

January 29, 2021
 Revised February 18, 2021
PG Sealed April 20, 2021

Mr. Robert Burke
 Energy Transfer
 1300 Main Street
 Houston, TX 77002

RE: Geotechnical Follow-Up to Geophysical Survey
 Sunoco Pipeline, LP Pipeline Project
 Horizontal Directional Drill S3-0360 Biddle Drive
 Uwchlan Township, Chester County, Pennsylvania
 RETTEW Project No. 096303002

Dear Rob:

As described in our December 9, 2020 report, RETTEW Associates, Inc. completed a multi-technique geophysical survey at the S3-0360 Biddle Drive horizontal directional drill (HDD) site (see **Figure 1**). The purpose of the survey was to detect and delineate fractures, soft zones, or subsurface voids that could potentially contribute to possible earth features at the site or could act as preferred pathways for water flow prior to the proposed 20-inch HDD Drill. A coincident survey was completed on the east or downstream end of the HDD in January of 2020 following drilling of the 16-inch HDD. The results of this survey were presented in a report dated February 27, 2020.

Based on the December 9, 2020 report results, RETTEW recommended follow-up geotechnical borings. The figures from the December 9, 2020 report have been revised to show the locations of the follow-up borings, and all previous borings that fall within the geophysical survey areas (see **Figures 2, 7A, 7B**). In addition, a schematic log for each boring that falls within the survey limits has been projected onto the closest seismic or electrical profile (see **Figures 4A, 4B, 5A, 5B, 6**). The borings completed at the site to date are listed below:


Label	Reported By	Date Drilled	Lon	Lat	East	North	Station
			WGS-84		PA SPG feet		feet (approx.)
S3_0360_AP_A1	PSI	1/4/2021	-75.636860	40.039880	2560114	264464	1507850
S3_0360_AP_B1	PSI	1/5/2021	-75.636500	40.039560	2560217	264349	1508004
360A	PSI	6/10/2020	-75.636210	40.039069	2560303	264173	1508182
360B	PSI	6/10/2020	-75.636020	40.039127	2560356	264195	1508211
B6-9E	Terracon	10/13/2017	-75.643658	40.044422	2558171	266072	1505325
B6-4W	Terracon	10/13/2017	-75.636034	40.038964	2560353	264136	1508247
OW-1	Tetra Tech	6/21/2017	-75.636502	40.038798	2560224	264072	1508194
S3-0350_SB-04	Tetra Tech	1/22/2016	-75.643761	40.044528	2558142	266110	1505277
S3-0360_SB-01	Tetra Tech	6/17/2015	-75.640288	40.042278	2559133	265314	1506552
S3-0360_SB-03	Tetra Tech	6/14/2015	-75.635947	40.038873	2560378	264103	1508288
S3-0360_SB-02	Tetra Tech	6/13/2015	-75.637599	40.040638	2559900	264735	1507513


The recent borings generally encountered material that became more competent with depth – e.g. increasing Standard Penetration Test (SPT) N values – with no evidence of voids or soft zones working their way up from the HDD. Boring S3_0360_AP_A1 encountered material with low N (<10) in the top 12 feet, providing a satisfactory explanation for the gravity anomaly for which it was located to proof. Boring S3_0360_AP_B1 encountered saprolite at a depth of 6 feet, and highly-weathered phyllite bedrock at 10 feet. This boring was shifted from the originally-intended location to avoid an elevated sand mound septic system. That mound may be the source of the gravity anomaly in both the December (Fall) 2020 and February (Spring) 2020 data (see **Figures 7A and 7B**, respectively).

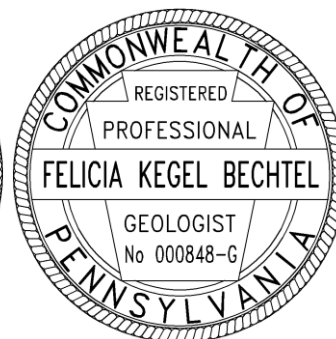
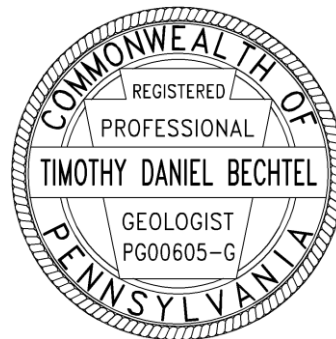
On **Figure 4B**, for Boring S3_0360_AP_A1, the 5,000 feet per second (fps) P-wave velocity contour matches closely with the top of rock. The top of rock in Boring S3_0360_AP_B1 is significantly above the 5,000 fps contour, suggesting that the boring may have encountered a float block or erosional remnant in the overburden. A similar float block was drilled-through in previous Boring B6-4W.

On **Figure 6**, the residuum-saprolite contact in Boring S3_0360_AP_A1 matches closely with a sharp increase in resistivity (near the 1,000 Ohm-meter contour). Since resistivity is typically dominated by moisture content, this may be the result of the saprolite being more compacted (less porous).

In summary, the borings are consistent with the geophysics, and detected no features requiring further investigation or mitigation.

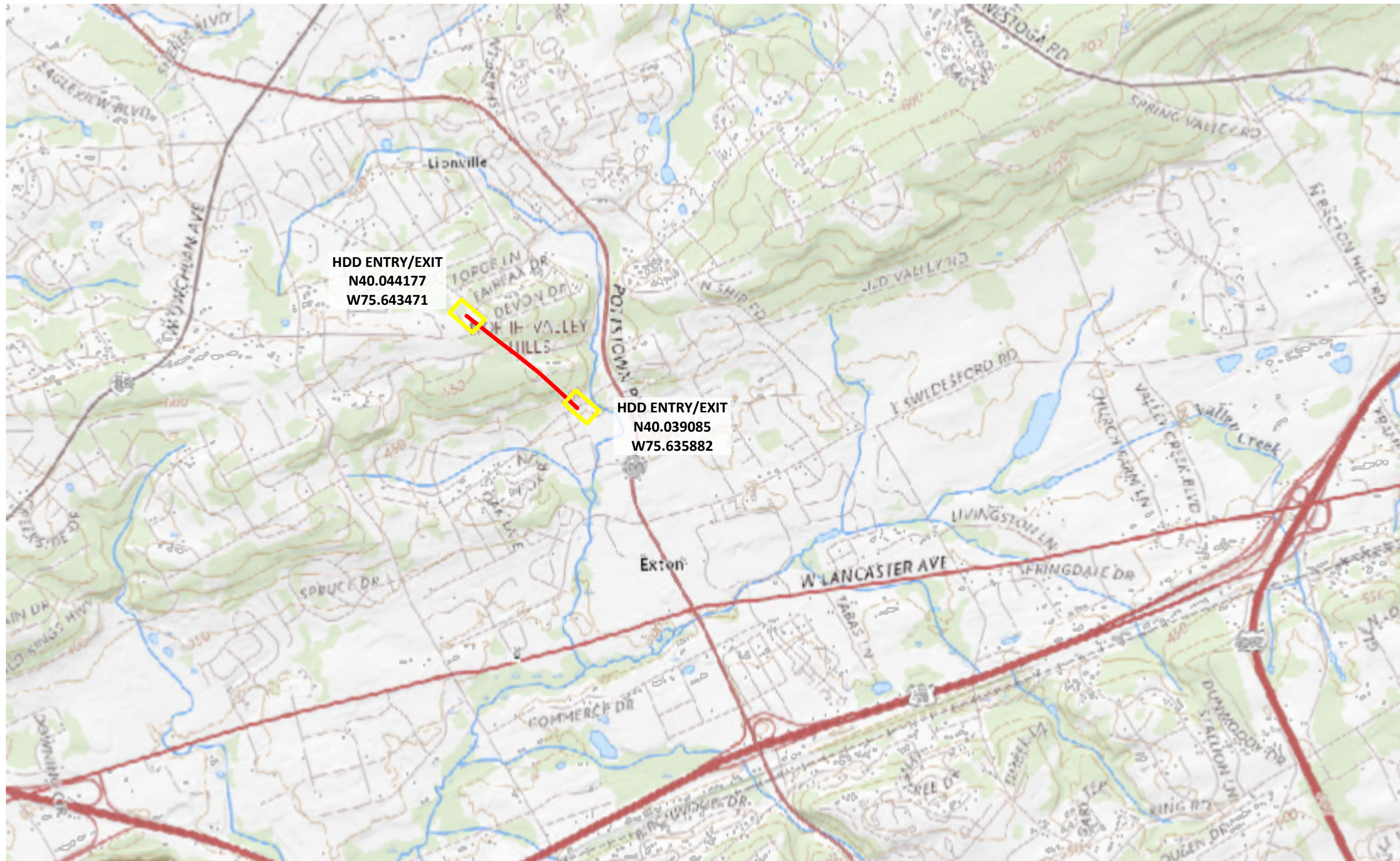

Timothy D. Bechtel, PhD, PG
Senior Project Manager


Felicia Kegel Bechtel, MSc, PG
Director of Geophysics






Enclosures

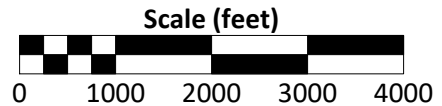
- Figure 1: Topographic Basemap – Fall 2020
- Figure 2: Data Coverage Map and Geologic Setting – Fall 2020
- Figure 3A: Residual Microgravity Results – Upstream (West) End – Fall 2020
- Figure 3B: Residual Microgravity Results – Downstream (East) End – Fall 2020
- Figure 4A: Seismic Refraction Profiles – Upstream (West) End – Fall 2020
- Figure 4B: Seismic Refraction Profiles – Downstream (East) End – Fall 2020
- Figure 5A: Seismic MASW Survey Profiles – Upstream (West) End – Fall 2020
- Figure 5B: Seismic MASW Survey Profiles – Downstream (East) End – Fall 2020
- Figure 6: Electrical Resistivity Survey Profiles – Fall 2020
- Figure 7A: Geophysical Survey Results Summary – December (Fall) 2020
- Figure 7B: Geophysical Survey Results Summary – February (Spring) 2020



Notes:
Basemap from NETR, USGS 2016 map.

