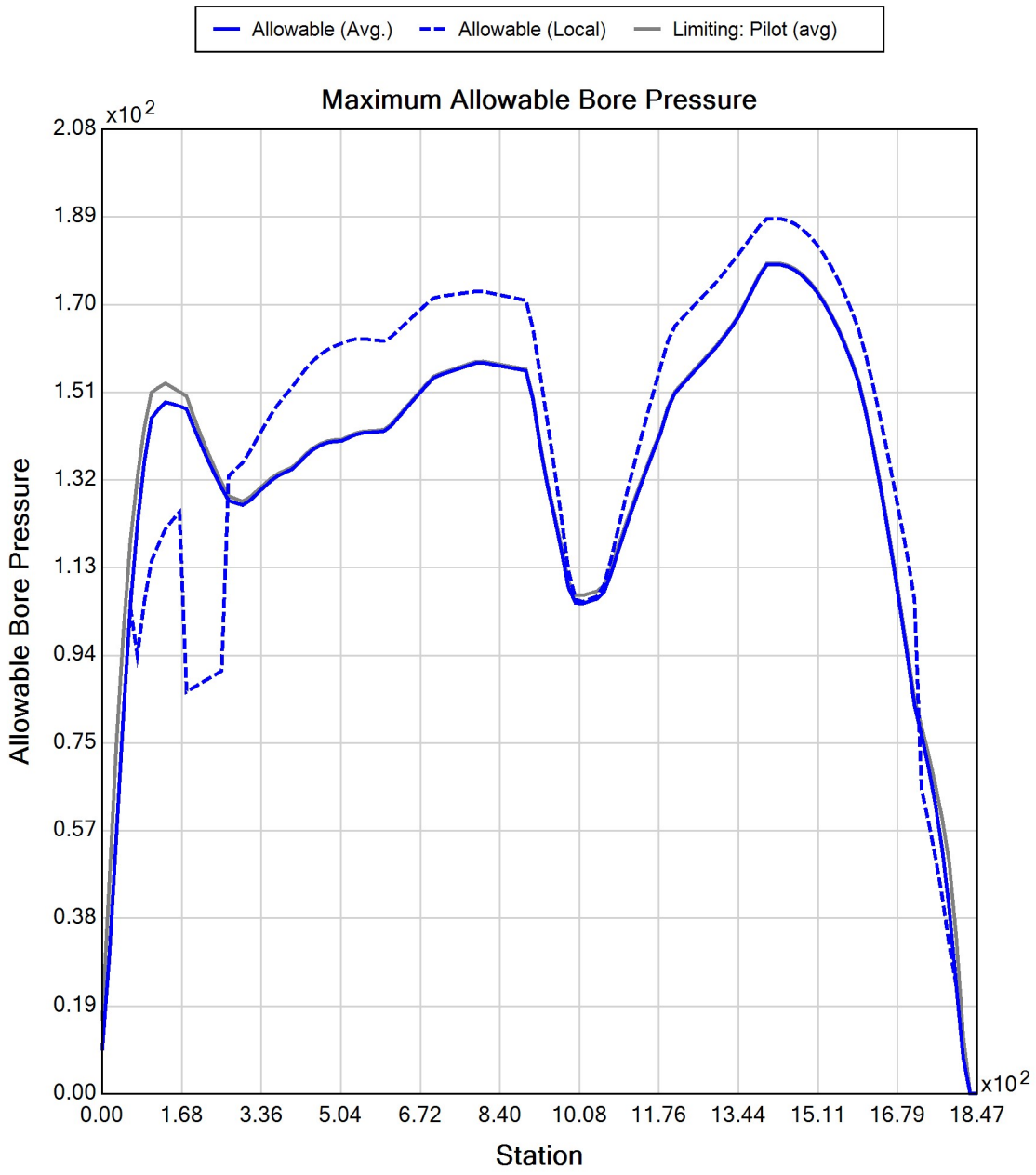


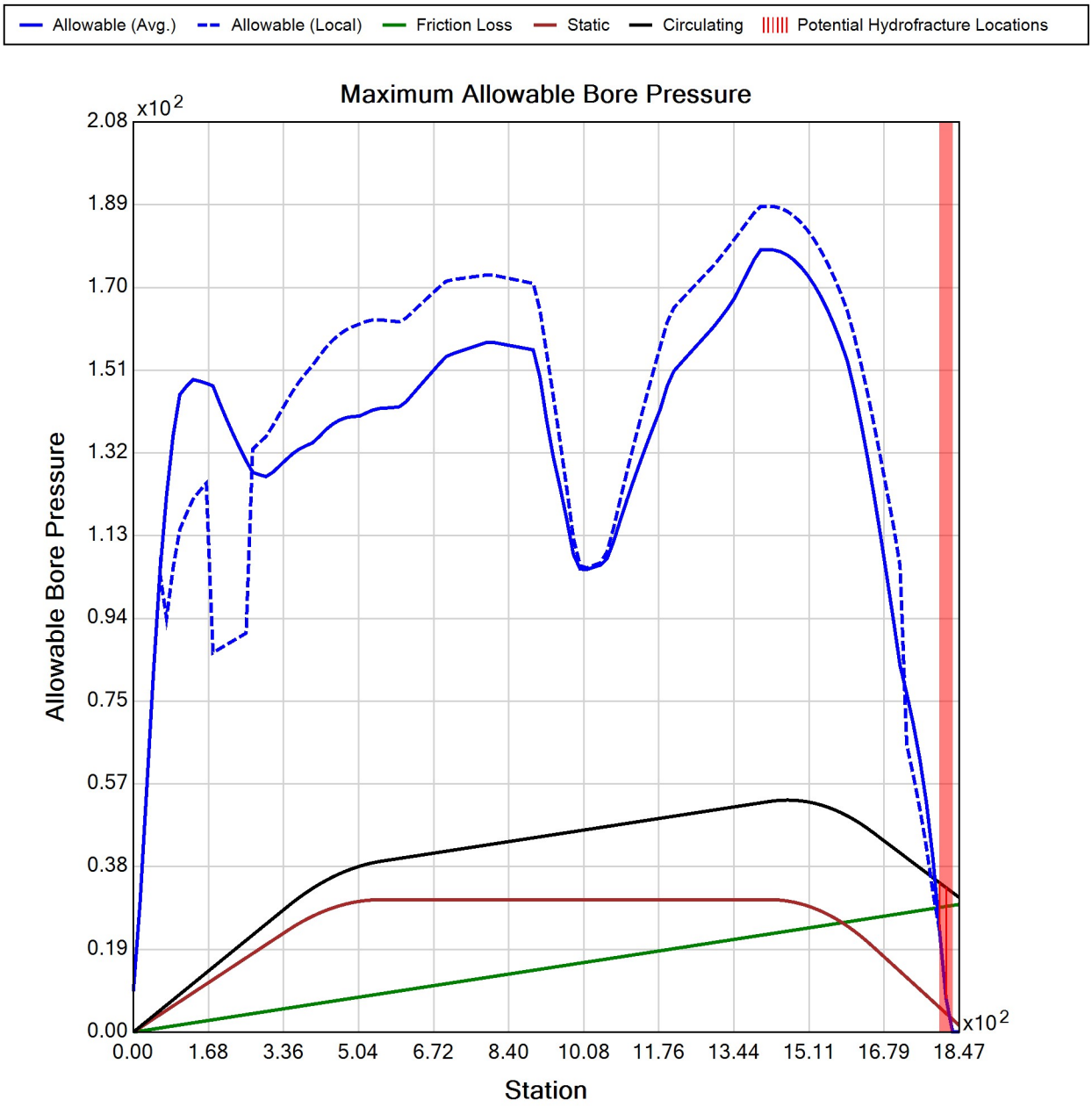












Generated Output

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Input Summary

Start Coordinate	(0.00, 0.00, 318.00) ft
End Coordinate	(1843.00, 0.00, 313.00) ft
Project Length	1843.00 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: 1860.00 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	1.5	35.1
Water Pressure	16.0	14.0
Surface Surcharge	0.0	0.0
Internal Pressure	0.0	0.0
Net Pressure	17.5	49.1
Deflection		
Earth Load Deflection	0.718	9.554
Buoyant Deflection	0.029	0.029
Reissner Effect	0	0
Net Deflection	0.747	9.583
Compressive Stress [psi]		
Compressive Wall Stress	78.9	220.9

Installation Load Summary:

Forces/Stresses	@Maximum Force	Absolute Maximum
Pullback Force [lb]	1592.0	1592.0
Pullback Stress [psi]	909.6	909.6
Pullback Strain	1.582E-2	1.582E-2
Bending Stress [psi]	0.0	5.5
Bending Strain	0	9.561E-5
Tensile Stress [psi]	909.6	909.6
Tensile Strain	1.582E-2	1.588E-2

Net External Pressure = 39.9 [psi]

Buoyant Deflection = 0.0

Hydrokinetic Force = 137.3 lb

In-service Analysis

	Calculated	Allowable	Factor of Safety	Check
Deflection [%]	0.747	7.5	10.0	OK
Unconstrained Collapse [psi]	41.2	131.9	3.2	OK
Compressive Wall Stress [psi]	78.9	1150.0	14.6	OK

Installation Analysis

	Calculated	Allowable	Factor of Safety	Check
Deflection [%]	0.014	7.5	524.3	OK
Unconstrained Collapse [psi]	51.1	198.8	3.9	OK
Tensile Stress [psi]	909.6	1200.0	1.3	OK

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Project Summary

General:	CHPE HDD 33 Conduit 2
	P3
	Start Date: 11-04-2022
	End Date: 11-04-2022
Project Owner:	TDI
Project Contractor:	Kiewit
Project Consultant:	CHA/BCE
Designer:	MB
	BCE
Description:	HDD 33 Conduit 2 10-inch DR 9

Input Summary

Start Coordinate	(0.00, 0.00, 318.00) ft
End Coordinate	(1843.00, 0.00, 313.00) ft
Project Length	1843.00 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, Gravel (G), GM
From Assistant
Unit Weight: 120.0000 (dry), 140.0000 (sat) [lb/ft3]
Phi: 37.00, S.M.: 1000.00, Coh: 0.00 [psi]

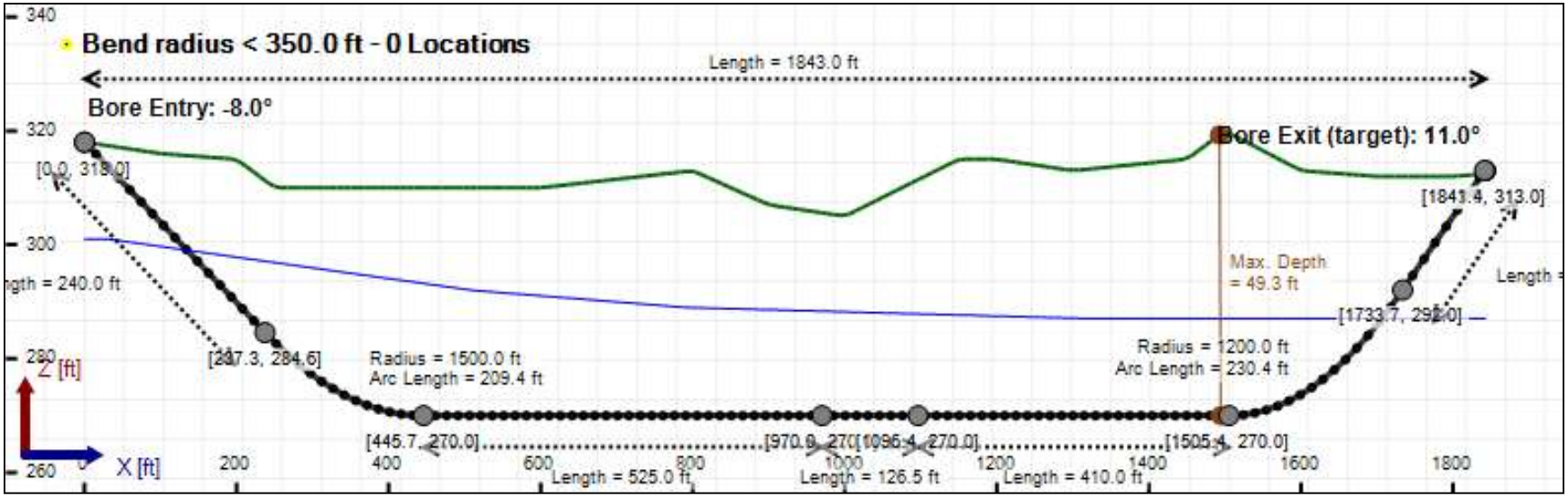
Soil Layer #2 USCS, Sand (S), SP
From Assistant
Unit Weight: 1.0000 (dry), 15.0000 (sat) [lb/ft3]
Phi: 34.00, S.M.: 500.00, Coh: 0.00 [psi]

Soil Layer #3 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]

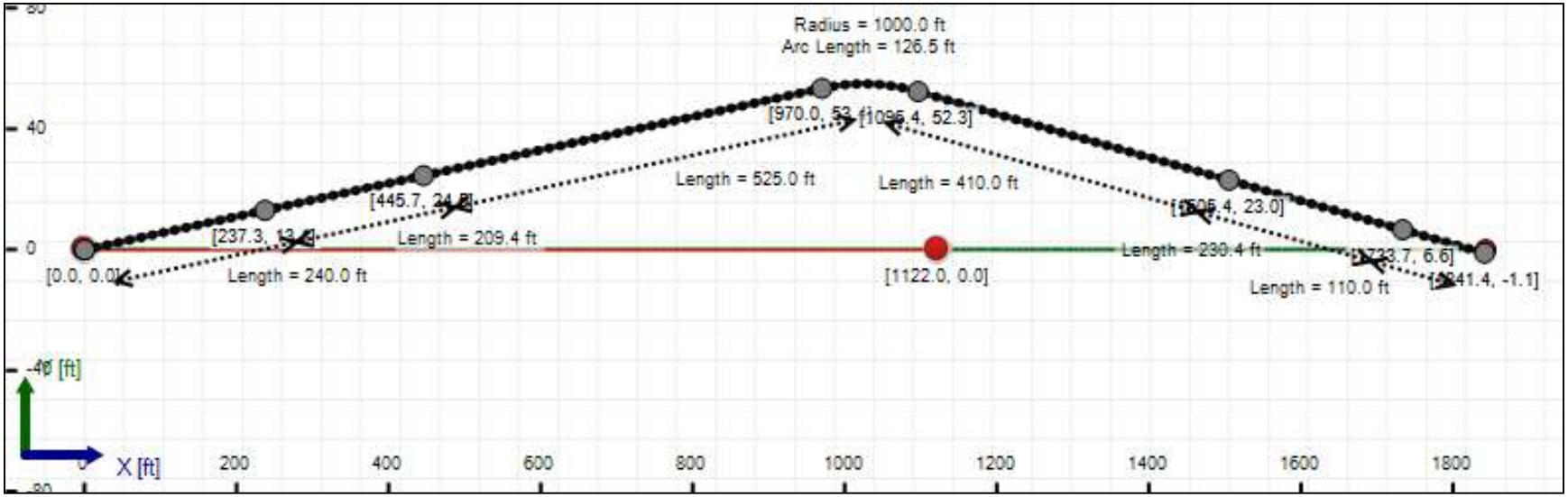
Soil Layer #4 USCS, Sand (S), SP
From Assistant
Unit Weight: 110.0000 (dry), 125.0000 (sat) [lb/ft3]
Phi: 34.00, S.M.: 500.00, Coh: 0.00 [psi]

Soil Layer #5 USCS, Sand (S), SP
From Assistant
Unit Weight: 110.0000 (dry), 124.0000 (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: 1860.00 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	2.4	26.8
Water Pressure	10.1	7.4
Surface Surcharge	0.0	0.0
Internal Pressure	0.0	0.0
Net Pressure	12.6	34.2
Deflection		
Earth Load Deflection	1.137	7.307
Buoyant Deflection	0.132	0.132
Reissner Effect	0	0
Net Deflection	1.269	7.439
Compressive Stress [psi]		
Compressive Wall Stress	56.5	153.9

Installation Load Summary:

Forces/Stresses	@Maximum Force	Absolute Maximum
Pullback Force [lb]	29961.4	29961.4
Pullback Stress [psi]	835.6	835.6
Pullback Strain	1.453E-2	1.453E-2
Bending Stress [psi]	0.0	25.8
Bending Strain	0	4.479E-4
Tensile Stress [psi]	835.6	847.2
Tensile Strain	1.453E-2	1.503E-2

Net External Pressure = 30.4 [psi]

Buoyant Deflection = 0.1

Hydrokinetic Force = 567.6 lb

In-service Analysis

	Calculated	Allowable	Factor of Safety	Check
Deflection [%]	1.269	7.5	5.9	OK
Unconstrained Collapse [psi]	31.2	123.2	3.9	OK
Compressive Wall Stress [psi]	56.5	1150.0	20.3	OK

Installation Analysis

	Calculated	Allowable	Factor of Safety	Check
Deflection [%]	0.065	7.5	115.8	OK
Unconstrained Collapse [psi]	41.2	202.9	4.9	OK
Tensile Stress [psi]	847.2	1200.0	1.4	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	149.451 psi	154.309 psi
1	8.00 in	12.00 in	149.243 psi	154.085 psi
2	12.00 in	16.13 in	148.943 psi	153.764 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

