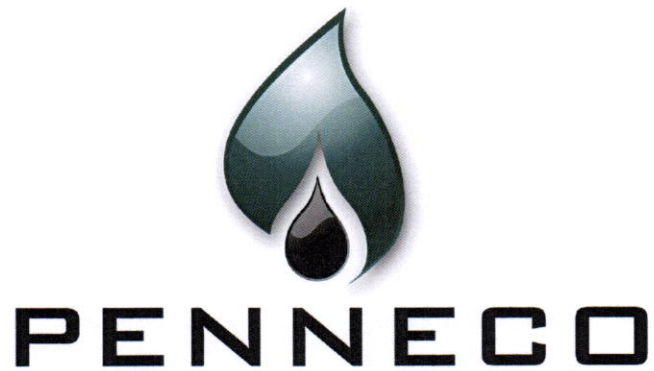


<p>BY: MEC</p> <p>CHK:</p> <p>DATE: 9-20-16</p> <p>Scale: 1" = 200'</p> <p>FILE: Final Water Purveyor Map</p> <p>JOB NO: 677415</p>	<p>WATER SUPPLY SURVEY FOR PENNECO ENVIRONMENTAL SOLUTIONS, LLC Plum Borough, Allegheny County Commonwealth of Pennsylvania</p>	<p>FOX & FOX, INC. 58 Timber Bridge Rd. Clarion, PA 16214 Phone: 814-745-2861 Fax: 814-745-2248 email: ronaldfox@foxandfoxinc.us web: www.foxandfoxinc.us</p>	<p>REVISIONS:</p>
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Notice of Deficiency Response

Penneco Environmental Solutions, LLC

Underground Injection Control Program
Class IID Injection Well Permit Application

Sedat #3A



September 10, 2016

Mr. Mark Nelson, Hydrologist
United States Environmental Protection Agency
Region III
1060 Chapline Street
Wheeling, West Virginia 26003

RE: Notice of Deficiency; Penneco Environmental Solutions, LLC
Underground Injection Control (UIC) Program
Class IID Injection Well Permit Application Sedat #3A

Dear Mr. Nelson,

Penneco Environmental Solutions, LLC is responding to the Notice of Deficiency dated July 8, 2016 for UIC facility ID PAS2D701BALL, for a proposed injection well for the disposal of E&P wastes. We have addressed the items listed in Attachment 1 of the NOD below and are enclosing revised application attachments as needed.

Item 1. Application Page

We field checked the latitude and longitude of the Sedat #3 A and found the location corresponds to the location shown on the AOR maps.

Item 2. Area of Review

The topographic map of the AOR has been revised to expand the radius from $\frac{1}{4}$ mile to $\frac{1}{2}$ mile from the injection well. Two (2) printed copies of the revised map are enclosed. A list of landowners and their address are included with the maps along with water well depths where known. Attachment A, Area of Review Methods, was revised to account for the change in radius from $\frac{1}{4}$ mile to $\frac{1}{2}$ mile. The additional wells within the enlarged radius were added to the well table in Attachment G.

Item 3. Attachment E-USDWs

We have expanded the Attachment E narrative giving more detail on USDWs in the AOR. See the revised enclosed Attachment E.

We are only listing two USWDs as being in the AOR. Pennsylvania Geological Survey Water Resource Reports #35 (Allegheny County) list three (3) and Report # 37 (Westmoreland County) list two (2) additional aquifers. The Allegheny County aquifers are the Monongahela Group, Conemaugh Group, and the Allegheny Group. In the AOR there are only two (2) the Conemaugh Group and the Allegheny Group. The surface rocks are predominately of the Conemaugh Group which is roughly 400 to 500 feet thick in the AOR. The Allegheny Group ranges from 200 to 300 feet in thickness and is around 450 feet deep in the AOR and in general any water found below 500 feet in depth is of poor quality (Report #37). The Worthington Sandstone, the lower sandstone unit of the Allegheny Group contains highly concentrated brine where the unit lies below drainage and any formations below the Worthington are not suitable as freshwater aquifers because of either low permeability or contain water high in salt content (page 61 report #35).

Report #37 (Westmoreland County) which covers a geographical area outside the Sedat AOR list an additional two aquifers, the Pottsville Group and the Mauch Chunk formation. The Pottsville lies at a depth of around 900 to 950' in western Westmoreland County and Report #37 on page 42 states that "the rocks of the Pocono Group are generally buried more than 500 feet deep, or more than 100 feet below the level of major streams. Wells drilled into these rocks usually encounter salt water". The Pocono Group is made up of three sandstones, the Homewood sandstone, Upper Connoquenessing sandstone and the Lower Connoquenessing sandstone. The drillers' names for these sands was First Salt sand, Second Salt sand and Maxton also sometimes referred to as the Third Salt sand. The Salt sands were drilled for the brine and the Maxton sand for gas, according to the Topographic and Geologic Atlas of Pennsylvania No. 36 Freeport Quadrangle. The Mauch Chunk is absent in the AOR due to either non deposition or erosion, according to Atlas of Pennsylvania No. 36 Freeport (15") Quadrangle, page 59.

A note about Driller's log reports of water shows on well records. These reports are unreliable and highly inaccurate; the water shows are neither measured for quantity nor sampled for quality analysis. The flow volume is estimated by site, and the quality is just a guess, in addition the water in the bore hole is commingled with waters from any zones left open to the bore hole at the time of sampling. The report of fresh water reported at 1,700 feet was a notational error according to Penneco which illustrates another type of widespread reporting error.

The majority of the conventional wells drilled in Western Pennsylvania were/are drilled by cable tool rigs or rotary air rigs and not logged until after the surface, coal and water strings are run and cemented and the well reaches total depth. Some wells do have a gamma ray log to surface but no electric logs are available.

Item 4, 5, 6, 7, and 8. Attachment G - Geologic Data

Items 4, 5, 6, 7 and 8 were addressed by revising Attachment G. Item 4 pertained to a typographical error for a permit number, the correct permit number is now shown in the table. Item 5 asked for additional information on the methodology used to determine the frac gradient. HFRAC provides additional information on the frac gradient in supplement 5 at the end of their original report. We have replaced pages 29 through 35 of the HFRAC report with new full size copies to take care of Item 6. Item 7 asked for justification of the use of 1.8mD for the permeability of the injection zone. HFRAC expands on why this value was chosen in supplement 7 which can be found at the end of

their report. To address Item 8 the geological narrative has been revised so that it now includes an additional structure map contoured on top of the Murrysville Sand, and an additional three (3) cross sections across the AOR showing no sand displacement.

Four seismic maps from the USGS Earthquake Hazards Program were added to the end of Attachment G. Map 1 shows historic seismic activity in Pennsylvania, showing there has been no activity in the AOR. Maps 2, 3 and 4 show the probability of natural or induced seismic activity in different formats. All three show low probability of any activity in the AOR.

Item 9. Attachment H - Operating Data

Attachment H was revised to provide more detail as to the source of the injection fluid, which is E&P waste, produced water and flow back fluids. Note that Penneco Environmental Solutions, LLC is applying for a commercial license.

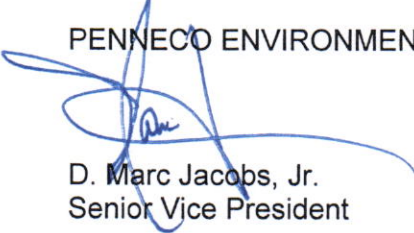
Item 10. Attachment P - Monitoring Program

Attachment P was revised to provide additional information on the monitoring program for both the injection well and the Sedat #1 monitoring well.

Should you need clarification on any other items, please do not hesitate to contact us.

Sincerely,

PENNECO ENVIRONMENTAL SOLUTIONS, LLC



D. Marc Jacobs, Jr.
Senior Vice President

**Attachment A
Area of Review Methods
Sedat #3A Injection Well**

Area of Review Methods:

The size of the area of review was determined by a fixed radius of one quarter mile as required by permit application but expanded to a fixed radius of one half mile at request of permit reviewer. Maps with a one quarter mile, one half mile and one mile radius were prepared. A topographic map extending one (1) mile beyond the well site was prepared by Fox and Fox, Inc. with assistance from Penneco Environmental Solutions, LLC. Maps detailing the area of review are in Attachment B. Research was conducted by:

- 1) Survey by Fox and Fox, Inc. registered professional surveyors
- 2) Conversation with surface landowners by Fox and Fox, representatives of Penneco Environmental Solutions LLC.
- 3) Review of Tax Parcel Maps from the county assessment office.
- 4) Research of Pennsylvania Bureau of Oil and Gas Management's well records
- 5) Research of Pennsylvania Geological Survey publications covering the area of review
- 6) Research of USGS publications covering the area of review.
- 7) Master Thesis (Two) From West Virginia University
- 8) Series of reservoir test by HFrac Consulting Services.

Using the results from the above research, along with topographic and tax maps displaying surface features such as buildings, and streams, maps of the AOR were prepared for and included in Attachment B.

The same research used to map the area of review was used to provide data on the geology of the injection zone and the confining formations described in Attachment G.

As part of larger study to assess its lease acreage in the area of the Sedat lease Penneco ran a series of reservoir tests using HFrac Consulting Services to determine the character of the Murrysville reservoir and the results are included in Attachment H.

Attachment E

USDWs for Sedat #3A Injection Well

The Sedat #3A AOR is located in the Pittsburgh Low Plateau Section of the Appalachian Plateau physiographic province (refer to map at the end of this attachment). Underlying rock types are shale, siltstone, sandstone, limestone and coal. Aquifers in the AOR are mainly sandstones of the Conemaugh Group and the Allegheny Group. The Pottsville Group and the Mauch Chunk Formation, identified as USDWs in some areas of Pennsylvania lie at too great a depth to serve as aquifers in the AOR or are absent due to non deposition or erosion as is the case for the Mauch Chunk. See the table on the following pages listing USDWs in Pennsylvania. The thickness of the section from the Conemaugh Group through the Allegheny Group runs in the range of 800 feet depending on surface elevation. A review of the well records shows water production as deep as 1,700 feet. However reports of water production by the driller on their driller's logs are highly unreliable, the quantity and quality of the water is not measured by instrument. The quantity is estimated by site and the water quality which is often measured by taste, is a commingled sample from all formations open to the bore hole at the time of sampling. Additionally, Pennsylvania Geological Survey Water Resource Reports #35 and #37 state water quality is extremely poor beyond 500 feet in depth because of moderate to high mineralization of the waters (high dissolved solids and brine).

Description of USDWs in AOR

Rock members of the Conemaugh Group predominate at the surface in the AOR: see the section of the geologic map of Pennsylvania at the end of the attachment. The Casselman and Glenshaw Formations make up the Conemaugh Group, and consist of shale, red shale, sandstone and coals.

The Allegheny Group consists of shale, sandstone, thin beds of limestone and coals. The Freeport Formation, Kittanning Formation, Vanport Limestone, and Clarion Formation make up the Allegheny Group.

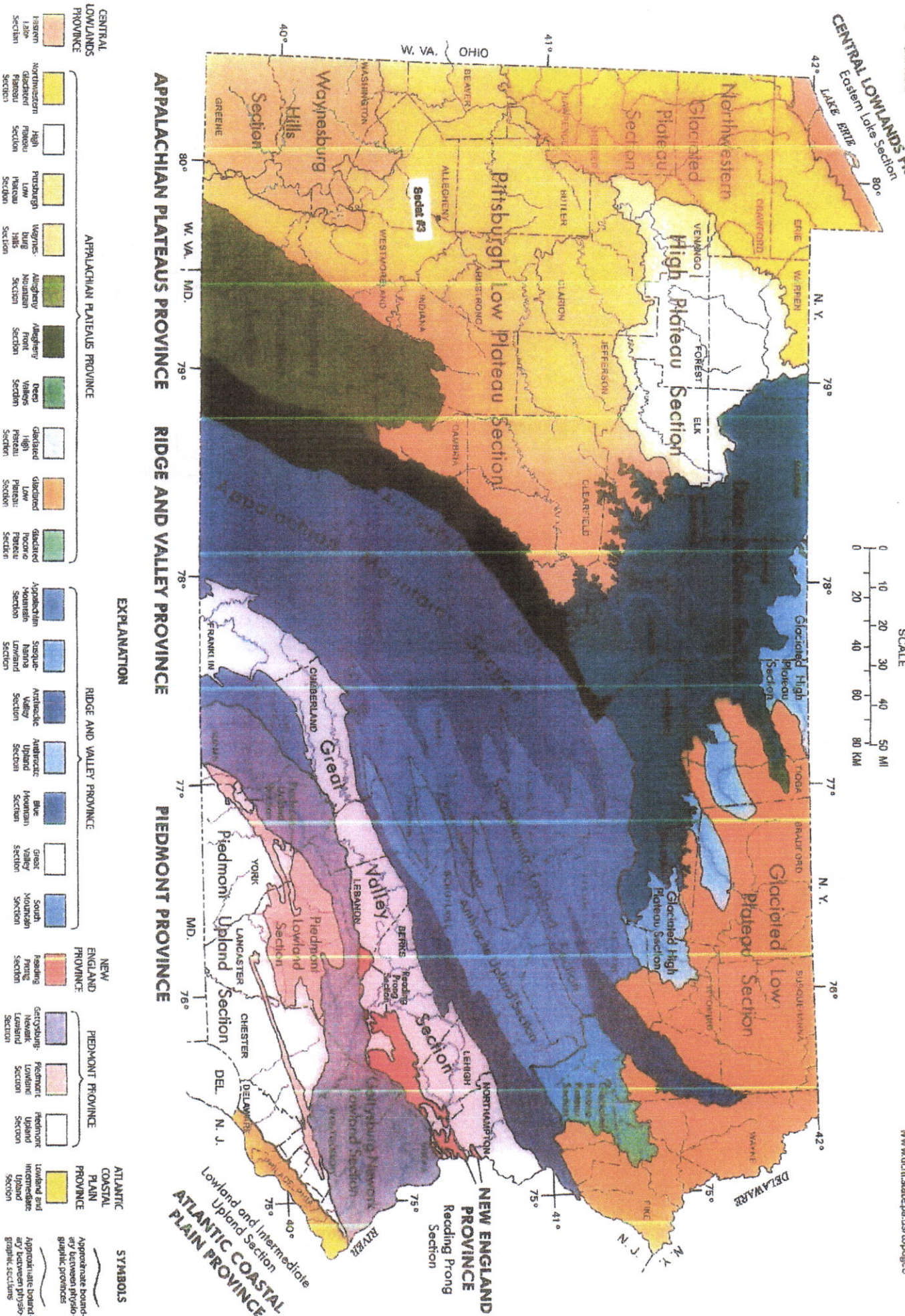
Figure 89. The principal aquifers in the Appalachian Basin Province in Segment 11 are sandstones in the geologic units shown in yellow and limestone shown in blue. Where fractured, rocks of the Greenbrier, the Catskill, and the Brallier Formations locally yield water. The gray areas represent missing rocks.

System	Pennsylvania	Maryland	West Virginia	Virginia
Permian	Dunkard Group		Dunkard Group	
Pennsylvanian	Monongahela Group	Monongahela Formation	Monongahela Group	
	Conemaugh Group	Conemaugh Formation	Conemaugh Group	
	Allegheny Group	Allegheny Formation	Allegheny Formation	
	Pottsville Group	Pottsville Formation		
			Pottsville Group	Hartman Formation
Mississippian				Wise Formation
				Norton Formation
				Isle Formation
	Mauch Chunk Formation	Mauch Chunk Formation	Mauch Chunk Group	Bluestone Formation
		Greenbrier Formation ¹	Greenbrier Limestone	Hinton Formation
				Stuartsd Formation
	Potomac Formation	Potomac Formation	Potomac Group	Marcrady Shale
	Huntley Mountain Formation			Priest Formation
Devonian	Catskill Formation ¹	Hampshire Formation	Hampshire Formation	Chattanooga Shale
		Chemung Formation	Chemung Formation	
	Timbers Rock Formation	Brallier Formation ¹	Brallier Formation ¹	
	Harel Formation	Harel Shale	Harel Shale	

¹Locally water-yielding

Modified from:

Witten, D.G., and others, 1985a, Correlation of stratigraphic units of North America (COSUNA) Project, southern Appalachian region: American Association of Petroleum Geologists, 1 sheet.
 _____, 1985b, Correlation of stratigraphic units of North America (COSUNA) Project, northern Appalachian region: American Association of Petroleum Geologists, 1 sheet.



Attachment G*
Geological Data on Injection and Confining Zones
SEDAT #3A Injection Well

Geological Data for Sedat #3A Injection Well

The Sedat #3A injection well will be a repurposed depleted natural gas well located in the Renton Gas Field in Plum Borough, Allegheny County, Pennsylvania. The injection well will target the Murrysville Sand as the injection zone which is water saturated and located very near the axis of the Duquesne-Fairmount syncline, see the copy of a section of Pittsburgh Region Structure Contour Map (Map 1) included with this attachment. Also included is a Geologic Map of the western part of Allegheny County, PA (Map 2). The immediate area around the well has been strip mined for coal (Pittsburgh Seam) and mined by underground methods for coal (Upper Freeport Seam); see the Area of Review map in Attachment B.

There are 15 wells within the 1/2 mile Area of Review (ARO) that penetrate the Murrysville sand, the state permit numbers for the wells are:

Permit #	Permit #	Permit #	Permit #
003-21287	003-21210	003-22200	003-21223
003-21222	003-21644	003-21238	003-21438
003-21228	003-00674	003-21964	003-21317
003-21225	003-20903	003-21868	

All the wells were cased and cemented through the Murrysville, well 003-00674 was plugged, the well records can be found in Attachment B. The Sedat #1A permit # 003-21210 will be converted to an observation well by perforating the cemented casing string at the depth of the Murrysville.

The Murrysville Sand is approximately 128' thick, and lies at a depth of 1,822' to 1,950' in the Sedat #3A AOR. The well had an original TD of 4,309' and was plugged back to 1,940' to just below the injection zone. See Attachment M Construction Details for well schematic and cement data. Fluid will be injected into a 40' section of the Murrysville Sand through a 4" injection string set on a packer at approximately 1,890' in 7" casing perforated with 41 holes from 1896' to 1936'. The confining zones are the Riddlesburg Shale (Sunbury Equivalent) which overlays the Murrysville with the Riceville-Oswayo Shale lying underneath as the lower confining zone.

The upper confining zone lying directly on top of the Murrysville is the Riddlesburg Shale. The Riddlesburg is a dark gray to greenish and grayish black laminated shale and siltstone with occasional sandstone and limestone beds. The Riddlesburg is between 80 to 90 feet thick in the Sedat #3A AOR; see the Riddlesburg Isopach map, Map 3 at the end of Attachment G.

The Murrysville is a greenish-yellow to gray sandstone with occasional conglomeratic lenses, with high porosity and permeability. Because of the Murrysville's thickness, high porosity and permeability the formation serves as a gas storage reservoir to the south of the Sedat. All most all the wells in the AOR including the Sedat #3A were drilled and cased through the Murrysville without running a porosity logs, see the well records in Attachment B. There are two wells for which porosity logs are available that show the average density porosity through the Murrysville Sand to average around 24%, which agrees with published reports of porosity values in the Murrysville. Refer to the log sections and location map at the end of this attachment for wells permit # 129-24721, and well permit #129-25581. Both wells were saturated with brine and did not produce gas.

Penneco conducted several tests to determine the reservoir characteristics of the Murrysville on its leases with the results included at the end of Attachment H. The test provided a breakdown pressure, the pressure needed to initiate a fracture, as 3,115 psi, ISP is estimated as 1,114 psi, with a fracture gradient of 1.23 psi. The reservoir pressure is 232 psi, with an estimated closure pressure of 553 psi. See the supplement to the HFrac report labeled Item 5 for more detail on the methodology used to determine the fracture gradient.

Formation permeability for the Murrysville was reported by Melissa Sager (Petrologic Study of the Murrysville sandstone in SW PA, 2007) as generally high throughout the formation, with a range of 0.005 to 1,000 millidarcies with an average of around 100 millidarcies. The permeability of the Murrysville in the Sedat #3A is estimated to be 1.8 mD and was determined from a series of tests to determine the reservoir characteristics of the Murrysville sand on Penneco leases conducted by HFrac Consulting Services, LLC, see the supplement to the HFrac report labeled Item 7 at the end of this attachment for additional detail. This value falls within the lower range of Sager's study.

The Riceville-Oswayo Shale lying directly beneath the Murrysville serves as the lower confining zone. The Riceville-Oswayo is about 30 feet thick in the AOR; see Map 4, Isopach map of the Oswayo Shale. The Riceville-Oswayo formation consists of dark gray to medium gray shale and siltstones.

Structurally the AOR has a series of northeast-southwest trending anticlines and synclines with the Sedat #3A well lying along the axis of the Duquesne-Fairmount syncline refer to Map 1. While there are some deep seated basement faults associated with the Rome Trough, review of Map 1, Map 2 and an additional structure map contoured on the top of the Murrysville Sand and additional cross sections across the AOR supports the idea that there are no apparent faults at shallower depths in the AOR. The Murrysville structure map along with additional cross sections across the AOR are from McDaniel's Subsurface Stratigraphy and Depositional Controls on Late Devonian-Early Mississippian Sediments in SW PA.

Review of Pennsylvania Geologic Publication, Atlas No. 36, Geology of the Freeport Quad (the Sedat #3A is in the SW corner of the quad) states on page 23 "displacement

faults where not seen in any outcrop. Inquiry among mine operators indicate practically the same thing". Penneco Environmental Solutions, LLC had a related company that at one time mined in the AOR and a search of its records supports the statement found in Atlas No. 36.

The U.S.G.S rates the probability of seismic activity in SW Pennsylvania with sufficient intensity to cause damage as low. A series of four earthquake maps from the U.S.G.S earthquake hazards program website are found at the end of this attachment.

Earthquake Map 1 shows the historical locations of earthquakes in Pennsylvania and nearby areas. Earthquake Map 2 shows the entire US color code to show the chance of a seismic event occurring from lowest to highest. Map 1 shows no seismic events are shown to have occurred in SW PA, and Map 2 shows the AOR lies in an area with the second lowest hazard level.

Earthquake Maps 3 and 4 are from U.S.G.S. open file report 2016 One Year Seismic Hazard Forecast for the Central and Eastern United States from Induced and Natural Earthquakes OFR-2016-1035. Map 3 shows there is a small chance (one percent) that ground shaking greater than IV on the Modified Mercalli Scale will occur. Map 4 indicates the change of damage in the NE from natural or induced seismic activity to be 1% to 2%.

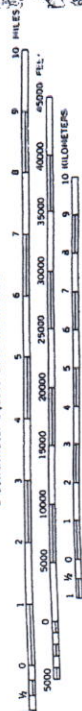
Penneco also contends that the maximum injection pressure is sufficiently below the pressure needed to initiate a fracture or reactive any unknown faults. The injection rate is also not of a sufficient volume to open or extend any fractures or reactive any unknown faults in the area, see the HFRAC report.

GREATER PITTSBURGH REGION
STRUCTURE CONTOUR MAP OF ALLEGHENY, ARMSTRONG, BEAVER,
BUTLER, WASHINGTON, AND WESTMORELAND COUNTIES
W. E. Wagner, L. Newman, A. L. Gird, W. B. Schenck, and J. A. Meyer
1978



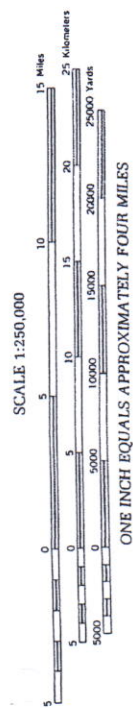
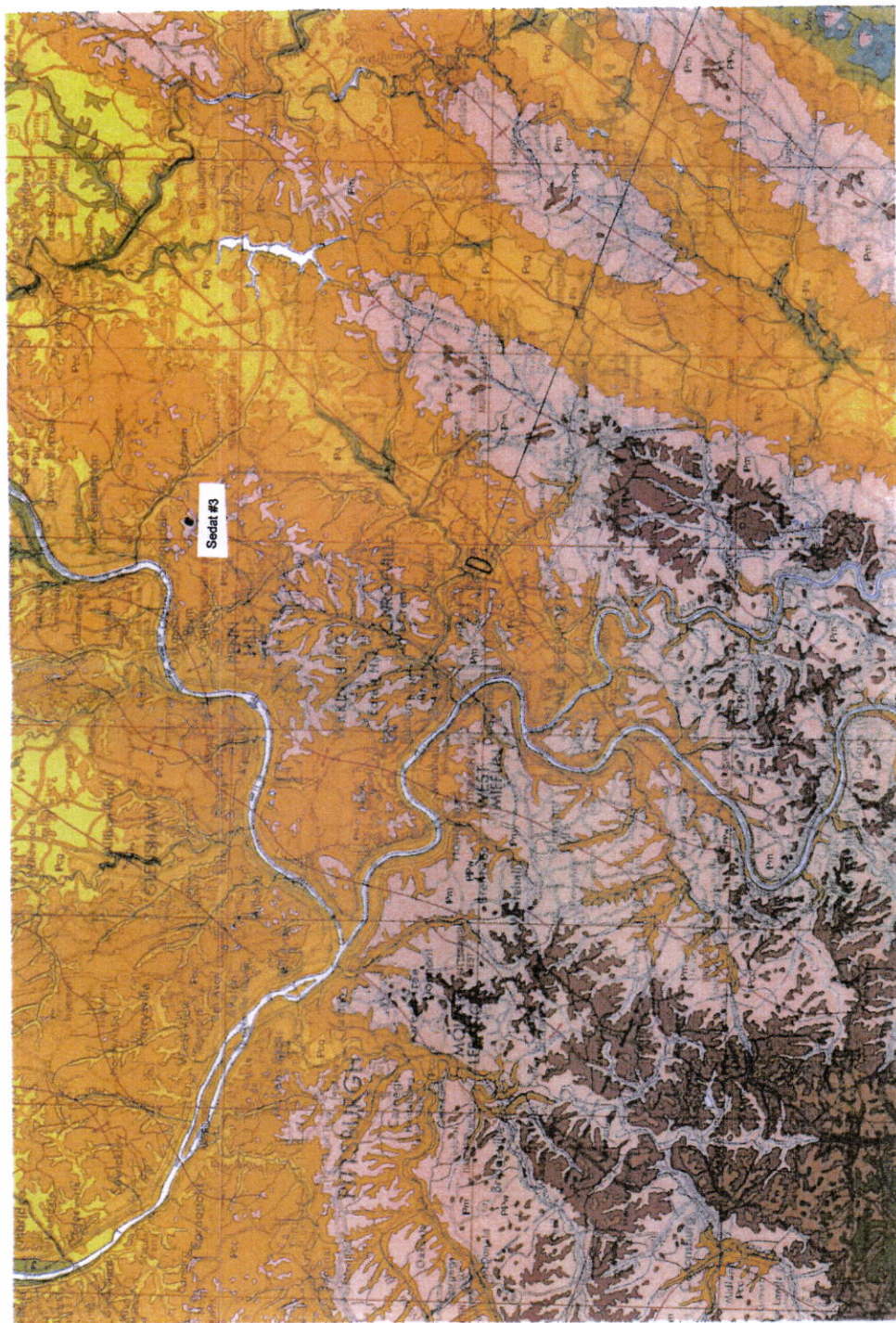
SCALE 1:125 000

1 inch equals approximately 2 miles
1 centimeter equals 1.25 kilometers



CONTOUR INTERVAL 100 FEET
DATUM IS MEAN SEA LEVEL

Map 2
From Pa Geologic Map
1980





SUPERIOR

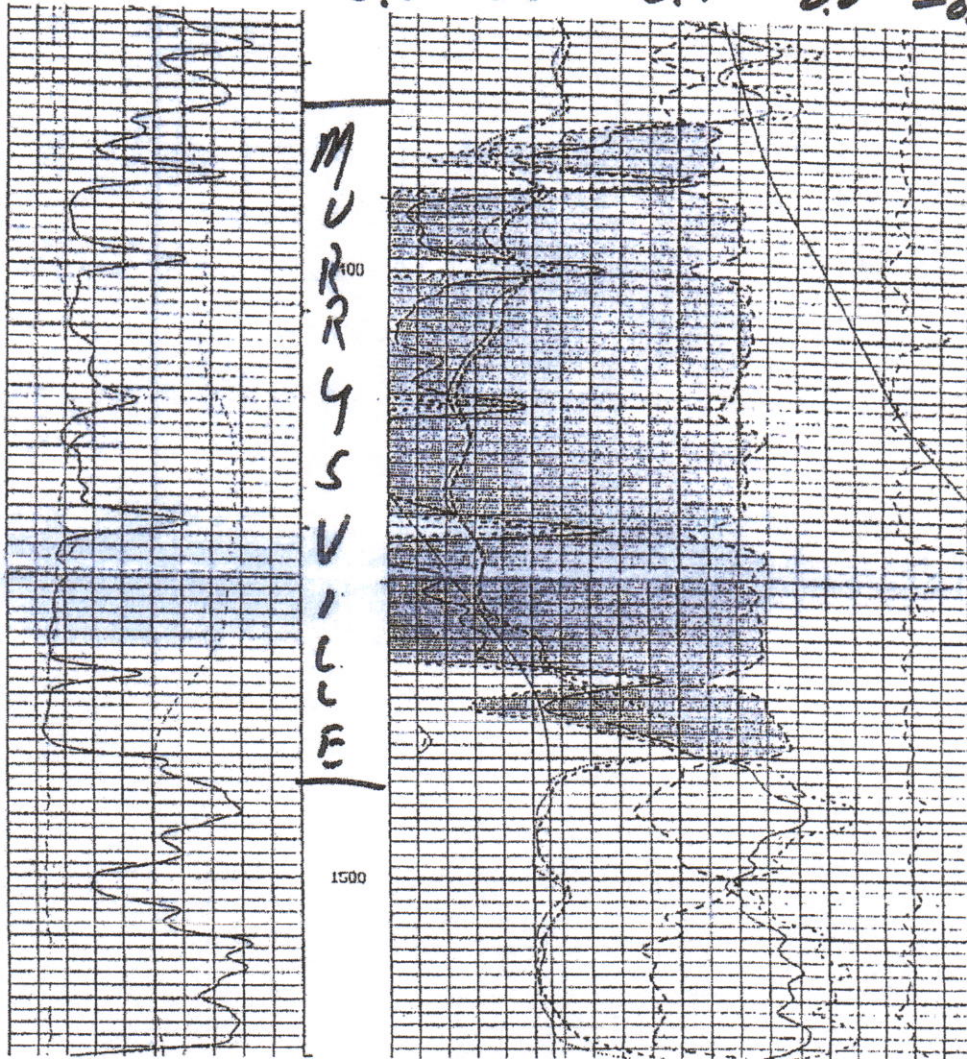
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Charleston, W. Va.

GAMMA RAY
NEUTRON
DENSITY
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CPNY PENNECO OIL COMPANY		PENNECO OIL COMPANY	
WELL: MARIONA HOMES #1 (PA-594)		WELL: MARIONA HOMES #1 (PA-594)	
FIELD: WESTMORELAND STPA		FIELD: WESTMORELAND OUNDRANGLE	
COUNTY: WESTMORELAND		COUNTY: WESTMORELAND	
LOCATION: PERMIT 129-24721 0° WEST LONG: 79° 37' 50.2" 0° SOUTH LAT: 40° 29' 24.5"		LOCATION: PERMIT 129-24721 0° WEST LONG: 79° 37' 50.2" 0° SOUTH LAT: 40° 29' 24.5"	
SEC: 106-14-02		TWP: WASHINGTON	
DATE: 106-14-02		DATE: 106-14-02	
RUN NO. 106		RUN NO. 106	
DEPTH-DRILLER 3850 FT.		DEPTH-DRILLER 3850 FT.	
DEPTH-LOGGER 3537 FT.		DEPTH-LOGGER 3537 FT.	
BATH. LOG INTER. 0 FT.		BATH. LOG INTER. 0 FT.	
CASING-DRILLER 1280 FT.		CASING-DRILLER 1280 FT.	
CASING-LOGGER 1280 FT.		CASING-LOGGER 1280 FT.	
BIT SIZE 6.25 IN.		BIT SIZE 6.25 IN.	
FLUID TYPE AIR/GAS		FLUID TYPE AIR/GAS	
DEMS.: UISC. N/A		DEMS.: UISC. N/A	
PH: FLUID LOSS N/A		PH: FLUID LOSS N/A	
SOURCE OF SAMPLE N/A		SOURCE OF SAMPLE N/A	
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RM P BHT N/A		RM P BHT N/A	
TIME SINCE CIRC. N/A		TIME SINCE CIRC. N/A	
POS. REC. TEMP. N/A		POS. REC. TEMP. N/A	
EQUIP.: LOCATION BGS/BLACK		EQUIP.: LOCATION BGS/BLACK	
RECORDED BY JERRY MOORE		RECORDED BY JERRY MOORE	
WITNESSED BY MR. JACOBS		WITNESSED BY MR. JACOBS	

Dens. T_1 ϕ

0.3 0.2 0.1 0.0 -0.1



LDT

Schlumberger

DOMINION EXPLORATION & PRODUCTION, INC.

JACOB SNYDER UNIT #3 (WPA06512)

HEMPFIELD TWP

WESTMORELAND

PENNSYLVANIA

LITHO DENSITY

COMPENSATED NEUTRON / GR
ARRAY INDUCTION / TEMPERATURE

LATITUDE: 40-15-34.2700

LONGITUDE: 79-40-1.3900

11711'S & 106' W OF NE CORNER

Permanent Datum: KB

Log Measured From: KB

Drilling Measured From: KB

APL Serial No: 37-128-25583-00

MAP SECTION: B

TOWNSHIP: HEMPFIELD

QUAD: IRWIN

Elev.: KB

G.L. 1080 R

D.F.

Elev.: 1080 R

8.0 ft above Perm. Datum

Company: DOMINION EXPLORATION & PRODUCTION, INC.

Well: JACOB SNYDER UNIT #3 (WPA06512)

Location: LATITUDE: 40-15-34.2700

Field: HEMPFIELD TWP

County: WESTMORELAND

Logging Date: 31-Aug-2005

Run Number: 1

Depth Driller: 2130 ft

Schlumberger Depth: 2135 ft

Bottom Log Interval: 2127 ft

Top Log Interval: 0 ft

Casing Driller Size @ Depth: 8.625 in

Casing Schlumberger: 8.625 in

Bit Size: 8.675 in

Type Fluid In Hole: AIR / GAS / PRODUCED FLUIDS

Density: 0 lbm/gal

Viscosity: @

Source Of Sample: @

RM @ Measured Temperature: @

RMF @ Measured Temperature: @

RMC @ Measured Temperature: @

Source RMF: @

RM @ MRT: @ 70

Maximum Recorded Temperature: @ 70

Circulation Stopped Time: 70 degF

Logger On Bottom Time: 31-Aug-2005

Unit Number: 3069

Recorded By: BRADFORD

Witnessed By: TIM LYON, MIKE KORNACKI

NATE ZIMMERMAN, MELISSA THURP

Run 1

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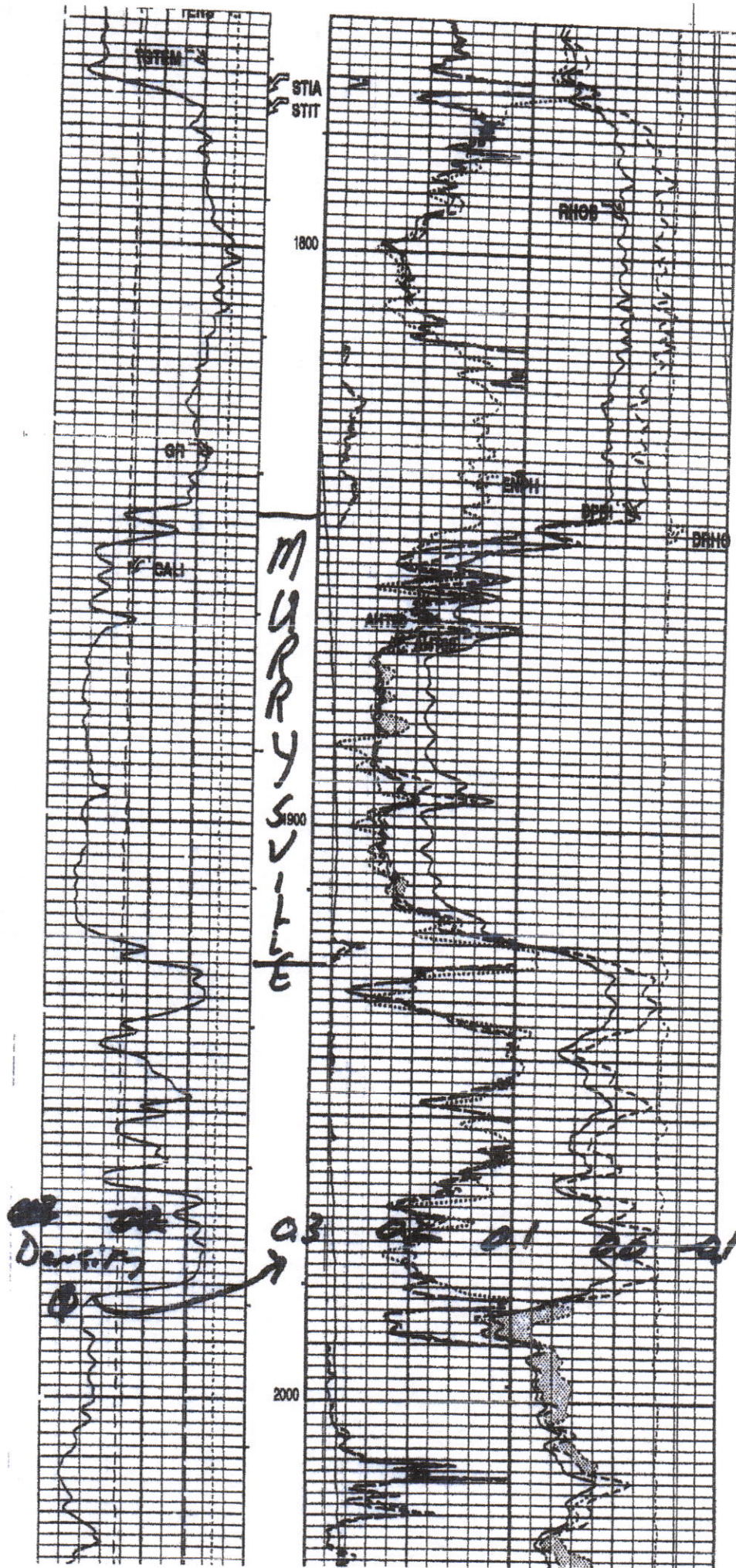
Run 278