Legend

-  Geophysical Survey Area
-  HDD Entry/Exit Point
-  HDD 16" HDD

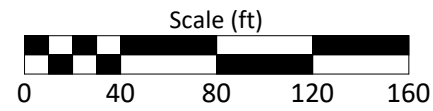
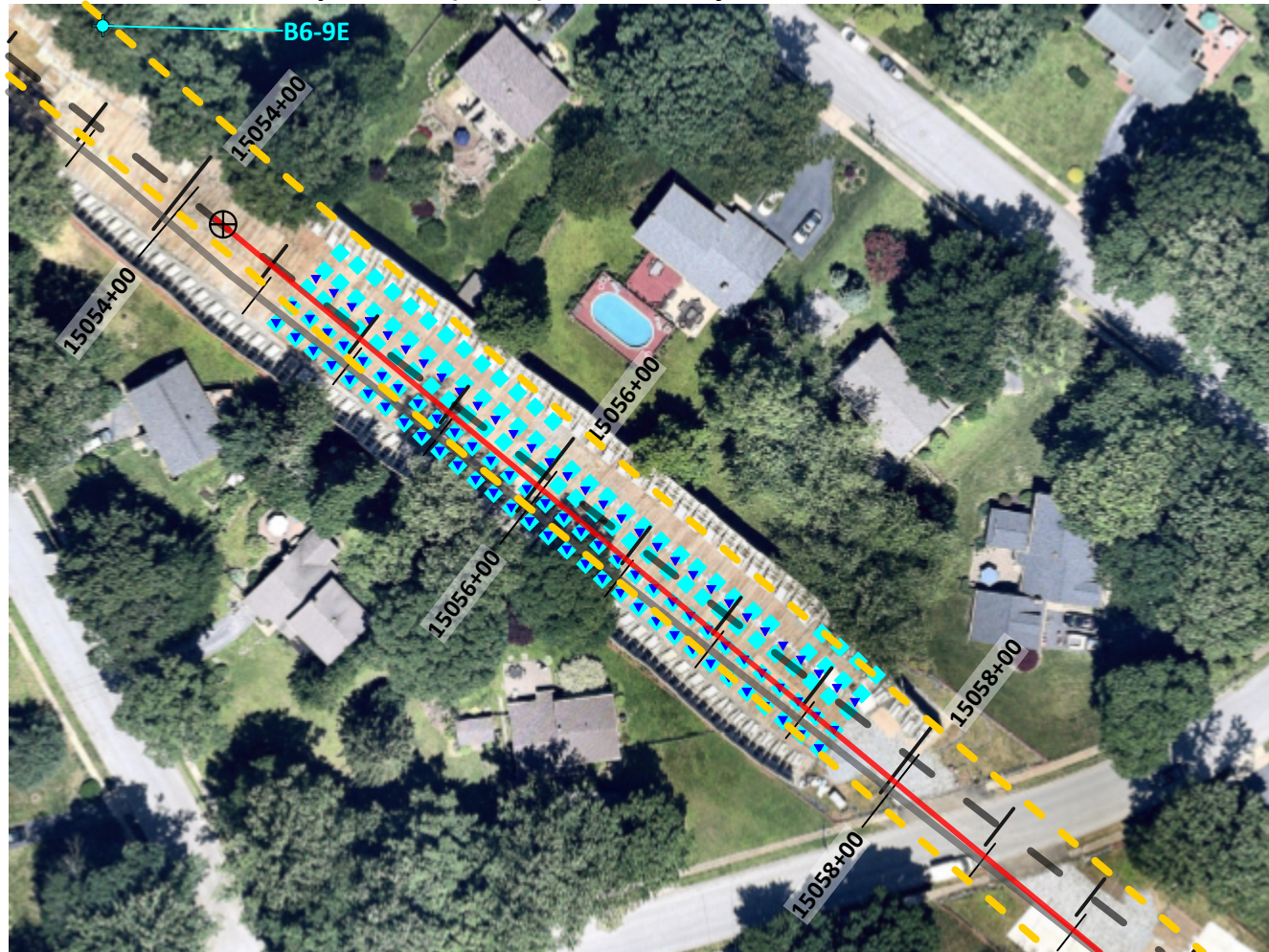


SURVEY DATE: 11/17/2020 (W), 10/19/2020 (E)
 RETTEW No.: 096303002
 REVIEWED BY: FKB
 DRAWN BY: CHR
 REVISION DATE: 02/18/2021
 SCALE: 1" = 2000'
 FIGURE NO. 1 of 7

RETTEWSM
 RETTEW Field Services, Inc.
 3020 Columbia Avenue, Lancaster, PA 17603
 Phone 1-800-738-8395

Figure 1:
Topographic Basemap
 Biddle Drive - Fall 2020
 S3-0360
 CHESTER COUNTY, PA
 UWCHLAN TOWNSHIP

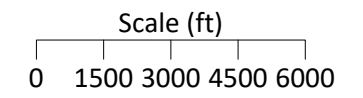
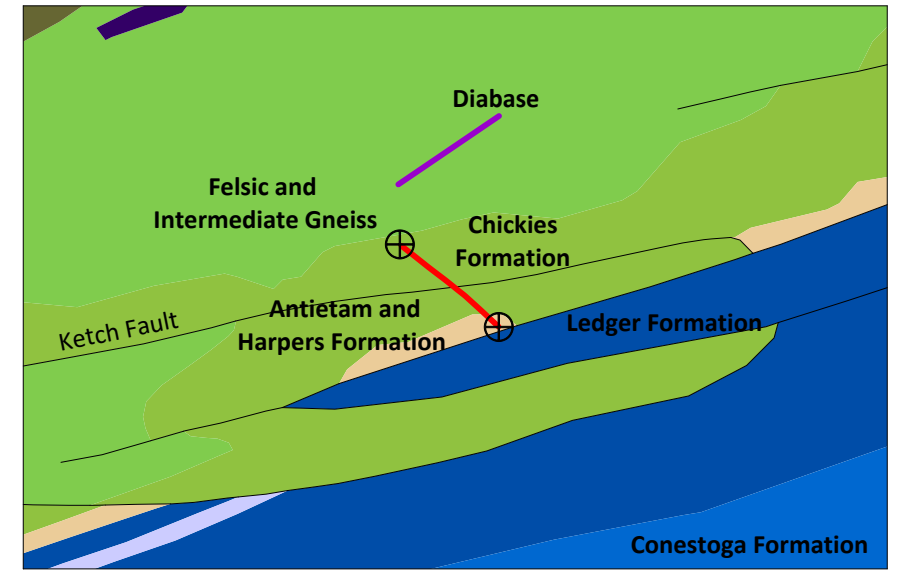
Upstream (West) End, Survey Date 11/17/2020



Geophysical Survey Legend

- Electrical Resistivity Station
- ◆ Microgravity Station
- ▼ Seismic Geophone Location
- 16-inch HDD from As-Built
- 16-inch Proposed Pipeline
- 20-inch Proposed Pipeline
- - - Existing Gas Pipelines
- ⊕ HDD Entry/Exit Point
- ◆ Geotechnical Boring

Notes:
 Basemap from Nearmap, February 2020.
 Survey profiles/stations from RTK survey by RETTEW.
 Geologic information from DCNR WMS Server, extracted 12/2019.



Downstream (East) End, Survey Date 10/19/2020

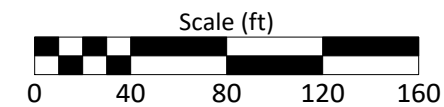
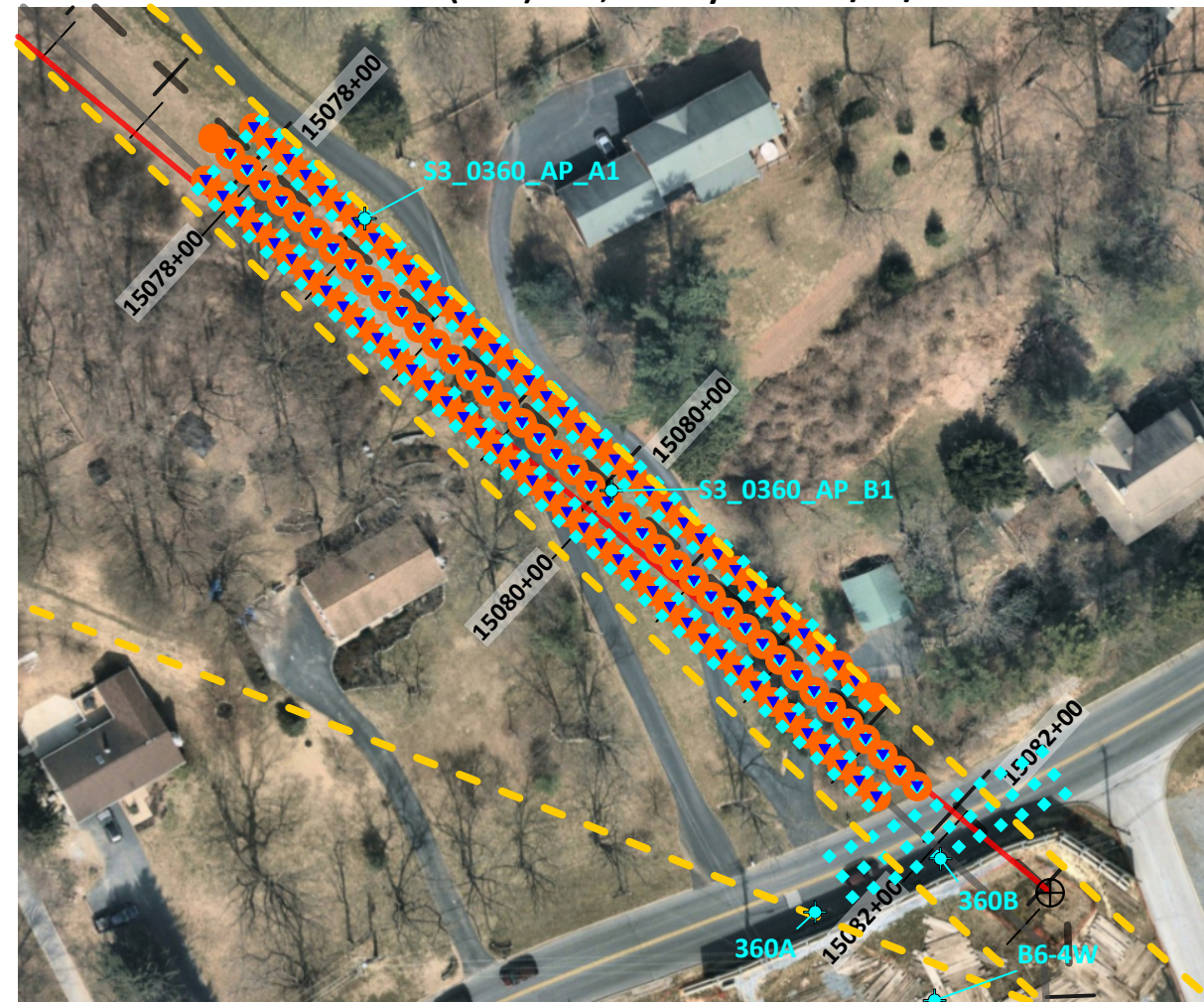
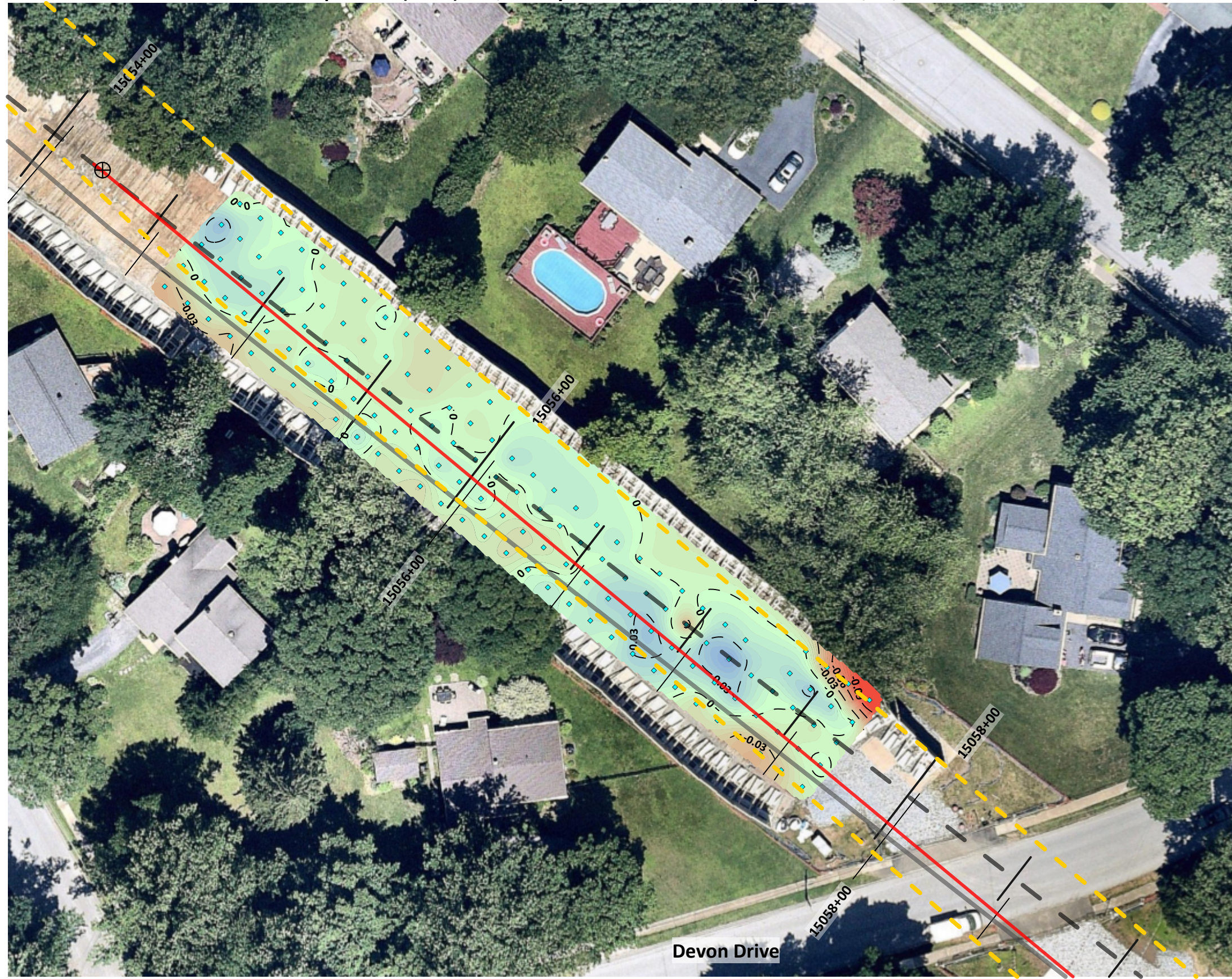