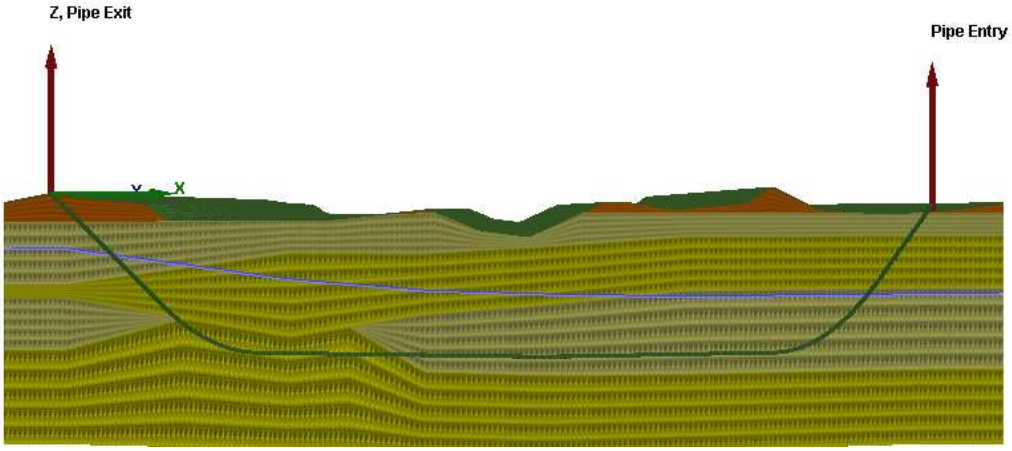
Rheological model: Power-Law

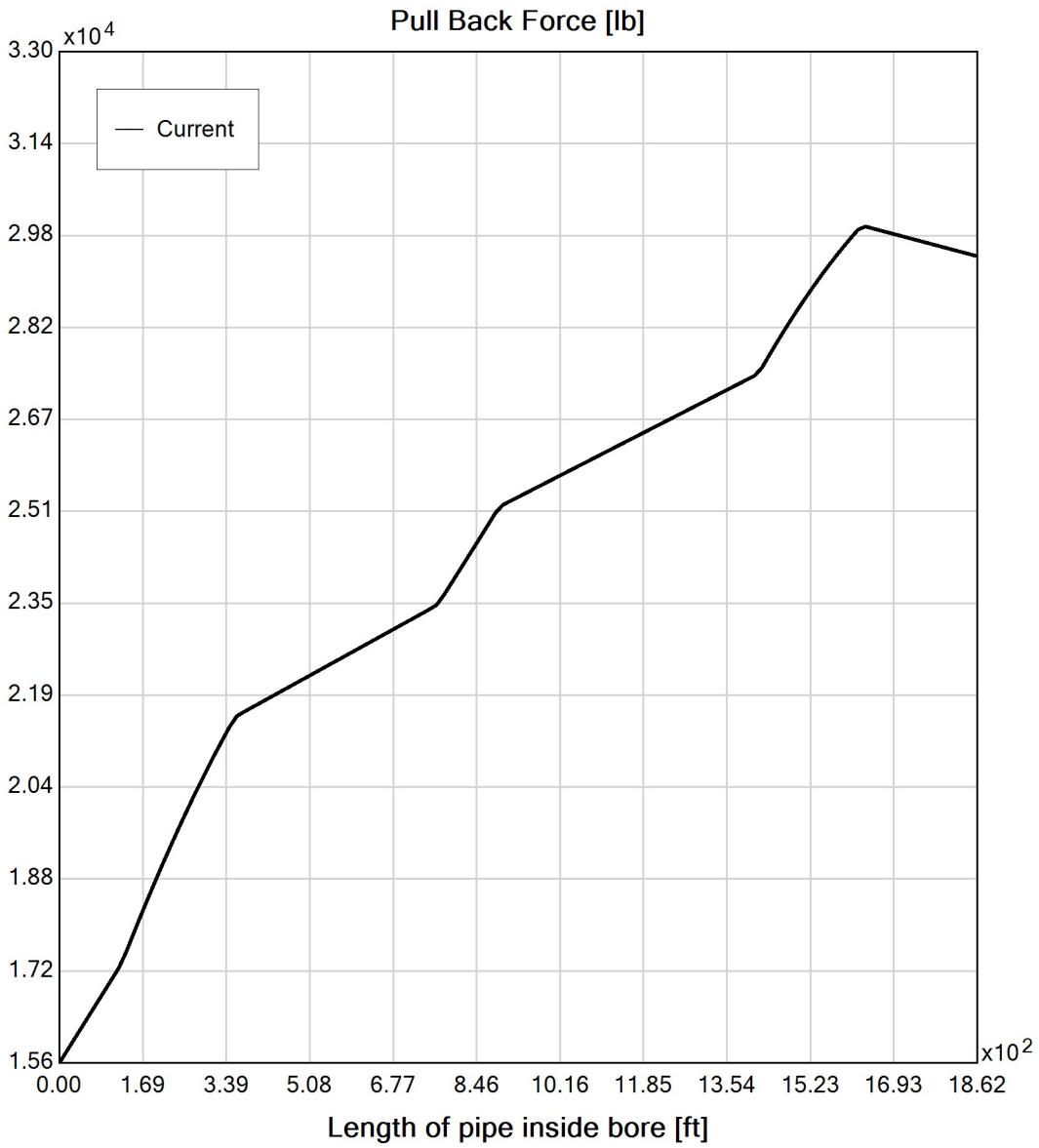
Fluid Consistency Index (K): 63.17

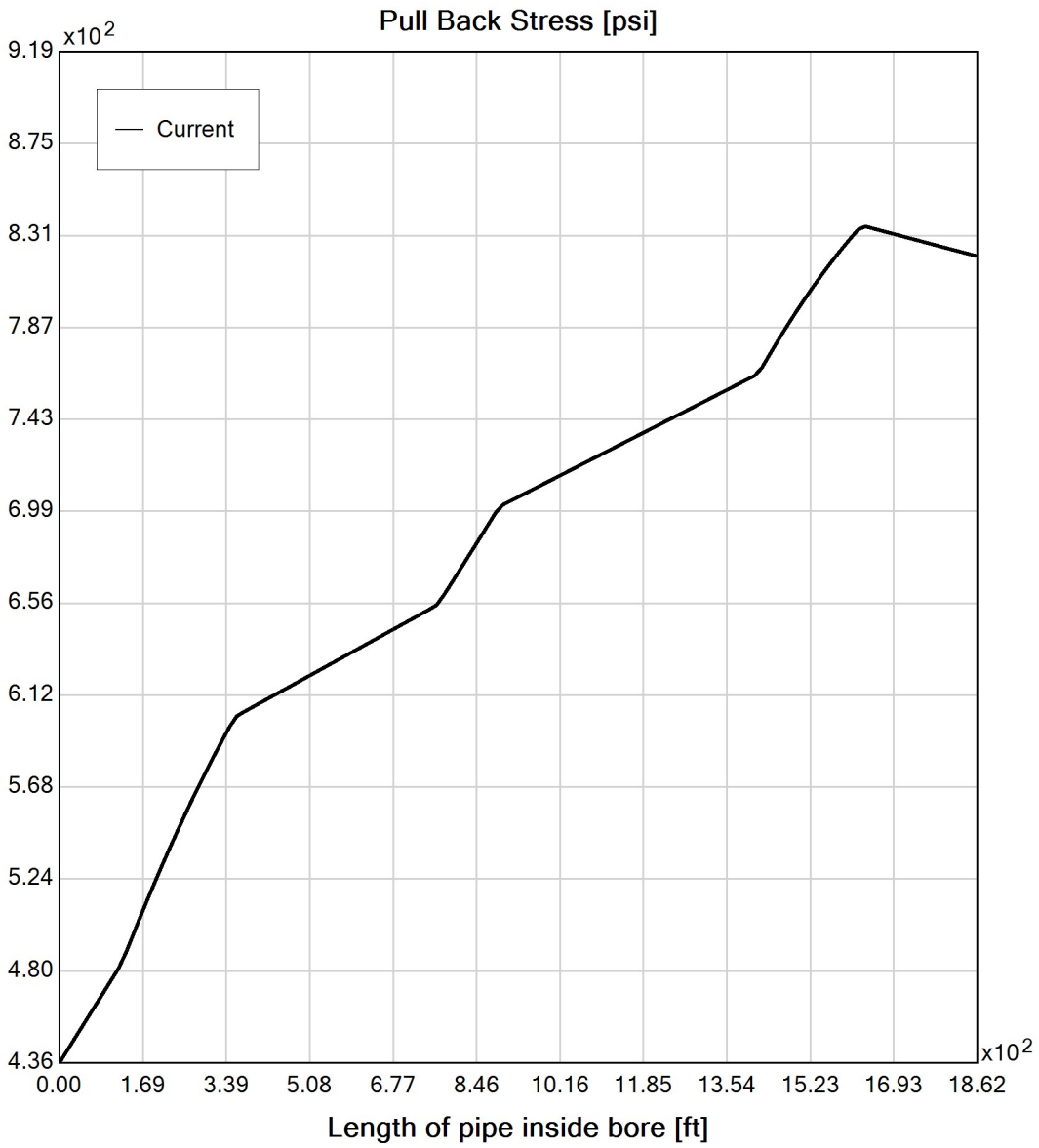
Power Law Exponent (n): 0.14

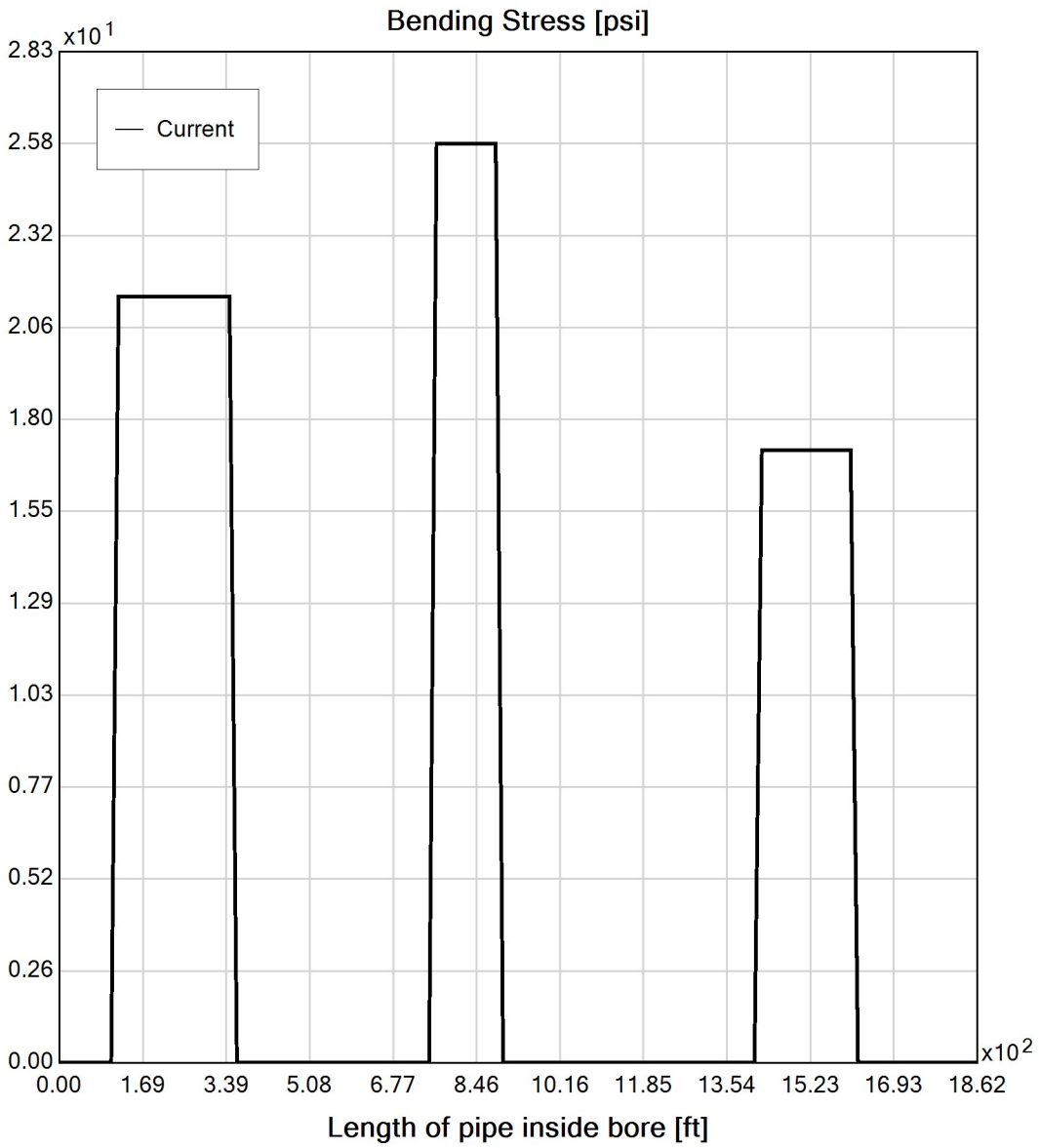
Effective Viscosity (cP): 859.3

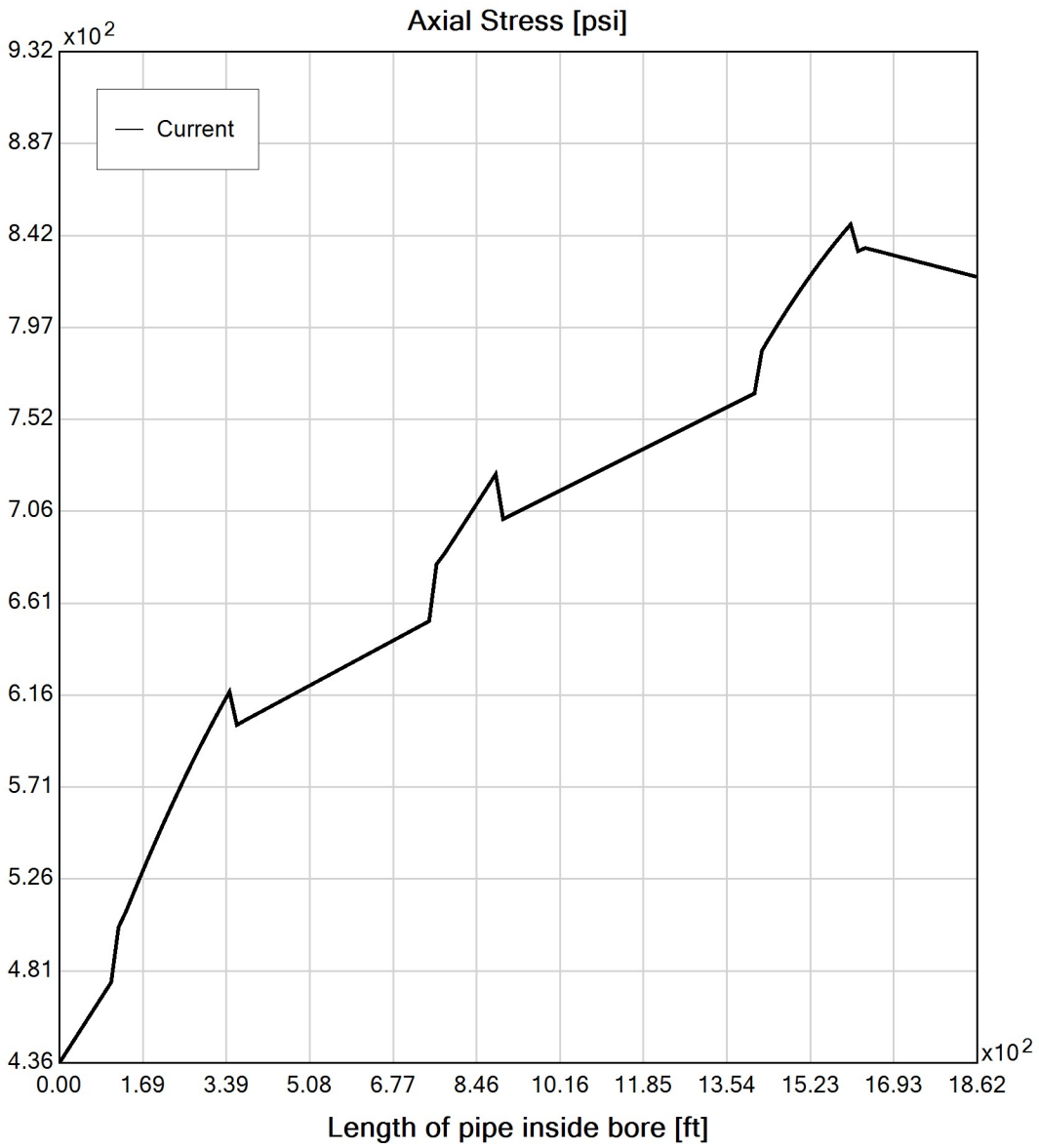
Virtual Site

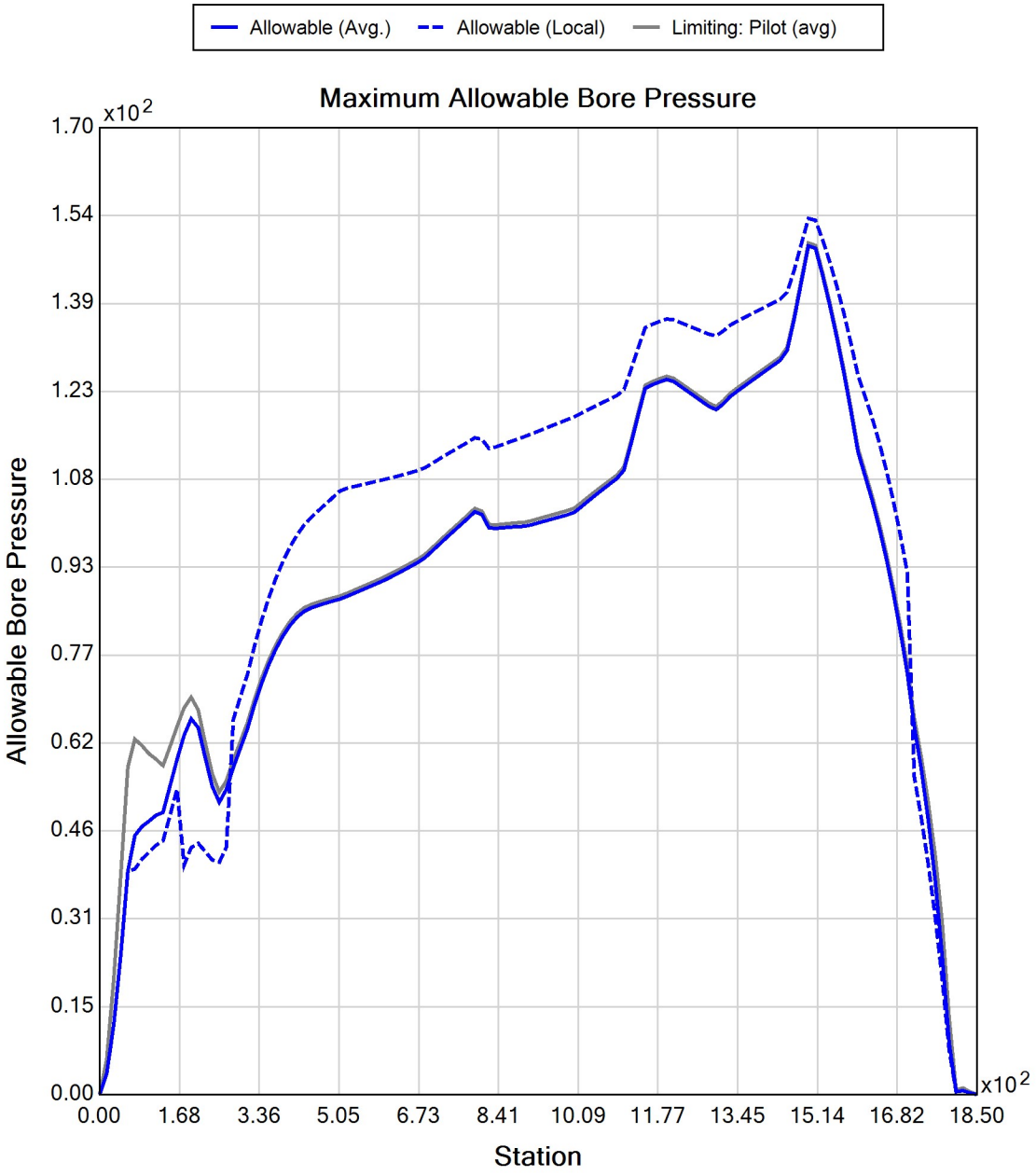


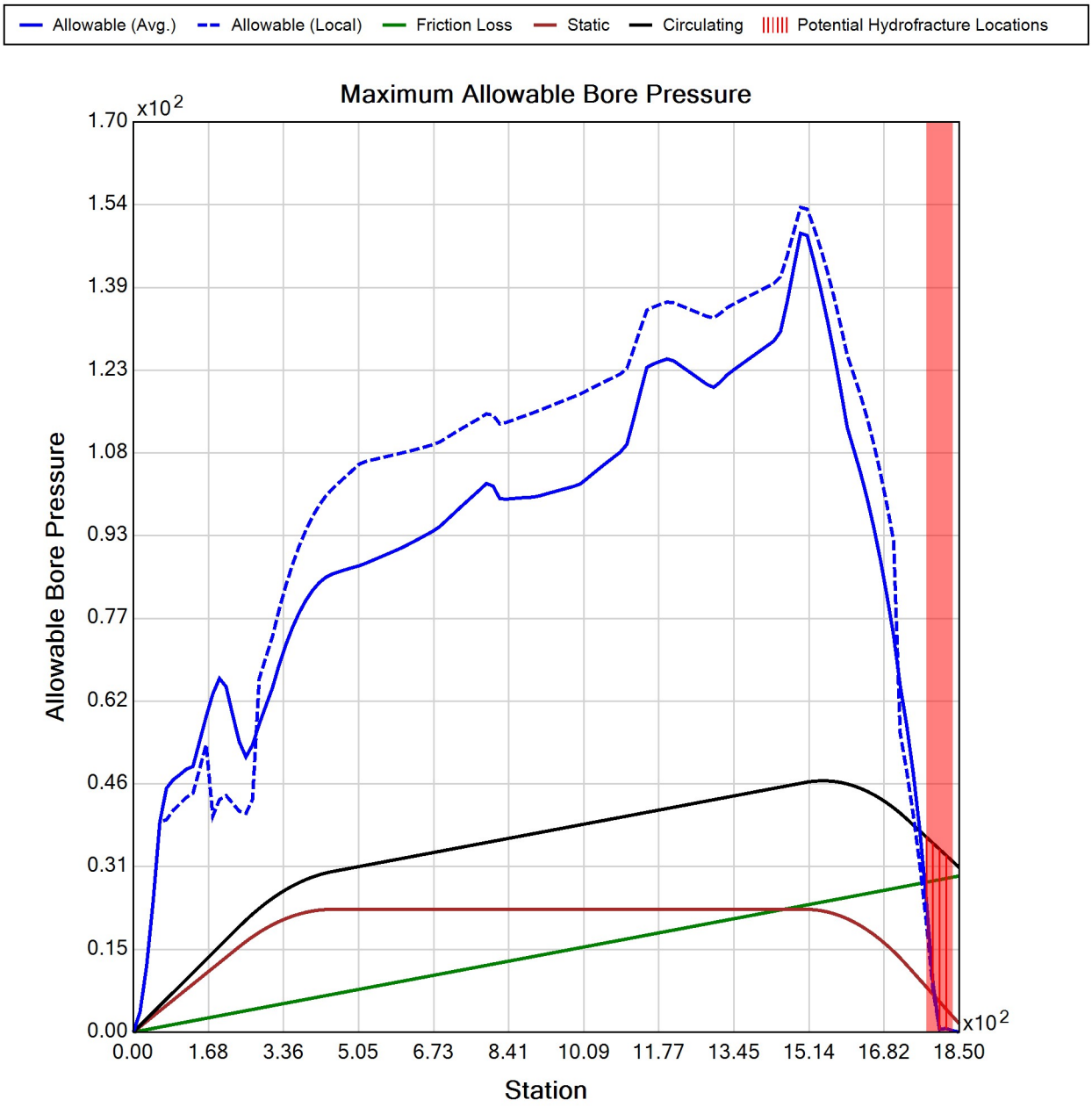












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Input Summary

Start Coordinate	(0.00, 0.00, 318.00) ft
End Coordinate	(1843.00, 0.00, 313.00) ft
Project Length	1843.00 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: 1860.00 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	0.9	26.8
Water Pressure	10.2	7.4
Surface Surcharge	0.0	0.0
Internal Pressure	0.0	0.0
Net Pressure	11.1	34.2
Deflection		
Earth Load Deflection	0.648	7.307
Buoyant Deflection	0.029	0.029
Reissner Effect	0	0
Net Deflection	0.677	7.336
Compressive Stress [psi]		
Compressive Wall Stress	50.0	153.9

Installation Load Summary:

Forces/Stresses	@Maximum Force	Absolute Maximum
Pullback Force [lb]	1572.0	1572.0
Pullback Stress [psi]	898.2	898.2
Pullback Strain	1.562E-2	1.562E-2
Bending Stress [psi]	0.0	5.7
Bending Strain	0	9.896E-5
Tensile Stress [psi]	898.2	898.2
Tensile Strain	1.562E-2	1.566E-2

Net External Pressure = 30.4 [psi]

Buoyant Deflection = 0.0

Hydrokinetic Force = 137.3 lb

In-service Analysis

	Calculated	Allowable	Factor of Safety	Check
Deflection [%]	0.677	7.5	11.1	OK
Unconstrained Collapse [psi]	31.2	132.3	4.2	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]	41.2	199.8	4.9	OK
Tensile Stress [psi]	898.2	1200.0	1.3	OK

Generated Output

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Project Summary

General:	CHPE HDD 35
	Ref: Fort Ann, NY Washington cty
	J2105
	Start Date: 11-14-2022
	End Date: 11-14-2022
Project Owner:	TDI
Project Contractor:	Kiewit
Project Consultant:	CHA-BCE
Designer:	MDB
	BCE
	Amherst, MA
Description:	North to South 10" DR9

Input Summary

Start Coordinate	(0.00, 0.00, 319.50) ft
End Coordinate	(2550.00, 0.00, 324.30) ft
Project Length	2550.00 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), SP
From Assistant
Unit Weight: 105.0000 (dry), 115.0000 (sat) [lb/ft3]
Phi: 30.00, S.M.: 200.00, Coh: 0.00 [psi]

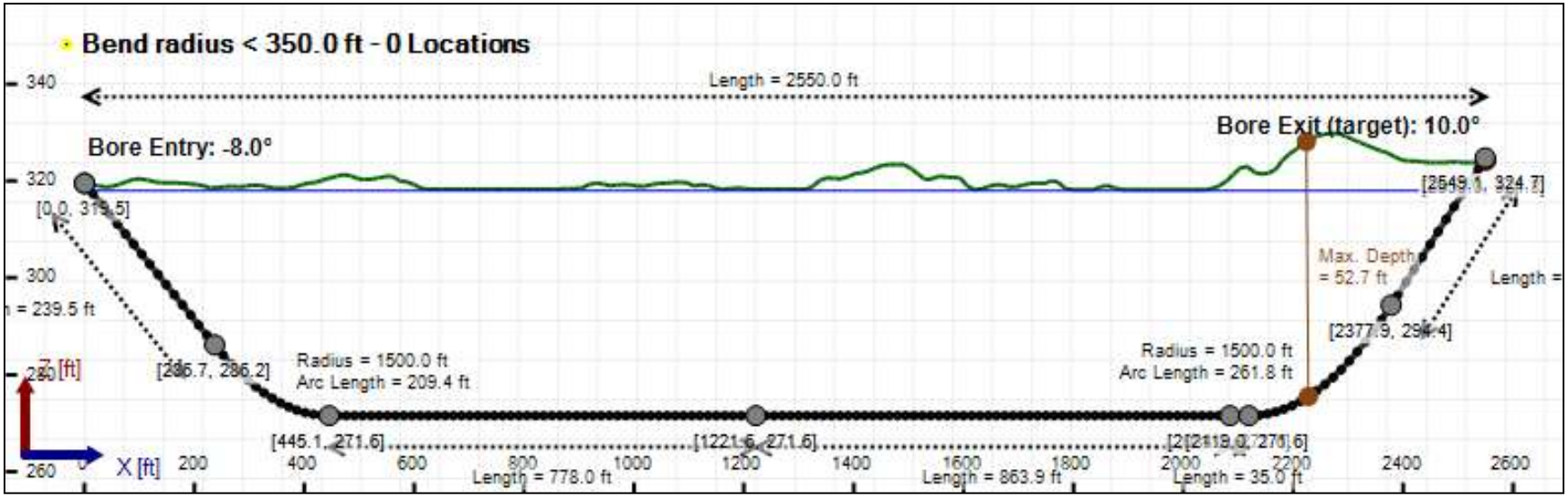
Soil Layer #2 USCS, Sand (S), SP
From Assistant
Unit Weight: 105.0000 (dry), 115.0000 (sat) [lb/ft3]
Phi: 30.00, S.M.: 200.00, Coh: 0.00 [psi]

Soil Layer #3 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]