Run 279

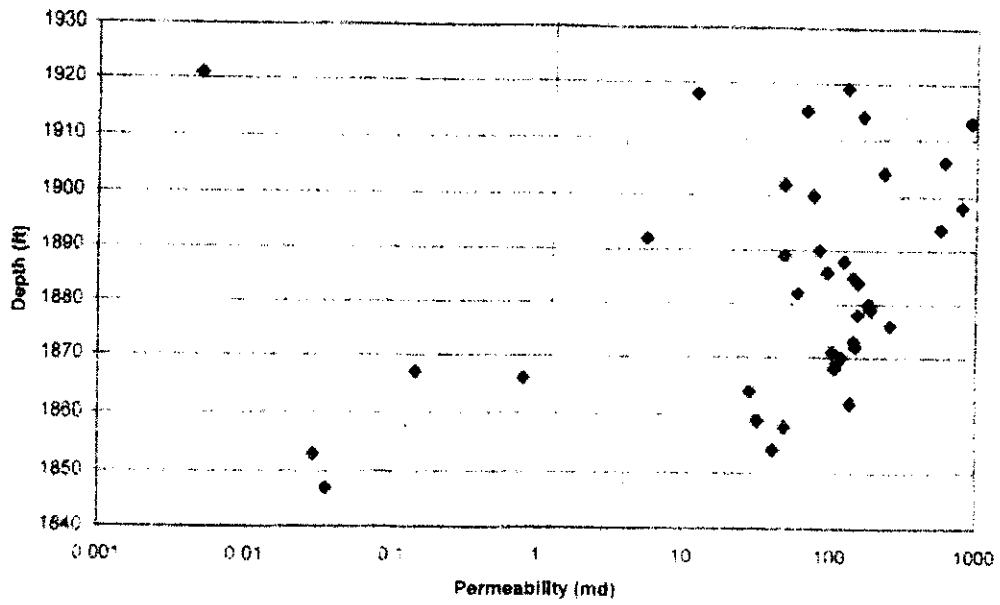
Run 280

Jacob Snyder Unit #3

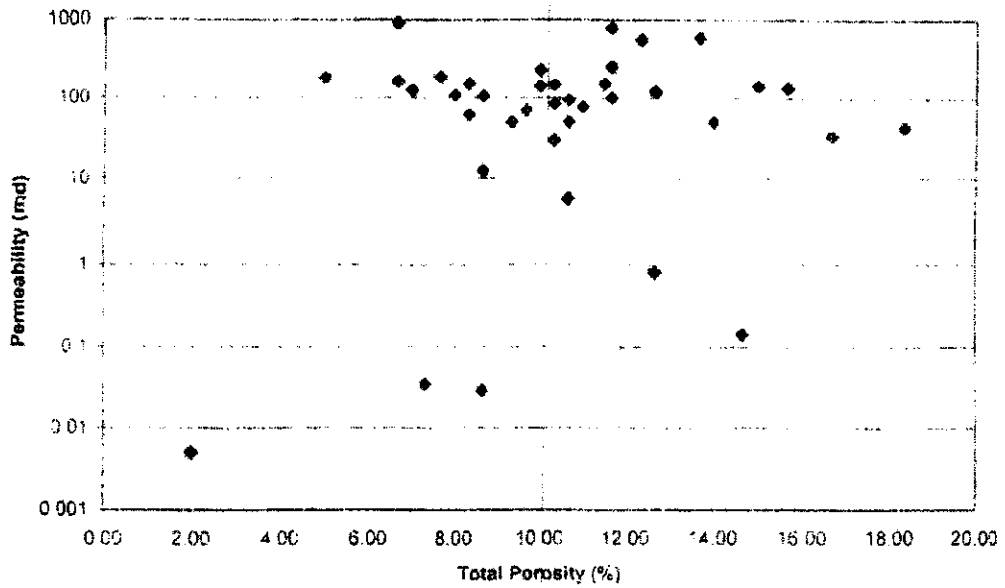
129-25581

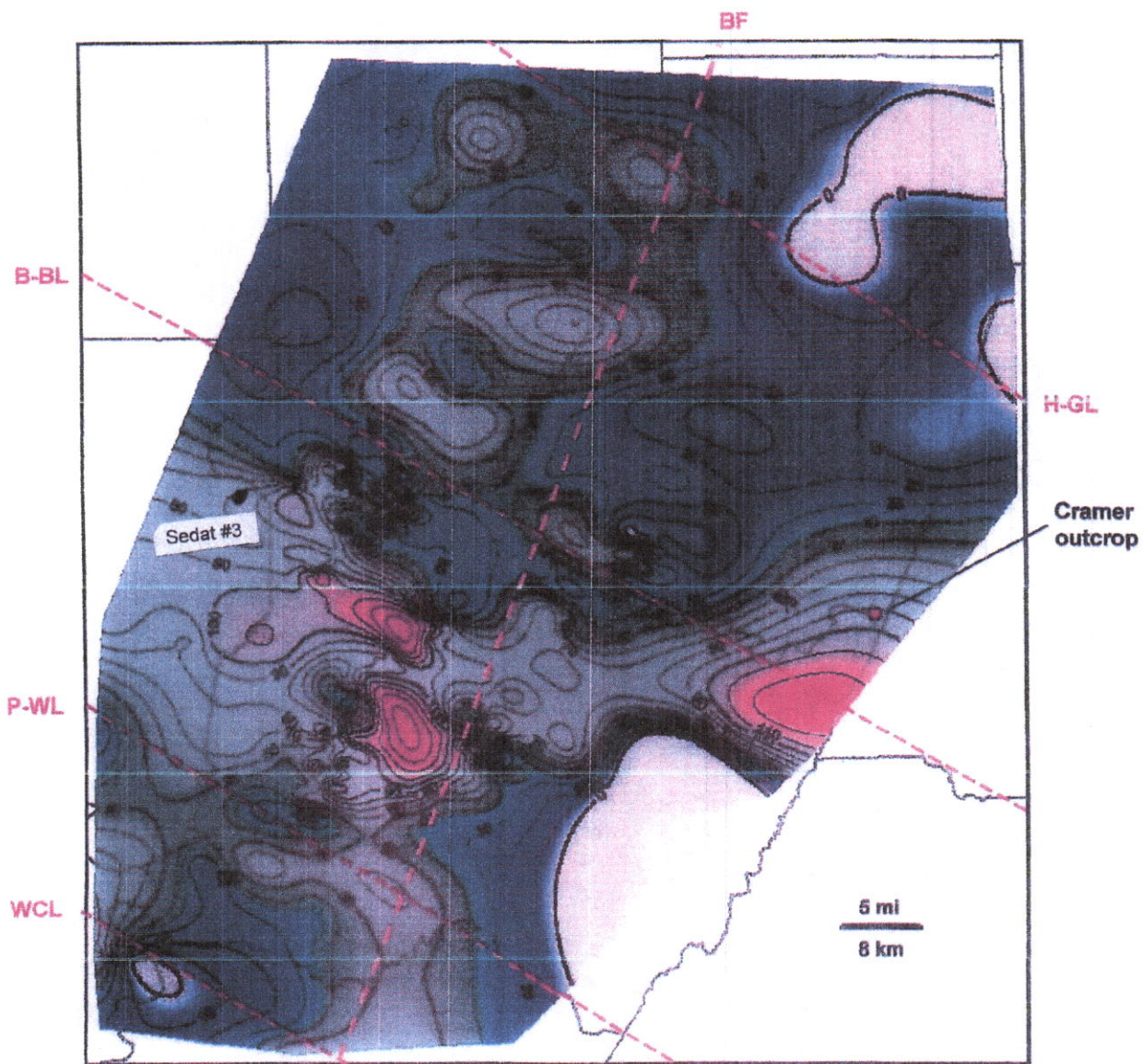


-- Permeability vs Depth



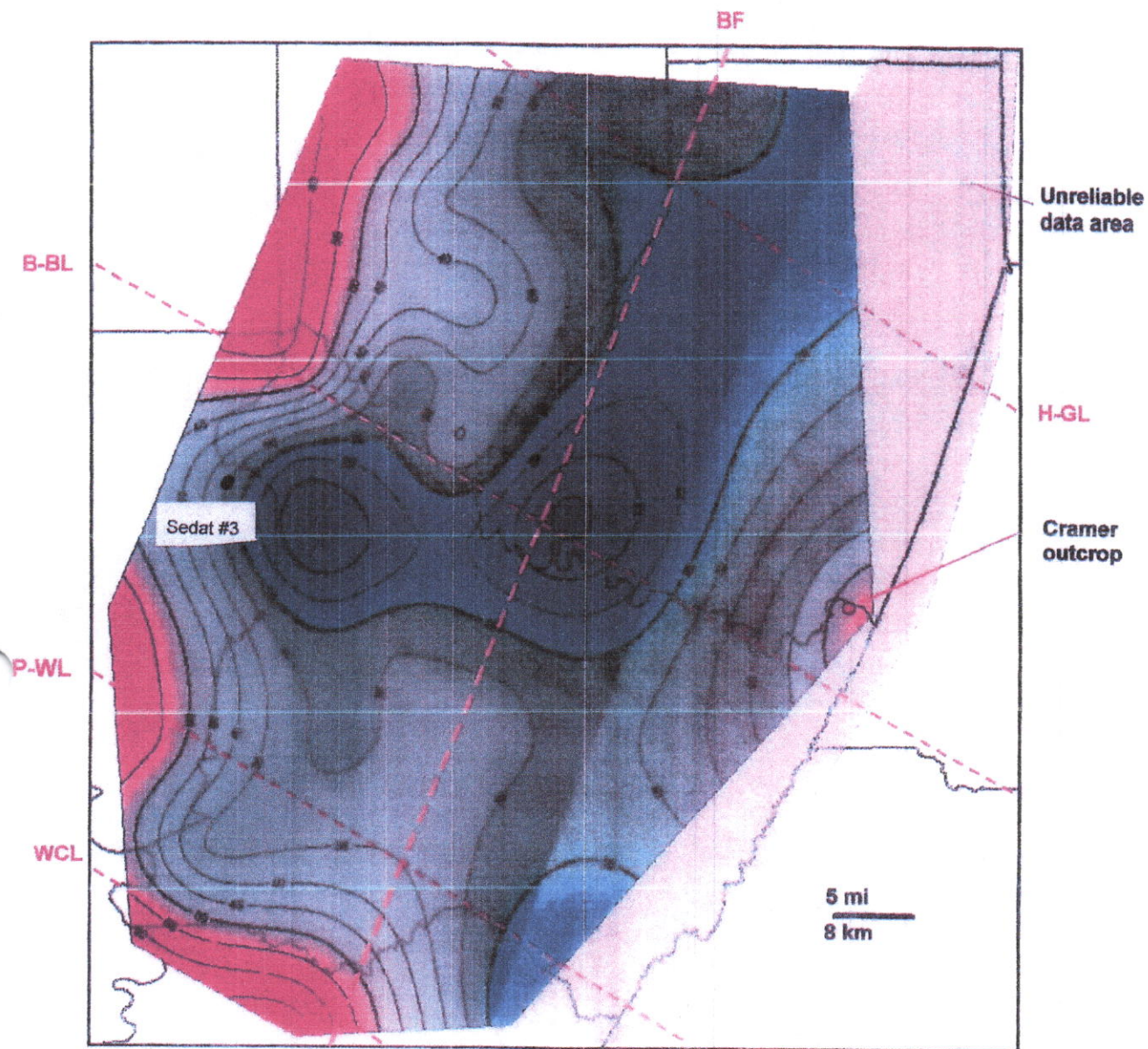
Total Porosity vs Permeability





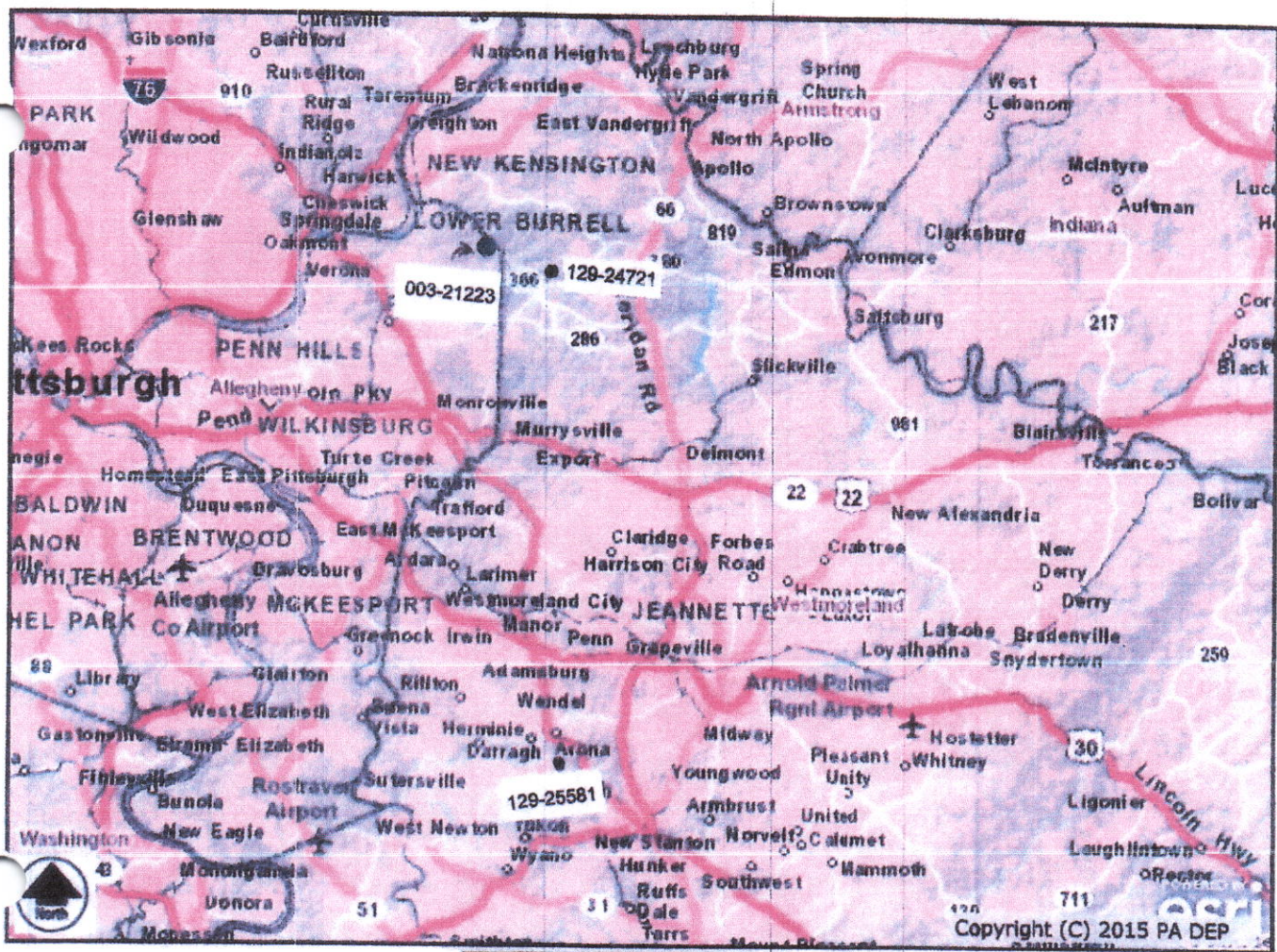
Map 3. Riddlesburg Shale Isopach Map

McDaniel, Bret, 2006. Subsurface Stratigraphy and Depositional Controls on Late Devonian-Early Mississippian Sediments in SW PA



Map 4. Riceville-Oswayo Shale Isopach Map

McDaniel, Bret, 2006. Subsurface Stratigraphy and Depositional Controls on Late Devonian-Early Mississippian Sediments in SW PA.



10 Miles

Legend

Unconventional Wells

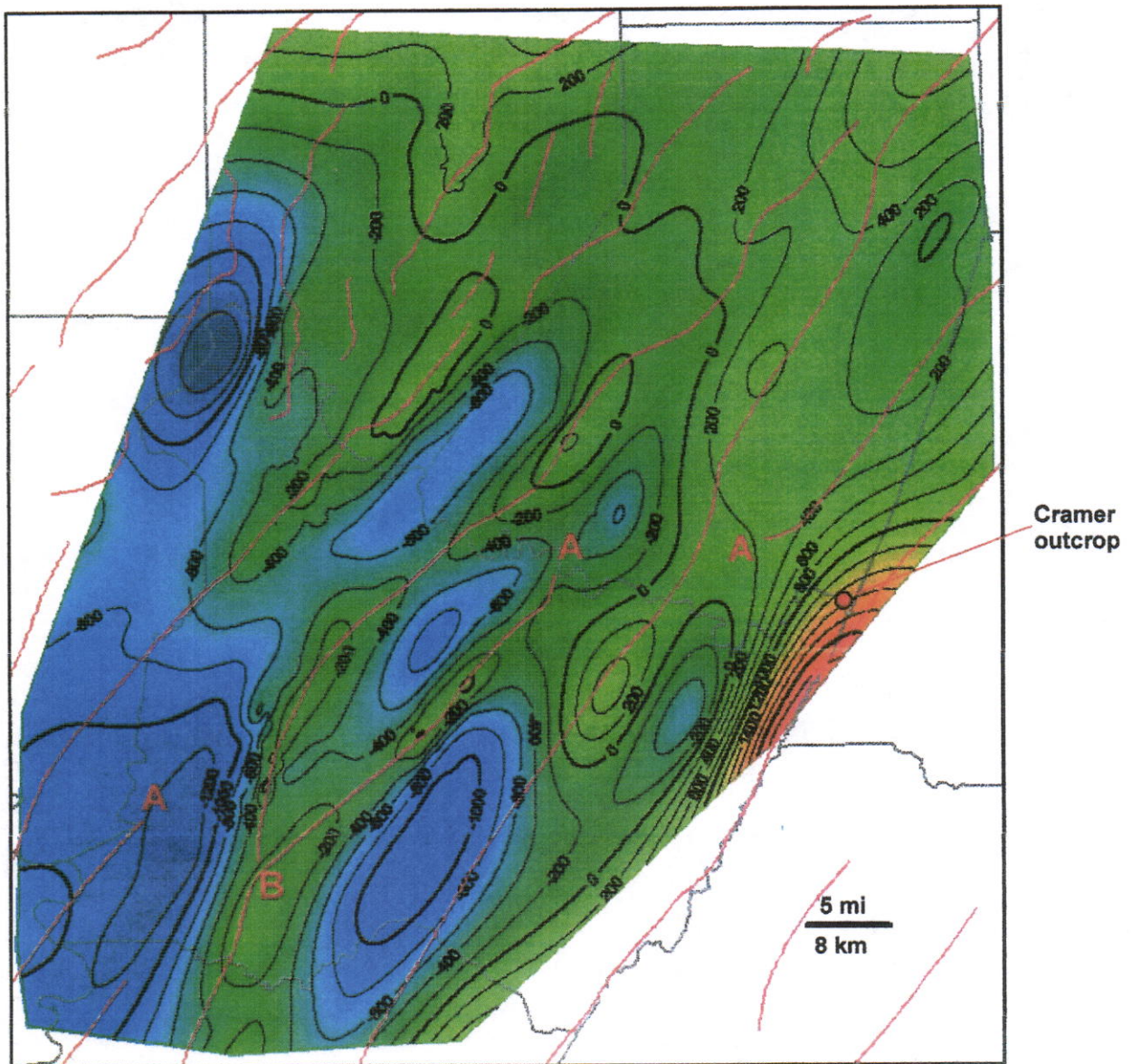


Conventional Wells



County Boundaries





Map 5. Structure Map on Top of Murrysville Sand
McDaniel, Bret, 2006, Subsurface Stratigraphic and Depositional Controls
on Late Devonian-Early Mississippian Sediments in SW PA

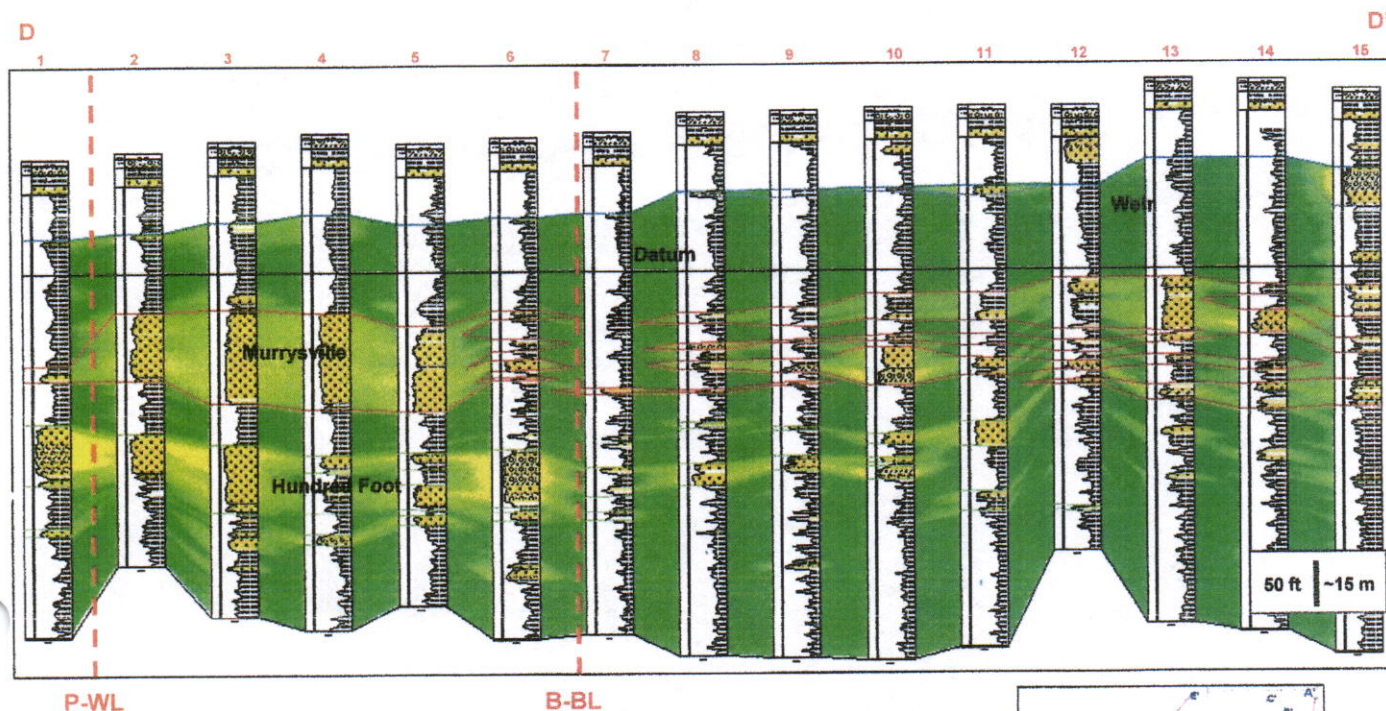
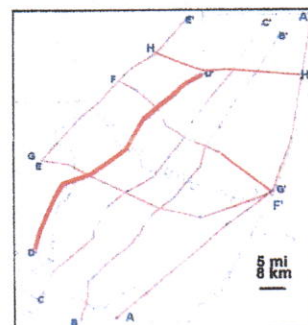


Figure 34. Cross section along D-D'. The most dramatic thinning occurs along this line as the Murrysville crosses the Blairsville-Broadtop Lineament (B-BL). Also evident is that there are two thick sequences of Murrysville, one thick and blocky in the southwest and another that lies to the northeast. It is unclear how this northeastern Murrysville relates to the blocky section to the south. One hypothesis may be that the north Murrysville may be nearshore deposits deposited north and south of the main channel the or perhaps these sandstones are abandoned delta lobes. The Weir is thin since it is far to the west of its depositional trend. The Hundred Foot becomes thick to the south, and it is here where the barrier bar sequence is best developed. See Figure 19 for the location of each numbered well.



Cross Section D-D'

McDaniel, Bret, 2006, Subsurface Stratigraphic and Depositional Controls on Late Devonian-Early Mississippian Sediments in SW PA

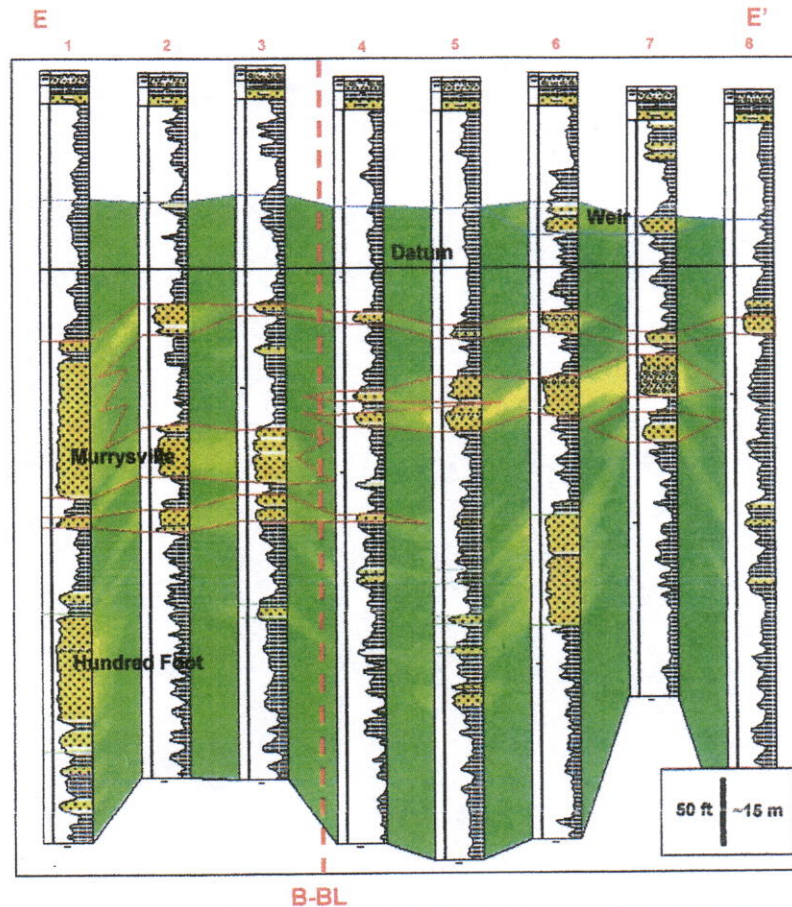
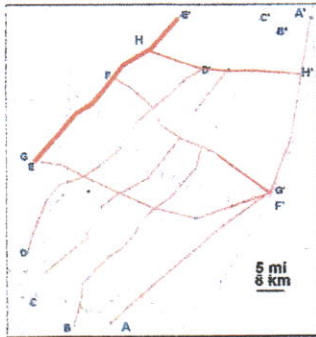


Figure 35. Cross-section along E-E'. This is the most erratic section in terms of correlative sand units. The data becomes difficult to interpret within this section, but there is still some evidence that the Blairsville-Broadtop Lineament (B-BL) may have had some influence on deposition of the Murrysville. The Weir sandstone is nearly gone this far west, with only a few intermittent sandstones. See Figure 19 for the location of each numbered well.

Cross Section E-E''

McDaniel, Bret, 2006, Subsurface Stratigraphic and Depositional Controls on Late Devonian-Early Mississippian Sediments in SW PA

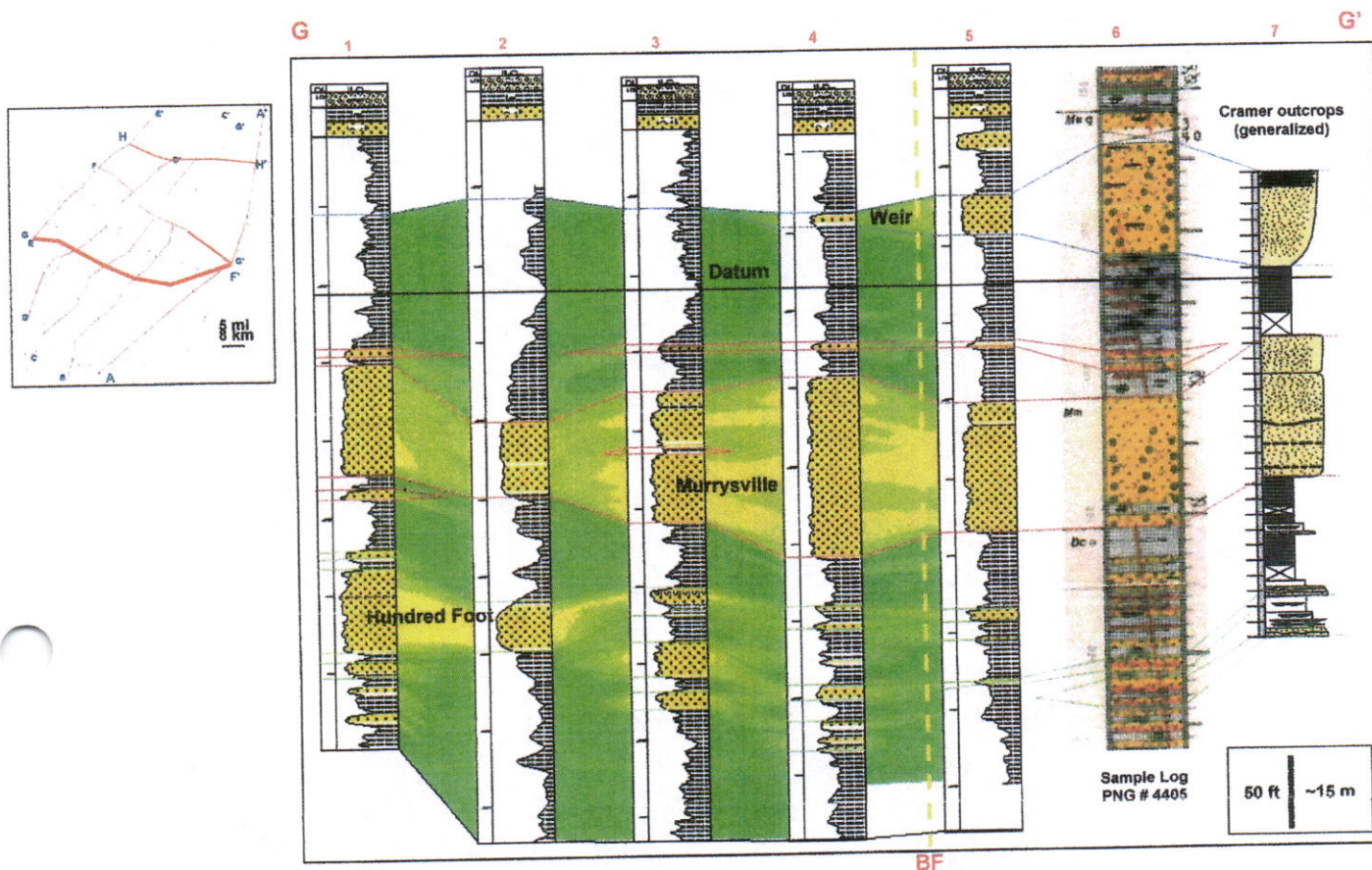


Figure 37. Cross section along G-G' section. This section attempts to tie the well log section to the outcrop data along the major Murrysville trend. Three things are evident from the section. (1) The Weir dramatically thins to the west across the proposed basement fault. (2) The Murrysville displays a thickened section to the west of the basement fault. (3) The Hundred Foot thins eastward as it reaches the basement fault. See Figure 19 for the location of each numbered well.

Cross Section G-G'

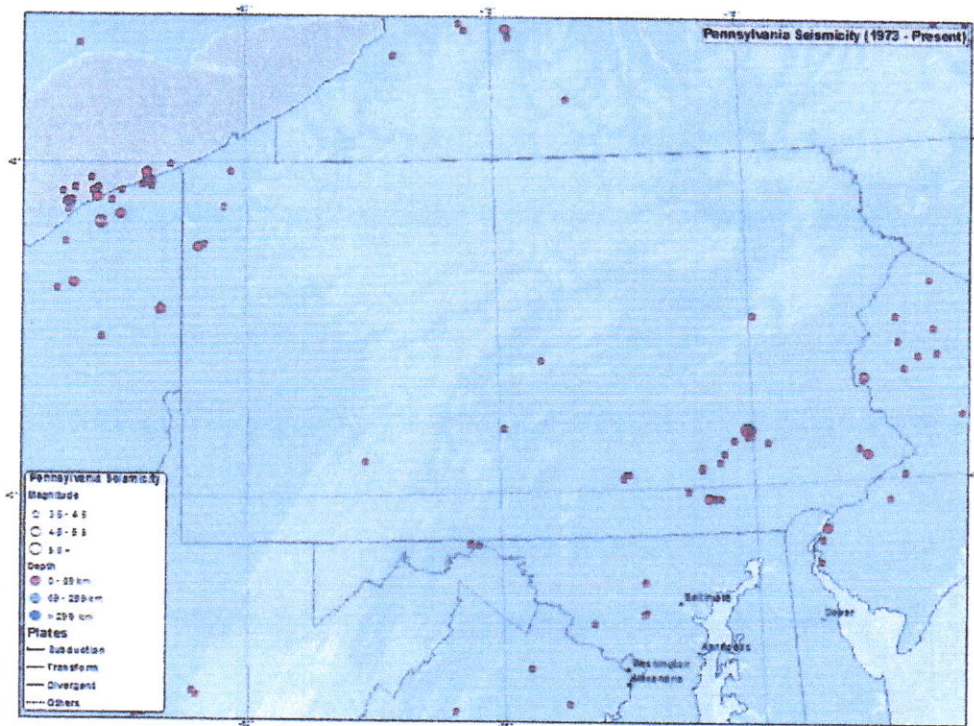
McDaniel, Bret, 2006, Subsurface Stratigraphic and Depositional Controls on Late Devonian-Early Mississippian Sediments in SW PA



Earthquake Hazards Program

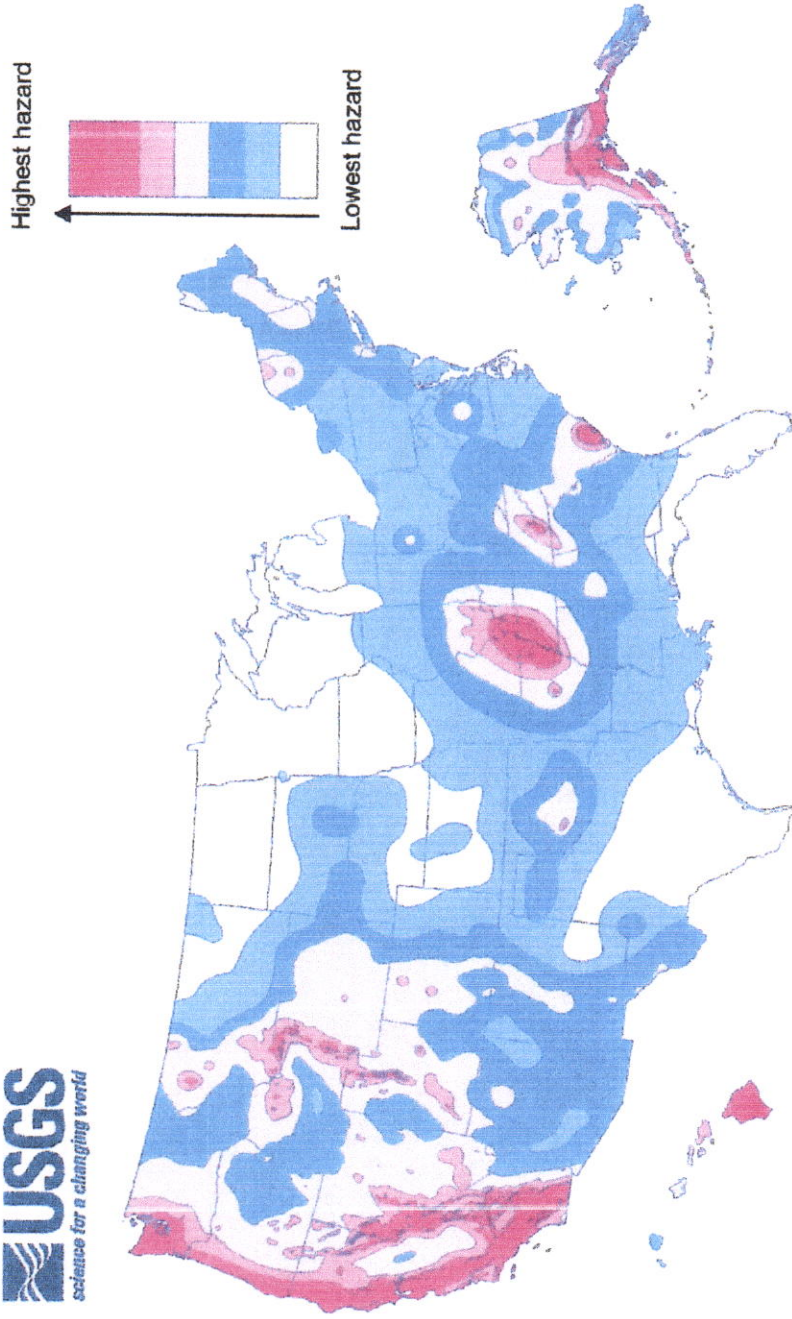
Pennsylvania

Seismicity Map - 1973 to March 2012



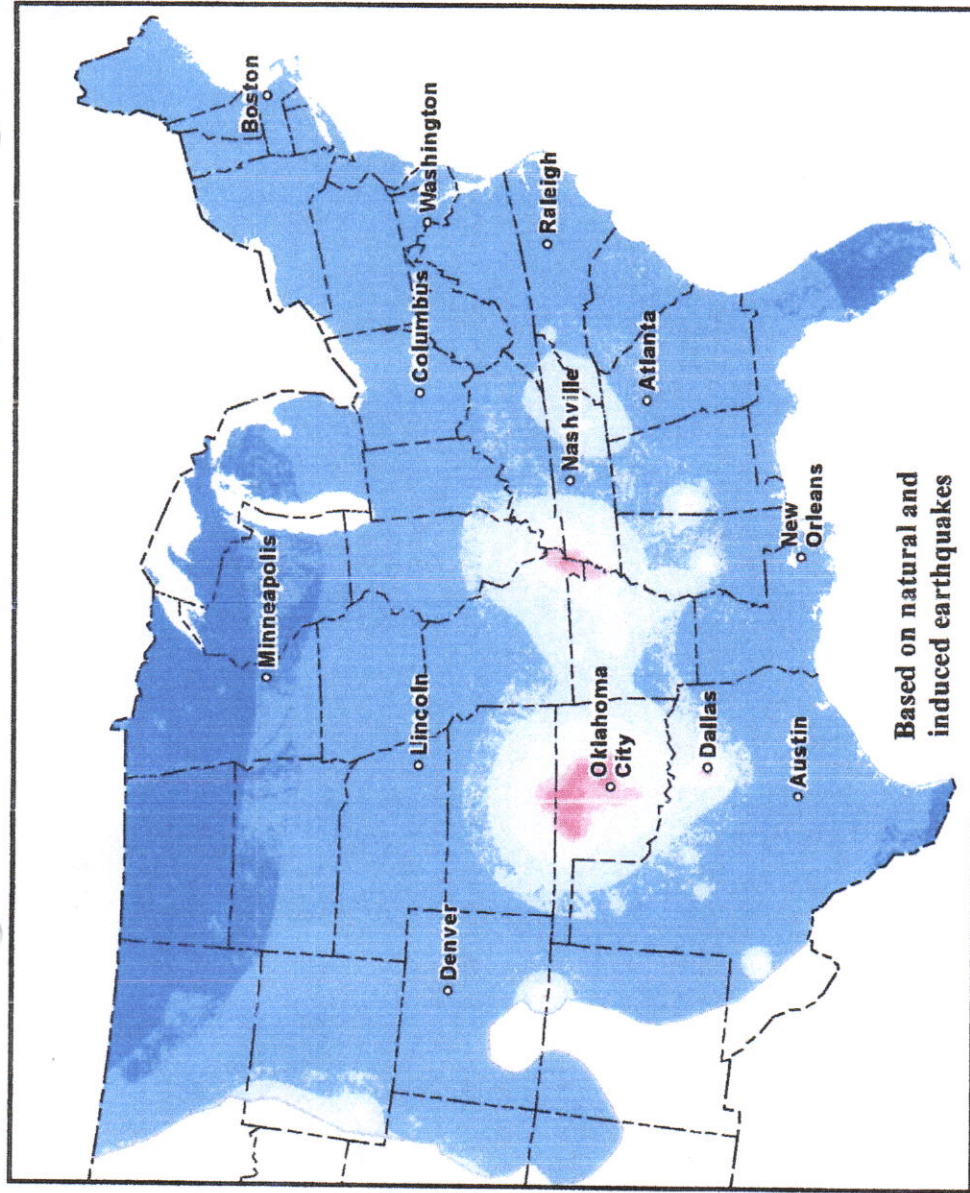
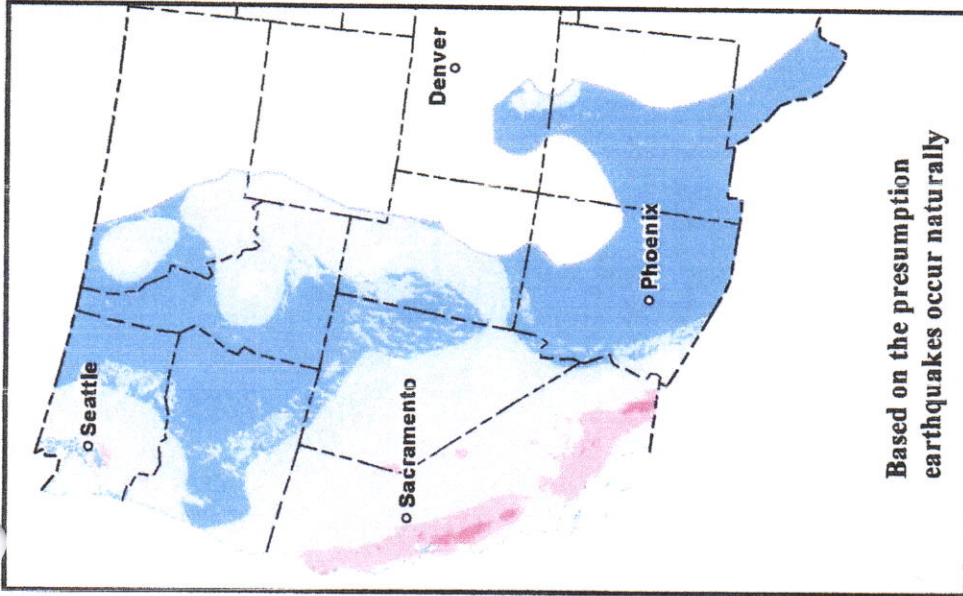
Share this page: [Facebook](#) [Twitter](#) [Google](#) [Email](#)

Earthquake Map 1



Earthquake Map 2

JSGS Forecast for Ground Shaking Intensity from Natural and Induced Earthquakes in 2000



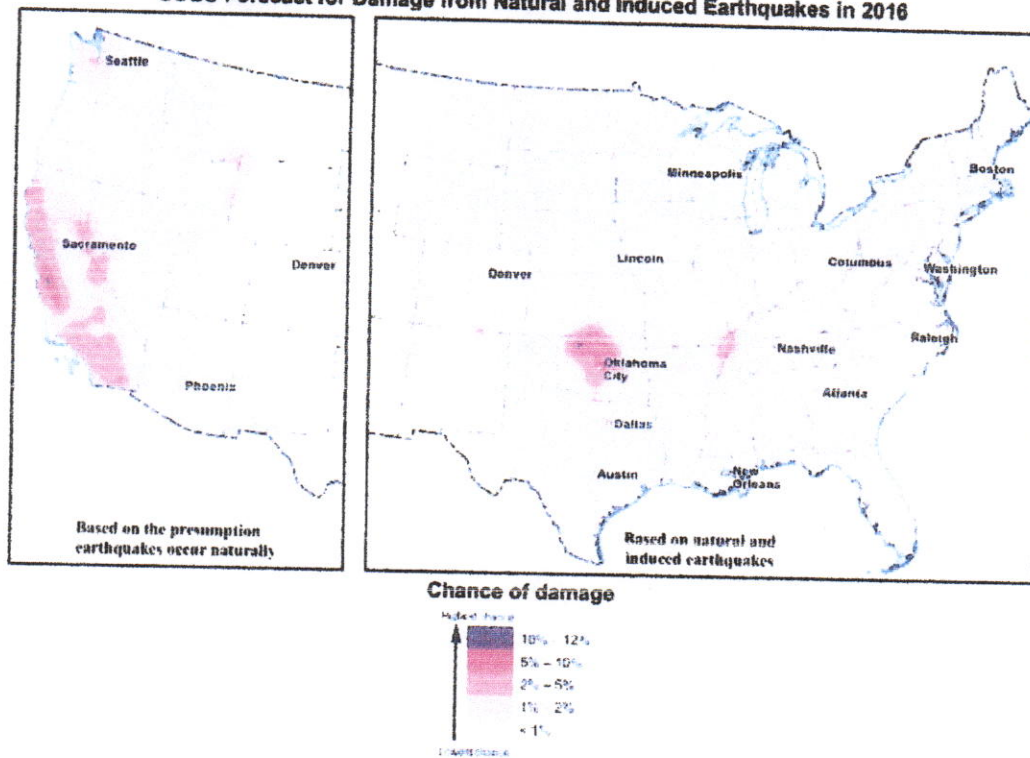
Modified Mercalli Intensity

VIII+	Shaking severe, heavier damage
VII	Shaking very strong, moderate damage
VI	Shaking strong, felt by all, minor damage
V	Shaking moderate, felt indoors by most, outdoors by many
IV	Shaking light, felt indoors by many, outdoors by few
III	Shaking weak, felt indoors by several

Earthquake Map 3

USGS map displaying intensity of potential ground shaking from natural and human-induced earthquakes. There is a small chance (one percent) that ground shaking intensity will occur at this level or higher. There is a greater chance (99 percent) that ground shaking will be lower than what is displayed in these maps.

USGS Forecast for Damage from Natural and Induced Earthquakes in 2016



USGS map displaying potential to experience damage from natural or human-induced earthquakes in 2016. Chances range from less than 1 percent to 12 percent.

