



# LINE 5 PIPELINE PROJECT

**MP 4 - PLAN AND PROFILE  
30-INCH PIPELINE CROSSING OF THE WHITE RIVER  
BY HORIZONTAL DIRECTIONAL DRILLING**

LOCATION: ASHLAND COUNTY, WISCONSIN						
DRAWN	DATE	CHECKED	APPROVED	SCALE	DRAWING LABEL	REVISION
DMP	01/15/20	KWW	JSP	SHOWN FOR D-SIZED PLOT	WHITE RIVER	P 1

[illegible]

**J.D.Hair & Associates, Inc.**  
Consulting Engineers

2424 East 21st Street  
Suite 510  
Tulsa, Oklahoma 74114

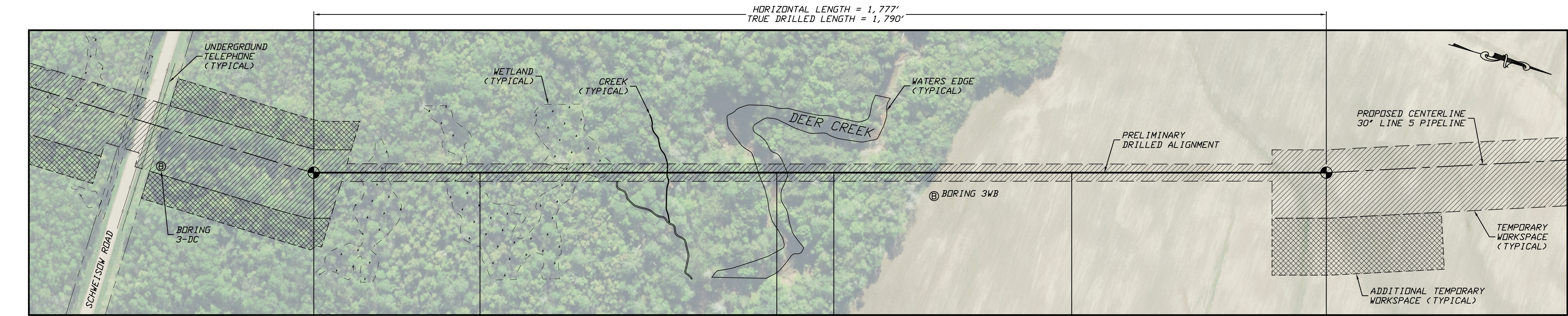
PROJECT NO.  
Enbridge\1938

SHEET NUMBER

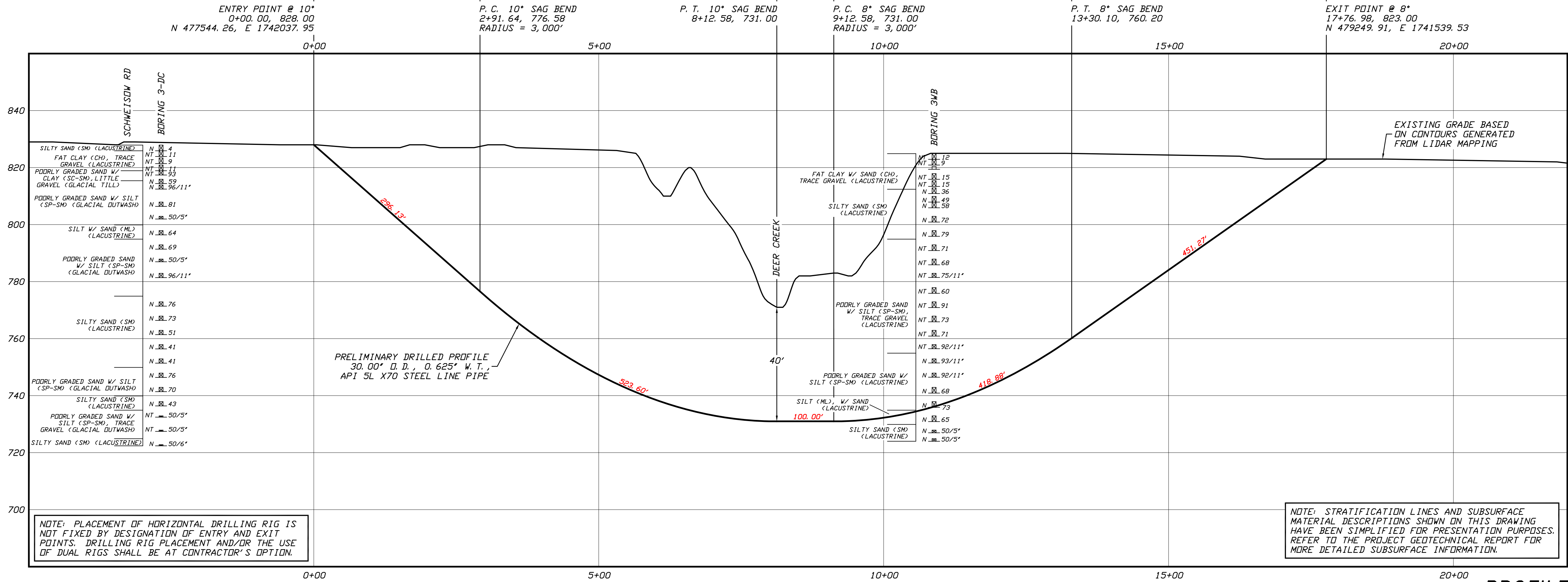
1

2424 East 21st Street  
Suite 510  
Tulsa, Oklahoma 74114





PLAN  
SCALE: 1"=100'



GENERAL LEGEND

- DRILLED PATH ENTRY/EXIT POINT

GEOTECHNICAL LEGEND

- ⊙ BORING LOCATION THIN WALL SAMPLE  
SPLIT SPOON SAMPLE 15" RECOVERY AMOUNT  
53.23 PENETRATION RESISTANCE IN BLOWS PER FOOT FOR A 140 POUND HAMMER FALLING 30 INCHES  
PERCENTAGE OF GRAVEL BY WEIGHT FOR SAMPLES CONTAINING GRAVEL  
CORE BARREL SAMPLE  
UCS 6,250 UNCONFINED COMPRESSIVE STRENGTH (PSI)  
53.6 MOHS HARDNESS  
ROCK QUALITY DESIGNATION (PERCENT)

GEOTECHNICAL NOTES

1. GEOTECHNICAL DATA PROVIDED BY BRAUN INTERTEC, DULUTH, MINNESOTA. REFER TO THE PRELIMINARY BORING LOGS DATED JULY 2020. FOR MORE DETAILED SUBSURFACE INFORMATION.
2. THE LETTER 'N' TO THE LEFT OF A SAMPLE INDICATES THAT NO GRAVEL WAS OBSERVED IN THE SAMPLE. THE LETTERS 'NT' INDICATE THAT GRAVEL WAS OBSERVED BUT NO GRADATION TEST WAS PERFORMED.
3. THE GEOTECHNICAL DATA IS ONLY DESCRIPTIVE OF THE LOCATIONS ACTUALLY SAMPLED. EXTENSION OF THIS DATA OUTSIDE OF THE ORIGINAL BORINGS MAY BE DONE TO CHARACTERIZE THE SOIL CONDITIONS, HOWEVER, COMPANY DOES NOT GUARANTEE THESE CHARACTERIZATIONS TO BE ACCURATE. CONTRACTOR MUST USE HIS OWN EXPERIENCE AND JUDGMENT IN INTERPRETING THIS DATA.

TOPOGRAPHIC SURVEY NOTES

1. TOPOGRAPHIC SURVEY DATA PROVIDED BY ENBRIDGE, DULUTH, MINNESOTA.
2. NORTHINGS AND EASTINGS ARE IN U.S. SURVEY FEET REFERENCED TO WISCONSIN STATE PLANE COORDINATES, NORTH ZONE, NAD 83.
3. ELEVATIONS ARE IN FEET REFERENCED TO NAVD 88.

DRILLED PATH NOTES

1. DRILLED PATH STATIONING IS IN FEET BY HORIZONTAL MEASUREMENT AND IS REFERENCED TO CONTROL ESTABLISHED FOR THE DRILLED SEGMENT.
2. DRILLED PATH COORDINATES REFER TO CENTERLINE OF PILOT HOLE AS OPPOSED TO TOP OF INSTALLED PIPE.

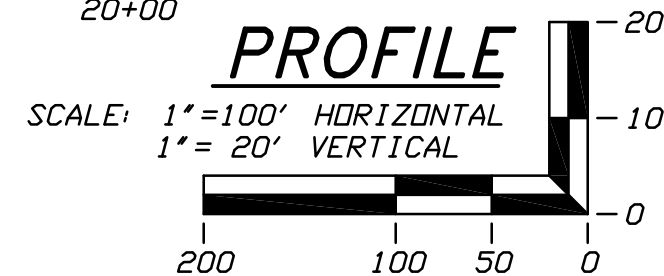
PILOT HOLE TOLERANCES

THE PILOT HOLE SHALL BE DRILLED TO THE TOLERANCES LISTED BELOW. HOWEVER, IN ALL CASES, RIGHT-OF-WAY RESTRICTIONS AND CONCERN FOR ADJACENT FACILITIES SHALL TAKE PRECEDENCE OVER THESE TOLERANCES.

1. ENTRY POINT: AS STAKED BY COMPANY
2. EXIT POINT: UP TO 10 FEET SHORT OR 20 FEET LONG RELATIVE TO THE DESIGNED EXIT POINT; UP TO 5 FEET RIGHT OR LEFT OF THE DESIGNED ALIGNMENT
3. ELEVATION: UP TO 2 FEET ABOVE AND 10 FEET BELOW THE DESIGNED PROFILE
4. ALIGNMENT: UP TO 5 FEET RIGHT OR LEFT OF THE DESIGNED ALIGNMENT
5. CURVE RADIUS: NO LESS THAN 2,000 FEET BASED ON A 3-JOINT AVERAGE (ASSUMING RANGE 2 DRILL PIPE)

PROTECTION OF EXISTING FACILITIES

- CONTRACTOR SHALL UNDERTAKE THE FOLLOWING STEPS PRIOR TO COMMENCING DRILLING OPERATIONS.
1. CONTACT THE UTILITY LOCATION/NOTIFICATION SERVICE FOR THE CONSTRUCTION AREA.
  2. POSITIVELY LOCATE AND STAKE ALL EXISTING UNDERGROUND FACILITIES. ANY FACILITIES LOCATED WITHIN 10 FEET OF THE DESIGNED DRILLED PATH SHALL BE EXPOSED.
  3. MODIFY DRILLING PRACTICES AND DOWNHOLE ASSEMBLIES AS NECESSARY TO PREVENT DAMAGE TO EXISTING FACILITIES.