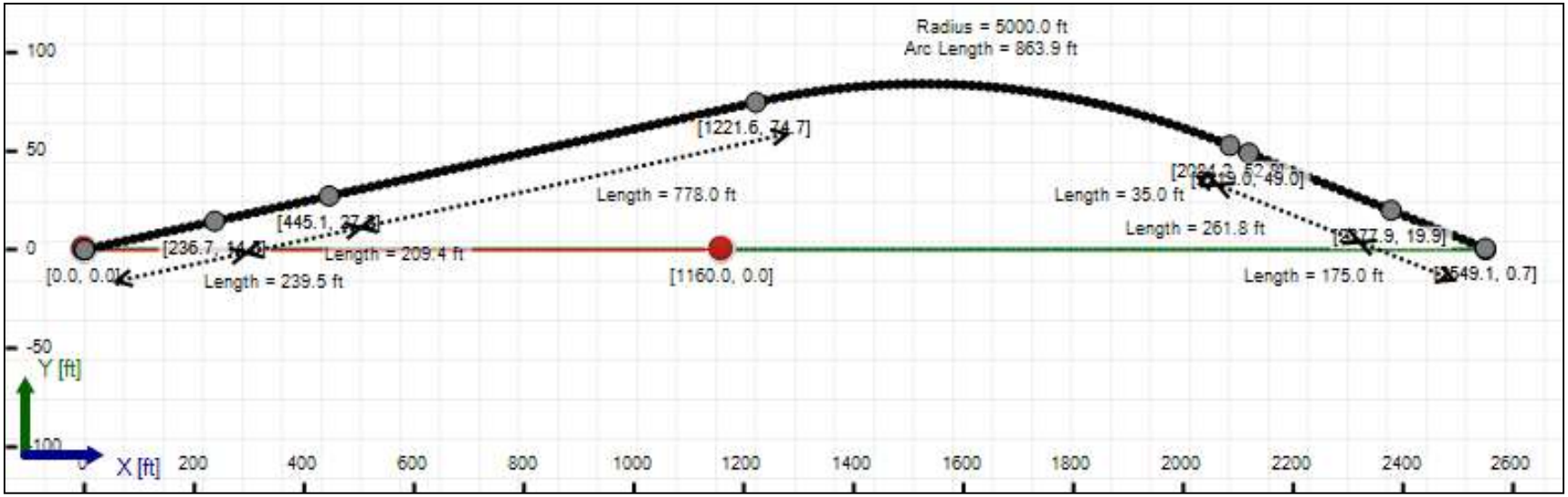
Soil Layer #4 USCS, Sand (S), SM
From Assistant
Unit Weight: 105.0000 (dry), 115.0000 (sat) [lb/ft3]
Phi: 30.00, S.M.: 200.00, Coh: 0.00 [psi]

Soil Layer #5 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]

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: 2565.00 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	3.5	23.5
Water Pressure	20.1	20.1
Surface Surcharge	0.0	0.0
Internal Pressure	0.0	0.0
Net Pressure	23.6	43.6
Deflection		
Earth Load Deflection	0.963	6.606
Buoyant Deflection	0.132	0.132
Reissner Effect	0	0
Net Deflection	1.095	6.738
Compressive Stress [psi]		
Compressive Wall Stress	106.2	196.3

Installation Load Summary:

Forces/Stresses	@Maximum Force	Absolute Maximum
Pullback Force [lb]	41099.6	41099.6
Pullback Stress [psi]	1146.2	1146.2
Pullback Strain	1.993E-2	1.993E-2
Bending Stress [psi]	0.0	17.2
Bending Strain	0	2.986E-4
Tensile Stress [psi]	1146.2	1160.7
Tensile Strain	1.993E-2	2.048E-2

Net External Pressure = 34.0 [psi]

Buoyant Deflection = 0.1

Hydrokinetic Force = 567.6 lb

In-service Analysis

	Calculated	Allowable	Factor of Safety	Check
Deflection [%]	1.095	7.5	6.8	OK
Unconstrained Collapse [psi]	34.8	125.4	3.6	OK
Compressive Wall Stress [psi]	106.2	1150.0	10.8	OK

Installation Analysis

	Calculated	Allowable	Factor of Safety	Check
Deflection [%]	0.065	7.5	115.8	OK
Unconstrained Collapse [psi]	44.7	177.8	4.0	OK
Tensile Stress [psi]	1160.7	1200.0	1.0	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	143.434 psi	155.089 psi
1	8.00 in	12.00 in	143.271 psi	154.877 psi
2	12.00 in	16.13 in	143.036 psi	154.570 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

