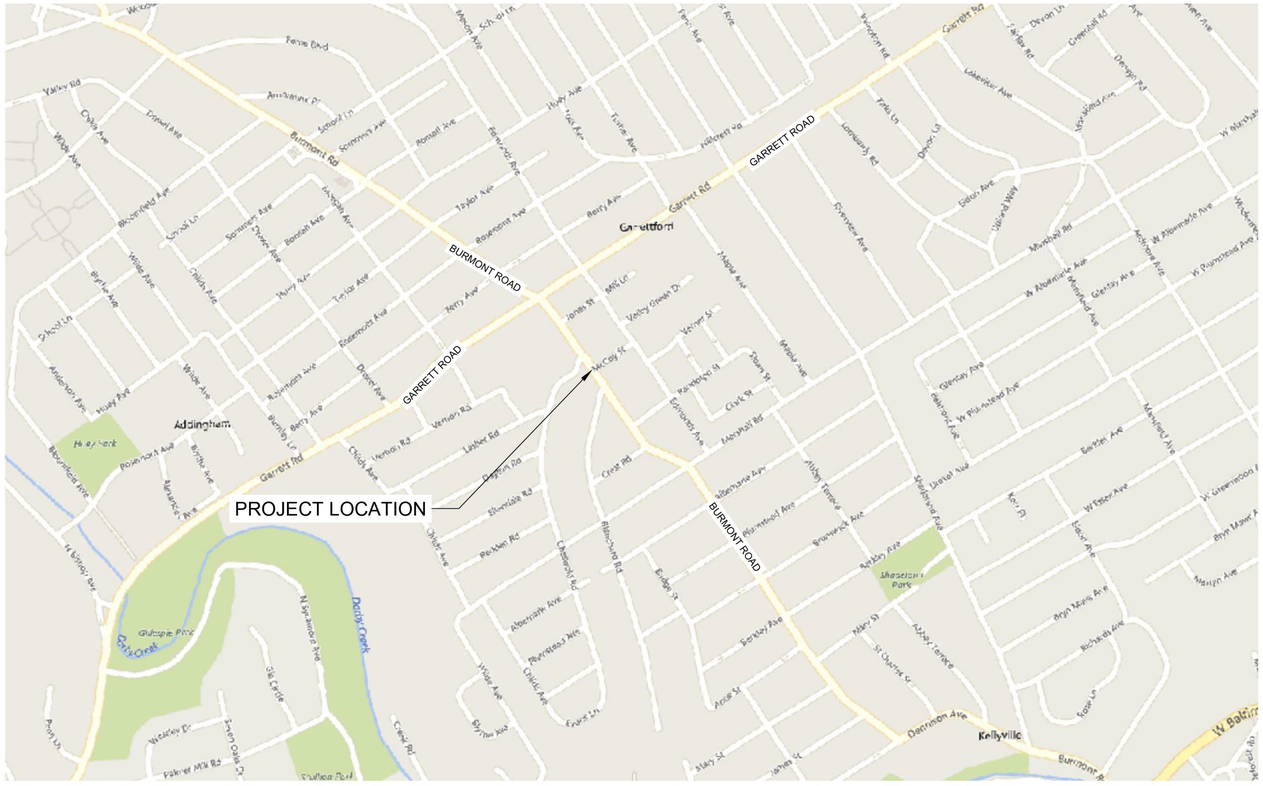
SEPTA RAIL CROSSING
BURMONT ROAD
UPPER DARBY B6
WORK ORDER #16028420

UPPER DARBY, PENNSYLVANIA
39°56'35.95"N 75°17'44.98"W



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4	GEOTECHNICAL PROFILE
5	CONSTRUCTION NOTES
6	CONSTRUCTION DETAILS
7	BORING LOG KEY
8	BORING LOGS
9	BORING LOGS

1 2

1

LEGEND

- EXISTING DRAINAGE PIPE
- EXISTING UNDERGROUND GAS UTILITY
- EXISTING UNDERGROUND SANITARY UTILITY
- EXISTING UNDERGROUND WATER UTILITY
- EXISTING UNDERGROUND COMMUNICATIONS UTILITY
- EXISTING UNDERGROUND ELECTRIC UTILITY
- EXISTING UNDERGROUND ELECTRIC UTILITY
- EXISTING TREE LINE
- EXISTING MINOR CONTOUR
- EXISTING MAJOR CONTOUR
- PROPOSED BORE PIT
- PROPOSED PIPE
- PROPOSED CASING
- EXCLUSION ZONE

CERTIFIED CORRECT PLANS

Daniel R. Hallock
Professional Engineer
Approved by Bureau of Technical Utility Services

PA PUBLIC UTILITY COMMISSION

ATTEST Rosemary Chiavetta
Secretary

Docket No. A-2021-3028075

811 Know what's **below.** **Call** before you dig.

CALL PENNSYLVANIA ONECALL (800)-242-1776 3 DAYS BEFORE YOU DIG

GENERAL NOTES:

1. EXISTING SURVEY DATA PROVIDED BY DENNIS W. SKLAR INC ON 9/27/2020.
2. PARCEL BOUNDARY DATA APPROXIMATED FROM MONTGOMEREY COUNTY GIS MAPS.

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Exton, PA 19341
Phone: 610-594-1444
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REVISIONS

REV	DESCRIPTION	DSN	CHK	DATE
		DWN	APP	
1	REVISED PER SEPTA COMMENTS	SMM	JMB	7/15/2021
		KWS	JMB	
2	REVISED PER SEPTA COMMENTS	SMM	JMB	8/6/2021
		SMM	JMB	

SCALE VERIFICATION

THIS BAR IS 1 INCH IN LENGTH ON ORIGINAL DRAWING

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ORIGINAL DRAWING SIZE IS 22 x 34

ISSUED FOR REVIEW

UPPER DARBY B6
WO#16028420
UPPER DARBY, PENNSYLVANIA

PECO
An Exelon Company

PECO
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COVER

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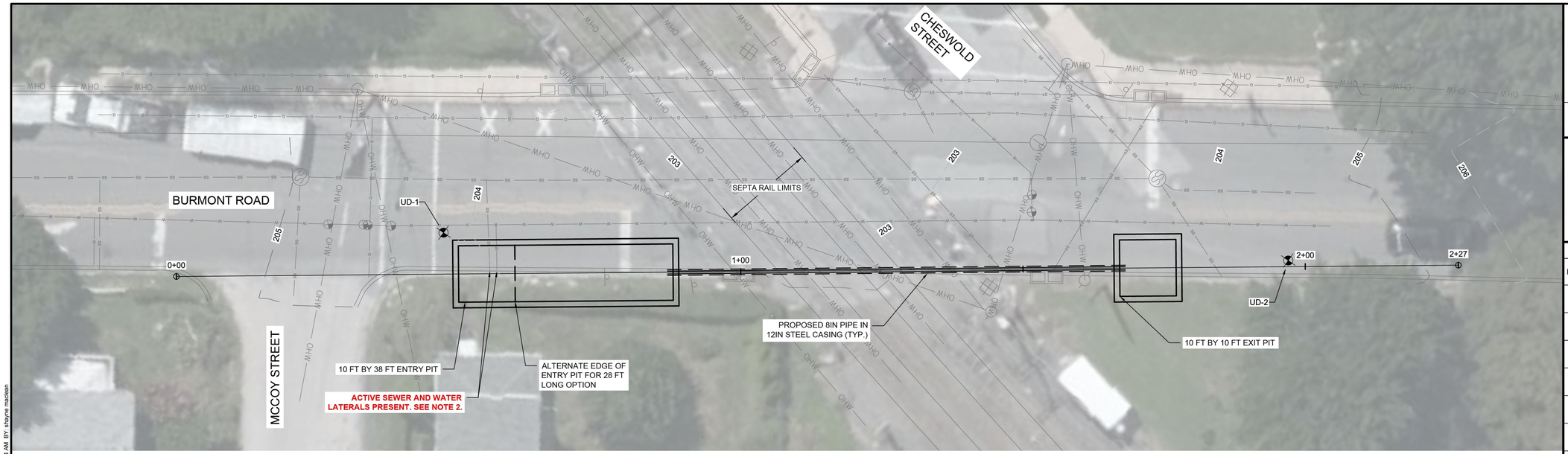
APPROVED BY	ESB

SHEET 1 of 9

1

CAD FILE \\kleinfelder.com\shares\EXTON-DATA\GROUPS\Company\Projects\20211296.004A PECO 2021 AGMP Trenchless Crossings\004A Upper Darby B6\Civil\Drawings\Upper Darby_Plan Sheets.dwg LAYOUT: COVER PLOTTED: 8/6/2021 11:34 AM BY: shayna maclean



PLAN VIEW
SCALE: 1" = 10'

0 10 20 30
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NOTES:

1. DESIGN ASSUMES 20 FT STEEL PIPE SECTIONS TO BE USED.
2. ACTIVE WATER AND SANITARY SEWER LATERALS PRESENT IN PROPOSED LOCATION OF ENTRY PIT OF THIS DESIGN. CONTRACTOR SHALL SUPPORT IN-PLACE, RELOCATE, OR INCORPORATE INTO JACKING PIT DESIGN. CONTRACTOR TO COORDINATE WITH RESIDENTS FOR TEMPORARY SHUTDOWN OR PROPOSE SHORTENING ENTRY PIT AND USING 10 FT STEEL PIPE SECTIONS.
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1

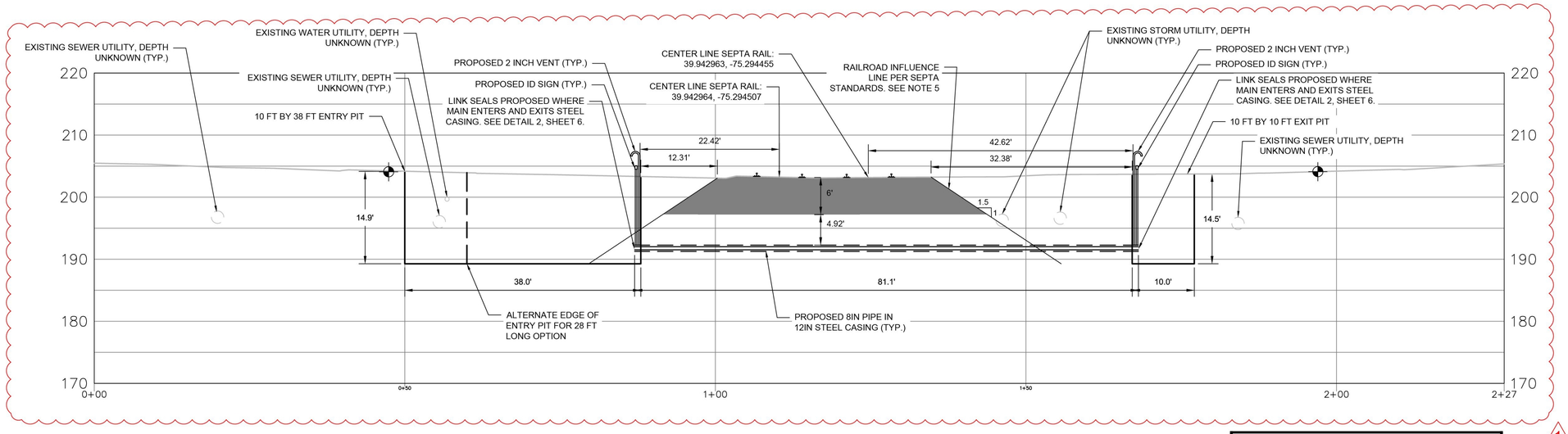
6. TO MINIMIZE THE POTENTIAL OF THE BORE HOLE COLLAPSING, ALL BACK REAMING WILL UTILIZE TRAILING RODS
7. CASING PIPE BORING AND DRILLING OPERATIONS SHALL COMMENCE CONTINUOUSLY WITHOUT STOPPAGE

2

BILL OF MATERIALS

QUANTITY	ITEMS
100 Ft	8.625 INCH X 0.25 INCH GRADE B STEEL PIPE WITH PRITEC COATING*
100 Ft	12.75 INCH X 0.5 INCH STEEL CASING (GRADE B OR BETTER)
24	LINK SEALS (LS-475-C / 447-54096)
8	CASING SPACERS (447-54117)

*CARRIER PIPE LENGTHS PROVIDED ONLY FOR PORTION WITHIN JACK AND BORE AND EXTENDING 5 FT ON EACH SIDE OF CASING.