USGS map displaying potential to experience damage from a natural or human-induced earthquake in 2016. Chances range from less than one percent to 12 percent.

Six States Face the Highest Hazards

The most significant hazards from induced seismicity are in six states, listed in order from highest to lowest potential hazard: Oklahoma, Kansas, Texas, Colorado, New Mexico and Arkansas. Oklahoma and Texas have the largest populations exposed to induced earthquakes.

"In the past five years, the USGS has documented high shaking and damage in areas of these six states, mostly from induced earthquakes," said Petersen. "Furthermore, the [USGS Did You Feel It?](#) website has archived tens of thousands of reports from the public who experienced shaking in those states, including about 1,500 reports of strong shaking or damage."

In developing this new product, USGS scientists identified 21 areas with increased rates of induced seismicity. Induced earthquakes have occurred within small areas of Alabama and Ohio but a recent decrease in induced earthquake activity has resulted in a lower hazard forecast in these states for the next year. In other areas of Alabama and small parts of Mississippi, there has been an increase in activity, and scientists are still investigating whether those events were induced or natural.

People living in areas of higher earthquake hazard should learn how to be prepared for earthquakes, and guidance can be found through [FEMA's Ready Campaign](#).

Earthquake Map 4



Natural Gas

Seismicity in Pennsylvania and the Pennsylvania State Seismic Network

Dr. Andrew Nyblade, Dept. of Geosciences, Penn State, discusses the research on seismic activity as part of a DCNR and DEP monitoring program

Time Log:

00:00 Introduction

03:41 Earthquake primer and review of seismicity in PA

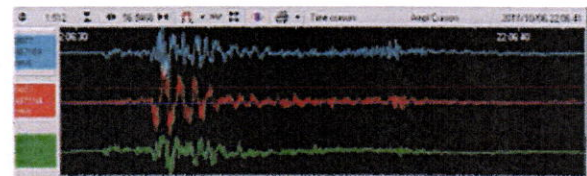
14:29 Review of building the PA Seismic network

20:56 Seismicity in PA 2013-2014

35:01 More on building PASEIS

42:54 Lawrence County Earthquakes

47:30 Q & A



www.dcnr.state.pa.us

[Seismicity in Pennsylvania and the Pennsylvania State Seismic Network powerpoint](#)
PDF, 5.5 MB

[Recorded Webinar - Seismicity in Pennsylvania and the Pennsylvania State Seismic Network](#)

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Seismicity in Pennsylvania and the Pennsylvania State Seismic Network (PASEIS)

Andy Nyblade

Department of Geosciences, Penn State University

May 19, 2016



PennState



pennsylvania
DEPARTMENT OF CONSERVATION
AND NATURAL RESOURCES



pennsylvania
DEPARTMENT OF ENVIRONMENTAL
PROTECTION

Introduction

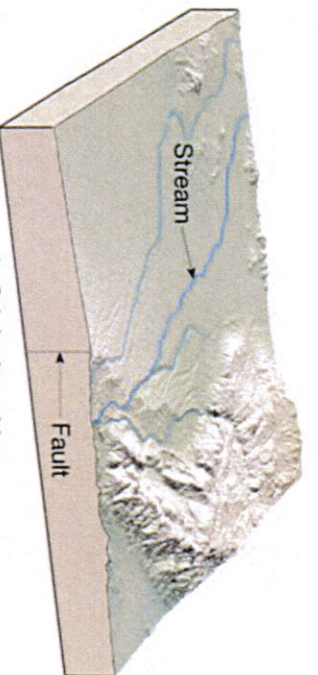
- Earthquake primer
- Review of seismicity in PA
- Review of seismic networks in PA
- Building the Pennsylvania State Network (PASEIS)
- Seismicity in Pennsylvania 2013-2014
- More on building PASEIS
- April 25, 2016 Lawrence County earthquakes

(

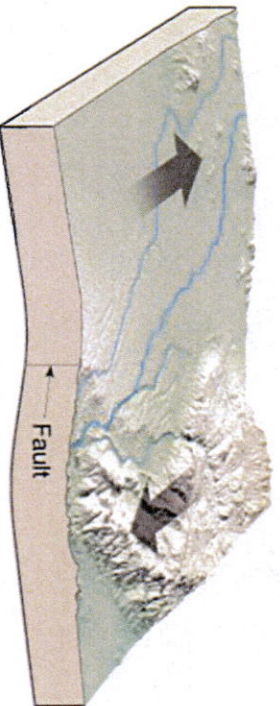
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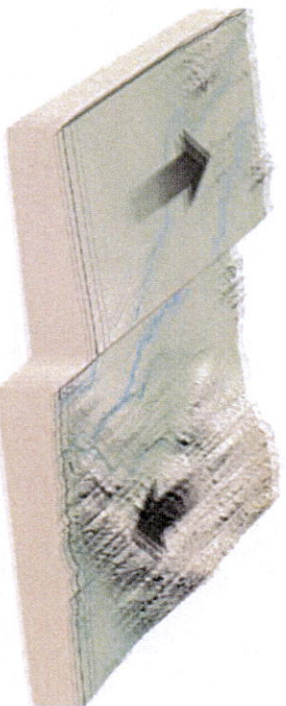
Deformation of rocks



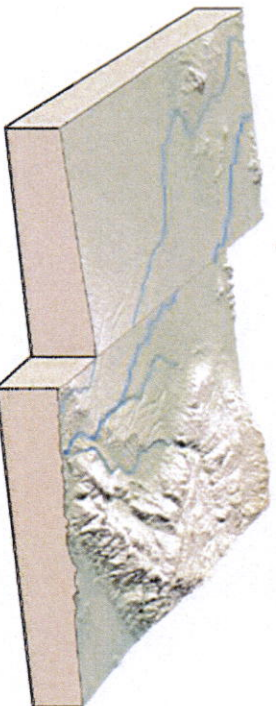
A. Original position



B. Buildup of strain

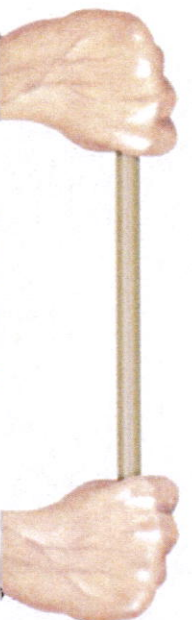


C. Slippage (earthquake)

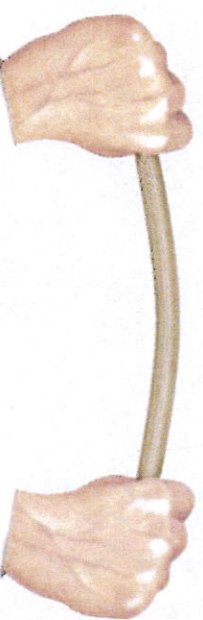


D. Strain released

Deformation of a limber stick



A. Original position



B. Buildup of strain

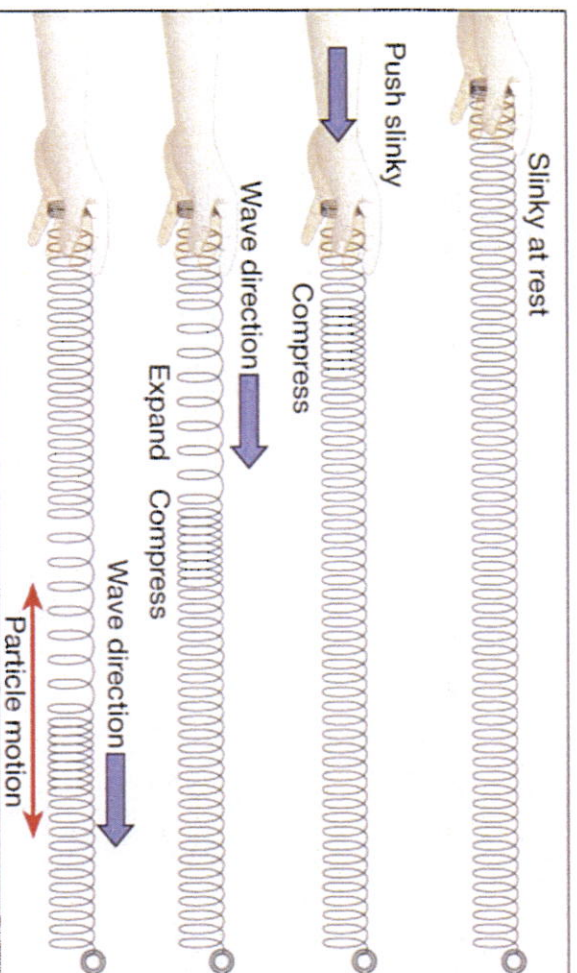


C. Rupture

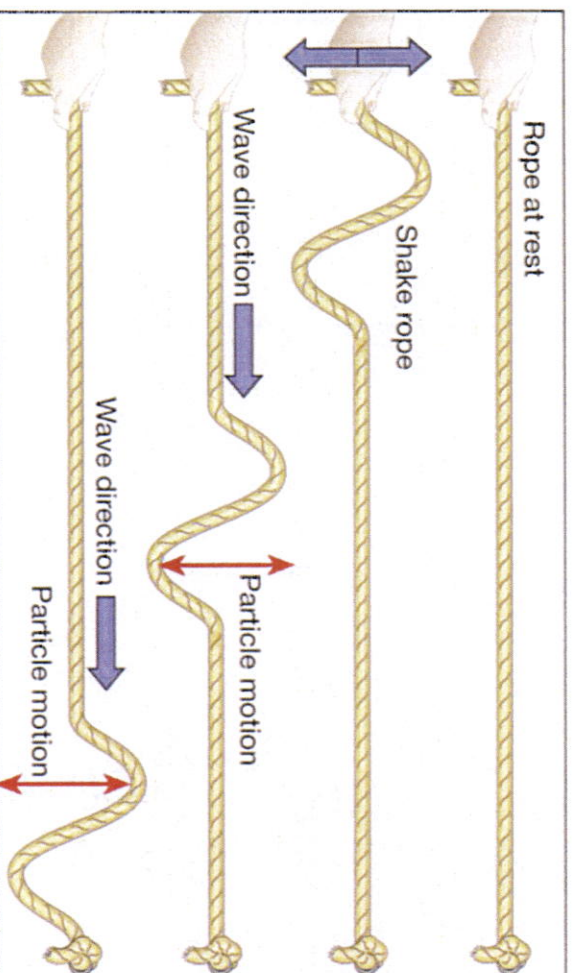


D. Strain released

Body Waves:

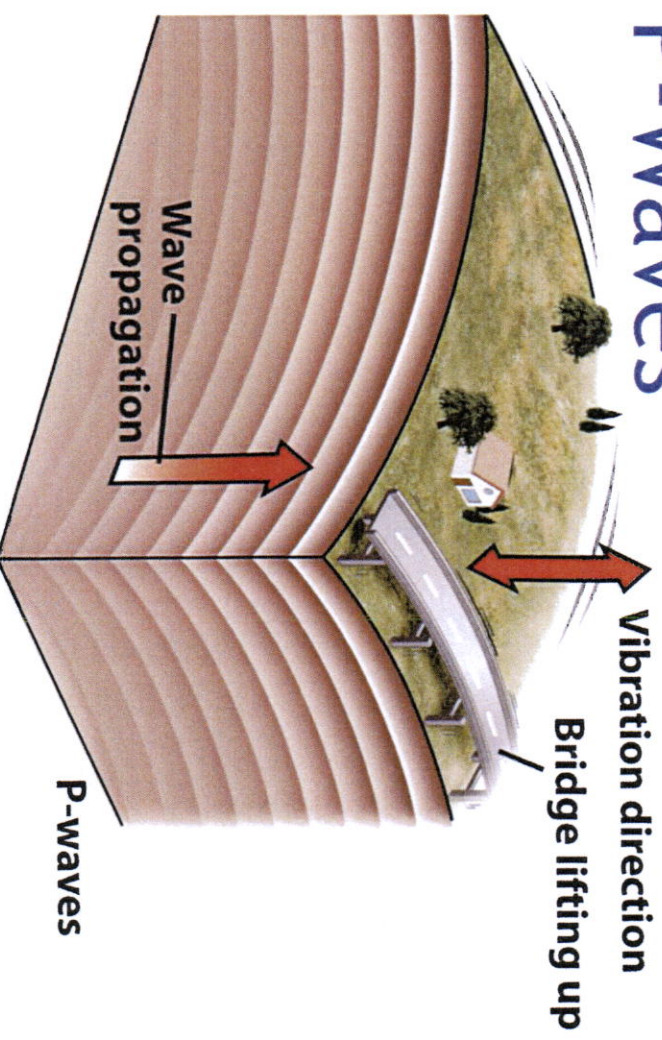


A. P waves generated using a slinky

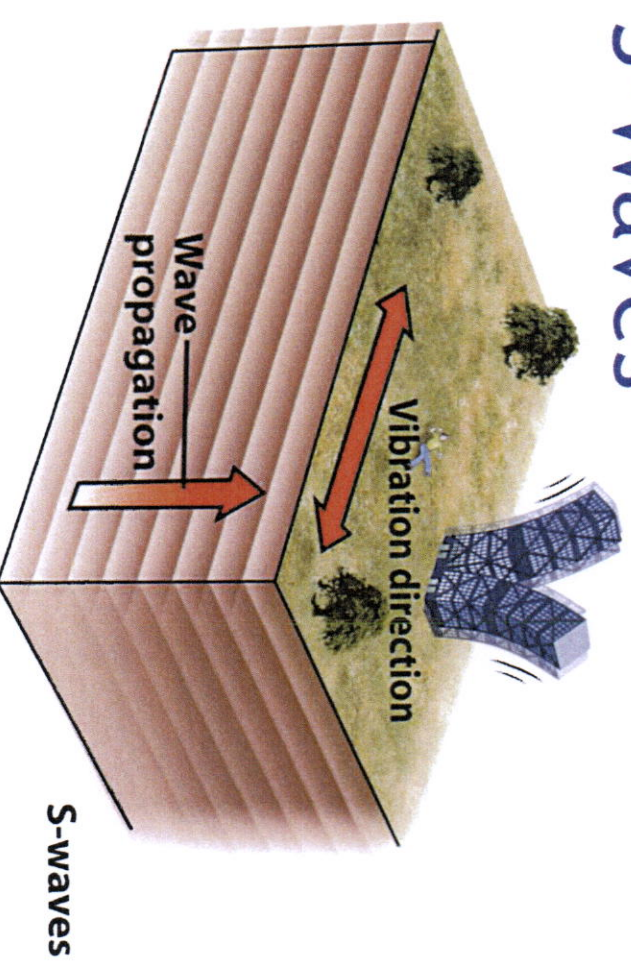


C. S waves generated using a rope

P-Waves

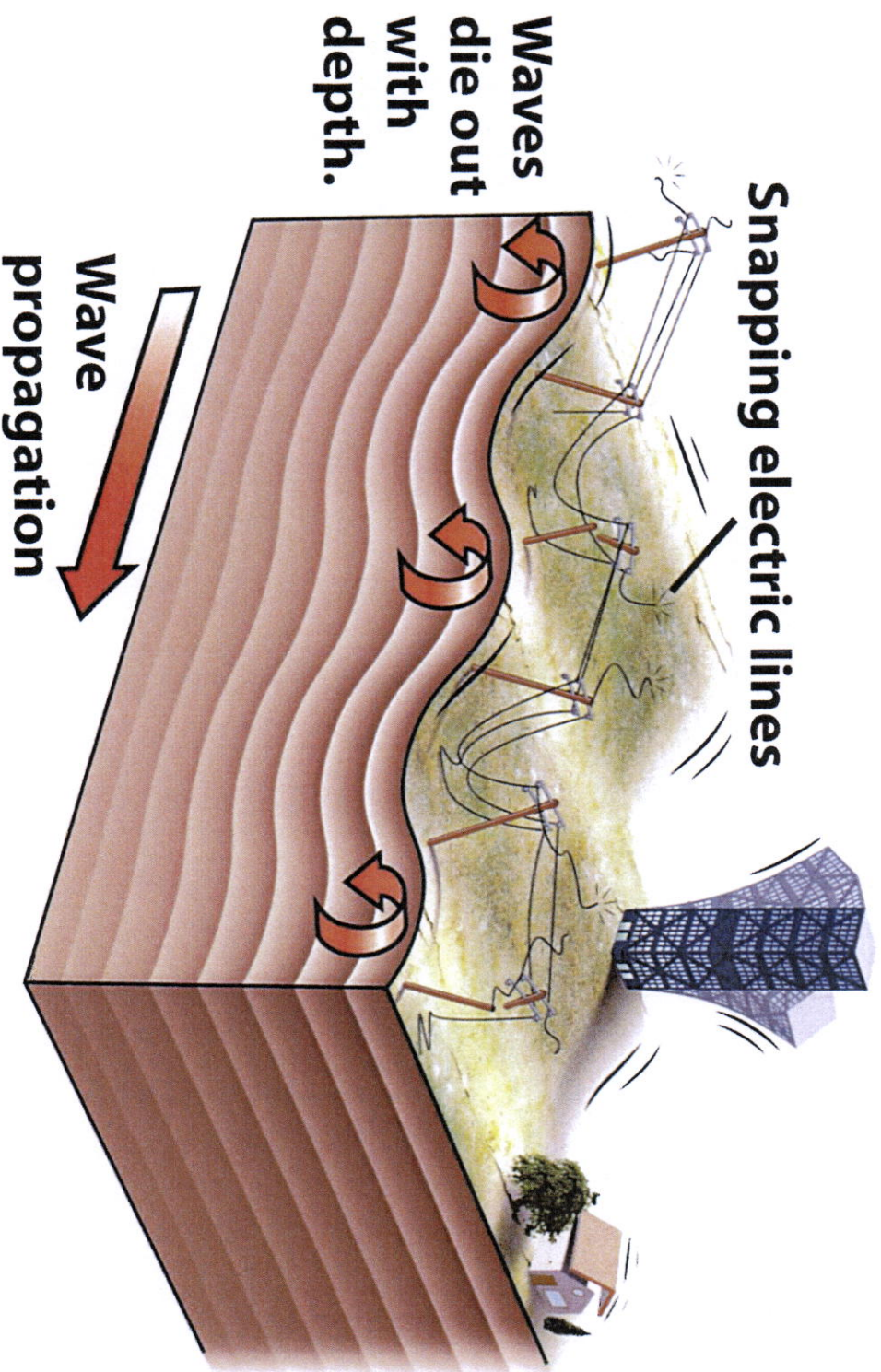


S-Waves

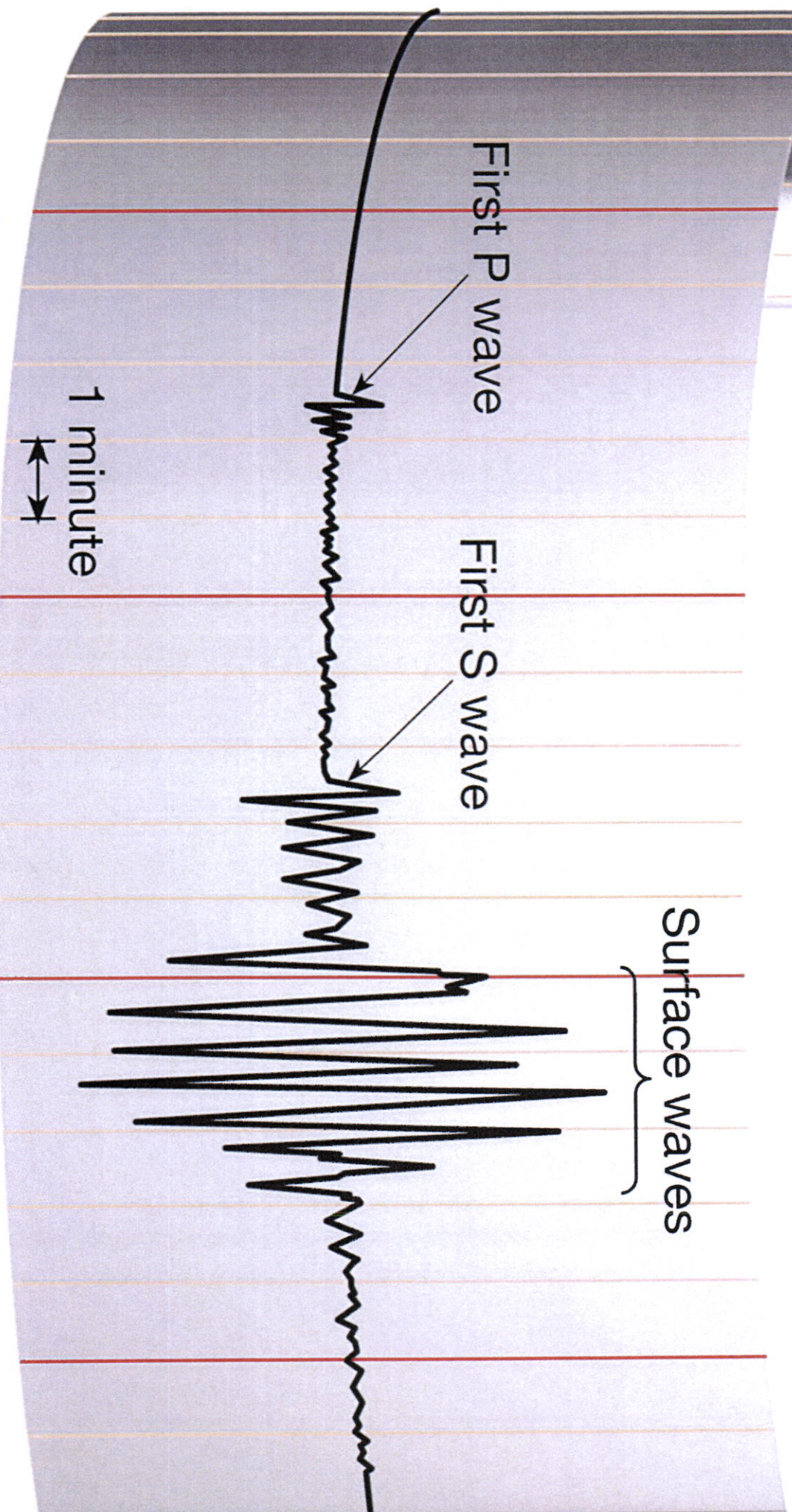


S-waves

Surface Waves:



Seismogram

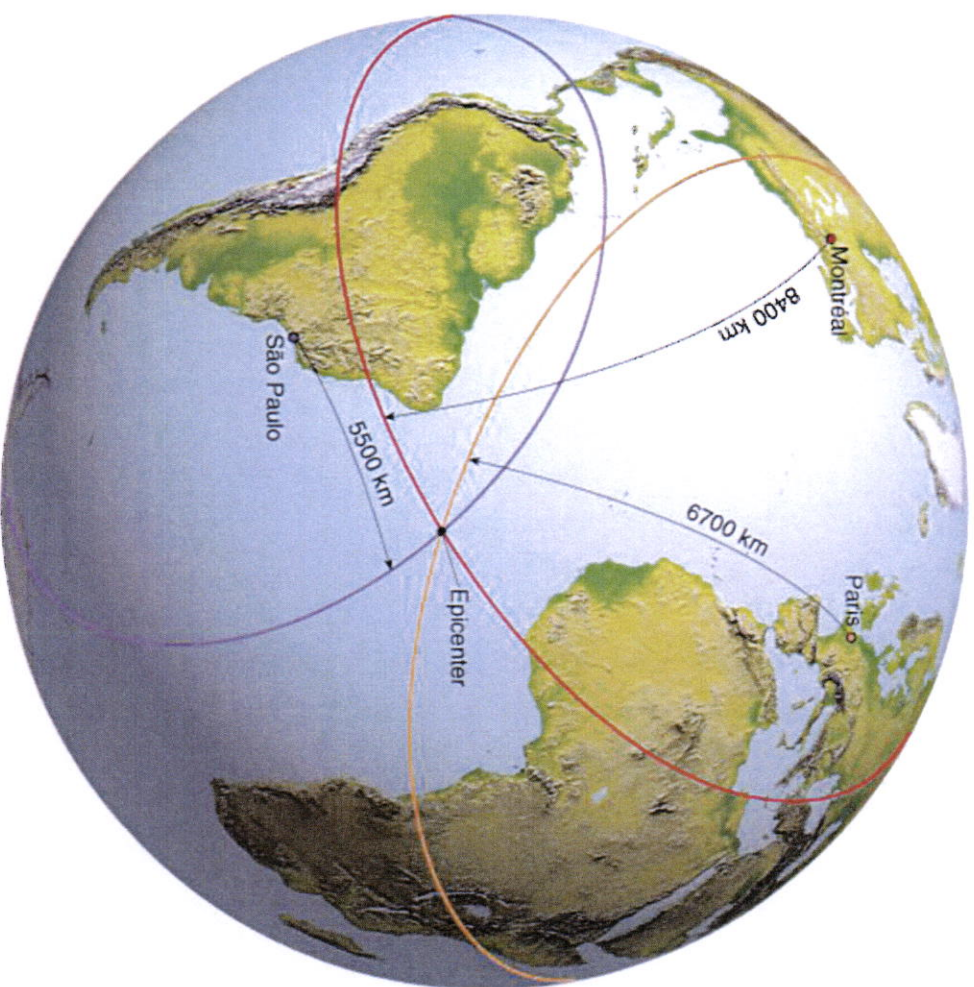
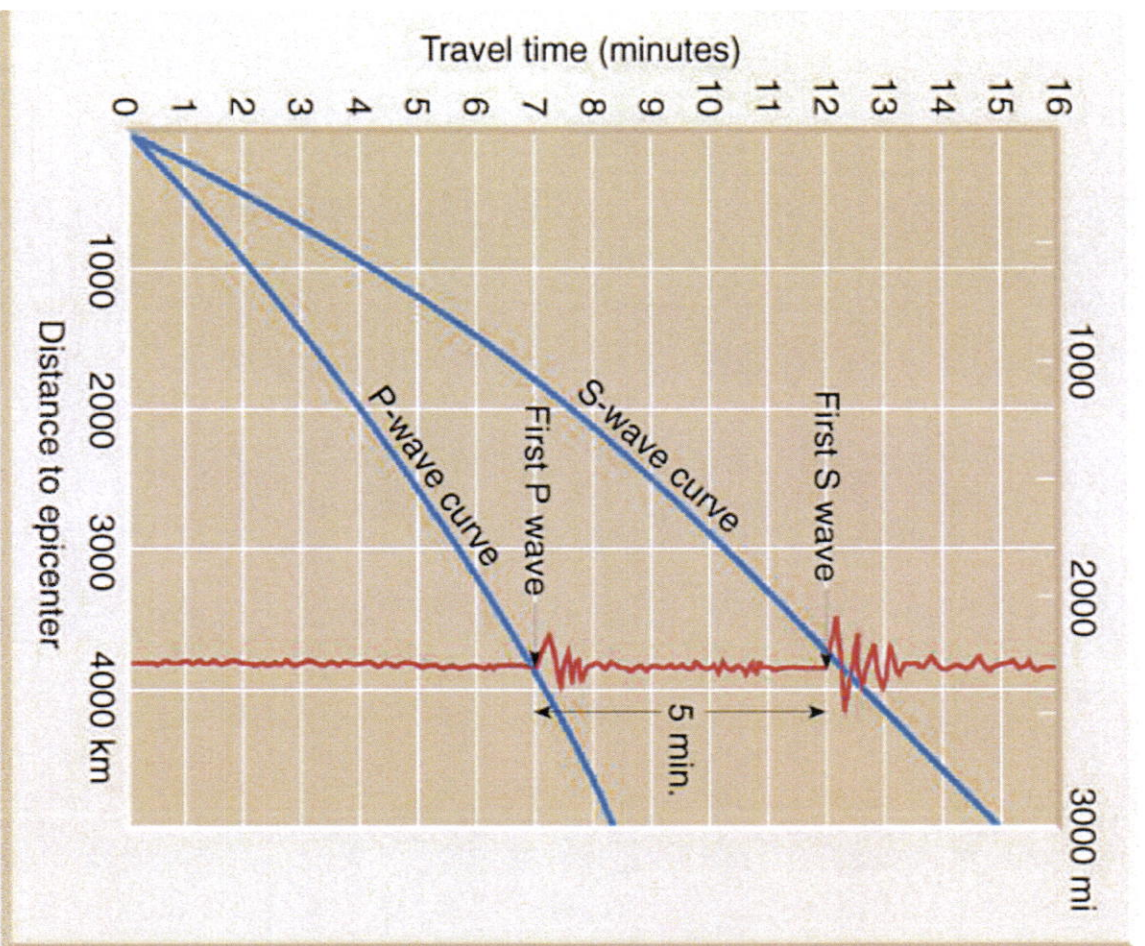


(Earlier)

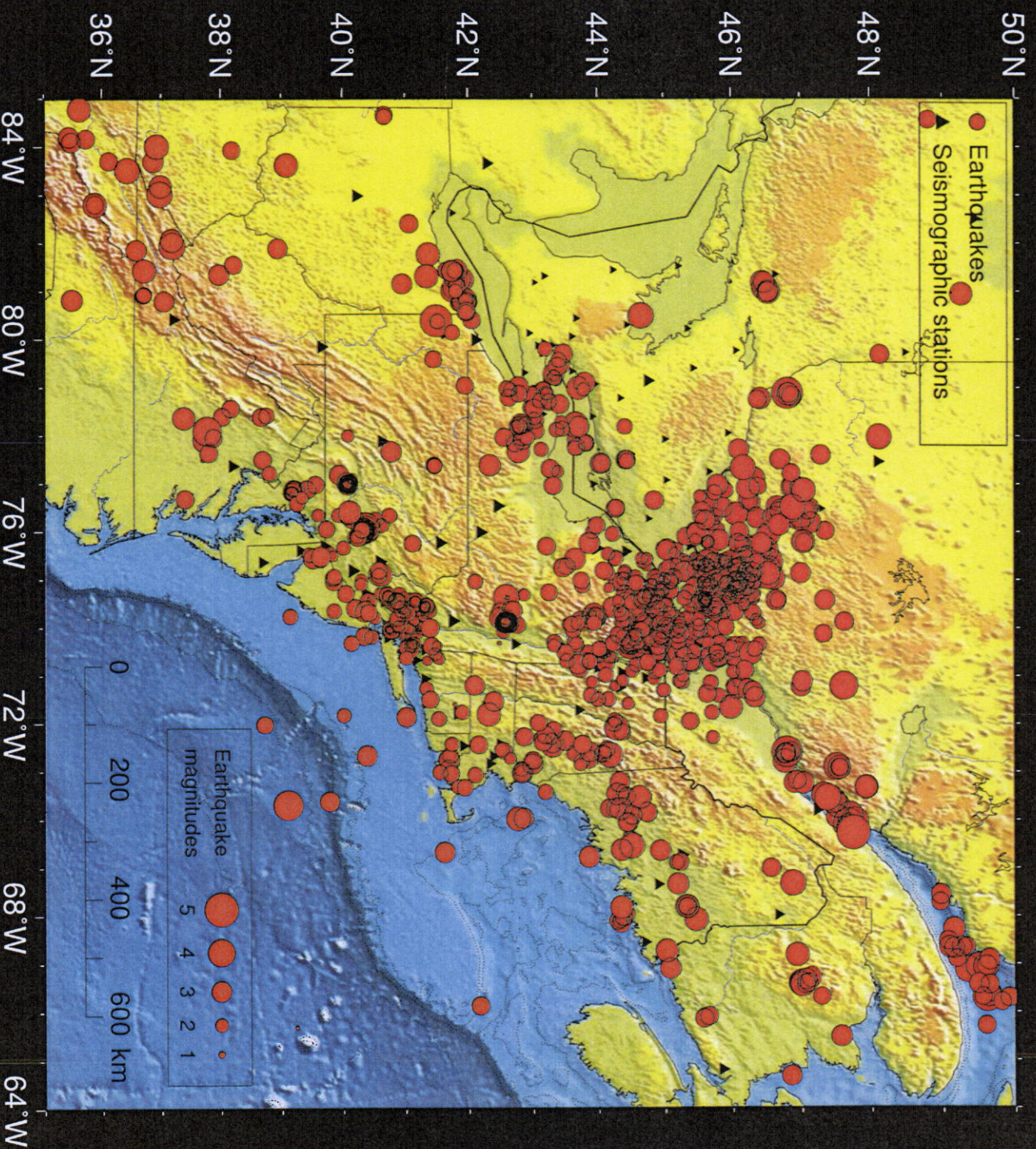
T I M E

(Later)

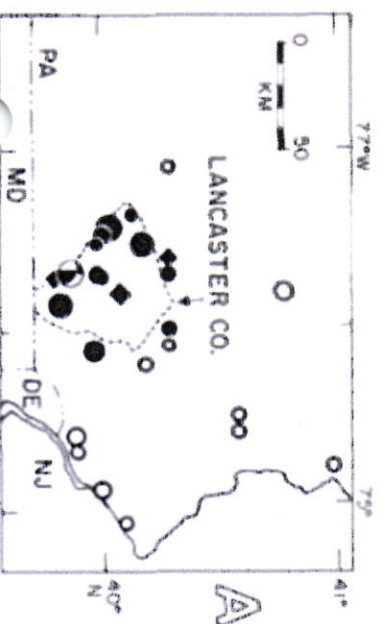
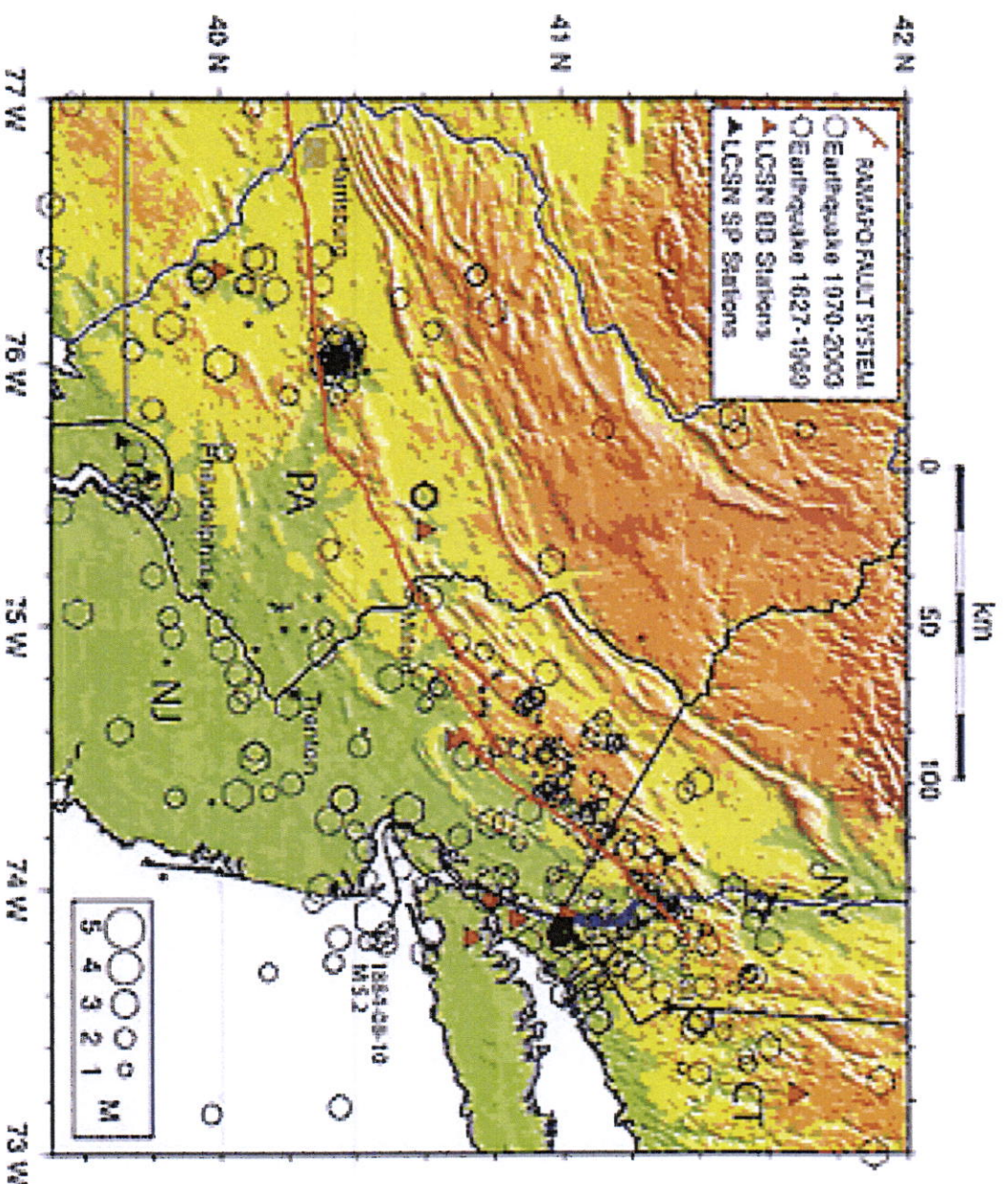
Earthquake Location



Earthquakes in NE United States and Canada 1990 - 2010

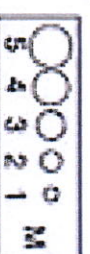


Earthquake locations by the Lamont Cooperative Seismographic Network, US Geological Survey and the Geological Survey of Canada.
June 2010, Won-Young Kim, Lamont-Doherty Earth Observatory of Columbia University, <www.ldeo.columbia.edu/LCSN>



LANCASTER SEISMIC ZONE

- MAG
2 3 4
● ○ ○
● ● ●
● ● ●
- EPICENTERS FROM:
STOVER ET AL., 1981
DEWEY & GORDON, 1984
ARMBRUSTER & SEEBER



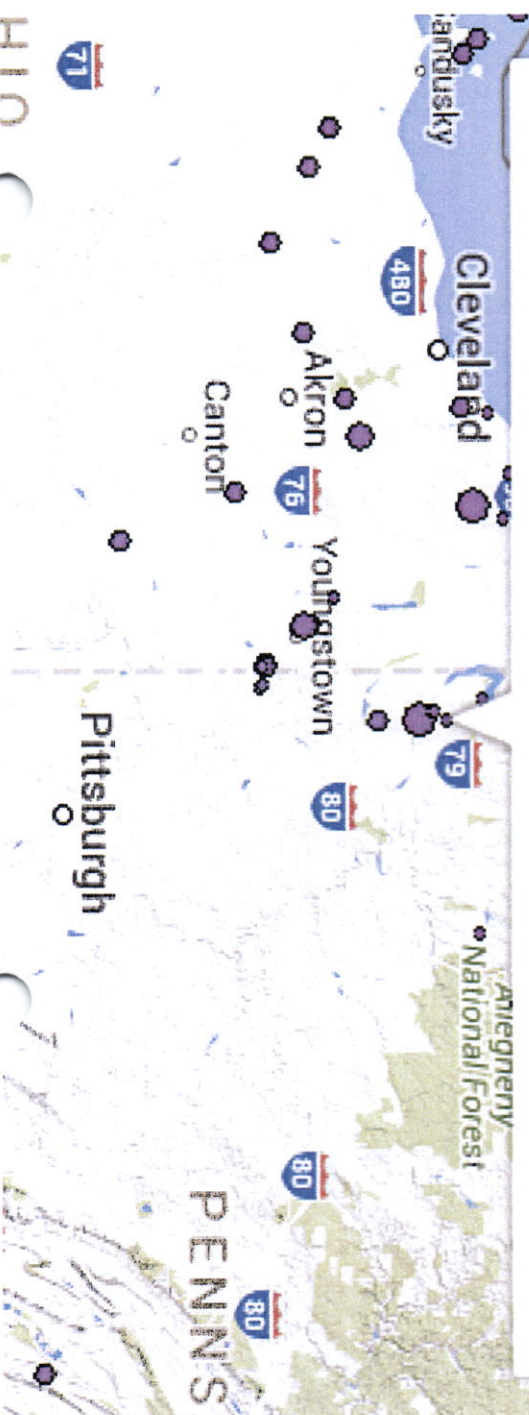
[www.earthinstitute.columbia.edu/
news/2004/story04-30-04b.html](http://www.earthinstitute.columbia.edu/news/2004/story04-30-04b.html)

Armbruster and Seeber
(1987)

IRIS Earthquake Browser

Mag	Depth km	Day	Time UTC	Lat	Lon	Dist km
4.8	5	1998-09-25	19:52:51	41.44	-80.34	0
2.3	5	2008-07-21	01:41:30	41.47	-80.37	3
2.2	5	2014-02-09	22:34:05	41.48	-80.37	4
2.2	5	2010-12-10	21:26:32	41.51	-80.33	7
3.2	18	1985-04-14	11:39:49	41.33	-80.34	13
2.2	5	2005-04-20	21:36:09	41.62	-80.41	20
2	5	2005-02-10	04:39:15	41.68	-80.32	26
2.1	5	2007-01-03	09:08:31	41.73	-80.17	34
2.5	5	2011-09-30	00:52:38	41.14	-80.68	44
4	5	2011-12-31	20:05:01	41.12	-80.68	46

Closest 10 quakes shown. [Zoom to this vicinity](#)



IRIS=Incorporated
Research Institutions
for Seismology
(www.iris.edu)

Sept. 25, 1998
Pymatuning, PA
earthquake
(Mag. 5.2)

IRIS Earthquake Browser

Mag	Depth km	Day	Time UTC	Lat	Lon	Dist km
3	1	1991-08-15	07:16:07	40.79	-77.65	0
2.5	0	1991-04-17	17:42:39	40.39	-77.95	51
2.8	0	2010-01-21	20:18:34	41.42	-77.37	73
2.6	0	2009-09-10	19:51:31	41.48	-77.37	80
2.1	0	2003-01-16	20:37:28	41.54	-77.33	87
2.1	1	2008-12-31	05:34:08	40.11	-77	93
1.7	5	2008-10-19	09:17:34	40.1	-77.01	94
2.8	0.5	2009-10-25	11:21:57	40.09	-77	95
1.3	1	2009-05-11	05:18:23	40.09	-77	95
2.6	0.5	2009-10-25	11:16:13	40.09	-77	95