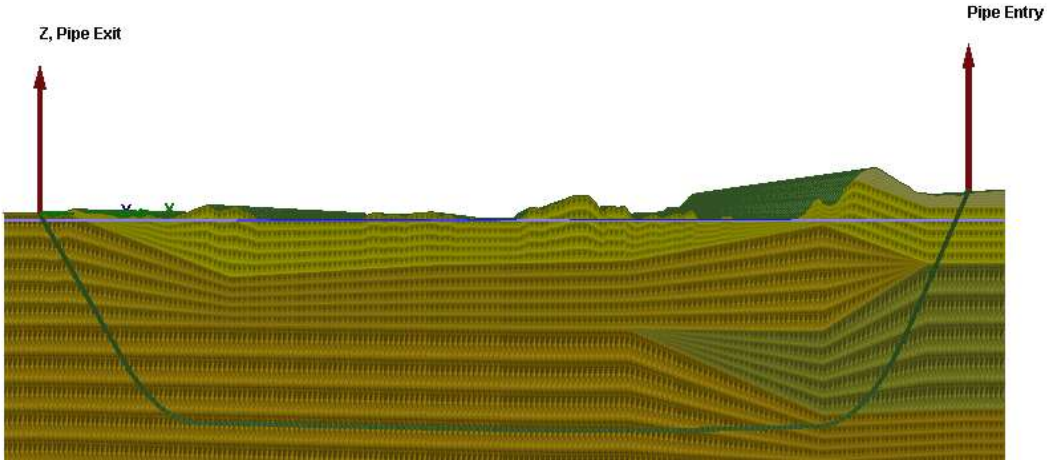
Rheological model: Power-Law

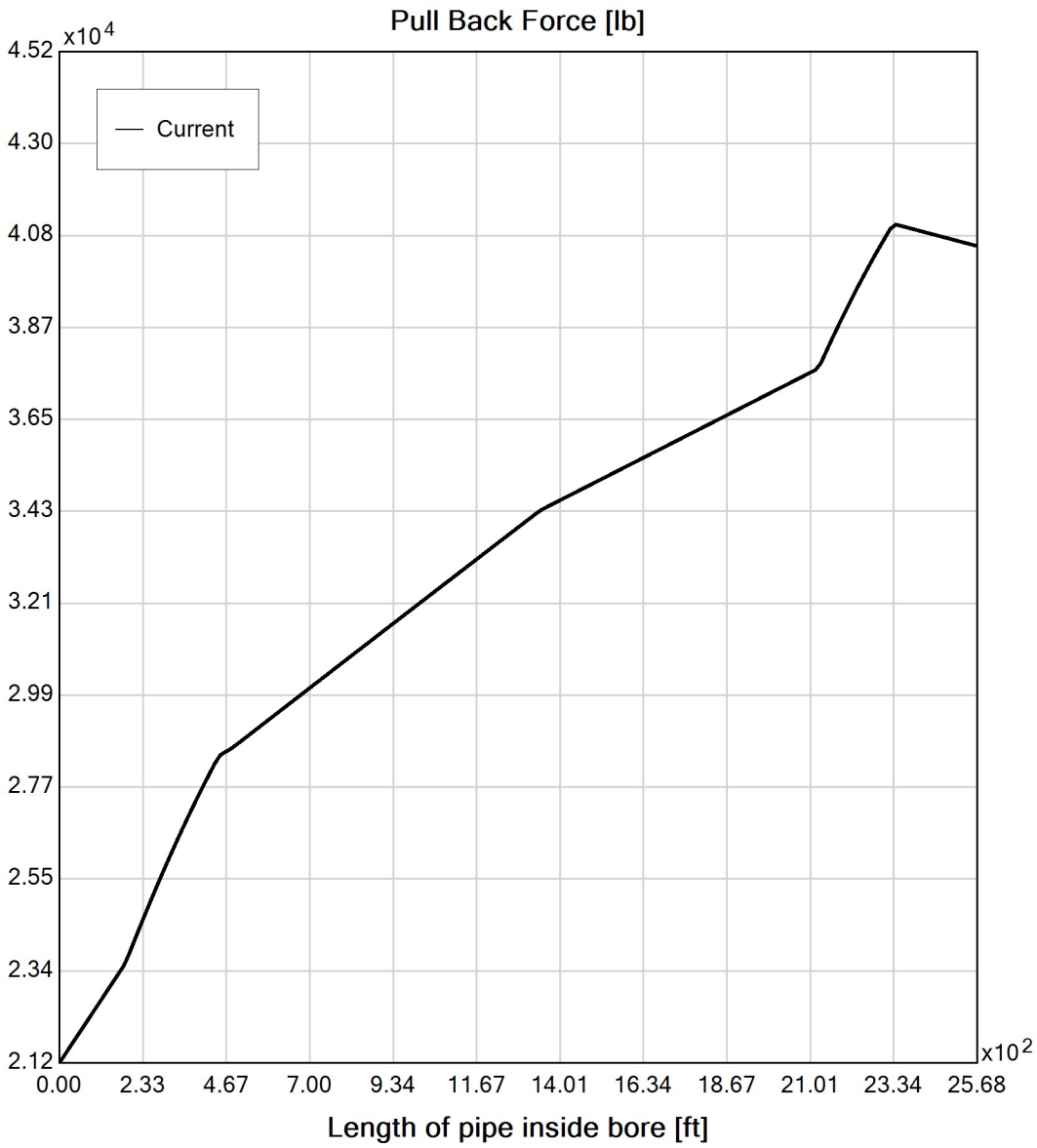
Fluid Consistency Index (K): 63.17

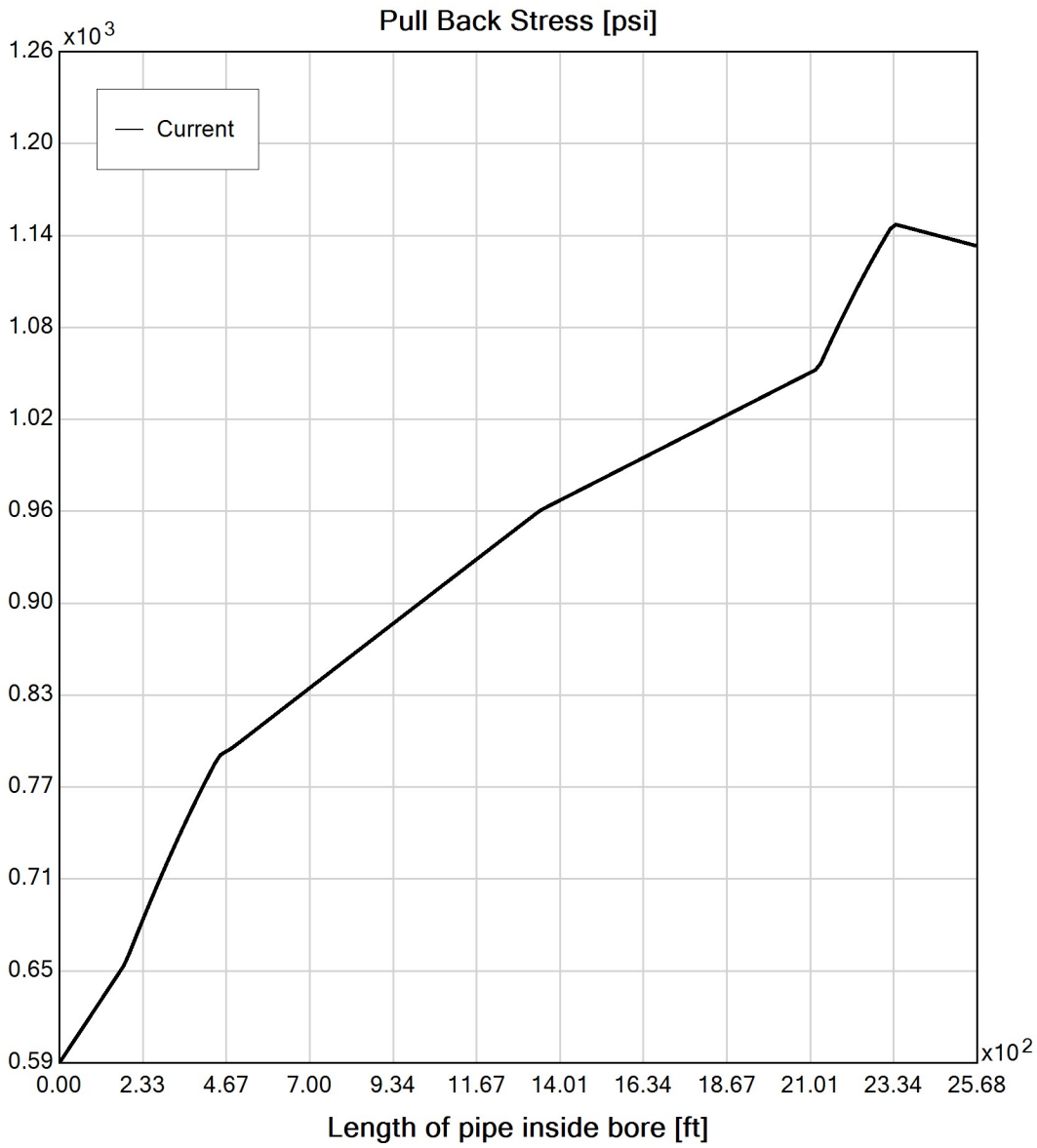
Power Law Exponent (n): 0.14

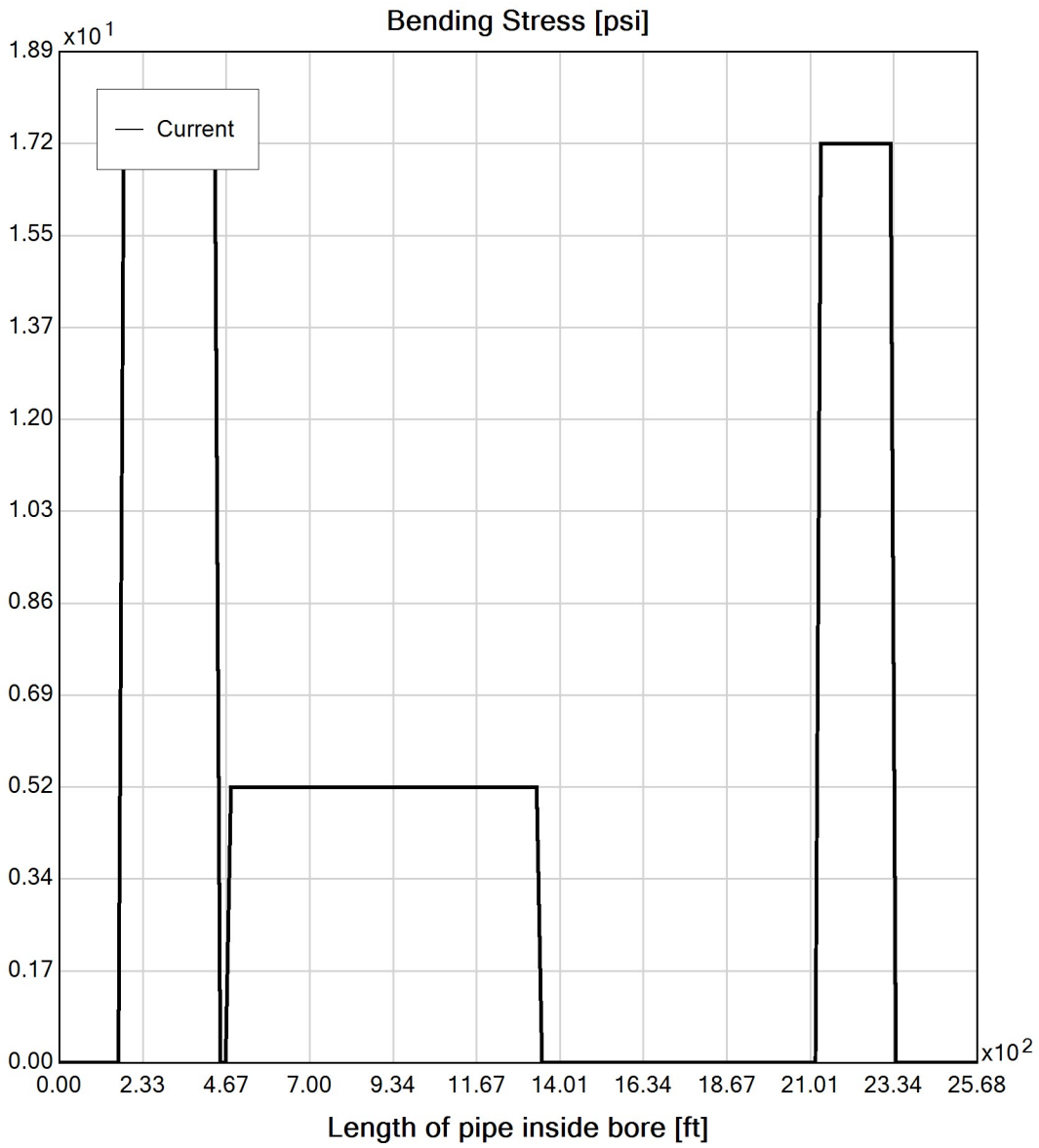
Effective Viscosity (cP): 859.3

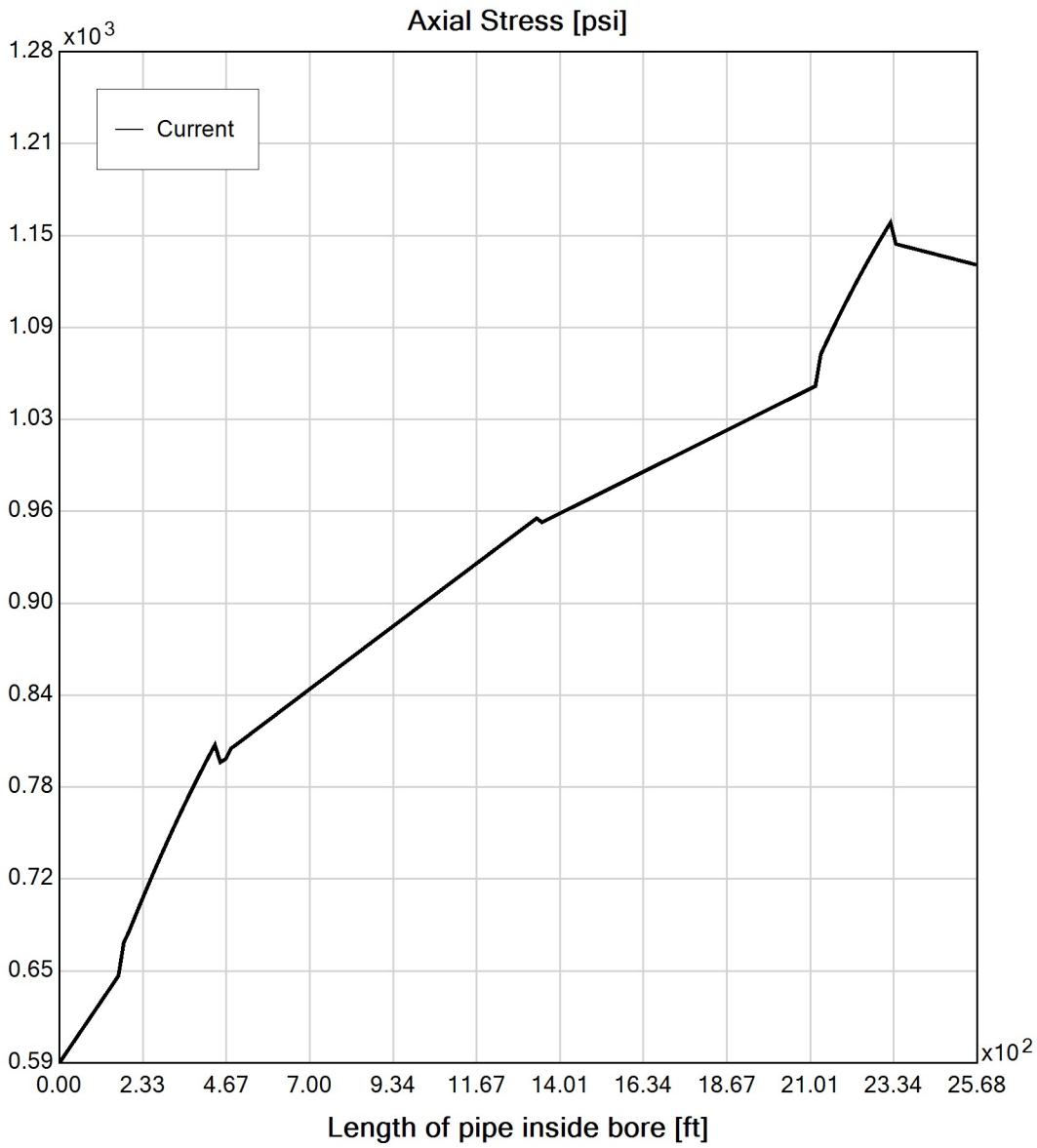
Virtual Site

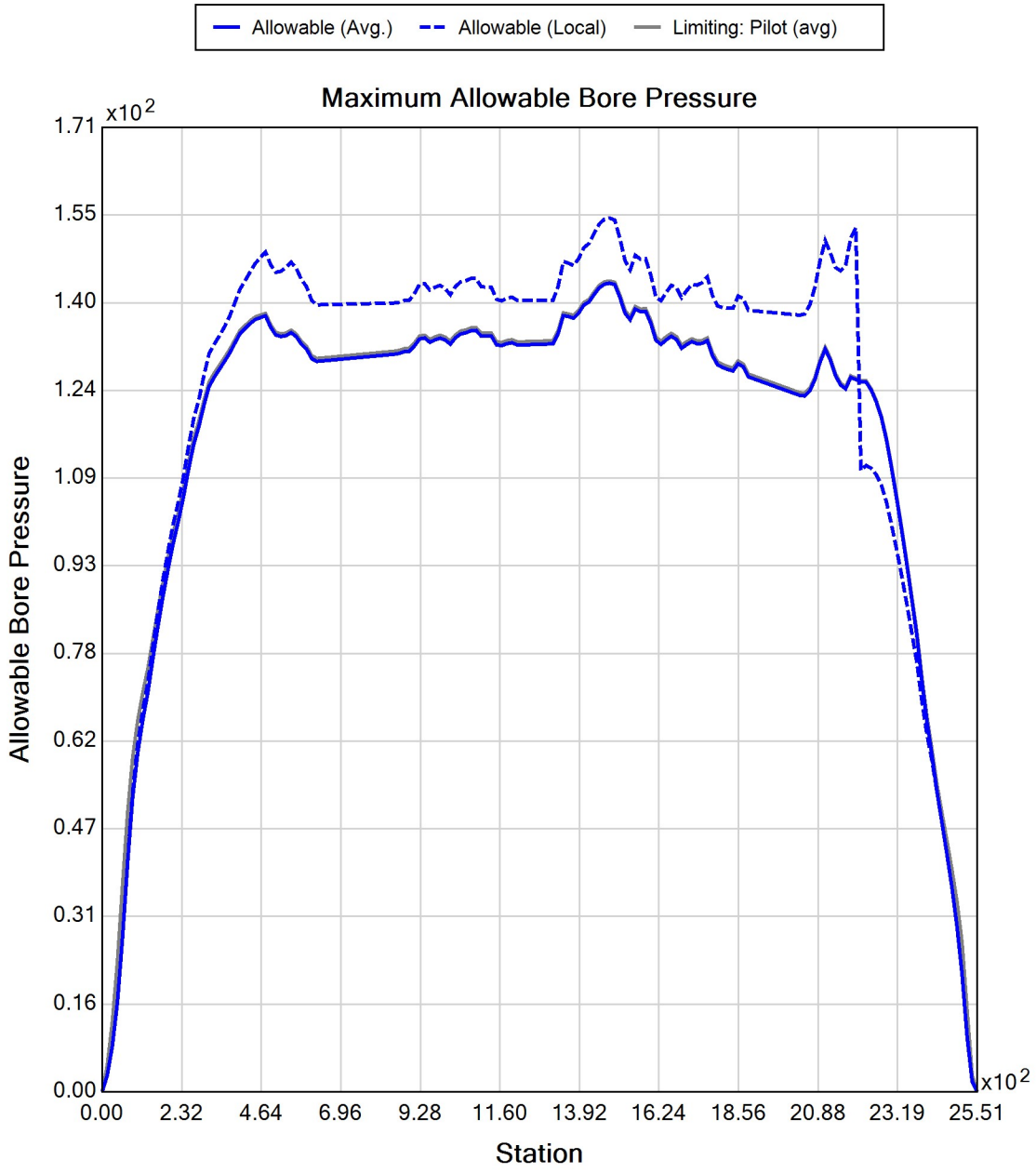


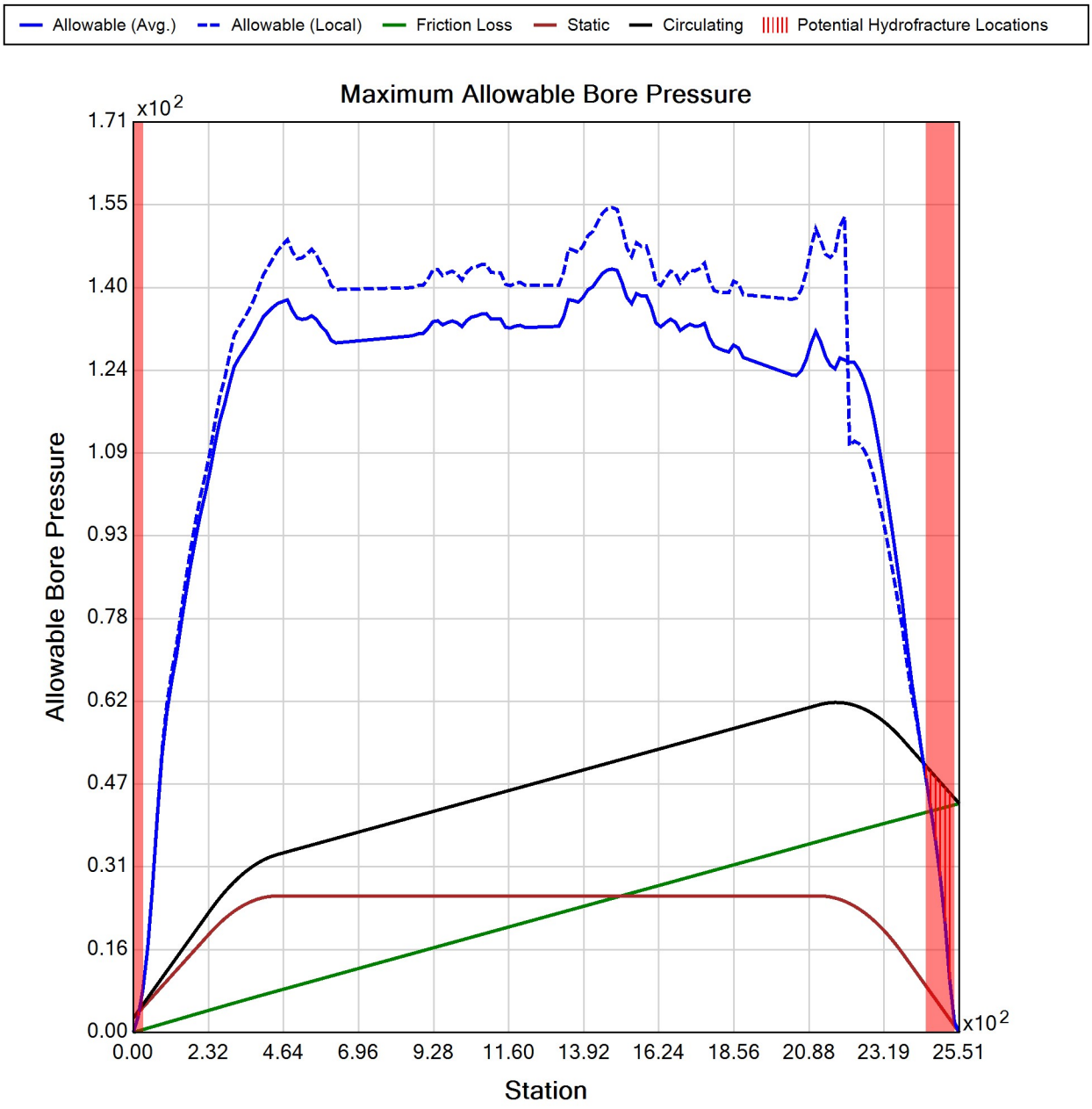












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Input Summary

Start Coordinate	(0.00, 0.00, 319.50) ft
End Coordinate	(2550.00, 0.00, 324.30) ft
Project Length	2550.00 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: 2565.00 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	1.4	23.5
Water Pressure	20.1	20.1
Surface Surcharge	0.0	0.0
Internal Pressure	0.0	0.0
Net Pressure	21.5	43.6
Deflection		
Earth Load Deflection	0.497	6.606
Buoyant Deflection	0.029	0.029
Reissner Effect	0	0
Net Deflection	0.526	6.635
Compressive Stress [psi]		
Compressive Wall Stress	96.8	196.3

Installation Load Summary:

Forces/Stresses	@Maximum Force	Absolute Maximum
Pullback Force [lb]	2115.7	2115.7
Pullback Stress [psi]	1208.8	1208.8
Pullback Strain	2.102E-2	2.102E-2
Bending Stress [psi]	0.0	3.8
Bending Strain	0	6.597E-5
Tensile Stress [psi]	1208.8	1209.9
Tensile Strain	2.102E-2	2.111E-2

Net External Pressure = 34.0 [psi]

Buoyant Deflection = 0.0

Hydrokinetic Force = 137.3 lb

In-service Analysis

	Calculated	Allowable	Factor of Safety	Check
Deflection [%]	0.526	7.5	14.3	OK
Unconstrained Collapse [psi]	34.8	133.2	3.8	OK
Compressive Wall Stress [psi]	96.8	1150.0	11.9	OK

Installation Analysis

	Calculated	Allowable	Factor of Safety	Check
Deflection [%]	0.014	7.5	524.3	OK
Unconstrained Collapse [psi]	44.7	174.0	3.9	OK
Tensile Stress [psi]	1209.9	1200.0	1.0	OK

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Project Summary

General:	CHPE HDD 36 Conduit 1
	P3
	Start Date: 12-10-2021
	End Date: 12-10-2021
Project Owner:	TDI
Project Contractor:	Kiewit
Project Consultant:	CHA/BCE
Designer:	AB
	CHA
Description:	HDD 36 Conduit 1 10-inch DR 9

Input Summary

Start Coordinate	(0.00, 0.00, 313.75) ft
End Coordinate	(621.00, 0.00, 324.25) ft
Project Length	621.00 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

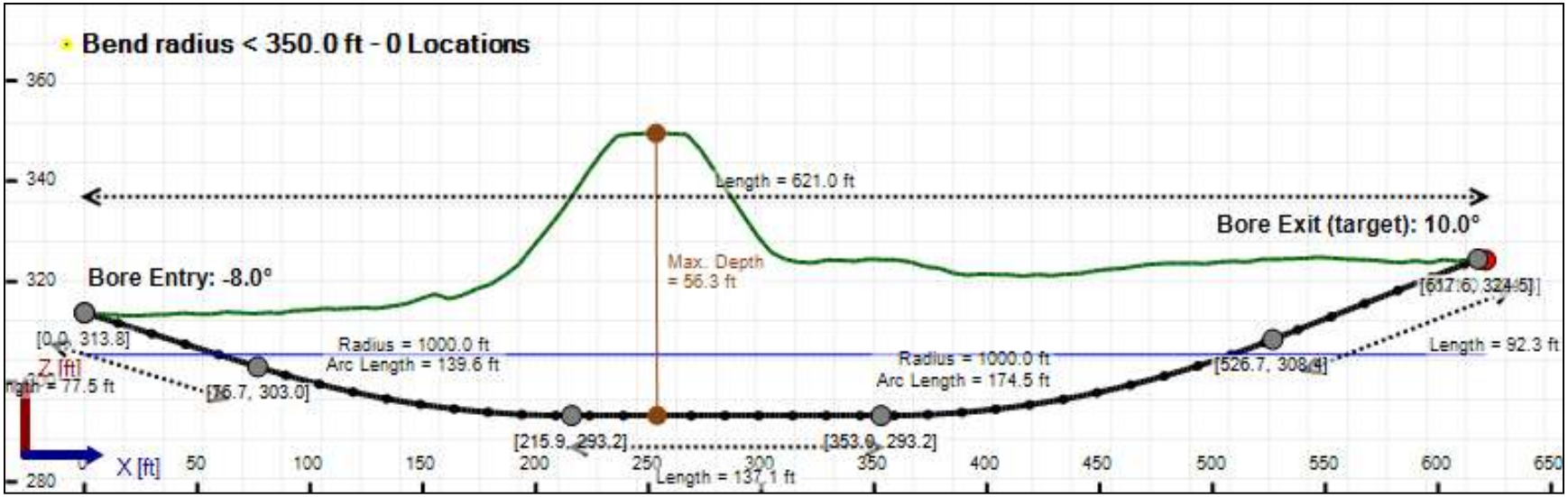
Number of Layers: 3

Soil Layer #1 USCS, Sand (S), SM
Depth: 9.20 ft
Unit Weight: 105.0000 (dry), 115.0000 (sat) [lb/ft3]
Phi: 30.00, S.M.: 145.00, Coh: 0.00 [psi]

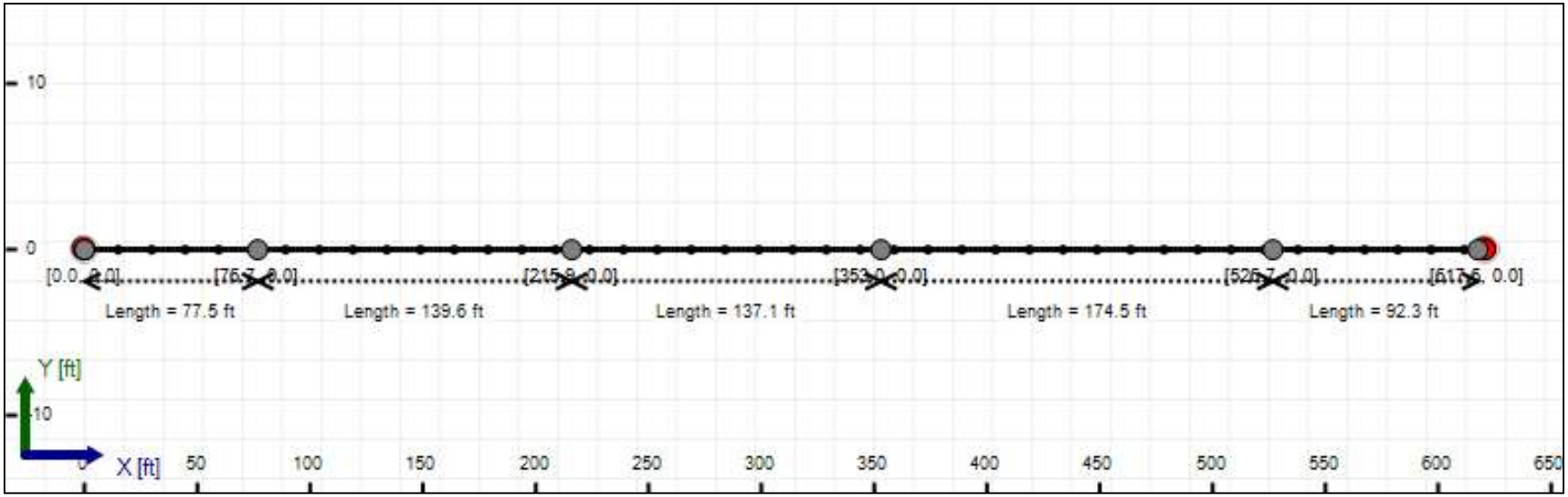
Soil Layer #2 USCS, Sand (S), SP
Depth: 9.50 ft
Unit Weight: 105.0000 (dry), 115.0000 (sat) [lb/ft3]
Phi: 30.00, S.M.: 145.00, Coh: 0.00 [psi]

Soil Layer #3 USCS, Sand (S), SM
Depth: 13.50 ft
Unit Weight: 105.0000 (dry), 115.0000 (sat) [lb/ft3]
Phi: 30.00, S.M.: 145.00, 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: 630.00 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	4.9	36.6
Water Pressure	5.3	5.3
Surface Surcharge	0.0	0.0
Internal Pressure	0.0	0.0
Net Pressure	10.2	41.9
Deflection		
Earth Load Deflection	1.367	9.972
Buoyant Deflection	0.132	0.132
Reissner Effect	0	0
Net Deflection	1.499	10.104
Compressive Stress [psi]		
Compressive Wall Stress	45.7	188.5

Installation Load Summary:

Forces/Stresses	@Maximum Force	Absolute Maximum
Pullback Force [lb]	10937.7	10937.7
Pullback Stress [psi]	305.0	305.0
Pullback Strain	5.305E-3	5.305E-3
Bending Stress [psi]	0.0	25.8
Bending Strain	0	4.479E-4
Tensile Stress [psi]	305.0	328.7
Tensile Strain	5.305E-3	6.164E-3

Net External Pressure = 23.4 [psi]

Buoyant Deflection = 0.1

Hydrokinetic Force = 567.6 lb

In-service Analysis

	Calculated	Allowable	Factor of Safety	Check
Deflection [%]	1.499	7.5	5.0	OK
Unconstrained Collapse [psi]	21.3	121.1	5.7	OK
Compressive Wall Stress [psi]	45.7	1150.0	25.1	OK

Installation Analysis

	Calculated	Allowable	Factor of Safety	Check
Deflection [%]	0.065	7.5	115.8	OK
Unconstrained Collapse [psi]	31.3	237.3	7.6	OK
Tensile Stress [psi]	328.7	1200.0	3.7	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	114.735 psi	114.735 psi
1	8.00 in	12.00 in	114.707 psi	114.707 psi
2	12.00 in	16.13 in	114.666 psi	114.666 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