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PROFILE VIEWS
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CERTIFIED CORRECT PLANS
Professional Engineer
Approved by Bureau of Technical Utility Services
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ATTEST
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PLAN AND PROFILE

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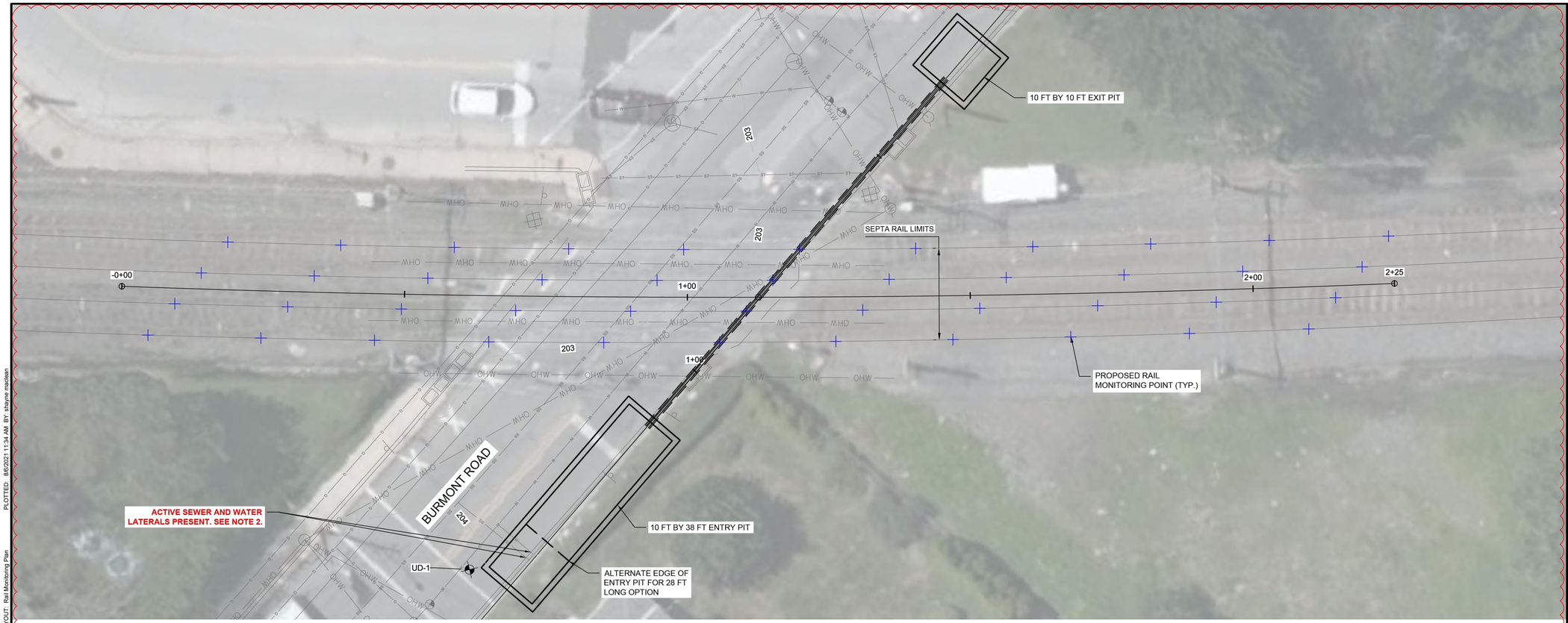
SHEET 2 of 9

2



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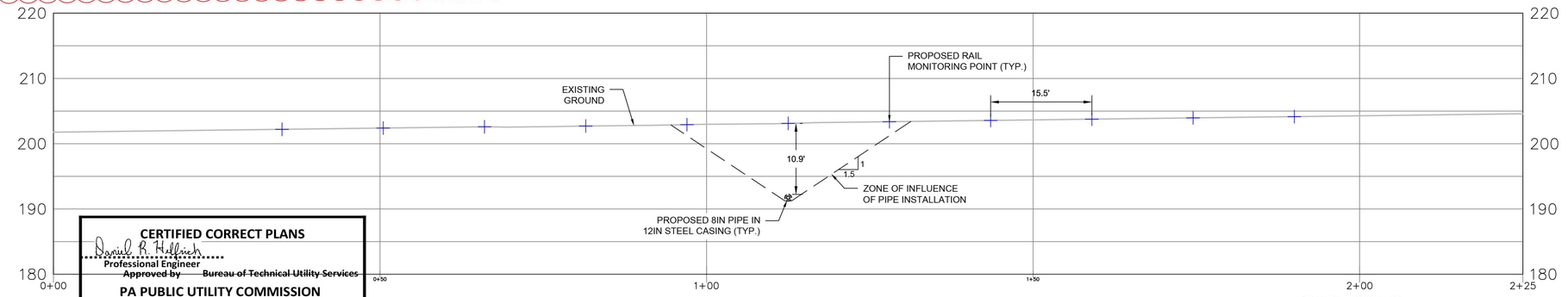
2

RAIL MONITORING REQUIREMENTS:

1. THE CONTRACTOR SHALL ESTABLISH REMOTE MONITORING POINTS (RMPs) FOR COLLECTION OF TRACK DATA WITH A MINIMUM NUMBER OF POINTS AS SHOWN ON THE PLAN.
2. ALL POINTS TO BE MEASURED EACH TIME MONITORING OCCURS. READINGS SHALL INCLUDE DATE, TIME, WEATHER CONDITIONS AND TEMPERATURE AND PROVIDE: TRACK NUMBER, BASE READING (WITH DATE), CHANGE IN ELEVATION, AND TOTAL DEFLECTION.
3. BASELINE MONITORING DATA SHALL BE COLLECTED DAILY FOR AT LEAST TEN (10) DAYS PRIOR TO THE START OF CONSTRUCTION.
4. DURING ACTIVE CONSTRUCTION ACTIVITIES MEASUREMENTS SHALL BE TAKEN AT THE BEGINNING OF EVERY HOUR.
5. DURING INACTIVE CONSTRUCTION ACTIVITIES MEASUREMENTS SHALL BE TAKEN EVERY 12 HOURS.
6. AFTER THE JACK AND BORE IS COMPLETE AND PITS BACKFILLED READINGS SHALL BE COLLECTED DAILY FOR 7 DAYS.
7. READINGS SHALL BE TRANSMITTED ELECTRONICALLY TO SEPTA ENGINEER IN CHARGE (EIC) DAILY.
8. DATA COLLECTION SHALL BE COMPLETED USING A TOTAL STATION INSTRUMENT HAVING A MINIMUM ANGULAR ACCURACY OF 1-SECOND AND AN ELECTRONIC DISTANCE MEASUREMENT ACCURACY OF 1.0MM = 2PPM. TOTAL STATION WILL LOCATE RMPs LOCATED ON THE TRACK(S) TO BE MONITORED.
9. THE CONTRACTOR SHALL SPACE THE RMPs AT MAXIMUM SPACING OF 15'-6" ALONG THE RAILS AS SHOWN ON THE PLAN.
10. WHERE POSSIBLE RMPs SHALL BE EITHER COMMERCIALLY AVAILABLE CALIBRATED REFLECTIVE TARGETS OR SMALL PRISMS. ALL TARGETS SHALL BE MOUNTED AT A UNIFORM ELEVATION BELOW THE TOP OF RAIL. SEE DETAIL OR APPROVED EQUIVALENT. PRISMS OR TARGETS SHOULD BE MOUNTED TO RAIL IN ACCORDANCE WITH MANUFACTURER'S SPECIFICATIONS USING EPOXY OR CLAMPS AS APPROPRIATE.
11. REFLECTIVE TARGETS SHALL BE LESS THAN 3-INCHES SQUARE AND MOUNTED TO THE WEB OF THE RAIL BY ADHESIVE. ALLOWABLE MINIMUM ANGLE FROM INSTRUMENT TO TARGET FACE: 30 DEGREES.
12. PRISMS MOUNTED ON RAIL BRACKETS (TYPICALLY FROM THE BASE), SHALL REMAIN AT LEAST ONE INCH BELOW TOP OF RAIL HEAD AND MUST NOT INTERFERE WITH TRACK COMPONENTS.
13. CONTRACTOR SHALL INCLUDE PRISMS ON THE TRACK(S) THE WORK PASSES BENEATH.
14. IF THE PRISMS ENCOUNTER SPECIAL TRACK WORK LOCATIONS (I.E.-CROSSINGS, TURNOUTS, AND MITER RAILS), CONTRACTOR SHALL NOTIFY SEPTA AND CONFIRM THAT A FIXED REFERENCE SUCH AS A PAINT MARK OR OTHER FEATURE ON OR ADJACENT TO THE TRACK CAN BE ESTABLISHED TO USE AS AN RMP WHERE A PRISM CANNOT BE MOUNTED TO THE EXISTING RAIL.



