Penneco Environmental Solutions, LLC
Sedat #3A

Table of Contents

Binder #1

Binder #2

OMB No. 2040-0042 Approval Expires 11/30/2014

United States Environmental Protection Agency

EPA

Underground Injection Control Permit Application

(Collected under the authority of the Safe Drinking Water Act. Sections 1421, 1422, 40 CFR 144)

I. EPA ID Number		T/A	C
U			

Read Attached Instructions Before Starting

For Official Use Only

Application approved (mo day year)	Date received (mo day year)	Permit Number	Well ID	FINDS Number

II. Owner Name and Address			III. Operator Name and Address		
Owner Name: Penneco Environmental Solutions LLC			Owner Name: Penneco Environmental Solutions LLC		
Street Address: 6608 Route 22		Phone Number: (724) 468-8232	Street Address: 6608 Route 22		Phone Number: (724) 468-8232
City: Delmont	State: PA	ZIP CODE: 15626-2408	City: Delmont	State: PA	ZIP CODE: 15626-2408

IV. Commercial Facility	V. Ownership	VI. Legal Contact	VII. SIC Codes
[x] Yes [ ] No	[x] Private [ ] Federal [ ] Other	[x] Owner [ ] Operator	

VIII. Well Status *(Mark "x")*

	Date Started (mo day year)		
[ ] A. Operating		[x] B. Modification/Conversion	[ ] C. Proposed

IX. Type of Permit Requested *(Mark "x" and specify if required)*

	Number of Existing Wells	Number of Proposed Wells	Name(s) of field(s) or project(s)
[x] A. Individual [ ] B. Area			Renton

X. Class and Type of Well *(see reverse)*

A. Class(es) (enter code(s))	B. Type(s) (enter code(s))	C. If class is "other" or type is code 'x,' explain	D. Number of wells per type (if area permit)
II	D		

XI. Location of Well(s) or Approximate Center of Field or Project

Latitude Deg	Latitude Min	Latitude Sec	Longitude Deg	Longitude Min	Longitude Sec	Sec	Twp	Range	1/4 Sec	Feet From	Line	Feet From	Line
40	31	38.5	-79	42	48.5								

XII. Indian Lands (Mark 'x')

[ ] Yes
[x] No

XIII. Attachments

(Complete the following questions on a separate sheet(s) and number accordingly; see instructions)

For Classes I, II, III, (and other classes) complete and submit on a separate sheet(s) Attachments A–U (pp 2-6) as appropriate. Attach maps where required. List attachments by letter which are applicable and are included with your application.

XIV. Certification

I certify under the penalty of law that I have personally examined and am familiar with the information submitted in this document and all attachments and that, based on my inquiry of those individuals immediately responsible for obtaining the information, I believe that the information is true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment. (Ref. 40 CFR 144.32)

A. Name and Title *(Type or Print)*	B. Phone No. *(Area Code and No.)*
	(724) 468-8232
C. Signature	D. Date Signed

Well Class and Type Codes

Class I Wells used to inject waste below the deepest underground source of drinking water.

Type **"I"** Nonhazardous industrial disposal well
"M" Nonhazardous municipal disposal well
"W" Hazardous waste disposal well injecting below USDWs
"X" Other Class I wells (not included in Type "I," "M," or "W")

Class II Oil and gas production and storage related injection wells.

Type **"D"** Produced fluid disposal well
"R" Enhanced recovery well
"H" Hydrocarbon storage well (excluding natural gas)
"X" Other Class II wells (not included in Type "D," "R," or "H")

Class III Special process injection wells.

Type **"G"** Solution mining well
"S" Sulfur mining well by Frasch process
"U" Uranium mining well (excluding solution mining of conventional mines)
"X" Other Class III wells (not included in Type "G," "S," or "U")

Other Classes Wells not included in classes above.
Class V wells which may be permitted under §144.12.
Wells not currently classified as Class I, II, III, or V.

Attachments to Permit Application

Class	**Attachments**
I new well	A, B, C, D, F, H – S, U
existing	A, B, C, D, F, H – U
II new well	A, B, C, E, G, H, M, Q, R; optional – I, J, K, O, P, U
existing	A, E, G, H, M, Q, R, – U; optional – J, K, O, P, Q
III new well	A, B, C, D, F, H, I, J, K, M – S, U
existing	A, B, C, D, F, H, J, K, M – U
Other Classes	To be specified by the permitting authority

INSTRUCTIONS - Underground Injection Control (UIC) Permit Application

Paperwork Reduction Act: The public reporting and record keeping burden for this collection of information is estimated to average 224 hours for a Class I hazardous well application, 110 hours for a Class I non-hazardous well application, 67 hours for a Class II well application, and 132 hours for a Class III well application. Burden means the total time, effort, or financial resource expended by persons to generate, maintain, retain, or disclose or provide information to or for a Federal Agency. This includes the time needed to review instructions; develop, acquire, install, and utilize technology and systems for the purposes of collecting, validating, and verifying information, processing and maintaining information, and disclosing and providing information; adjust the existing ways to comply with any previously applicable instructions and requirements; train personnel to be able to respond to the collection of information; search data sources; complete and review the collection of information; and, transmit or otherwise disclose the information. An agency may not conduct or sponsor, and a person is not required to respond to, a collection of information unless it displays a currently valid OMB control number. Send comments on the Agency's need for this information, the accuracy of the provided burden estimates, and any suggested methods for minimizing respondent burden, including the use of automated collection techniques to Director, Collection Strategies Division, U.S. Environmental Protection Agency (2822), 1200 Pennsylvania Ave., NW, Washington, DC 20460. Include the OMB control number in any correspondence. Do not send the completed forms to this address.