PRELIMINARY – NOT FOR CONSTRUCTION

LINE 5 PIPELINE PROJECT

MP 6 - PLAN AND PROFILE  
30-INCH PIPELINE CROSSING OF DEER CREEK  
BY HORIZONTAL DIRECTIONAL DRILLING

LOCATION: ASHLAND COUNTY, WISCONSIN	CHECKED: DLB	APPROVED: JSP	DRAWING LABEL: DEER CREEK	REVISION: P1
DRAWN: KWW	DATE: 06/17/20	SCALE: SHOWN FOR D-SIZED PLOT		

J.D.Hair&Associates, Inc.  
Consulting Engineers

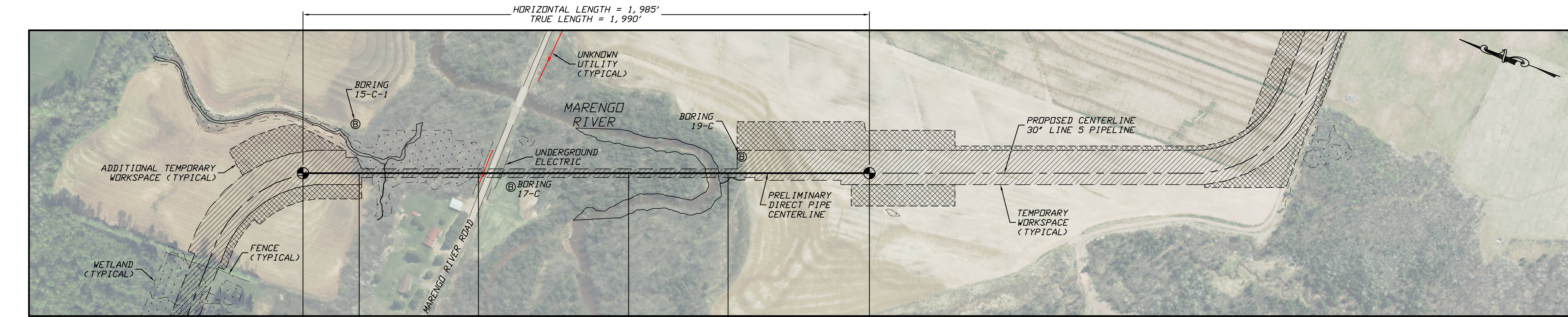
2424 East 21st Street  
Tulsa, Oklahoma 74114

PROJECT NO.  
Enbridge\1938

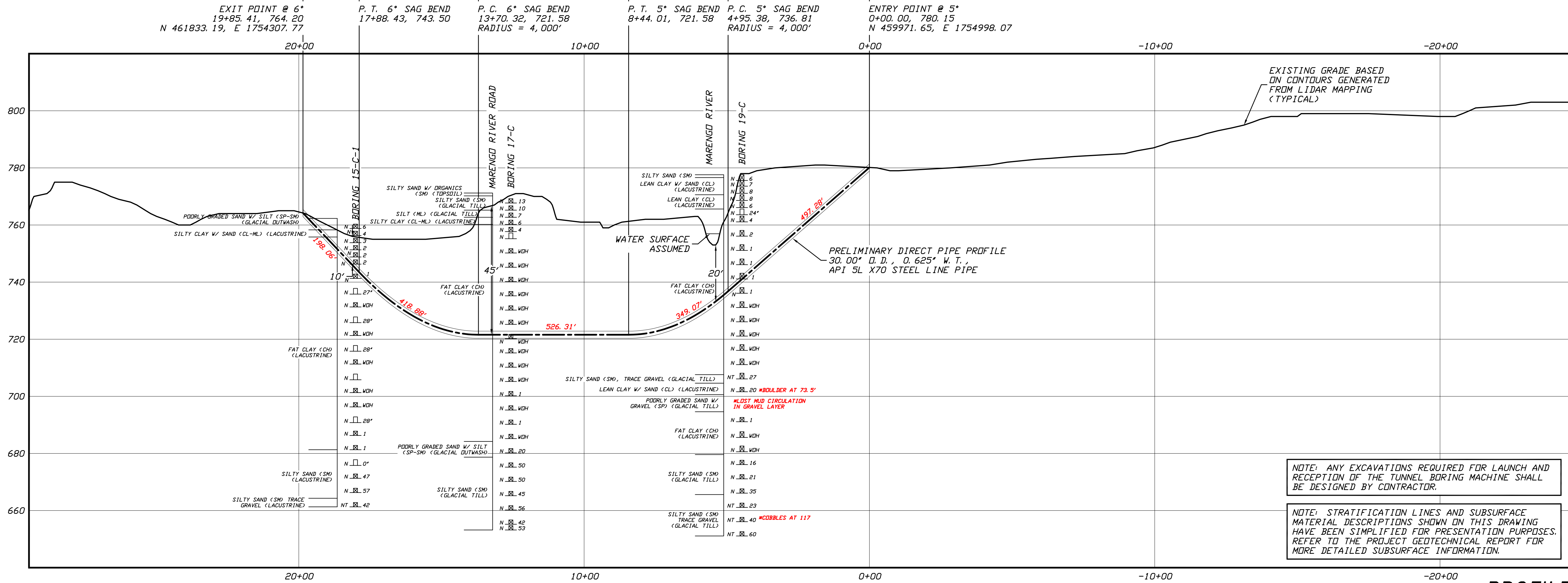
SHEET NUMBER

1





**PLAN**  
SCALE: 1"=200'



NOTE: ANY EXCAVATIONS REQUIRED FOR LAUNCH AND RECEPTION OF THE TUNNEL BORING MACHINE SHALL BE DESIGNED BY CONTRACTOR.

NOTE: STRATIFICATION LINES AND SUBSURFACE MATERIAL DESCRIPTIONS SHOWN ON THIS DRAWING HAVE BEEN SIMPLIFIED FOR PRESENTATION PURPOSES. REFER TO THE PROJECT GEOTECHNICAL REPORT FOR MORE DETAILED SUBSURFACE INFORMATION.

**GENERAL LEGEND**

- DIRECT PIPE ENTRY/EXIT POINT
- BORING LOCATION
- THIN WALL SAMPLE
- SPLIT SPOON SAMPLE
- PENETRATION RESISTANCE IN BLOWS PER FOOT FOR A 140 POUND HAMMER FALLING 30 INCHES
- PERCENTAGE OF GRAVEL BY WEIGHT FOR SAMPLES CONTAINING GRAVEL
- CORE BARREL SAMPLE
- UCS 6,250 — UNCONFINED COMPRESSIVE STRENGTH (PSI)
- 53.6 — MOHS HARDNESS
- ROCK QUALITY DESIGNATION (PERCENT)

**GEOTECHNICAL NOTES**

- GEOTECHNICAL DATA PROVIDED BY BRAUN INTERTEC, DULUTH, MINNESOTA. REFER TO THE DRAFT BORING LOGS DATED MAY 2020 FOR MORE DETAILED SUBSURFACE INFORMATION.
- THE LETTER 'N' TO THE LEFT OF A SAMPLE INDICATES THAT NO GRAVEL WAS OBSERVED IN THE SAMPLE. THE LETTERS 'NT' INDICATE THAT GRAVEL WAS OBSERVED BUT NO GRADATION TEST WAS PERFORMED.
- THE GEOTECHNICAL DATA IS ONLY DESCRIPTIVE OF THE LOCATIONS ACTUALLY SAMPLED. EXTENSION OF THIS DATA OUTSIDE OF THE ORIGINAL BORINGS MAY BE DONE TO CHARACTERIZE THE SOIL CONDITIONS, HOWEVER, COMPANY DOES NOT GUARANTEE THESE CHARACTERIZATIONS TO BE ACCURATE. CONTRACTOR MUST USE HIS OWN EXPERIENCE AND JUDGMENT IN INTERPRETING THIS DATA.

**TOPOGRAPHIC SURVEY NOTES**

- TOPOGRAPHIC SURVEY DATA PROVIDED BY ENBRIDGE, DULUTH, MINNESOTA.
- NORTHINGS AND EASTINGS ARE IN U.S. SURVEY FEET REFERENCED TO WISCONSIN STATE PLANE COORDINATES, NORTH ZONE, NAD 83.
- ELEVATIONS ARE IN FEET REFERENCED TO NAVD 88.

**COORDINATE GEOMETRY NOTES**

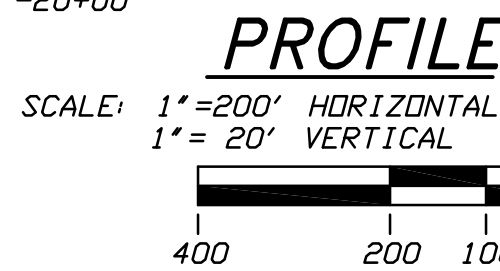
- STATIONING IS IN FEET BY HORIZONTAL MEASUREMENT AND IS REFERENCED TO CONTROL ESTABLISHED FOR THE DIRECT PIPE SEGMENT.
- COORDINATES REFER TO DIRECT PIPE CENTERLINE AS OPPOSED TO TOP OF INSTALLED PIPE.

**DIRECTIONAL TOLERANCES**

- THE CENTERLINE OF THE DIRECT PIPE INSTALLATION SHALL CONFORM TO THE TOLERANCES LISTED BELOW. HOWEVER, IN ALL CASES, RIGHT-OF-WAY RESTRICTIONS AND CONCERN FOR ADJACENT FACILITIES SHALL TAKE PRECEDENCE OVER THESE TOLERANCES.
- ELEVATION: UP TO 2 FEET ABOVE AND 5 FEET BELOW THE DESIGNED PROFILE
  - ALIGNMENT: UP TO 10 FEET RIGHT OR LEFT OF THE DESIGNED ALIGNMENT
  - CURVE RADIUS: NO LESS THAN 2,000 FEET

**PROTECTION OF EXISTING FACILITIES**

- CONTRACTOR SHALL UNDERTAKE THE FOLLOWING STEPS PRIOR TO COMMENCING DIRECT PIPE OPERATIONS.
- CONTACT THE UTILITY LOCATION/NOTIFICATION SERVICE FOR THE CONSTRUCTION AREA.
  - POSITIVELY LOCATE AND STAKE ALL EXISTING UNDERGROUND FACILITIES. ANY FACILITIES LOCATED WITHIN 10 FEET OF THE DESIGNED DIRECT PIPE CENTERLINE SHALL BE EXPOSED.
  - MODIFY DIRECT PIPE OPERATIONS AS NECESSARY TO PREVENT DAMAGE TO EXISTING FACILITIES.