Figure 2: Data Coverage and Geologic Setting

Biddle Drive - Fall 2020
 S3-0360

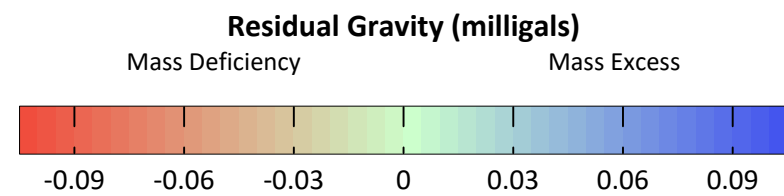
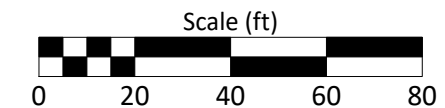
SURVEY DATE:	11/17/2020 (W), 10/19/20 (E)
RETTEW No.:	096303002
REVIEWED BY:	FKB
DRAWN BY:	CHR
REVISION DATE:	01/26/2021
SCALE:	Graphical
FIGURE NO.:	2 of 7

Upstream (West) End, Survey Date 11/17/2020, Report Date 12/09/2020



Geophysical Survey Legend

- Exit/Entry
- Microgravity Station
- 16-inch HDD from As-Built
- 16-inch Proposed Pipeline
- 20-inch Proposed Pipeline
- Existing Gas Pipelines



Notes:

Basemap from Nearmap, June 2019.

Data from Scintrex CG-5 microgravity meter with complete Bouguer correction.



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Phone 1-800-738-8395

Figure 3A: Upstream Residual Microgravity

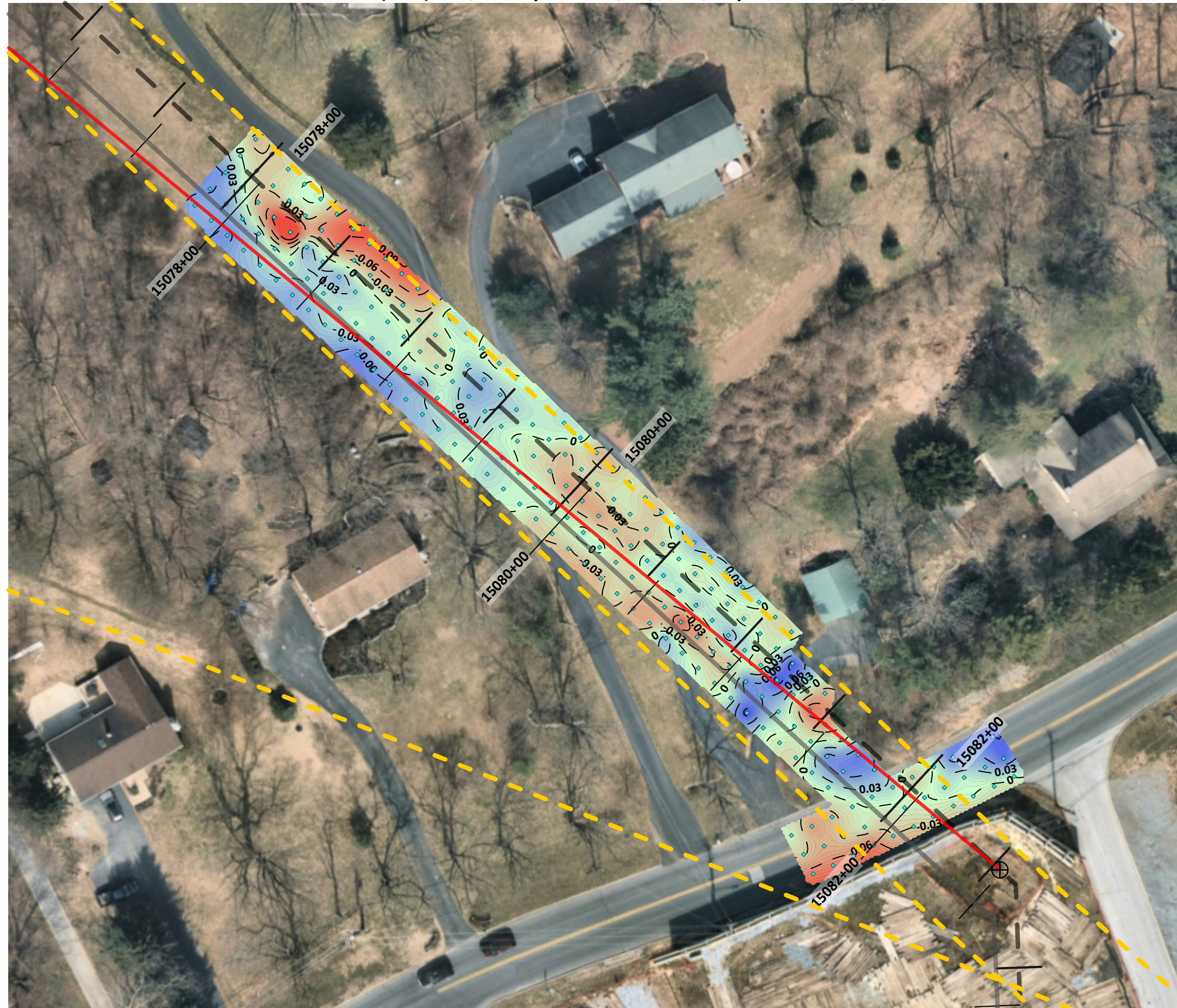
Biddle Drive - Fall 2020
S3-0360

CHESTER COUNTY, PA







LUWCLIAN TOWNSHIP

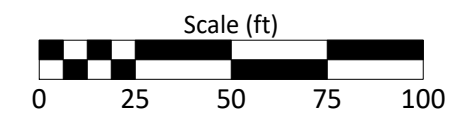
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REVIEWED BY:	FKB
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FIGURE NO.:	3A of 7

Downstream (East) End, Survey Date 10/19/2020, Report Date 12/09/2020



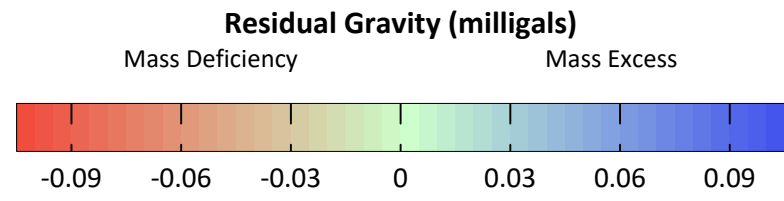
Geophysical Survey Legend

-  Exit/Entry
-  Microgravity Station
-  16-inch HDD from As-Built
-  16-inch Proposed Pipeline
-  20-inch Proposed Pipeline
-  Existing Gas Pipelines



Notes:

Basemap from Nearmap, December 2019.
 Data from Scintrex CG-5 microgravity meter with complete Bouguer correction.