This form must be completed by all owners or operators of Class I, II, and III injection wells and others who may be directed to apply for permit by the Director.

I. **EPA I.D. NUMBER** - Fill in your EPA Identification Number. If you do not have a number, leave blank.

II. **OWNER NAME AND ADDRESS** - Name of well, well field or company and address.

III. **OPERATOR NAME AND ADDRESS** - Name and address of operator of well or well field.

IV. **COMMERCIAL FACILITY** - Mark the appropriate box to indicate the type of facility.

V. **OWNERSHIP** - Mark the appropriate box to indicate the type of ownership.

VI. **LEGAL CONTACT** - Mark the appropriate box.

VII. **SIC CODES** - List at least one and no more than four Standard Industrial Classification (SIC) Codes that best describe the nature of the business in order of priority.

VIII. **WELL STATUS** - Mark Box A if the well(s) were operating as injection wells on the effective date of the UIC Program for the State. Mark Box B if wells(s) existed on the effective date of the UIC Program for the State but were not utilized for injection. Box C should be marked if the application is for an underground injection project not constructed or not completed by the effective date of the UIC Program for the State.

IX. **TYPE OF PERMIT** - Mark "Individual" or "Area" to indicate the type of permit desired. Note that area permits are at the discretion of the Director and that wells covered by an area permit must be at one site, under the control of one person and do not inject hazardous waste. If an area permit is requested the number of wells to be included in the permit must be specified and the wells described and identified by location. If the area has a commonly used name, such as the "Jay Field," submit the name in the space provided. In the case of a project or field which crosses State lines, it may be possible to consider an area permit if EPA has jurisdiction in both States. Each such case will be considered individually, if the owner/operator elects to seek an area permit.

X. **CLASS AND TYPE OF WELL** - Enter in these two positions the Class and type of injection well for which a permit is requested. Use the most pertinent code selected from the list on the reverse side of the application. When selecting type X please explain in the space provided.

XI. **LOCATION OF WELL** - Enter the latitude and longitude of the existing or proposed well expressed in degrees, minutes, and seconds or the location by township, and range, and section, as required by 40 CFR Part 146. If an area permit is being requested, give the latitude and longitude of the approximate center of the area.

XII. **INDIAN LANDS** - Place an "X" in the box if any part of the facility is located on Indian lands.

XIII. **ATTACHMENTS** - Note that information requirements vary depending on the injection well class and status. Attachments for Class I, II, III are described on pages 4 and 5 of this document and listed by Class on page 2. Place EPA ID number in the upper right hand corner of each page of the Attachments.

XIV. **CERTIFICATION** - All permit applications (except Class II) must be signed by a responsible corporate officer for a corporation, by a general partner for a partnership, by the proprietor of a sole proprietorship, and by a principal executive or ranking elected official for a public agency. For Class II, the person described above should sign, or a representative duly authorized in writing.

Attachments to be submitted with permit application for Class I, II, III and other wells.

A. **AREA OF REVIEW METHODS** - Give the methods and, if appropriate, the calculations used to determine the size of the area of review (fixed radius or equation).The area of review shall be a fixed radius of 1/4 mile from the well bore unless the use of an equation is approved in advance by the Director.

B. **MAPS OF WELL/AREA AND AREA OF REVIEW** - Submit a topographic map, extending one mile beyond the property boundaries, showing the injection well(s) or project area for which a permit is sought and the applicable area of review. The map must show all intake and discharge structures and all hazardous waste treatment, storage, or disposal facilities. If the application is for an area permit, the map should show the distribution manifold (if applicable) applying injection fluid to all wells in the area, including all system monitoring points. Within the area of review, the map must show the following:

Class I

The number, or name, and location of all producing wells, injection wells, abandoned wells, dry holes, surface bodies of water, springs, mines (surface and subsurface), quarries, and other pertinent surface features, including residences and roads, and faults, if known or suspected. In addition, the map must identify those wells, springs, other surface water bodies, and drinking water wells located within one quarter mile of the facility property boundary. Only information of public record is required to be included in this map;

Class II

In addition to requirements for Class I, include pertinent information known to the applicant. This requirement does not apply to existing Class II wells;

Class III

In addition to requirements for Class I, include public water systems and pertinent information known to the applicant.