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0 10 20 30
SCALE: 1" = 10' SCALE IN FEET

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CERTIFIED CORRECT PLANS
David R. Hollins
Professional Engineer
Approved by Bureau of Technical Utility Services
PA PUBLIC UTILITY COMMISSION
ATTEST Rosemary Chiavetta
Secretary

1

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RAIL MONITORING PLAN

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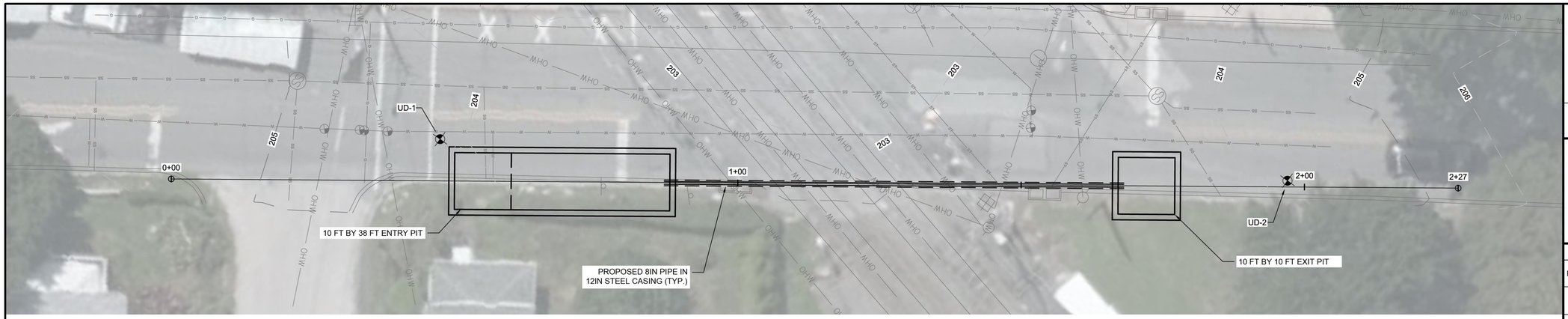
DESIGNED BY	SMM
DRAWN BY	SMM
CHECKED BY	DJD
APPROVED BY	ESB

SHEET 3 of 9

3

PLOTTED 8/6/2021 11:34 AM BY shayne maclean
CAD FILE \\kleinfelder.com\shares\EXTON-DATA\GROUPS\Company\Projects\20211296.004A PECO 2021 AGMP Trenchless Crossings\004A Upper Darby B6\Civil\Drawings\Upper Darby_Plan Sheets.dwg LAYOUT: Rail Monitoring Plan



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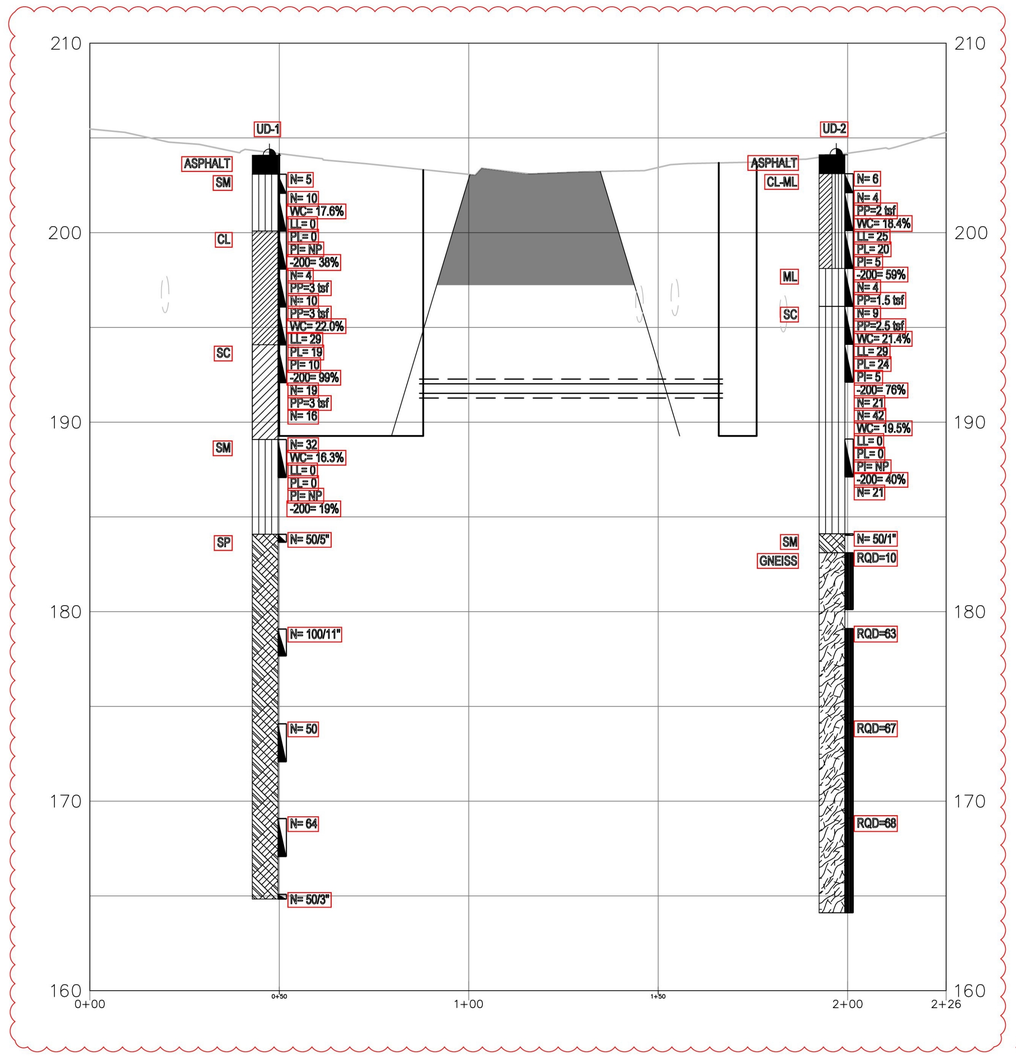

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PROFILE VIEWS
HORIZONTAL SCALE: 1" = 20'

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VERTICAL SCALE: 1" = 4'

0 4 8 12
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CERTIFIED CORRECT PLANS
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Approved by Bureau of Technical Utility Services
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SHEET 4 of 9

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LAYOUT: Geotech Profile
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JACK AND BORE CONSTRUCTION NOTES

PART 1. GENERAL

1.01 SCOPE

A. CONTRACTOR SHALL INSTALL THE WELDED PIPE STRING USING THE JACK AND BORE METHOD.

B. CONTRACTOR SHALL PROVIDE AND MOBILIZE ALL NECESSARY EQUIPMENT, INSTRUMENTATION, AND SUPPLIES TO INSTALL THE WELDED PIPE STRING USING THE JACK AND BORE METHOD OF CONSTRUCTION.

C. THE CONTRACTOR SHALL CALL THE PENNSYLVANIA ONE CALL SYSTEM (811) PRIOR TO CONSTRUCTION.

D. CONTRACTOR IS RESPONSIBLE FOR LOCATING AND PROTECTING ALL UNDERGROUND AND OVERHEAD UTILITIES WITHIN THE CONSTRUCTION AREA.

E. CONTRACTOR IS RESPONSIBLE FOR ALL LOSSES AND REPAIRS OCCASIONED BY DAMAGE TO UNDERGROUND FACILITIES/UTILITIES RESULTING FROM THEIR WORK.

F. CONTRACTOR SHALL RESTORE THE AREA TO EXISTING CONDITIONS.

G. CONSTRUCTION OF THE PIPELINE SHALL ADHERE TO PECO CONSTRUCTION AND WELDING STANDARDS.

1.02 REFERENCED STANDARDS

A. API SPECIFICATION 13A SPECIFICATION FOR DRILLING FLUID MATERIALS

1.03 CONTRACTOR REQUIREMENTS.

A. FOR OBSERVATION OF THE INSTALLATION, NOTIFY THE ENGINEER THAT WORK WILL START AT LEAST 3 WORKING DAYS PRIOR TO THE START OF WORK.

B. THE JACK AND BORE CONTRACTOR SHALL BE EXPERIENCED IN THE INSTALLATION OF JACK AND BORES AND HAVE SUCCESSFULLY COMPLETED AT LEAST 5 PROJECTS OF A SIMILAR NATURE IN SIMILAR SUBSURFACE CONDITIONS AND COMPLETED IN THE LAST 5 YEARS. A BRIEF DESCRIPTION OF EACH PROJECT WITH THE OWNER'S NAME AND A CURRENT PHONE NUMBER SHALL BE INCLUDED.

C. THE JACK AND BORE CONTRACTOR'S SUPERINTENDENT SHALL HAVE A MINIMUM OF 3 YEARS OF EXPERIENCE SUPERVISING JACK AND BORE INSTALLATION. THE DRILL OPERATORS AND THE ON-SITE SUPERVISORS SHALL HAVE A MINIMUM OF 1 YEAR OF EXPERIENCE INSTALLING JACK AND BORES. PRIOR TO STARTING THE WORK, THE CONTRACTOR SHALL SUBMIT A LIST IDENTIFYING THE SUPERINTENDENT, DRILL RIG OPERATIONS, AND ON-SITE SUPERVISORS ASSIGNED TO THE PROJECT. THE LIST SHALL CONTAIN A SUMMARY OF EACH INDIVIDUAL'S EXPERIENCE AND SHALL BE SUFFICIENTLY COMPLETE FOR THE ENGINEER TO EVALUATE THE INDIVIDUAL'S QUALIFICATIONS.

D. WORK SHALL NOT BEGIN UNTIL WRITTEN APPROVAL OF THE QUALIFICATIONS IS GIVEN BY THE ENGINEER.

E. THE OWNER'S REPRESENTATIVE MAY SUSPEND THE WORK IF THE CONTRACTOR SUBSTITUTES NON-APPROVED PERSONNEL FOR APPROVED PERSONNEL. THE CONTRACTOR SHALL BE FULLY LIABLE FOR ADDITIONAL COSTS RESULTING FROM THE SUSPENSION OF WORK. NO ADJUSTMENTS IN CONTRACT TIME RESULTING FROM THE WORK SUSPENSION SHALL BE ALLOWED.

F. ALL EQUIPMENT PROVIDED BY THE CONTRACTOR SHALL BE LEAK-FREE, FULLY FUNCTIONAL FOR ITS INTENDED PURPOSE AND BE IN GOOD OPERATING CONDITION.

G. ALL INSTRUMENTATION PROVIDED BY THE CONTRACTOR SHALL BE CALIBRATED/CERTIFIED AS PER THE MANUFACTURER'S RECOMMENDATIONS, HAVE APPROPRIATE DOCUMENTATION THAT SUMMARIZES THE RESULTS OF THE MOST RECENT CALIBRATION/CERTIFICATION PROCESS, BE FULLY FUNCTIONAL FOR ITS INTENDED PURPOSE AND BE MAINTAINED IN GOOD OPERATING CONDITION.

H. ALL SUPPLIES PROVIDED BY THE CONTRACTOR SHALL BE FULLY FUNCTIONAL FOR THEIR INTENDED PURPOSE AND BE STORED AS PER THE MANUFACTURER'S RECOMMENDATIONS AND ANY APPLICABLE CONSTRUCTION AND/OR ENVIRONMENTAL PERMITS/REGULATIONS.

I. THE CONTRACTOR'S DRAWINGS AND CALCULATIONS INDICATING THE DESIGN OF THE WORK OF THIS SECTION SHALL BE PREPARED, STAMPED, AND SIGNED BY A PROFESSIONAL ENGINEER (CIVIL OR STRUCTURAL) REGISTERED IN THE COMMONWEALTH OF PENNSYLVANIA WITH A MINIMUM OF 5-YEARS DEMONSTRATED EXPERIENCE IN THE DESIGN AND INSTALLATION OF JACKING SLEEVES, PITS, PIPES, AND APPURTENANCES. THE DRAWINGS AND DESIGN CONCEPT SHALL INCLUDE BUT NOT BE LIMITED TO THE DEWATERING, SOIL STABILIZATION, JACKING PITS, JACKS, REACTION BLOCKS, PROTECTION OF EXISTING STRUCTURES, AND INSTALLATION SCHEDULE. THE CONTRACTOR'S ENGINEER SHALL REVIEW ALL OF THE AVAILABLE INFORMATION INDICATED ON THE DRAWINGS AND PROVIDED HEREIN AND SHALL BE RESPONSIBLE FOR MAKING WHATEVER ADDITIONAL INVESTIGATIONS OF THE SITE THAT MAY BE NECESSARY.