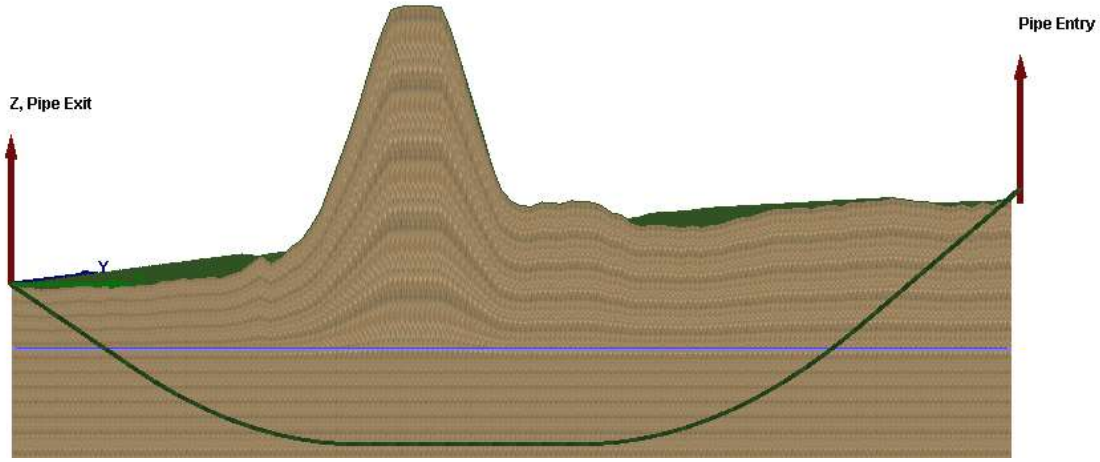
Rheological model: Bingham-Plastic

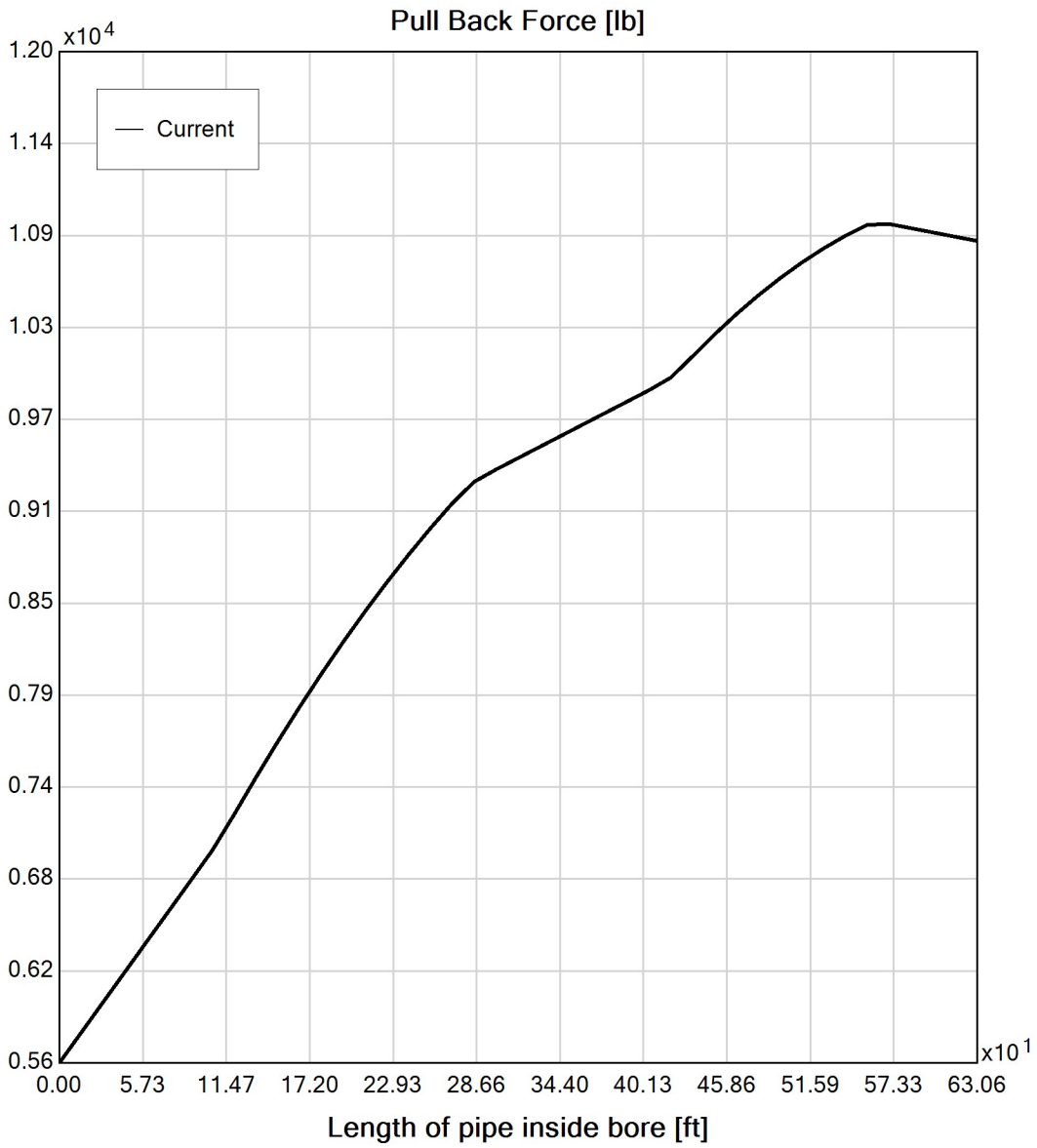
Plastic Viscosity (PV): 25.53

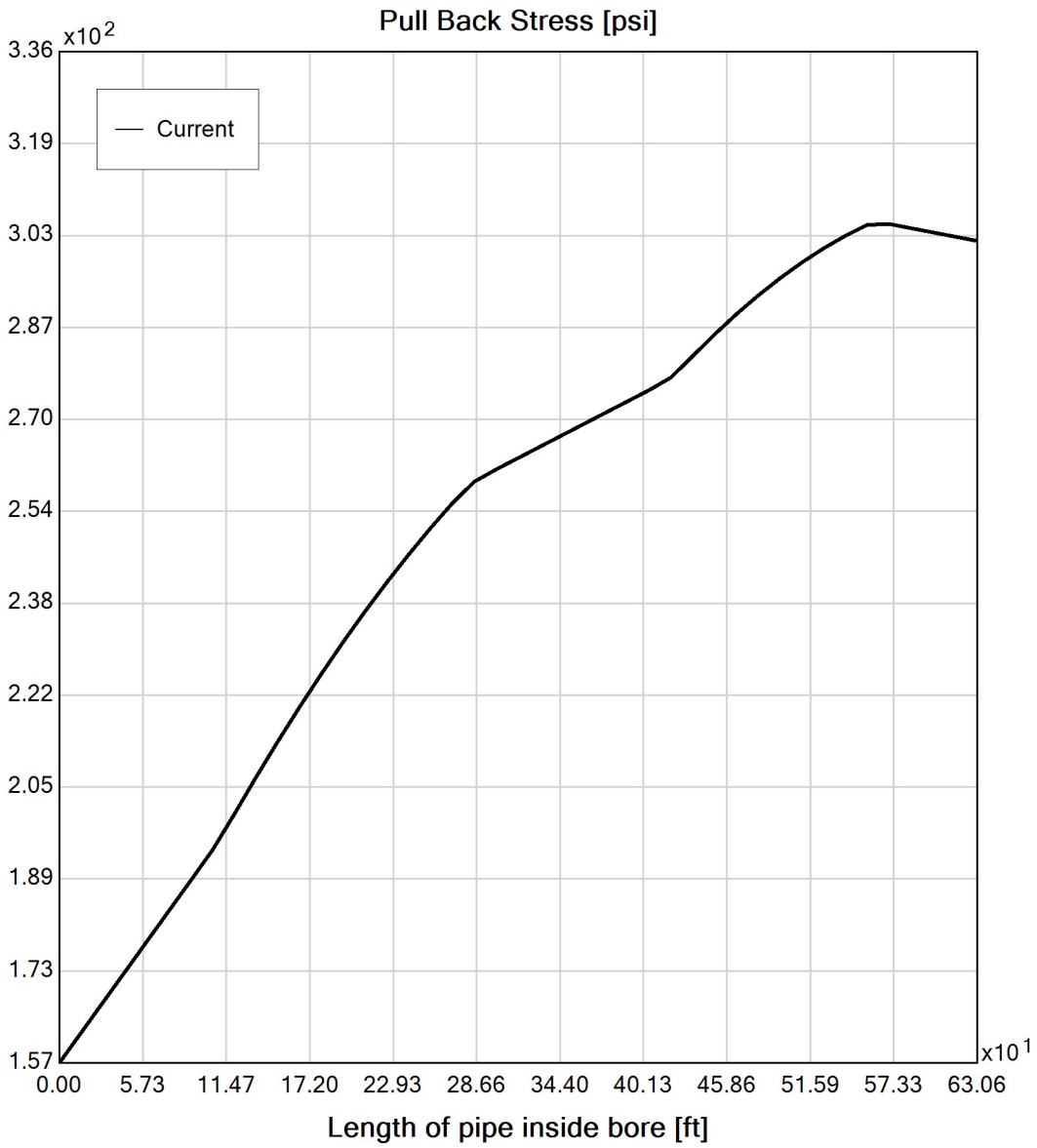
Yield Point (YP): 16.49

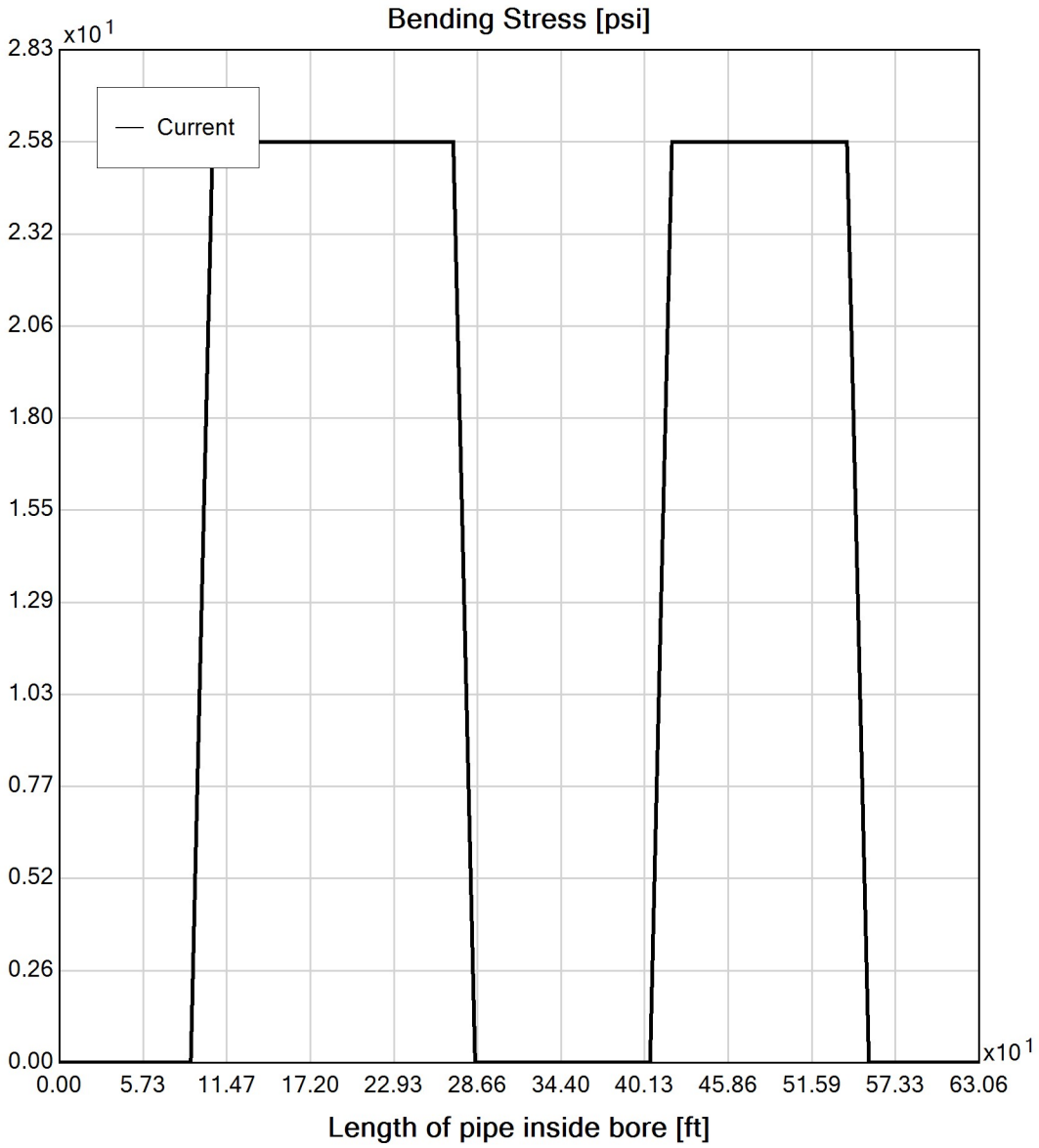
Effective Viscosity (cP): 1202.0

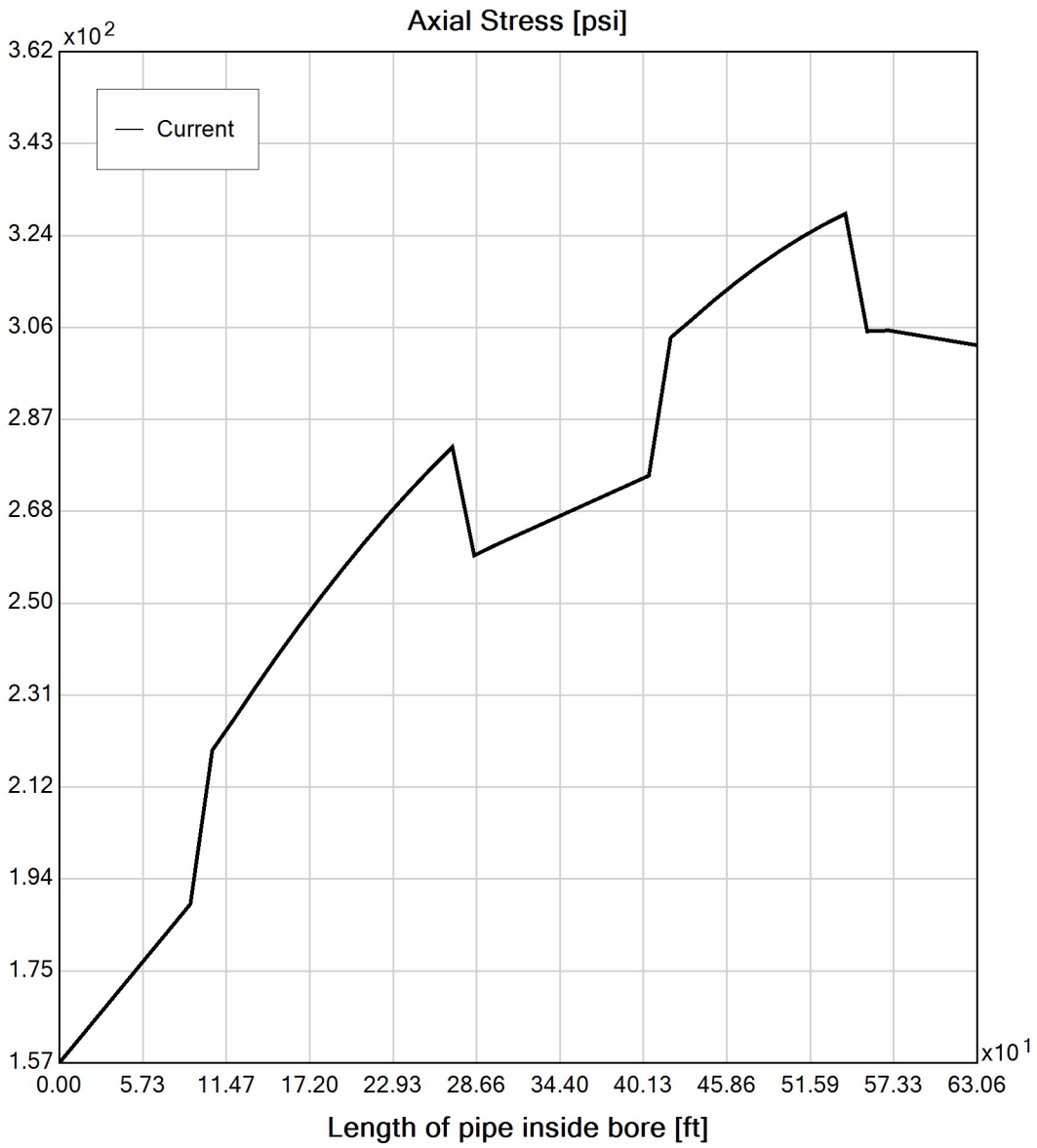
Virtual Site

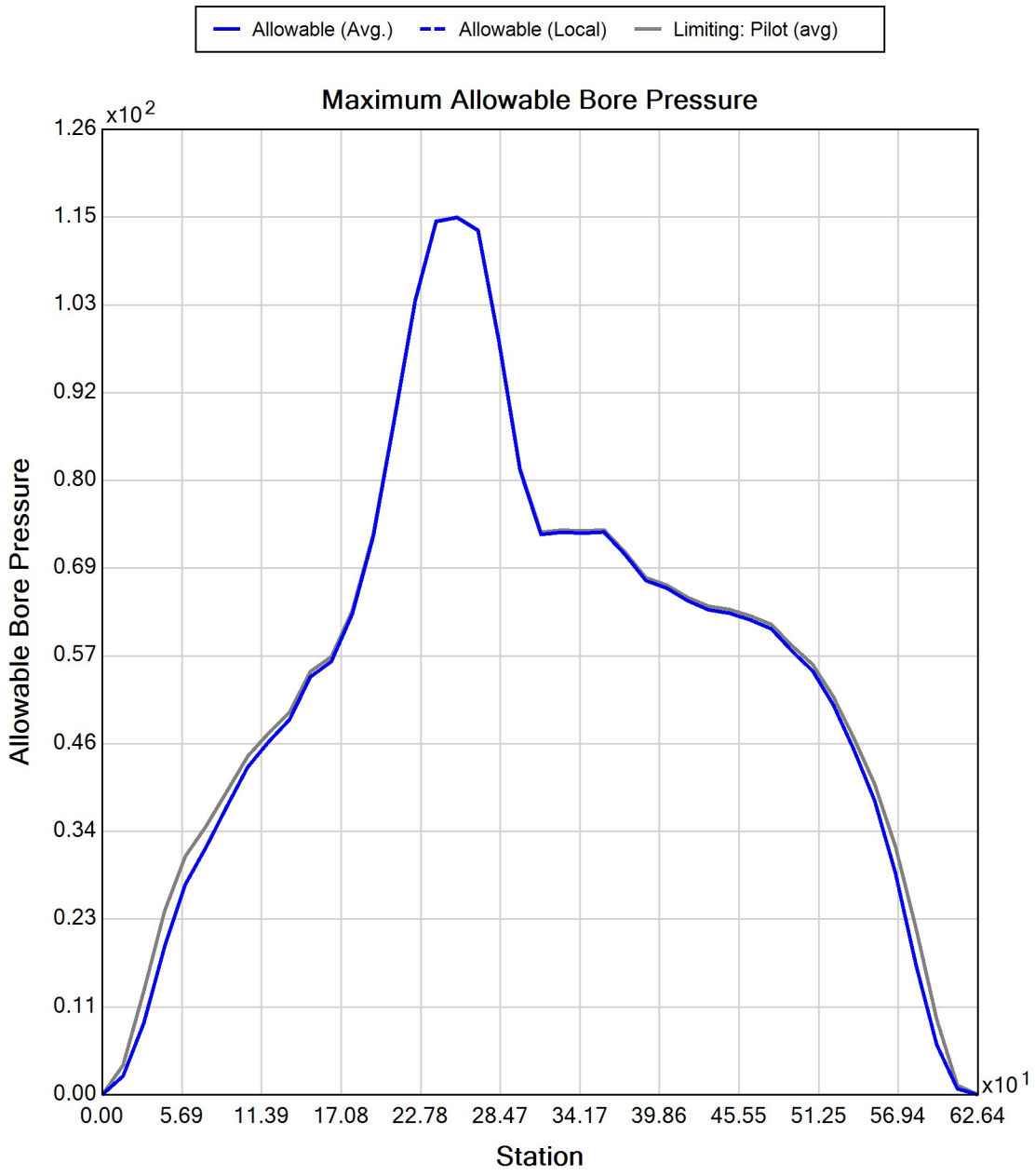


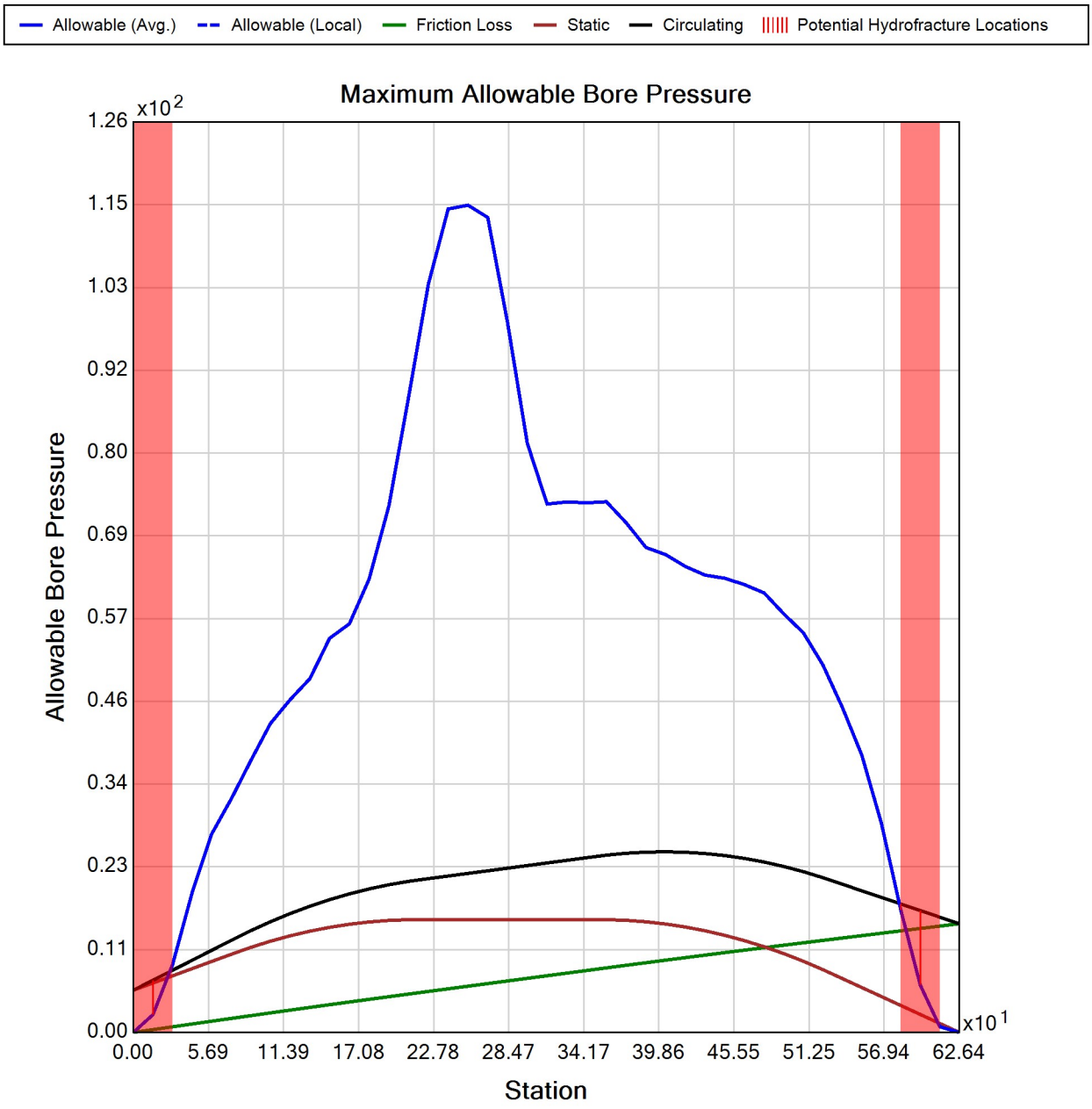












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Input Summary

Start Coordinate	(0.00, 0.00, 313.75) ft
End Coordinate	(621.00, 0.00, 324.25) ft
Project Length	621.00 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: 630.00 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	36.6
Water Pressure	5.3	5.3
Surface Surcharge	0.0	0.0
Internal Pressure	0.0	0.0
Net Pressure	7.2	41.9
Deflection		
Earth Load Deflection	0.588	9.972
Buoyant Deflection	0.029	0.029
Reissner Effect	0	0
Net Deflection	0.617	10.002
Compressive Stress [psi]		
Compressive Wall Stress	32.4	188.5

Installation Load Summary:

Forces/Stresses	@Maximum Force	Absolute Maximum
Pullback Force [lb]	643.5	643.5
Pullback Stress [psi]	367.7	367.7
Pullback Strain	6.394E-3	6.394E-3
Bending Stress [psi]	0.0	5.7
Bending Strain	0	9.896E-5
Tensile Stress [psi]	367.7	371.3
Tensile Strain	6.394E-3	6.555E-3

Net External Pressure = 23.4 [psi]

Buoyant Deflection = 0.0

Hydrokinetic Force = 137.3 lb

In-service Analysis

	Calculated	Allowable	Factor of Safety	Check
Deflection [%]	0.617	7.5	12.1	OK
Unconstrained Collapse [psi]	21.3	131.4	6.2	OK
Compressive Wall Stress [psi]	32.4	1150.0	35.5	OK

Installation Analysis

	Calculated	Allowable	Factor of Safety	Check
Deflection [%]	0.014	7.5	524.3	OK
Unconstrained Collapse [psi]	31.3	235.6	7.5	OK
Tensile Stress [psi]	371.3	1200.0	3.2	OK

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Project Summary

General:	CHPE HDD 36 Conduit 2
	P3
	Start Date: 12-10-2021
	End Date: 12-10-2021
Project Owner:	TDI
Project Contractor:	Kiewit
Project Consultant:	CHA/BCE
Designer:	AB
	CHA
Description:	HDD 36 Conduit 2 10-inch DR 9

Input Summary

Start Coordinate	(0.00, 0.00, 313.75) ft
End Coordinate	(621.00, 0.00, 319.00) ft
Project Length	621.00 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

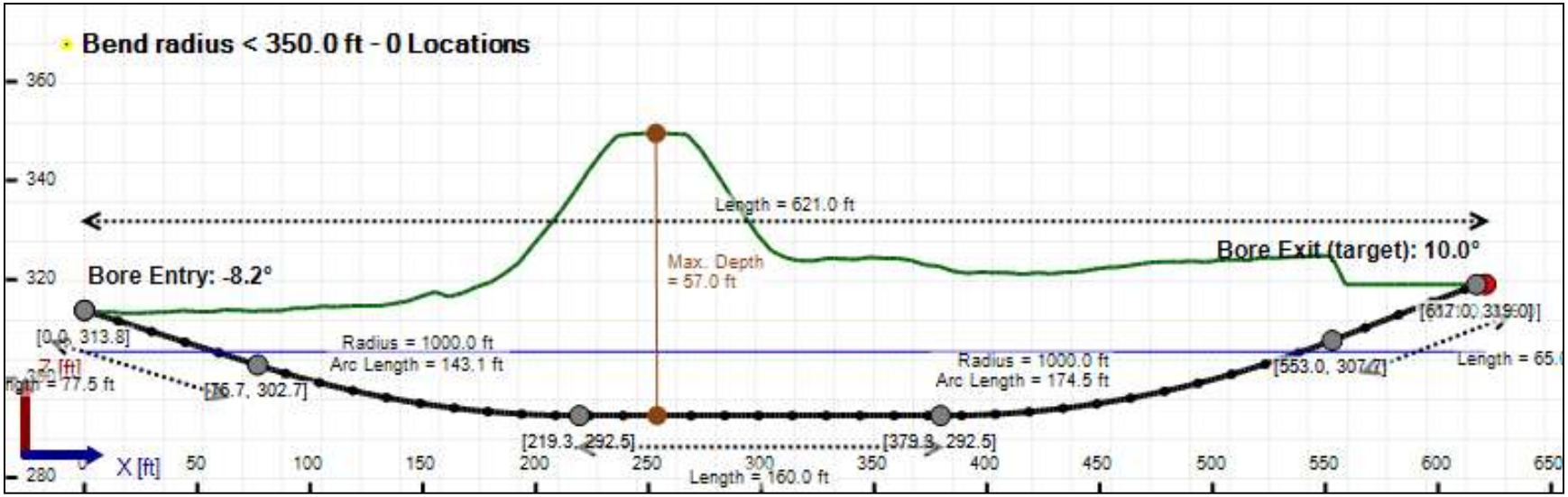
Number of Layers: 3

Soil Layer #1 USCS, Sand (S), SM
Depth: 9.20 ft
Unit Weight: 105.0000 (dry), 115.0000 (sat) [lb/ft3]
Phi: 30.00, S.M.: 145.00, Coh: 0.00 [psi]

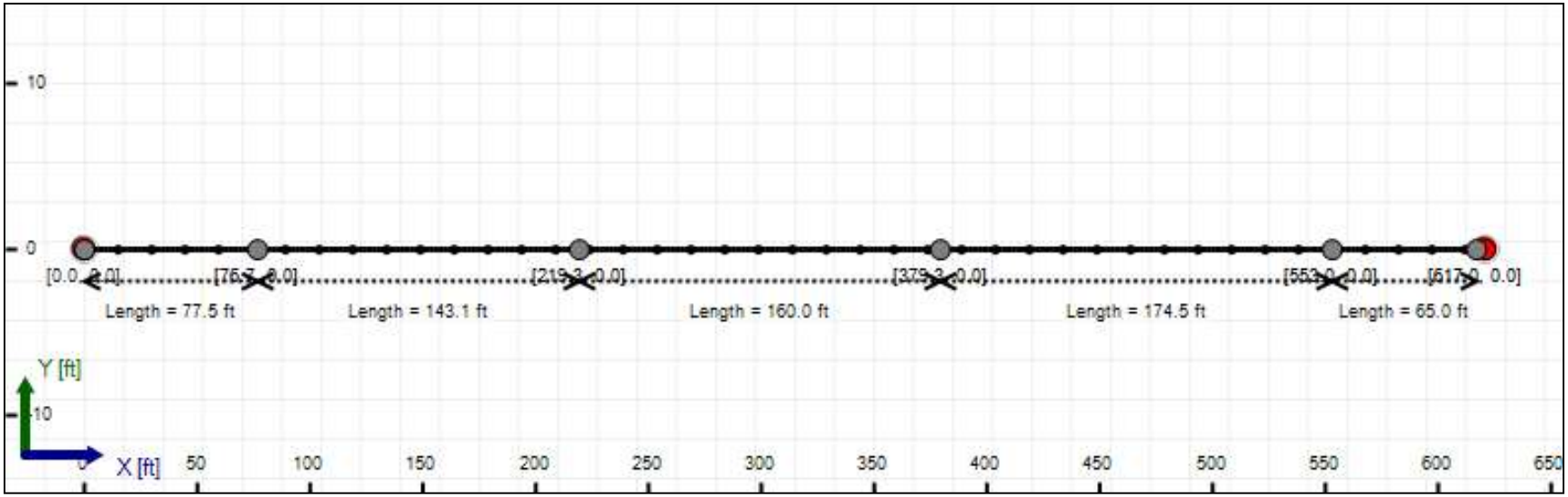
Soil Layer #2 USCS, Sand (S), SP
Depth: 9.50 ft
Unit Weight: 105.0000 (dry), 115.0000 (sat) [lb/ft3]
Phi: 30.00, S.M.: 145.00, Coh: 0.00 [psi]