SURVEY DATE:	11/17/2020 (W), 10/19/20 (E)
RETIEW No.:	096303002
REVIEWED BY:	FKB
DRAWN BY:	CHR
REVISION DATE:	01/27/2021
SCALE:	1" = 50'
FIGURE NO.:	3B of 7



Figure 3B: Downstream Residual Microgravity

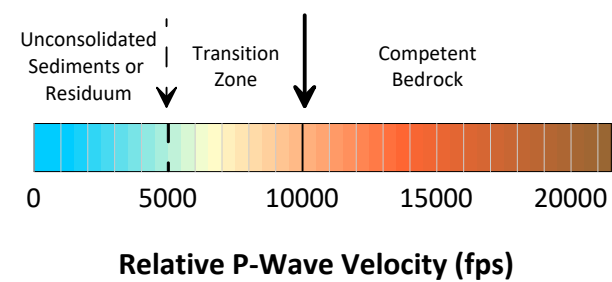
Biddle Drive - Fall 2020
 S3-0360

Geophysical Survey Legend

 Possible Fracture Zone

 16-inch HDD (from As-Built)

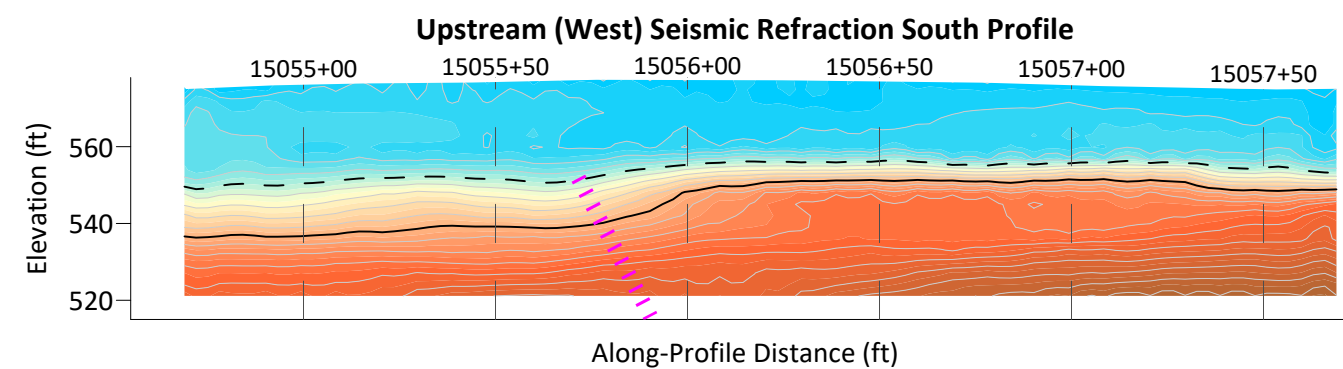
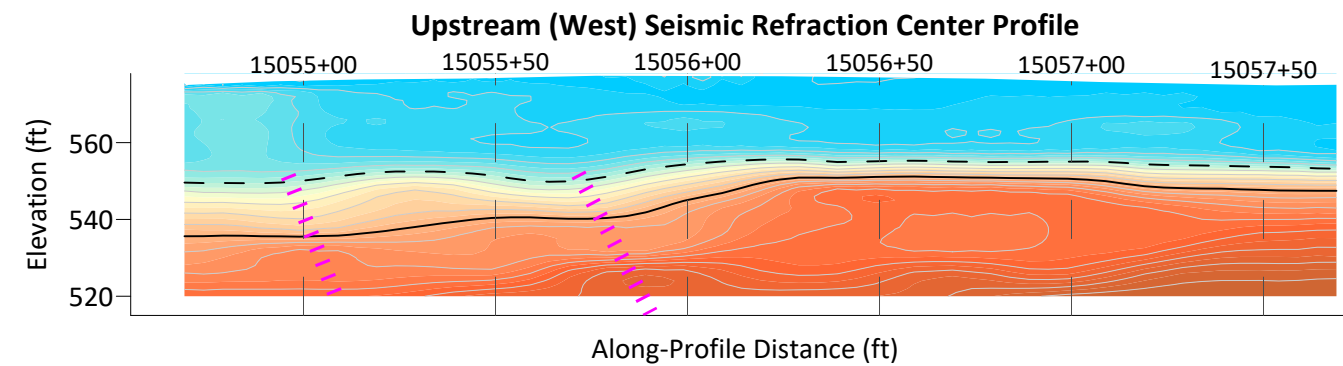
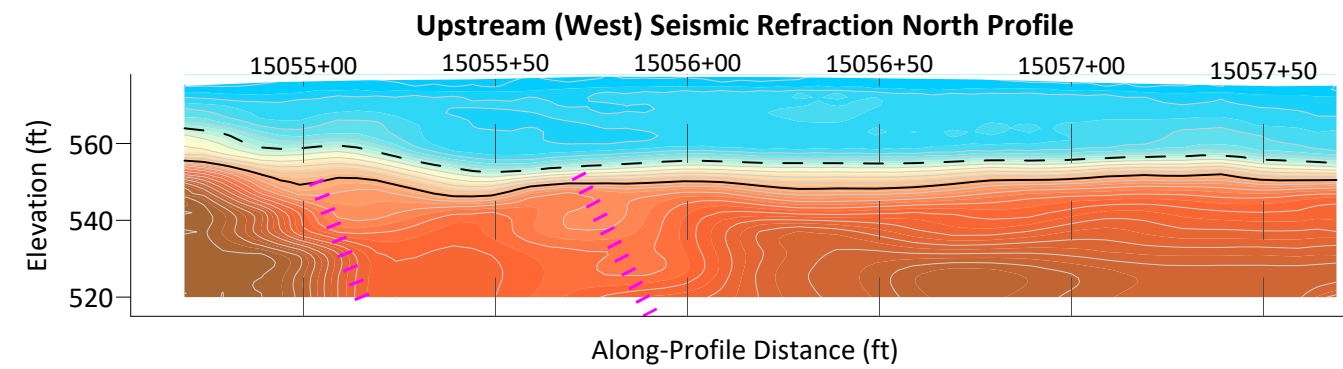
15338+00 Pipeline Station Number



Notes:

Seismic data from Geometrics 24-channel Geode with 4.0 Hz geophones.

Relative seismic velocity models from SeisImager (by Oyo Corporation) tomographic and ray-tracing inversions.

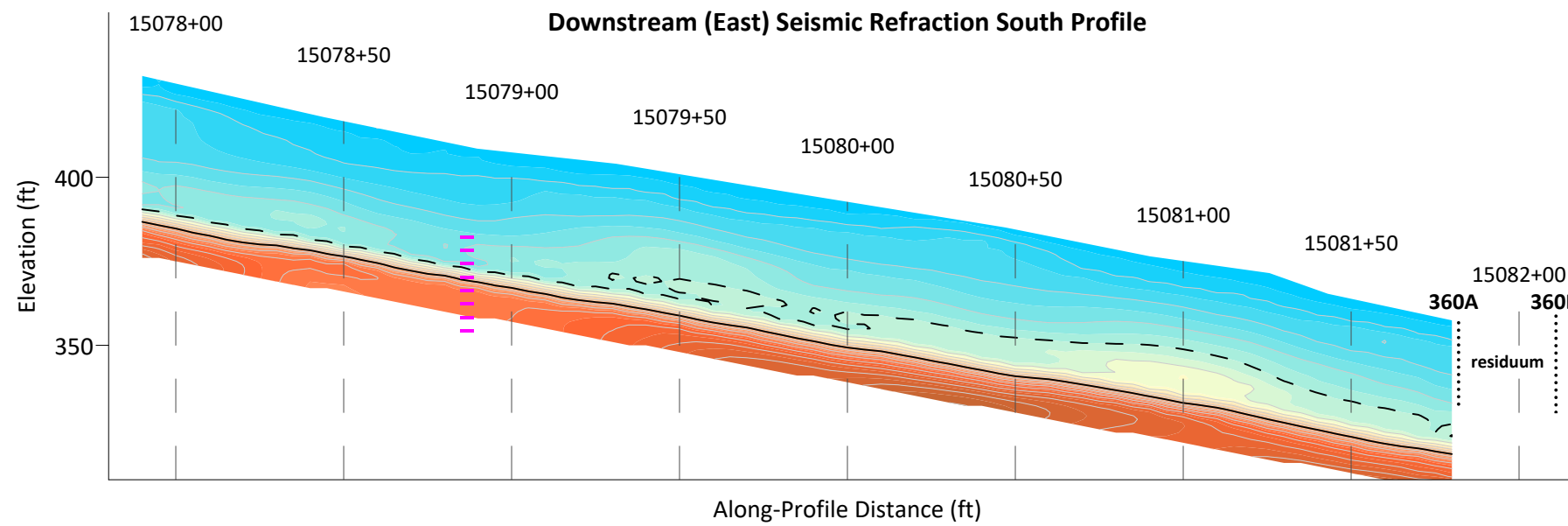
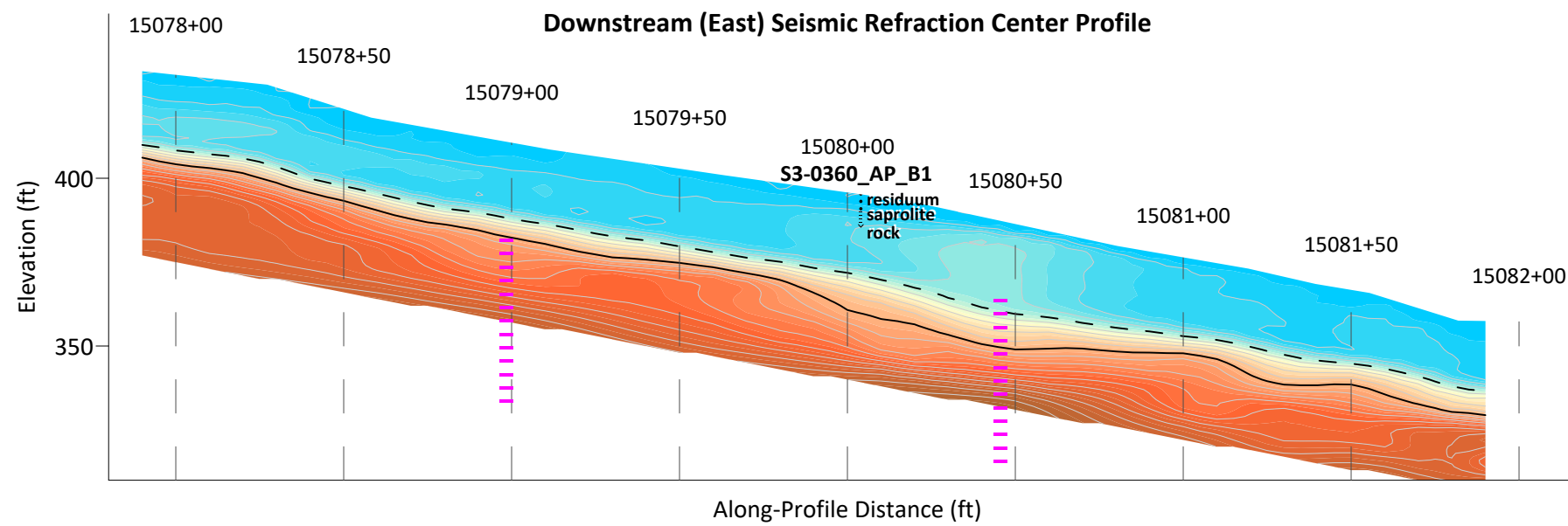
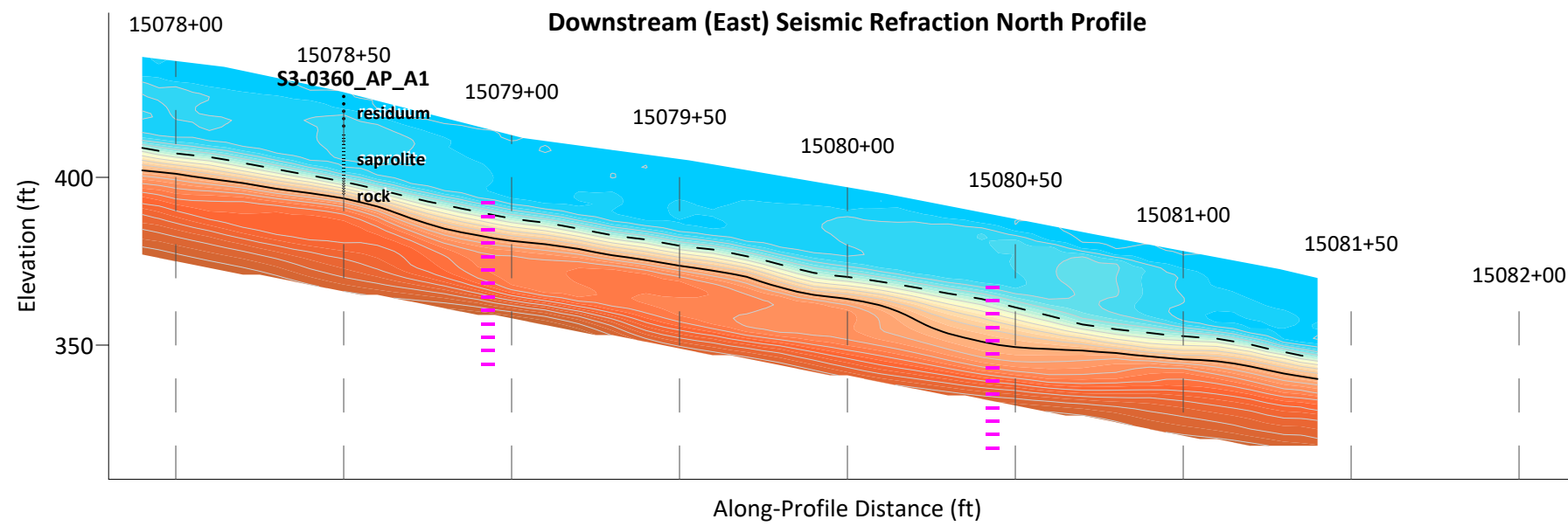