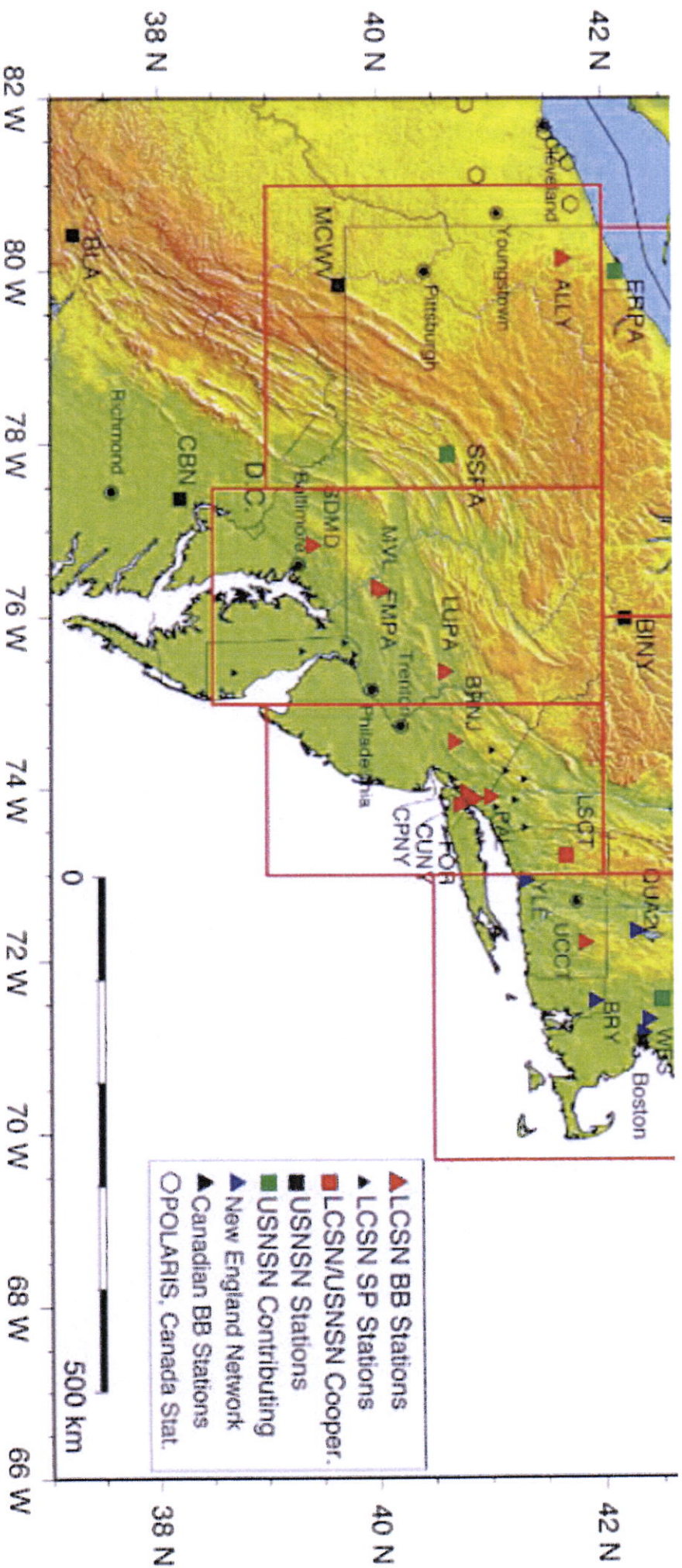
Closest 10 quakes shown. [Zoom to this vicinity](#)

Aug. 15, 1991
Centre Hall
earthquake
(Mag. 3)

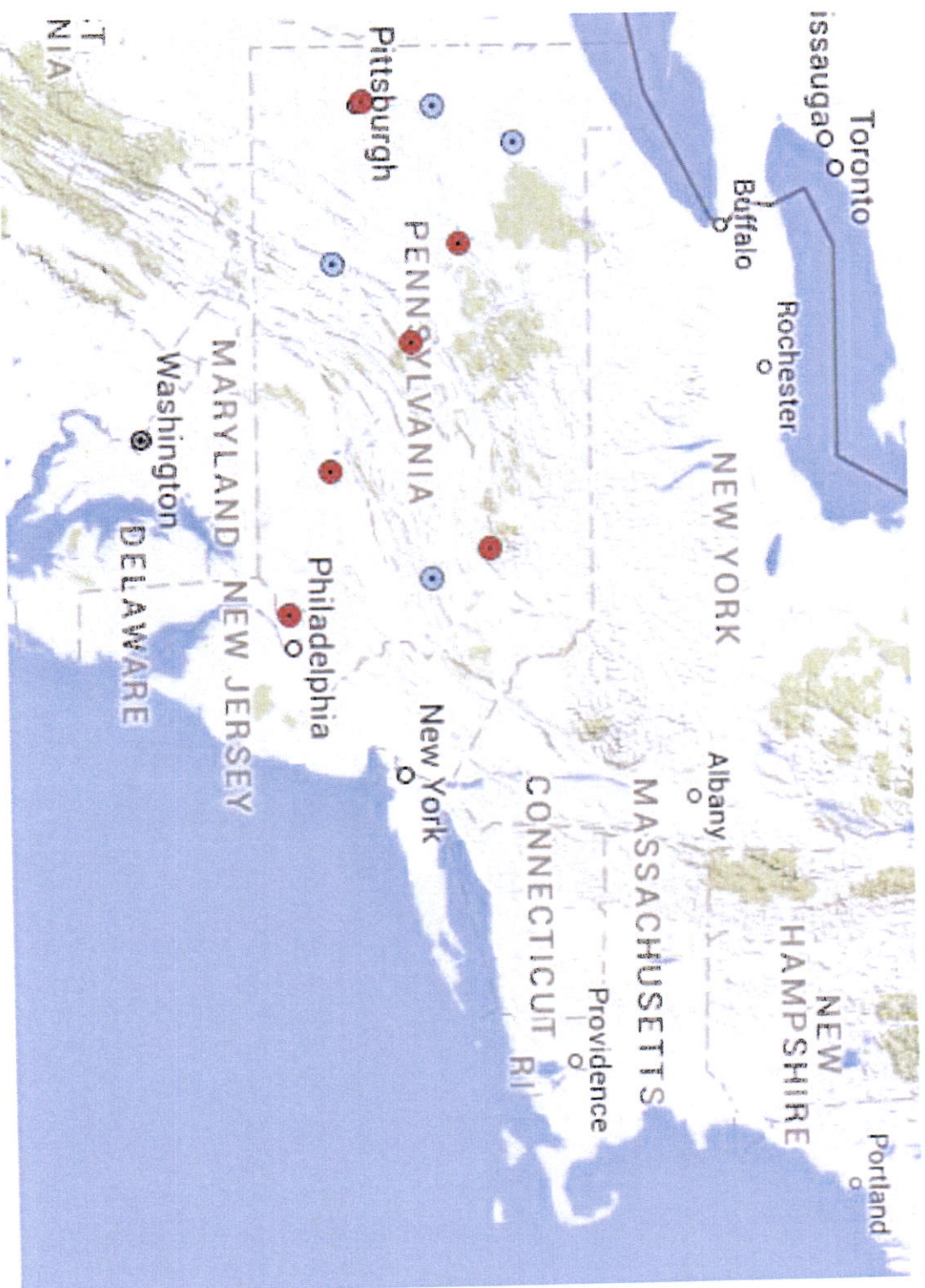
Permanent Seismic Stations in PA through 2015

3 Networks:

- USGS National Network (2 stations)
- Lamont Doherty Earth Observatory Cooperative Seismic Network (LCSN) (supported as a regional network by the USGS) (6 stations)
- Initial 10 PASEIS stations

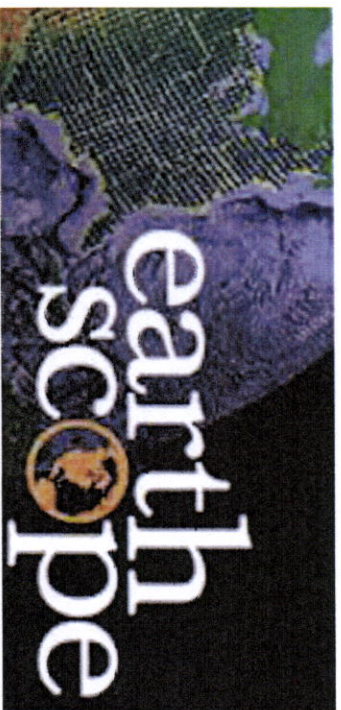
[illegible]

Initial 10 PASEIS stations



History of building a PA state seismic network

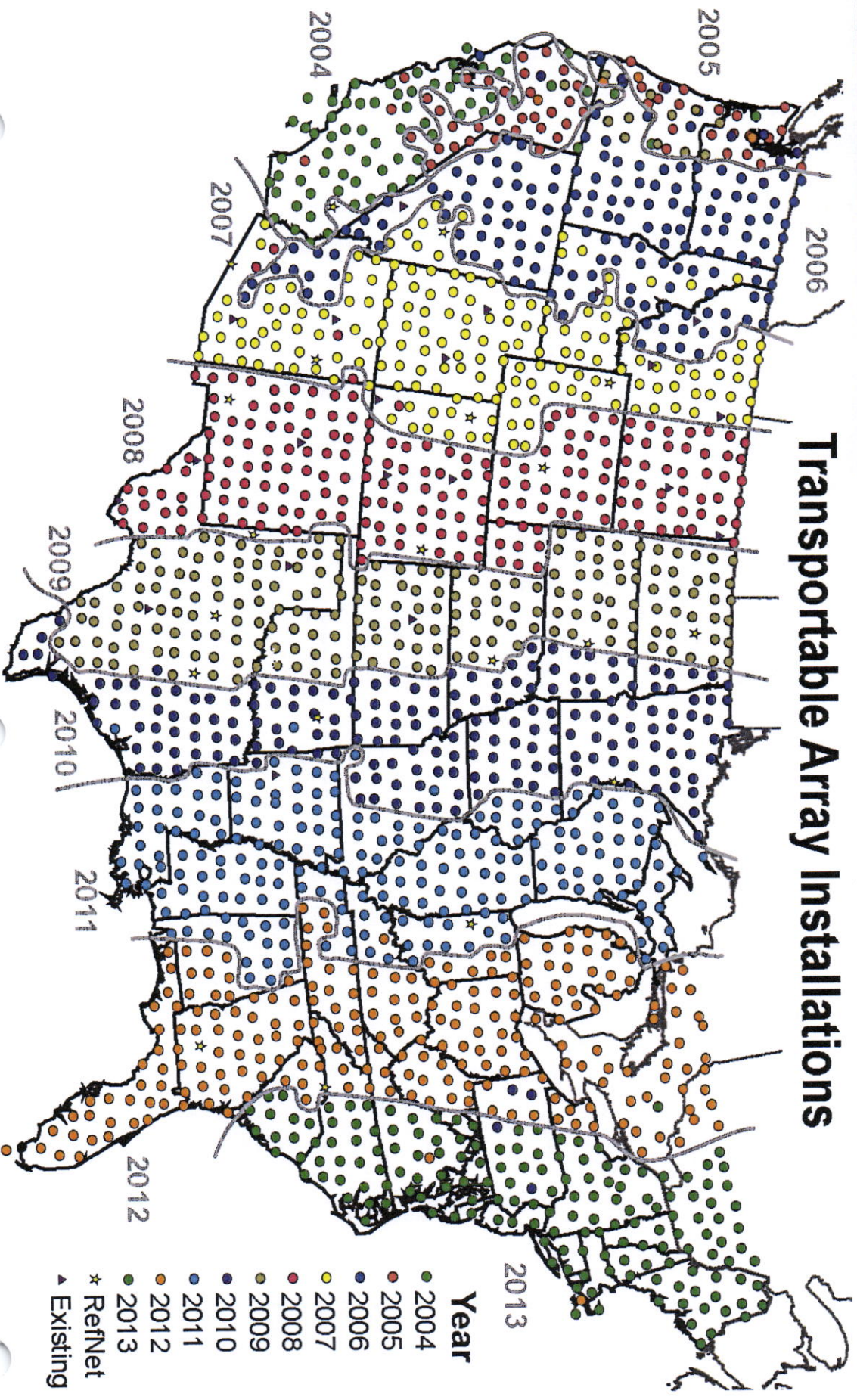
- 2006-2010 Establishment of the first 6 permanent PASEIS stations – DCNR
- 2009 Carbon sequestration technical assessment - DCNR
 - *25 portable seismic stations*
- 2010 Purchase of 4 USArray stations from IRIS – DCNR
- 2013 Earthquake monitoring during USArray - DCNR
 - *Support for temporary network to densify the USArray network, develop seismicity catalog*
- 2015 Expand the 10-station permanent network to 30 stations and provide seismic event information – DCNR and DEP



USArray



Transportable Array Installations





-



PA seismicity 2/2013 to 12/2014 (from Kyle Homman's MS thesis)

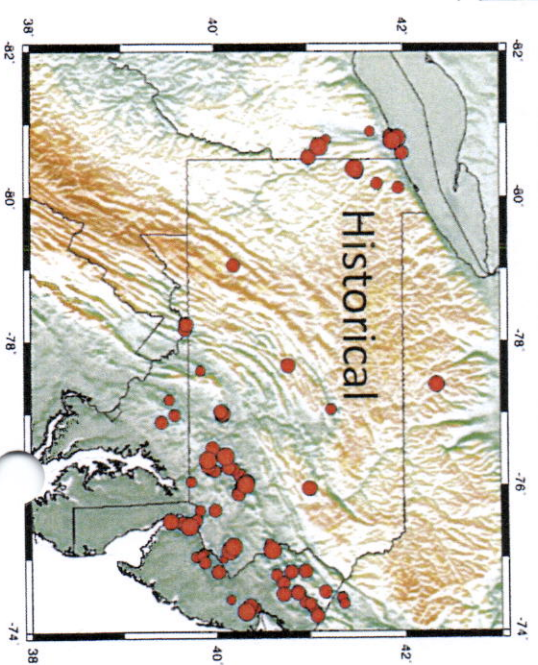
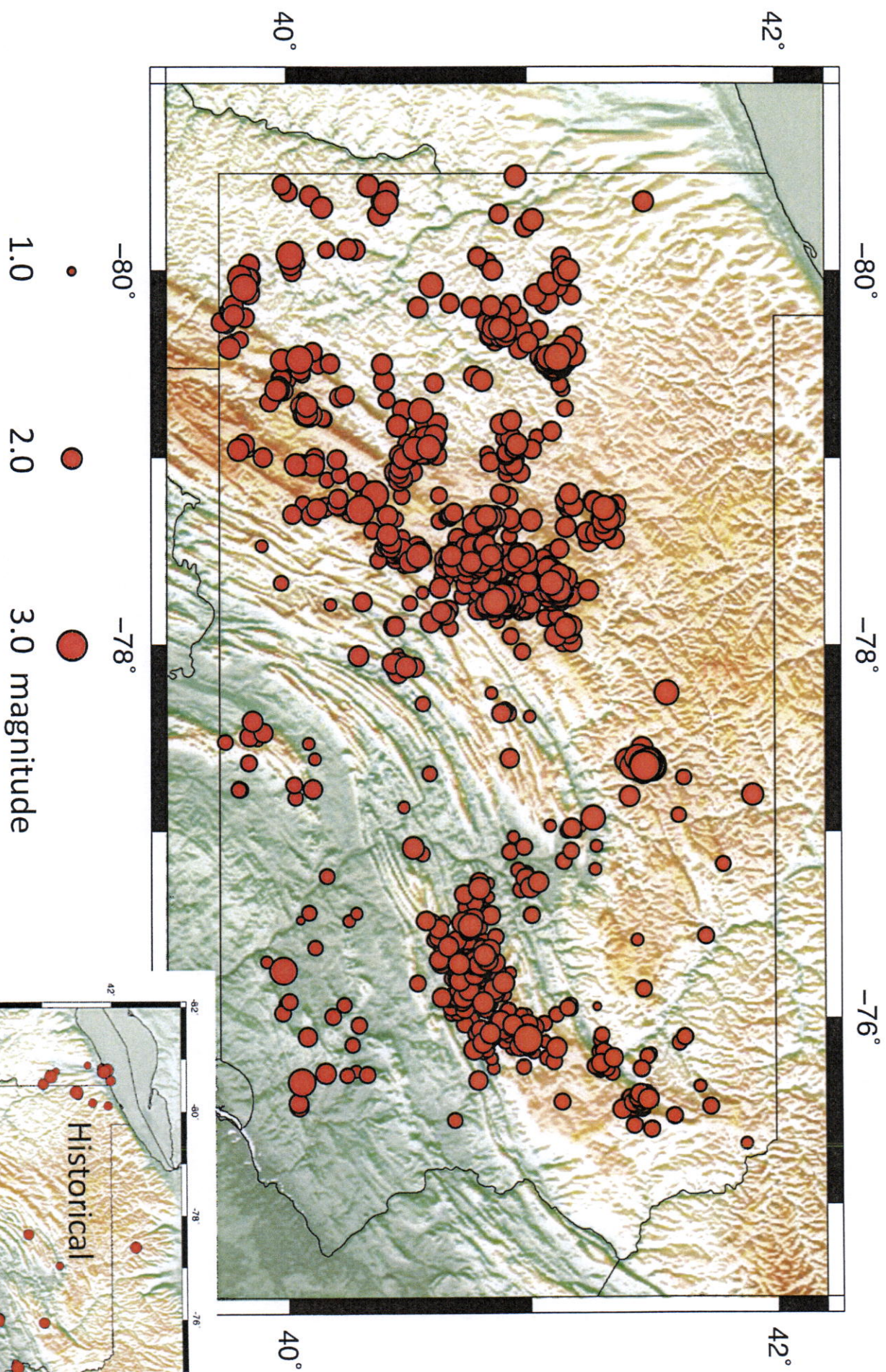
- Average number of stations used for each event: 10
- Minimum number of stations used was 4
- 1568 events with 1355 located in Pennsylvania

Picking and Locating Events

- Used Antelope Software package
- Manually picked arrival times
- Filtered with a 1-5 Hz bandpass filter
- Preliminary locations from Antelope using IASP91 velocity model
- Relocated using HYPOLLIPSE and a velocity model for Pennsylvania
- Magnitudes determined using Richter's method for local magnitude

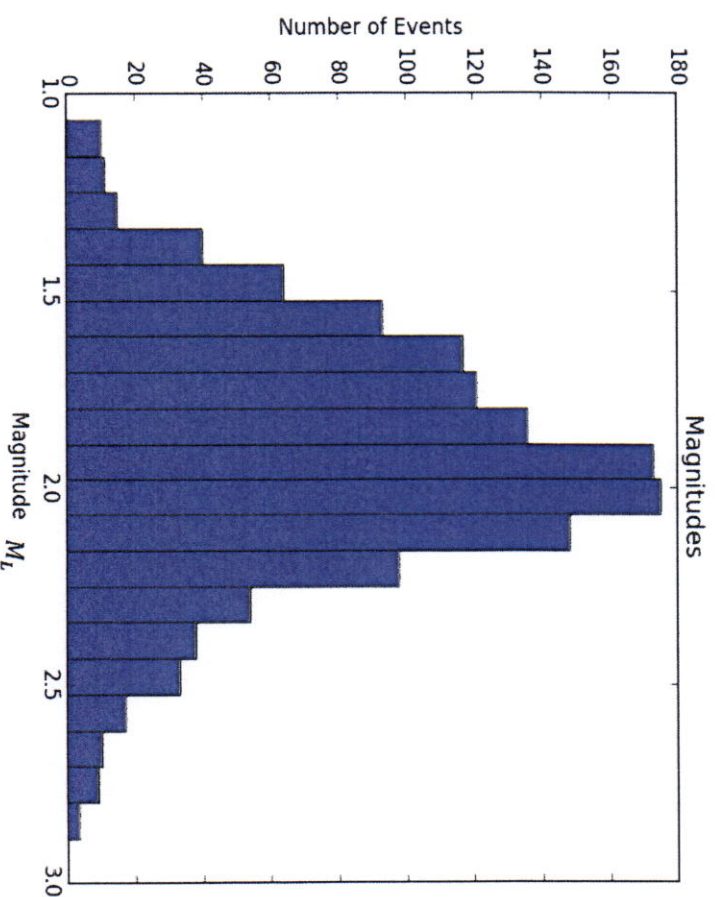
Layer	P-wave Velocity (km/s)	Depth of Interface (km)	Vp/Vs Ratio
1	6.0	0.0	1.74
2	6.3	10.0	1.74
3	6.6	20.0	1.74
4	6.9	30.0	1.74
5	8.1	37.0	1.74

Adapted from Katz (1955)



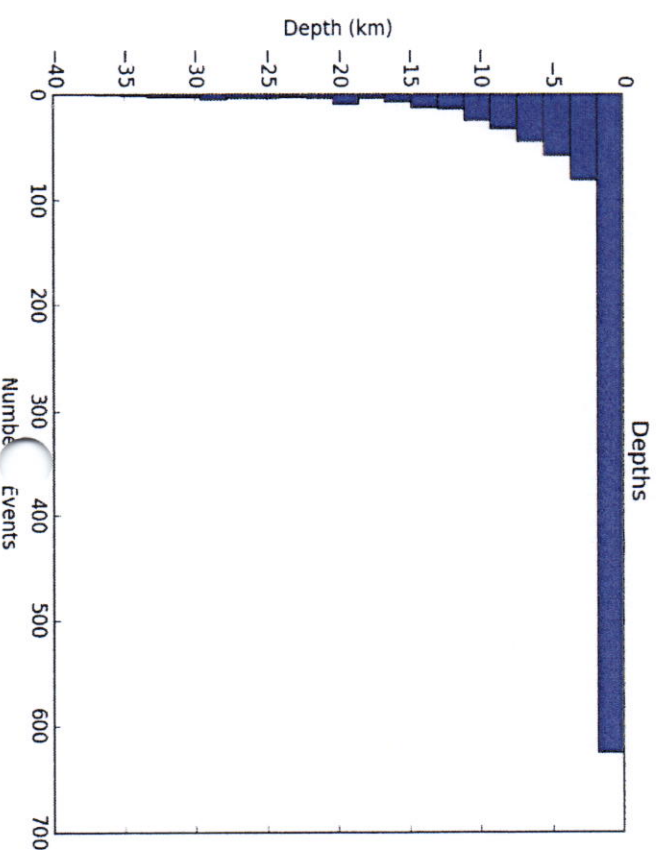
Magnitudes and Depths

- Local magnitudes range from 1.07 to 2.89



Catalog is complete to magnitude 2

- Depths mostly < 1 km



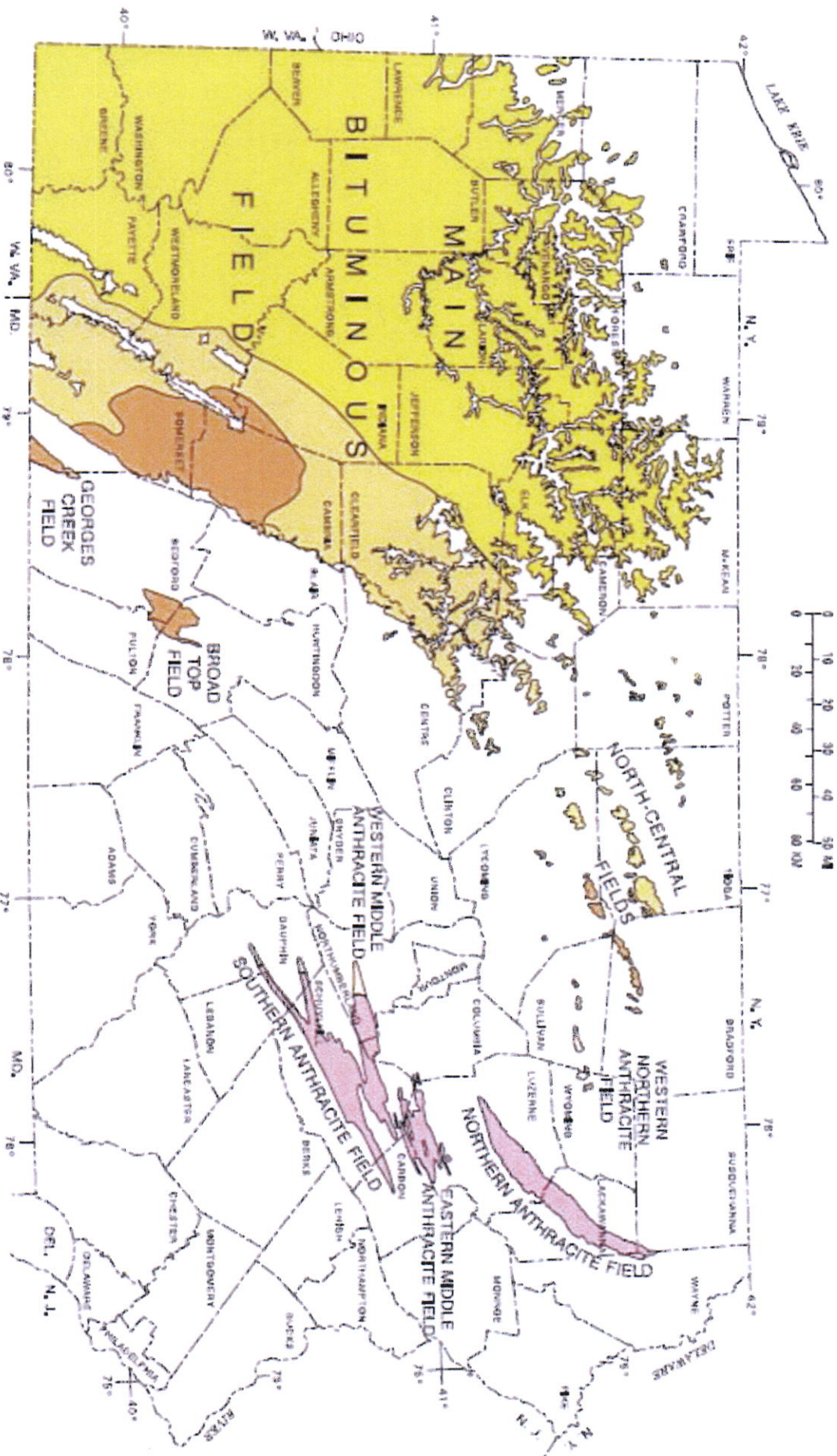
What are the sources of the seismic events?

Several possibilities

- tectonic earthquakes
- mine blasts (quarries, coal mines, other mines)
- induced seismicity from wastewater disposal wells
- induced seismicity from hydraulic fracking

DISTRIBUTION OF PENNSYLVANIA COALS

SCALE 1:2,000,000



BITUMINOUS FIELDS

- High-volatile bituminous coal
- Medium-volatile bituminous coal
- Low-volatile bituminous coal

ANTHRACITE FIELDS

- Semi-anthracite
- Anthracite

EXPLANATION

USGS Event Classification for Blasts

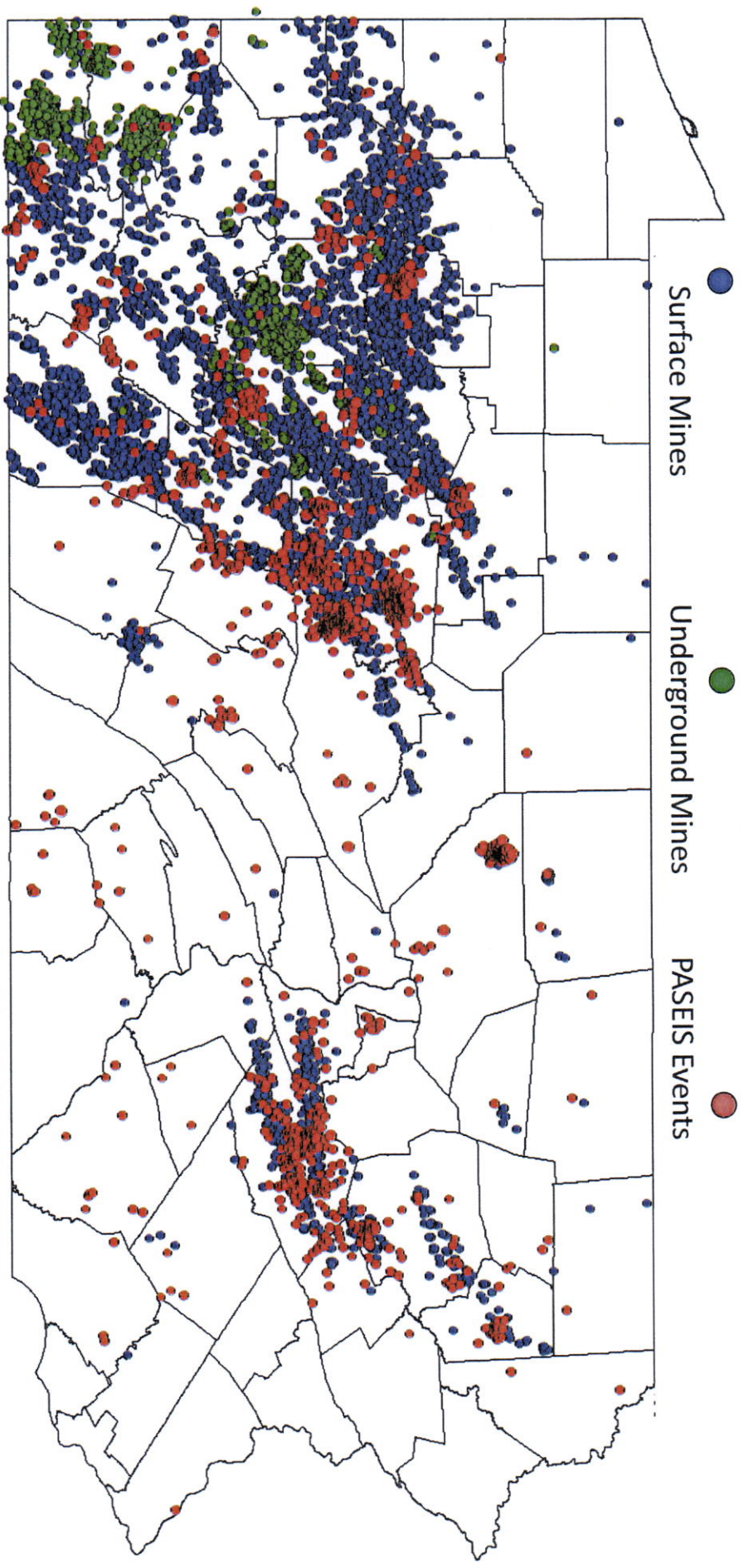
- Time of event (during working hours)
- Location of events relative to mines and quarries (within 5 km)
- Emergent phase arrivals
- Lack of clear S-wave arrivals
- Excessive low-frequency signal
- Presence of a short period surface wave

(

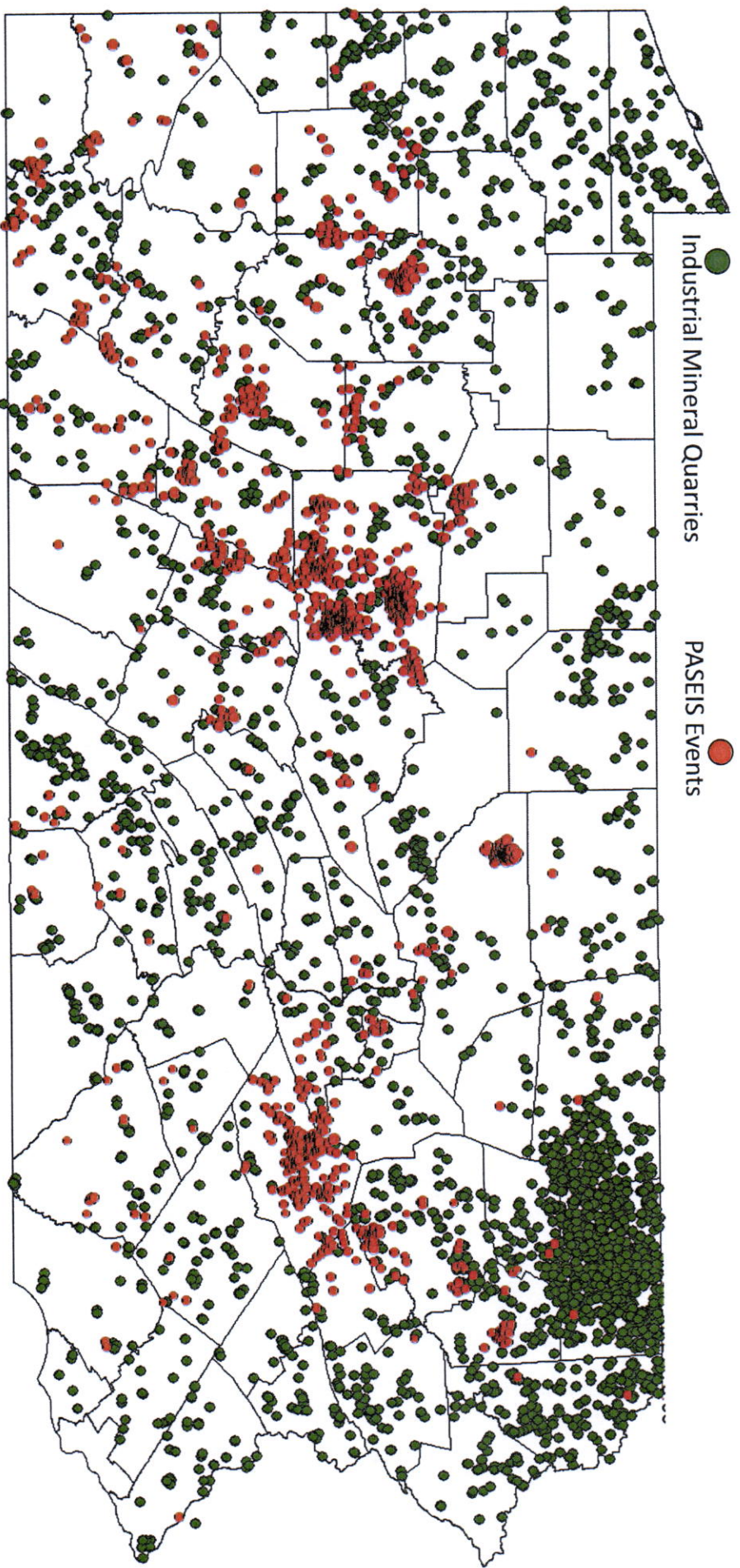
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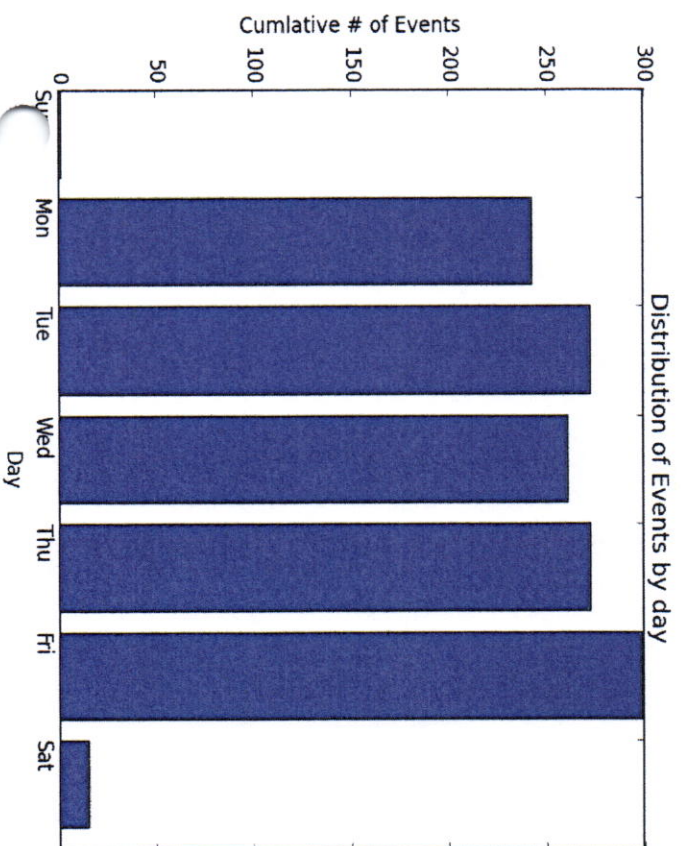
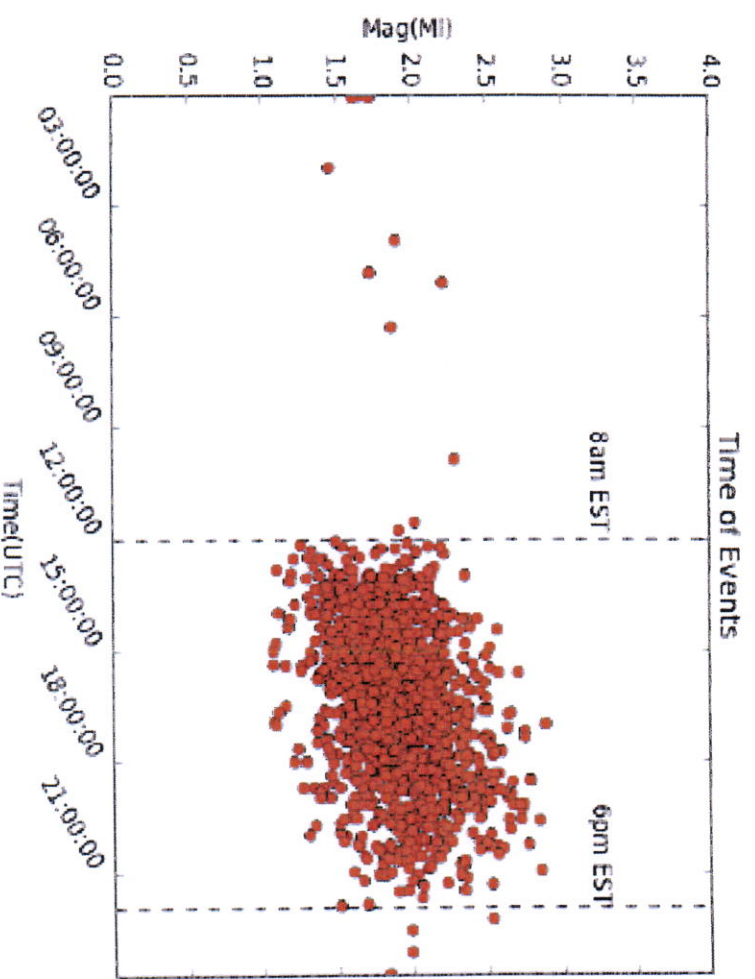
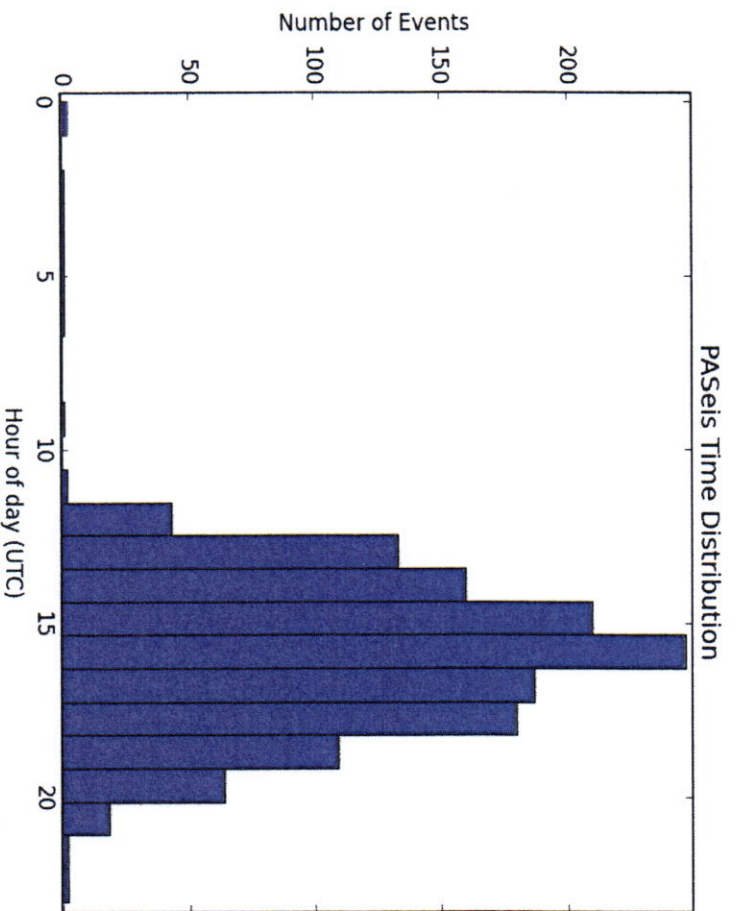
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Spatial correlation with coal mines