Soil Layer #3 USCS, Sand (S), SM
Depth: 13.50 ft
Unit Weight: 105.0000 (dry), 115.0000 (sat) [lb/ft3]
Phi: 30.00, S.M.: 145.00, 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: 630.00 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	4.9	36.9
Water Pressure	5.6	5.6
Surface Surcharge	0.0	0.0
Internal Pressure	0.0	0.0
Net Pressure	10.5	42.5
Deflection		
Earth Load Deflection	1.372	10.047
Buoyant Deflection	0.132	0.132
Reissner Effect	0	0
Net Deflection	1.504	10.179
Compressive Stress [psi]		
Compressive Wall Stress	47.1	191.2

Installation Load Summary:

Forces/Stresses	@Maximum Force	Absolute Maximum
Pullback Force [lb]	10663.4	10663.4
Pullback Stress [psi]	297.4	297.4
Pullback Strain	5.172E-3	5.172E-3
Bending Stress [psi]	0.0	25.8
Bending Strain	0	4.479E-4
Tensile Stress [psi]	297.4	321.3
Tensile Strain	5.172E-3	6.035E-3

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 [%]	1.504	7.5	5.0	OK
Unconstrained Collapse [psi]	18.3	121.2	6.6	OK
Compressive Wall Stress [psi]	47.1	1150.0	24.4	OK

Installation Analysis

	Calculated	Allowable	Factor of Safety	Check
Deflection [%]	0.065	7.5	115.8	OK
Unconstrained Collapse [psi]	28.3	237.7	8.4	OK
Tensile Stress [psi]	321.3	1200.0	3.7	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	115.614 psi	115.614 psi
1	8.00 in	12.00 in	115.586 psi	115.586 psi
2	12.00 in	16.13 in	115.546 psi	115.546 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

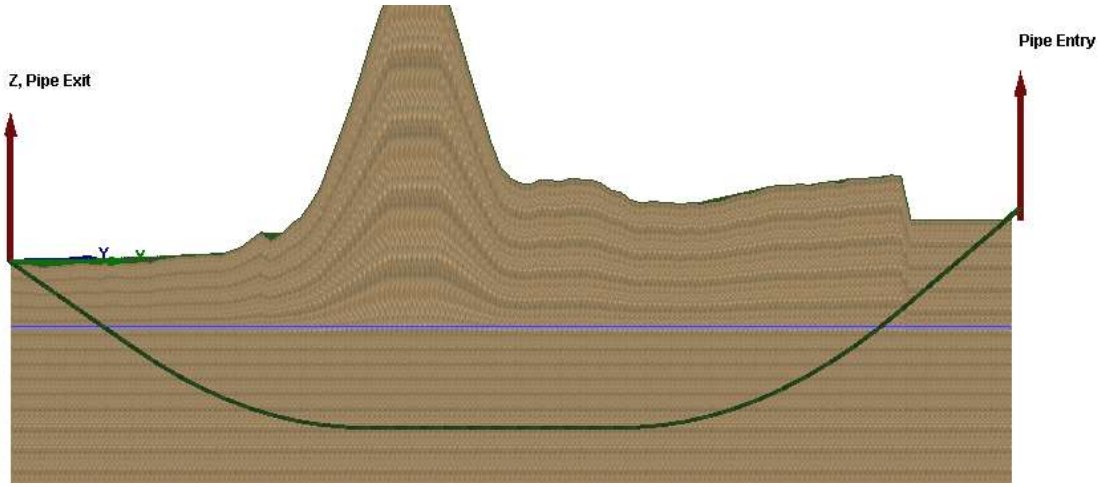
Rheological model: Power-Law

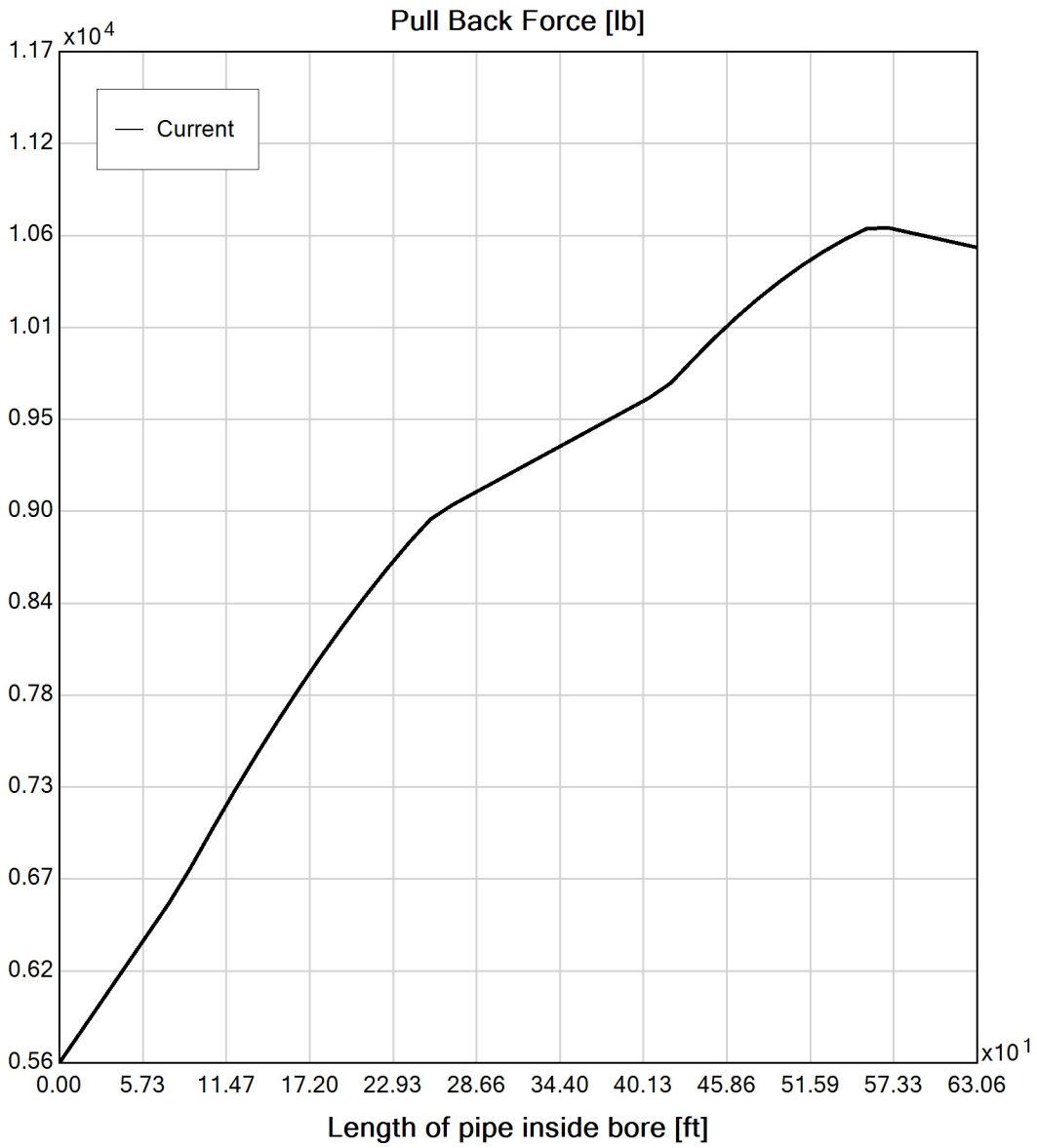
Fluid Consistency Index (K): 63.17

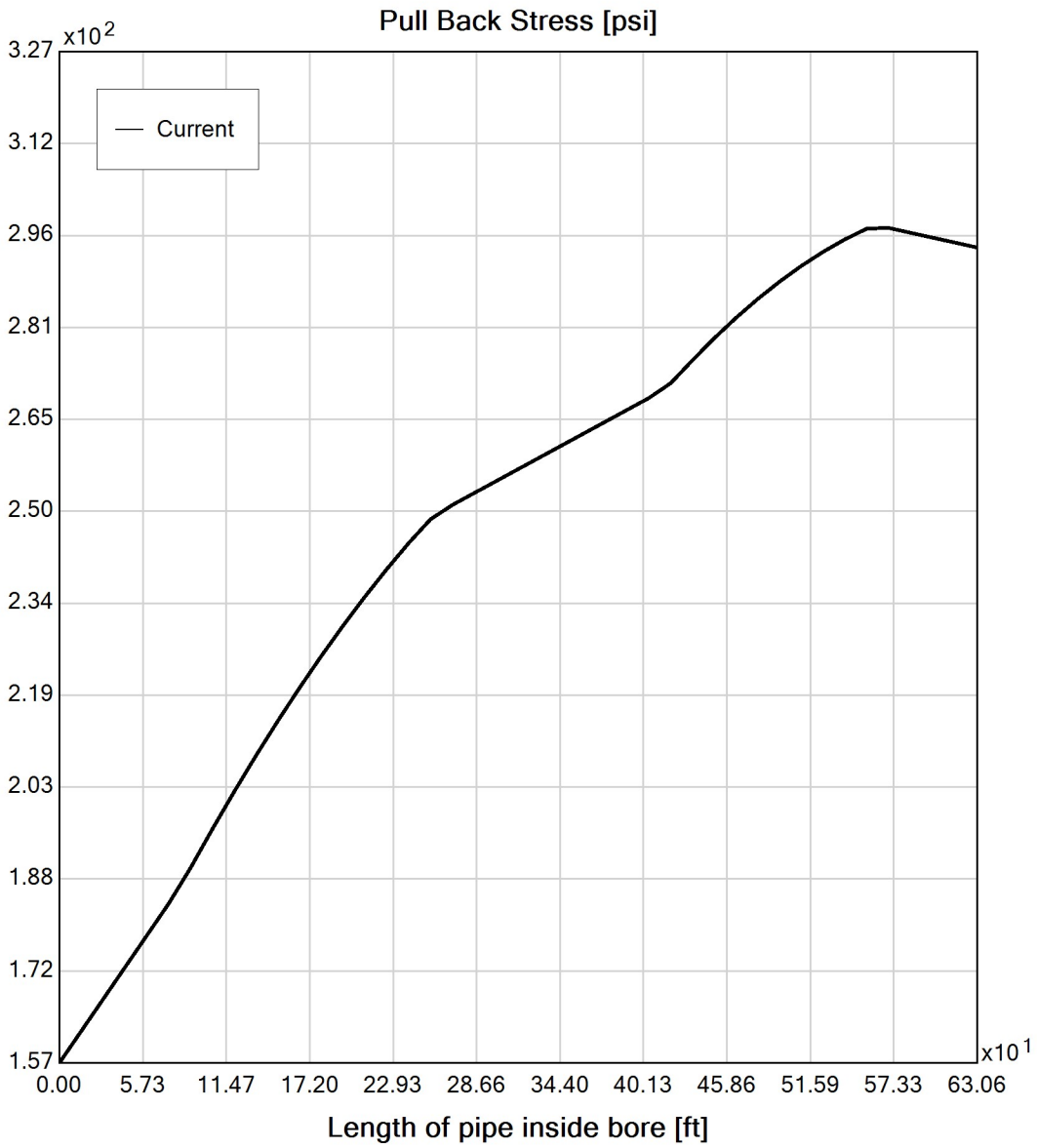
Power Law Exponent (n): 0.14

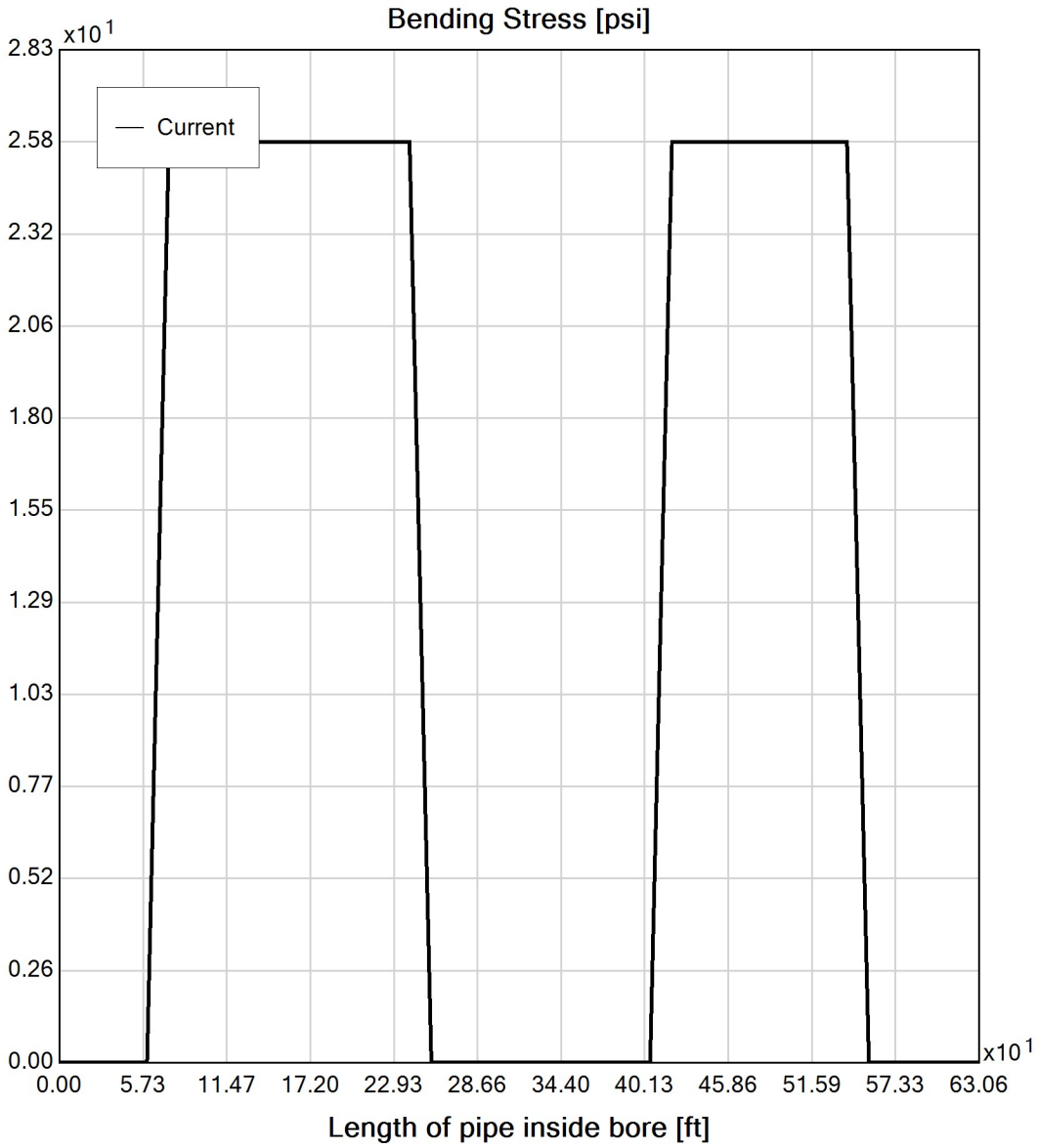
Effective Viscosity (cP): 859.3

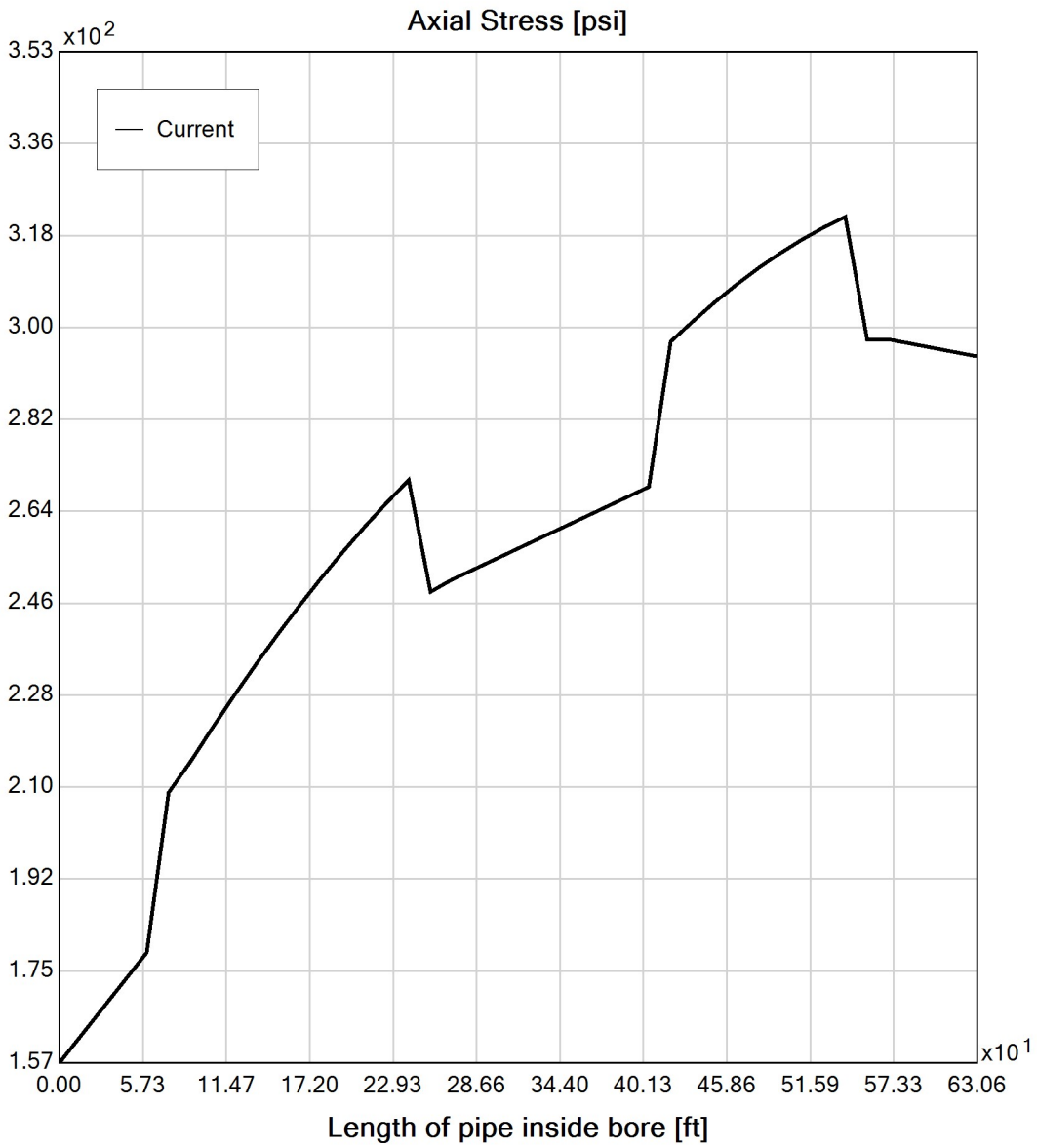
Virtual Site

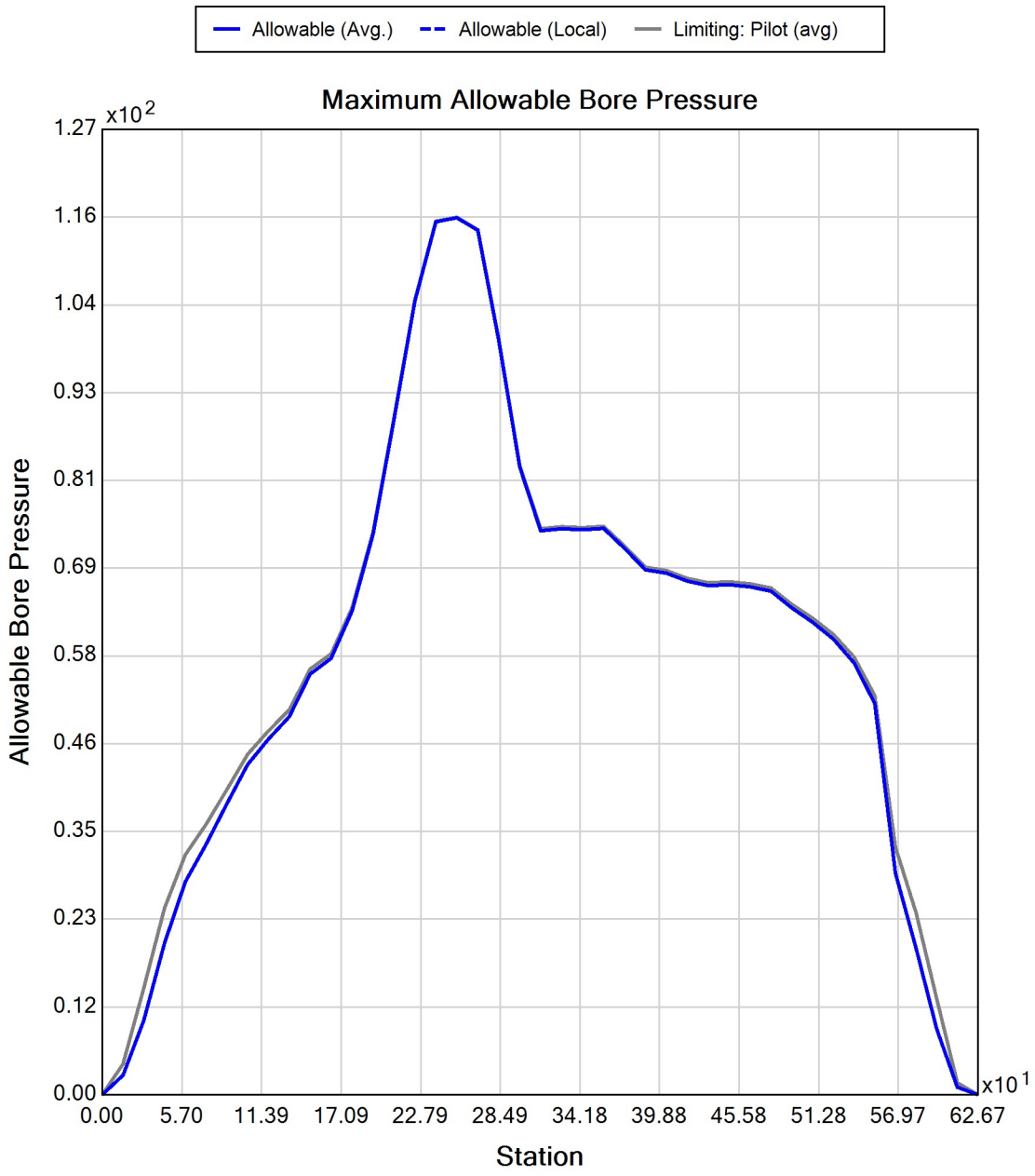


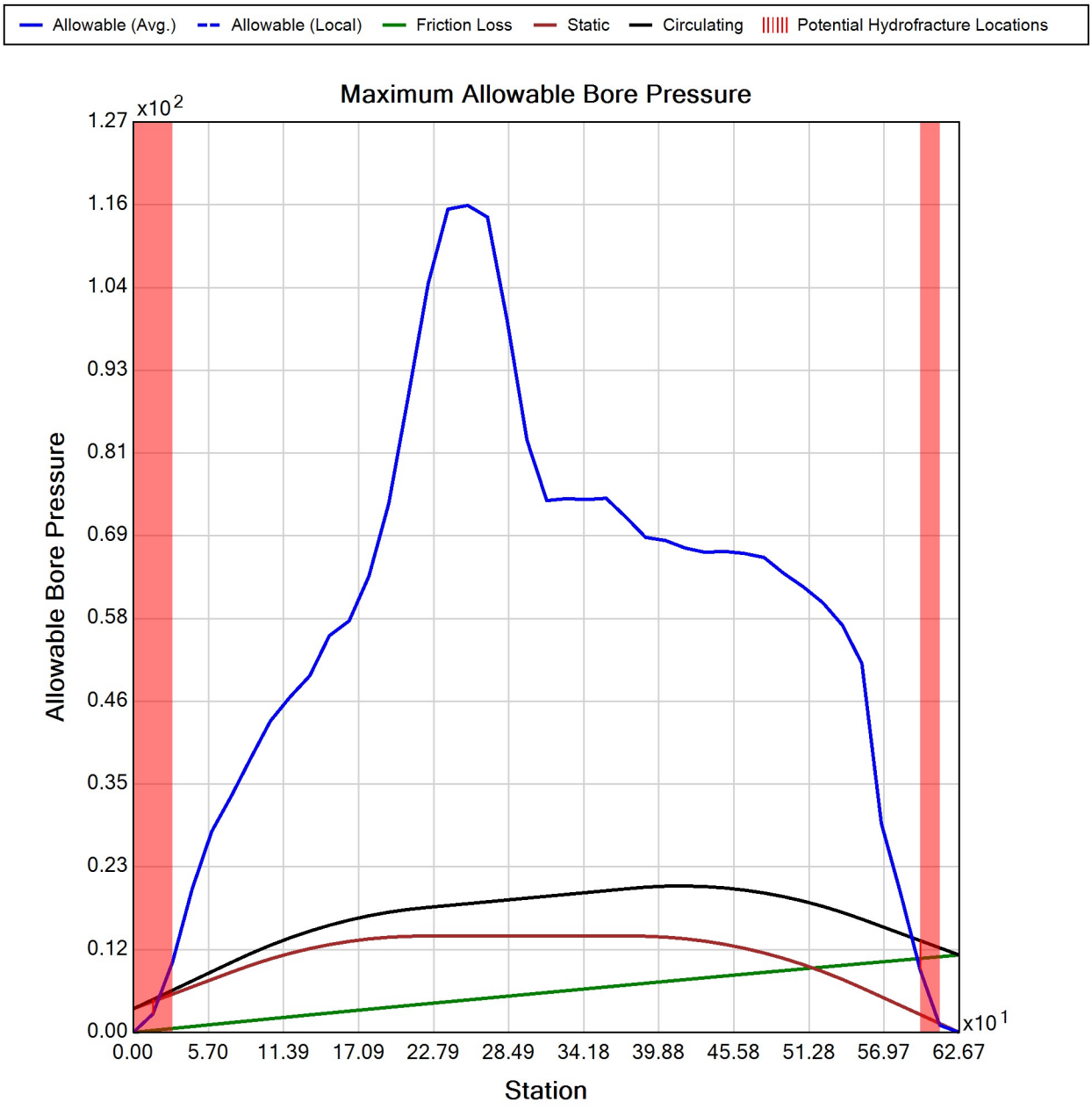












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Input Summary

Start Coordinate	(0.00, 0.00, 313.75) ft
End Coordinate	(621.00, 0.00, 319.00) ft
Project Length	621.00 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: 630.00 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	36.9
Water Pressure	5.6	5.6
Surface Surcharge	0.0	0.0
Internal Pressure	0.0	0.0
Net Pressure	7.5	42.5
Deflection		
Earth Load Deflection	0.588	10.047
Buoyant Deflection	0.029	0.029
Reissner Effect	0	0
Net Deflection	0.617	10.077
Compressive Stress [psi]		
Compressive Wall Stress	33.9	191.2