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RETTEW No.:	096303002
REVIEWED BY:	FKB
DRAWN BY:	CHR
REVISION DATE:	01/27/2021
SCALE:	1" = 60'
FIGURE NO.:	4A of 7



Figure 4A: Seismic Refraction Profiles

Biddle Drive - Fall 2020
S3-0360

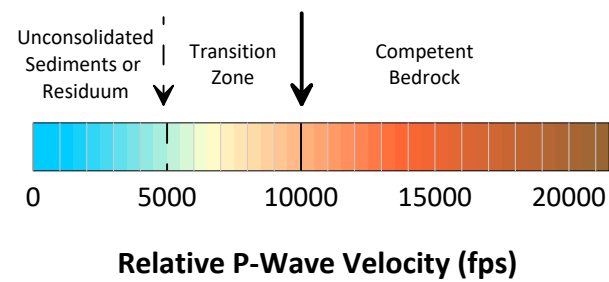


Geophysical Survey Legend

Possible Fracture Zone

16-inch HDD (from As-Built)

Pipeline Station Number



Notes:

Seismic data from Geometrics 24-channel Geode with 4.0 Hz geophones.

Relative seismic velocity models from SeisImager (by Oyo Corporation) tomographic and ray-tracing inversions.

SURVEY DATE:	11/17/2020 (W), 10/19/20 (E)
RETIEW No.:	096303002
REVIEWED BY:	FKB
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REVISION DATE:	01/27/2021
SCALE:	1" = 60'
FIGURE NO.:	4B of 7




Figure 4B: Seismic Refraction Profiles


Biddle Drive - Fall 2020
S3-0360


CHESTER COUNTY, PA

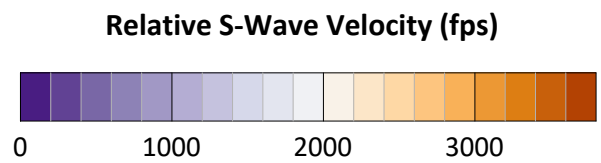
UWCHLAN TOWNSHIP

Geophysical Survey Legend

 Possible Fracture Zone

 16-inch HDD (from As-Built)

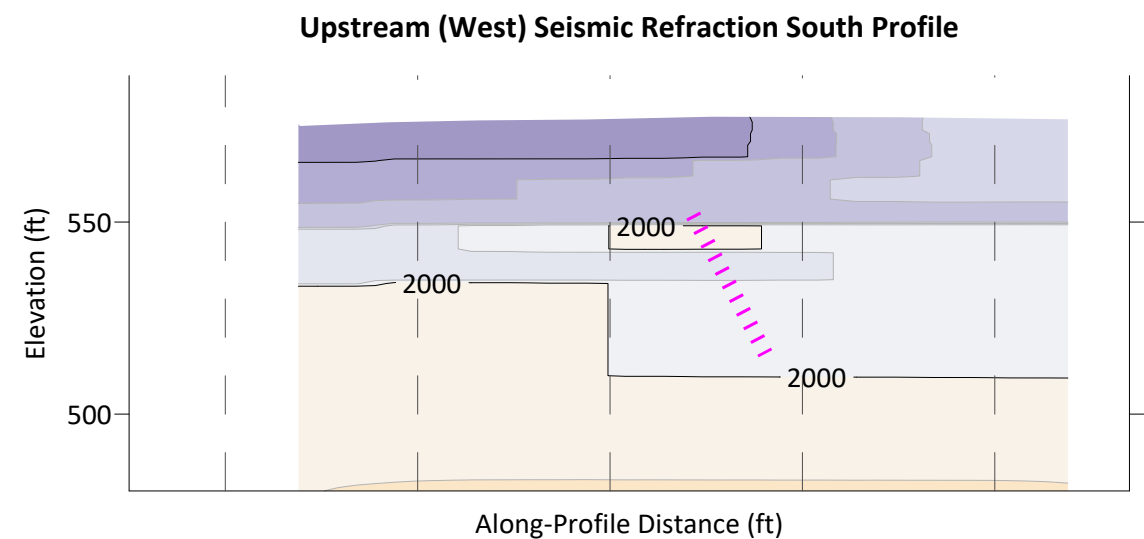
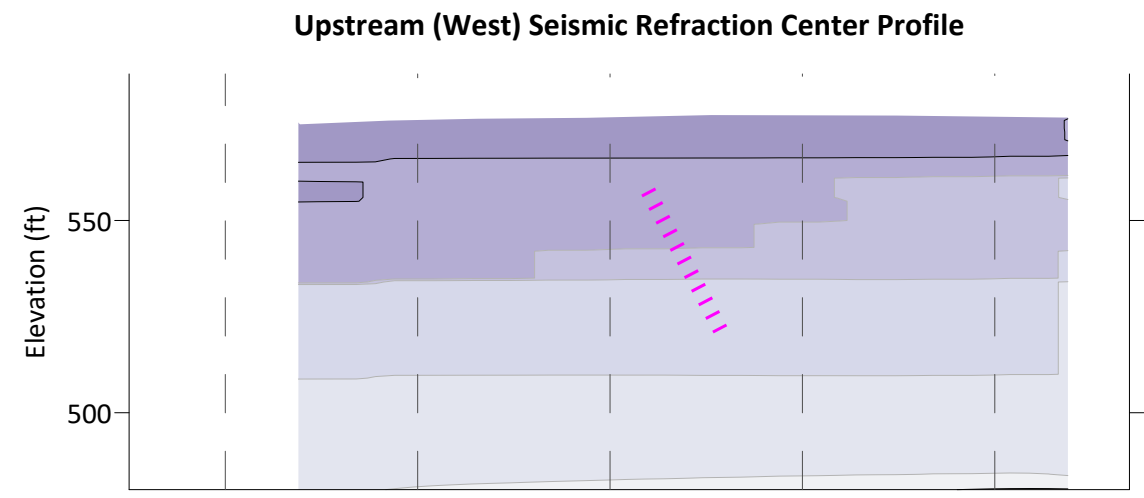
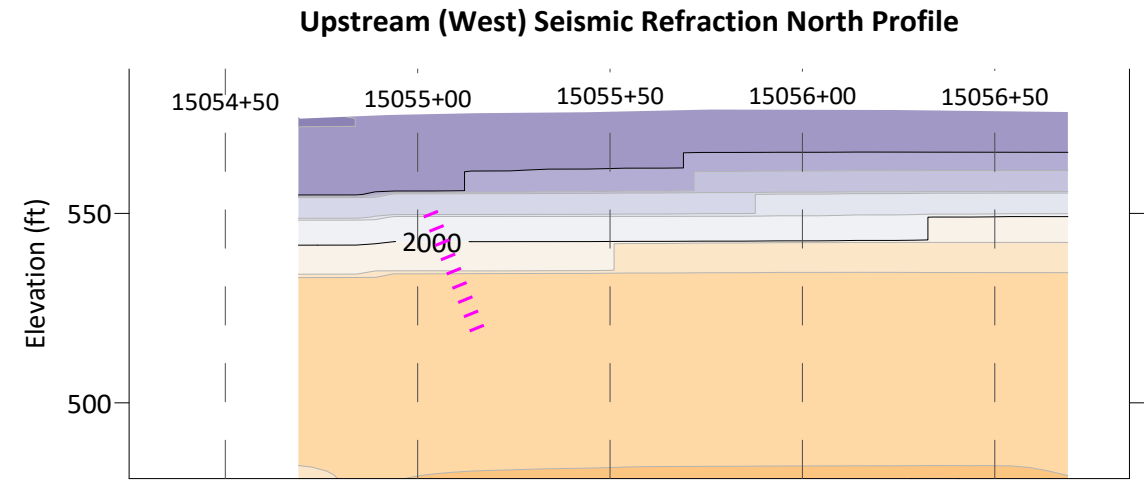
 Pipeline Station Number



Notes:

Seismic data from Geometrics 24-channel Geode with 4.0 Hz geophones.

Relative seismic velocity models from SurfSeis (by Kansas Geological Survey) active MASW inversions.



SURVEY DATE: 11/17/2020 (W), 10/19/20 (E)

RETTEW No.: 096303002

REVIEWED BY: FKB

DRAWN BY: CHR

REVISION DATE: 01/27/2021

SCALE: 1" = 60'