1.04 SUBMITTALS

A. THE FOLLOWING SUBMITTALS SHALL BE PROVIDED BY THE CONTRACTOR FOR THE ENGINEER'S REVIEW AND APPROVAL. THE CONTRACTOR WILL NOT BE ALLOWED TO BEGIN INSTALLATION UNTIL ALL SUBMITTAL REQUIREMENTS ARE SATISFIED AND FOUND ACCEPTABLE TO THE ENGINEER. CHANGES OR DEVIATIONS FROM THE APPROVED SUBMITTALS MUST BE RE-SUBMITTED FOR APPROVAL. NO ADJUSTMENTS IN THE CONTRACT TIME WILL BE ALLOWED BECAUSE OF INCOMPLETE SUBMITTALS. AT LEAST TWO WEEKS PRIOR TO INITIATING THE WORK, THE CONTRACTOR SHALL SUBMIT TO THE ENGINEER:

1. A SUMMARY OF CONTRACTOR EXPERIENCE AND QUALIFICATIONS.
2. FOR INFORMATIONAL PURPOSES ONLY, SUBMIT DETAILED DESCRIPTION OF EQUIPMENT, MATERIALS, SEQUENCE AND PROCEDURES FOR JACKING STEEL SLEEVES AND PIPE, INCLUDING PROVISIONS FOR STANDBY AND BACKUP EQUIPMENT, INCLUDING A DESCRIPTION OF THE METHOD FOR THE EXCAVATING AND REMOVAL OF ALL ROCK, BOULDERS, AND OBSTRUCTING MATERIAL.
3. SIZE AND ARRANGEMENT OF SOIL STABILIZATION (IF PROPOSED).
4. DEWATERING PLAN AND EQUIPMENT.
5. DETAILED DESCRIPTIONS OF MATERIALS, SEQUENCE AND PROCEDURES FOR INSTALLING THE PIPELINE WITHIN THE STEEL JACKING SLEEVES, INCLUDING CLEANING AND TESTING THE PIPELINE WITHIN THE CASING.
6. PROPOSED METHOD OF CONTROLLING LINE AND GRADE.
7. METHOD OF PLACEMENT OF SPACERS IN THE ANNULAR SPACE BETWEEN THE INSTALLED PIPELINE AND THE STEEL JACKING SLEEVE.
8. THE BULKHEAD DESIGNS
9. PRESSURE GAUGE CERTIFICATIONS
10. CERTIFICATE OF DESIGN STAMPED BY A REGISTERED PROFESSIONAL ENGINEER (CIVIL OR STRUCTURAL) STATING THAT THE STEEL JACKING SLEEVE IS DESIGNED FOR THE ANTICIPATED JACKING AND DESIGN LOADS, AND THAT PIPE JOINTS SHALL WITHSTAND THE JACKING FORCES.
11. SURVEY OF THE AS-BUILT PIPE ALIGNMENT.

PART 2. MATERIALS

2.01 MATERIAL SPECIFICATIONS

A. THE PIPELINE STRING AND CASING WILL BE PROVIDED BY PECO.

PART 3. EXECUTION

3.01 PAD/SITE PREPARATION

A. THE CONTRACTOR IS RESPONSIBLE FOR THEIR MEANS AND METHODS TO ANCHOR THEIR EQUIPMENT DURING CONSTRUCTION.

B. EROSION AND SEDIMENT CONTROL IS NOT DEPICTED ON THESE DRAWINGS. THE HDD CONTRACTOR IS RESPONSIBLE FOR INSTALLING AND MAINTAINING EROSION AND SEDIMENT CONTROL DEVICES IN ACCORDANCE WITH STATE AND LOCAL REGULATIONS.

C. TEMPORARY EXCAVATIONS SHALL BE IN ACCORDANCE WITH OSHA REQUIREMENTS.

D. THE CONTRACTOR SHALL RESTORE THE SITE GRADING ASPHALT, CURB, SIDEWALK, AND LANDSCAPING TO ITS PRE-CONSTRUCTION CONDITION AT THE COMPLETION OF WORK.

3.02 PROJECT / SITE CONDITIONS

A. THE CONTRACTOR SHALL KEEP THE JACKING PIT SUBGRADE CONTINUOUSLY FREE FROM GROUND AND SURFACE WATER DURING THE OPERATION AND SHALL BE PREPARED TO IMPLEMENT ADDITIONAL GROUNDWATER CONTROL ON SHORT NOTICE. OBSERVED GROUNDWATER LEVELS SHALL BE BELOW THE BOTTOM ELEVATION OF THE JACKING PIT PRIOR TO STARTING THE BORING OPERATIONS. GROUNDWATER CONTROL ALONG AND AT THE FACE OF THE JACKING SLEEVE SHALL INCLUDE MODIFICATION AS REQUIRED TO ACHIEVE THE SPECIFIED RESULTS.

B. ONCE THE JACKING OPERATION HAS BEGUN, THE CONTRACTOR SHALL WORK CONTINUOUSLY (24 HOURS PER DAY/7 DAYS PER WEEK) UNTIL THE COMPLETE LENGTH OF PIPE HAS BEEN INSTALLED, IF REQUIRED.

C. THE CONTRACTOR SHALL REMOVE OBSTRUCTIONS THAT PREVENT THE PIPE FROM BEING INSTALLED AT THE PROPER GRADE AND ALIGNMENT. SHOULD OBSTRUCTIONS ASSOCIATED WITH CONCRETE AND TIMBER PILE, FOUNDATIONS, SUPPORTING WALLS, WOOD, SHEETING, BOULDERS, AND UTILITIES BE ENCOUNTERED, THE CONTRACTOR SHALL IMMEDIATELY NOTIFY COMPANY. THE CONTRACTOR SHALL PROPOSE HIS APPROACH TO CLEAR THE OBSTRUCTION SO WORK CAN PROCEED.

D. IF ANY MOVEMENT OR SETTLEMENT OCCURS WHICH HAS CAUSED OR MIGHT CAUSE DAMAGE TO EXISTING STRUCTURES OVER, ALONG OR ADJACENT TO THE WORK, THE CONTRACTOR SHALL IMMEDIATELY STOP ALL WORK EXCEPT THAT WHICH ASSISTS IN MAKING THE WORK SECURE AND IN PREVENTING FURTHER MOVEMENT, SETTLEMENT OR DAMAGE. THE CONTRACTOR SHALL RESUME JACKING ONLY AFTER ALL PRECAUTIONS HAVE BEEN TAKEN TO PREVENT FURTHER MOVEMENT, SETTLEMENT OR DAMAGE AND SHALL REPAIR THE DAMAGE.

3.03 JACKING AND RECEIVING PITS

A. GROUNDWATER CONTROL AND DEWATERING IS THE RESPONSIBILITY OF THE CONTRACTOR.

B. THE CONTRACTOR SHALL CONSIDER A LAUNCH PORTAL BETWEEN THE OUTFACE OF THE JACKING SLEEVE AND THE PENETRATION THROUGH THE JACKING AND RECEIVING PIT WALLS. THE LAUNCH PORTAL SHALL PROVIDE ENOUGH RESISTANCE TO PREVENT SOIL FINES FROM WASHING OUT FROM THE RETAINED SOIL. THE METHOD OF SEALING THIS SECTION OF THE PIT IS THE RESPONSIBILITY OF THE CONTRACTOR.

C. VERTICAL WOOD SHEETING, STEEL SHEETING OR TRENCH BOXES SHALL BE USED FOR EXCAVATION SUPPORT. CONCRETE FOR BACKSTOP SHALL HAVE A MINIMUM 28-DAY STRENGTH OF 3,000 PSI.

D. THE CONTRACTOR SHALL FURNISH, INSTALL AND REMOVE, TO THE EXTENT REQUIRED, THRUST BLOCK OR WHATEVER PROVISIONS MAY BE REQUIRED IN DRIVING THE SLEEVES FORWARD.

E. STEEL RAILS OR BEAMS SHALL BE PROPERLY SECURED FOR PLACEMENT AND ALIGNMENT OF EACH PIECE OF STEEL SLEEVE OR PIPE DURING INSTALLATION OPERATIONS.

F. AFTER COMPLETION OF THE JACKING OPERATION, THE CONTRACTOR SHALL REMOVE THE JACKING AND RECEIVING PITS AND FURNISHING AND PLACING BACKFILL, TO THE NORMAL SUBGRADE WITH THE SURFACE RESTORED.

3.04 BORED OR TUNNELED CONSTRUCTION

A. FOR CASED CROSSINGS, THE HOLE DIAMETER RESULTING FROM BORED OR TUNNELED INSTALLATIONS SHALL NOT EXCEED THE OUTSIDE DIAMETER OF THE CASING BY MORE THAN THREE-QUARTER (3/4) INCH.

B. WHERE UNSTABLE SOIL CONDITIONS EXIST, BORING OR TUNNELING OPERATIONS SHALL BE CONDUCTED IN SUCH A MANNER AS NOT TO BE DETRIMENTAL TO THE HIGHWAY BEING CROSSED.

C. IF EXCESSIVE VOIDS OR TOO LARGE A BORED HOLE IS PRODUCED DURING CASING OR PIPELINE INSTALLATIONS, OR IF IT IS NECESSARY TO ABANDON A BORED OR TUNNELED HOLE, PROMPT REMEDIAL ACTION SHALL BE TAKEN BY CONTRACTOR.

3.05 JACKING OPERATIONS - GENERAL REQUIREMENTS

A. THE CONTRACTOR SHALL PREVENT THE OCCURRENCE OF VOIDS OUTSIDE THE JACKING SLEEVE THAT WILL ENDANGER EXISTING ROADS OR STRUCTURES. IF VOIDS OCCUR, THE CONTRACTOR SHALL FILL THEM WITH CEMENT GROUT. IN ORDER TO MINIMIZE THE VOIDS PRODUCED DURING EXCAVATION IN THE FORWARD END OF THE SLEEVE, THE CONTRACTOR SHALL BE REQUIRED TO USE A JACKING SHIELD IN GRANULAR MATERIALS.

B. PROPER ALIGNMENT AND ELEVATION OF THE SLEEVES SHALL BE CONSISTENTLY MAINTAINED THROUGHOUT THE JACKING OPERATION.

C. THE STEEL SLEEVE CASING SHALL BE CONSTRUCTED TO PREVENT LEAKAGE OF ANY SUBSTANCE INTO THE CASING THROUGHOUT ITS LENGTH, EXCEPT AT THE ENDS OF THE CASING.