Installation Load Summary:

Forces/Stresses	@Maximum Force	Absolute Maximum
Pullback Force [lb]	630.1	630.1
Pullback Stress [psi]	360.0	360.0
Pullback Strain	6.261E-3	6.261E-3
Bending Stress [psi]	0.0	5.7
Bending Strain	0	9.896E-5
Tensile Stress [psi]	360.0	363.8
Tensile Strain	6.261E-3	6.426E-3

Net External Pressure = 20.1 [psi]

Buoyant Deflection = 0.0

Hydrokinetic Force = 137.3 lb

In-service Analysis

	Calculated	Allowable	Factor of Safety	Check
Deflection [%]	0.617	7.5	12.1	OK
Unconstrained Collapse [psi]	18.3	131.4	7.2	OK
Compressive Wall Stress [psi]	33.9	1150.0	34.0	OK

Installation Analysis

	Calculated	Allowable	Factor of Safety	Check
Deflection [%]	0.014	7.5	524.3	OK
Unconstrained Collapse [psi]	28.3	236.0	8.3	OK
Tensile Stress [psi]	363.8	1200.0	3.3	OK

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Project Summary

General:	CHPE HDD 37
	P3
	Start Date: 12-10-2021
	End Date: 12-10-2021
Project Owner:	TDI
Project Contractor:	Kiewit
Project Consultant:	CHA/BCE
Designer:	AJB
	CHA
Description:	HDD 37 10-inch DR 9

Input Summary

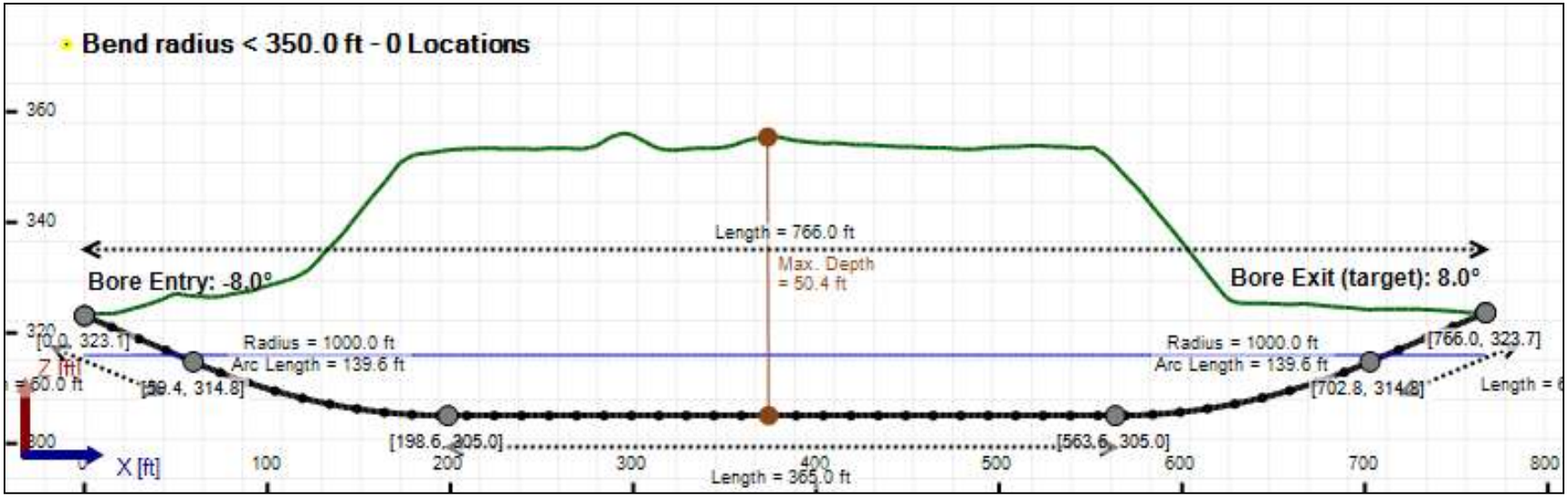
Start Coordinate	(0.00, 0.00, 323.12) ft
End Coordinate	(766.00, 0.00, 323.67) ft
Project Length	766.00 ft
Pipe Type	HDPE
OD Classification	IPS
Pipe OD	10.750 in
Pipe DR	9.0
Pipe Thickness	1.19 in
Rod Length	15.00 ft
Rod Diameter	3.5 in
Drill Rig Location	(0.00, 0.00, 0.00) ft

Soil Summary

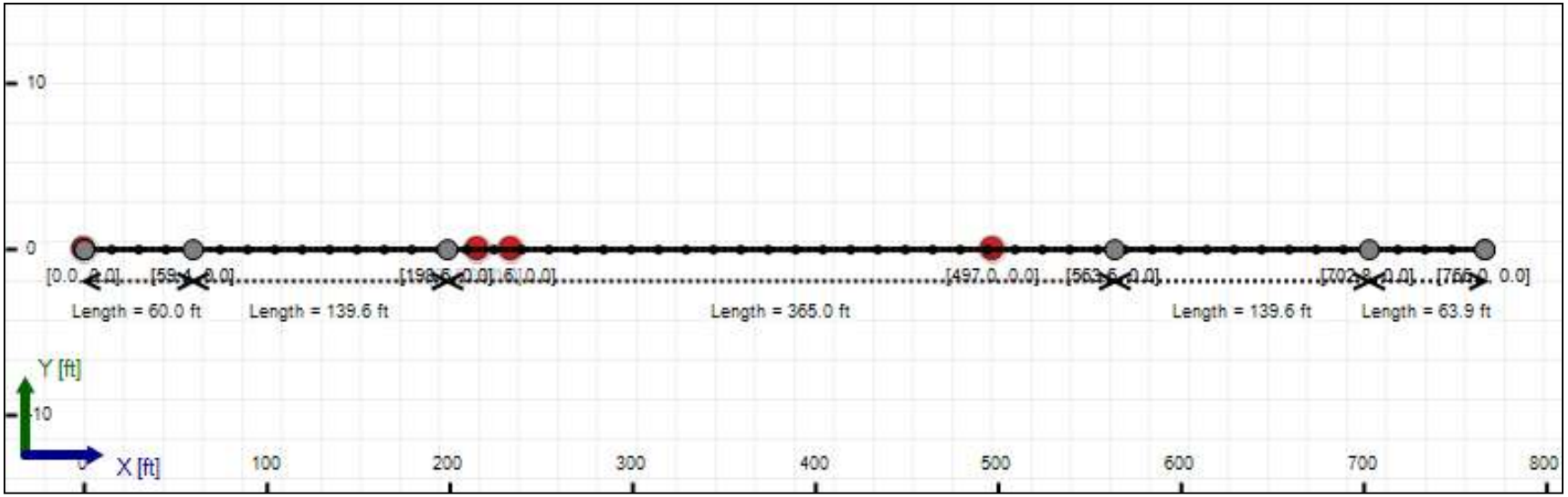
Number of Layers: 1

Soil Layer #1 USCS, Sand (S), SP
Depth: 30.00 ft
Unit Weight: 105.0000 (dry), 115.0000 (sat) [lb/ft3]
Phi: 30.00, S.M.: 145.00, 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: 780.00 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	4.9	33.1
Water Pressure	4.8	4.8
Surface Surcharge	0.0	0.0
Internal Pressure	0.0	0.0
Net Pressure	9.6	37.8
Deflection		
Earth Load Deflection	1.332	9.009
Buoyant Deflection	0.132	0.132
Reissner Effect	0	0
Net Deflection	1.464	9.141
Compressive Stress [psi]		
Compressive Wall Stress	43.4	170.2

Installation Load Summary:

Forces/Stresses	@Maximum Force	Absolute Maximum
Pullback Force [lb]	12436.8	12436.8
Pullback Stress [psi]	346.8	346.8
Pullback Strain	6.032E-3	6.032E-3
Bending Stress [psi]	0.0	25.8
Bending Strain	0	4.479E-4
Tensile Stress [psi]	346.8	369.3
Tensile Strain	6.032E-3	6.870E-3

Net External Pressure = 15.5 [psi]

Buoyant Deflection = 0.1

Hydrokinetic Force = 567.6 lb

In-service Analysis

	Calculated	Allowable	Factor of Safety	Check
Deflection [%]	1.464	7.5	5.1	OK
Unconstrained Collapse [psi]	13.2	121.1	9.2	OK
Compressive Wall Stress [psi]	43.4	1150.0	26.5	OK

Installation Analysis

	Calculated	Allowable	Factor of Safety	Check
Deflection [%]	0.065	7.5	115.8	OK
Unconstrained Collapse [psi]	23.2	234.9	10.1	OK
Tensile Stress [psi]	369.3	1200.0	3.2	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	107.037 psi	107.037 psi
1	8.00 in	12.00 in	107.001 psi	107.001 psi
2	12.00 in	16.13 in	106.949 psi	106.949 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