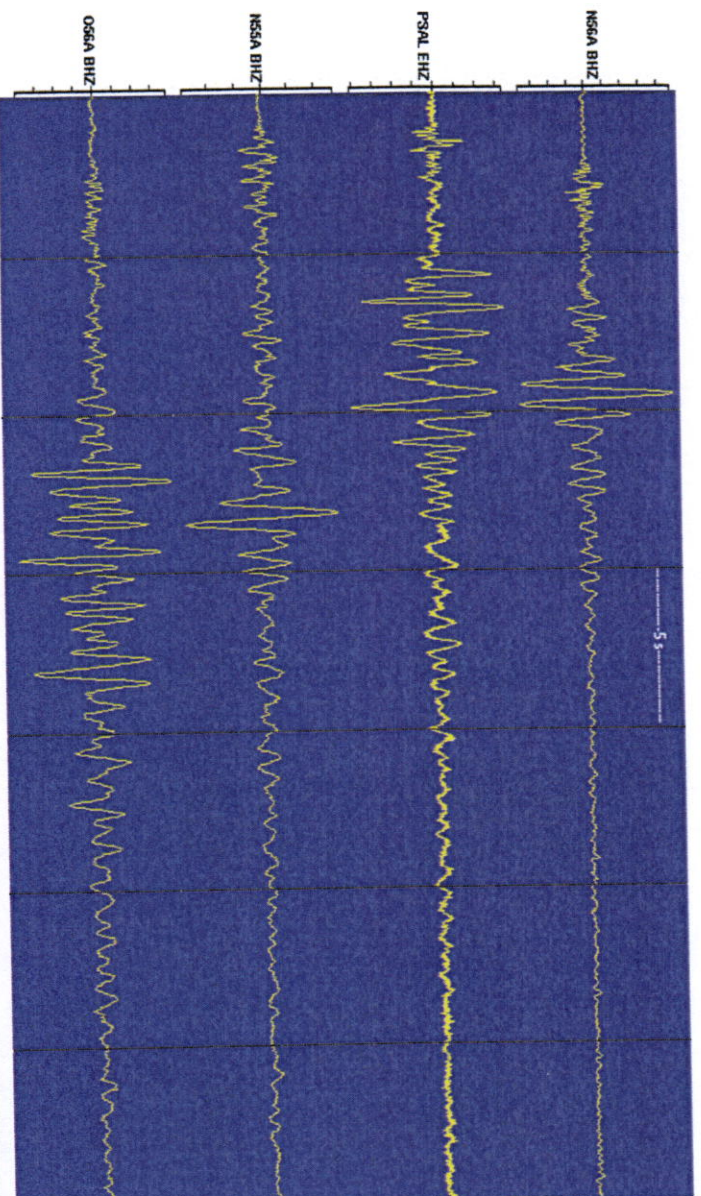


Spatial correlation with other mines





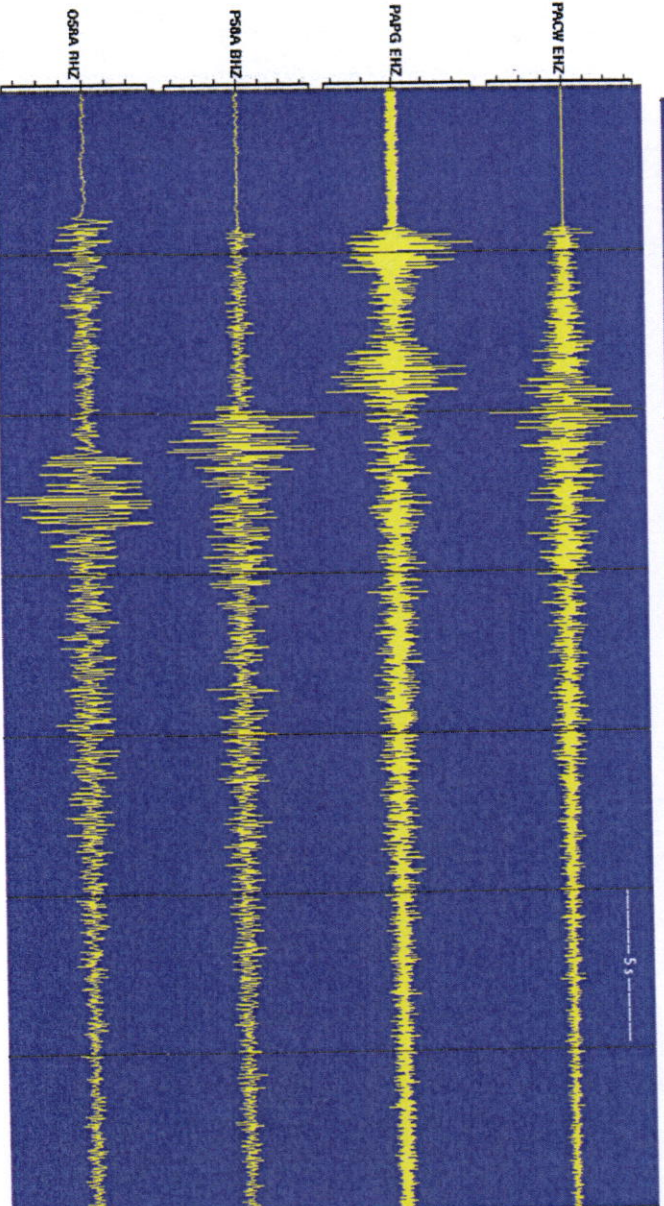
Timing of Events



Blasting event

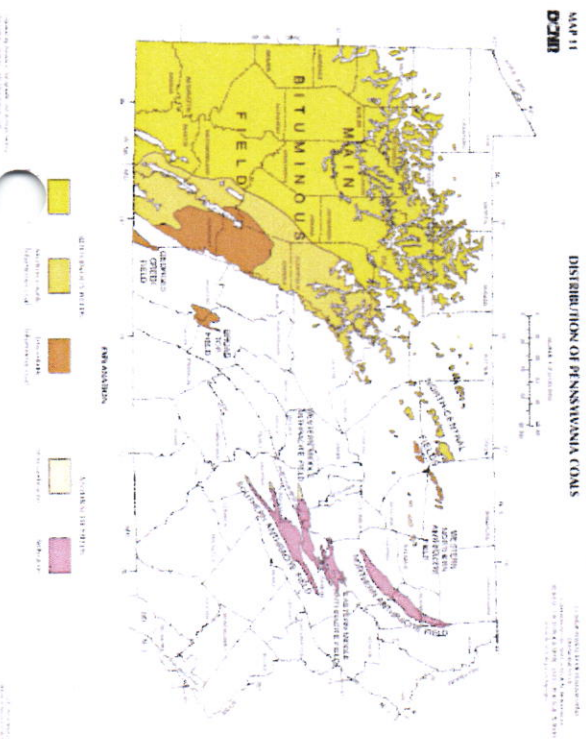
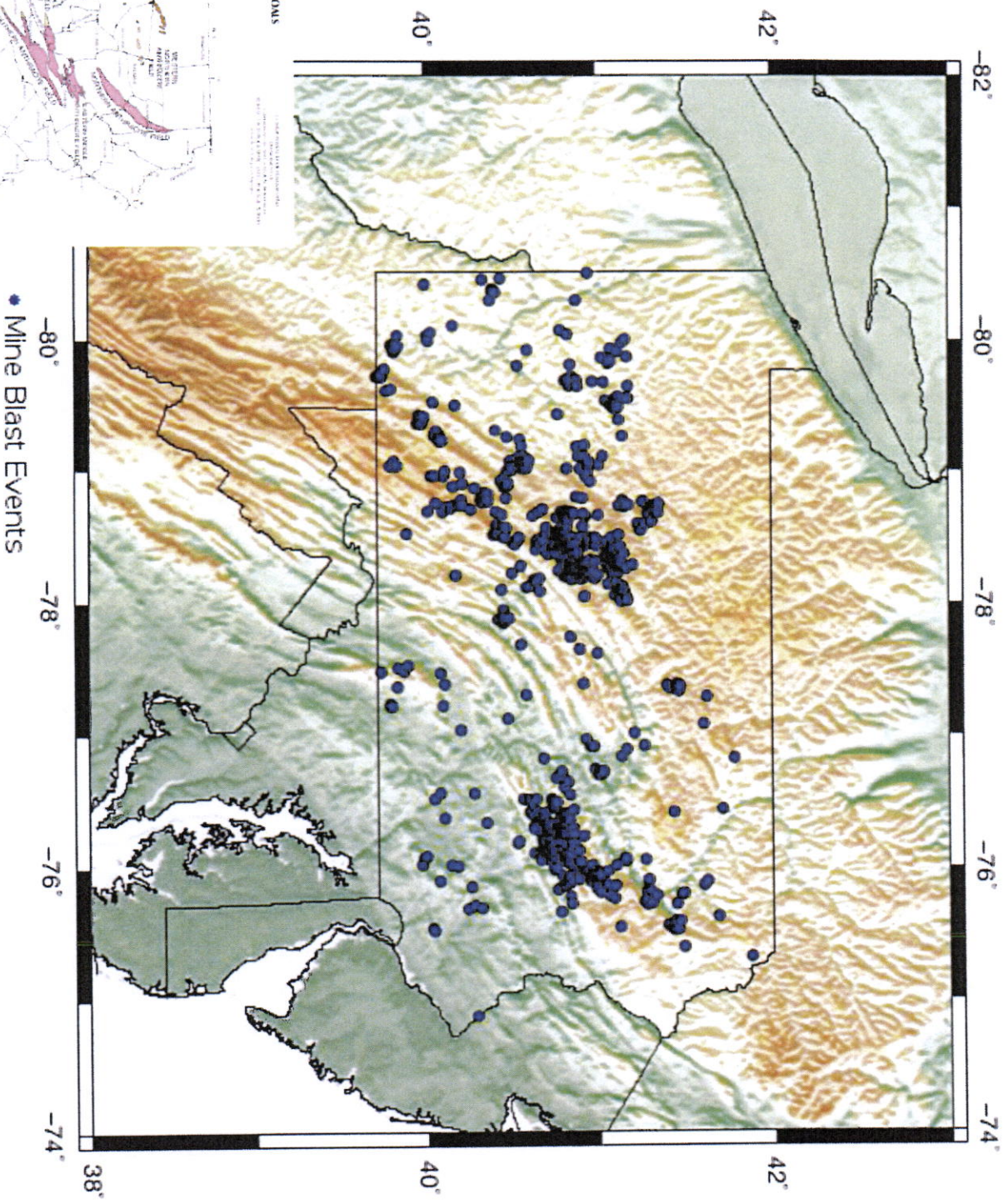
Waveform characteristics

- Emergent phase arrivals
- Lack of clear S-wave arrivals
- Excessive low-frequency signal
- Presence of a short period surface wave

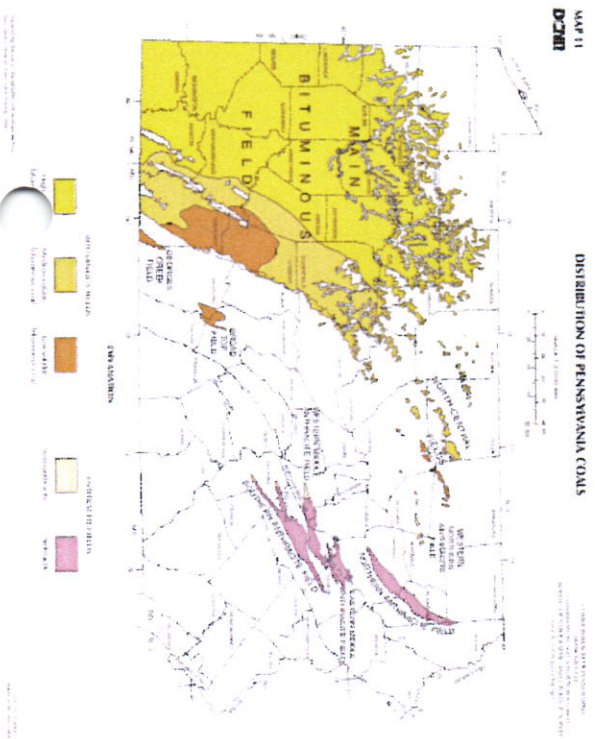
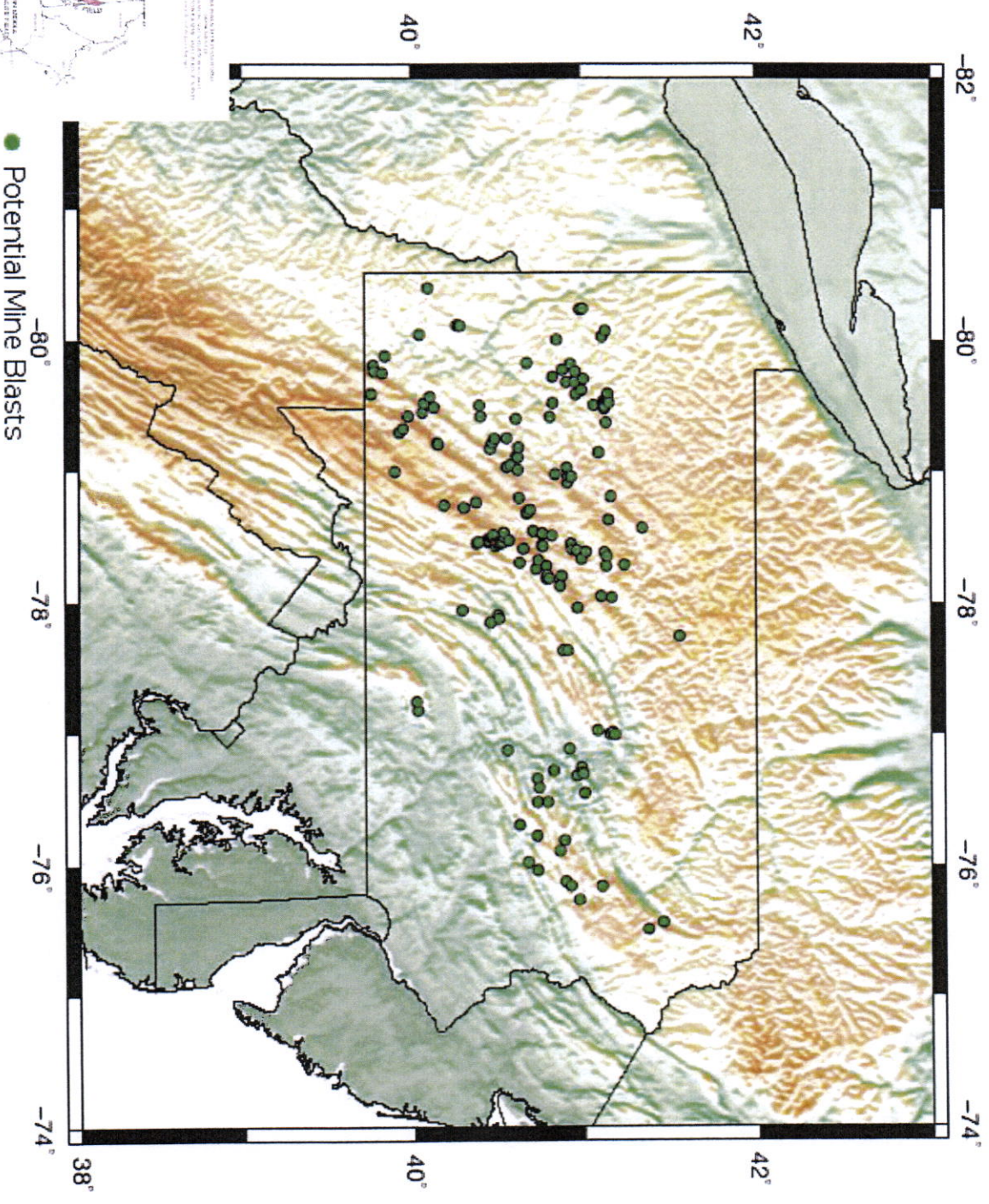


Earthquake

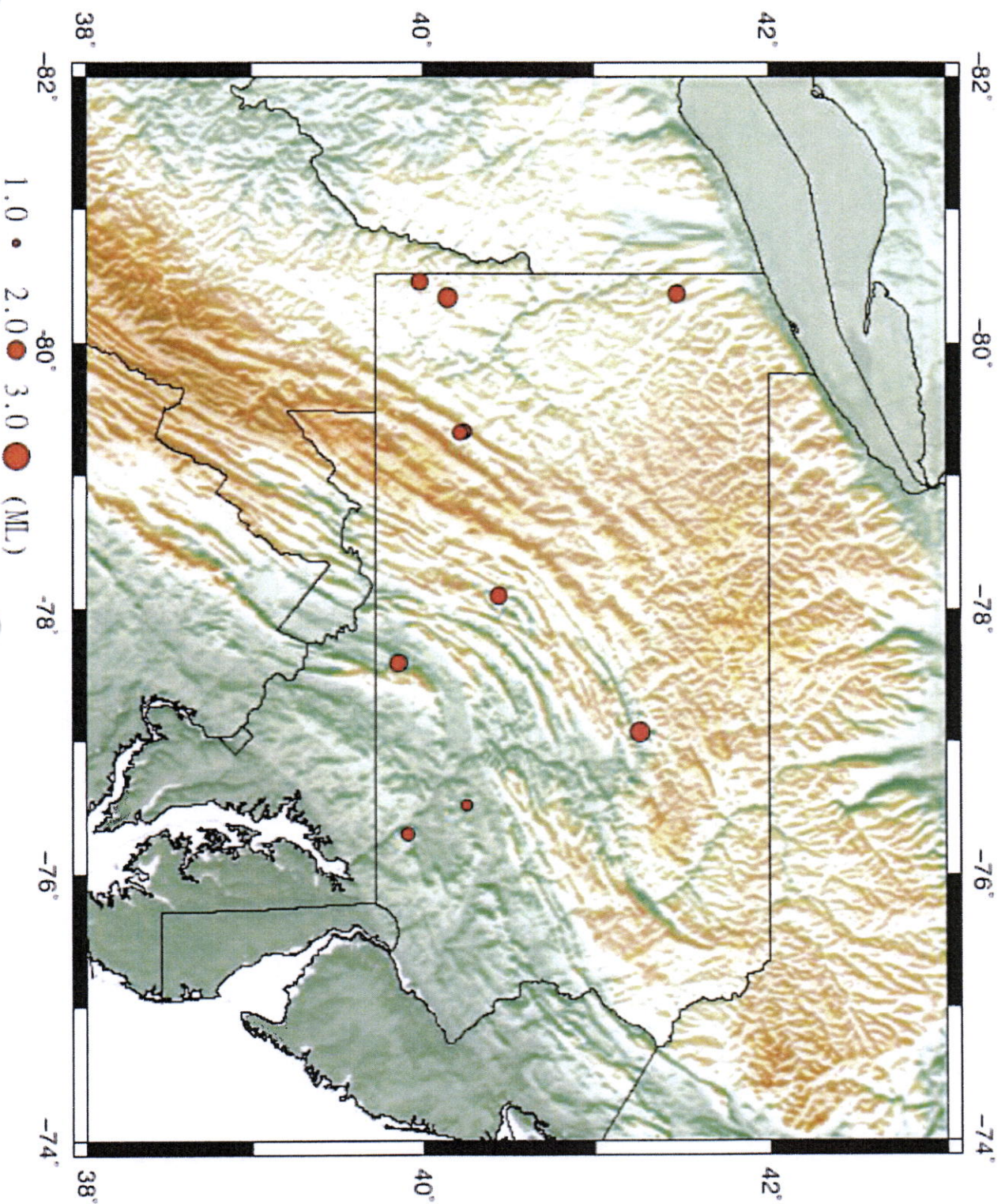
Mine or Quarry Blasts (1117 events)



Potential Mine or Quarry Blasts (165 events)



Non-mining events – 11 of them.



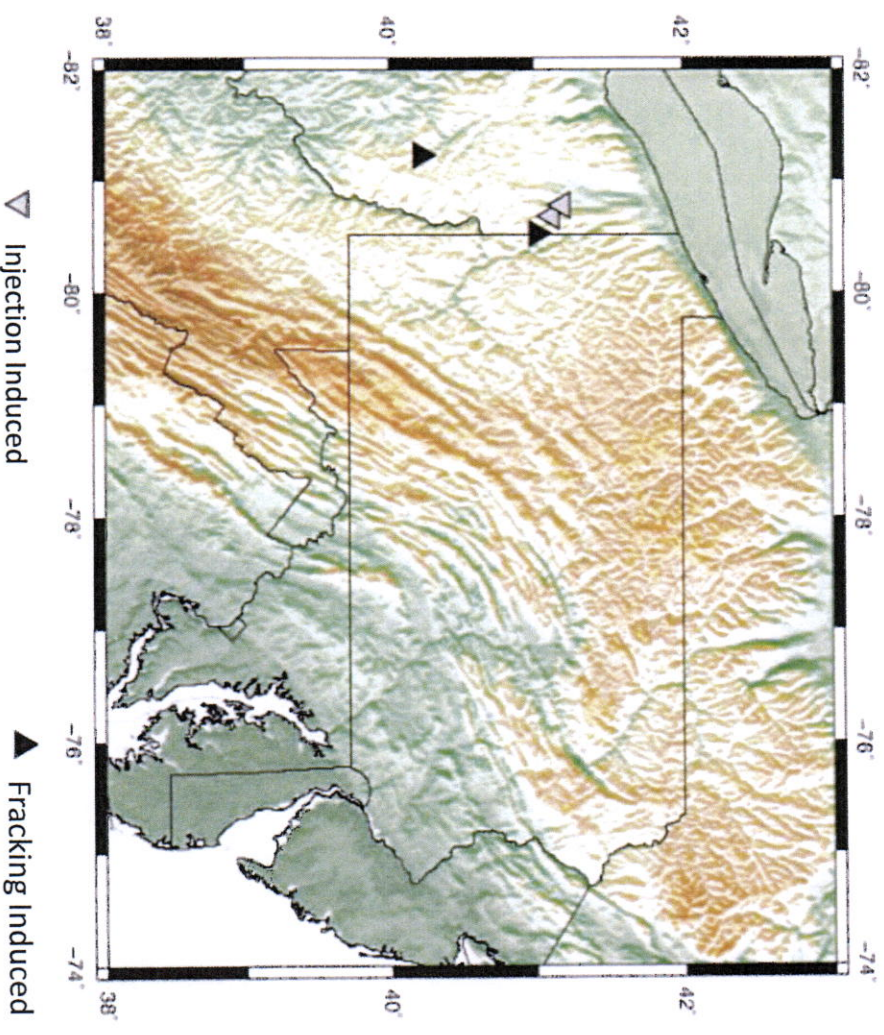
What are the sources of the non-mining seismic events?

Several possibilities

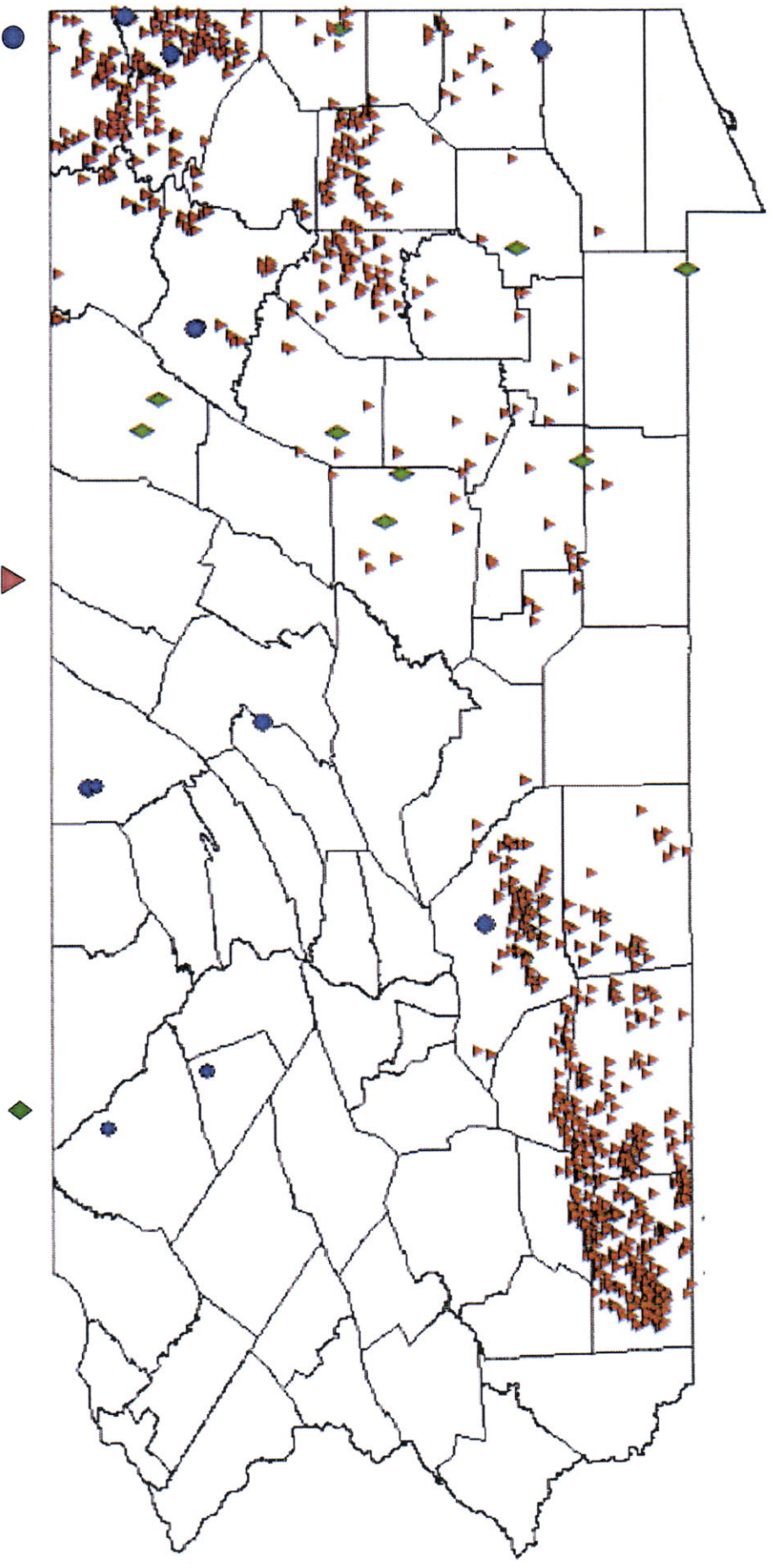
- tectonic earthquakes
- induced seismicity from wastewater disposal wells
- induced seismicity from hydraulic fracking

Induced Seismicity

- Induced events have occurred in several areas of the US
- Both wastewater injection and hydraulic fracturing can induce seismic activity – events of both kinds in Ohio
- Pennsylvania has both hydraulic fracture wells and wastewater injection wells



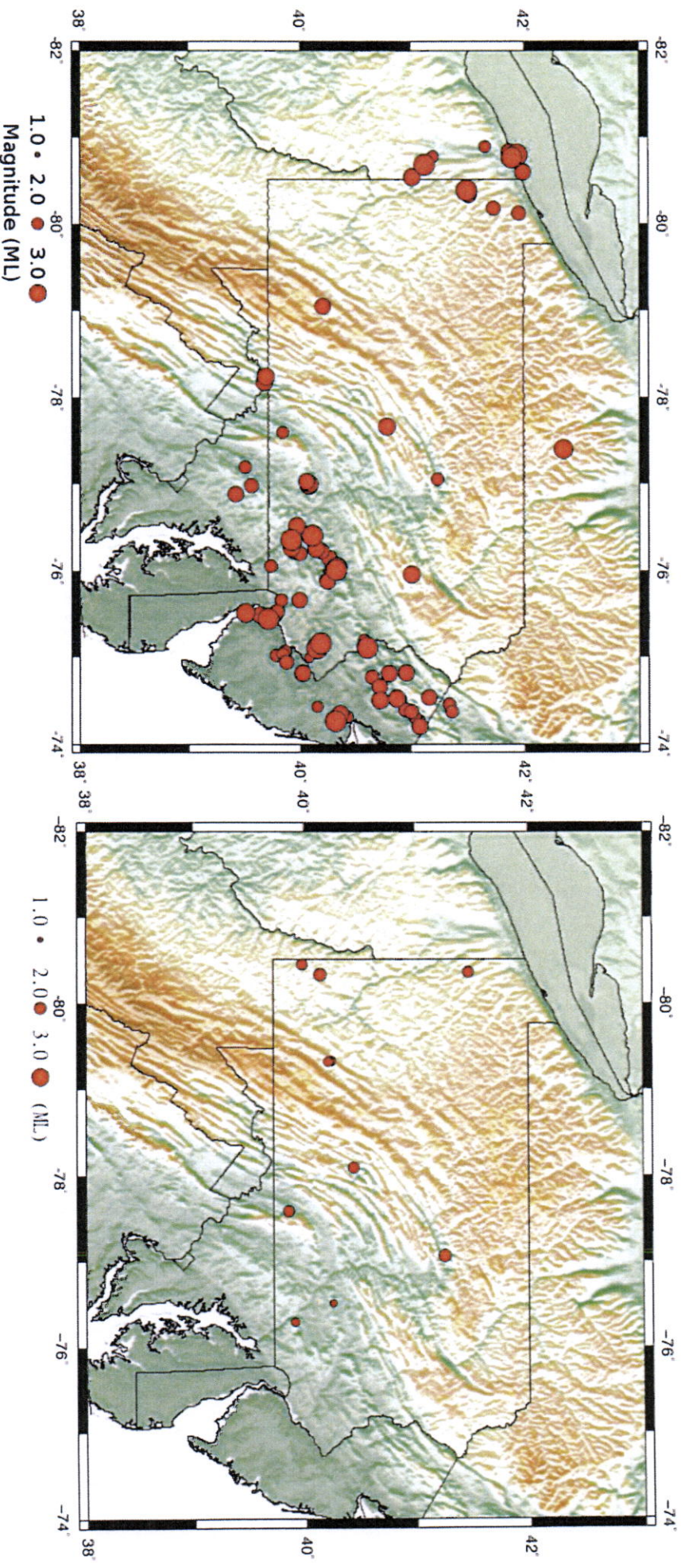
Are there spatial and temporal correlations with well activity?



**-No correlation has been found with either injection wells or
fracked wells**

Summary of findings: 1344 mining related events

11 Non-mining events – they are all probably tectonic earthquakes

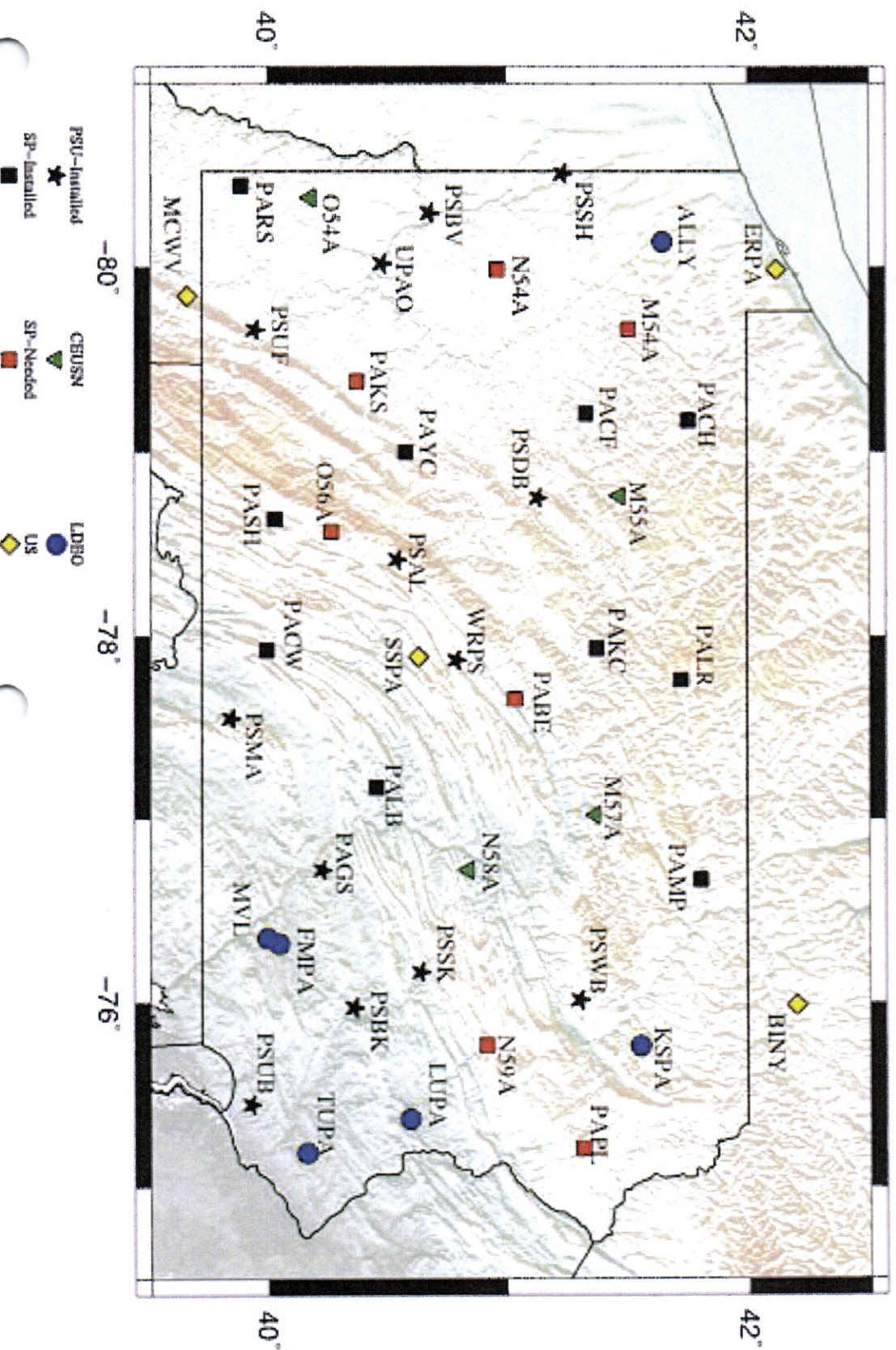


Historical

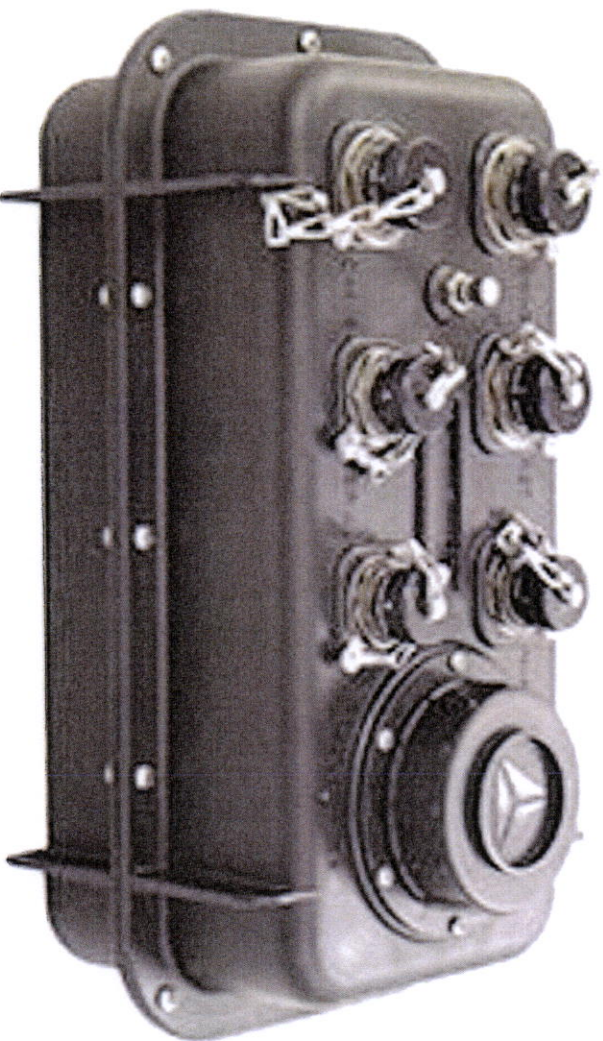
2013-2014

Expanding the Pennsylvania State Seismic Network

- 30 stations in the PASEIS network by summer 2016
 - 6 stations operated by LCSN (LDEO)
 - 2 stations operated by the USGS (US)
 - 4 stations in the CEUSN network operated by IRIS/USGS
- + several stations in neighboring states



PASEIS Seismic Equipment

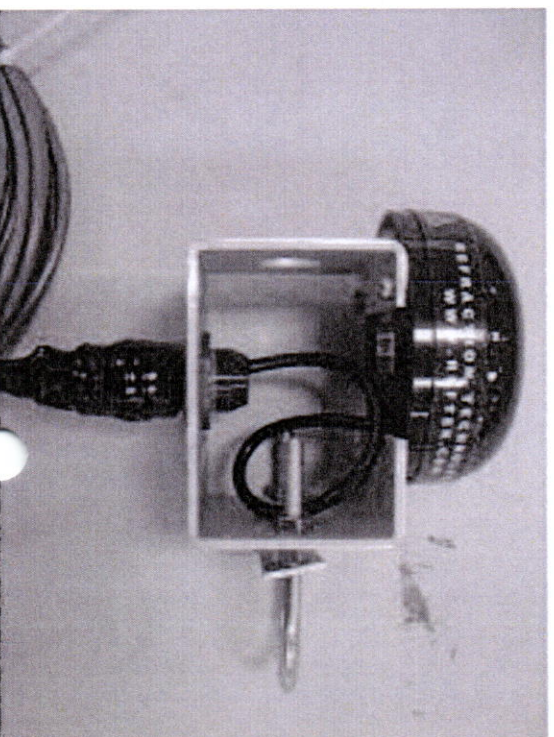


Data logger/Digitizer



3-component
ground motion
sensor (vertical,
north-south,
east-west)

GPS clock



What does a PASEIS station look like?



PASEIS data are openly available from the IRIS Data Management Center
<http://ds.iris.edu/mda/PENN>) or (<http://ds.iris.edu/mda/PE>)

Virtual network summary (1 time span)

Virtual Network _PENN :: Pennsylvania State Geological Survey :: _PENN Network Map

Start 2004/04/01 00:00:00

End 2599/12/31 23:59:59

Stations for _PENN virtual network (25 stations) :: Click column title to sort

Network	Station	Site	Latitude	Longitude	Elevation	Vnet start	Vnet end
A PE	NCAT	NC A&T Campus	36.078958	-79.771183	243	2004/01/01 00:00:00	2500/12/30 23:59:59
R A PE	PACH	Chapman State Park, Clarendon, PA	41.756660	-79.171430	431	2004/01/01 00:00:00	2500/12/30 23:59:59
R A PE	PAGS	PA Geological Survey, Middletown, PA, USA	40.230000	-76.720000	120	2004/01/01 00:00:00	2500/12/30 23:59:59
R A PE	PAKC	Kettle Creek State Park, Renovo, PA	41.374710	-77.932530	294	2004/01/01 00:00:00	2500/12/30 23:59:59
R A PE	PALB	Little Buffalo State Park, PA, USA	40.458910	-77.167830	145	2004/01/01 00:00:00	2500/12/30 23:59:59
R A PE	PALR	Lyman Run State Park, Galeton, PA	41.725095	-77.760062	537	2004/01/01 00:00:00	2500/12/30 23:59:59
R A PE	PAMP	Mt. Pisgah State Park, Troy, PA	41.805900	-76.668890	348	2004/01/01 00:00:00	2500/12/30 23:59:59
R A PE	PARS	Chapman State Park, Clarendon, PA	39.886320	-80.445220	305	2004/01/01 00:00:00	2500/12/30 23:59:59
R A PE	PASH	Shawnee State Park, Schnellsburg, PA	40.026000	-78.635690	393	2004/01/01 00:00:00	2500/12/30 23:59:59
R A PE	PSAL	PSU Altoona Campus, PA, USA	40.543700	-78.414500	402	2004/01/01 00:00:00	2500/12/30 23:59:59



Station summary (1 time span)

Network	PE :: Penn State Network :: PE Network Map		
Station	PACH :: Chapman State Park, Clarendon, PA :: Penn State Network :: PACH Station Map :: RESP :: SAC PZs :: XML		
Latitude	41.756660		
Longitude	-79.171430		
Elevation	431		
Start	2016/03/18 (078) 00:00:00		
End	2599/12/31 (365) 23:59:59		
Epoch	2016/03/18 (078) 00:00:00 - 2599/12/31 (365) 23:59:59		
Instrument	Reftek 130 Datalogger		
Channels (Hz)	Location --: LOG (0)		
Instrument	Nanometrics Trillium Compact/Reftek 130 Datalogger		
Channels (Hz)	Location --: HHE (100) RA , HHN (100) RA , HHZ (100) RA , LHE (1), LHN (1), LHZ (1)		
MetaData Load	2016/04/15 (106) 14:10:37		

Virtual network affiliations:

Name	Description	Primary DC	Secondary DC
PENN	Pennsylvania State Geological Survey	PENN	IRIS DMC
REALTIME	Stations collected and served in real time at the DMC	IRIS DMC	IRIS DMC
UNRESTRICTED	All unrestricted stations, generated via cron	IRIS DMC	IRIS DMC
US-REGIONAL	US Regional Networks	PSU	IRIS DMC

Real-time data availability ([view Station Monitor](#))

View some of
the data

Earliest	Latest
----------	--------

[R](#) 2016/05/06 (127) 00:00:00 2016/05/18 (139) 00:00:00

Information on
how to request
the data

Archive data availability - [Make a batch request for data \(breq_fast\)](#) - ([data access overview](#))

Station Monitor

Choose a station

Network: PE

Station: WRPS

or choose: List Stations in Network

WRPS - PSU, University Park, PA, USA

Show Station

WRPS - PSU, University Park, PA, USA

Network: PE - Penn State Network

Location: 40.79°N - 77.87°W

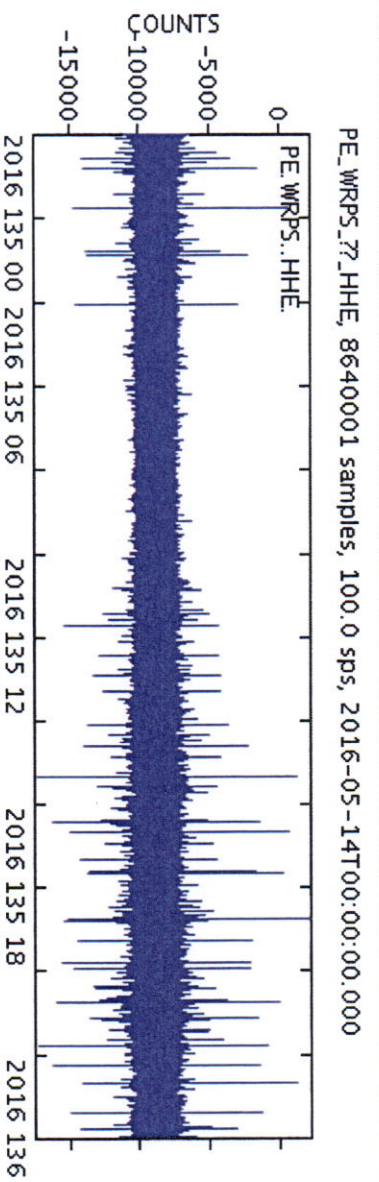
Daily Data

Day: 2016-05-14



Location/Channels: --:HHH/HHN/HHZ

Update



PASEIS web site – coming soon

- Station information
- Station and event maps
- Instructions on obtaining data
- Seismic event information determined from the 42 stations in PA plus open stations in neighboring states – event location, depth, origin time and magnitude

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Minor earthquake measures near city

Posted: Tuesday, April 19, 2016 12:08 am

By Stella Ruggiero stella@titusvilleherald.com | 0 comments

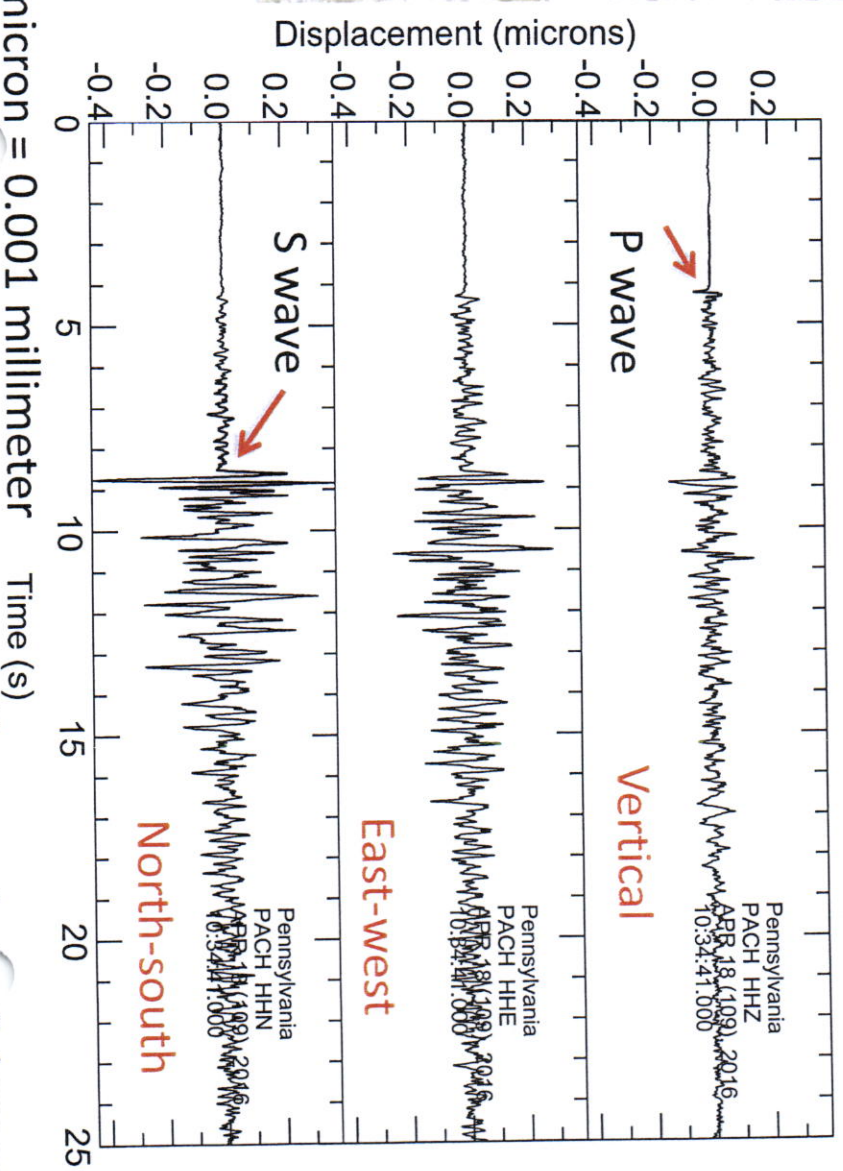
A small earthquake, which was likely too weak to be noticed by anyone other than geologists, measured in the Titusville area on Monday, around 6:34 a.m.