D. AFTER THE SLEEVE HAS BEEN COMPLETELY INSTALLED, THE CONTRACTOR SHALL THOROUGHLY CLEAN THE INTERIOR. CASING SPACERS SHALL BE USED TO INSTALL THE FORCE MAIN WITHIN THE STEEL SLEEVE.

E. AFTER THE CARRIER PIPE IS INSTALLED WITHIN THE JACKING SLEEVE, THE CONTRACTOR SHALL PERFORM A HYDROSTATIC TEST ON THE CARRIER PIPE AS SPECIFIED. ALL LEAKS WHICH ARE DISCOVERED DURING THE TESTING PHASE SHALL BE REPAIRED TO THE SATISFACTION OF THE ENGINEER.

F. THE SECTIONS OF STEEL SLEEVE CASING SHALL BE FIELD WELDED IN ACCORDANCE WITH THE APPLICABLE PORTIONS OF AWWA C 206 AND AWS D7.0 FOR FIELD WELDED WATER PIPE JOINTS.

G. THE CONTRACTOR SHALL USE A JACKING RING TO EVENLY DISTRIBUTE THE JACKING PRESSURE AROUND THE WALL OF THE JACKING SLEEVE OR PIPE.

H. THE CONTRACTOR SHALL USE A FABRICATED STRUCTURAL STEEL JACKING FRAME TO EVENLY DISTRIBUTE THE STRESSES FROM THE JACKS TO THE JACKING RING.

I. THE CONTRACTOR SHALL BE REQUIRED TO HAVE ON SITE AT ALL TIMES EQUIPMENT AND MATERIALS FOR BREASTING THE FULL FACE OF THE JACKING SLEEVE.

J. THE CONTRACTOR SHALL BE REQUIRED TO HAVE ON SITE AT ALL TIMES PUMPS AND OTHER ASSOCIATED EQUIPMENT TO DEWATER THE JACKING OPERATION.

3.06 SOIL STABILIZATION

A. IF SOIL STABILIZATION IS REQUIRED, THE CONTRACTOR SHALL BE SOLELY RESPONSIBLE TO DETERMINE THE GROUT TO BE USED AND THE PROCEDURE TO BE FOLLOWED. A GROUT INJECTION PATTERN SHALL BE DESIGNED TO MEET SOIL AND WATER CONDITIONS. THE STABILIZATION SHALL EXTEND AS FAR AS NECESSARY OUTSIDE THE PERIPHERY OF THE PIPE AND IN FRONT OF THE EXCAVATION IN ORDER TO MAINTAIN A STABLE FACE AT THE HEADING. RATE AND INJECTION SEQUENCE SHOULD BE DETERMINED BY THE CONTRACTOR.

B. ALL GROUTING EQUIPMENT SHALL BE OF A TYPE, CAPACITY, AND MECHANICAL CONDITION SUITABLE FOR DOING THE WORK, AS DETERMINED BY CONRAIL. THE CONTRACTOR SHALL FURNISH WRITTEN CERTIFICATION FROM THE GROUT MANUFACTURER THAT THE EQUIPMENT AND LAYOUT ARE EQUIVALENT OR BETTER THAN THAT RECOMMENDED FOR USE WITH THE GROUT.

C. THE CONTRACTOR SHALL CLEAN AND REMOVE ALL WASTE OF THE GROUTING OPERATIONS.

3.07 SETTLEMENT MONITORING PROGRAM

A. THE CONTRACTOR SHALL ENGAGE AN INDEPENDENT, REGISTERED PROFESSIONAL LAND SURVEYOR TO PROVIDE A DETAILED HORIZONTAL AND VERTICAL SETTLEMENT MONITORING PROGRAM DURING THE JACKING OPERATION TO ASSURE NO SETTLEMENT HAS OCCURRED TO EXISTING SIDEWALKS, UTILITIES OR RAIL LINE.

B. SETTLEMENT POINTS ON ROADWAY SURFACES SHALL BE PLACED ALONG THE ALIGNMENT OF THE SLEEVE AT THE LOCATIONS SHOWN ON THE DRAWINGS. THE MONITORING PROGRAM SHALL CONSIST OF DAILY MONITORING DURING THE ACTUAL JACKING OPERATION, AND AT 15, 30, AND 90 DAYS AFTER COMPLETION OF THE JACKING. SIX COPIES OF THE FIELD NOTES WITH A LOCATION PLAN OF THE MONITORING POINTS SHALL BE PROVIDED TO THE AUTHORITY. ANY SETTLEMENT CAUSED BY THE JACKING OPERATION SHALL BE REPAIRED BY THE CONTRACTOR AT NO ADDITIONAL COST TO THE COMPANY.

3.08 CLEANUP

A. THE CONTRACTOR SHALL CLEAN-UP THE SITE AFTER THE JACKING HAS BEEN COMPLETED AND APPROVED BY COMPANY AND THE ENGINEER. PREVENT CONTAMINATION OF THE SITE DURING THE EXECUTION OF THE JACKING WORK.

3.09 QUALITY ASSURANCE AND TESTING

A. THE CONTRACTOR SHALL PROVIDE VOLUMES OF ANNULAR SPACE (OUTSIDE CASING PIPE) GROUT SUPPLIED, INSTALLED, AND DISPOSED.

B. CONTRACTOR SHALL COORDINATE THE WITNESSING OF GROUTING ACTIVITIES BY PECO OR THEIR REPRESENTATIVE.

Project Info

Job Number		20211296.004A
Job Name		Upper Darby B6
Date of Analysis		10/8/2020
Calc By		ESB
Check By		RS

Pipe Properties

Casing Outside Diameter	D	12.75 in
Casing Wall Thickness	t	0.5 in
Casing Inside Diameter	d	11.75 in

Bore Path Summary

Bore Diameter	B_t	12.75 inch
Cover Depth	H	11 feet
Length of Bore	L	80 feet

Installation Equipment

Assumed Max. Jacking Capacity	Pj	200 kips

Check Jacking Force

Estimated Jacking Force	Pt	28 kip		
Jacking Capacity	Pj	200 kip		
Factor of Safety		7.2	>=	1.5 OK

Check Vertical Loading

Vertical Thrust Load	T	0.70125 kip/ft		
Wall Capacity	Tw	210 kip/ft		
Factor of Safety		299.5	>=	2 OK

Check Horizontal Loading

	Pn	673 kip		
Jacking Capacity	Pj	200 kip		
Factor of Safety		3.4	>=	1.5 OK

Check Combined Horizontal and Vertical

Factor of Safety	3.3	>=	1.5 OK

1/4 PIPE JACKING CALCULATION
SCALE: NTS

CERTIFIED CORRECT PLANS
Daniel R. Hellrich
Professional Engineer
Approved by Bureau of Technical Utility Services
PA PUBLIC UTILITY COMMISSION
ATTEST
Secretary

KLEINFELDER
Bright People. Right Solutions.
180 Sheree Boulevard, Suite 3800
Exton, PA 19341
Phone: 610-594-1444
www.kleinfelder.com

REVISIONS

REV	DESCRIPTION	DSN	CHK	DATE
		DWN	APP	
1	REVISED PER SEPTA COMMENTS	SMM	JMB	7/15/2021
		KWS	JMB	
2	REVISED PER SEPTA COMMENTS	SMM	JMB	8/6/2021
		SMM	JMB	

SCALE VERIFICATION
THIS BAR IS 1 INCH IN LENGTH ON ORIGINAL DRAWING
0 1"
IF IT'S NOT 1 INCH ON THIS SHEET ADJUST YOUR SCALES ACCORDINGLY

ORIGINAL DRAWING SIZE IS 22 x 34

ISSUED FOR REVIEW

UPPER DARBY B6
WO#16028420
UPPER DARBY, PENNSYLVANIA

PECO
An Exelon Company

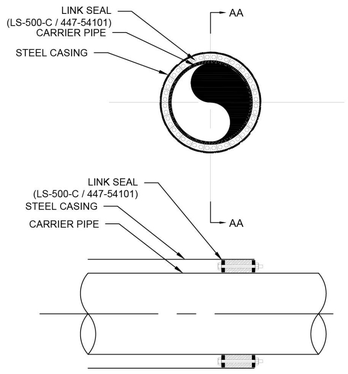
PECO
25 FRONT STREET
CONSHOHOCKEN, PA 19428

CONSTRUCTION NOTES

PROJECT NO.	20211296.004A
ISSUE DATE	8/6/2021
CURRENT REVISION	2
DESIGNED BY	SMM
DRAWN BY	SMM
CHECKED BY	DJD
APPROVED BY	ESB

SHEET 5 of 9

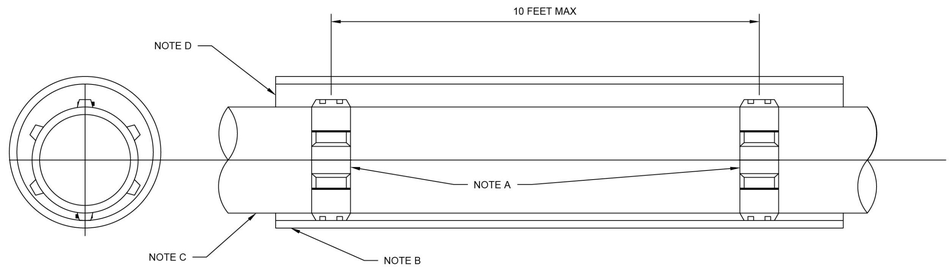
5



SECTION A-A

1/6 LINK SEAL DETAIL AND SECTION VIEW

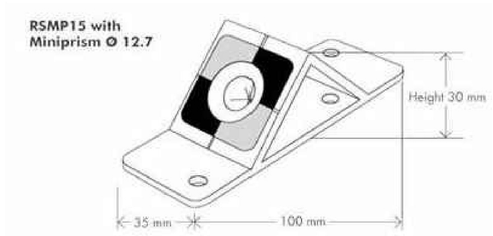
SCALE: NTS



NOTES:
A) MAXIMUM SPACING BETWEEN CASING SPACER'S SHALL BE 10 FEET.
B) STRAIGHT ALIGNMENT OF CASING IS NECESSARY TO PERMIT SMOOTH INSERTION OF PIPE IN CASING.
C) PIPE SHALL NOT BE ALLOWED TO COME INTO ELECTRICAL CONTACT WITH CASING.
D) USE LINK SEALS WHERE MAIN ENTERS AND EXITS THE CASING. SEE DETAIL 2.

2/6 CASING SPACER AND SEAL INSTALLATION

SCALE: NTS



Dia: 12.7mm with a tolerance of +/- 0.2 mm
Height of the 12.7 mm prism: 9.525 mm
with a tolerance of +/- 0.2 mm
Accuracy is 5 arc sec with a tolerance of +/-2 arc
Use 5mm or #10 mounting hardware (Not Included)

3/6 RAIL MONITORING PRISM (OPTION #1)

SCALE: NTS

CERTIFIED CORRECT PLANS
Daniel R. Hellrich
Professional Engineer
Approved by Bureau of Technical Utility Services
PA PUBLIC UTILITY COMMISSION
ATTEST Rosemary C. Chiavetta
Secretary

GEO INSTRUMENTS — Rail Clip Prism

Applications

The Rail Clip Prism is designed for use with automated total stations (AMTS) to monitor railroad tracks for settlement, heave, lateral displacements, and changes in super-elevation.