C. **CORRECTIVE ACTION PLAN AND WELL DATA** - Submit a tabulation of data reasonably available from public records or otherwise known to the applicant on all wells within the area of review, including those on the map required in B, which penetrate the proposed injection zone. Such data shall include the following:

Class I

A description of each well's types, construction, date drilled, location, depth, record of plugging and/or completion, and any additional information the Director may require. In the case of new injection wells, include the corrective action proposed to be taken by the applicant under 40 CFR 144.55.

Class II

In addition to requirement for Class I, in the case of Class II wells operating over the fracture pressure of the injection formation, all known wells within the area of review which penetrate formations affected by the increase in pressure. This requirement does not apply to existing Class II wells.

Class III

In addition to requirements for Class I, the corrective action proposed under 40 CFR 144.55 for all Class III wells.

D. **MAPS AND CROSS SECTION OF USDWs** - Submit maps and cross sections indicating the vertical limits of all underground sources of drinking water within the area of review (both vertical and lateral limits for Class I), their position relative to the injection formation and the direction of water movement, where known, in every underground source of drinking water which may be affected by the proposed injection. (Does not apply to Class II wells.)

E. **NAME AND DEPTH OF USDWs (CLASS II)** - For Class II wells, submit geologic name, and depth to bottom of all underground sources of drinking water which may be affected by the injection.

F. **MAPS AND CROSS SECTIONS OF GEOLOGIC STRUCTURE OF AREA** - Submit maps and cross sections detailing the geologic structure of the local area (including the lithology of injection and confining intervals) and generalized maps and cross sections illustrating the regional geologic setting. (Does not apply to Class II wells.)

G. **GEOLOGICAL DATA ON INJECTION AND CONFINING ZONES (Class II)** - For Class II wells, submit appropriate geological data on the injection zone and confining zones including lithologic description, geological name, thickness, depth and fracture pressure.

H. **OPERATING DATA** - Submit the following proposed operating data for each well (including all those to be covered by area permits): (1) average and maximum daily rate and volume of the fluids to be injected; (2) average and maximum injection pressure; (3) nature of annulus fluid; (4) for Class I wells, source and analysis of the chemical, physical, radiological and biological characteristics, including density and corrosiveness, of injection fluids; (5) for Class II wells, source and analysis of the physical and chemical characteristics of the injection fluid; (6) for Class III wells, a qualitative analysis and ranges in concentrations of all constituents of injected fluids. If the information is proprietary, maximum concentrations only may be submitted, but all records must be retained.

I. **FORMATION TESTING PROGRAM** - Describe the proposed formation testing program For Class I wells the program must be designed to obtain data on fluid pressure, temperature, fracture pressure, other physical, chemical, and radiological characteristics of the injection matrix and physical and chemical characteristics of the formation fluids.

For Class II wells the testing program must be designed to obtain data on fluid pressure, estimated fracture pressure, physical and chemical characteristics of the injection zone. (Does not apply to existing Class II wells or projects.)

For Class III wells the testing must be designed to obtain data on fluid pressure, fracture pressure, and physical and chemical characteristics of the formation fluids if the formation is naturally water bearing. Only fracture pressure is required if the program formation is not water bearing. (Does not apply to existing Class III wells or projects.)

J. **STIMULATION PROGRAM** - Outline any proposed stimulation program.

K. **INJECTION PROCEDURES** - Describe the proposed injection procedures including pump, surge, tank, etc.

L. **CONSTRUCTION PROCEDURES** - Discuss the construction procedures (according to §146.12 for Class I, §146.22 for Class II, and §146.32 for Class III) to be utilized. This should include details of the casing and cementing program, logging procedures, deviation checks, and the drilling, testing and coring program, and proposed annulus fluid. (Request and submission of justifying data must be made to use an alternative to packer for Class I.)

M. **CONSTRUCTION DETAILS** - Submit schematic or other appropriate drawings of the surface and subsurface construction details of the well.

N. **CHANGES IN INJECTED FLUID** - Discuss expected changes in pressure, native fluid displacement, and direction of movement of injection fluid. (Class III wells only.)

O. **PLANS FOR WELL FAILURES** - Outline contingency plans (proposed plans, if any, for Class II) to cope with all shut-ins or wells failures, so as to prevent migration of fluids into any USDW.

P. **MONITORING PROGRAM** - Discuss the planned monitoring program. This should be thorough, including maps showing the number and location of monitoring wells as appropriate and discussion of monitoring devices, sampling frequency, and parameters measured. If a manifold monitoring program is utilized, pursuant to §146.23(b)(5), describe the program and compare it to individual well monitoring.

Q. **PLUGGING AND ABANDONMENT PLAN** - Submit a plan for plugging and abandonment of the well including: (1) describe the type, number, and placement (including the elevation of the top and bottom) of plugs to be used; (2) describe the type, grade, and quantity of cement to be used; and (3) describe the method to be used to place plugs, including the method used to place the well in a state of static equilibrium prior to placement of the plugs. Also for a Class III well that underlies or is in an exempted aquifer, demonstrate adequate protection of USDWs. Submit this information on EPA Form 7520-14, Plugging and Abandonment Plan.