PRELIMINARY – NOT FOR CONSTRUCTION

**LINE 5 PIPELINE PROJECT**

**MP 11 - PLAN AND PROFILE  
30-INCH PIPELINE CROSSING OF THE MARENGO RIVER  
BY THE DIRECT PIPE METHOD**

LOCATION: ASHLAND COUNTY, WISCONSIN	CHECKED	APPROVED	SCALE	SHOWN FOR	DRAWING LABEL	REVISION
DRAWN	DATE	03/12/20	JSP	D-SIZED PLOT	MARENGO DP	P2
DLB						

J.D.Hair&Associates,Inc.  
Consulting Engineers

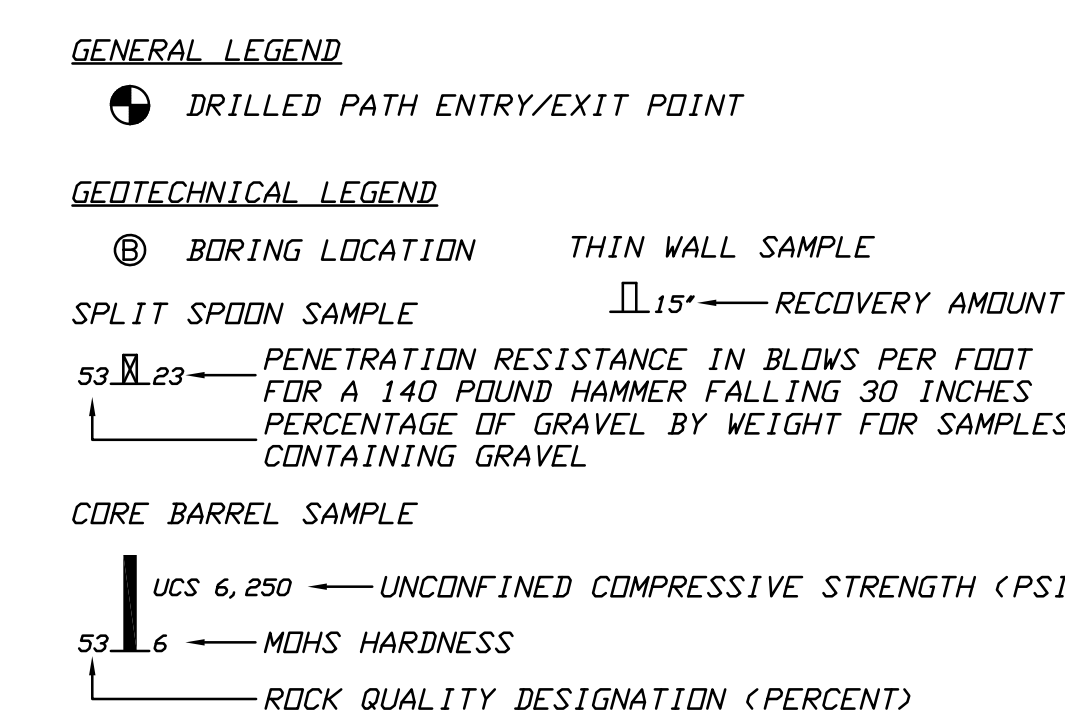
2424 East 21st Street  
Tulsa, Oklahoma 74114

PROJECT NO.  
Enbridge\1938

SHEET NUMBER

1





- GEO TECHNICAL NOTES
1. GEOTECHNICAL DATA PROVIDED BY BRAUN INTERTEC, DULUTH, MINNESOTA, REFER TO THE DRAFT BORING LOGS DATED MAY & JUNE 2020 FOR MORE DETAILED SUBSURFACE INFORMATION.
  2. THE LETTER 'N' TO THE LEFT OF A SAMPLE INDICATES THAT NO GRAVEL WAS OBSERVED IN THE SAMPLE. THE LETTERS 'NT' INDICATE THAT GRAVEL WAS OBSERVED BUT NO GRADATION TEST WAS PERFORMED.
  3. THE GEOTECHNICAL DATA IS ONLY DESCRIPTIVE OF THE LOCATIONS ACTUALLY SAMPLED. EXTENSION OF THIS DATA OUTSIDE OF THE ORIGINAL BORINGS MAY BE DONE TO CHARACTERIZE THE SOIL CONDITIONS, HOWEVER, COMPANY DOES NOT GUARANTEE THESE CHARACTERIZATIONS TO BE ACCURATE. CONTRACTOR MUST USE HIS OWN EXPERIENCE AND JUDGMENT IN INTERPRETING THIS DATA.

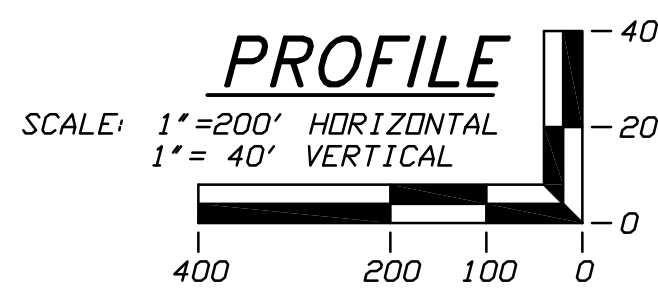
- TOPOGRAPHIC SURVEY NOTES
1. TOPOGRAPHIC SURVEY DATA PROVIDED BY ENBRIDGE, DULUTH, MINNESOTA.
  2. NORTHINGS AND EASTINGS ARE IN U. S. SURVEY FEET REFERENCED TO WISCONSIN STATE PLANE COORDINATES, NORTH ZONE, NAD 83.
  3. ELEVATIONS ARE IN FEET REFERENCED TO NAVD 88.
- DRILLED PATH NOTES
1. DRILLED PATH STATIONING IS IN FEET BY HORIZONTAL MEASUREMENT AND IS REFERENCED TO CONTROL ESTABLISHED FOR THE DRILLED SEGMENT.
  2. DRILLED PATH COORDINATES REFER TO CENTERLINE OF PILOT HOLE AS OPPOSED TO TOP OF INSTALLED PIPE.

- PILOT HOLE TOLERANCES
- THE PILOT HOLE SHALL BE DRILLED TO THE TOLERANCES LISTED BELOW. HOWEVER, IN ALL CASES, RIGHT-OF-WAY RESTRICTIONS AND CONCERN FOR ADJACENT FACILITIES SHALL TAKE PRECEDENCE OVER THESE TOLERANCES.
- ENTRY POINT: AS STAKED BY COMPANY
- EXIT POINT: UP TO 10 FEET SHORT OR 20 FEET LONG RELATIVE TO THE DESIGNED EXIT POINT, UP TO 5 FEET RIGHT OR LEFT OF THE DESIGNED ALIGNMENT
- ELEVATION: UP TO 2 FEET ABOVE AND 10 FEET BELOW THE DESIGNED PROFILE
- ALIGNMENT: UP TO 5 FEET RIGHT OR LEFT OF THE DESIGNED ALIGNMENT
- CURVE RADIUS: NO LESS THAN 2,000 FEET BASED ON A 3-JOINT AVERAGE (ASSUMING RANGE 2 DRILL PIPE

PROTECTION OF EXISTING FACILITIES

CONTRACTOR SHALL UNDERTAKE THE FOLLOWING STEPS PRIOR TO COMMENCING DRILLING OPERATIONS:

1. CONTACT THE UTILITY LOCATION/NOTIFICATION SERVICE FOR THE CONSTRUCTION AREA.
2. POSITIVELY LOCATE AND STAKE ALL EXISTING UNDERGROUND FACILITIES. ANY FACILITIES LOCATED WITHIN 10 FEET OF THE DESIGNED DRILLED PATH SHALL BE EXPOSED.
3. MODIFY DRILLING PRACTICES AND DOWNHOLE ASSEMBLIES AS NECESSARY TO PREVENT DAMAGE TO EXISTING FACILITIES.



PRELIMINARY – NOT FOR CONSTRUCTION

# LINE 5 PIPELINE PROJECT

**MP 14 - PLAN AND PROFILE  
30-INCH PIPELINE CROSSING OF THE BRUNSWEILER RIVER  
BY HORIZONTAL DIRECTIONAL DRILLING**

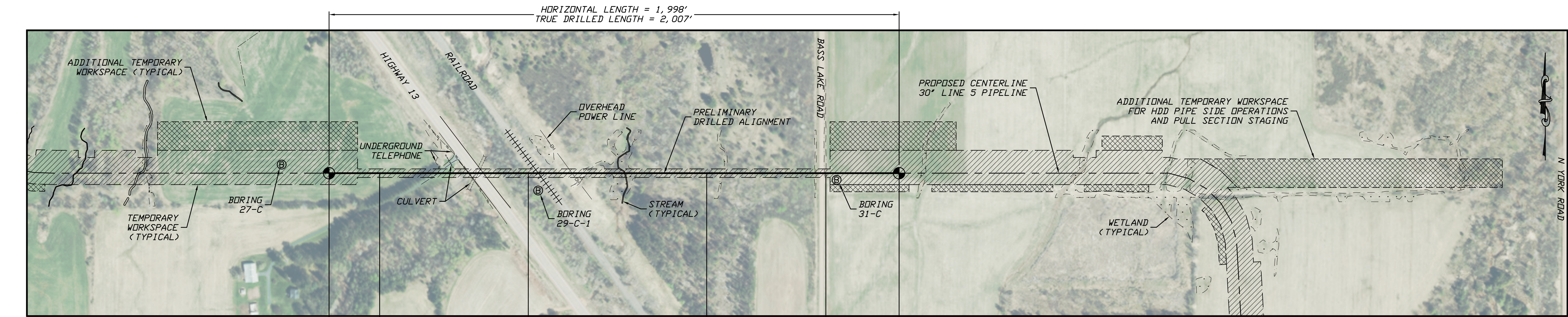
LOCATION: ASHLAND COUNTY, WISCONSIN				
DRAWN	DATE	CHECKED	APPROVED	SCALE
DMP	12/17/19	KWW	JSP	SHOWN FOR D-SIZED PLOT
				DRAWING LABEL
				BRUNSWELLER
				REVISION
				P2

[illegible]

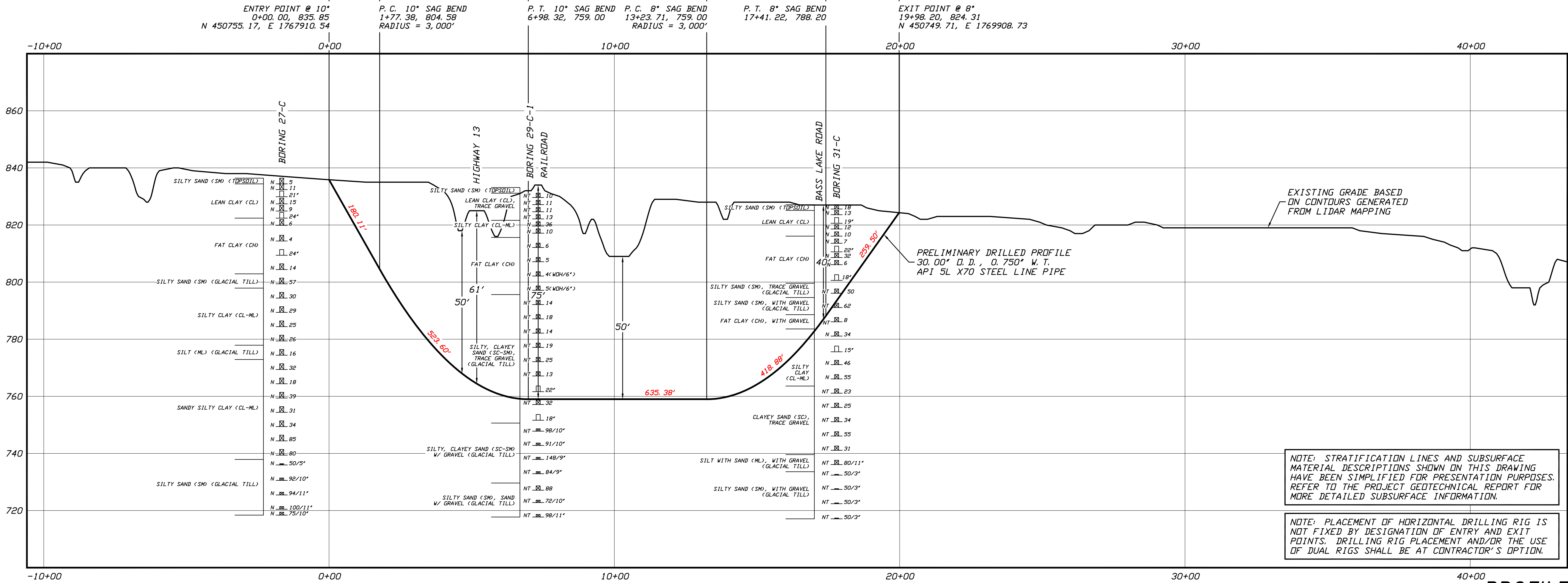
**J.D.Hair & Associates, Inc.**  
*Consulting Engineers*