Installation

Rail Clip Prisms are typically installed on both rails, spaced at regular intervals to span the the track to be monitored.

Each prism has two components: a rail clip and an L-bar mini-prism. The only tool needed for installation is a hex wrench.

1. Fit the rail clip to the rail. Tighten the hex screws until the clip is firmly attached.
2. Attach the L-bar, adjusting its angle so that the prism will directly face the AMTS.
3. Attach the prism to the L-bar, aiming it at the AMTS.

Advantages

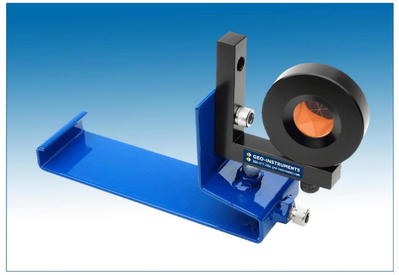
- **High Performance:** Coated optics for better performance.
- **Durable:** Simple, waterproof construction with no moving parts or electronics.
- **Quick Installation:** Fit rail clip and tighten screws. No drilling or wiring required.
- **Cost Effective:** Low cost per monitored point compared to conventional sensors.

Specifications

Rail Clip: Power-coated steel, stainless steel screws. Available in 5.5 or 6-inch sizes.
L-Bar Bracket: 3 inch arms, black anodized aluminum.
Mini Prism: 25 mm optical glass with anti-reflection and copper coatings.
Mini Prism Offset: -25.5 mm.
Mini Prism Offset for Leica: +8.92 mm.

Part Numbers

Rail Clip for 5.5" Rail, with prism **TSP705**
Rail Clip for 6" Rail, with prism **TSP706**
Rail Clip for 5.5" Rail, no prism **TSP710**
Rail Clip for 6" Rail, no prism **TSP720**
L-Bar Mini Prism **TSP110**



Rail Clip Prism

AMTS monitoring rail clip prisms

Prisms on tracks and tunnel

Paired prisms monitor changes in cant

Prisms can be installed quickly

www.geo-instruments.com 800-477-2506 sales@geo-instruments.com

Rhode Island • New York • DC • Georgia • Florida • Illinois • Texas • Nevada • Washington • California

4/6 RAIL MONITORING PRISM (OPTION #2)

SCALE: NTS

1

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180 Sheree Boulevard, Suite 3800
Exton, PA 19341
Phone: 610-594-1444
www.kleinfelder.com

REVISIONS

REV	DESCRIPTION	DSN / DWN	CHK / APP	DATE
1	REVISED PER SEPTA COMMENTS	SMM / KWS	JMB / JMB	7/15/2021
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UPPER DARBY, PENNSYLVANIA

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CONSTRUCTION DETAILS

PROJECT NO.	20211296.004A
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DESIGNED BY	SMM
DRAWN BY	SMM
CHECKED BY	DJD
APPROVED BY	ESB

SHEET 6 of 9

6

SAMPLER AND DRILLING METHOD GRAPHICS

- BULK / GRAB / BAG SAMPLE
- STANDARD PENETRATION SPLIT SPOON SAMPLER (2 in. (50.8 mm.) outer diameter and 1-3/8 in. (34.9 mm.) inner diameter)
- MODIFIED CALIFORNIA SAMPLER (2 or 2-1/2 in. (50.8 or 63.5 mm.) outer diameter)
- CALIFORNIA SAMPLER (3 in. (76.2 mm.) outer diameter)
- SHELBY TUBE SAMPLER
- GEO-PROBE SAMPLER
- DYNAMIC CONE PENETROMETER
- SONIC CONTINUOUS SAMPLER
- AUGER CUTTINGS
- WATER SAMPLE
- NO RECOVERY
- HOLLOW STEM AUGER
- SOLID STEM AUGER

CORE SAMPLER TYPE GRAPHICS

- CORE SAMPLER
- AQ CORE BARREL (1.067 in. (27.1 mm.) core diameter)
- AX CORE BARREL (1.185 in. (30.1 mm.) core diameter)
- BQ CORE BARREL (1.433 in. (36.4 mm.) core diameter)
- CONTINUOUS CORE SAMPLE (2.000 in. (50.8 mm.) core diameter)
- EX CORE BARREL (0.846 in. (21.5 mm.) core diameter)
- HQ CORE SAMPLE (2.500 in. (63.5 mm.) core diameter)
- NQ CORE SAMPLE (1.874 in. (47.6 mm.) core diameter)
- NO RECOVERY CORE SAMPLE
- NX CORE SAMPLE (2.154 in. (54.7 mm.) core diameter)

GROUND WATER GRAPHICS

- WATER LEVEL (level where first observed)
- WATER LEVEL (level after exploration completion)
- WATER LEVEL (additional levels after exploration)
- OBSERVED SEEPAGE

UNIFIED SOIL CLASSIFICATION SYSTEM (ASTM D 2487)

COARSE GRAINED SOILS (More than half of material is larger than the #200 sieve)

GRAVELS (More than half of coarse fraction is larger than the #4 sieve)

CLEAN GRAVEL WITH <5% FINES	Cu ≥ 4 and 1 ≤ Cc ≤ 3	GW	WELL-GRADED GRAVELS, GRAVEL-SAND MIXTURES WITH LITTLE OR NO FINES
	Cu < 4 and/or 1 > Cc > 3	GP	POORLY GRADED GRAVELS, GRAVEL-SAND MIXTURES WITH LITTLE OR NO FINES
GRAVELS WITH 5% TO 12% FINES	Cu ≥ 4 and 1 ≤ Cc ≤ 3	GW-GM	WELL-GRADED GRAVELS, GRAVEL-SAND MIXTURES WITH LITTLE FINES
		GW-GC	WELL-GRADED GRAVELS, GRAVEL-SAND MIXTURES WITH LITTLE CLAY FINES
	Cu < 4 and/or 1 > Cc > 3	GP-GM	POORLY GRADED GRAVELS, GRAVEL-SAND MIXTURES WITH LITTLE FINES
		GP-GC	POORLY GRADED GRAVELS, GRAVEL-SAND MIXTURES WITH LITTLE CLAY FINES
GRAVELS WITH > 12% FINES		GM	SILTY GRAVELS, GRAVEL-SILT-SAND MIXTURES
		GC	CLAYEY GRAVELS, GRAVEL-SAND-CLAY MIXTURES
		GC-GM	CLAYEY GRAVELS, GRAVEL-SAND-CLAY-SILT MIXTURES

SANDS (More than half of coarse fraction is smaller than the #4 sieve)

CLEAN SANDS WITH <5% FINES	Cu ≥ 6 and 1 ≤ Cc ≤ 3	SW	WELL-GRADED SANDS, SAND-GRAVEL MIXTURES WITH LITTLE OR NO FINES
	Cu < 6 and/or 1 > Cc > 3	SP	POORLY GRADED SANDS, SAND-GRAVEL MIXTURES WITH LITTLE OR NO FINES
SANDS WITH 5% TO 12% FINES	Cu ≥ 6 and 1 ≤ Cc ≤ 3	SW-SM	WELL-GRADED SANDS, SAND-GRAVEL MIXTURES WITH LITTLE FINES
		SW-SC	WELL-GRADED SANDS, SAND-GRAVEL MIXTURES WITH LITTLE CLAY FINES
	Cu < 6 and/or 1 > Cc > 3	SP-SM	POORLY GRADED SANDS, SAND-GRAVEL MIXTURES WITH LITTLE FINES
		SP-SC	POORLY GRADED SANDS, SAND-GRAVEL MIXTURES WITH LITTLE CLAY FINES
SANDS WITH > 12% FINES		SM	SILTY SANDS, SAND-GRAVEL-SILT MIXTURES
		SC	CLAYEY SANDS, SAND-GRAVEL-CLAY MIXTURES
		SC-SM	CLAYEY SANDS, SAND-SILT-CLAY MIXTURES

FINE GRAINED SOILS (More than half of material is smaller than the #200 sieve)

SILTS AND CLAYS (Liquid Limit less than 50)		ML	INORGANIC SILTS AND VERY FINE SANDS, SILTY OR CLAYEY FINE SANDS, SILTS WITH SLIGHT PLASTICITY
		CL	INORGANIC CLAYS OF LOW TO MEDIUM PLASTICITY, GRAVELLY CLAYS, SANDY CLAYS, SILTY CLAYS, LEAN CLAYS
		CL-ML	INORGANIC CLAYS-SILTS OF LOW PLASTICITY, GRAVELLY CLAYS, SANDY CLAYS, SILTY CLAYS, LEAN CLAYS
		OL	ORGANIC SILTS & ORGANIC SILTY CLAYS OF LOW PLASTICITY
SILTS AND CLAYS (Liquid Limit greater than 50)		MH	INORGANIC SILTS, MICACEOUS OR DIATOMACEOUS FINE SAND OR SILT
		CH	INORGANIC CLAYS OF HIGH PLASTICITY, FAT CLAYS
		OH	ORGANIC CLAYS & ORGANIC SILTS OF MEDIUM-TO-HIGH PLASTICITY

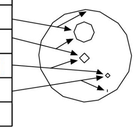
NOTES

- The report and graphics key are an integral part of these logs. All data and interpretations in this log are subject to the explanations and limitations stated in the report.
- Lines separating strata on the logs represent approximate boundaries only. Actual transitions may be gradual or differ from those shown.
- No warranty is provided as to the continuity of soil or rock conditions between individual sample locations.
- Logs represent general soil or rock conditions observed at the point of exploration on the date indicated.
- In general, Unified Soil Classification System designations presented on the logs were based on visual classification in the field and were modified where appropriate based on gradation and index property testing.
- Fine grained soils that plot within the hatched area on the Plasticity Chart, and coarse grained soils with between 5% and 12% passing the No. 200 sieve require dual USCS symbols, ie., GW-GM, GP-GM, GW-GC, GP-GC, GC-GM, SW-SM, SP-SM, SW-SC, SP-SC, SC-SM.
- If sampler is not able to be driven at least 6 inches then 50/X indicates number of blows required to drive the identified sampler X inches with a 140 pound hammer falling 30 inches.