R. **NECESSARY RESOURCES** - Submit evidence such as a surety bond or financial statement to verify that the resources necessary to close, plug or abandon the well are available.

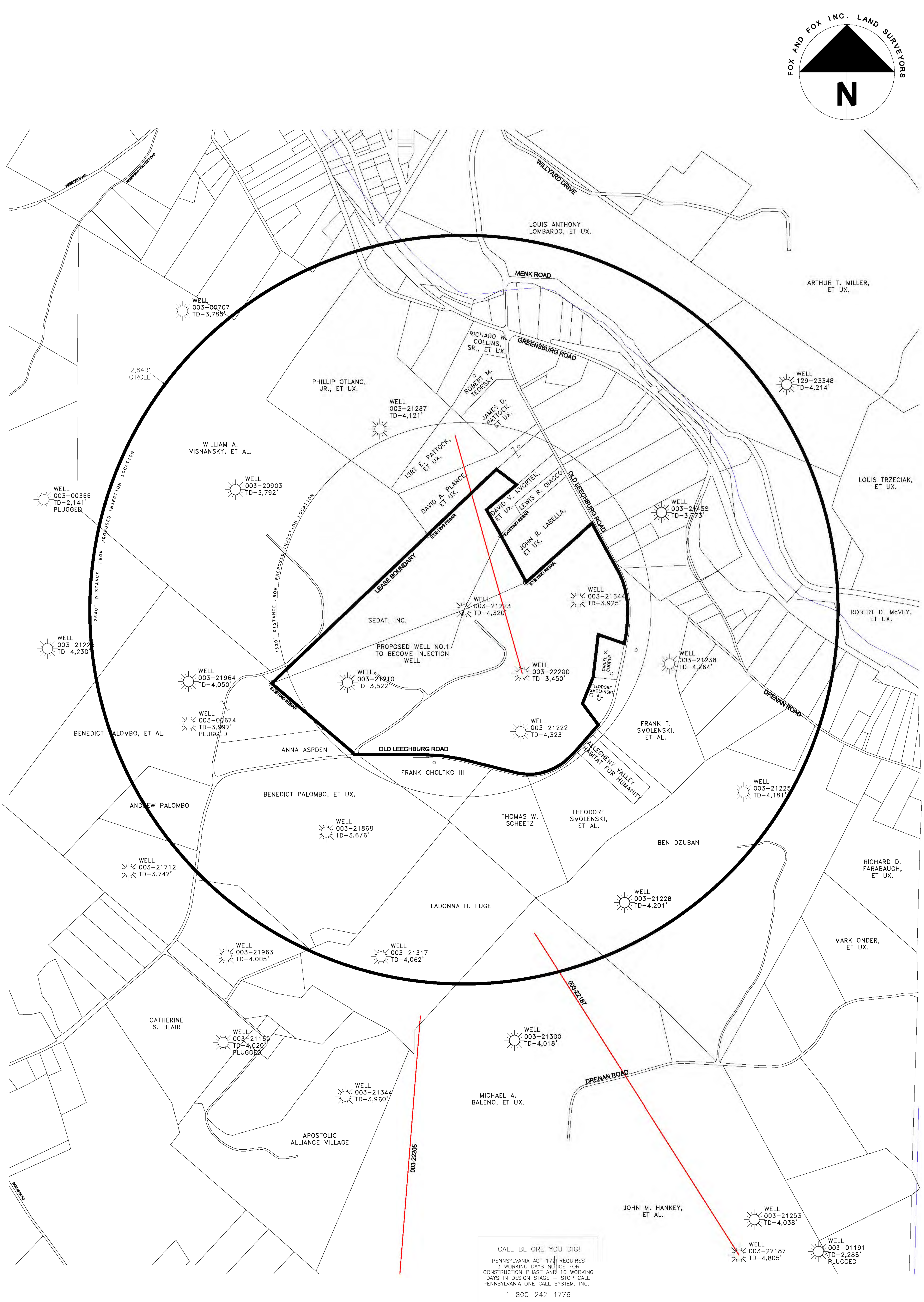
S. **AQUIFER EXEMPTIONS** - If an aquifer exemption is requested, submit data necessary to demonstrate that the aquifer meets the following criteria: (1) does not serve as a source of drinking water; (2) cannot now and will not in the future serve as a source of drinking water; and (3) the TDS content of the ground water is more than 3,000 and less than 10,000 mg/l and is not reasonably expected to supply a public water system. Data to demonstrate that the aquifer is expected to be mineral or hydrocarbon production, such as general description of the mining zone, analysis of the amenability of the mining zone to the proposed method, and time table for proposed development must also be included. For additional information on aquifer exemptions, see 40 CFR Sections 144.7 and 146.04.