2424 East 21st Street  
Suite 510  
Tulsa, Oklahoma 74114





**PLAN**  
SCALE: 1"=200'



NOTE: STRATIFICATION LINES AND SUBSURFACE MATERIAL DESCRIPTIONS SHOWN ON THIS DRAWING HAVE BEEN SIMPLIFIED FOR PRESENTATION PURPOSES. REFER TO THE PROJECT GEOTECHNICAL REPORT FOR MORE DETAILED SUBSURFACE INFORMATION.

NOTE: PLACEMENT OF HORIZONTAL DRILLING RIG IS NOT FIXED BY DESIGNATION OF ENTRY AND EXIT POINTS. DRILLING RIG PLACEMENT AND/OR THE USE OF DUAL RIGS SHALL BE AT CONTRACTOR'S OPTION.

**GENERAL LEGEND**

● DRILLED PATH ENTRY/EXIT POINT

**GEOTECHNICAL LEGEND**

⊙ BORING LOCATION THIN WALL SAMPLE  
15' RECOVERY AMOUNT  
SPLIT SPOON SAMPLE  
53.23 PENETRATION RESISTANCE IN BLOWS PER FOOT FOR A 140 POUND HAMMER FALLING 30 INCHES  
PERCENTAGE OF GRAVEL BY WEIGHT FOR SAMPLES CONTAINING GRAVEL

**CORE BARREL SAMPLE**

6.250 UNCONFINED COMPRESSIVE STRENGTH (PSI)  
6 MOHS HARDNESS  
ROCK QUALITY DESIGNATION (PERCENT)

**GEOTECHNICAL NOTES**

- GEOTECHNICAL DATA PROVIDED BY BRAUN INTERTEC, DULUTH, MINNESOTA. REFER TO THE SUBSURFACE INVESTIGATION REPORT DATED 05/27/20 FOR MORE DETAILED SUBSURFACE INFORMATION.
- THE LETTER 'N' TO THE LEFT OF A SAMPLE INDICATES THAT NO GRAVEL WAS OBSERVED IN THE SAMPLE. THE LETTERS 'NT' INDICATE THAT GRAVEL WAS OBSERVED BUT NO GRADATION TEST WAS PERFORMED.
- THE GEOTECHNICAL DATA IS ONLY DESCRIPTIVE OF THE LOCATIONS ACTUALLY SAMPLED. EXTENSION OF THIS DATA OUTSIDE OF THE ORIGINAL BORINGS MAY BE DONE TO CHARACTERIZE THE SOIL CONDITIONS, HOWEVER, COMPANY DOES NOT GUARANTEE THESE CHARACTERIZATIONS TO BE ACCURATE. CONTRACTOR MUST USE HIS OWN EXPERIENCE AND JUDGMENT IN INTERPRETING THIS DATA.

**TOPOGRAPHIC SURVEY NOTES**

- TOPOGRAPHIC SURVEY DATA PROVIDED BY ENBRIDGE, DULUTH, MINNESOTA.
- NORTHINGS AND EASTINGS ARE IN U.S. SURVEY FEET REFERENCED TO WISCONSIN STATE PLANE COORDINATES, NORTH ZONE, NAD 83.
- ELEVATIONS ARE IN FEET REFERENCED TO NAVD 88.

**DRILLED PATH NOTES**

- DRILLED PATH STATIONING IS IN FEET BY HORIZONTAL MEASUREMENT AND IS REFERENCED TO CONTROL ESTABLISHED FOR THE DRILLED SEGMENT.
- DRILLED PATH COORDINATES REFER TO CENTERLINE OF PILOT HOLE AS OPPOSED TO TOP OF INSTALLED PIPE.

**PILOT HOLE TOLERANCES**

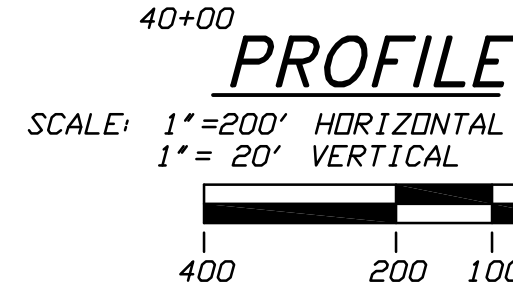
THE PILOT HOLE SHALL BE DRILLED TO THE TOLERANCES LISTED BELOW. HOWEVER, IN ALL CASES, RIGHT-OF-WAY RESTRICTIONS AND CONCERN FOR ADJACENT FACILITIES SHALL TAKE PRECEDENCE OVER THESE TOLERANCES.

- ENTRY POINT: AS STAKED BY COMPANY
- EXIT POINT: UP TO 10 FEET SHORT OR 20 FEET LONG RELATIVE TO THE DESIGNED EXIT POINT; UP TO 5 FEET RIGHT OR LEFT OF THE DESIGNED ALIGNMENT
- ELEVATION: UP TO 2 FEET ABOVE AND 10 FEET BELOW THE DESIGNED PROFILE
- ALIGNMENT: UP TO 5 FEET RIGHT OR LEFT OF THE DESIGNED ALIGNMENT
- CURVE RADIUS: NO LESS THAN 2,000 FEET BASED ON A 3-JOINT AVERAGE (ASSUMING RANGE 2 DRILL PIPE)

**PROTECTION OF EXISTING FACILITIES**

CONTRACTOR SHALL UNDERTAKE THE FOLLOWING STEPS PRIOR TO COMMENCING DRILLING OPERATIONS.

- CONTACT THE UTILITY LOCATION/NOTIFICATION SERVICE FOR THE CONSTRUCTION AREA.
- POSITIVELY LOCATE AND STAKE ALL EXISTING UNDERGROUND FACILITIES. ANY FACILITIES LOCATED WITHIN 10 FEET OF THE DESIGNED DRILLED PATH SHALL BE EXPOSED.
- MODIFY DRILLING PRACTICES AND DOWNHOLE ASSEMBLIES AS NECESSARY TO PREVENT DAMAGE TO EXISTING FACILITIES.



PRELIMINARY – NOT FOR CONSTRUCTION

**LINE 5 PIPELINE PROJECT**

**MP 15 - PLAN AND PROFILE  
30-INCH PIPELINE CROSSING OF HIGHWAY 13  
BY HORIZONTAL DIRECTIONAL DRILLING**

LOCATION: ASHLAND COUNTY, WISCONSIN

DRAWN	CHECKED	APPROVED	SCALE	DRAWING LABEL	REVISION
DMP	KWW	JSP	SHOWN FOR D-SIZED PLOT	HIGHWAY 13	P4

J.D. Hair & Associates, Inc.  
Consulting Engineers

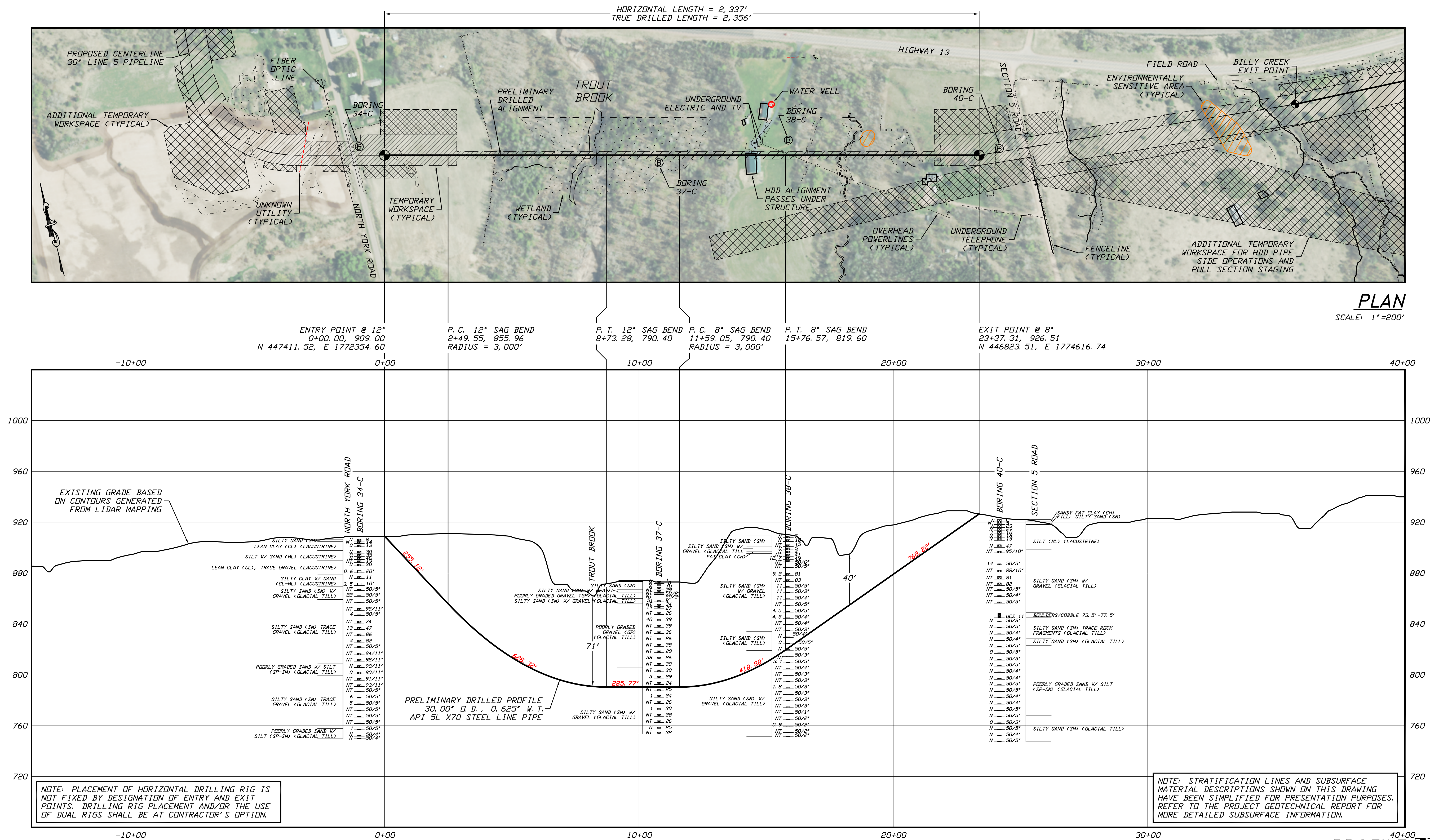
PROJECT NO.  
Enbridge\1938

SHEET NUMBER

1

2424 East 21st Street  
Tulsa, Oklahoma 74114





GENERAL LEGEND

- DRILLED PATH ENTRY/EXIT POINT

GEOTECHNICAL LEGEND

- ⊙ BORING LOCATION THIN WALL SAMPLE  
SPLIT SPOON SAMPLE  
53.1 23 PENETRATION RESISTANCE IN BLOWS PER FOOT FOR A 140 POUND HAMMER FALLING 30 INCHES  
PERCENTAGE OF GRAVEL BY WEIGHT FOR SAMPLES CONTAINING GRAVEL