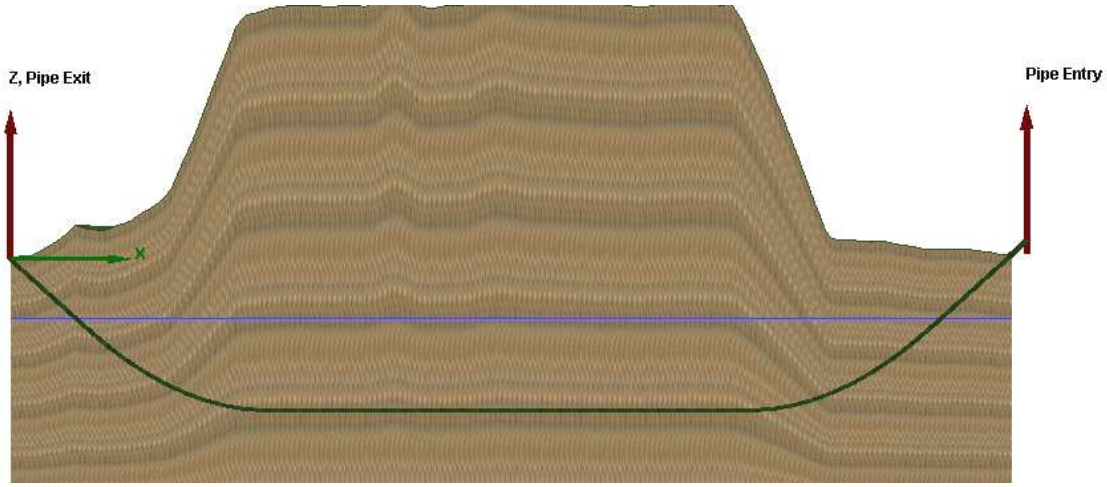
Rheological model: Bingham-Plastic

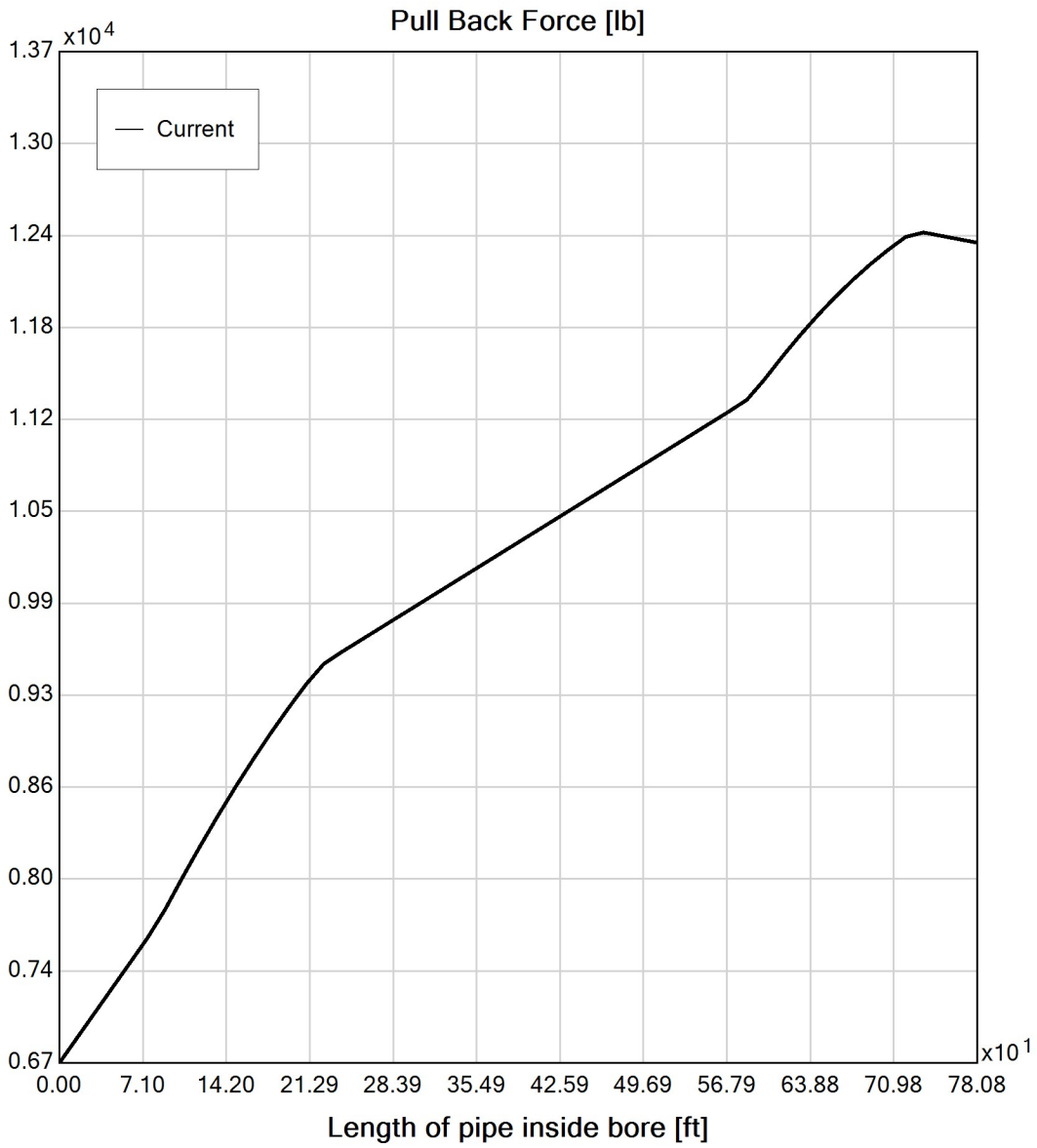
Plastic Viscosity (PV): 25.53

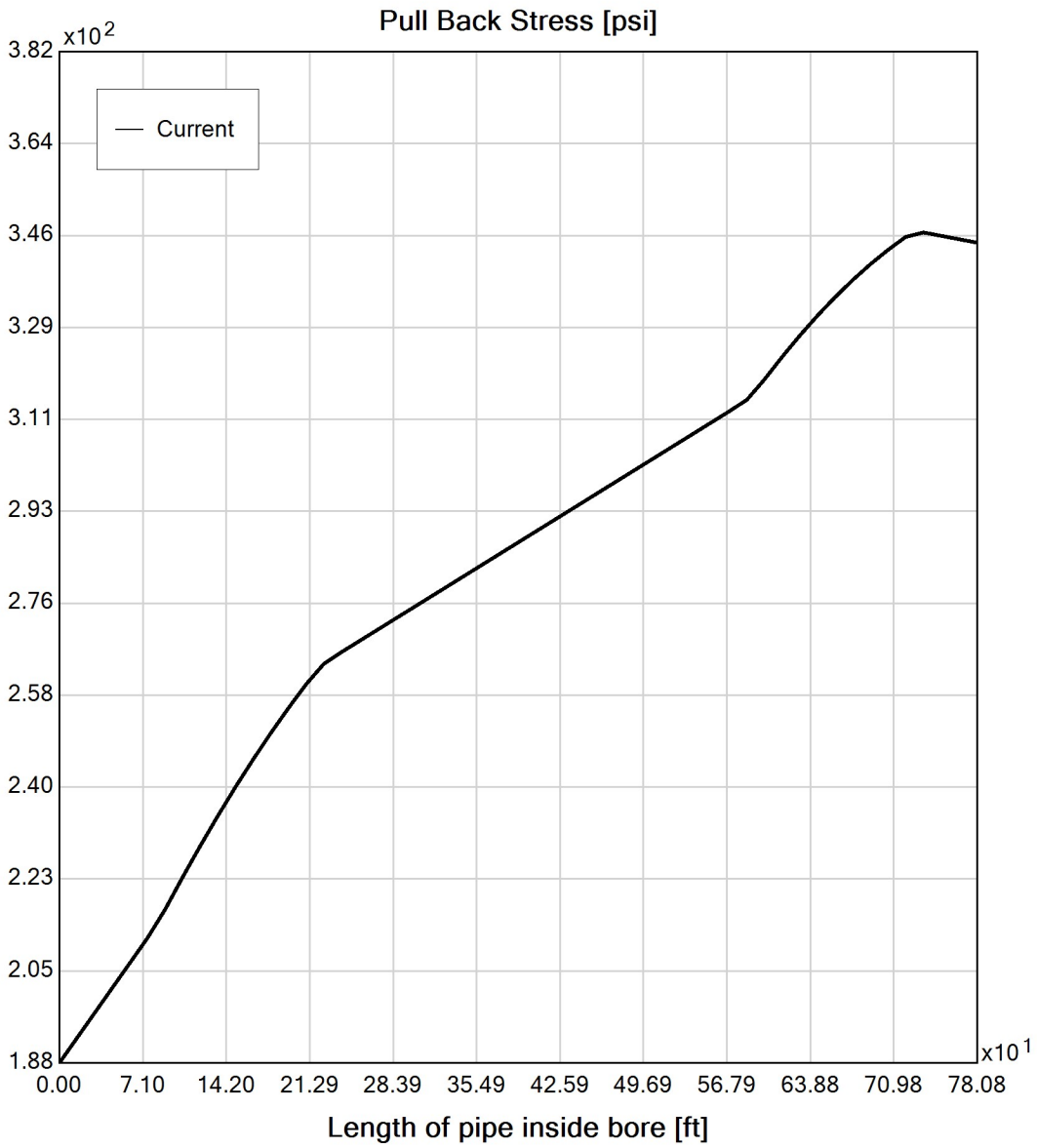
Yield Point (YP): 16.49

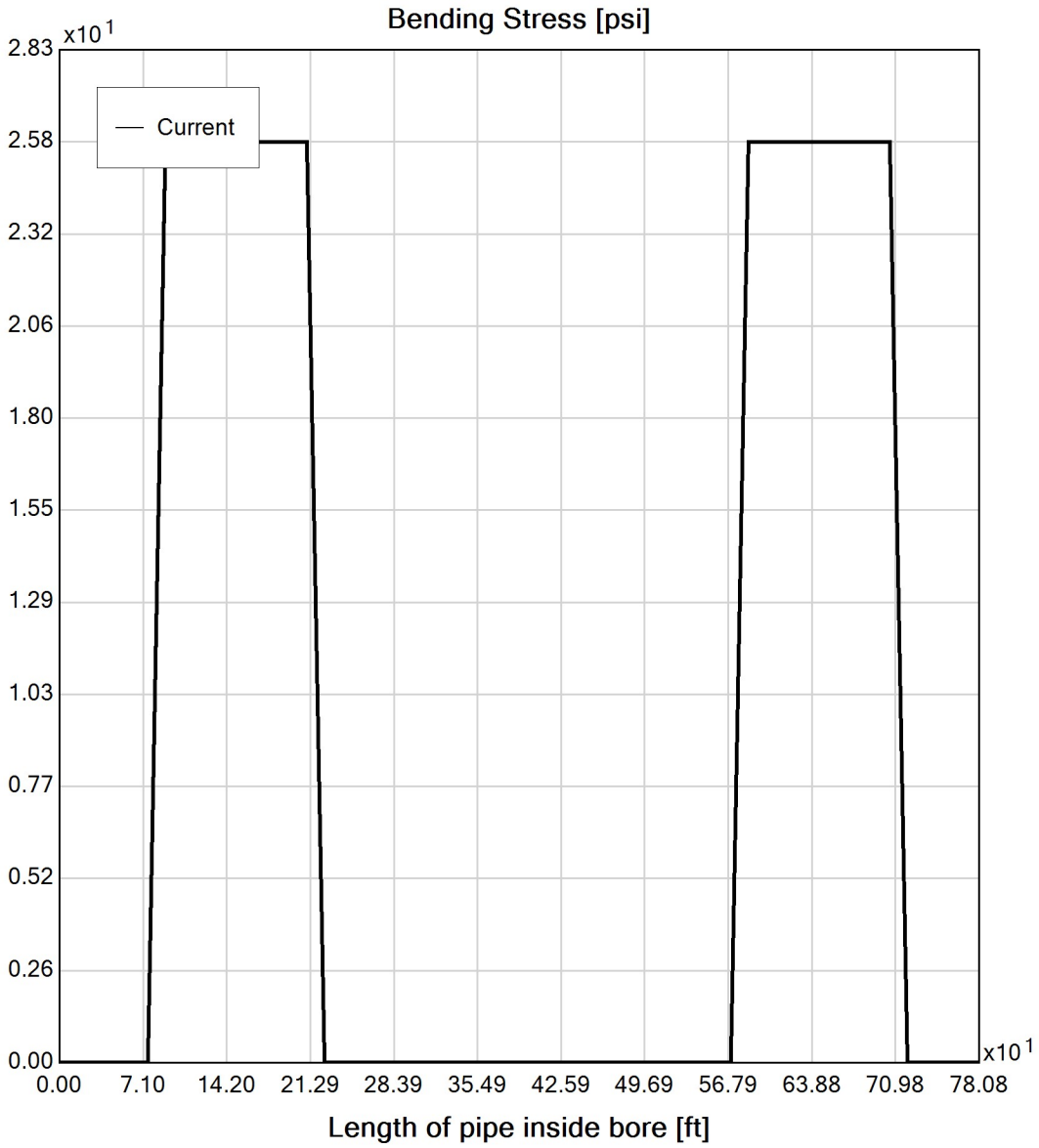
Effective Viscosity (cP): 1202.0

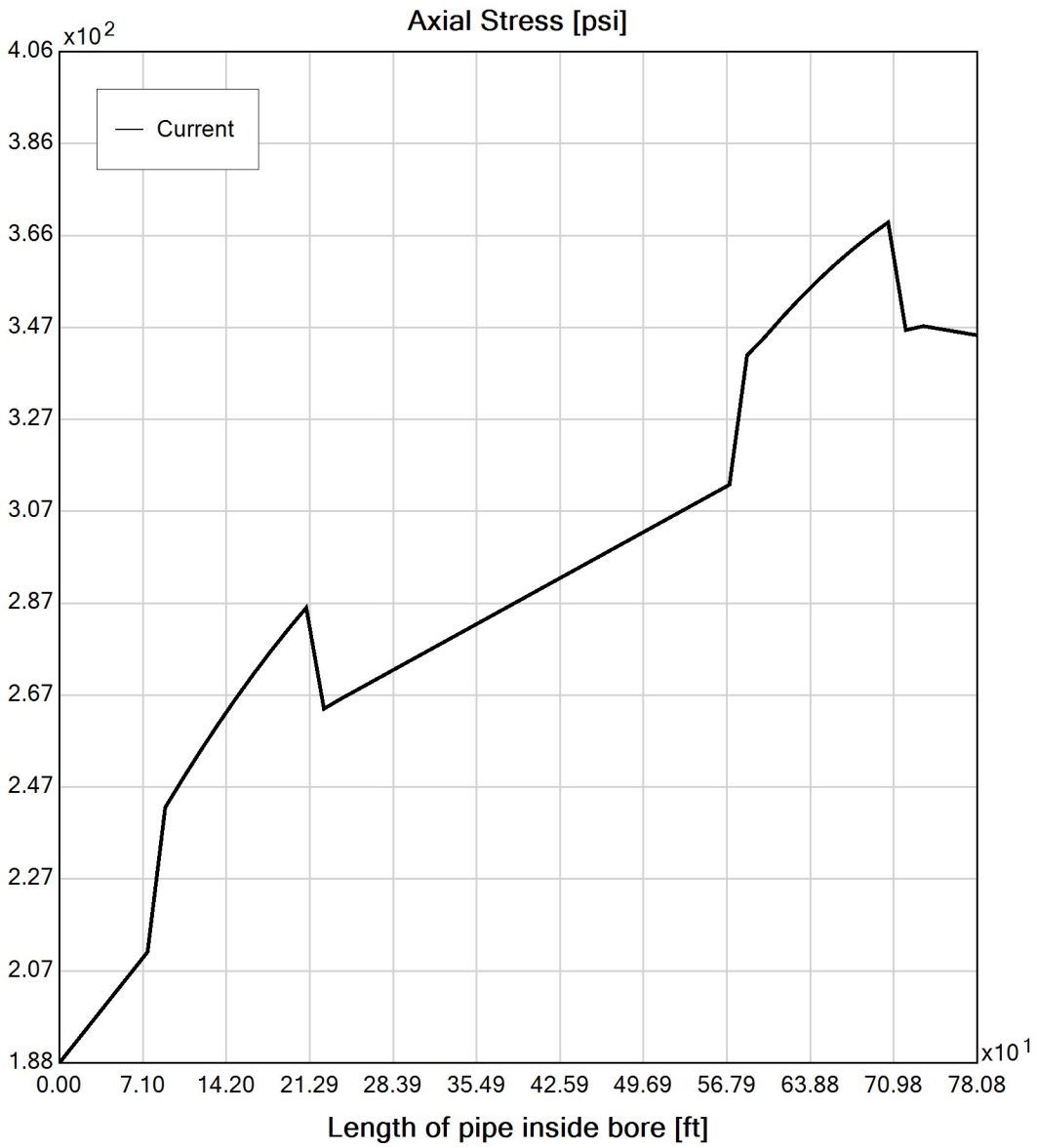
Virtual Site

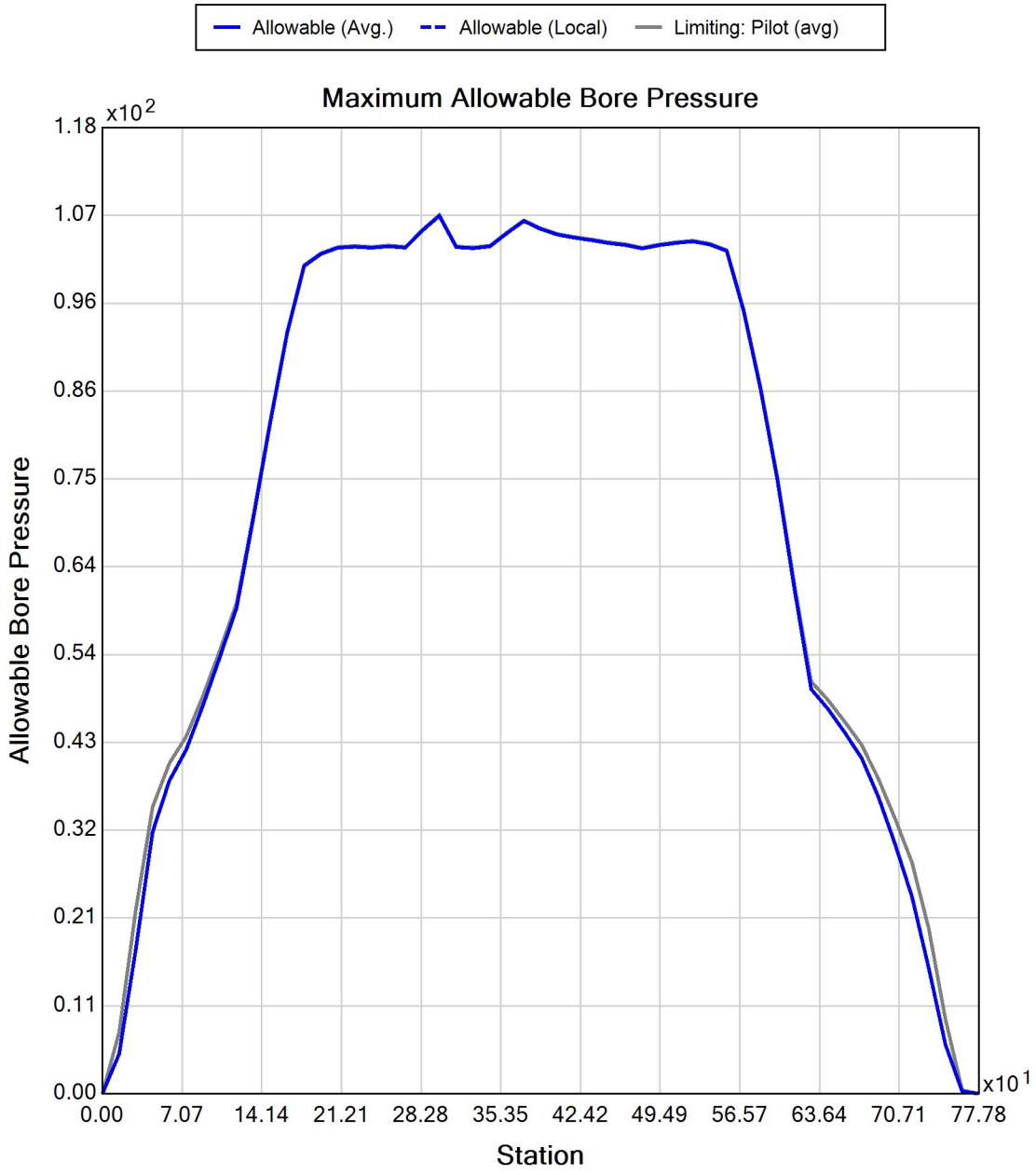


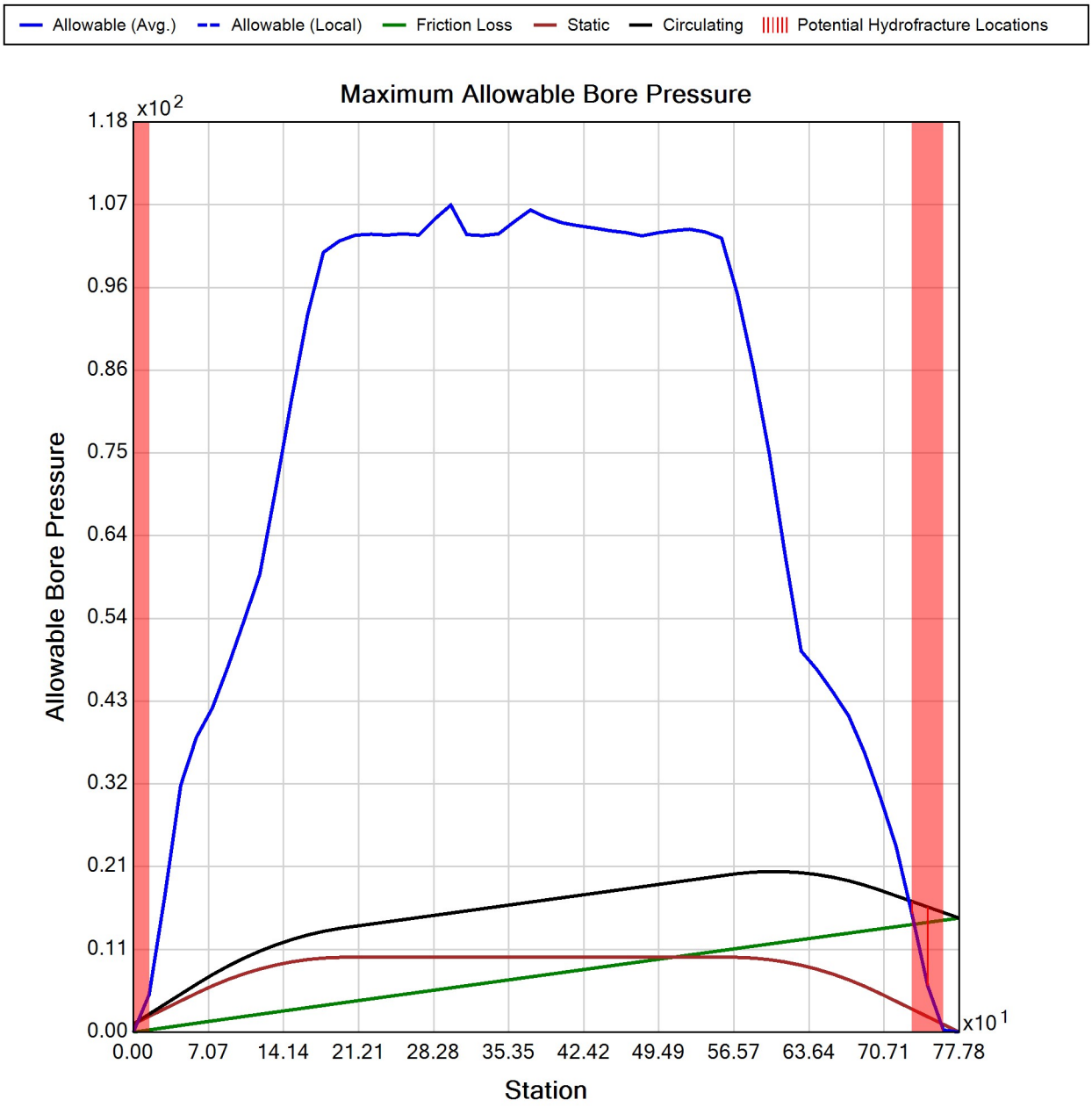












Generated Output

WARNING: The accuracy of the data obtained by the BoreAid® system is highly dependent upon accurate data gathering, data input and proper use of the software. Vermeer is not responsible for that information. BoreAid® data is not intended to replace the need for future on-site utility locating, measuring and verification procedures, which are essential for accurate placement of new underground installations and avoidance of existing utilities.

CALL YOUR ONE-CALL SYSTEM FIRST

WARNING: Always contact your local One-Call system before the start of your digging project. The BoreAid® system is intended to be used with other utility locating methods, such as the use of the One-Call system and the exposing of existing utilities by potholing.

Locate utilities before drilling. Call 811 (U.S. only) or 1-888-258-0808 (U.S. or Canada) or local utility companies or national regulating authority.

Before you start any digging project, do not forget to call the local One-Call system in your area and any utility company that does not subscribe to the One-Call system. For areas not represented by One-Call Systems International, contact the appropriate utility companies or national regulating authority to locate and mark the underground installations. If you do not call, you may have an accident or suffer injuries; cause interruption of services; damage the environment; or experience job delays.

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.

Input Summary

Start Coordinate	(0.00, 0.00, 323.12) ft
End Coordinate	(766.00, 0.00, 323.67) ft
Project Length	766.00 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: 780.00 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	33.1
Water Pressure	4.8	4.8
Surface Surcharge	0.0	0.0
Internal Pressure	0.0	0.0
Net Pressure	6.7	37.8
Deflection		
Earth Load Deflection	0.567	9.009
Buoyant Deflection	0.029	0.029
Reissner Effect	0	0
Net Deflection	0.596	9.038
Compressive Stress [psi]		
Compressive Wall Stress	30.1	170.2

Installation Load Summary:

Forces/Stresses	@Maximum Force	Absolute Maximum
Pullback Force [lb]	716.6	716.6
Pullback Stress [psi]	409.5	409.5
Pullback Strain	7.121E-3	7.121E-3
Bending Stress [psi]	0.0	5.7
Bending Strain	0	9.896E-5
Tensile Stress [psi]	409.5	411.8
Tensile Strain	7.121E-3	7.261E-3

Net External Pressure = 15.5 [psi]

Buoyant Deflection = 0.0

Hydrokinetic Force = 137.3 lb

In-service Analysis

	Calculated	Allowable	Factor of Safety	Check
Deflection [%]	0.596	7.5	12.6	OK
Unconstrained Collapse [psi]	13.2	131.4	10.0	OK
Compressive Wall Stress [psi]	30.1	1150.0	38.2	OK

Installation Analysis

	Calculated	Allowable	Factor of Safety	Check
Deflection [%]	0.014	7.5	524.3	OK
Unconstrained Collapse [psi]	23.2	233.2	10.1	OK
Tensile Stress [psi]	411.8	1200.0	2.9	OK

Generated Output

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Project Summary

General:	CHPE HDD 38 Conduit 1
	P3
	Start Date: 11-15-2022
	End Date: 11-15-2022
Project Owner:	TDI
Project Contractor:	Kiewit
Project Consultant:	CHA/BCE
Designer:	MCS
	CHA
Description:	HDD 38 Conduit 1 10-inch DR 9

Input Summary

Start Coordinate	(0.00, 0.00, 319.00) ft
End Coordinate	(1515.00, 0.00, 310.00) ft
Project Length	1515.00 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

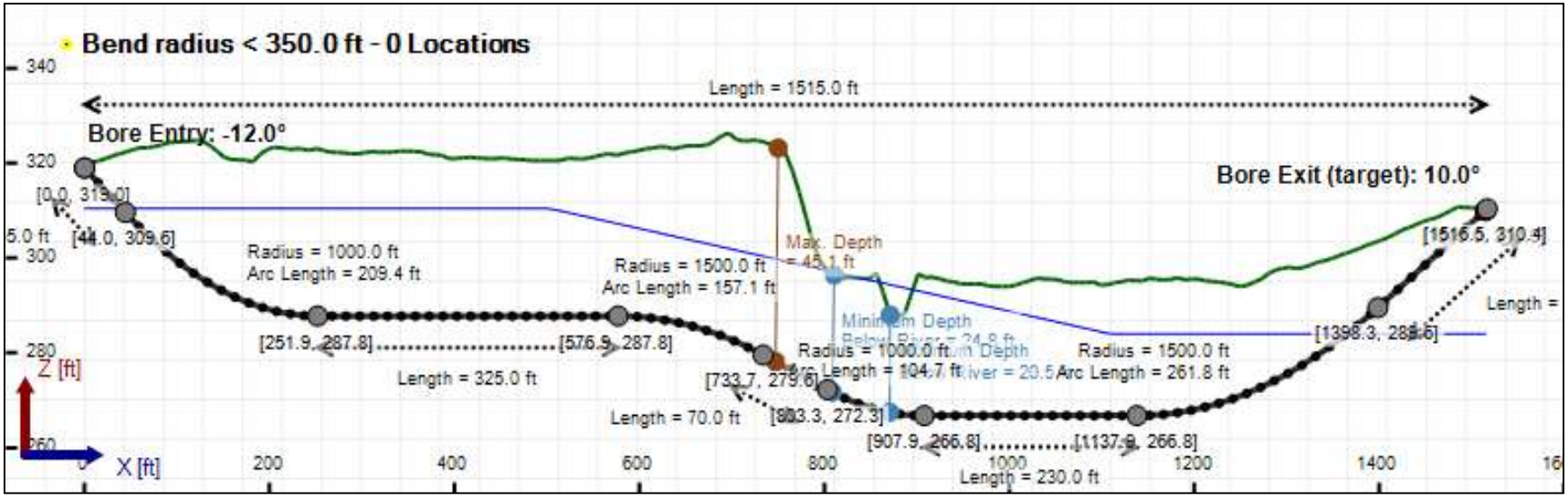
Soil Summary

Number of Layers: 2

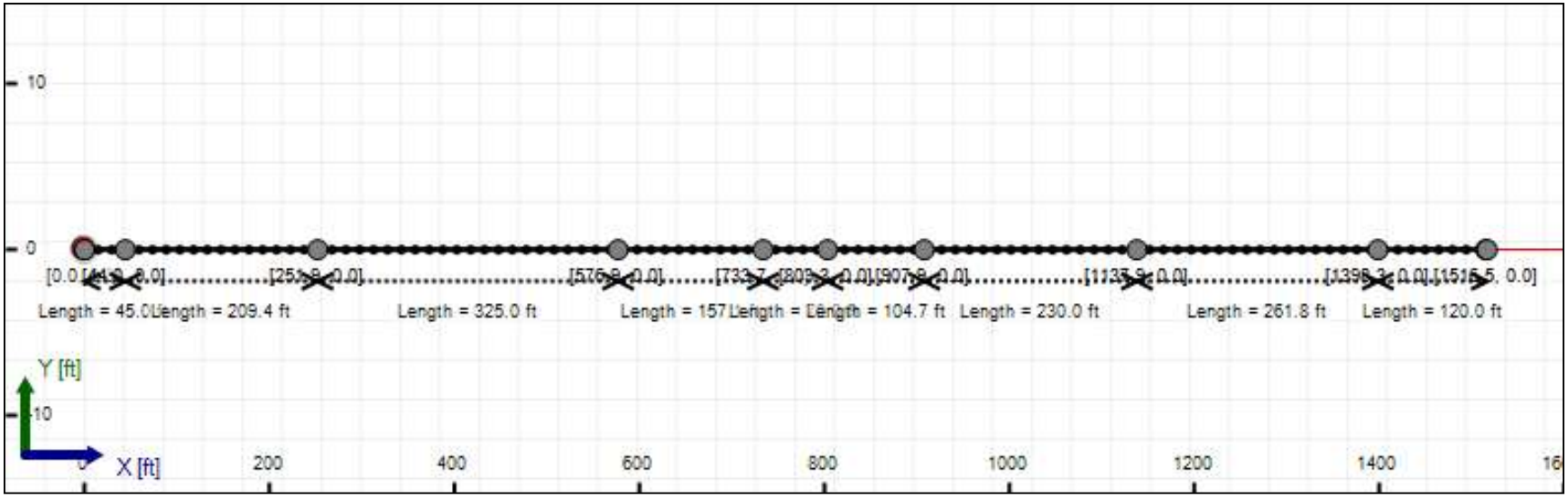
Soil Layer #1 USCS, Sand (S), SP
From Assistant
Unit Weight: 105.0000 (dry), 115.0000 (sat) [lb/ft3]
Phi: 30.00, S.M.: 200.00, Coh: 0.00 [psi]

Soil Layer #2 USCS, Sand (S), SM
From Assistant
Unit Weight: 110.0000 (dry), 125.0000 (sat) [lb/ft3]
Phi: 30.00, 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: 1530.00 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	26.0
Water Pressure	11.7	9.4
Surface Surcharge	0.0	0.0
Internal Pressure	0.0	0.0
Net Pressure	14.8	35.4
Deflection		
Earth Load Deflection	1.324	7.093
Buoyant Deflection	0.132	0.132
Reissner Effect	0	0
Net Deflection	1.456	7.225
Compressive Stress [psi]		
Compressive Wall Stress	66.4	159.4

Installation Load Summary:

Forces/Stresses	@Maximum Force	Absolute Maximum
Pullback Force [lb]	27031.9	27031.9
Pullback Stress [psi]	753.9	753.9
Pullback Strain	1.311E-2	1.311E-2
Bending Stress [psi]	0.0	25.8
Bending Strain	0	4.479E-4
Tensile Stress [psi]	753.9	774.3
Tensile Strain	1.311E-2	1.391E-2

Net External Pressure = 14.1 [psi]

Buoyant Deflection = 0.1

Hydrokinetic Force = 567.6 lb

In-service Analysis

	Calculated	Allowable	Factor of Safety	Check
Deflection [%]	1.456	7.5	5.2	OK
Unconstrained Collapse [psi]	34.0	124.1	3.7	OK
Compressive Wall Stress [psi]	66.4	1150.0	17.3	OK

Installation Analysis

	Calculated	Allowable	Factor of Safety	Check
Deflection [%]	0.065	7.5	115.8	OK
Unconstrained Collapse [psi]	43.9	218.9	5.0	OK
Tensile Stress [psi]	774.3	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	118.581 psi	140.974 psi
1	8.00 in	12.00 in	118.460 psi	140.720 psi
2	12.00 in	16.13 in	118.286 psi	140.354 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): 400.00 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): 143.2

Virtual Site