T. **EXISTING EPA PERMITS** - List program and permit number of any existing EPA permits, for example, NPDES, PSD, RCRA, etc.

U. **DESCRIPTION OF BUSINESS** - Give a brief description of the nature of the business.

ATTACHMENT "A"

Area of Review Methods



CALL BEFORE YOU DIG!

PENNSYLVANIA ACT 172 REQUIRES 3 WORKING DAYS NOTICE FOR CONSTRUCTION PHASE AND 10 WORKING DAYS IN DESIGN STAGE – STOP CALL PENNSYLVANIA ONE CALL SYSTEM, INC.

1-800-242-1776

1/2 MILE

– WETLANDS STATEMENT –

BEFORE ANY CONSTRUCTION BEGINS IN THE SURVEYED AREA SHOWN ON THIS MAP. IT IS THE RESPONSIBILITY OF PROPERTY OWNER OR CONTRACTOR TO DETERMINE IF IN FACT – WETLANDS – EXIST WITHIN THE SURVEYED AREA.

SHEET: 1 OF 1
JOB NO.: 67741S_HALF_MILE_RADIUS
FILE: PENNECO-INJECTION
SCALE HORZ.: 1" = 300' VERT.:
CHKD.:
BY: RJF
DATE: FEB. 12, 2016

SEAL
COMMONWEALTH OF PENNSYLVANIA
REGISTERED PROFESSIONAL