CORE BARREL SAMPLE

- 53.1 6 UCS 6,250 UNCONFINED COMPRESSIVE STRENGTH (PSI)  
53.1 6 MOHS HARDNESS  
ROCK QUALITY DESIGNATION (PERCENT)

GEOTECHNICAL NOTES

- GEOTECHNICAL DATA PROVIDED BY BRAUN INTERTEC, DULUTH, MINNESOTA. REFER TO THE SUBSURFACE INVESTIGATION REPORT DATED 06/19/20 FOR MORE DETAILED SUBSURFACE INFORMATION.
- THE LETTER "N" TO THE LEFT OF A SAMPLE INDICATES THAT NO GRAVEL WAS OBSERVED IN THE SAMPLE. THE LETTERS "NT" INDICATE THAT GRAVEL WAS OBSERVED BUT NO GRADATION TEST WAS PERFORMED.
- THE GEOTECHNICAL DATA IS ONLY DESCRIPTIVE OF THE LOCATIONS ACTUALLY SAMPLED. EXTENSION OF THIS DATA OUTSIDE OF THE ORIGINAL BORINGS MAY BE DONE TO CHARACTERIZE THE SOIL CONDITIONS, HOWEVER, COMPANY DOES NOT GUARANTEE THESE CHARACTERIZATIONS TO BE ACCURATE. CONTRACTOR MUST USE HIS OWN EXPERIENCE AND JUDGMENT IN INTERPRETING THIS DATA.

TOPOGRAPHIC SURVEY NOTES

- TOPOGRAPHIC SURVEY DATA PROVIDED BY ENBRIDGE, DULUTH, MINNESOTA.
- NORTHINGS AND EASTINGS ARE IN U.S. SURVEY FEET REFERENCED TO WISCONSIN STATE PLANE COORDINATES, NORTH ZONE, NAD 83.
- ELEVATIONS ARE IN FEET REFERENCED TO NAVD 88.

DRILLED PATH NOTES

- DRILLED PATH STATIONING IS IN FEET BY HORIZONTAL MEASUREMENT AND IS REFERENCED TO CONTROL ESTABLISHED FOR THE DRILLED SEGMENT.
- DRILLED PATH COORDINATES REFER TO CENTERLINE OF PILOT HOLE AS OPPOSED TO TOP OF INSTALLED PIPE.

PILOT HOLE TOLERANCES

THE PILOT HOLE SHALL BE DRILLED TO THE TOLERANCES LISTED BELOW. HOWEVER, IN ALL CASES, RIGHT-OF-WAY RESTRICTIONS AND CONCERN FOR ADJACENT FACILITIES SHALL TAKE PRECEDENCE OVER THESE TOLERANCES.

- ENTRY POINT: AS STAKED BY COMPANY
- EXIT POINT: UP TO 10 FEET SHORT OR 20 FEET LONG RELATIVE TO THE DESIGNED EXIT POINT; UP TO 5 FEET RIGHT OR LEFT OF THE DESIGNED ALIGNMENT
- ELEVATION: UP TO 2 FEET ABOVE AND 10 FEET BELOW THE DESIGNED PROFILE
- ALIGNMENT: UP TO 5 FEET RIGHT OR LEFT OF THE DESIGNED ALIGNMENT
- CURVE RADIUS: NO LESS THAN 2,000 FEET BASED ON A 3-JOINT AVERAGE (ASSUMING RANGE 2 DRILL PIPE)

PROTECTION OF EXISTING FACILITIES

- CONTRACTOR SHALL UNDERTAKE THE FOLLOWING STEPS PRIOR TO COMMENCING DRILLING OPERATIONS.
- CONTACT THE UTILITY LOCATION/NOTIFICATION SERVICE FOR THE CONSTRUCTION AREA.
  - POSITIVELY LOCATE AND STAKE ALL EXISTING UNDERGROUND FACILITIES. ANY FACILITIES LOCATED WITHIN 10 FEET OF THE DESIGNED DRILLED PATH SHALL BE EXPOSED.
  - MODIFY DRILLING PRACTICES AND DOWNHOLE ASSEMBLIES AS NECESSARY TO PREVENT DAMAGE TO EXISTING FACILITIES.

PRELIMINARY - NOT FOR CONSTRUCTION

LINE 5 PIPELINE PROJECT

MP 16- PLAN AND PROFILE  
30-INCH PIPELINE CROSSING OF TROUT BROOK  
BY HORIZONTAL DIRECTIONAL DRILLING

DRAWN KWW	DATE 01/15/20	CHECKED DMP	APPROVED JSP	SCALE SHOWN FOR D-SIZED PLOT	DRAWING LABEL TROUT BROOK	REVISION P3

LOCATION: ASHLAND COUNTY, WISCONSIN

J.D.Hair & Associates, Inc.  
Consulting Engineers

PROJECT NO.  
Enbridge\1938

SHEET NUMBER

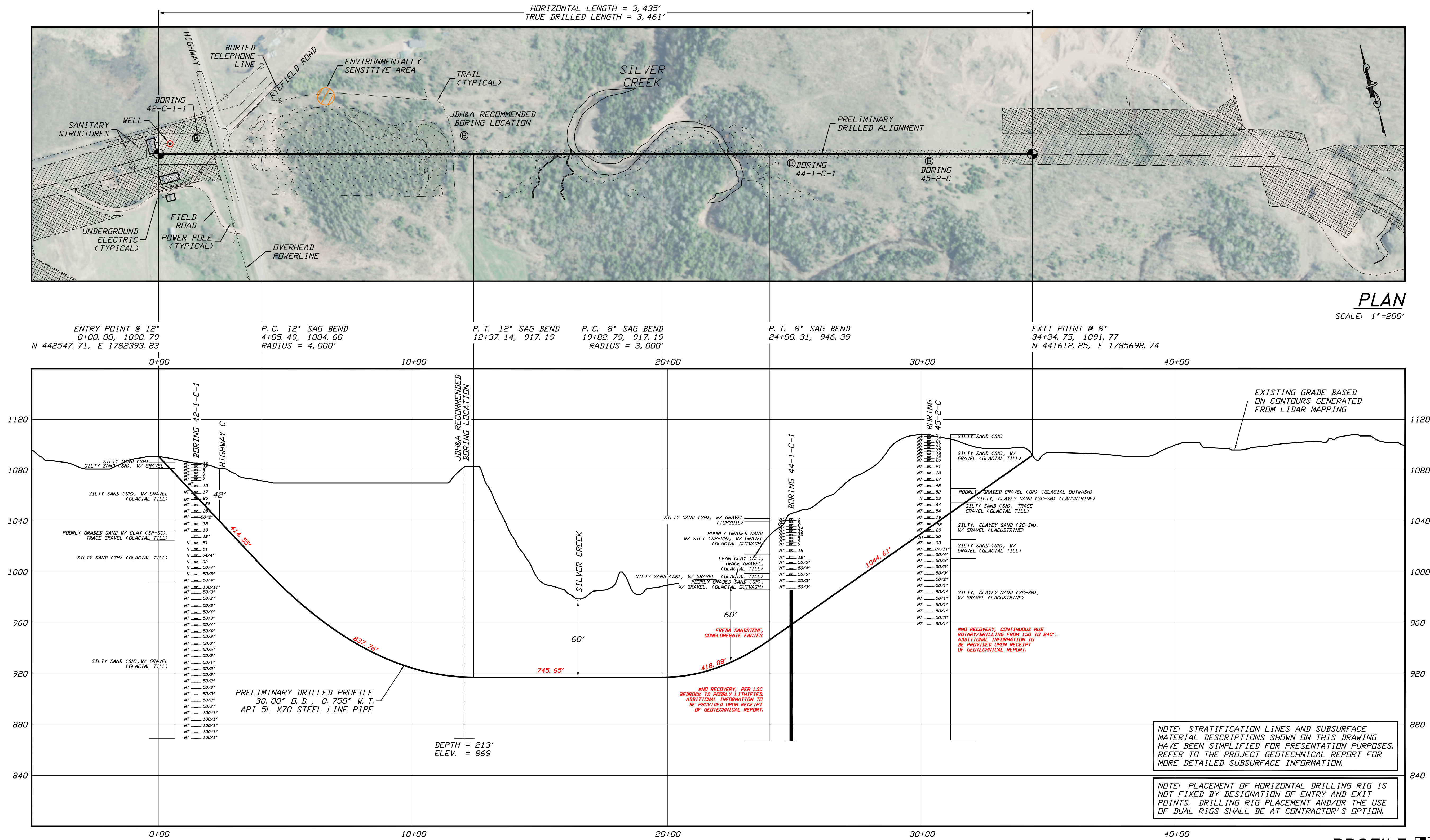
1

2424 East 21st Street  
Suite 510  
Tulsa, Oklahoma 74114









GENERAL LEGEND

● DRILLED PATH ENTRY/EXIT POINT

GEOTECHNICAL LEGEND

⊙ BORING LOCATION THIN WALL SAMPLE  
SPLIT SPOON SAMPLE  
53.1.23 PENETRATION RESISTANCE IN BLOWS PER FOOT FOR A 140 POUND HAMMER FALLING 30 INCHES PERCENTAGE OF GRAVEL BY WEIGHT FOR SAMPLES CONTAINING GRAVEL

CORE BARREL SAMPLE

1.6 UCS 6,250 UNCONFINED COMPRESSIVE STRENGTH (PSI)  
53.1.6 MOHS HARDNESS  
ROCK QUALITY DESIGNATION (PERCENT)

GEOTECHNICAL NOTES

- GEOTECHNICAL DATA PROVIDED BY BRAUN INTERTEC, DULUTH, MINNESOTA. REFER TO THE DRAFT BORING LOGS DATED 05/08/20 FOR MORE DETAILED SUBSURFACE INFORMATION.
- THE LETTER "N" TO THE LEFT OF A SAMPLE INDICATES THAT NO GRAVEL WAS OBSERVED IN THE SAMPLE. THE LETTERS "NT" INDICATE THAT GRAVEL WAS OBSERVED BUT NO GRADATION TEST WAS PERFORMED.
- THE GEOTECHNICAL DATA IS ONLY DESCRIPTIVE OF THE LOCATIONS ACTUALLY SAMPLED. EXTENSION OF THIS DATA OUTSIDE OF THE ORIGINAL BORINGS MAY BE DONE TO CHARACTERIZE THE SOIL CONDITIONS, HOWEVER, COMPANY DOES NOT GUARANTEE THESE CHARACTERIZATIONS TO BE ACCURATE. CONTRACTOR MUST USE HIS OWN EXPERIENCE AND JUDGMENT IN INTERPRETING THIS DATA.