FIGURE NO.: 5A of 7



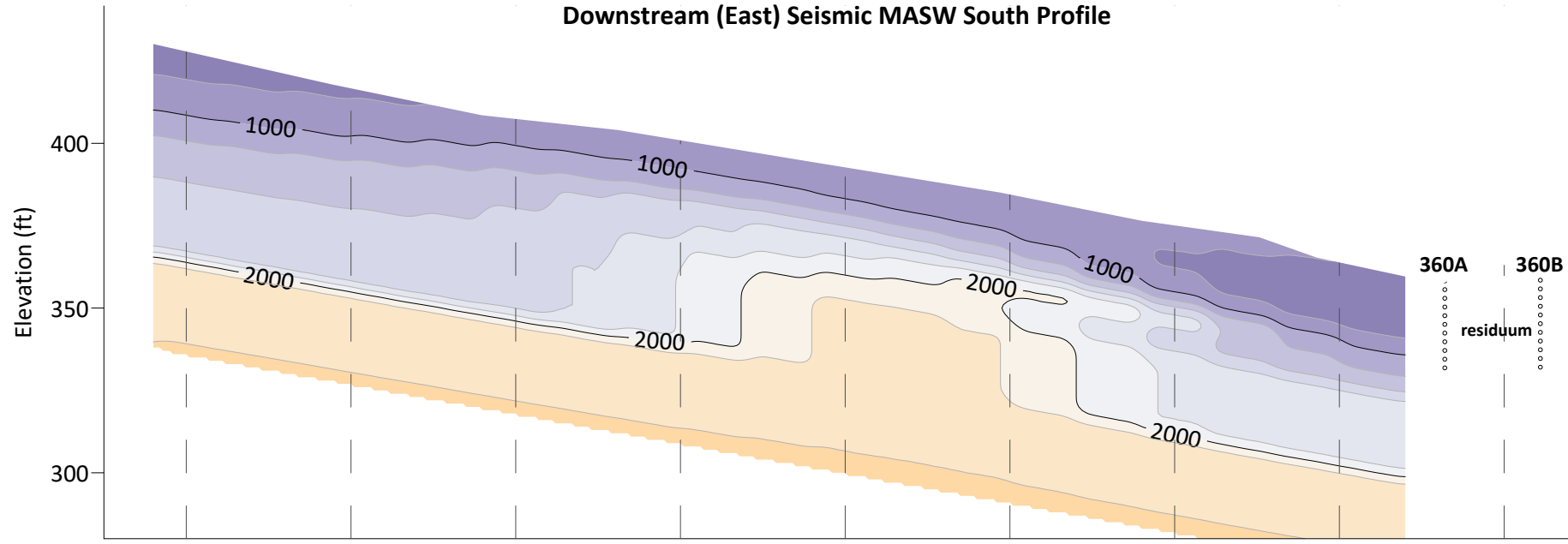
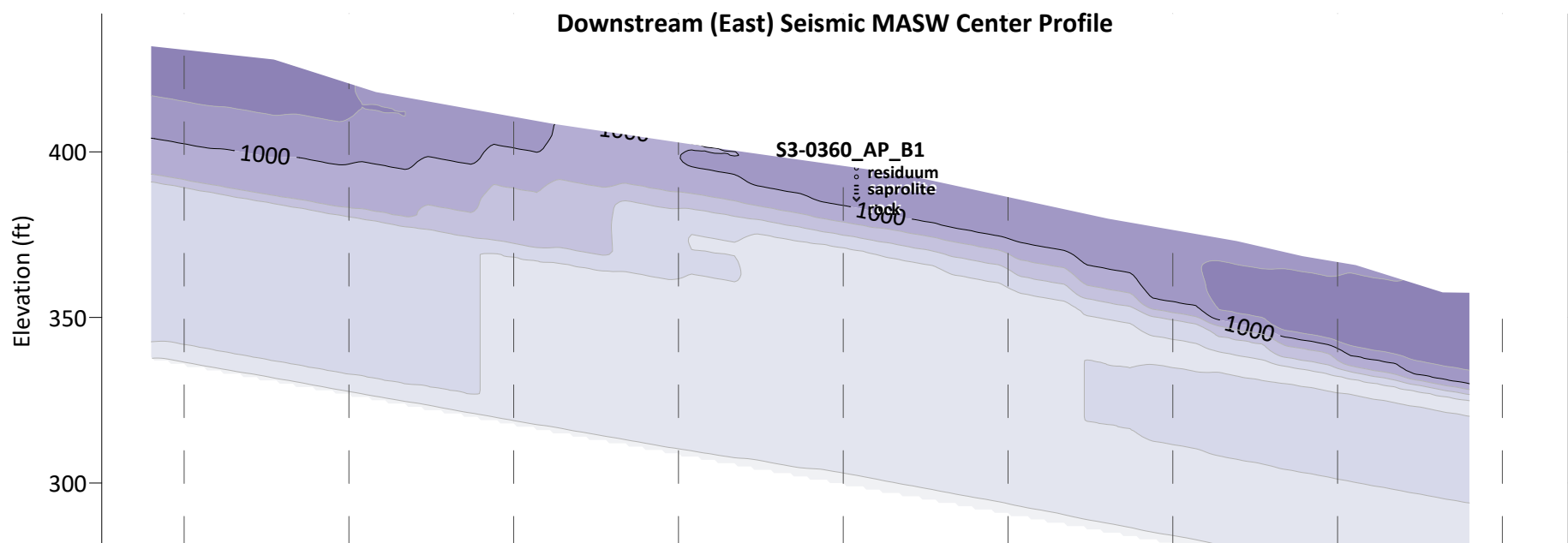
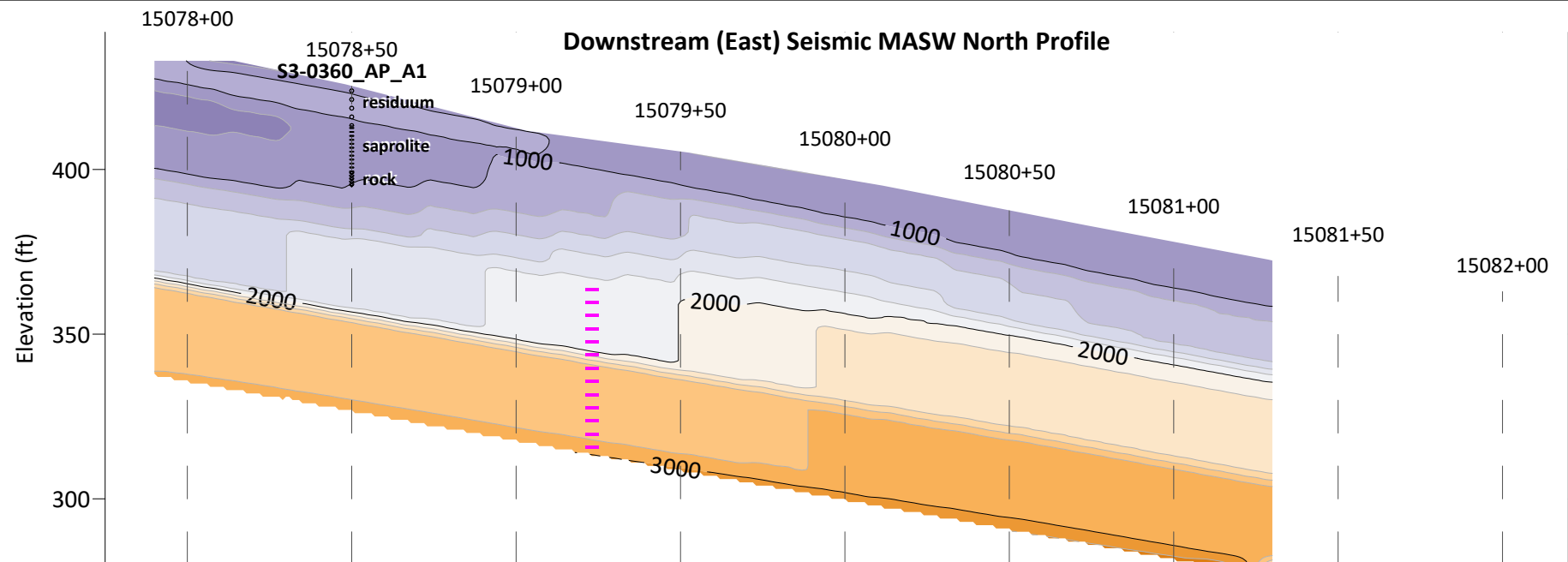
Figure 5A: Seismic MASW Profiles

Biddle Drive - Fall 2020

S3-0360

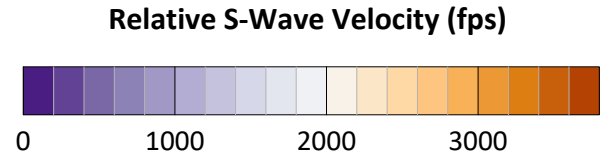
UWCHLAN TOWNSHIP

CHESTER COUNTY, PA



Geophysical Survey Legend

- Possible Fracture Zone
- 16-inch HDD (from As-Built)
- Pipeline Station Number

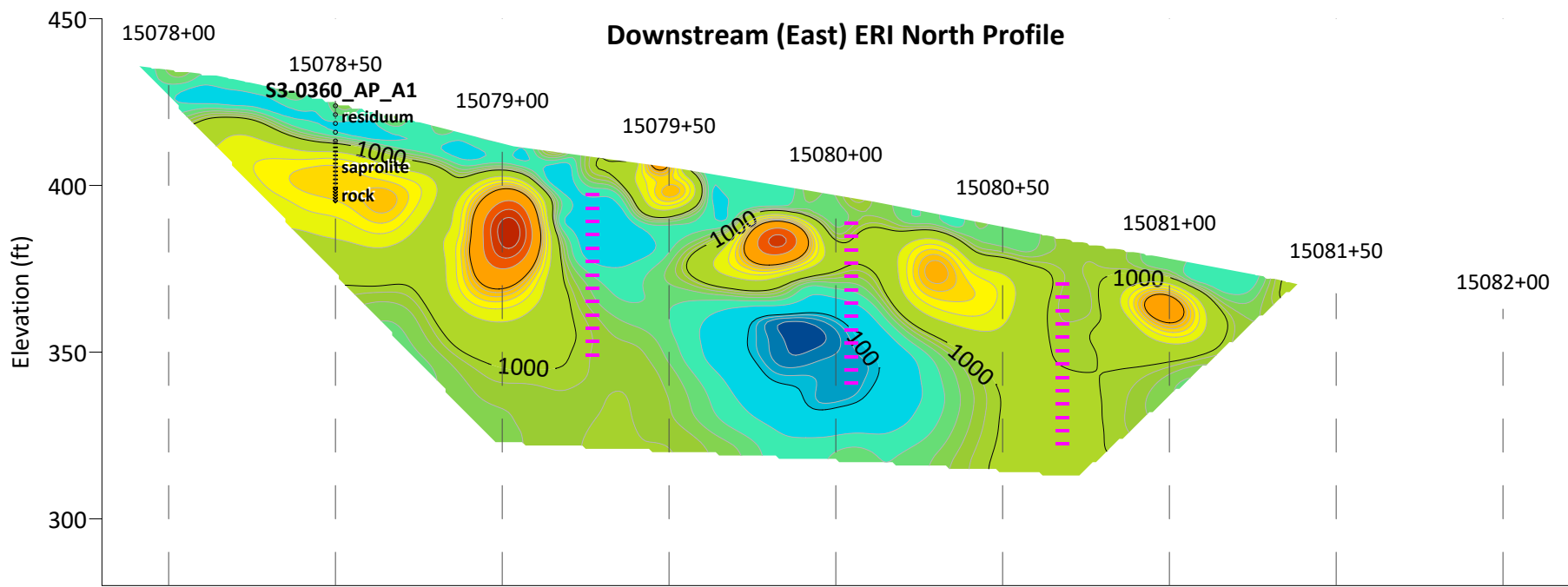


Notes:
 Seismic data from Geometrics 24-channel Geode with 4.0 Hz geophones.
 Relative seismic velocity models from SurfSeis (by Kansas Geological Survey) active MASW inversions.