The quake was magnitude 2.2, according to AccuWeather meteorologist Jordan Root. He said it was fairly weak on the scale, and not likely felt by many people, or maybe no one at all. As of late Monday afternoon, Root had received no reports of anyone experiencing the quake.



Magnitude 2.2
Time: 2016/04/18 06:34:40 local
Depth 3.3 miles (5.2 km)
Near Titusville, PA

What do the data look like? (Chapman State Park)



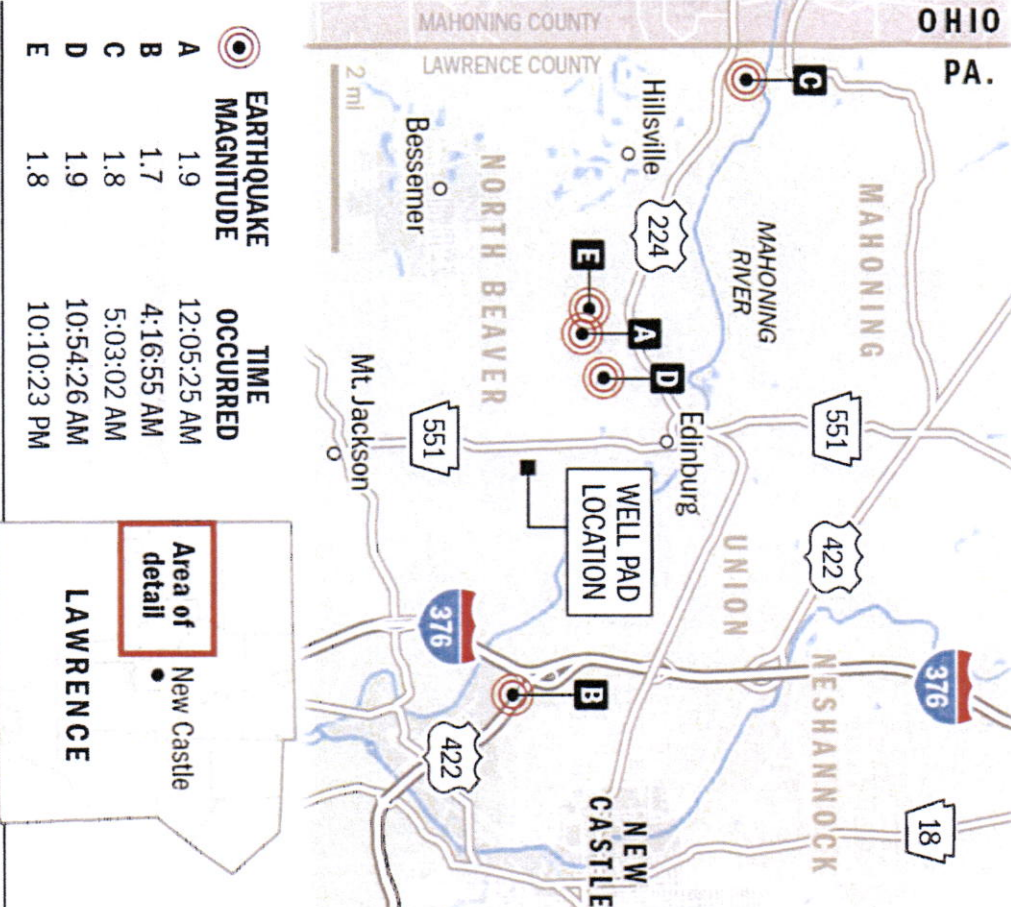
1 micron = 0.001 millimeter

Figure courtesy C. Ammon

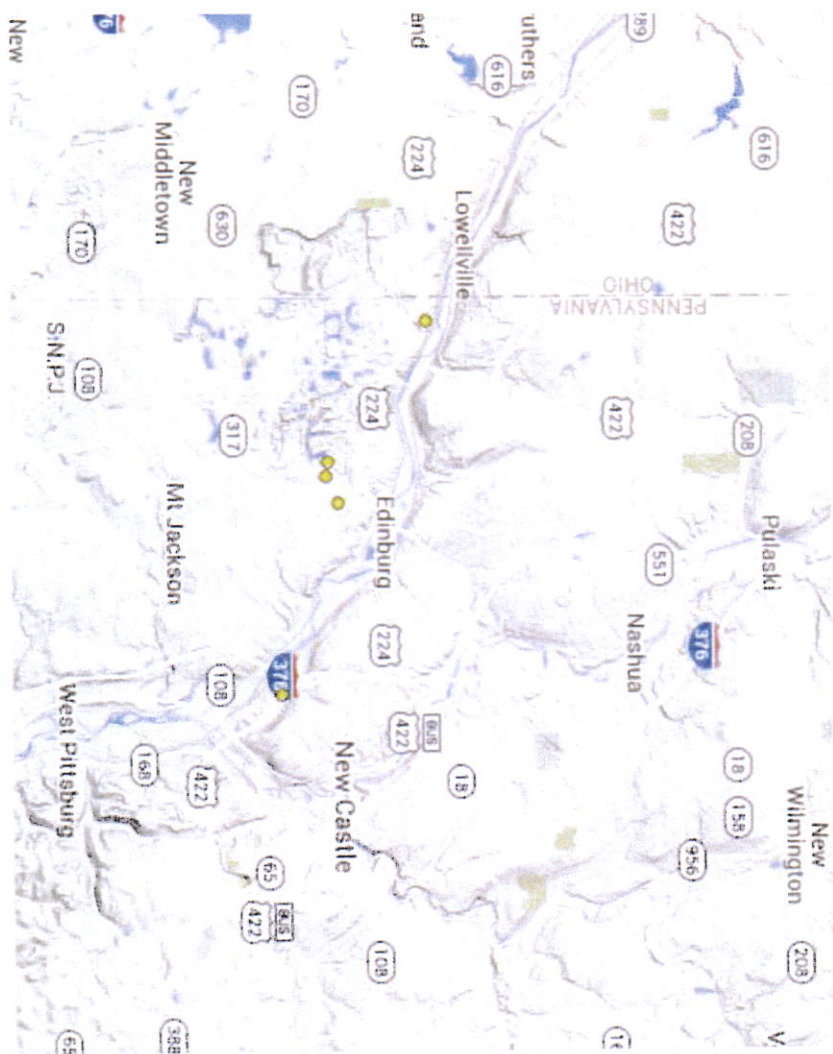
State studying link between fracking, Lawrence County earthquakes

By Laura Legere / Pittsburgh Post-Gazette April 29, 2016

Epicenters of Monday's earthquakes in Lawrence County compared with the location of the shale gas well pad that potentially triggered them.



Source: Esri, Pennsylvania Department of Environmental Protection, United States Geological Survey

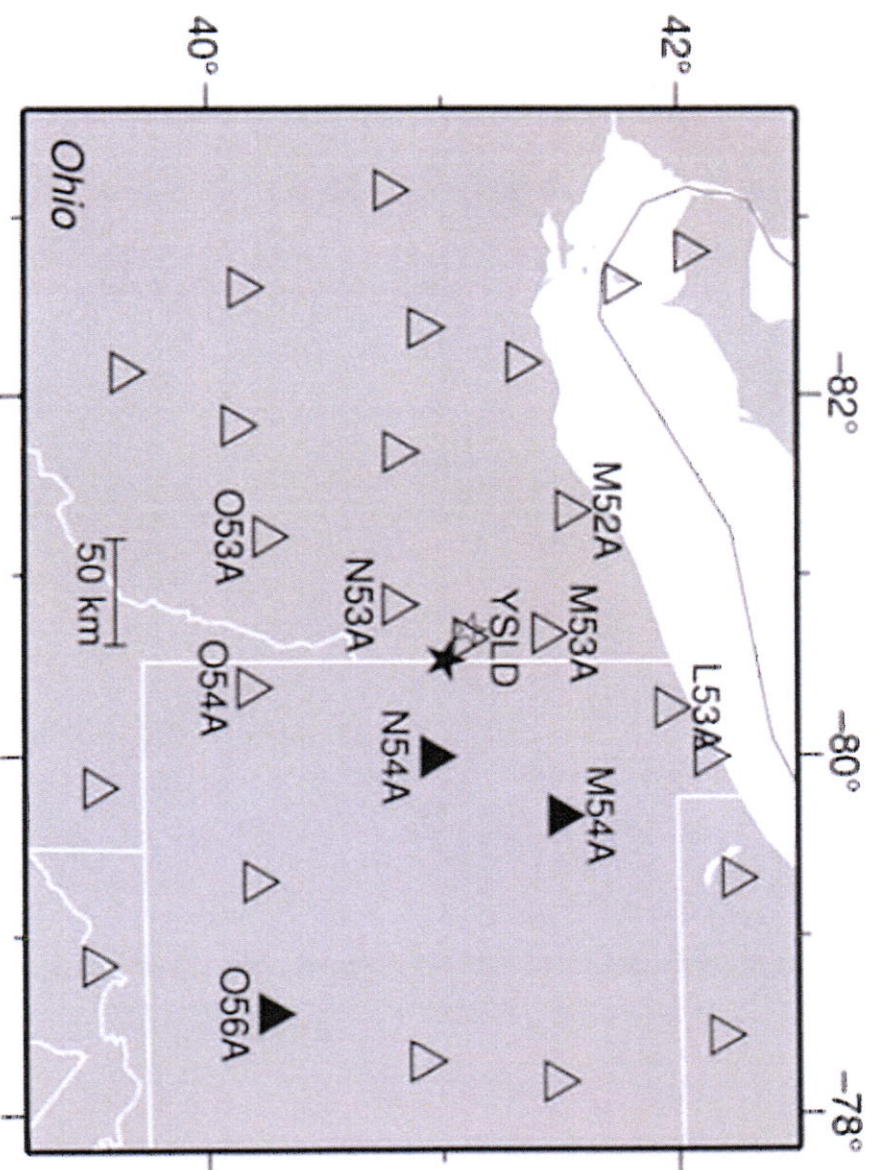


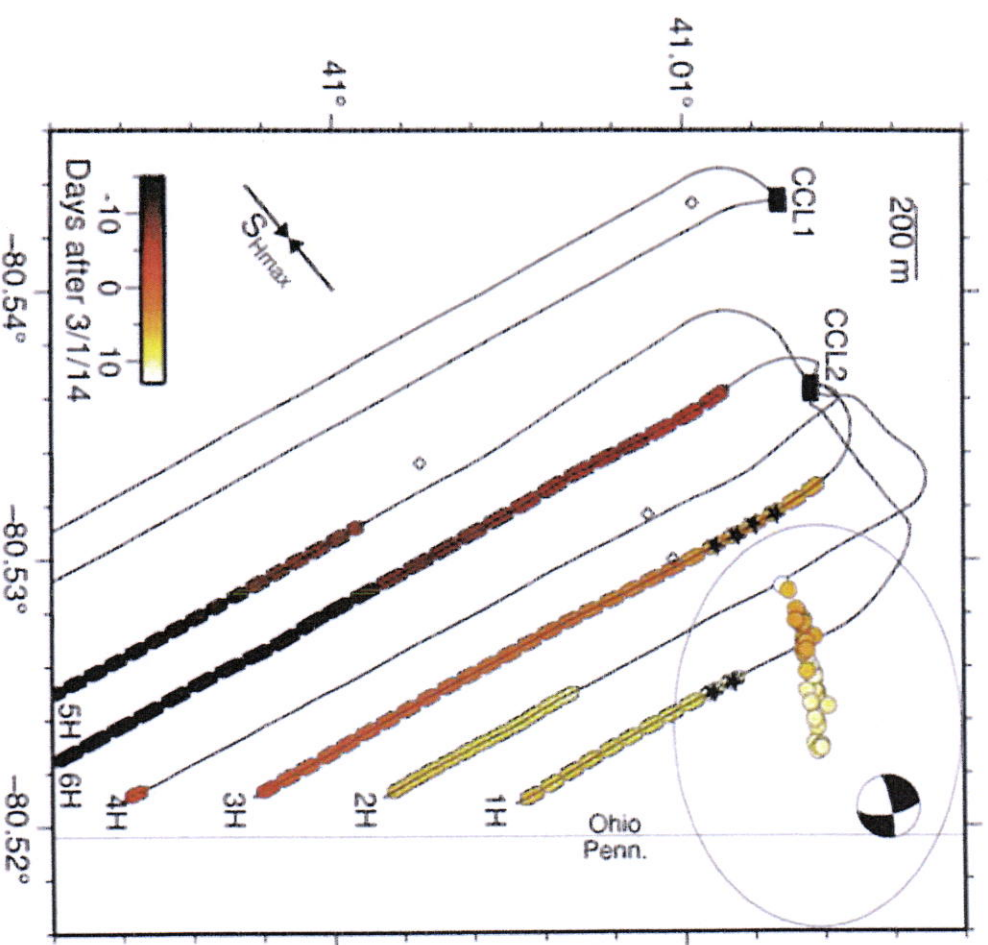
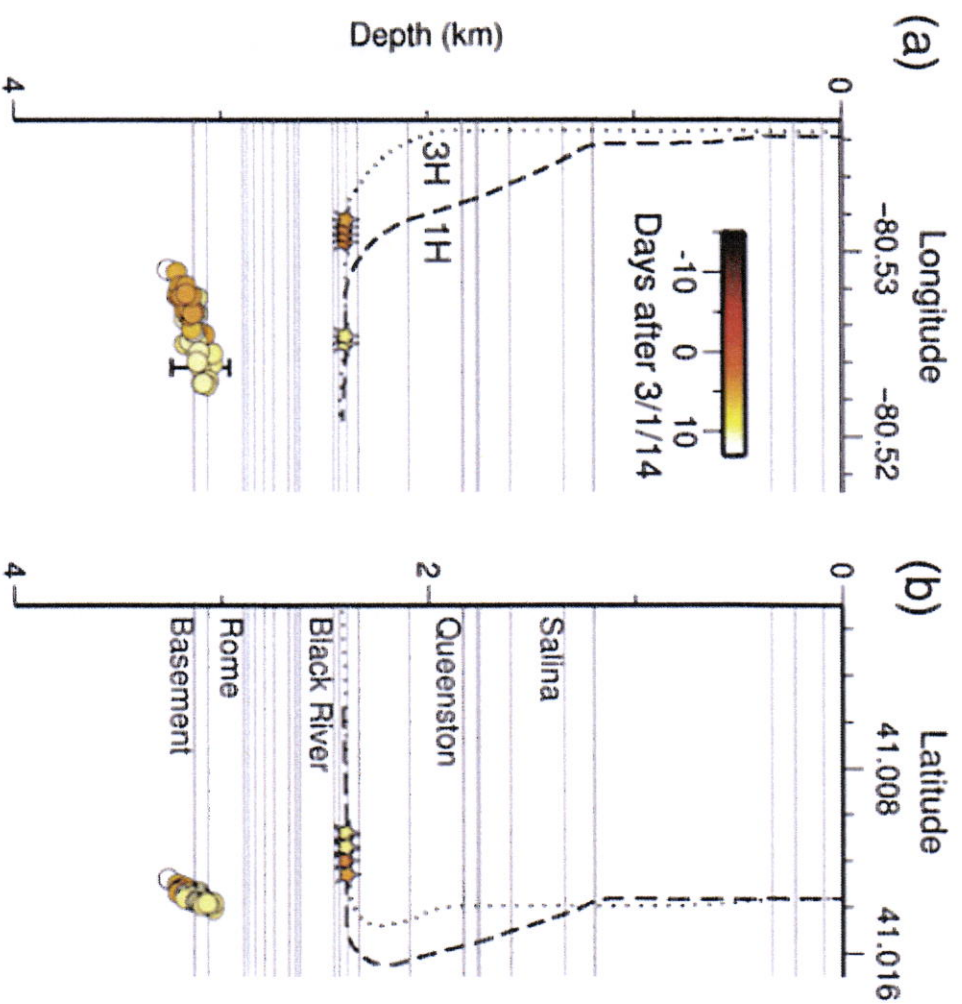
Post-Gazette

Earthquakes Induced by Hydraulic Fracturing in Poland Township, Ohio

by Robert J. Skoumal, Michael R. Brudzinski, and Brian S. Currie

- March 4-12, 2014
- 77 events identified
- Magnitudes 1 to 3
- Correlated with fracking of the Utica Shale





Did a similar thing happen with the Lawrence County earthquakes? Possibly.

-initial analysis of data indicates >30 events with magnitude >1

Initial Performance of PASEIS network

2014 Poland Township events:

- Initial event detected was magnitude 3

2016 Lawrence County events:

- Initial event detected was magnitude 1.9

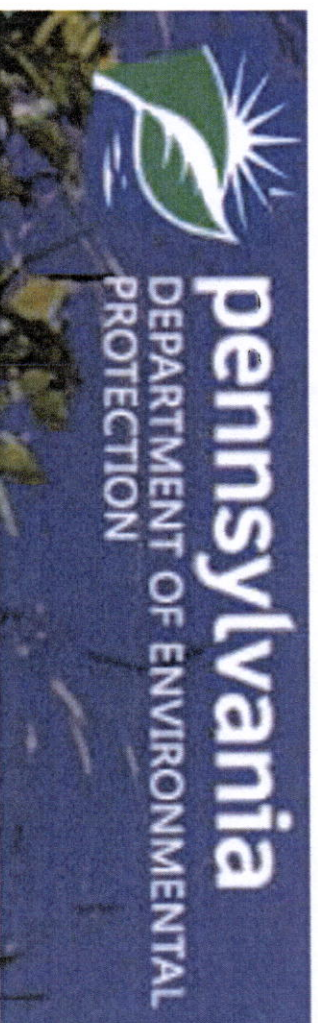
PASEIS network is designed for detecting and locating magnitude 2 and larger events.

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Thanks to DCNR and DEP for promoting open data access!



Thanks to IRIS for providing data archiving and distribution!





December 7, 2015

Mr. Marc Jacobs, Jr.
Senior Vice President
Penneco
6608 Route 22
Delmont, PA 15626

Re: Sedat #3A (Murrysville) – Reservoir and Fracture Characterization

Dear Marc,

The following summarizes the reservoir and fracture characterization for the Murrysville formation in the Sedat #3A located in Plum Borough, Allegheny County, Pennsylvania.

A series of tests were designed and conducted at the Sedat #3A to gain a better understanding of the reservoir and fracture characteristics of the Murrysville formation which underlies a sizeable portion of Penneco's proximate lease acreage.

The tests were comprised of (1) formation breakdown, (2) DFIT (diagnostic fluid injection test) to determine closure stress, reservoir pressure, and reservoir transmissibility (kH/mu), (3) Step Rate to determine the fracture extension pressure, and (4) Rate Stepdown to determine the near wellbore friction which includes perforation friction and friction caused by near wellbore tortuosity.

Table 1 shows the timeline of the work performed on the Sedat #3A.

Several high level observations from the work performed was that (1) the well goes on vacuum very quickly after injection stops (i.e., pressure goes to zero on the surface) and (2) the surface treating pressures were excessively high given the depth of the well and the closure stress.

On September 1, 2015 a DFIT was pumped to determine the closure stress, reservoir pressure, and reservoir transmissibility (kH/mu). The DFIT was pumped at 4 bpm for 1500 gals. Bottomhole pressure was recorded with a bottomhole gauge set 1910 ft. The results from the DFIT using the Nolte G function gave a bottomhole closure stress of 553 psi which gives a closure stress gradient of 0.29 psi/ft.

330.401.1921
hjacot@hfrac.com
www.hfrac.com

P.O. Box 801 • New Philadelphia, OH 44663

The pressure decline data after closure (ACA) was analyzed with the Nolte FR function to determine reservoir transmissibility. Based on the pressure response it appears that pseudoradial flow was reached. The reservoir transmissibility was 88 mD-ft/cP assuming a reservoir fluid viscosity of 1 cP. The actual results will vary based on the actual reservoir fluid viscosity. The formation capacity (kH) was 88 mD-ft. Assuming a height of 50 ft gives a reservoir permeability of 1.8 mD.

Following the DFIT, an attempt was made on September 29, 2015 to breakdown additional perforations with 500 gals of 15 percent HCL acid and small concentrations of sand pumped in a 20 lb/1000 gal linear gel. The surface pressure was reduced when the acid entered the perforations but quickly increased as low concentration (0.25 lb/gal) of 40/70 sand entered the perforations. The sand was cut and the well flushed.

On October 1, 2015 a Step Rate was pumped to determine the fracture extension pressure. The initial rate was 0.25 bpm and increased to 1.0 bpm in increments of 0.25 bpm. The rate was then increased to 4 bpm in increments of 0.50 bpm. The injection time for each rate was four hours.

The results from the Step Rate gave a fracture extension pressure of 1.70 psi/ft which is abnormally high and cannot be used for formation evaluation. The cause of the excessively high fracture extension pressure was near wellbore friction comprised of perforation friction and friction caused by tortuosity (i.e., a poor connection between the wellbore and the created hydraulic fracture).

Based on the results from the Step Rate another attempt was made to reduce the near wellbore friction with additional acid and higher injection rates. On November 17, 2015 several injections were performed to reduce near wellbore friction. The first injection consisted of 1500 gals 7.5 percent HCl acid and the second injection used 750 gals 15 percent HCl acid. Following the second acid injection the injection rate was 26 bpm and the surface pressure was 2980 psi.

A Stepdown was performed after the second acid injection to quantify the amount of near wellbore friction and break out the perforation friction and friction caused by tortuosity. Perforation friction varies with the flow rate squared and tortuosity varies with the square root of the flow rate. The results from the Stepdown show a total near wellbore friction of 2011 psi at 26 bpm of which 1300 psi is perforation friction and 711 psi is friction caused by tortuosity. The number of open perforations was 5 assuming a discharge coefficient of 0.60.

The perforation efficiency is very low with only 5 out of 41 perforations open.

The ISIP at the end of the last injection was 1446 psi giving a F.G (fracture gradient) of 1.23 psi/ft suggesting a possible horizontal component to the created fracture. The high fracture gradient could also be the result of near to mid-field fracture complexity. As with the other injections the surface pressure quickly fell to zero. This rapid pressure decrease following the rate shutdown is a common response for mid-field fracture complexity (i.e., restriction away from the wellbore).

The results from the tests on the Sedat #3A are shown in Table 2.

In summary the Murrysville formation in the Sedat #3A is characterized by low reservoir pressure, 232 psi, low closure stress, 0.29 psi/ft., and higher than anticipated pumping pressures because of complex near or mid-field fracture complexity. Low perforation efficiency also contributed to the higher than expected pumping pressures.

Thank you for the opportunity to work on the Sedat #3A project with Penneco. If you have any questions or comments let me know.

Sincerely,

Henry Jacot
H-Frac Consulting Services, LLC

Table 1 – Timeline

Activity	Date
Perforate	August 7, 2015
Spot Acid and Pull Tubing	August 28, 2015
Break Formation and Pump DFIT	September 1, 2015
Perforation Cleanup	September 29, 2015
Step Rate	October 1, 2015
Perforation Breakdown	November 17, 2015

Table 2 - Results

Parameter	Value
Breakdown Pressure	3115 psi
Bottomhole Closure Stress	553 psi
Closure Stress Gradient	0.29 psi/ft
Surface ISIP	1446 psi
Fracture Gradient	1.23 psi/ft
Reservoir Pressure	232 psi
Reservoir Transmissibility (kH/mu)	88 mD-ft/cP
Formation Capacity (kH)	88 mD-ft
Reservoir Permeability	1.8 mD
Fracture Extension Pressure	N/A

PENNECO
SEDAT #3A
PLUM BOROUGH
ALLEGHENY COUNTY, PA

December 7, 2015



TEST OBJECTIVES

- ✓ Formation Breakdown Pressure
- ✓ Closure Stress
- ✓ Fracture Gradient (F.G.)
- ✓ Reservoir Pressure
- ✓ Reservoir Transmissibility (kH/mu)
- ~~x Fracture Extension Pressure~~



TIME LINE

Activity	Date
Perforate	August 7, 2015
Spot Acid and Pull Tubing	August 28, 2015
Break Formation/Pump DFIT	September 1, 2015
Perforation Cleanup	September 29, 2015
Step Rate	October 1, 2015
Perforation Breakdown	November 17, 2015



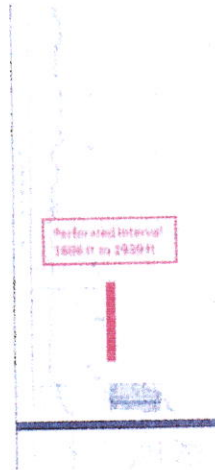
TEST RESULTS

Parameter	Value
Breakdown Pressure	3115 psi
Closure Stress	553 psi
Closure Stress Gradient	0.29 psi/ft
ISIP	1446 psi
Fracture Gradient	1.23 psi/ft
Reservoir Pressure	232 psi
Reservoir Transmissibility (kH/mu)	88 mD-ft/cP
Formation Capacity (kH)	88 mD-ft
Reservoir Permeability	1.8 mD
Fracture Extension Pressure	N/A

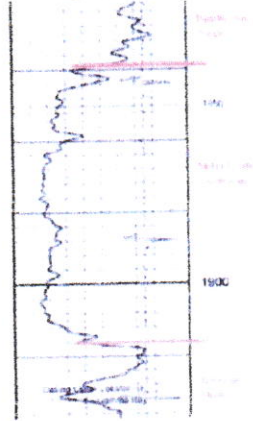


MURRYSVILLE LOGS

Sedat #3A



Snyder
Unit #3

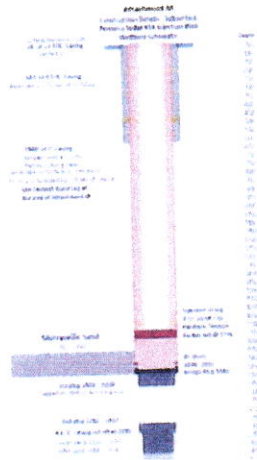


Watt #3



Murrysville type logs.

SEDAT #3A
WELLBORE SCHEMATIC



PERFORATION DATA

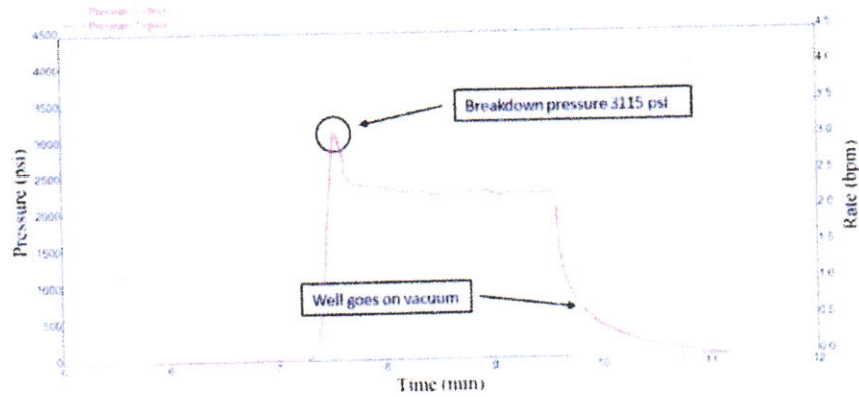
Description	Value
Entry Hole Diameter	0.58"
Phasing	60 degree
Type	EHC
Charge	25 grams
Depth	1896 ft to 1939 ft
Perforations	41 ea



The Sedat #3A was perforated in the Murrysville from 1896 ft to 1939 ft with 41 0.58 in entry hole perforations. Perforation phasing was 60 degrees and the charge was 25 grams.

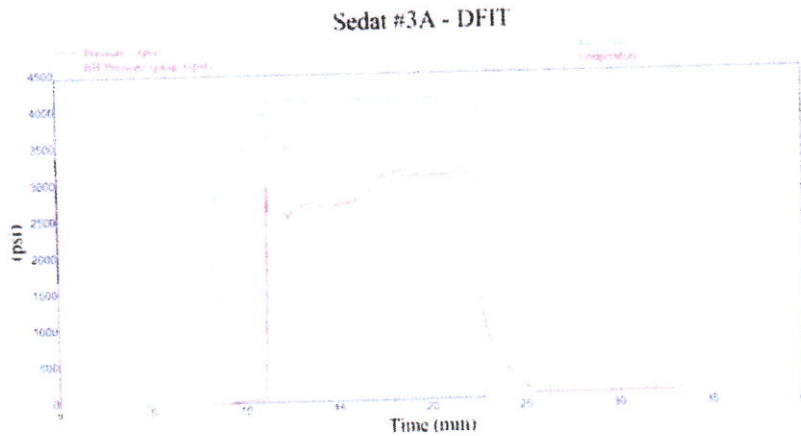
SEDAT #3A BREAKDOWN

Sedat #3A - Breakdown



The Murrysville formation in the Sedat #3A was broke down on September 1, 2015. The breakdown pressure was 3115 psi. Following the breakdown the acid was displaced at 4 bpm. The well was on vacuum after shutdown with the pressure decreasing to zero in less than two minutes.

SEDAT #3A DFIT DATA

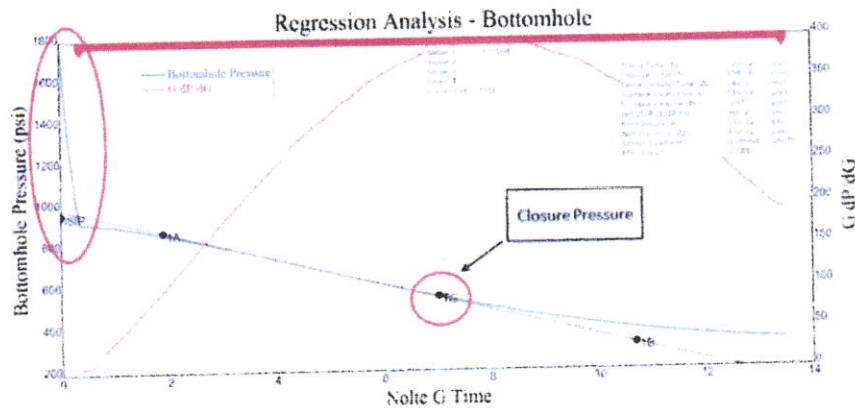


Following the formation breakdown a DFIT (diagnostic fluid injection test) was pumped in the Murrys ville to determine closure stress, reservoir pressure, and reservoir transmissibility (kh/mu). Prior to starting the DFIT the whole was loaded with water. After the hole was loaded 1500 gals of water was pumped at 4.1 bpm. The average surface treating pressure was 2902 psi and the average bottomhole treating pressure was 3816 psi.

During the injection the surface pressure increased from 2700 psi to 3100 psi with a constant rate indication some type of restriction.

After the rate went to zero the surface pressure declined rapidly and went to zero. The bottomhole pressure was recorded with a bottomhole pressure gauge at 1910 ft.

NOLTE G FUNCTION



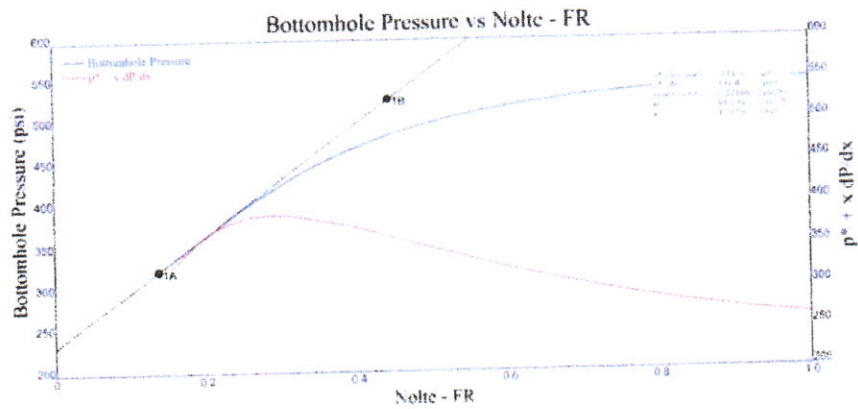
The bottomhole pressure from the DFIT was analyzed with the Nolte G function to determine the closure pressure and closure stress gradient.

Following the injection the pressure declined rapidly. The rapid pressure decline is most likely caused by fracture complexity and low closure stress and not leakoff into the formation.

The estimated bottomhole ISIP is 960 psi resulting in a fracture gradient of 0.50 psi/ft.

Closure occurred at a Nolte G time of 7.2 giving a bottomhole closure of 553 psi. The closure stress gradient is 0.29 psi. The net pressure was 407 psi and the fluid efficiency was 79 percent.

SEDAT #3A AFTER CLOSURE ANALYSIS

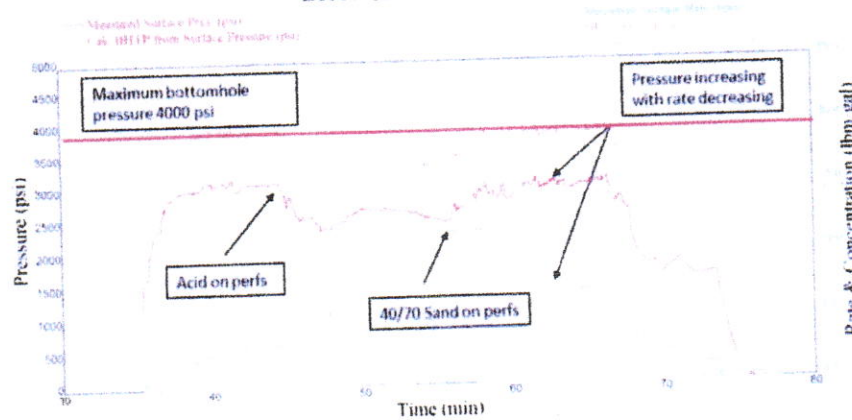


The bottomhole pressure after closure was analyzed using the Nolte FR function. If the late time data reaches pseudoradial flow estimates of reservoir transmissibility (kh/mu) and reservoir pressure can be determined.

The results from the Nolte FR function show that pseudoradial flow was reached. P^* was 232 psi. The formation capacity (kH) was 88 mD-ft assuming a reservoir fluid viscosity of 1 cP. Using a formation height of 50 ft the reservoir permeability is 1.8 mD.

SEDAT #3A PERFORATION CLEANUP

BHTP & Surface Pressure



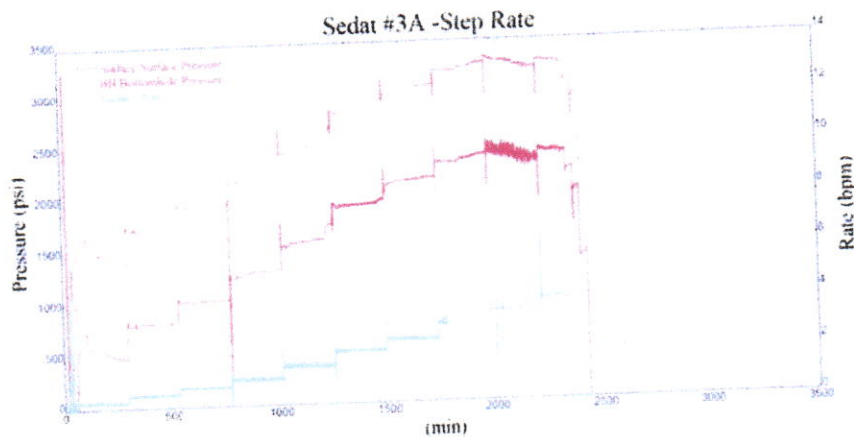
On September 29, 2015 an attempt was made to remove excess friction seen on the DFIT. 500 gals of 15% HCL was pumped. A decrease on the surface treating pressure was seen when the acid was on the perforations. The surface pressure decreased and the injection rate was increased to 12 bpm. The surface pressure continued to decrease to 2500 psi.

Low concentration (0.25 lb/gal) of 40/70 sand was pumped in an effort to remove the excess friction. The surface pressure initially decreased with the 40/70 sand on the perforations but increased rapidly to over 3000 psi on the surface. The maximum pressure on the packer was 4000 psi so the injection was decreased to 11 bpm then to 7 bpm.

The calculated bottomhole pressure remained close to 4000 psi and was erratic.

The rate was reduced and the pressure declined to zero in less than two minutes.

SEDAT #3A STEP RATE TEST

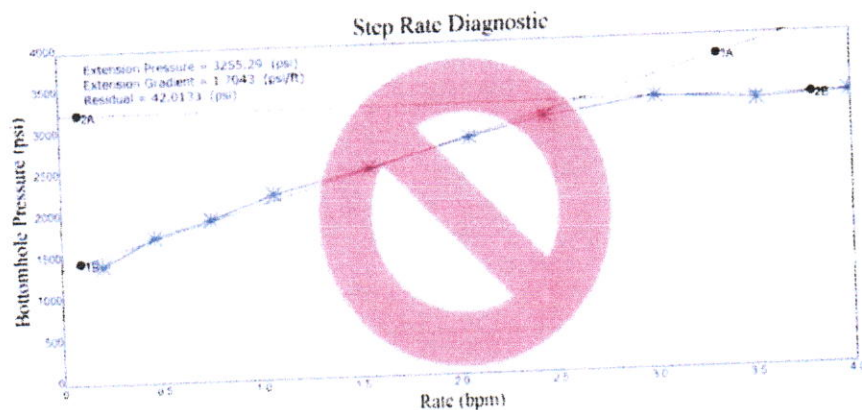


A Step Rate Test was pumped on October 1, 2015 to determine the fracture extension pressure. The initial rate was 0.25 bpm and increased in 0.25 bpm increments until 1 bpm where it was increased to 4 bpm in 0.5 bpm increments. Injection period for each rate stage was 4 hours.

Following the rate increases the rate was decreased from 4 bpm in 1 bpm increments until the rate reached zero.

Total injected volume was 4292 bbls.

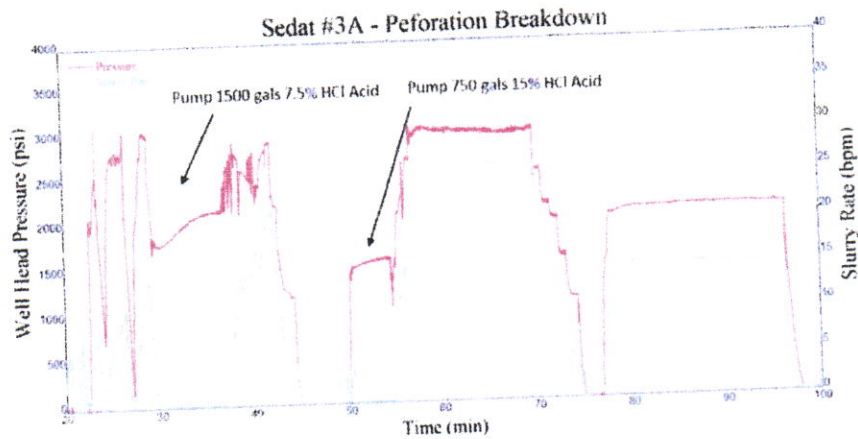
SEDAT #3A STEP RATE



Analysis of the Step Rate gave a fracture extension pressure of 3255 psi and fracture extension gradient of 1.70 psi/ft. This high of extension pressure gradient is unrealistic and cannot be used.

The high fracture extension pressure gradient is a result of excess near wellbore friction as evidenced by the sudden pressure increase with each rate increase (slide 13).

SEDAT #3A PERFORATION BREAKDOWN



On November 17, 2015 additional acid was pumped in an attempt to breakdown additional perforations and remove excess near wellbore friction to establish better communication between the wellbore and created hydraulic fracture.

The first acid injection consisted of 1500 gals 7.5% HCl and the second acid injection was 750 gals 15% HCl acid.