TOPOGRAPHIC SURVEY NOTES

- TOPOGRAPHIC SURVEY DATA PROVIDED BY ENBRIDGE, DULUTH, MINNESOTA.
- NORTHINGS AND EASTINGS ARE IN U.S. SURVEY FEET REFERENCED TO WISCONSIN STATE PLANE COORDINATES, NORTH ZONE, NAD 83.
- ELEVATIONS ARE IN FEET REFERENCED TO NAVD 88.

DRILLED PATH NOTES

- DRILLED PATH STATIONING IS IN FEET BY HORIZONTAL MEASUREMENT AND IS REFERENCED TO CONTROL ESTABLISHED FOR THE DRILLED SEGMENT.
- DRILLED PATH COORDINATES REFER TO CENTERLINE OF PILOT HOLE AS OPPOSED TO TOP OF INSTALLED PIPE.

PILOT HOLE TOLERANCES

THE PILOT HOLE SHALL BE DRILLED TO THE TOLERANCES LISTED BELOW. HOWEVER, IN ALL CASES, RIGHT-OF-WAY RESTRICTIONS AND CONCERN FOR ADJACENT FACILITIES SHALL TAKE PRECEDENCE OVER THESE TOLERANCES.

- ENTRY POINT: AS STAKED BY COMPANY
- EXIT POINT: UP TO 10 FEET SHORT OR 20 FEET LONG RELATIVE TO THE DESIGNED EXIT POINT; UP TO 5 FEET RIGHT OR LEFT OF THE DESIGNED ALIGNMENT
- ELEVATION: UP TO 2 FEET ABOVE AND 10 FEET BELOW THE DESIGNED PROFILE
- ALIGNMENT: UP TO 5 FEET RIGHT OR LEFT OF THE DESIGNED ALIGNMENT
- CURVE RADIUS: NO LESS THAN 2,000 FEET BASED ON A 3-JOINT AVERAGE (ASSUMING RANGE 2 DRILL PIPE)

PROTECTION OF EXISTING FACILITIES

- CONTRACTOR SHALL UNDERTAKE THE FOLLOWING STEPS PRIOR TO COMMENCING DRILLING OPERATIONS.
- CONTACT THE UTILITY LOCATION/NOTIFICATION SERVICE FOR THE CONSTRUCTION AREA.
  - POSITIVELY LOCATE AND STAKE ALL EXISTING UNDERGROUND FACILITIES. ANY FACILITIES LOCATED WITHIN 10 FEET OF THE DESIGNED DRILLED PATH SHALL BE EXPOSED.
  - MODIFY DRILLING PRACTICES AND DOWNHOLE ASSEMBLIES AS NECESSARY TO PREVENT DAMAGE TO EXISTING FACILITIES.

PRELIMINARY – NOT FOR CONSTRUCTION

LINE 5 PIPELINE PROJECT

MP 19 - PLAN AND PROFILE  
30-INCH PIPELINE CROSSING OF SILVER CREEK  
BY HORIZONTAL DIRECTIONAL DRILLING

LOCATION: ASHLAND COUNTY, WISCONSIN	CHECKED KWW	APPROVED JSP	DRAWING LABEL SILVER CREEK ALT	REVISION P1
DRAWN DLB	DATE 01/31/20	SCALE SHOWN FOR D-SIZED PLOT		

J.D.Hair & Associates, Inc.  
Consulting Engineers

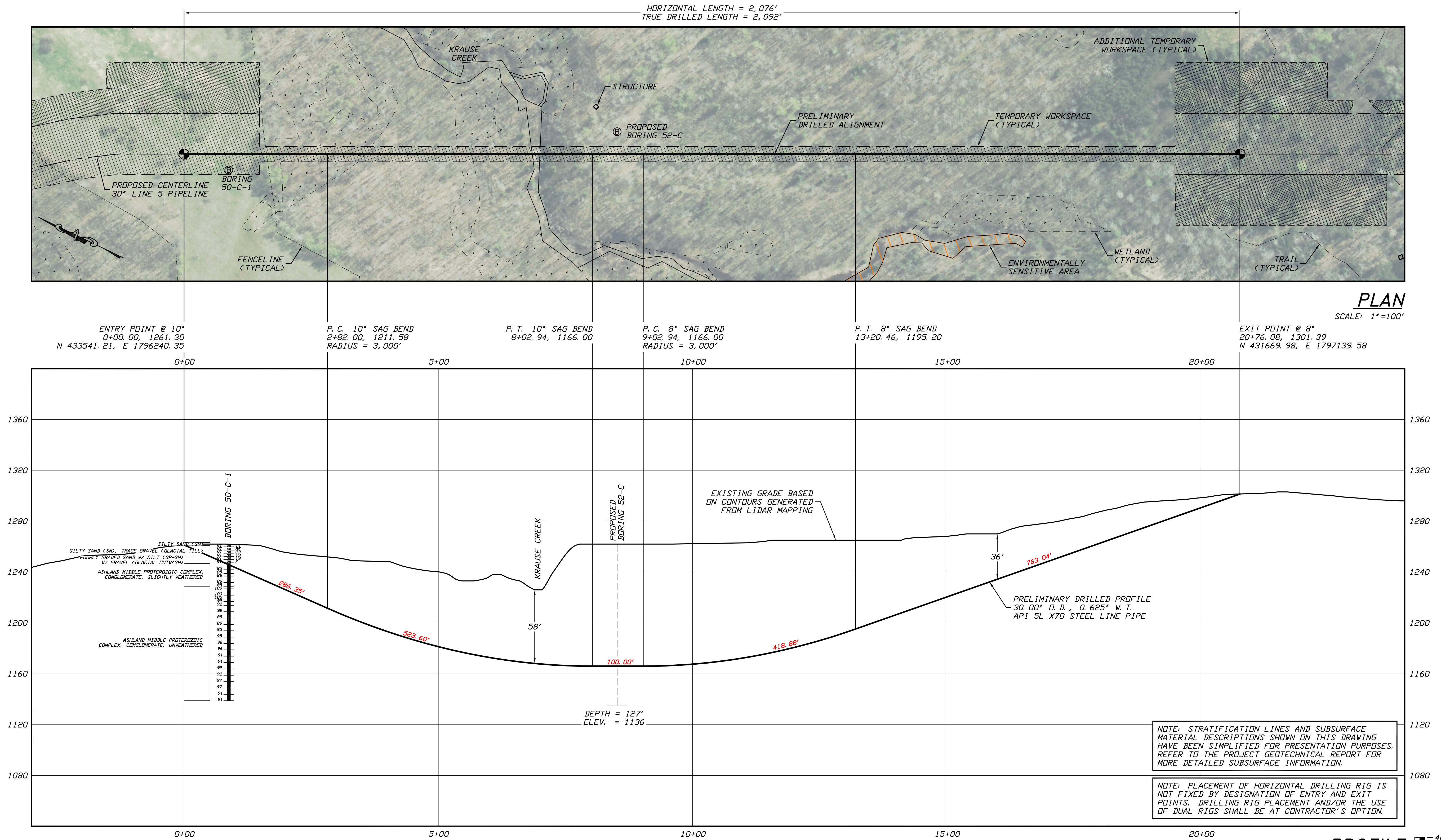
2424 East 21st Street  
Suite 510  
Tulsa, Oklahoma 74114

PROJECT NO.  
Enbridge\1938

SHEET NUMBER

1





GENERAL LEGEND

- DRILLED PATH ENTRY/EXIT POINT

GEOTECHNICAL LEGEND

- ⊙ BORING LOCATION THIN WALL SAMPLE
- 15" RECOVERY AMOUNT
- 53.23 PENETRATION RESISTANCE IN BLOWS PER FOOT FOR A 140 POUND HAMMER FALLING 30 INCHES PERCENTAGE OF GRAVEL BY WEIGHT FOR SAMPLES CONTAINING GRAVEL
- CORE BARREL SAMPLE
- UCS 6,250 UNCONFINED COMPRESSIVE STRENGTH (PSI)
- 53.6 MOHS HARDNESS
- ROCK QUALITY DESIGNATION (PERCENT)

GEOTECHNICAL NOTES

- GEOTECHNICAL DATA PROVIDED BY BRAUN INTERTEC, DULUTH, MN. REFER TO THE DRAFT BORING LOG DATED 2/19/20 FOR MORE DETAILED SUBSURFACE INFORMATION.
- THE LETTER "N" TO THE LEFT OF A SAMPLE INDICATES THAT NO GRAVEL WAS OBSERVED IN THE SAMPLE. THE LETTERS "NT" INDICATE THAT GRAVEL WAS OBSERVED BUT NO GRADATION TEST WAS PERFORMED.
- THE GEOTECHNICAL DATA IS ONLY DESCRIPTIVE OF THE LOCATIONS ACTUALLY SAMPLED. EXTENSION OF THIS DATA OUTSIDE OF THE ORIGINAL BORINGS MAY BE DONE TO CHARACTERIZE THE SOIL CONDITIONS, HOWEVER, COMPANY DOES NOT GUARANTEE THESE CHARACTERIZATIONS TO BE ACCURATE. CONTRACTOR MUST USE HIS OWN EXPERIENCE AND JUDGMENT IN INTERPRETING THIS DATA.

TOPOGRAPHIC SURVEY NOTES

- TOPOGRAPHIC SURVEY DATA PROVIDED BY ENBRIDGE, DULUTH, MINNESOTA.
- NORTHINGS AND EASTINGS ARE IN U.S. SURVEY FEET REFERENCED TO WISCONSIN STATE PLANE COORDINATES, NORTH ZONE, NAD 83.
- ELEVATIONS ARE IN FEET REFERENCED TO NAVD 83.