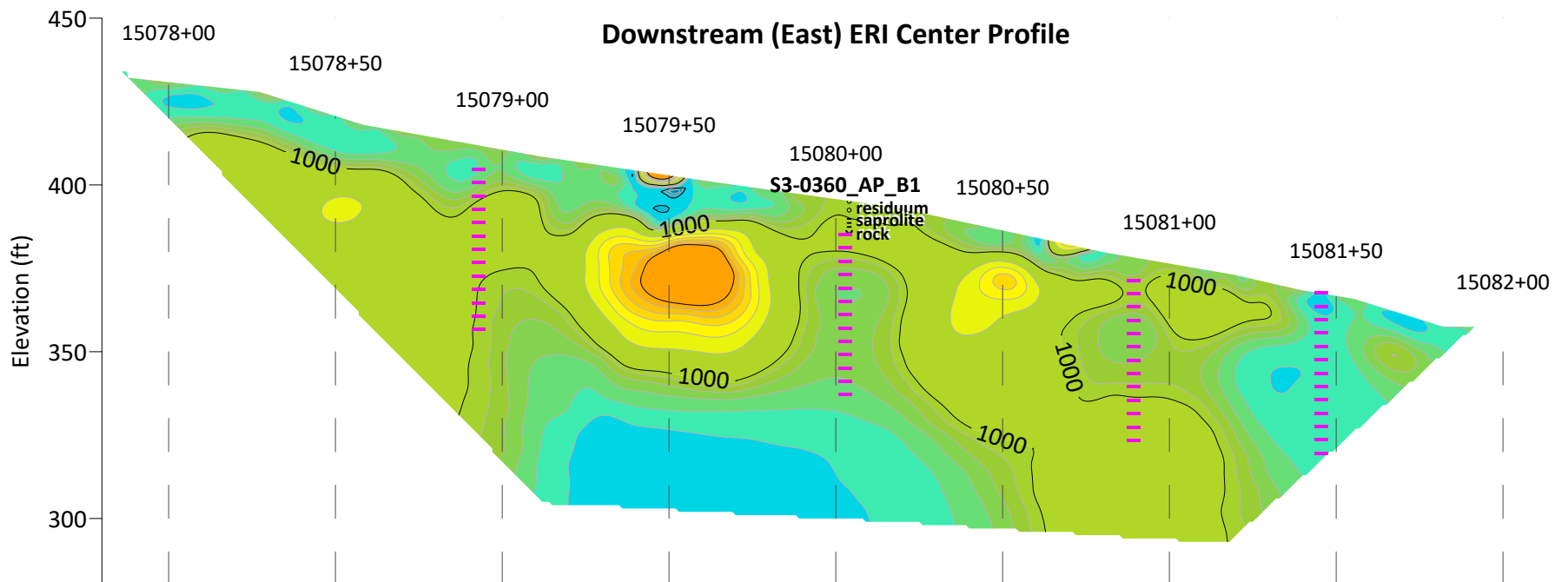
SURVEY DATE:	11/17/2020 (W), 10/19/20 (E)
RETTEW No.:	096303002
REVIEWED BY:	FKB
DRAWN BY:	CHR
REVISION DATE:	01/27/2021
SCALE:	1" = 60'
FIGURE NO.:	5B of 7



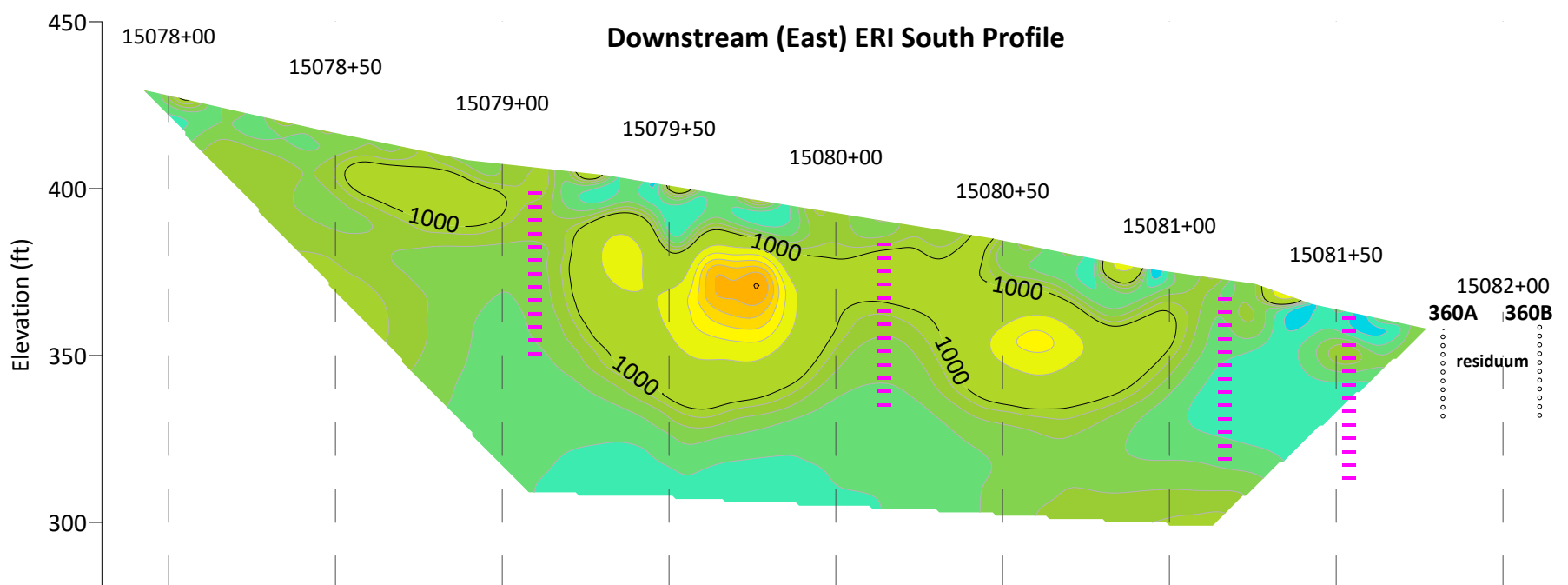
Figure 5B: Seismic MASW Profiles
 Biddle Drive - Fall 2020
 S3-0360
 CHESTER COUNTY, PA
 UWCHLAN TOWNSHIP



Along-Profile Distance (ft)

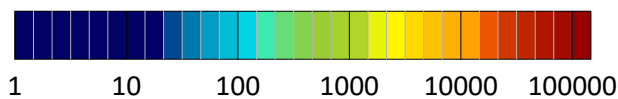


Along-Profile Distance (ft)



Along-Profile Distance (ft)

Electrical Resistivity (Ohm·m)



Geophysical Survey Legend

- Possible Fracture Zone
- 16-inch HDD (from As-Built)
- 15338+00 Pipeline Station Number

Notes:

Resistivity data from AGI Super Sting 112 channels, 15-ft electrode spacing.
 Resistivity models from EarthImager2D (by AGI Corporation).