ABBREVIATIONS
WOH – Weight of Hammer
WOR – Weight of Rod

GRAIN SIZE

DESCRIPTION		SIEVE SIZE	GRAIN SIZE	APPROXIMATE SIZE
Boulders		>12 in. (304.8 mm.)	>12 in. (304.8 mm.)	Larger than basketball-sized
Cobbles		3 – 12 in. (76.2 – 304.8 mm.)	3 – 12 in. (76.2 – 304.8 mm.)	Fist-sized to basketball-sized
Gravel	coarse	3/4 –3 in. (19 – 76.2 mm.)	3/4 –3 in. (19 – 76.2 mm.)	Thumb-sized to fist-sized
	fine	#4 – 3/4 in. (#4 – 19 mm.)	0.19 – 0.75 in. (4.8 – 19 mm.)	Pea-sized to thumb-sized
Sand	coarse	#10 – #4	0.079 – 0.19 in. (2 – 4.9 mm.)	Rock salt-sized to pea-sized
	medium	#40 – #10	0.017 – 0.079 in. (0.43 – 2 mm.)	Sugar-sized to rock salt-sized
	fine	#200 – #40	0.0029 – 0.017 in. (0.07 – 0.43 mm.)	Flour-sized to sugar-sized
Fines		Passing #200	<0.0029 in. (<0.07 mm.)	Flour-sized and smaller



SECONDARY CONSTITUENT

Term of Use	AMOUNT: Secondary Constituent is Fine Grained	AMOUNT: Secondary Constituent is Coarse Grained
Trace	<5%	<15%
With	5 to <15%	15 to <30%
Modifier	≥15%	≥30%

MOISTURE CONTENT

DESCRIPTION	FIELD TEST
Dry	Absence of moisture, dusty, dry to the touch
Moist	Damp but no visible water
Wet	Visible free water, usually soil is below water table

CEMENTATION

DESCRIPTION	FIELD TEST
Weakly	Crumbles or breaks with handling or slight finger pressure
Moderately	Crumbles or breaks with considerable finger pressure
Strongly	Will not crumble or break with finger pressure

ANGULARITY

DESCRIPTION	CRITERIA
Angular	Particles have sharp edges and relatively plane sides with unpolished surfaces.
Subangular	Particles are similar to angular description but have rounded edges.
Subrounded	Particles have nearly plane sides but have well-rounded corners and edges.
Rounded	Particles have smoothly curved sides and no edges.

CONSISTENCY – FINE-GRAINED SOIL

CONSISTENCY	SPT – N60 (# blows / ft)	Pocket Pen (tsf)	UNCONFINED COMPRESSIVE STRENGTH (Qu)(psf)	VISUAL / MANUAL CRITERIA
Very Soft	<2	PP < 0.25	<500	Thumb will penetrate more than 1 inch (25 mm). Extrudes between fingers when squeezed.
Soft	2 – 4	0.25 ≤ PP <0.5	500 – 1000	Thumb will penetrate soil about 1 inch (25 mm). Remolded by light finger pressure.
Medium Stiff	4 – 8	0.5 ≤ PP <1	1000 – 2000	Thumb will penetrate soil about 1/4 inch (6 mm). Remolded by strong finger pressure.
Stiff	8 – 15	1 ≤ PP <2	2000 – 4000	Can be imprinted with considerable pressure from thumb.
Very Stiff	15 – 30	2 ≤ PP <4	4000 – 8000	Thumb will not indent soil but readily indented with thumbnail.
Hard	>30	4 ≤ PP	>8000	Thumbnail will not indent soil.

FROM TERZAGHI AND PECK, 1948; LAMBE AND WHITMAN, 1969; FHWA, 2002; AND ASTM D2488

APPARENT / RELATIVE DENSITY – COARSE-GRAINED SOIL

APPARENT DENSITY	SPT-N60 (# blows/ft)	MODIFIED CA SAMPLER (# blows/ft)	CALIFORNIA SAMPLER (# blows/ft)	RELATIVE DENSITY (%)
Very Loose	<4	<4	<5	0 – 15
Loose	4 – 10	5 – 12	5 – 15	15 – 35
Medium Dense	10 – 30	12 – 35	15 – 40	35 – 65
Dense	30 – 50	35 – 60	40 – 70	65 – 85
Very Dense	>50	>60	>70	85 – 100

FROM TERZAGHI AND PECK, 1948

PLASTICITY

DESCRIPTION	LL	FIELD TEST
Non-plastic	NP	A 1/8-in. (3 mm.) thread cannot be rolled at any water content.
Low (L)	< 30	The thread can barely be rolled and the lump or thread cannot be formed when drier than the plastic limit.
Medium (M)	30 – 50	The thread is easy to roll and not much time is required to reach the plastic limit. The thread cannot be rerolled after reaching the plastic limit. The lump or thread crumbles when drier than the plastic limit.
High (H)	> 50	It takes considerable time rolling and kneading to reach the plastic limit. The thread can be rerolled several times after reaching the plastic limit. The lump or thread can be formed without crumbling when drier than the plastic limit.

REACTION WITH HYDROCHLORIC ACID

DESCRIPTION	FIELD TEST
None	No visible reaction
Weak	Some reaction, with bubbles forming slowly
Strong	Violent reaction, with bubbles forming immediately

INFILLING TYPE

NAME	ABBR	NAME	ABBR
Albite	Al	Muscovite	Mus
Apatite	Ap	None	No
Biotite	Bi	Pyrite	Py
Clay	Cl	Quartz	Qz
Calcite	Ca	Sand	Sd
Chlorite	Ch	Sericite	Ser
Epidote	Ep	Silt	Si
Iron Oxide	Fe	Talc	Ta
Manganese	Mn	Unknown	Uk

RELATIVE HARDNESS / STRENGTH DESCRIPTIONS

GRADE		UCS (Mpa)	FIELD TEST
R0	Extremely Weak	0.25 – 1.0	Indented by thumbnail
R1	Very Weak	1.0 – 5.0	Crumbles under firm blows of geological hammer, can be peeled by a pocket knife.
R2	Weak	5.0 – 25	Can be peeled by a pocket knife with difficulty, shallow indentations made by firm blow with point of geological hammer.
R3	Medium Strong	25 – 50	Cannot be scraped or peeled with a pocket knife, specimen can be fractured with a single firm blow of a geological hammer.
R4	Strong	50 – 100	Specimen requires more than one blow of geological hammer to fracture it.
R5	Very Strong	100 – 250	Specimen requires many blows of geological hammer to fracture it.
R6	Extremely Strong	> 250	Specimen can only be chipped with a geological hammer.

ROCK QUALITY DESIGNATION (RQD)

DESCRIPTION	RQD (%)
Very Poor	0 – 25
Poor	25 – 50
Fair	50 – 75
Good	75 – 90
Excellent	90 – 100

RQD = Rough measure of the degree of jointing or fracture in a rock mass, measured as a percentage of the drill core in lengths of 10 cm. or more.

DENSITY/SPACING OF DISCONTINUITIES

DESCRIPTION	SPACING CRITERIA
Unfractured	>6 ft. (>1.83 meters)
Slightly Fractured	2 – 6 ft. (0.061 – 1.83 meters)
Moderately Fractured	8 in – 2 ft. (203.20 – 609.60 mm)
Highly Fractured	2 – 8 in (50.80 – 203.30 mm)
Intensely Fractured	<2 in (<50.80 mm)

BEDDING CHARACTERISTICS

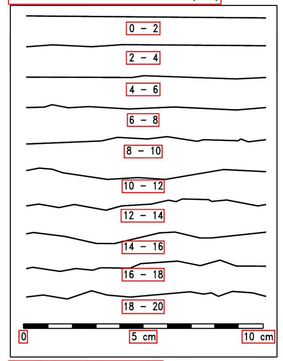
DESCRIPTION	Thickness (in (mm))
Very Thick Bedded	>36 (>915)
Thick Bedded	12 – 36 (305 – 915)
Moderately Bedded	4 – 12 (102 – 305)
Thin Bedded	1 – 4 (25 – 102)
Very Thin Bedded	0.4 – 1 (10 – 25)
Laminated	0.1 – 0.4 (2.5 – 10)
Thinly Laminated	<0.1 (<2.5)

Bedding Planes	Planes dividing the individual layers, beds, or stratigraphy of rocks.
Joint	Fracture in rock, generally more or less vertical to bedding.
Seam	Applies to bedding plane with unspecified degree of weather.

APERTURE

DESCRIPTION	CRITERIA (in (mm))
Tight	<0.04 (<1)
Open	0.04 – 0.20 (1 – 5)
Wide	>0.20 (>5)

JOINT ROUGHNESS COEFFICIENT (JRC)



From Barton and Choubey, 1977

ADDITIONAL TEXTURAL ADJECTIVES

DESCRIPTION	RECOGNITION
Pit (Pitted)	Pinhole to 0.03 ft. (3/8 in.) (>1 to 10 mm.) openings
Vug (Vuggy)	Small openings (usually lined with crystals) ranging in diameter from 0.03 ft. (3/8 in.) to 0.33 ft. (4 in.) (10 to 100 mm.)
Cavity	An opening larger than 0.33 ft. (4 in.) (100 mm.); size descriptions are required, and adjectives such as small, large, etc., may be used
Honeycombed	If numerous enough that only thin walls separate individual pits or vugs, this term further describes the preceding nomenclature to indicate cell-like form.
Vesicle (Vesicular)	Small openings in volcanic rocks of variable shape and size formed by entrapped gas bubbles during solidification.

ADDITIONAL TEXTURAL ADJECTIVES

DESCRIPTION	CRITERIA
Unweathered	No evidence of chemical / mechanical alternation; rings with hammer blow.
Slightly Weathered	Slight discoloration on surface; slight alteration along discontinuities; <10% rock volume altered.
Moderately Weathered	Discoloring evident; surface pitted and alteration penetration well below surface; Weathering "halos" evident; 10–50% rock altered.
Highly Weathered	Entire mass discolored; Alteration pervading most rock, some slight weathering pockets; some minerals may be leached out.
Decomposed	Rock reduced to soil with relic rock texture/structure; Generally molded and crumbled by hand.

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REVISIONS

REV	DESCRIPTION	DSN / DWN	CHK / APP	DATE
1	REVISED PER SEPTA COMMENTS	SMM / KWS	JMB / JMB	7/15/2021
2	REVISED PER SEPTA COMMENTS	SMM / SMM	JMB / JMB	8/6/2021

CERTIFIED CORRECT PLANS
Darrell R. Ruffner
Professional Engineer
Approved by Bureau of Technical Utility Services
PA PUBLIC UTILITY COMMISSION
ATTEST Rosemary Chiavetta
Secretary

SCALE VERIFICATION
THIS BAR IS 1 INCH IN LENGTH ON ORIGINAL DRAWING
0 1"
IF IT'S NOT 1 INCH ON THIS SHEET ADJUST YOUR SCALES ACCORDINGLY

ORIGINAL DRAWING SIZE IS 22 x 34

ISSUED FOR REVIEW

UPPER DARBY B6
WO#16028420
UPPER DARBY, PENNSYLVANIA

PECO
An Exelon Company
PECO
25 FRONT STREET
CONSHOHOCKEN, PA 19428

BORING LOG KEY

PROJECT NO.	20211296.004A
ISSUE DATE	8/6/2021
CURRENT REVISION	2
DESIGNED BY	SMM
DRAWN BY	SMM
CHECKED BY	DJD
APPROVED BY	ESB
SHEET	7 of 9

7

PLOTTED: 8/6/2021 11:35 AM BY: shayne.madsen
CAD FILE: \\kleinfelder.com\shares\EXTON\DATA\GROUP\SP\Company Projects\2021\1296.004A PECO 2021\4GMP Trenchless Crossings\004A Upper Darby B6\Civil\Drawings\Upper Darby_Plan Sheets.dwg LAYOUT: BORING LOG KEY

Date Begin - End: 8/31/2020 **Drilling Company:** Boring Brothers, Inc.

Logged By: A. Oaks **Drill Crew:** S. Headley

Hor.-Vert. Datum: WGS 1984 - NAVD88 **Drilling Equipment:** CME-55 Track Rig **Hammer Type - Drop:** 140 lb. Auto - 30 in.