RONALD L. FOX
SURVEYOR

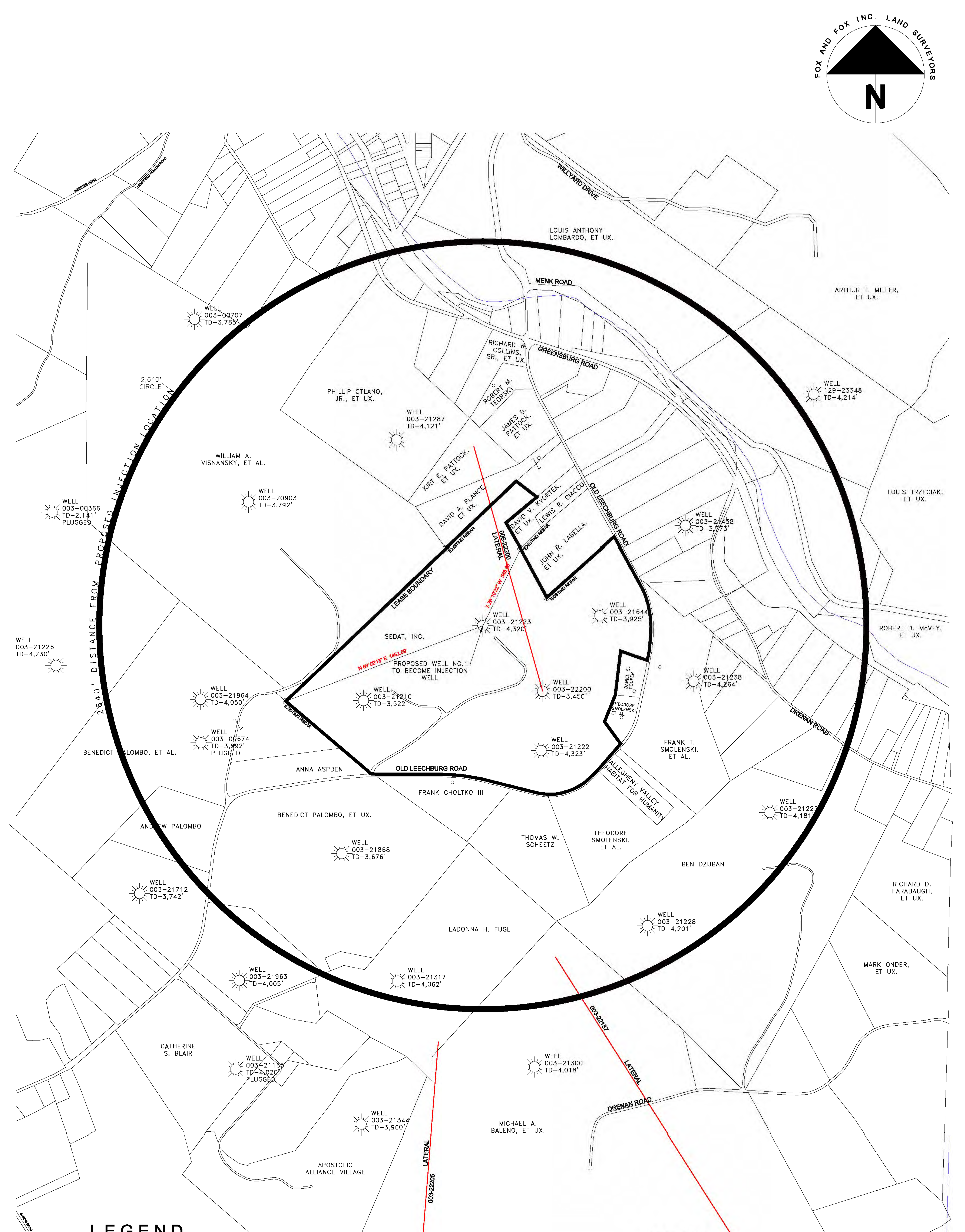
PROPOSED INJECTION WELL
FOR
PENNECO ENVIRONMENTAL SOLUTIONS, LLC

PLUM BOROUGH, ALLEGHENY COUNTY
PENNSYLVANIA

FOX & FOX, INC.
58 Timber Bridge Road, Suite 20
Clarion, Pa. 16214
Phone: 814-745-2861 Fax: 814-745-2248
email: ronaldlfox@foxandfoxinc.us
web: www.foxandfoxinc.us

REVISIONS

	DESCRIPTION



LEGEND

EXIST. 3/4" REBAR	- EXISTING MONUMENT AS NOTED
	- TRACT LINES
	- ROADS
WELL 003-20903 TD-3,792'	- EXISTING GAS WELLS

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1/2 MILE RADIUS

SHEET: 1 OF 1
JOB NO.: 677415_HALF_MILE_RADIUS
FILE: PENNECO-INJECTION
SCALE HORZ.: 1" = 300' VERT.:
BY: RLF CHK.:
DATE: JAN. 11, 2016

SEAL: COMMONWEALTH OF PENNSYLVANIA REGISTERED PROFESSIONAL RONALD L. FOX SURVEYOR

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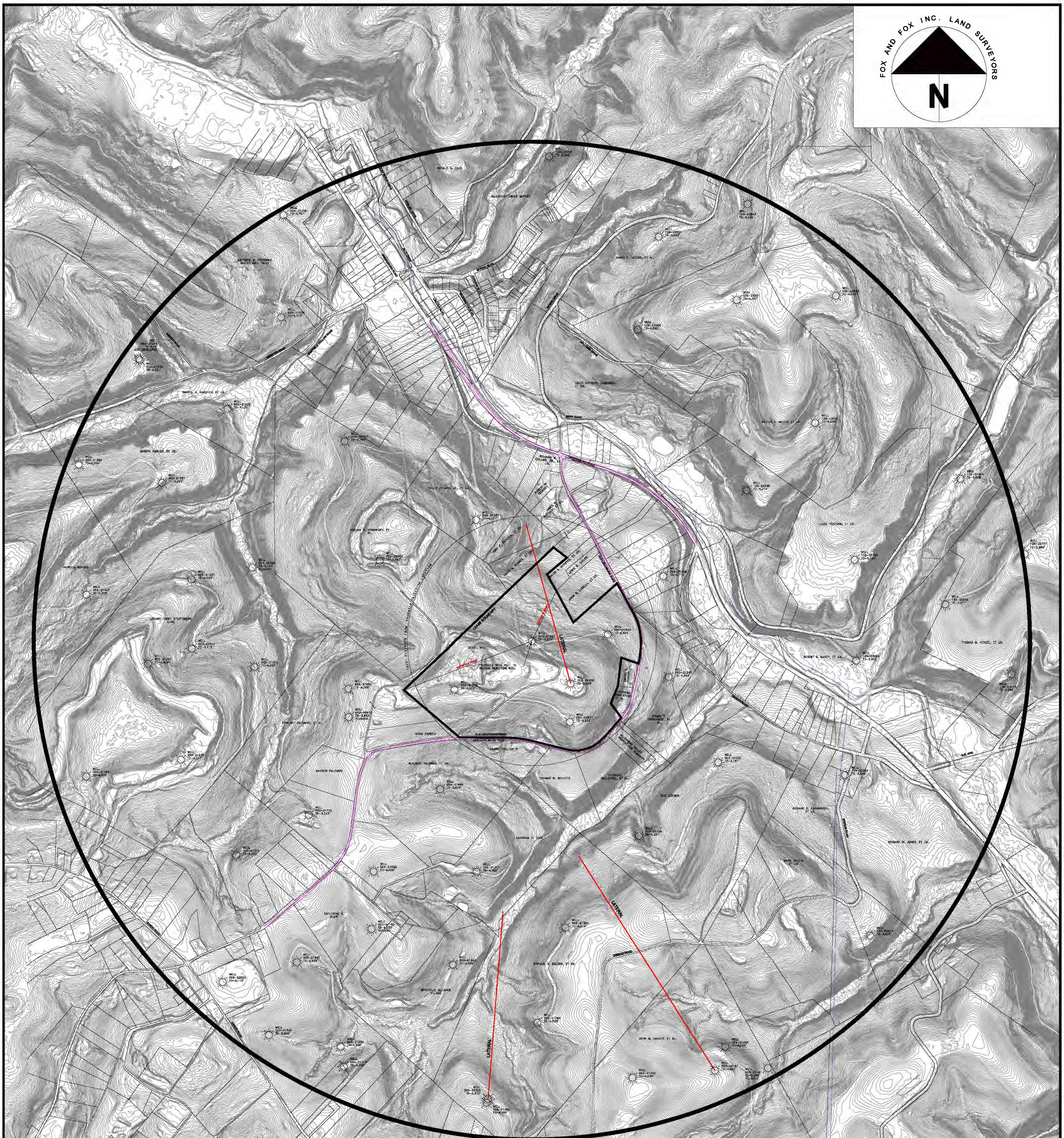