Figure 6: Electrical Resistivity Profiles

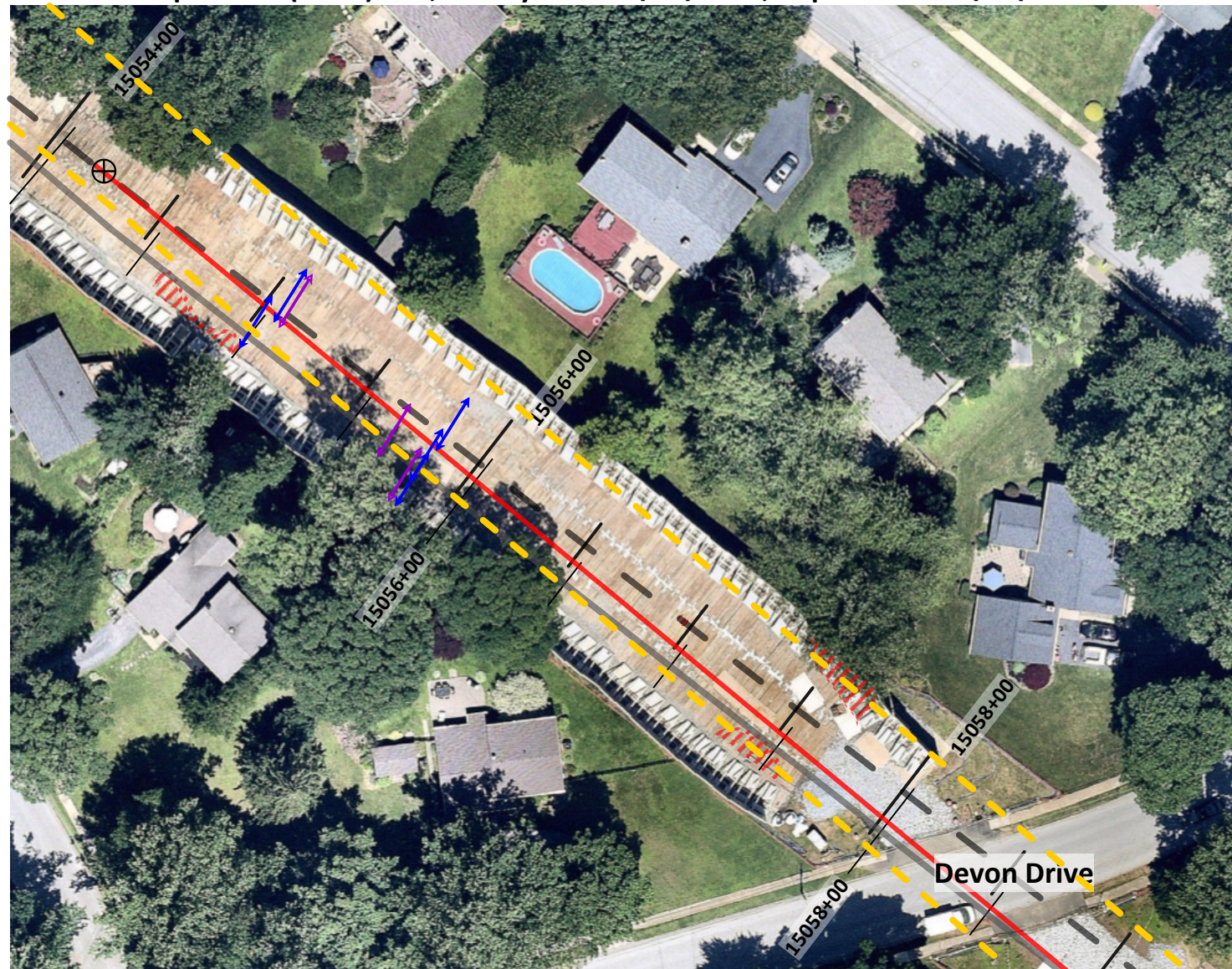
Biddle Drive - Fall 2020
 S3-0360



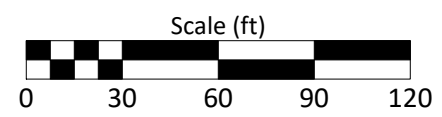
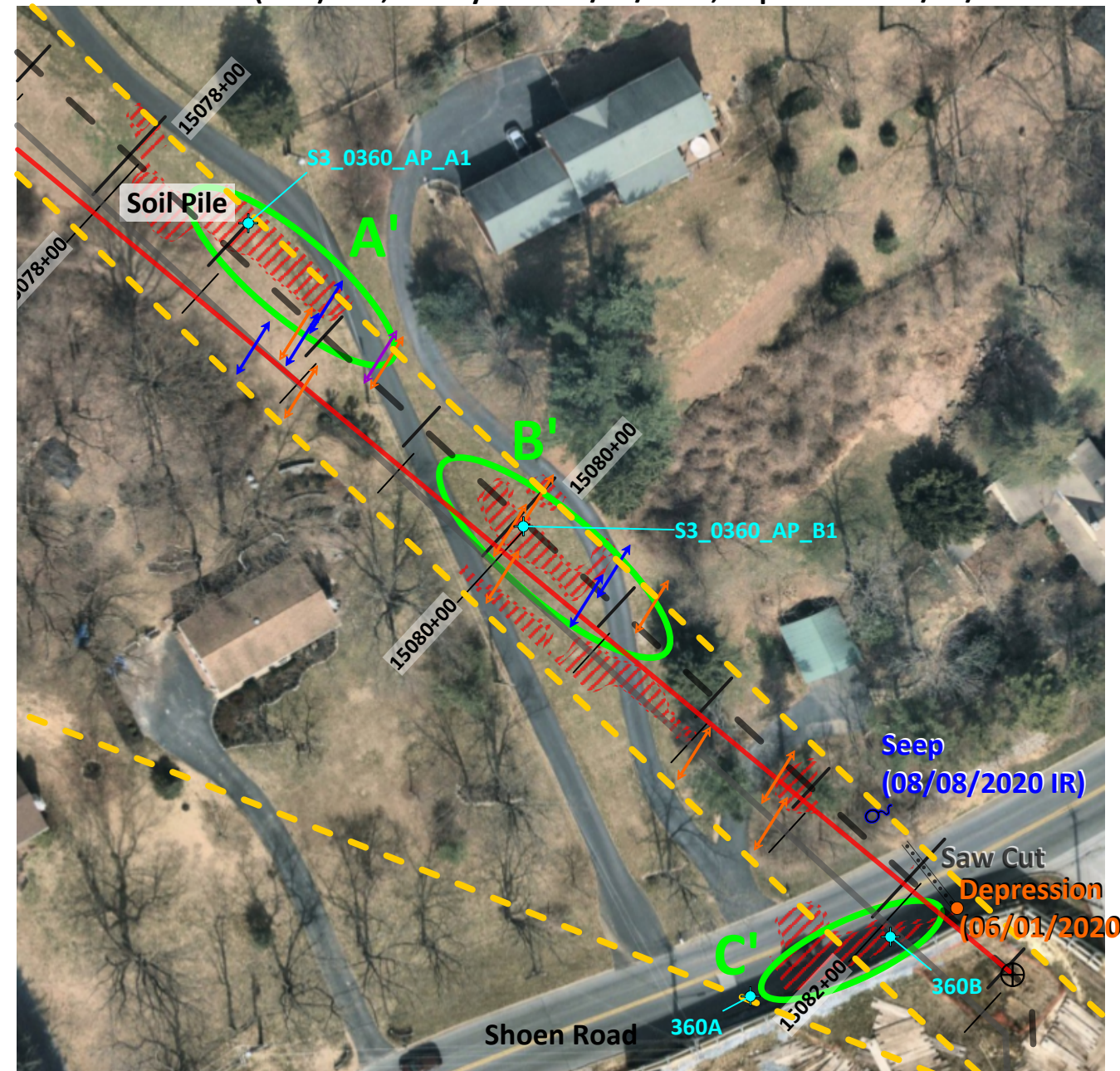
RETTEW Field Services, Inc.
 3020 Columbia Avenue, Lancaster, PA 17603
 Phone 1-800-738-8395

SURVEY DATE:	11/17/2020 (W), 10/19/20 (E)
RETTEW No.:	096303002
REVIEWED BY:	FKB
DRAWN BY:	CHR
REVISION DATE:	01/27/2021
SCALE:	1" = 50'
FIGURE NO.	6 of 7

Upstream (West) End, Survey Date 11/17/2020, Report Date 12/09/2020



Downstream (East) End, Survey Date 10/19/2020, Report Date 12/09/2020



Geophysical Survey Legend

- 16-inch HDD fom As-Built
 - 16-inch Proposed Pipeline
 - 20-inch Proposed Pipeline
 - Existing Gas Pipelines
 - Geotechnical Boring
 - Microgravity Mass Deficiencies
- Possible Fracture Zone Detected By:
- Electrical Imaging
 - Seismic MASW
 - Seismic Refraction

Area Previously Recommended for Further Testing



Notes:

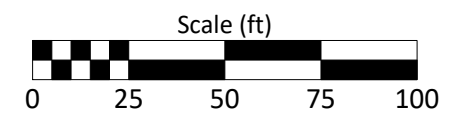
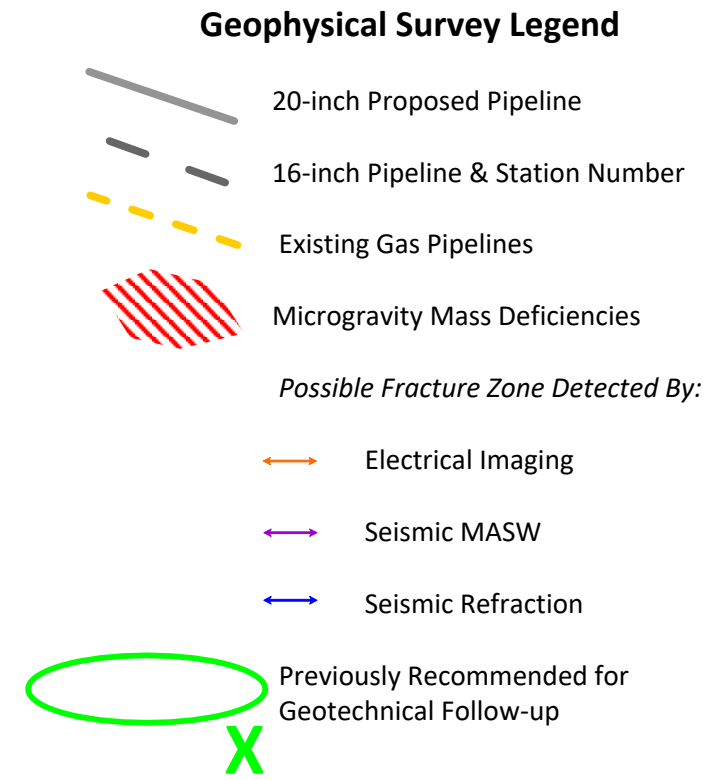
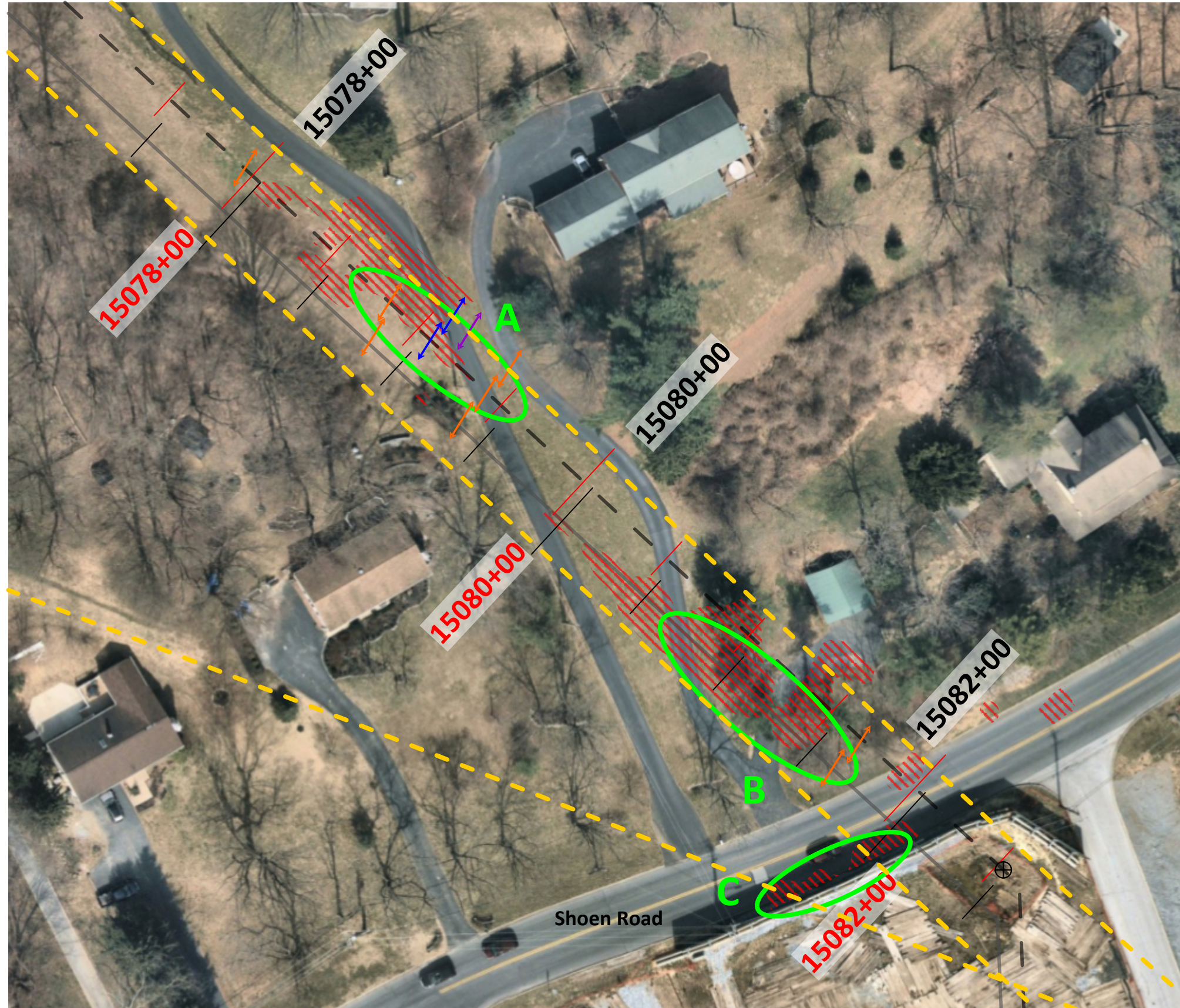
- Basemap from Nearmap, January 2020.
- Seep location from LW Survey Co. Plat Map, 04-02-2020.
- Shoen Road pavement saw cut and IR from Attachment A of Chapter 102 Permit No. ESG0100015001 Minor Modification Request 01/15/2020.

SURVEY DATE:	11/17/2020 (W), 10/19/20 (E)
RETTEW No.:	096303002
REVIEWED BY:	FKB
DRAWN BY:	CHR
REVISION DATE:	01/27/2021
SCALE:	1" = 60'
FIGURE NO.:	7A of 7

RETTEWSM
 RETTEW Field Services, Inc.
 3020 Columbia Avenue, Lancaster, PA 17603
 Phone 1-800-738-8395

Figure 7A: Geophysical Survey Results Summary

Biddle Drive - Fall 2020
 S3-0360



Notes:

Basemap from Nearmap, January 2020.

Survey profiles/stations from DGPS survey by RETTEW.

SURVEY DATE:	02/12/2020
RETTEW No.:	096303002
REVIEWED BY:	FKB
DRAWN BY:	CHR
REVISION DATE:	01/27/2021
SCALE:	1" = 50'
FIGURE NO.:	7B of 7



**Figure 7B: Previous (02/2020)
Geophysical Survey Results Summary**
Biddle Drive - Spring 2020
S3-0360

CHESTER COUNTY, PA

LWICHIAN TOWNSHIP