DRILLED PATH NOTES

- DRILLED PATH STATIONING IS IN FEET BY HORIZONTAL MEASUREMENT AND IS REFERENCED TO CONTROL ESTABLISHED FOR THE DRILLED SEGMENT.
- DRILLED PATH COORDINATES REFER TO CENTERLINE OF PILOT HOLE AS OPPOSED TO TOP OF INSTALLED PIPE.

PILOT HOLE TOLERANCES

THE PILOT HOLE SHALL BE DRILLED TO THE TOLERANCES LISTED BELOW. HOWEVER, IN ALL CASES, RIGHT-OF-WAY RESTRICTIONS AND CONCERN FOR ADJACENT FACILITIES SHALL TAKE PRECEDENCE OVER THESE TOLERANCES.

- ENTRY POINT: AS STAKED BY COMPANY
- EXIT POINT: UP TO 10 FEET SHORT OR 20 FEET LONG RELATIVE TO THE DESIGNED EXIT POINT, UP TO 5 FEET RIGHT OR LEFT OF THE DESIGNED ALIGNMENT
- ELEVATION: UP TO 2 FEET ABOVE AND 10 FEET BELOW THE DESIGNED PROFILE
- ALIGNMENT: UP TO 5 FEET RIGHT OR LEFT OF THE DESIGNED ALIGNMENT
- CURVE RADIUS: NO LESS THAN 2,000 FEET BASED ON A 3-JOINT AVERAGE (ASSUMING RANGE 2 DRILL PIPE)

PROTECTION OF EXISTING FACILITIES

CONTRACTOR SHALL UNDERTAKE THE FOLLOWING STEPS PRIOR TO COMMENCING DRILLING OPERATIONS.

- CONTACT THE UTILITY LOCATION/NOTIFICATION SERVICE FOR THE CONSTRUCTION AREA.
- POSITIVELY LOCATE AND STAKE ALL EXISTING UNDERGROUND FACILITIES. ANY FACILITIES LOCATED WITHIN 10 FEET OF THE DESIGNED DRILLED PATH SHALL BE EXPOSED.
- MODIFY DRILLING PRACTICES AND DOWNHOLE ASSEMBLIES AS NECESSARY TO PREVENT DAMAGE TO EXISTING FACILITIES.

PRELIMINARY – NOT FOR CONSTRUCTION

LINE 5 PIPELINE PROJECT

MP 22 - PLAN AND PROFILE  
30-INCH PIPELINE CROSSING OF KRAUSE CREEK  
BY HORIZONTAL DIRECTIONAL DRILLING

LOCATION: ASHLAND COUNTY, WISCONSIN		DRAWING LABEL		REVISION	
DRAWN	DATE	CHECKED	APPROVED	SCALE SHOWN FOR D-SIZED PLOT	REVISION
KWW	01/10/20	DMP	JSP	JSP	P1

J.D.Hair & Associates, Inc.  
Consulting Engineers

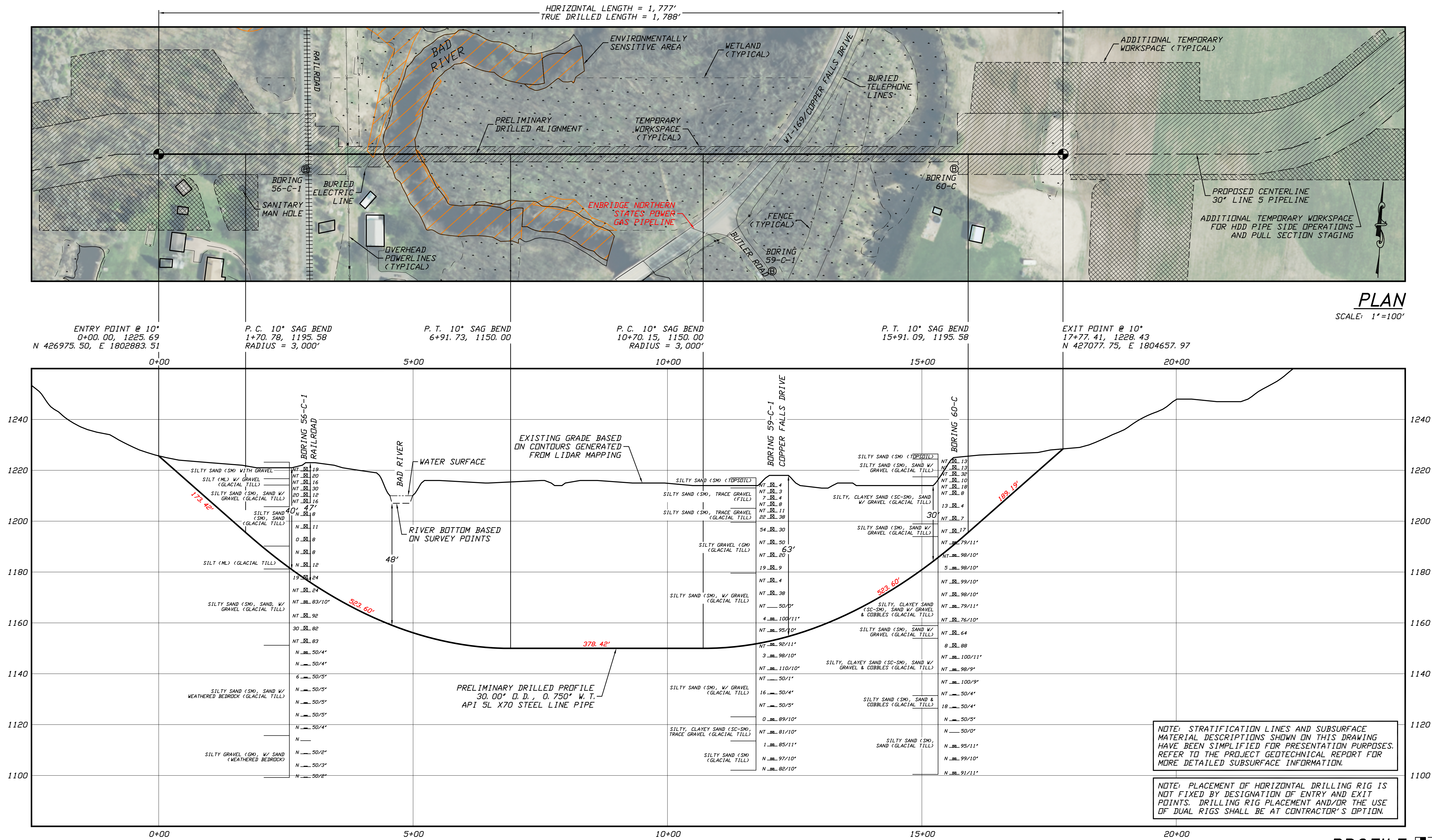
2424 East 21st Street  
Suite 510  
Tulsa, Oklahoma 74114

PROJECT NO.  
Enbridge\1938

SHEET NUMBER

1





GENERAL LEGEND

● DRILLED PATH ENTRY/EXIT POINT

GEOTECHNICAL LEGEND

⊗ BORING LOCATION

SPLIT SPOON SAMPLE

53.1 23 PENETRATION RESISTANCE IN BLOWS PER FOOT FOR A 140 POUND HAMMER FALLING 30 INCHES  
PERCENTAGE OF GRAVEL BY WEIGHT FOR SAMPLES CONTAINING GRAVEL

CORE BARREL SAMPLE

53.1 6 UCS 6,250 UNCONFINED COMPRESSIVE STRENGTH (PSI)

53.1 6 MOHS HARDNESS

ROCK QUALITY DESIGNATION (PERCENT)

GEOTECHNICAL NOTES

- GEOTECHNICAL DATA PROVIDED BY BRAUN INTERTEC, DULUTH, MINNESOTA. REFER TO THE SUBSURFACE INVESTIGATION REPORT DATED 5/27/20 FOR MORE DETAILED SUBSURFACE INFORMATION.
- THE LETTER "N" TO THE LEFT OF A SAMPLE INDICATES THAT NO GRAVEL WAS OBSERVED IN THE SAMPLE. THE LETTERS "NT" INDICATE THAT GRAVEL WAS OBSERVED BUT NO GRADATION TEST WAS PERFORMED.
- THE GEOTECHNICAL DATA IS ONLY DESCRIPTIVE OF THE LOCATIONS ACTUALLY SAMPLED. EXTENSION OF THIS DATA OUTSIDE OF THE ORIGINAL BORINGS MAY BE DONE TO CHARACTERIZE THE SOIL CONDITIONS, HOWEVER, COMPANY DOES NOT GUARANTEE THESE CHARACTERIZATIONS TO BE ACCURATE. CONTRACTOR MUST USE HIS OWN EXPERIENCE AND JUDGMENT IN INTERPRETING THIS DATA.

TOPOGRAPHIC SURVEY NOTES

- TOPOGRAPHIC SURVEY DATA PROVIDED BY ENBRIDGE, DULUTH, MINNESOTA.
- NORTHINGS AND EASTINGS ARE IN U.S. SURVEY FEET REFERENCED TO WISCONSIN STATE PLANE COORDINATES, NORTH ZONE, NAD 83.
- ELEVATIONS ARE IN FEET REFERENCED TO NAVD 88.

DRILLED PATH NOTES

- DRILLED PATH STATIONING IS IN FEET BY HORIZONTAL MEASUREMENT AND IS REFERENCED TO CONTROL ESTABLISHED FOR THE DRILLED SEGMENT.
- DRILLED PATH COORDINATES REFER TO CENTERLINE OF PILOT HOLE AS OPPOSED TO TOP OF INSTALLED PIPE.

PILOT HOLE TOLERANCES

THE PILOT HOLE SHALL BE DRILLED TO THE TOLERANCES LISTED BELOW. HOWEVER, IN ALL CASES, RIGHT-OF-WAY RESTRICTIONS AND CONCERN FOR ADJACENT FACILITIES SHALL TAKE PRECEDENCE OVER THESE TOLERANCES.

- ENTRY POINT: AS STAKED BY COMPANY
- EXIT POINT: UP TO 10 FEET SHORT OR 20 FEET LONG RELATIVE TO THE DESIGNED EXIT POINT; UP TO 5 FEET RIGHT OR LEFT OF THE DESIGNED ALIGNMENT
- ELEVATION: UP TO 2 FEET ABOVE AND 10 FEET BELOW THE DESIGNED PROFILE
- ALIGNMENT: UP TO 5 FEET RIGHT OR LEFT OF THE DESIGNED ALIGNMENT
- CURVE RADIUS: NO LESS THAN 2,000 FEET BASED ON A 3-JOINT AVERAGE (ASSUMING RANGE 2 DRILL PIPE)

PROTECTION OF EXISTING FACILITIES

CONTRACTOR SHALL UNDERTAKE THE FOLLOWING STEPS PRIOR TO COMMENCING DRILLING OPERATIONS.