1 MILE RADIUS

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LEGEND

EXIST. REBAR ○	- EXISTING MONUMENT AS NOTED
	- TRACT LINES
	- ROADS
WELL 003-20903 TD-3,792'	- EXISTING GAS WELLS

SHEET: 1 OF 1
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FILE: PENNECO-INJECTION
SCALE HORZ.: 1" = 500'
VERT.:
CHK:
DATE: FEB. 12, 2016
BY: RLF

SEAL

COMMONWEALTH OF PENNSYLVANIA
REGISTERED PROFESSIONAL
RONALD L. FOX
SURVEYOR

PROPOSED INJECTION WELL
FOR
PENNECO ENVIRONMENTAL SOLUTIONS, LLC

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REVISIONS

DESCRIPTION

FOX AND FOX INC. LAND SURVEYORS

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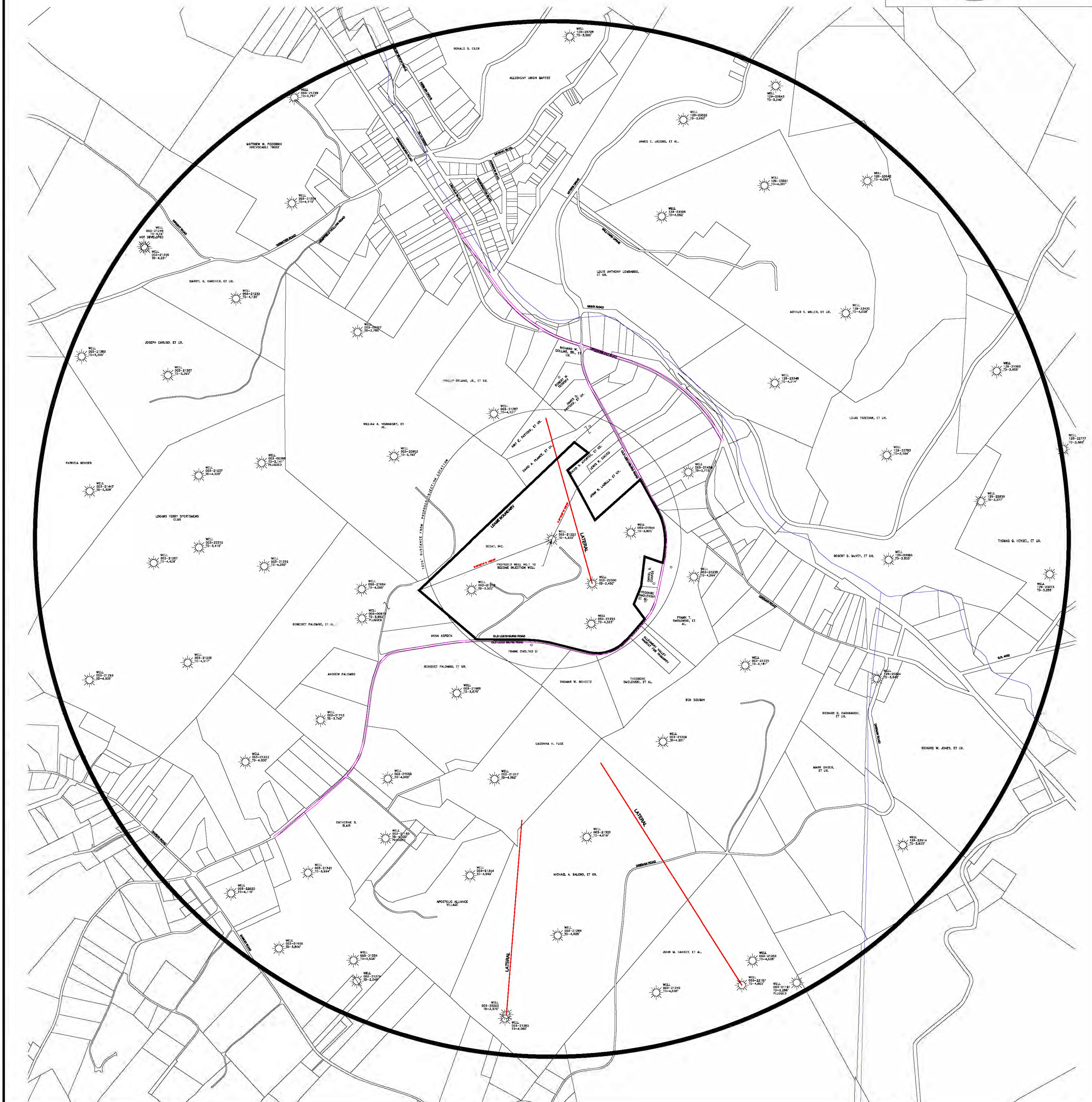