Plunge: -90 degrees **Drilling Method:** Mud Rotary

Weather: 85°F Clear **Exploration Diameter:** 3.75 in. O.D.

BORING LOG UD-1

FIELD EXPLORATION

Latitude: 39.94303° N
Longitude: -75.29604° E
Approximate Ground Surface Elevation (ft.): 204.00
Surface Condition: Asphalt

Approximate Elevation (feet)	Depth (feet)	Graphical Log	Lithologic Description	Sample Number	Sample Type	Blow Counts(BC)= Uncorr Blows/6 in. Pocket Pen(PP)= tsf RQD=%	Recovery (NR=No Recovery)	USCS Symbol	Water Content (%)	Dry Unit Wt. (pcf)	Passing #4 (%)	Passing #200 (%)	Liquid Limit	Plasticity Index (NP=NonPlastic)	Additional Tests/ Remarks
			~12 inches ASPHALT												
			Residual: **Silty SAND (SM)**: medium plasticity, light brown, moist, loose	S-1		BC=5 5	3"								
				S-2		BC=7 6 4 4	12"	SM	17.6		86	38	NP	NP	
200	5		**Lean CLAY (CL)**: medium plasticity, light greenish gray, moist, stiff, trace sand	S-3		BC=2 2 2 4 PP=3	12"								
				S-4		BC=6 5 5 7 PP=3	18"	CL	22.0		100	99	29	10	
195				S-5		BC=7 9 10 11 PP=3	12"								
	10		**Clayey SAND (SC)**: brown, moist, medium dense	S-6		BC=11 9 7 8	12"								
190															
	15		**Silty SAND with Gravel (SM)**: brown, moist, dense	S-7		BC=14 16 16 17	10"	SM	16.3		65	19	NP	NP	
185															
	20		**Weathered Bedrock Sampled as:** **Poorly graded SAND (SP)**: brown, moist, very dense, trace gravel	S-8		BC=50/5"	5"								
180															

KLEINFELDER Bright People. Right Solutions.	PROJECT NO.: 20211296.004A DRAWN BY: AO CHECKED BY: CZH DATE: 9/27/2020	BORING LOG UD-1 AGIMP 2021 Project Upper Darby B6 Burmont Road, Upper Darby, PA	BORING UD-1 PAGE: 1 of 2

Date Begin - End: 8/31/2020 **Drilling Company:** Boring Brothers, Inc.

Logged By: A. Oaks **Drill Crew:** S. Headley

Hor.-Vert. Datum: WGS 1984 - NAVD88 **Drilling Equipment:** CME-55 Track Rig **Hammer Type - Drop:** 140 lb. Auto - 30 in.

Plunge: -90 degrees **Drilling Method:** Mud Rotary

Weather: 85°F Clear **Exploration Diameter:** 3.75 in. O.D.

BORING LOG UD-1

FIELD EXPLORATION

Latitude: 39.94303° N
Longitude: -75.29604° E
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Approximate Elevation (feet)	Depth (feet)	Graphical Log	Lithologic Description	Sample Number	Sample Type	Blow Counts(BC)= Uncorr Blows/6 in. Pocket Pen(PP)= tsf RQD=%	Recovery (NR=No Recovery)	USCS Symbol	Water Content (%)	Dry Unit Wt. (pcf)	Passing #4 (%)	Passing #200 (%)	Liquid Limit	Plasticity Index (NP=NonPlastic)	Additional Tests/ Remarks
			Weathered Bedrock Sampled as: **Poorly graded SAND (SP)**: brown, moist, very dense, trace gravel	S-9		BC=38 50 50/5"	17"								
175	30			S-10		BC=36 14 36 50/5"	12"								Loss of some fluid return from 30 to 35 ft.
170	35			S-11		BC=36 30 34 12	18"								
165				S-12		BC=50/3"	3"								
160	40		The boring was terminated at approximately 39.3 ft. below ground surface. The boring was backfilled with bentonite chips and patched at surface on August 31, 2020.												
155	45														

GROUNDWATER LEVEL INFORMATION:
Groundwater was not observed prior to the introduction of drilling fluids.

GENERAL NOTES:
Elevation estimated from survey data provided by Dennis W. Sklar, Inc collected on September 14, 2020.
The exploration was located with an accuracy of 5 meters.

CERTIFIED CORRECT PLANS
Daniel B. Hallock
Professional Engineer
Approved by Bureau of Technical Utility Services
PA PUBLIC UTILITY COMMISSION
ATTEST Rosemary Chiavetta
Secretary

KLEINFELDER Bright People. Right Solutions.	PROJECT NO.: 20211296.004A DRAWN BY: AO CHECKED BY: CZH DATE: 9/27/2020	BORING LOG UD-1 AGIMP 2021 Project Upper Darby B6 Burmont Road, Upper Darby, PA	BORING UD-1 PAGE: 2 of 2

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1	REVISED PER SEPTA COMMENTS	SMM / KWS	JMB / JMB	7/15/2021
2	REVISED PER SEPTA COMMENTS	SMM / SMM	JMB / JMB	8/6/2021

SCALE VERIFICATION

THIS BAR IS 1 INCH IN LENGTH ON ORIGINAL DRAWING

0 1"

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ORIGINAL DRAWING SIZE IS 22 x 34

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UPPER DARBY, PENNSYLVANIA

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BORING LOGS

PROJECT NO.	20211296.004A
ISSUE DATE	8/6/2021
CURRENT REVISION	2
DESIGNED BY	SMM
DRAWN BY	SMM
CHECKED BY	DJD
APPROVED BY	ESB

8

SHEET 8 of 9

Date Begin - End: 9/01/2020 **Drilling Company:** Boring Brothers, Inc. **BORING LOG UD-2**

Logged By: A. Oaks **Drill Crew:** S. Headley

Hor.-Vert. Datum: WGS 1984 - NAVD88 **Drilling Equipment:** CME-55 Track Rig **Hammer Type - Drop:** 140 lb. Auto - 30 in.

Plunge: -90 degrees **Drilling Method:** Mud Rotary

Weather: 75°F Partly Cloudy **Exploration Diameter:** 3.75 in. O.D.

Latitude: 39.94338° N
Longitude: -75.29632° E
Approximate Ground Surface Elevation (ft.): 204.00
Surface Condition: Asphalt

Approx. Elevation (feet)	Depth (feet)	Graphical Log	Lithologic Description	Sample Number	Sample Type	Blow Counts(BC)= Uncorr Blows/6 in. / Pocket Pen(PP)= tsf / RQD=%	Recovery (NR=No Recovery)	USCS Symbol	Water Content (%)	Dry Unit Wt. (pcf)	Passing #4 (%)	Passing #200 (%)	Liquid Limit	Plasticity Index (NP=NonPlastic)	Additional Tests/ Remarks
			~12 inches ASPHALT												
			Residual: **Silty CLAY with Sand (CL-ML)**: low to medium plasticity, light brown, moist, stiff	S-1		BC=6 6	3"								
				S-2		BC=3 2 2 2 PP=2	10"	CL-ML	18.4		95	59	25	5	
200	5			S-3		BC=2 2 2 2 PP=1.5	12"								
			SILT (ML): medium to high plasticity, light brown, moist, medium stiff	S-4		BC=4 4 5 8 PP=2.5	12"	ML	21.4		96	76	29	5	
195	10		**Silty SAND (SC)**: brown, moist, medium dense	S-5		BC=27 12 9 4	6"								
			dense	S-6		BC=8 25 17 10	18"	SM	19.5		91	40	NP	NP	
190	15		yellowish brown, medium dense	S-7		BC=16 8 13 10	15"								
185	20		**Weathered Bedrock Sampled as:** **Silty SAND (SM)**: yellowish brown, moist, very dense	S-8		BC=50/1"	NR			177.9					Drill bit grinding and rattling from 20 to 21 ft. **Unc. Comp. Str.-Rock=** q_u: 7130 psi Start rock coring at 21 ft. ~3 min/ft
			WISSAHICKON FORMATION **GNEISS**: highly weathered, R3 TO R4, intensely fractured, vertical to sub vertical fractures, jrc: 8-10	R-1		RQD=10	100%								
180															

PLOTTED: 09/27/2020 11:22 PM BY: CHamrick
OFFICE FILTER: EXTON
PROJECT NUMBER: 20211296.004A
gINT TEMPLATE: E:\KLF_STANDARD_GINT_LIBRARY_2021.GLB [__KLF_BORING/TEST PIT SOIL LOG]
gINT FILE: Klf_gint_master_2021

Date Begin - End: 9/01/2020 **Drilling Company:** Boring Brothers, Inc. **BORING LOG UD-2**

Logged By: A. Oaks **Drill Crew:** S. Headley

Hor.-Vert. Datum: WGS 1984 - NAVD88 **Drilling Equipment:** CME-55 Track Rig **Hammer Type - Drop:** 140 lb. Auto - 30 in.

Plunge: -90 degrees **Drilling Method:** Mud Rotary

Weather: 75°F Partly Cloudy **Exploration Diameter:** 3.75 in. O.D.

Latitude: 39.94338° N
Longitude: -75.29632° E
Approximate Ground Surface Elevation (ft.): 204.00
Surface Condition: Asphalt

Approx. Elevation (feet)	Depth (feet)	Graphical Log	Lithologic Description	Sample Number	Sample Type	Blow Counts(BC)= Uncorr Blows/6 in. / Pocket Pen(PP)= tsf / RQD=%	Recovery (NR=No Recovery)	USCS Symbol	Water Content (%)	Dry Unit Wt. (pcf)	Passing #4 (%)	Passing #200 (%)	Liquid Limit	Plasticity Index (NP=NonPlastic)	Additional Tests/ Remarks
175	30		**WISSAHICKON FORMATION** **GNEISS**: highly weathered, R3 TO R4, intensely fractured, vertical to sub vertical fractures, jrc: 8-10 Moderately weathered, moderately fractured	R-2		RQD=63	100%			169.4					~2 min/ft Minor fluid loss consistently from 25 to 40 ft. **Unc. Comp. Str.-Rock=** q_u: 4800 psi
				R-3		RQD=67	100%								
170	35			R-4		RQD=68	100%			178.5					**Unc. Comp. Str.-Rock=** q_u: 14020 psi
165	40														
160	45														
155															

The boring was terminated at approximately 40 ft. below ground surface. The boring was backfilled with bentonite chips and patched at surface on September 01, 2020. Rock was encountered at a depth of 20 ft. during this exploration. Coring started at a depth of 21 ft.

GROUNDWATER LEVEL INFORMATION:
Groundwater was not observed prior to the introduction of drilling fluids.
GENERAL NOTES:
Elevation estimated from survey data provided by Dennis W. Sklar, Inc collected on September 14, 2020.
The exploration was located with an accuracy of 5 meters.

CERTIFIED CORRECT PLANS
Daniel R. Hallinan
Professional Engineer
Approved by Bureau of Technical Utility Services
PA PUBLIC UTILITY COMMISSION
ATTEST Rosemary Chiavetta
Secretary

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SHEET 9 of 9