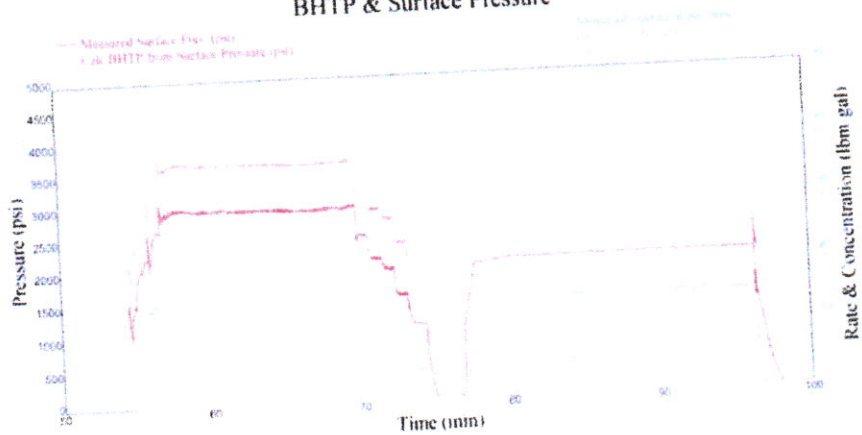
Following the acid injections the maximum rate was 26 bpm at an average surface pressure of 2980 psi.

A rate stepdown was performed at the end of the acid breakdown. An additional injection was pumped at 15 bpm to establish an ISIP.

The ISIP was 1441 psi.

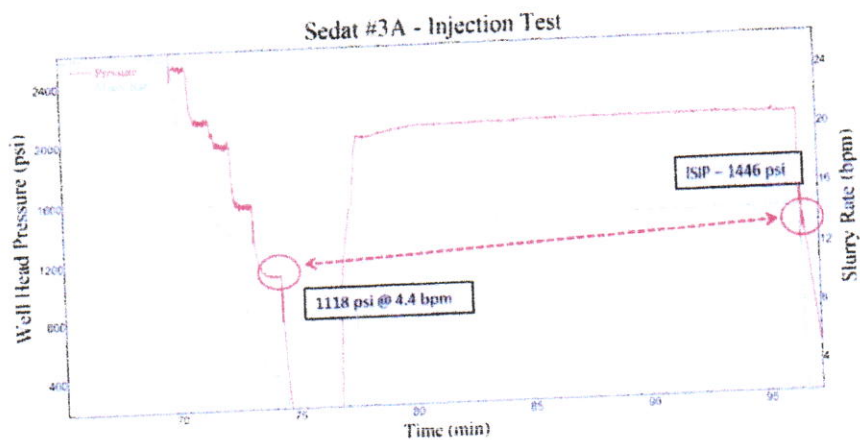
SEDAT #3A **SURFACE & CALC'D BH PRESSURE**

BHTP & Surface Pressure



This plot shows the calculated bottomhole pressure from the acid breakdown.

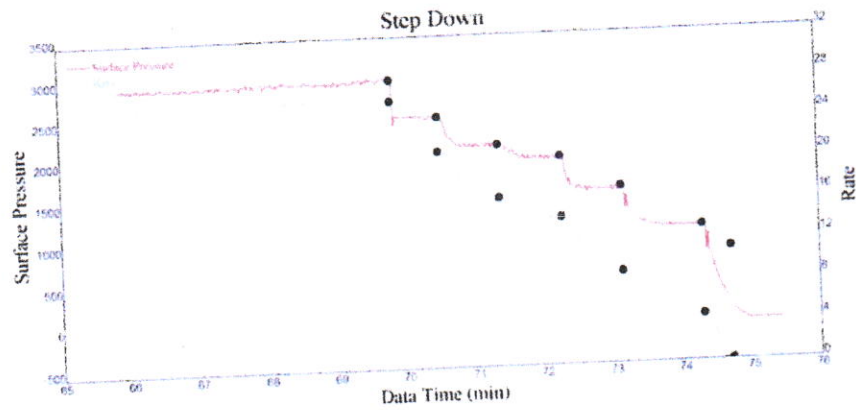
SEDAT #3A INJECTION TEST (ZOOMED)



This plot zooms in on the rate stepdown and final injection. The final rate on the stepdown was 4.4 bpm and the pressure was 1118 psi. The final ISIP was 1446 psi giving a fracture gradient of 1.23 psi/ft

This high of fracture gradient may be caused by either a horizontal fracture or excess fracture complexity.

SEDAT #3A STEPDOWN POINT SELECTION



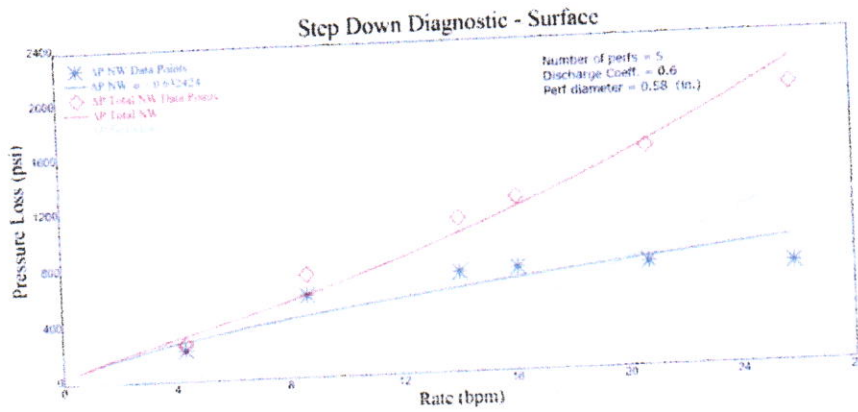
A Stepdown Analysis was conducted to determine the cause of the excess near wellbore friction.

SEDAT #3A
STEPPDOWN TABLE

[illegible]

Stepdown Table showing the point selection and friction values.

SEDAT #3A STEPPDOWN ANALYSIS



The Stepdown Analysis gives a total near wellbore friction of 2011 psi at 26 bpm. Of which 1300 psi is perforation friction and 711 is near wellbore tortuosity. The resulting number of perforations is 5 assuming a discharge coefficient of 0.60.

SEDAT #3A SUMMARY

- A series of injections were pumped on the Sedat #3A to determine closure stress, fracture gradient, reservoir pressure, reservoir transmissibility (permeability), and breakdown pressure.
- During the injection tests excess friction existed either because of limited number of perforations open or near wellbore fracture complexity.
- Attempts were made to reduce the excess friction with acid, higher rates, and low concentrations of 40/70 sand. Acid and higher injection rates removed some of the excess friction but the high excess pressures still existed.
- The rate stepdown analysis showed total near wellbore friction of 2000 psi comprised of 1300 psi of perforation friction and 700 psi of near wellbore tortuosity of fracture complexity.



SEDAT #3A SUMMARY (CONT.)

- The rate stepdown shows only 5 perforations open out of 41 perforations.
- After each injection the pressure quickly fell to zero at the surface because of the low closure stress of the Murrysville.
- The closure stress determined from the DFIT was 553 psi giving a closure stress gradient of 0.29 psi/ft. The Murrysville in the Sedat #3A cannot support a column of water.
- The DFIT reached pseudoradial flow. The After Closure Analysis with the Nolte FR function gave a reservoir transmissibility (kH/μ) of 88 mD-ft/cP assuming a reservoir fluid viscosity of 1 cP. Assuming a height of 50 ft the reservoir permeability is 1.76 mD.



SEDAT #3A

SUMMARY (CONT.)

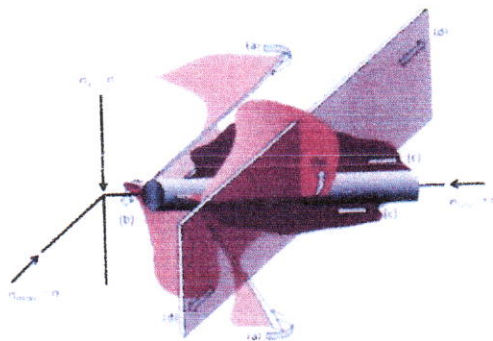
- The ISIP at the end of the last injection was 1446 psi giving a fracture gradient of 1.23 psi/ft suggesting a possible horizontal fracture. The high fracture gradient could also be the result of near or mid-field fracture complexity.



APPENDIX



COMPLEX FRACTURE PROPAGATION HORIZONTAL WELLBORE



2004-04-04 08:00:00 - 08:00:00



AFTER CLOSURE ANALYSIS

- The reservoir transmissiblity (kh/μ) can be calculated by analyzing the pressure decline data after closure; if the late time pressure data reaches pseudo-radial flow.
- Similar to a Horner analysis with the reservoir transmissiblity calculated from the slope of the late time data.
- The pressure data when plotted on log-log scale will exhibit a slope of unity when pseudo-radial flow has developed.



RADIAL FLOW TIME FUNCTION

$$F_R(t, t_c) = \frac{1}{4} \ln \left(1 + \frac{\chi t_c}{t - t_c} \right)$$

where

$\chi = 16 \pi^2$

t_c = time to closure, min

t = time, min

F_R = radial flow function

W. J. LUTHER - SEP 1986 (2)



AFTER CLOSURE ANALYSIS

$$kh / \mu = 251,000 \left(\frac{V_i}{m_R t_c} \right)$$

where

k = reservoir permeability, mD

h = net pay, ft

μ = reservoir fluid viscosity, cP

V_i = volume injected, bbl

m_R = slope

t_c = time to closure, min

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LANCE SHIREY

API Permit #: 3700321223

Customer: PENNECO OIL COMPANY

Lease and Well Name: SEDAT 3A

A.F.E #: N/A

UNIVERSAL
WELL SERVICES, INC.

Job Type: DFIT

Cement Operator: JAMES CAMPBELL

Date Cemented: 10/1/2015

Drilling Contractor: N/A

Cement Slurry Information

No. of Sacks	Cement Blend Composition	Yield (ft ³ /sk)	Mix Water (gal/sk)	Density (lb/gal)	(bbl) Mix Water	(ft ³) Of Slurry	(bbl) Of Slurry
Totals							

Wellbore Information

	New/Used	Diameter (in)	Weight (lb/ft)	Top (ft)	Bottom (ft)	Collapse/Burst Pressures (psi)	Requested TOC (ft)
Casing	USED	4 1/2	10.5	SURFACE	1,930		TVD (ft)
Previous Casing							Displacement Depth (ft)
Tubing or Drillpipe							Displacement (bbl)
Open Hole							
Open Hole							

Pumping Returns

Cement Slurry Temperature Record (°F)

Fluid Information

Spacer or Gel Sweep Return Seen At Surface	Cement	Reading 1	Reading 2	Reading 3	Average	Mix Water Temp (°F)
Cement Returns Seen at Surface	Blend 1					Displacement Fluid Type
Amount of Cement Returns (BBL)	Blend 2					Displacement Fluid Temp (°F)
	Blend 3					Displacement Fluid Density (lb/gal)

Time	Rate (bpm)	Volume (bbl)	Pressure (psi)	Event or Stage Description
0730				ARRIVE ON LOCATION, HOLD JSEA
0745				SPOT TRUCKS, MAKE HOOKUPS, WAIT ON RIG
				HOLD SAFETY MEETING
				LOAD LINES, PSI TEST
0927	.1-1	.1	0-3300	PUMP WATER TO LOAD HOLE
0932	.3-2	.14	0-100	PUMP WATER TO START DFIT
0944	.25	2.7	0-450	SHUTDOWN, RELEASE PRESSURE, UNHOOK
0955	0	0	0	WELL HEAD FLANGE NEEDS TIGHTENED
				PUMP WATER TO START DFIT
1005	.25	60	0-700	RATE CHANGE TO .5 BBL/MIN
1405	.5	120	450-825	RATE CHANGE TO .75 BBL/MIN
1805	.75	180	825-1075	RATE CHANGE TO 1 BBL/MIN
2206	1	240	1075-1330	RATE CHANGE TO 1.5 BBL/MIN
0205	1.5	360	1330-1770	RATE CHANGE TO 2 BBL/MIN
0605	2	480	1770-2004	RATE CHANGE TO 2.5 BBL/MIN
1005	2.5	600	2004-2162	RATE CHANGE TO 3 BBL/MIN
1406	3	720	2162-2400	RATE CHANGE TO 3.5 BBL/MIN
1806	3.5	840	2300-2600	RATE CHANGE TO 4 BBL/MIN
2205	4	512	2450-2500	RATE CHANGE TO 3 BBL/MIN
0011	3	90	2200-2250	RATE CHANGE TO 2 BBL/MIN
0041	2	60	2025-2050	RATE CHANGE TO 1 BBL/MIN
0111	1	30	1400-1450	SHUTDOWN, MONITOR PRESSURE 10 MIN.
0141	0	0	1427-0	RELEASE PRESSURE, UNHOOK
0155				RACKUP
0200				JOB COMPLETE, LEAVE LOCATION
0230				

Comments:

WELL WENT ON VACUUM WHEN PUMPS WERE SHUT DOWN TO MONITOR THE WELL.

HFRAC Report – Page 31

"THANK YOU"

Customer Representative Signature:

TREATMENT SUMMARY			
Customer Name:	Penneco Oil Co	Acid Breakdown	Date: 11/17/15
Well Name:	Sedat #3A		

CLEAN VOLUMES IN GAL

TOP PERF TVD	1896	PAD	
BTM PERF TVD	1936	DISPL	1270
TREATMENT	27888	TTL VOL	36750

RATES IN B.P.M.

AVG TREATING	18.4	MAXIMUM	26.3
--------------	------	---------	------

DESCRIPTION OF JOB Slickwater Fracture

										Totals									
--	--	--	--	--	--	--	--	--	--	---------------	--	--	--	--	--	--	--	--	--



UNIVERSAL
WELL SERVICES, INC.



CWM Environmental
101 Parkview Drive Ext.
Kittanning, Pennsylvania 16201
724-543-3011
Lab # 03-457

Lab Analysis Report

Sample Number: 07163702

Customer: Penneco Oil Co., Inc.

Site: Gas Well

Monitoring Pt: DeSimone #3

Source Type: Discharge

Collection Date: 07/29/16 13:00

Received Date: 07/29/16 15:43

Matrix: Non Potable Water (NPW)

Collection Method: Grab

07163702	Result	Reporting Limit	Method	Analysis Date	Analyst
Specific Gravity	1.1027 grams/ml	grams/ml	ASTM D1429	8/3/16 0:00	33-325
Total Dissolved Solids	140958 mg/L	5 mg/L	SM 2540 C	8/3/16 8:12	PLP
pH	5.78 SU	SU	SM4500 H+B	8/1/16 13:00	EJK

Sample Comments:

pH: The pH result measured @ temperature of 25 deg C pH: The pH was analyzed outside of the 15 minutes holding time.

Ryan C. Shafer, Vice President of Operations

Analyst Reference: 33-325 - G & C Laboratory

HFRAC Report – Page 33



CWM Environmental
11931 State Route 85
Kittanning, Pennsylvania 16201
724-543-3011
Lab # 03-457

Lab Analysis Report

Sample Number: 09150657

Customer: Penneco Oil Co., Inc.	Collection Date: 08/28/15 08:00
Site: Sedat #3A	Received Date: 09/04/15 16:17
Monitoring Pt: Tank Water	Matrix: Non Potable Water (NPW)
Source Type: Discharge	Collection Method: Grab

09150657	Result	Reporting Limit	Method	Analysis Date	Analyst
Specific Gravity	11084 gr/ml	0 gr/ml	ASTM D-1298	9/9/15 0:00	33-325
pH	4.69 SU	SU	SM4500 H+B	9/9/15 13:30	JRD
Total Dissolved Solids	155476 mg/L	5 mg/L	SM 2540 C	9/8/15 16:03	ARB

Sample Comments:

pH: The pH result measured @ temperature of 25 deg C pH: The pH was analyzed outside of the 15 minutes holding time.

Ryan C Shafer, Vice President of Operations

HFRAC Report – Page 34

Analyst Reference: 33-325 - G & C Laboratory

Analyte names in bold are listed under the laboratory's current NELAP scope of accreditation.

Universal Well Services, Inc.
 Chemical Technology
 13549 S. Mosiertown Road
 Meadville, PA
 814-373-3107



Laboratory Water Analysis

Sample Information

Company	Penneco
Well Name	Sedat 3a
Sample ID	Frac Water
Formation	
Date Sampled	9/23/2015
Date Analyzed	9/23/2015
Analyst	Bilich

Analysis Results

Sample 1 Sample 2

pH	4.90	5.10	
Temperature	74.4	74.3	°F
Specific Gravity	1.110	1.132	
Fluid Density	9.26	9.44	lb/gal
Chlorides (titrated)	100,000	120,000	mg/L
Total Dissolved Solids	159,500	191,400	mg/L
Total Suspended Solids	N/A	N/A	mg/L
Approximate Salt Percentage	14.4	16.9	%
Total Hardness	67,000	70,000	mg/L
Ca Hardness	63,000	60,000	mg/L
Ca ²⁺	25,200	24,000	mg/L
Mg Hardness	4,000	10,000	mg/L
Mg ²⁺	971	2,428	mg/L
Total Iron (titrated)	437	319	mg/L
Sulfates	39	10	mg/L
Hydroxide Alkalinity as CaCO ₃	0	0	mg/L
Carbonate Alkalinity as CaCO ₃	0	0	mg/L
Bicarbonate Alkalinity as CaCO ₃	0	0	mg/L
Total Alkalinity as CaCO ₃	0	0	mg/L
Tannin/ Lignin	N/A	N/A	mg/L
Barium/ Strontium PS	< 1	< 1	mg/L
Specific Conductance	172,500	193,200	µmhos/cm

— HFrac Report Supplement Items 5 and 7

—

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Item 5 Attachment Geologic Data

The Fracture Gradient (F.G.) 1.23 psi/ft was calculated using the ISIP (instantaneous shut-in pressure) of 1446 psi and fluid S.G. of 1.10 psi/ft. The mid-perforation depth was 1917.5 ft (1896 ft – 1939 ft).

$$F.G. = \frac{ISIP + HydrostaticHead}{Depth}$$

$$F.G. = \frac{1446 + 913}{1917.5} = 1.23$$

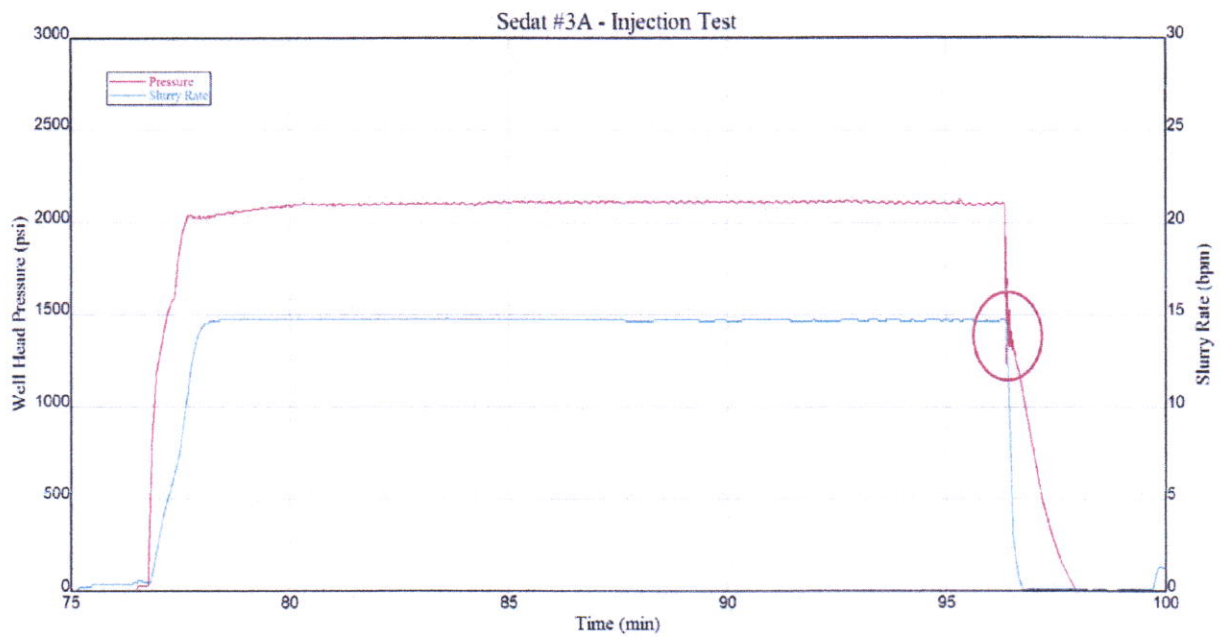


Figure 1 - Sedat 3A Injection Test pumped on November 17, 2015. ISIP 1446 psi.

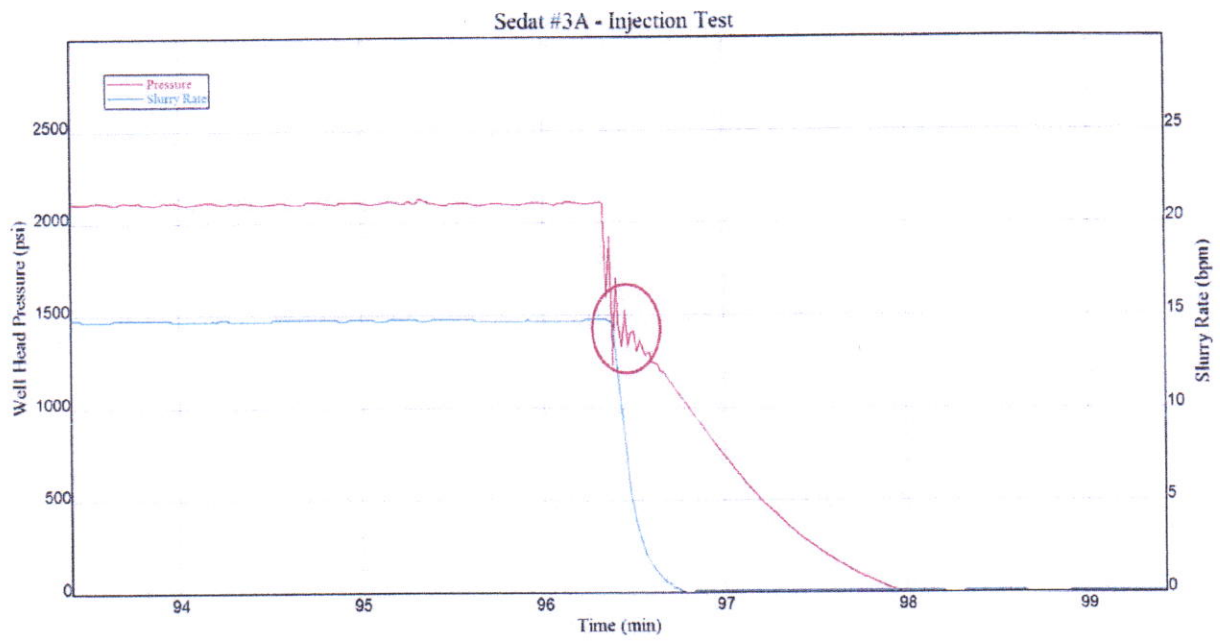


Figure 2 - Sedat #3A Injection Test pumped on November 17, 2015 (zoomed). ISIP 1446 psi

Item 7 Attachment Geologic Data

The reservoir permeability of 1.80 mD was an average permeability using a formation height of 50 ft. Using a reservoir permeability of 1.8 mD and formation height of 50 ft the formation capacity (k/H) was 90 mD/ft.

The bottomhole pressure after closure was analyzed using the Nolte FR function. If the late time data reaches pseudoradial flow estimates of reservoir transmissibility (kh/mu) and reservoir pressure can be determined.

The results from the Nolte FR function show that pseudoradial flow was reached. P* was 232 psi. The formation capacity (kH) was 90 mD-ft assuming a reservoir fluid viscosity of 1 cP. Using a formation height of 50 ft the reservoir permeability is 1.8 mD.

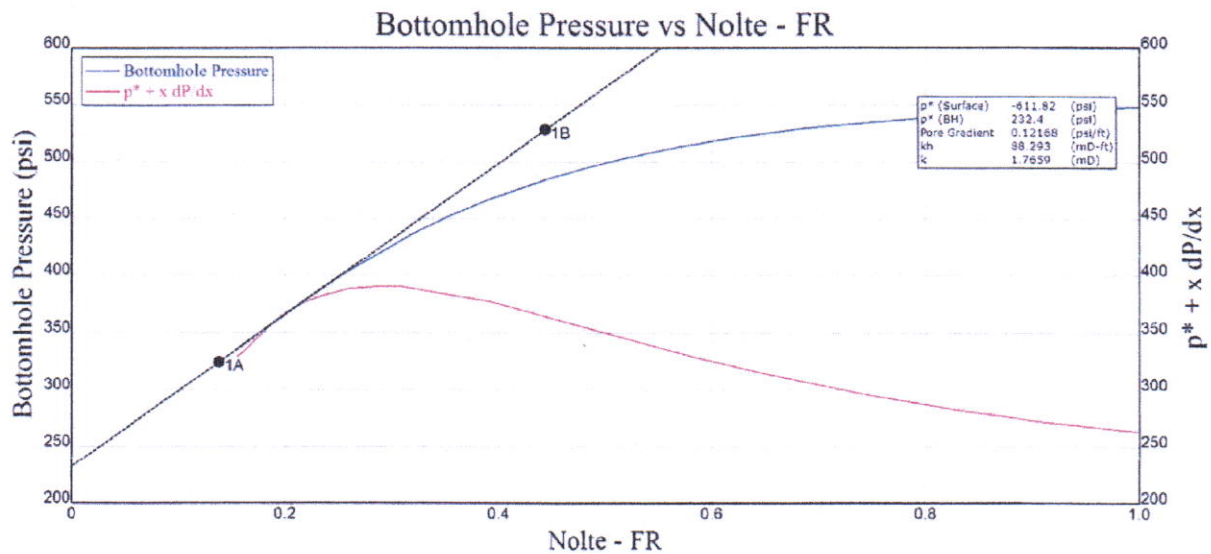


Figure 3 - Sedat #3A After Closure Analysis (ACA)

$$kh / \mu = 251,000 \left(\frac{V_i}{m_R t_c} \right)$$

where

k = reservoir permeability, mD

h = net pay, ft

μ = reservoir fluid viscosity, cP

V_i = volume injected, bbl

m_R = slope

t_c = time to closure, min

**Attachment H
Operating Data
Sedat #3A Injection Well**

Injection Rates and Volumes

- 1) The proposed average injection rate is 1,800 BBLs of water per day and the maximum rate should be no greater than 2,000 BBLs of water per day or 54,000 BBLs per month.

Injection Pressures

- 2) Injection pressure is expected to be below 1,420 psi, the calculated maximum injection pressure at the well head, without accounting for any friction through the perforations through the 7" casing and the pipe friction through the 4 ½" injection string. The bottom hole pressure/reservoir pressure as measured with a bottom hole pressure gage is 232 psi.

The maximum injection pressure of 1,420 psi, was calculated using the formula published in 40 CFR 147.1953, $P_m = [(FG - (0.433)(S_g)]D$, for a column of water. The fracture gradient of 1.23 from the Reservoir and Characterization study found at the end of Attachment G was used. The S_g used was 1.11, the S_g of the produced brine water used in the formation study and a depth of 1,896' the top perforation in the Sedat #3A. $[P_m = (1.23 - 0.433 (1.11))1896]$; $P_m = 1,420\#$.

Annulus Fluid

- 3) Fresh water will be placed in the 4 ½" by 7" annulus, mixed with a chemical such as ALPHA 3207 which acts as a corrosion inhibitor and bacteria growth preventer. One (1) gallon of ALPHA 3207 will be mixed with approximately every 1,000 gallons of fresh water placed in the annulus. The MSD sheet for the chemical mixture ALPHA 3201 listing ingredients and physical data is included in this section. Positive pressure will be maintained on the annulus to monitor mechanical integrity.

Source and Analysis of Injection Fluid

- 4) The source of the injection fluid will be E&P wastes, produced water from oil and gas wells and flow back fluid from oil and gas well stimulation activities. Penneco Environmental Solutions, LLC will accept fluid generated by other drilling and production companies (filing a commercial application) The geographic area from which fluids will be generated is Western Pennsylvania and possibly a small amount of the fluids may originate in the shale gas fields of North Eastern Pennsylvania. Representative sample analyses from two wells are included with this attachment. Before injection the produced fluid will be analyzed for the parameters required by the permit. The produced fluid and flow back water will be subjected to treatment and passed through a filter to remove

large particles and suspended solids from the fluid before injection. The solids removed will be transported to an appropriate waste disposal site.

8-24-16

**Attachment P
Monitoring Program
Sedat #3A Injection Well**

Monitoring Program for Sedat #3A Injection Well

The Sedat #3A injection well will be monitored for the well's entire life in compliance with all EPA monitoring guidelines and reporting requirements.

The injection site is located so that the facilities cannot be seen from public roads or public or private properties adjacent to the site. The access road is gated and will be locked when the site is not operating. The injection site and surface facilities will be fenced and lighted at night with the fenced gate locked when the site is not operating.

There will be one (1) monitoring well, identified by its Pennsylvania issued permit number, 003-21210. This is a depleted gas well that will be adapted for use as an observation well and is 1,010' to the south west of the Sedat #3A, see well plat map at end of Attachment. The well has satisfactory spacing and placement to provide adequate sampling area without having to drill a well or wells for the specific propose of sampling. A monitoring string set on a packer immediately above the Murrysville Sand will be installed to isolate the Murrysville injection zone. Penneco will sample, monitor and record quarterly, or more often if required by permit, the fluid level in the Sedat #1 monitoring well, either by slick line or service rig. The company will monitor the pressure at the well head and as well as the 7" – isolation string annulus. The results will be reported as required by permit or according to EPA guidelines. Any change in fluid level or fluid makeup will be investigated as to its cause. Quarterly mechanical integrity testing will also be conducted.

Pressure and rate monitoring will be at the well site (wellhead); both injection pressure and the pressure on the 7" by 4 ½" annulus will be monitored. The company will also conduct quarterly mechanical integrity testing as required by Pennsylvania Oil and Gas regulations. Pressure will be measured by use of a continuously recording pressure gage and the injection rate by a continuously recording flow meter. Results will be reported to the EPA as required by the injection permit or according to EPA guidelines, but not less than annually.

The specific gravity of each truck load will be measured to ensure the specific gravity of the fluid to be injected does not exceed the allowed value.

Injection fluids will be sampled and analyzed quarterly with the sample taken at the injection site (wellhead). The results will be reported as required by the permit or according to EPA guidelines.

The company will also be prepared to conduct any other monitoring or sampling as required by the permit.

CLIENT

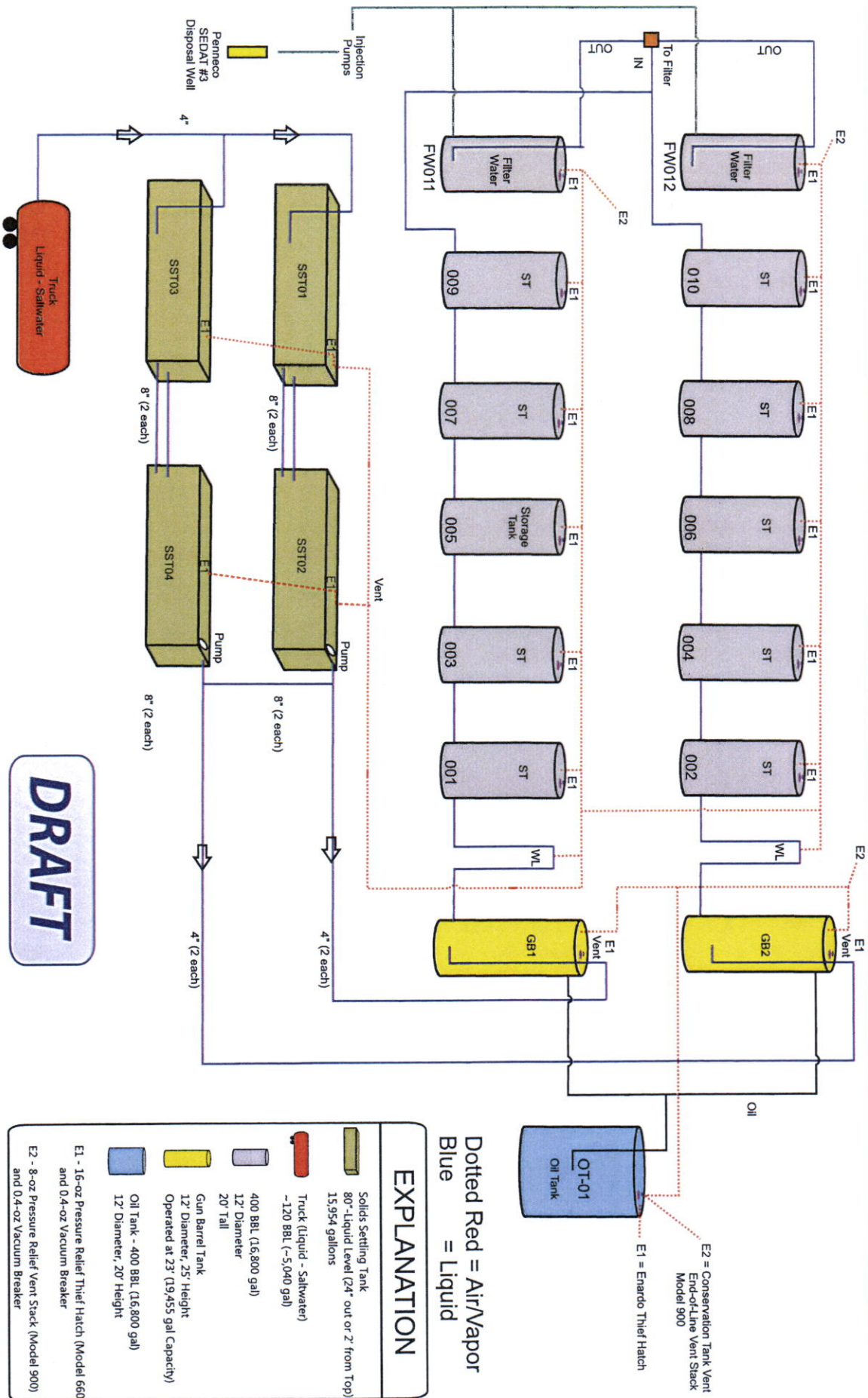
PROJECT DESCRIPTION

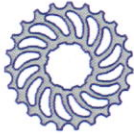
FIGURE 1

DRAFT

EXPLANATION

- Solids Settling Tank
80'-Liquid Level (24" out or 2' from Top)
15,954 gallons
- Truck (liquid - Saltwater)
~120 BBL (~5,040 gal)
- 400 BBL (16,800 gal)
12" Diameter
20' Tall
- Gun Barrel Tank
12" Diameter, 25' Height
Operated at 23' (19,455 gal Capacity)
- Oil Tank - 400 BBL (16,800 gal)
12" Diameter, 20' Height
- E1 - 16-oz Pressure Relief Thief Hatch (Model 660) and 0.4-oz Vacuum Breaker
- E2 - 8-oz Pressure Relief Vent Stack (Model 900) and 0.4-oz Vacuum Breaker





Titanium Environmental Services, LLC

P.O. Box 4029
Longview, Texas 75606-4029

Phone (903) 234-8443
Fax (903) 234-1641

September 28, 2016

Mr. Marc Jacobs
Penneco Environmental Solutions, LLC
6608 Route 22
Delmont, Pa 15626-2408

RE: Proposal for a Surface Facility for your proposed Sedat #3 SWD

Dear Mr. Jacobs,

Titanium Environmental Services, LLC (TES) is pleased to present the draft drawings and process flow for Penneco Environmental Solutions, LLC (PES) Sedat #3 Salt Water Disposal (SWD) well surface facility. As previously discussed, PES and TES agree that safe and environmentally sound design and operations are paramount to meeting PES's expectations for their operation.

In that vein, TES has proposed a facility that would be acceptable for Resource Conservation and Recovery Act (RCRA) waste operations. TES believes that ultimately the requirements for wells and surface facilities that manage class II waste related to exploration and production will be raised to match those presently applicable to class 1 non-hazardous well and facility operations. Some of these requirements will be very expensive or even impossible to incorporate into existing wells and surface structures. As the cost to construct the well(s) and surface equipment with the safeguards that will be regulatory mandates is not significant, if incorporated with the construction design, we recommend and have incorporated these protective components into our plans.

The entire surface facility will be built atop a multilayered secondary containment system/structure. The facility will begin with a base layer of clay, felt liner, 60 mil High Density Polyethylene (HDPE) liner, and another felt liner, perforated liquid collection pipe system covered by pea gravel, concrete containment floor and walls. The edge of the HDPE liner will be folded up against the containment walls to keep rainwater from entering the system. The liquid collection system piping will be extended from under the containment to allow for inspection or liquid (condensation) removal and as the last mechanical containment to intercept a leak.

Notice the truck unloading pad is built to prevent rainwater run on and all rainwater or truck leakage will be collected by the truck bay collection system which empties into the solids settling tank containment which can hold all the trucks that could be in the truck bays. All sump pumps automatically empty the sumps without human intervention. If the receiving tanks can't hold the trucks trying to unload (Level transmitters) the system closes all unloading lines until there is sufficient room to

continue unloading. Further if there is insufficient room in the storage tanks, the system will not let the transfer pumps move fluid from the receiving/settling tanks to the storage tanks. Thus the unloading valves won't open nor will the transfer pumps transfer fluid into tanks that are already full. The water filtering pumps will transfer filtered water into the pre-injection tanks (Filtered Water) as long as the fluid level in the filtered water tanks does not exceed the upper limit established by the operator. The injection pumps will inject water into the well as long as there is sufficient filtered water to inject and all control parameters for the well are within preset value ranges.

All liquid unloading at the facility will enter tanks that are equipped with internal piping that allows fluids to be introduced under the liquid level in the tanks (submerged loading). Submerged loading is a recognized method of reducing emissions. All liquid transfer systems are connected together by a vent header to vapor balance the exchange between the receiving and transferring tanks. All used filters and tank cleanout solids are collected and disposed of to a permitted facility.

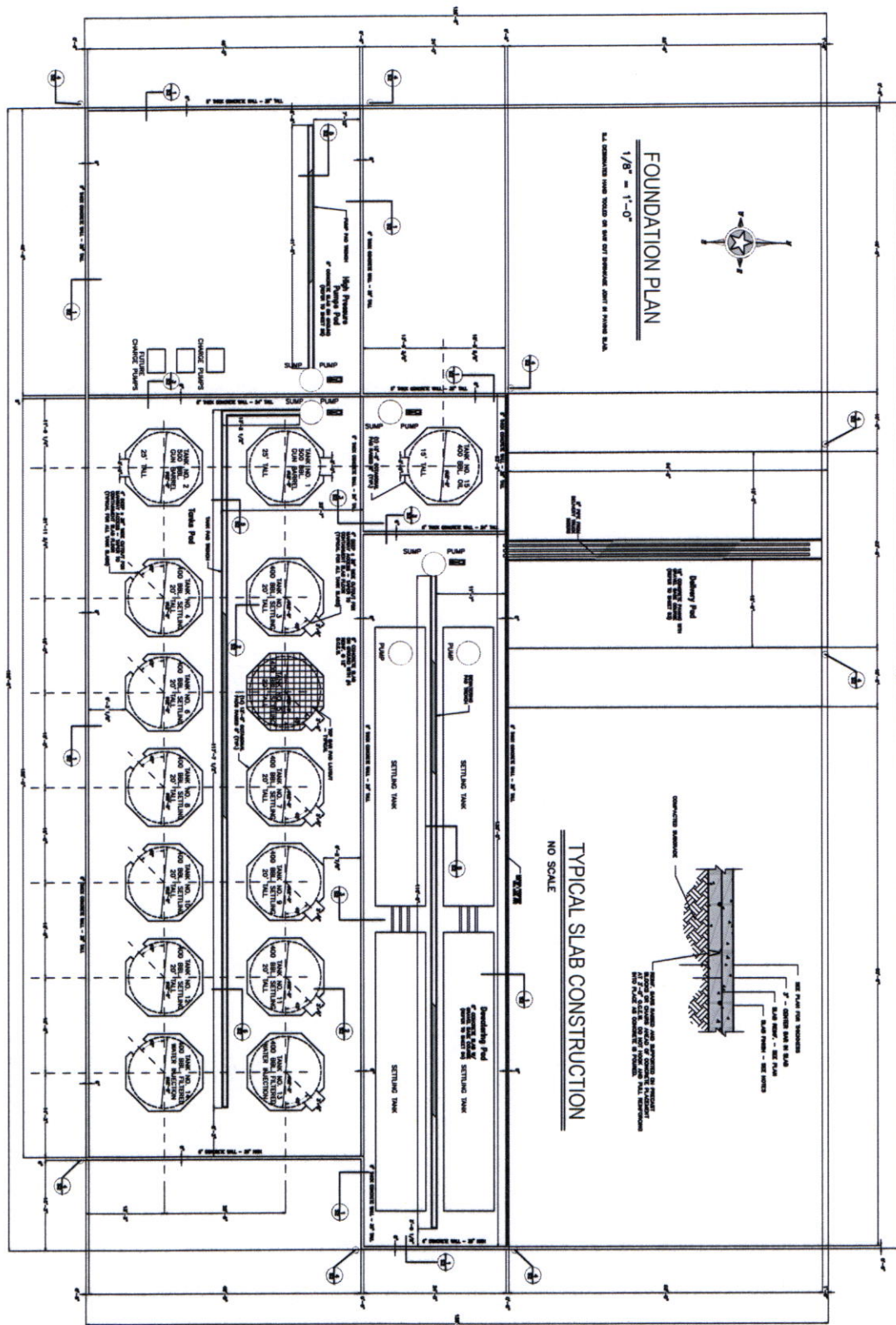
TES suggest Standard Operating Procedures (SOP) and daily facility inspections which would not be addendums to the Permit as they will have to be modified over time and could be "Permit Modifications" if they were addendums. All waste should have an approved profile to be accepted at the facility. All trucks would be unloaded through Mass Flow Meters recording density and volume. Likewise Mass Flow Meters would be used for injection measurement for reporting of density and volume.

Simplicity in design with many passive controls that don't require human attention or maintenance is TES's design goal. The design also reduces the number of incidents/accidents caused by operator error or inattention. Tanks that might fail, can be valved out of operation and bypassed with no effect on the operation. There is one transfer pump (plus one standby), one filter pump (plus one standby), one charge pump (plus one standby) and one injection pump (plus one standby). Three unloading bays and only one or two required. Since the PLC logic instructs the continuous filtration and injection of water, the only operator interaction is changing the filters when required and making sure inbound trucks/loads are approved into the facility and then enabling the specific unloading valve. All sump pumps activate automatically and are freeze protected as is the transfer pump. All containments have a fluid level alarm to detect leaks and have reduced height walls between them that together can contain 110% of any of the tank systems plus a twenty-five year 24 hour rainfall event.