- CONTACT THE UTILITY LOCATION/NOTIFICATION SERVICE FOR THE CONSTRUCTION AREA.
- POSITIVELY LOCATE AND STAKE ALL EXISTING UNDERGROUND FACILITIES. ANY FACILITIES LOCATED WITHIN 10 FEET OF THE DESIGNED DRILLED PATH SHALL BE EXPOSED.
- MODIFY DRILLING PRACTICES AND DOWNHOLE ASSEMBLIES AS NECESSARY TO PREVENT DAMAGE TO EXISTING FACILITIES.

PRELIMINARY – NOT FOR CONSTRUCTION

LINE 5 PIPELINE PROJECT

MP 24 - PLAN AND PROFILE  
30-INCH PIPELINE CROSSING OF THE BAD RIVER  
BY HORIZONTAL DIRECTIONAL DRILLING

LOCATION: ASHLAND COUNTY, WISCONSIN		DRAWING LABEL		REVISION	
DRAWN	DATE	CHECKED	APPROVED	SCALE	SHOWN FOR D-SIZED PLOT
DMP	01/10/20	CDS	JSP	JSP	P4

J.D.Hair & Associates, Inc.  
Consulting Engineers

PROJECT NO.  
Enbridge\1938

SHEET NUMBER

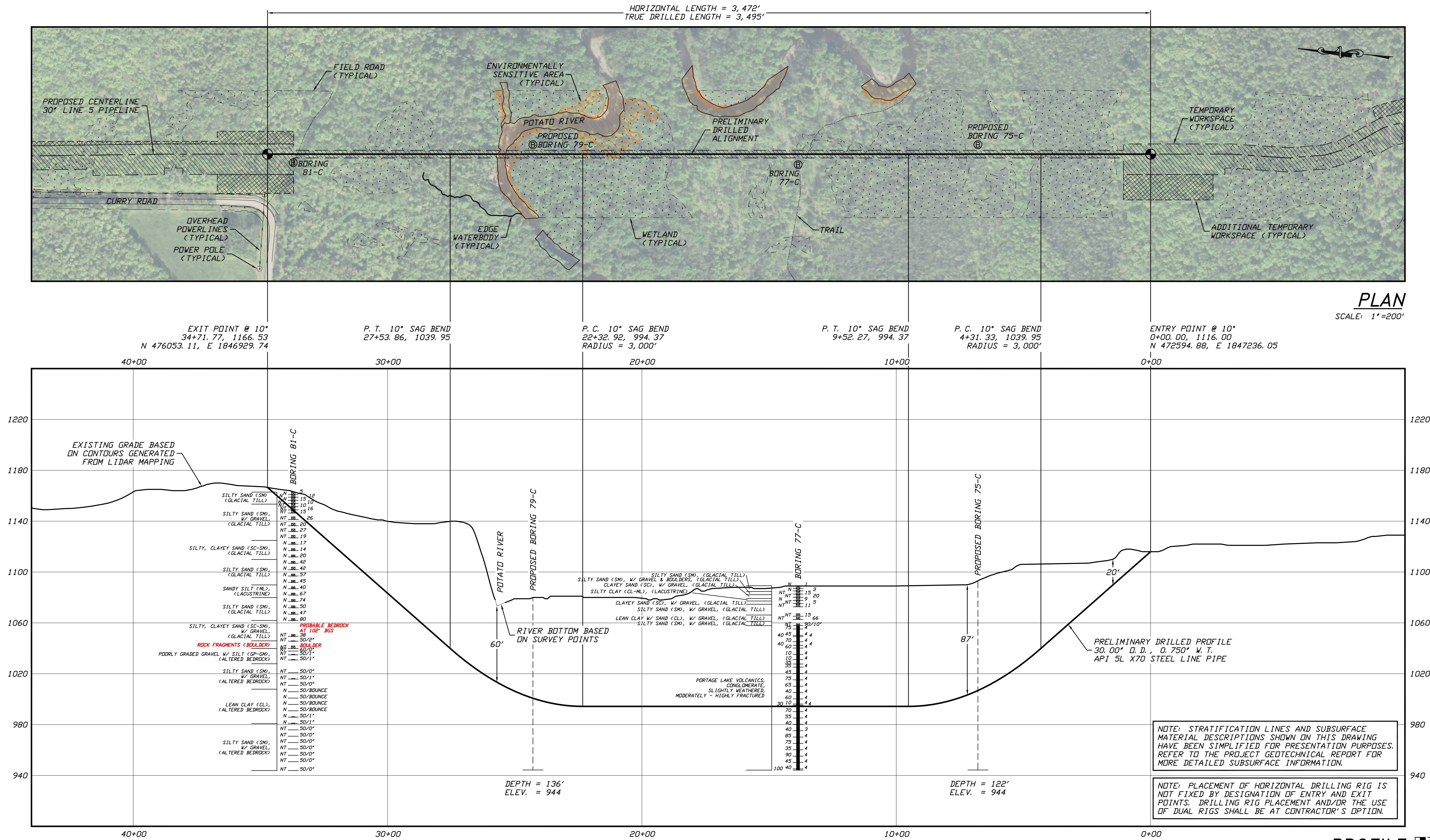
1

2424 East 21st Street  
Suite 510  
Tulsa, Oklahoma 74114









#### GENERAL LEGEND

- DRILLED PATH ENTRY/EXIT POINT

#### GEOTECHNICAL LEGEND

- ⊙ BORING LOCATION

#### SPLIT SPOON SAMPLE

- 53.1 23 PENETRATION RESISTANCE IN BLOWS PER FOOT FOR A 140 POUND HAMMER FALLING 30 INCHES  
PERCENTAGE OF GRAVEL BY WEIGHT FOR SAMPLES CONTAINING GRAVEL

#### CORE BARREL SAMPLE

- 53.1 6 UCS 6,250 UNCONFINED COMPRESSIVE STRENGTH (PSI)  
53.1 6 MOHS HARDNESS  
ROCK QUALITY DESIGNATION (PERCENT)

#### GEOTECHNICAL NOTES

- GEOTECHNICAL DATA PROVIDED BY BRAUN INTERTEC, DULUTH, MINNESOTA. REFER TO THE PRELIMINARY BORING LOGS DATED APRIL & MAY 2020 FOR MORE DETAILED SUBSURFACE INFORMATION.
- THE LETTER "N" TO THE LEFT OF A SAMPLE INDICATES THAT NO GRAVEL WAS OBSERVED IN THE SAMPLE. THE LETTERS "NT" INDICATE THAT GRAVEL WAS OBSERVED BUT NO GRADATION TEST WAS PERFORMED.
- THE GEOTECHNICAL DATA IS ONLY DESCRIPTIVE OF THE LOCATIONS ACTUALLY SAMPLED. EXTENSION OF THIS DATA OUTSIDE OF THE ORIGINAL BORINGS MAY BE DONE TO CHARACTERIZE THE SOIL CONDITIONS, HOWEVER, COMPANY DOES NOT GUARANTEE THESE CHARACTERIZATIONS TO BE ACCURATE. CONTRACTOR MUST USE HIS OWN EXPERIENCE AND JUDGMENT IN INTERPRETING THIS DATA.

#### TOPOGRAPHIC SURVEY NOTES

- TOPOGRAPHIC SURVEY DATA PROVIDED BY ENBRIDGE, DULUTH, MINNESOTA.
- NORTHINGS AND EASTINGS ARE IN U.S. SURVEY FEET REFERENCED TO WISCONSIN STATE PLANE COORDINATES, NORTH ZONE, NAD 83.
- ELEVATIONS ARE IN FEET REFERENCED TO NAVD 88.

#### DRILLED PATH NOTES

- DRILLED PATH STATIONING IS IN FEET BY HORIZONTAL MEASUREMENT AND IS REFERENCED TO CONTROL ESTABLISHED FOR THE DRILLED SEGMENT.
- DRILLED PATH COORDINATES REFER TO CENTERLINE OF PILOT HOLE AS OPPOSED TO TOP OF INSTALLED PIPE.

#### PILOT HOLE TOLERANCES

THE PILOT HOLE SHALL BE DRILLED TO THE TOLERANCES LISTED BELOW. HOWEVER, IN ALL CASES, RIGHT-OF-WAY RESTRICTIONS AND CONCERN FOR ADJACENT FACILITIES SHALL TAKE PRECEDENCE OVER THESE TOLERANCES.

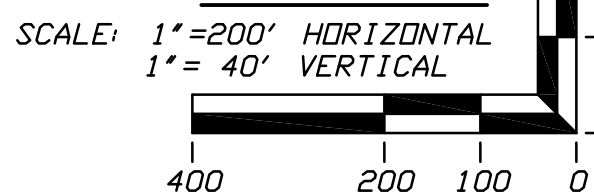
- ENTRY POINT: AS STAKED BY COMPANY
- EXIT POINT: UP TO 10 FEET SHORT OR 20 FEET LONG RELATIVE TO THE DESIGNED EXIT POINT; UP TO 5 FEET RIGHT OR LEFT OF THE DESIGNED ALIGNMENT
- ELEVATION: UP TO 2 FEET ABOVE AND 10 FEET BELOW THE DESIGNED PROFILE
- ALIGNMENT: UP TO 5 FEET RIGHT OR LEFT OF THE DESIGNED ALIGNMENT
- CURVE RADIUS: NO LESS THAN 2,000 FEET BASED ON A 3-JOINT AVERAGE (ASSUMING RANGE 2 DRILL PIPE)

#### PROTECTION OF EXISTING FACILITIES

CONTRACTOR SHALL UNDERTAKE THE FOLLOWING STEPS PRIOR TO COMMENCING DRILLING OPERATIONS.

- CONTACT THE UTILITY LOCATION/NOTIFICATION SERVICE FOR THE CONSTRUCTION AREA.
- POSITIVELY LOCATE AND STAKE ALL EXISTING UNDERGROUND FACILITIES. ANY FACILITIES LOCATED WITHIN 10 FEET OF THE DESIGNED DRILLED PATH SHALL BE EXPOSED.
- MODIFY DRILLING PRACTICES AND DOWNHOLE ASSEMBLIES AS NECESSARY TO PREVENT DAMAGE TO EXISTING FACILITIES.

#### PROFILE



PRELIMINARY – NOT FOR CONSTRUCTION

#### LINE 5 PIPELINE PROJECT

#### MP 38 - PLAN AND PROFILE 30-INCH PIPELINE CROSSING OF THE POTATO RIVER BY HORIZONTAL DIRECTIONAL DRILLING

LOCATION: IRON COUNTY, WISCONSIN	CHECKED	APPROVED	SCALE	DRAWING LABEL	REVISION
DRAWN KWW	DATE 01/14/20	JSP	SHOWN FOR D-SIZED PLOT	POTATO RIVER	P1

J.D.Hair & Associates, Inc.  
Consulting Engineers

2424 East 21st Street  
Suite 510  
Tulsa, Oklahoma 74114

PROJECT NO.  
Enbridge\1938

SHEET NUMBER

1





PRELIMINARY – NOT FOR CONSTRUCTION

1

2424 East 21st Street  
Suite 510  
Tulsa, Oklahoma 74114

2424 East 21st Street  
Suite 510  
Tulsa, Oklahoma 74114