If you have any questions about this letter or any of the drawings or process flow diagram please call TES' Special Projects Manager, Lynn Goldston – 903-235-1477.

[illegible][illegible][illegible]

part of a law drafted and passed by the U.S. House of Representatives in 1990. The law, which is known as the Americans with Disabilities Act, prohibits discrimination against people with disabilities in employment, public accommodations, and telecommunications. The law also requires employers to make reasonable accommodations for people with disabilities. The law is a landmark piece of legislation that has helped to ensure that people with disabilities have the same opportunities as everyone else.



WATER SUPPLY SURVEY

MUNICIPALITY	COUNTY	STATE	OWNER	Address	City, State, Zip	PIN	Water	Well Details	Mailed Assessment Address	Called	Notes
Plum	Allegheny	PA	James D & Suzanne Pattock	2029 Old Leechburg Rd	New Kensington, PA 15068	1233-P-00003	No Response		7/28/2016	Voicemail Message on or before 9-8-16	
Plum	Allegheny	PA	Nancy Rosenberg	2032 Old Leechburg Rd	New Kensington, Pa 15068-8324	1233-P-00036	No Response		7/28/2016	Voicemail Message on or before 9-8-16	
Plum	Allegheny	PA	Mark M & Judith Ann Sweeny	2024 Old Leechburg Rd	New Kensington, Pa 15068-8324	1233-P-00109	No Response		7/28/2016	Voicemail Message on or before 9-8-16	
Plum	Allegheny	PA	Kirt E & Lisa M Pattock	4059 7Th Street Rd	New Kensington, Pa 15068	1234-A-00160	No Response		7/28/2016	Voicemail Message on or before 9-8-16	
Plum	Allegheny	PA	David V & Teresa D Kvortek	864 Hill St	New Kensington, Pa 15068	1234-B-00322	No Response		7/28/2016	Voicemail Message on or before 9-8-16	
Plum	Allegheny	PA	Benjamin F. Buchholz	1924 Old Leechburg Rd.	New Kensington, Pa 15068	1234-F-00085	No Response		7/28/2016	Voicemail Message on or before 9-8-16	
Plum	Allegheny	PA	Daniel S Cooper	1855 Old Leechburg Rd	New Kensington, Pa 15068	1234-F-00159	No Response		7/28/2016	Voicemail Message on or before 9-8-16	
Plum	Allegheny	PA	Lewis R Giacco	P.O. Box 327	West Sunbury, PA 16061	1234-F-00242	No Response		7/28/2016	Voicemail Message on or before 9-8-16	
Plum	Allegheny	PA	Janet Ann & Russell William Mitchell	504 Clarendon St	Pittsburgh, Pa 15238	1234-G-00026	No Response		7/28/2016	Voicemail Message on or before 9-8-16	
Plum	Allegheny	PA	Herman E & Irene B Vanhorn	1920 Drennen Rd.	New Kensington, PA 15068	1234-G-00086	No Response		7/28/2016	Voicemail Message on or before 9-8-16	
Plum	Allegheny	PA	Shirley Ann & Eddie Lion Sprouse	1927 Drennen Rd	New Kensington, Pa 15068-1804	1234-G-00148	No Response		7/28/2016	Voicemail Message on or before 9-8-16	
Plum	Allegheny	PA	James & Shirley Smith	1933 Drennen Rd	New Kensington, Pa 15068	1234-G-00155	No Response		7/28/2016	Voicemail Message on or before 9-8-16	
Plum	Allegheny	PA	Romaine E Kozuch	229 5Th Ave	New Kensington, Pa 15068	1234-G-00219 & 00230	No Response		7/28/2016	Mailed Tax assessment address.	
Plum	Allegheny	PA	Joshua Hipple	1958 Greensburg Rd.	New Kensington, Pa 15068	1234-H-00270	No Response		7/28/2016	Voicemail Message on or before 9-8-16	
Plum	Allegheny	PA	Robert J & Mary Lee Dziuban	Po Box 961252	Fort Worth, Tx 76161	1234-L-00142	No Response		7/28/2016	Voicemail Message on or before 9-8-16	
Plum	Allegheny	PA	Harry L & Patricia L. Burkey	1942 Drennen Rd	New Kensington, Pa 15068	1234-L-00184	No Response		7/28/2016	Called 9-8-16 and 9-9-16	
Upper Burrell	Westmoreland	PA	Walter T Menhart	109 Myers Dr	New Kensington Pa 15068	62-07-00-0-013	No Response		7/28/2016	Voicemail Message on or before 9-8-16	
Upper Burrell	Westmoreland	PA	Gerald L & Joy Greiner	134 W Pittsburgh St	Delmont Pa 15626	62-08-00-0-006	No Response		7/28/2016	Voicemail Message on or before 9-8-16	
Upper Burrell	Westmoreland	PA	David & Edna Kasmoch	1509 Big Bend Rd.	Emlenton, PA 16373	62-08-00-0-008	No Response		7/28/2016	Voicemail Message on or before 9-8-16	

Upper Burrell	Westmoreland	PA	Jessalin M. Callender	1920 Greensburg Rd	New Kensington Pa 15068	62-80-00-0-001	No Response		7/28/2016	Voicemail Message on or before 9-8-16	
Plum	Allegheny	PA	Andrew Palombo	430 Donald Rd	Pittsburgh, Pa 15235	1097-S-00395	None		7/28/2016		Message left 8-25-16
Plum	Allegheny	PA	Mable Harris	Undeliverable	Undeliverable	1096-M-00016	None		7/28/2016		
Plum	Allegheny	PA	Palombo-Aiello Maria Palombo Ferdinand	433 Donald Rd	Pittsburgh, Pa 15235	1097-S-00301	None		7/28/2016		
Plum	Allegheny	PA	Alvin R Iii & Diane Elizabeth Miller	Undeliverable	Undeliverable	1098-D-00128	None		7/28/2016		
Plum	Allegheny	PA	Anna Louise & Kathleen Costa Miller	2240 Freeport Rd 622 Frank Dr	New Kensington, Pa 15068	1233-J-00342 & 1233-N-00346	None		7/28/2016		
Plum	Allegheny	PA	Klint L & Jennifer S Macro	1814 Greensburg Rd	New Kensington, Pa 15068	1233-P-00044	None	Vacant	7/28/2016		
Plum	Allegheny	PA	Lucille Christina & Raymond Armoul Logan Frere	1206 5Th Ave	New Kensington, Pa 15068	1234-C-00347	None	Vacant	7/28/2016		
Plum	Allegheny	PA	Joseph & Ilde Pasquarelli	693 Harrogate Rd	Pittsburgh, Pa 15241	1234-C-00377	None		7/28/2016		
Plum	Allegheny	PA	Sedat Inc	6608 Route 22	Delmont, Pa 15626-2408	1234-F-00206	None		7/28/2016		
Plum	Allegheny	PA	Ttmar Inc	Undeliverable	Undeliverable	1234-G-00077	None		7/28/2016		
Plum	Allegheny	PA	Joseph & Michelle Vaglia	418 Willowbrook Rd	Apollo, Pa 15613	1234-G-00126	None		7/28/2016		
Plum	Allegheny	PA	Theodore & Virginia Smolenski	14 Tenby Chase Dr	Newark, De 19711	1234-K-00134	None		7/28/2016		
Plum	Allegheny	PA	Allegheny Valley Habitat For Humanity	Po Box 147	Natrona Heights, Pa 15065	1234-K-00154	None	n/a	7/28/2016	8/23/2016	
Plum	Allegheny	PA	Ben Dziuban	520 Walnut St BAD 204 Ohara Woods Dr. NEW	Pittsburgh, Pa 15238	1234-L-00106	None	n/a	7/28/2016		
Plum	Allegheny	PA	Donna Jean Haas	4130 7Th Street Rd	New Kensington, Pa 15068	1096-M-00261	None		7/28/2016		
Plum	Allegheny	PA	Clarence Chambers	1609 Greensburg Rd	New Kensington, Pa 15068	1096-H-00355	None		7/28/2016		
Plum	Allegheny	PA	A William Visnansky & Susan M Balazik & Jean A Milko	9517 Ferry Harbour Ct	Alexandria, Va 22309	1096-M-00010	Public	n/a	7/28/2016	8/23/2016	
Plum	Allegheny	PA	Benedict & Ferdinand & Andrew Palombo	370 Hamilton Dr Ext	Pittsburgh, Pa 15235	1097-M-00126	Public		7/28/2016		
Plum	Allegheny	PA	Antoinette Cardinale	360 Hamilton Dr Ext	Pittsburgh, Pa 15235	1097-R-00100	Public		7/28/2016		
Plum	Allegheny	PA	Benedict & Kathy Ann Palombo	1778 Old Leechburg Rd	New Kensington, Pa 15068	1097-S-00348	Public		7/28/2016		
Plum	Allegheny	PA	Ladonna H Fuge	1730 Old Leechburg Rd	New Kensington, Pa 15068	1098-D-00299 & 00277	Public		7/28/2016		
Plum	Allegheny	PA	Rosalyn Christopherson			1233-N-00269	Public		7/28/2016		
Plum	Allegheny	PA	Robert W & Barbara L Matt				Public		7/28/2016		
Plum	Allegheny	PA	Annie Rebecca Cook NEW OWNER	732 Tradewinds Dr 1746 Faulk Rd. (Tax)	Brandon, Fl 33511 New Kensington, PA 15068 (Tax)	1233-N-00303	Public		7/28/2016		
Plum	Allegheny	PA	Phillip Jr & Allene C Otlano	5137 Butler St	Pittsburgh, Pa 15201	1233-N-00326	Public		7/28/2016		
Plum	Allegheny	PA	Andrew & Anna Daugherty	1823 Greensburg Rd 1755 Greensburg Rd (Tax)	New Kensington, PA 15068	1233-N-00354	Public		7/28/2016		
Plum	Allegheny	PA	Marvin H Williams	431 Markle Rd	Apollo, Pa 15613	1233-N-00362	Public		7/28/2016		
Plum	Allegheny	PA	Andrew R & Linda E Strano	516 Farneth Rd	New Kensington, Pa 15068	1233-N-00375	Public		7/28/2016		
Plum	Allegheny	PA	Jennie E & Louis R Daugherty	1769 Greensburg Rd	New Kensington, Pa 15068	1233-N-00384	Public		7/28/2016		
Plum	Allegheny	PA	Lottie E Park & Arthur D Phillips & Anna Phillips	1804 Greensburg Rd	New Kensington, Pa 15068	1233-P-00069	Public		7/28/2016		
Plum	Allegheny	PA	Matthew W Podobnik	1932 Old Leechburg Rd	New Kensington, Pa 15068	1234-B-00160	Public		7/28/2016		
Plum	Allegheny	PA	John R & Margaret J Labella	77 S Main St	Washington, Pa 15301	1234-B-00293	Public		7/28/2016		
Plum	Allegheny	PA	Ralph & Ethely Nankrom	38 Terrace Rd	Carnegie, Pa 15106-1053	1234-G-00071	Public		7/28/2016		
Plum	Allegheny	PA	Beverly J & William E Siskos	103 Rock Springs Rd	Delmont, Pa 15626-1114	1234-G-00098	Public		7/28/2016		
Plum	Allegheny	PA	Thomas W Scheetz	1730 Old Leechburg Rd	New Kensington, Pa 15068	1234-J-00010	Public		7/28/2016		
Plum	Allegheny	PA	James J & Donna J Hoey	Po Box 8469	Canton, Oh 44711	1234-L-00165	Public		7/28/2016		
Plum	Allegheny	PA	Michael A & Linda S. Baleno	2701 Renton Rd	Pittsburgh, Pa 15239	1235-K-00276	Public		7/28/2016		
Plum	Allegheny	PA	Martha J Slack	2008 Old Leechburg Rd	New Kensington, Pa 15068-8324	1234-B-00217 & 00227	Public		7/28/2016		
Plum	Allegheny	PA	William C & Gail Z Powell	1724 Greensburg Rd	New Kensington, Pa 15068-1718	1096-M-00062	Public		7/28/2016		
Plum	Allegheny	PA	John L Pater	2016 Old Leechburg Rd	New Kensington, Pa 15068	1233-P-00129	Public		7/28/2016		
Upper Burrell	Westmoreland	PA	Dwight E & Kenna Householder	101 Myers Dr	New Kensington Pa 15068	62-07-00-0-014	Residential	Has an old well that does not work and has no pump	7/28/2016		
Plum	Allegheny	PA	Anna Aspden	1781 Old Leechburg Rd	New Kensington, Pa 15068	1097-M-00142	Spring	located 144' East of the house	7/28/2016		

Plum	Allegheny	PA	Frank T & Marcia Marie Smolenski	1900 Old Leechburg Rd	New Kensington, Pa 15068	1234-K-00185	Spring	Middle of property	7/28/2016		
Upper Burrell	Westmoreland	PA	Louis Cynthia Louise Trzeciak	1500 Menk Rd	New Kensington Pa 15068	62-08-00-0-086	Well	40' from house, 75' deep	7/28/2016		Via Mail
Plum	Allegheny	PA	Robert M Teorsky	1 Home Campus	Des Moines, Ia 50328	1233-N-00241	Well	Geo Thermal heat supply well	7/28/2016		
Plum	Allegheny	PA	Klint L & Jennifer S Macro	Po Box 961252	Fort Worth, Tx 76161	1233-P-00086	Well	2 Directly next to the house	7/28/2016		
Plum	Allegheny	PA	Leonard J & Nina E Hasson			1233-P-00198	Well	not provided	7/28/2016		
Plum	Allegheny	PA	Richard A & Mary Jane Martin	1819 Greensburg Rd	New Kensington, Pa 15068	1233-P-00215	Well	not provided	7/28/2016		
Plum	Allegheny	PA	Louis R Daugherty	1815 Greensburg Rd	New Kensington, Pa 15068	1233-P-00245 & 00227	Well	back corner of house	7/28/2016		
Plum	Allegheny	PA	David R Daugherty	1801 Greensburg Rd	New Kensington, Pa 15068	1233-P-00258 & 00262	Well		7/28/2016		
Plum	Allegheny	PA	Mary C Schwartz	4198 Brittany Dr	Ellicott City, Md 21043	1234-B-00198	Well	Not working at this time.	7/28/2016		
Plum	Allegheny	PA	Wilton E & Gracie E Barker (deceased)	1123 Park View Dr	Covina, Ca 91724	1234-G-00164	Well	house is in foreclosure	7/28/2016		
Plum	Allegheny	PA	Donald J & Florence M (W) Anuskiewicz	1938 Greensburg Rd	New Kensington, Pa 15068	1234-G-00204	Well		7/28/2016		
Plum	Allegheny	PA	Frank Choltko Iii	1820 Old Leechburg Rd	New Kensington, Pa 15068	1234-J-00087	Well	Front yard	7/28/2016		
Plum	Allegheny	PA	Theodore & Virginia Smolenski	1835 Old Leechburg Rd	New Kensington, Pa 15068	1234-K-00222	Well	At House	7/28/2016		
Upper Burrell	Westmoreland	PA	Louis Anthony & Sandy Lombardo	1550 Menk Rd	New Kensington Pa 15068	62-07-00-0-015	Well	115' deep, 70' of water, 6 feet south of house	7/28/2016		
Plum	Allegheny	PA	David A & Stephanie Plance	2013 Old Leechburg Rd	New Kensington, Pa 15068	1234-B-00254 & 00258	Well		7/28/2016		

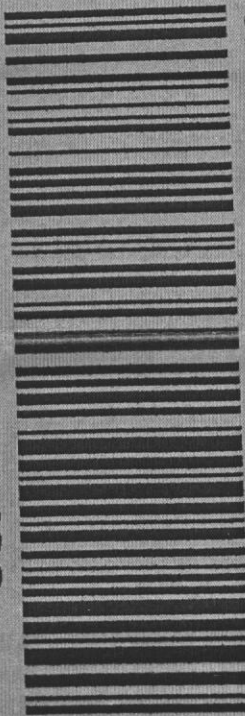
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DATE & TIME	STATUS OF ITEM	LOCATION
July 29, 2016 , 2:56 pm	Delivered, In/At Mailbox	NEW KENSINGTON, PA 15068

Your item was delivered in or at the mailbox at 2:56 pm on July 29, 2016 in NEW KENSINGTON, PA 15068.

July 29, 2016 , 7:50 am	Out for Delivery	NEW KENSINGTON, PA 15068
July 29, 2016 , 7:40 am	Sorting Complete	NEW KENSINGTON, PA 15068
July 29, 2016 , 7:30 am	Departed USPS Facility	PITTSBURGH, PA 15290
July 29, 2016 , 7:22 am	Arrived at Post Office	NEW KENSINGTON, PA 15068
July 29, 2016 , 5:08 am	Arrived at USPS Origin Facility	PITTSBURGH, PA 15290
July 29, 2016 , 4:30 am	Departed USPS Facility	WARRENDALE, PA 15095
July 29, 2016 , 4:17 am	Arrived at USPS Origin Facility	WARRENDALE, PA 15095
July 29, 2016 , 2:27 am	Departed USPS Facility	WARRENDALE, PA 15086
July 28, 2016 , 11:57 pm	Arrived at USPS Origin Facility	WARRENDALE, PA 15086
July 28, 2016 , 5:02 pm	Departed Post Office	CLARION, PA 16214
July 28, 2016 , 10:57 am	Acceptance	CLARION, PA 16214

Available Actions

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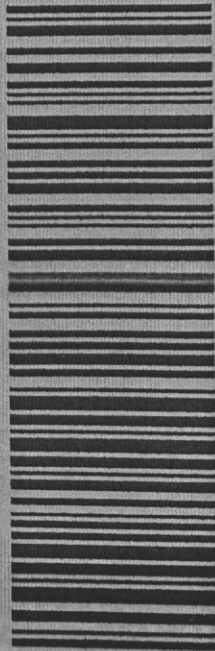
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Jessalin M. Callender
1920 Greensburg Rd
New Kensington Pa 15068

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Product & Tracking Information

Postal Product:

Features:

USPS Tracking®

DATE & TIME

STATUS OF ITEM

LOCATION

July 29, 2016 , 11:41 am

Delivered, In/At Mailbox

NEW
KENSINGTON, PA 15068

Your item was delivered in or at the mailbox at 11:41 am on July 29, 2016 in NEW KENSINGTON, PA 15068.

July 29, 2016 , 7:50 am

Out for Delivery

NEW
KENSINGTON, PA 15068

July 29, 2016 , 7:40 am

Sorting Complete

NEW
KENSINGTON, PA 15068

July 29, 2016 , 7:22 am

Arrived at Post Office

NEW
KENSINGTON, PA 15068

July 29, 2016 , 4:30 am

Departed USPS Facility

WARRENDALE, PA 15095

July 29, 2016 , 3:03 am

Arrived at USPS Origin
Facility

WARRENDALE, PA 15095

July 29, 2016 , 2:27 am

Departed USPS Facility

WARRENDALE, PA 15086

July 28, 2016 , 11:56 pm

Arrived at USPS Origin
Facility

WARRENDALE, PA 15086

July 28, 2016 , 5:02 pm

Departed Post Office

CLARION, PA 16214

July 28, 2016 , 10:57 am

Acceptance

CLARION, PA 16214

Available Actions

Track Another Package

Tracking (or receipt) number

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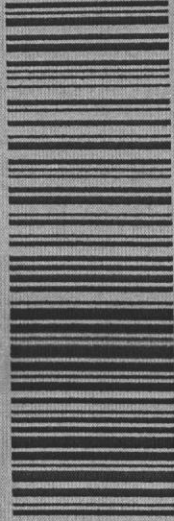
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Clarion, PA 16214



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9114 9999 4431 3758 4338 75

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Daniel S Cooper
1855 Old Leechburg Rd
New Kensington, Pa 15068

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Product & Tracking Information

Postal Product:

Features:
USPS Tracking®

DATE & TIME	STATUS OF ITEM	LOCATION
July 29, 2016 , 12:58 pm	Delivered, In/At Mailbox	NEW KENSINGTON, PA 15068

Your item was delivered in or at the mailbox at 12:58 pm on July 29, 2016 in NEW KENSINGTON, PA 15068.

July 29, 2016 , 7:50 am	Out for Delivery	NEW KENSINGTON, PA 15068
July 29, 2016 , 7:40 am	Sorting Complete	NEW KENSINGTON, PA 15068
July 29, 2016 , 7:22 am	Arrived at Post Office	NEW KENSINGTON, PA 15068
July 28, 2016 , 5:02 pm	Departed Post Office	CLARION, PA 16214
July 28, 2016 , 10:57 am	Acceptance	CLARION, PA 16214

Available Actions

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Tracking (or receipt) number

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9114 9999 4431 3758 4199 47

Robert J & Mary Lee Dziuban
Po Box 961252
Fort Worth, Tx 76161

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Product & Tracking Information

Postal Product:**Features:**

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DATE & TIME	STATUS OF ITEM	LOCATION
July 30, 2016 , 5:19 am	Delivered, PO Box	FORT WORTH, TX 76161

Your item has been delivered and is available at a PO Box at 5:19 am on July 30, 2016 in FORT WORTH, TX 76161.

July 30, 2016 , 5:17 am	Arrived at Post Office	FORT WORTH, TX 76161
July 30, 2016 , 4:35 am	Departed USPS Facility	FORT WORTH, TX 76161
July 30, 2016 , 12:17 am	Arrived at USPS Facility	FORT WORTH, TX 76161
July 28, 2016 , 11:51 pm	Departed USPS Origin Facility	WARRENDALE, PA 15086
July 28, 2016 , 11:50 pm	Arrived at USPS Origin Facility	WARRENDALE, PA 15086
July 28, 2016 , 5:02 pm	Departed Post Office	CLARION, PA 16214
July 28, 2016 , 10:57 am	Acceptance	CLARION, PA 16214

Available Actions

Track Another Package

Tracking (or receipt) number

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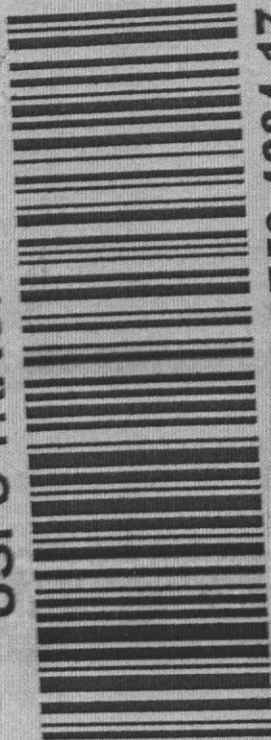
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Clarion, PA 16214



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9114 9999 4431 3758 4334 17

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Lewis R Giacco
Po Box 327
West Sunbury, Pa 16061

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Product & Tracking Information

Postal Product:**Features:**

USPS Tracking®

DATE & TIME	STATUS OF ITEM	LOCATION
July 29, 2016 , 9:19 am	Delivered, PO Box	WEST SUNBURY, PA 16061

Your item has been delivered and is available at a PO Box at 9:19 am on July 29, 2016 in WEST SUNBURY, PA 16061.

July 29, 2016 , 9:03 am	Arrived at Post Office	WEST SUNBURY, PA 16061
July 29, 2016 , 4:30 am	Departed USPS Facility	WARRENDALE, PA 15095
July 29, 2016 , 3:27 am	Arrived at USPS Origin Facility	WARRENDALE, PA 15095
July 28, 2016 , 11:45 pm	Arrived at USPS Origin Facility	WARRENDALE, PA 15086
July 28, 2016 , 5:02 pm	Departed Post Office	CLARION, PA 16214
July 28, 2016 , 10:57 am	Acceptance	CLARION, PA 16214

Available Actions

Track Another Package

Tracking (or receipt) number

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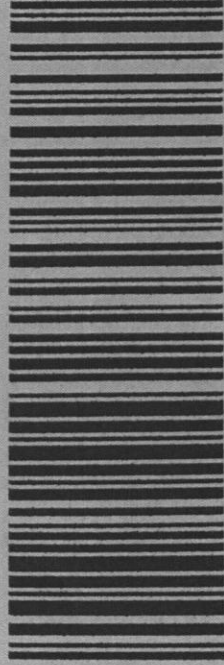
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Gerald L & Joy Greiner
134 W Pittsburgh St
Delmont Pa 15626



USPS TRACKING #



9114 9999 4431 3758 4330 59

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[Sign up for My USPS.](#)Tracking Number: **9114999944313758433059**

Product & Tracking Information

Postal Product:**Features:**

USPS Tracking®

DATE & TIME	STATUS OF ITEM	LOCATION
July 30, 2016 , 11:43 am	Delivered, In/At Mailbox	DELMONT, PA 15626
Your item was delivered in or at the mailbox at 11:43 am on July 30, 2016 in DELMONT, PA 15626.		
July 30, 2016 , 9:49 am	Arrived at Post Office	DELMONT, PA 15626
July 30, 2016 , 6:47 am	Departed USPS Facility	PITTSBURGH, PA 15290
July 30, 2016 , 4:36 am	Arrived at USPS Origin Facility	PITTSBURGH, PA 15290
July 30, 2016 , 3:15 am	Departed USPS Origin Facility	WARRENDALE, PA 15095
July 29, 2016 , 3:27 am	Arrived at USPS Origin Facility	WARRENDALE, PA 15095
July 28, 2016 , 11:47 pm	Departed USPS Origin Facility	WARRENDALE, PA 15086
July 28, 2016 , 11:43 pm	Arrived at USPS Origin Facility	WARRENDALE, PA 15086
July 28, 2016 , 5:02 pm	Departed Post Office	CLARION, PA 16214
July 28, 2016 , 10:57 am	Acceptance	CLARION, PA 16214

Available Actions

Track Another Package

Tracking (or receipt) number

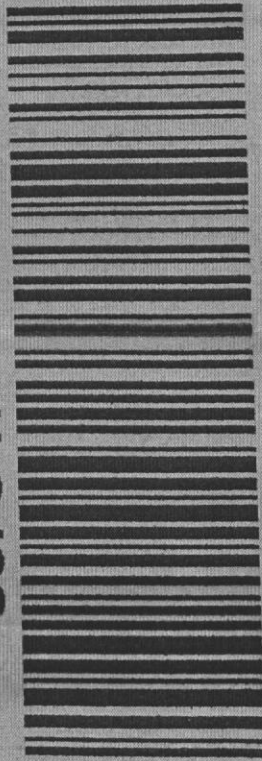
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9114 9999 4431 3758 4199 61

Romaine E Kozuch
229 5Th Ave
New Kensington, Pa 15068

Label 400 Jan. 2013
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Tracking Number: **9114999944313758419961**Updated Delivery Day: **Friday, July 29, 2016**

Product & Tracking Information

Postal Product:

Features:

USPS Tracking®

DATE & TIME

STATUS OF ITEM

LOCATION

July 29, 2016 , 10:50 am

Delivered, In/At Mailbox

**NEW
KENSINGTON, PA 15068**

Your item was delivered in or at the mailbox at 10:50 am on July 29, 2016 in NEW KENSINGTON, PA 15068.

July 29, 2016 , 7:50 am

Out for Delivery

NEW
KENSINGTON, PA 15068

July 29, 2016 , 7:40 am

Sorting Complete

NEW
KENSINGTON, PA 15068

July 29, 2016 , 7:22 am

Arrived at Post Office

NEW
KENSINGTON, PA 15068

July 29, 2016 , 4:30 am

Departed USPS Facility

WARRENDALE, PA 15095

July 29, 2016 , 3:05 am

Arrived at USPS Origin
Facility

WARRENDALE, PA 15095

July 29, 2016 , 2:27 am

Departed USPS Facility

WARRENDALE, PA 15086

July 28, 2016 , 11:53 pm

Arrived at USPS Origin
Facility

WARRENDALE, PA 15086

July 28, 2016 , 5:02 pm

Departed Post Office

CLARION, PA 16214

July 28, 2016 , 10:57 am

Acceptance

CLARION, PA 16214

Available Actions

Track Another Package

Tracking (or receipt) number

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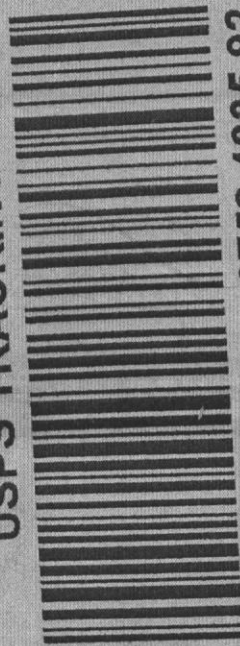
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USPS TRACKING #



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David V & Teresa D Kvortek
864 Hill St
New Kensington, Pa 15068

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WEIGHT: Up to 13 ounces for First-Class Mail and Priority Mail Express. Up to 70 pounds for Priority Mail. For details, visit <http://pe.usps.com>

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Tracking Number: **9114999944313758433592**Updated Delivery Day: **Friday, July 29, 2016**

Product & Tracking Information

Postal Product:**Features:**

USPS Tracking®

DATE & TIME	STATUS OF ITEM	LOCATION
July 29, 2016 , 11:48 am	Delivered, In/At Mailbox	NEW KENSINGTON, PA 15068

Your item was delivered in or at the mailbox at 11:48 am on July 29, 2016 in NEW KENSINGTON, PA 15068.

July 29, 2016 , 7:50 am	Out for Delivery	NEW KENSINGTON, PA 15068
July 29, 2016 , 7:40 am	Sorting Complete	NEW KENSINGTON, PA 15068
July 29, 2016 , 7:22 am	Arrived at Post Office	NEW KENSINGTON, PA 15068
July 29, 2016 , 4:30 am	Departed USPS Facility	WARRENDALE, PA 15095
July 29, 2016 , 3:04 am	Arrived at USPS Origin Facility	WARRENDALE, PA 15095
July 29, 2016 , 2:27 am	Departed USPS Facility	WARRENDALE, PA 15086
July 28, 2016 , 11:58 pm	Arrived at USPS Origin Facility	WARRENDALE, PA 15086
July 28, 2016 , 5:02 pm	Departed Post Office	CLARION, PA 16214
July 28, 2016 , 10:57 am	Acceptance	CLARION, PA 16214

Available Actions

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Tracking (or receipt) number

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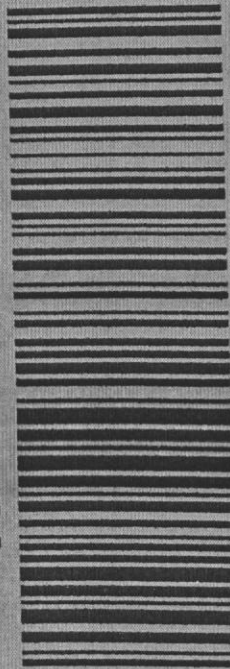
58 Timber Bridge Rd., Suite 20

Clarion, PA 16214



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9114 9999 4431 3758 4339 12

Label 400 Jan. 2013
7690-16-000-7948

Walter T Menhart
109 Myers Dr
New Kensington Pa 15068

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Product & Tracking Information

Postal Product:

Features:

USPS Tracking®

DATE & TIME

STATUS OF ITEM

LOCATION

July 29, 2016 , 12:52 pm

Delivered, In/At Mailbox

**NEW
KENSINGTON, PA 15068**

Your item was delivered in or at the mailbox at 12:52 pm on July 29, 2016 in NEW KENSINGTON, PA 15068.

July 29, 2016 , 7:50 am

Out for Delivery

NEW
KENSINGTON, PA 15068

July 29, 2016 , 7:40 am

Sorting Complete

NEW
KENSINGTON, PA 15068

July 29, 2016 , 7:22 am

Arrived at Post Office

NEW
KENSINGTON, PA 15068

July 29, 2016 , 4:30 am

Departed USPS Facility

WARRENDALE, PA 15095

July 29, 2016 , 3:06 am

Arrived at USPS Origin
Facility

WARRENDALE, PA 15095

July 29, 2016 , 2:27 am

Departed USPS Facility

WARRENDALE, PA 15086

July 28, 2016 , 11:53 pm

Arrived at USPS Origin
Facility

WARRENDALE, PA 15086

July 28, 2016 , 5:02 pm

Departed Post Office

CLARION, PA 16214

July 28, 2016 , 10:57 am

Acceptance

CLARION, PA 16214

Available Actions

Track Another Package

Tracking (or receipt) number

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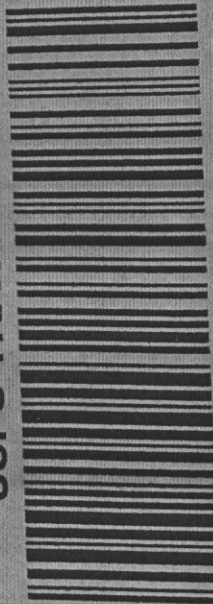
58 Timber Bridge Rd., Suite 20

Clarion, PA 16214



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9114 9999 4431 3758 4331 72

Label 400 Jan. 2013
7690-16-000-7948

Janet Ann & Russell William Mitchell
504 Clarendon St
Pittsburgh, Pa 15238

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Tracking Number: **9114999944313758433172**Updated Delivery Day: **Friday, July 29, 2016**

Product & Tracking Information

Postal Product:

Features:

USPS Tracking®

DATE & TIME

STATUS OF ITEM

LOCATION

July 29, 2016 , 11:22 am

Delivered, In/At Mailbox

PITTSBURGH, PA 15238

Your item was delivered in or at the mailbox at 11:22 am on July 29, 2016 in PITTSBURGH, PA 15238.

July 29, 2016 , 8:13 am

Out for Delivery

PITTSBURGH, PA 15238

July 29, 2016 , 8:03 am

Sorting Complete

PITTSBURGH, PA 15238

July 29, 2016 , 7:52 am

Arrived at Post Office

PITTSBURGH, PA 15238

July 29, 2016 , 7:30 am

Departed USPS Facility

PITTSBURGH, PA 15290

July 29, 2016 , 5:22 am

Arrived at USPS Origin Facility

PITTSBURGH, PA 15290

July 29, 2016 , 4:30 am

Departed USPS Facility

WARRENDALE, PA 15095

July 29, 2016 , 3:05 am

Arrived at USPS Origin Facility

WARRENDALE, PA 15095

July 28, 2016 , 5:02 pm

Departed Post Office

CLARION, PA 16214

July 28, 2016 , 10:57 am

Acceptance

CLARION, PA 16214

Available Actions

Track Another Package

Tracking (or receipt) number

[Track It](#)

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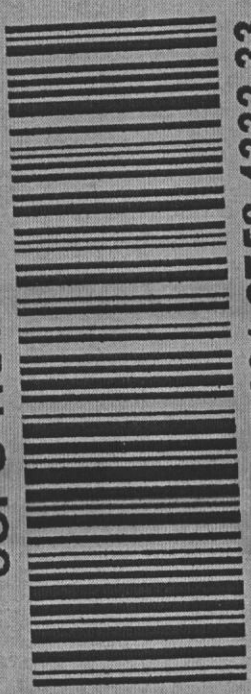
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9114 9999 4431 3758 4332 33

Label 400 Jan. 2013
7690-16-000-7948

Kirt E & Lisa M Pattock
4059 7Th Street Rd
New Kensington, Pa 15068

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Product & Tracking Information

Postal Product:**Features:**

USPS Tracking®

DATE & TIME**STATUS OF ITEM****LOCATION****July 29, 2016 , 12:38 pm**

Delivered, In/At Mailbox

**NEW
KENSINGTON, PA 15068**

Your item was delivered in or at the mailbox at 12:38 pm on July 29, 2016 in NEW KENSINGTON, PA 15068.

July 29, 2016 , 7:50 am

Out for Delivery

NEW
KENSINGTON, PA 15068

July 29, 2016 , 7:40 am

Sorting Complete

NEW
KENSINGTON, PA 15068

July 29, 2016 , 7:22 am

Arrived at Post Office

NEW
KENSINGTON, PA 15068

July 29, 2016 , 4:30 am

Departed USPS Facility

WARRENDALE, PA 15095

July 29, 2016 , 4:10 am

Arrived at USPS Origin
Facility

WARRENDALE, PA 15095

July 29, 2016 , 2:27 am

Departed USPS Facility

WARRENDALE, PA 15086

July 28, 2016 , 11:58 pm

Arrived at USPS Origin
Facility

WARRENDALE, PA 15086

July 28, 2016 , 5:02 pm

Departed Post Office

CLARION, PA 16214

July 28, 2016 , 10:57 am

Acceptance

CLARION, PA 16214

Available Actions

Track Another Package

Tracking (or receipt) number

[Track It](#)

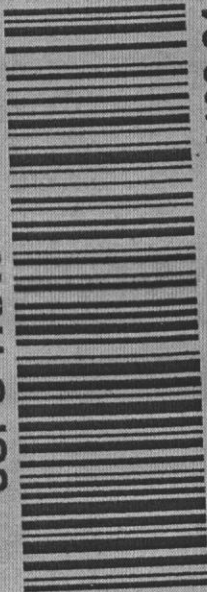
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9114 9999 4431 3758 4198 24

Label 400 Jan. 2013
7690-16-000-7948

Nancy Rosenberg
2032 Old Leechburg Rd
New Kensington, Pa 15068-8324

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Product & Tracking Information

Postal Product:

Features:
USPS Tracking®

DATE & TIME	STATUS OF ITEM	LOCATION
July 29, 2016 , 12:55 pm	Delivered, In/At Mailbox	NEW KENSINGTON, PA 15068

Your item was delivered in or at the mailbox at 12:55 pm on July 29, 2016 in NEW KENSINGTON, PA 15068.

July 29, 2016 , 7:50 am	Out for Delivery	NEW KENSINGTON, PA 15068
July 29, 2016 , 7:40 am	Sorting Complete	NEW KENSINGTON, PA 15068
July 29, 2016 , 7:22 am	Arrived at Post Office	NEW KENSINGTON, PA 15068
July 29, 2016 , 4:30 am	Departed USPS Facility	WARRENDALE, PA 15095
July 29, 2016 , 3:05 am	Arrived at USPS Origin Facility	WARRENDALE, PA 15095
July 29, 2016 , 2:27 am	Departed USPS Facility	WARRENDALE, PA 15086
July 28, 2016 , 11:51 pm	Arrived at USPS Origin Facility	WARRENDALE, PA 15086
July 28, 2016 , 5:02 pm	Departed Post Office	CLARION, PA 16214
July 28, 2016 , 10:57 am	Acceptance	CLARION, PA 16214

Available Actions

Track Another Package

Tracking (or receipt) number

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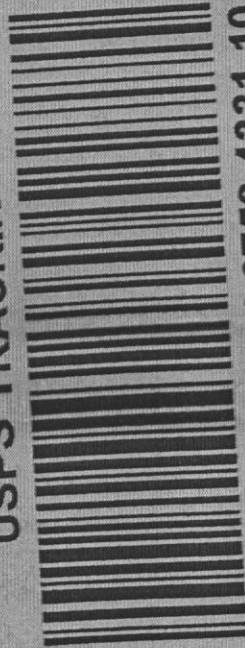
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Clarion, PA 16214



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9114 9999 4431 3758 4331 10

Label 400 Jan. 2013
7690-16-000-7948

James & Shirley Smith
1933 Drennen Rd
New Kensington, Pa 15068

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Product & Tracking Information

Postal Product:**Features:**

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DATE & TIME**STATUS OF ITEM****LOCATION****July 29, 2016 , 2:55 pm**

Delivered, In/At Mailbox

**NEW
KENSINGTON, PA 15068**

Your item was delivered in or at the mailbox at 2:55 pm on July 29, 2016 in NEW KENSINGTON, PA 15068.

July 29, 2016 , 7:50 am

Out for Delivery

**NEW
KENSINGTON, PA 15068**

July 29, 2016 , 7:40 am

Sorting Complete

**NEW
KENSINGTON, PA 15068**

July 29, 2016 , 7:22 am

Arrived at Post Office

**NEW
KENSINGTON, PA 15068**

July 29, 2016 , 4:30 am

Departed USPS Facility

WARRENDALE, PA 15095

July 29, 2016 , 3:05 am

Arrived at USPS Origin Facility

WARRENDALE, PA 15095

July 29, 2016 , 2:27 am

Departed USPS Facility

WARRENDALE, PA 15086

July 28, 2016 , 11:57 pm

Arrived at USPS Origin Facility

WARRENDALE, PA 15086

July 28, 2016 , 5:02 pm

Departed Post Office

CLARION, PA 16214

July 28, 2016 , 10:57 am

Acceptance

CLARION, PA 16214

Available Actions

Track Another Package

Tracking (or receipt) number

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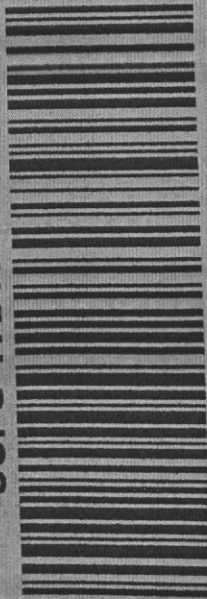
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9114 9999 4431 3758 4197 49

Label 400 Jan. 2013
7690-16-000-7948

Mark M & Judith Ann Sweeny
2024 Old Leechburg Rd
New Kensington, Pa 15068-8324

9114 9999 4431 3758 4198 00

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Product & Tracking Information

Postal Product:**Features:**

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DATE & TIME**STATUS OF ITEM****LOCATION****July 29, 2016 , 12:56 pm**

Delivered, In/At Mailbox

**NEW
KENSINGTON, PA 15068**

Your item was delivered in or at the mailbox at 12:56 pm on July 29, 2016 in NEW KENSINGTON, PA 15068.

July 29, 2016 , 7:50 am

Out for Delivery

NEW
KENSINGTON, PA 15068

July 29, 2016 , 7:40 am

Sorting Complete

NEW
KENSINGTON, PA 15068

July 29, 2016 , 7:22 am

Arrived at Post Office

NEW
KENSINGTON, PA 15068

July 29, 2016 , 4:30 am

Departed USPS Facility

WARRENDALE, PA 15095

July 29, 2016 , 3:07 am

Arrived at USPS Origin
Facility

WARRENDALE, PA 15095

July 29, 2016 , 2:27 am

Departed USPS Facility

WARRENDALE, PA 15086

July 28, 2016 , 11:50 pm

Arrived at USPS Origin
Facility

WARRENDALE, PA 15086

July 28, 2016 , 5:02 pm

Departed Post Office

CLARION, PA 16214

July 28, 2016 , 10:57 am

Acceptance

CLARION, PA 16214

Track Another Package

Tracking (or receipt) number

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