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FILE: PENNECO-INJECTION

SCALE HORZ.: 1" = 500' VERT.:

BY: RLF

CHK:

DATE: FEB. 12, 2016

SEAL

COMMONWEALTH OF PENNSYLVANIA REGISTERED PROFESSIONAL RONALD L. FOX SURVEYOR NO. 25729-E

PROPOSED INJECTION WELL FOR PENNECO ENVIRONMENTAL SOLUTIONS, LLC

PLUM BOROUGH, ALLEGHENY COUNTY PENNSYLVANIA

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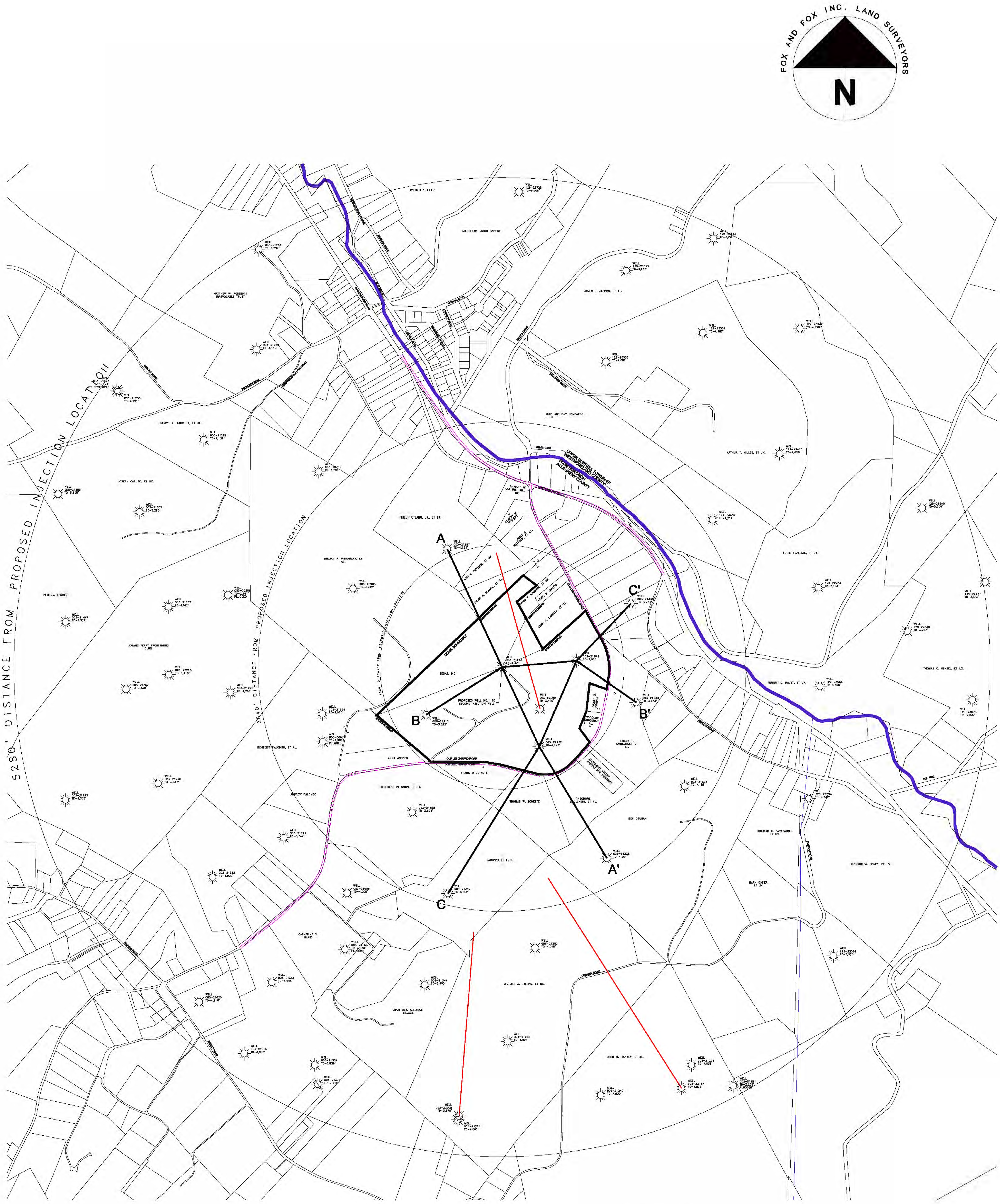

LEGEND

- CROSS SECTION LINES
- TRACT LINES
- ROADS
- EXISTING GAS WELLS
- LATERALS FROM GAS WELLS
- MUNICIPALITY LINE

SHEET: 1 OF 1	JOB NO.: 677415_PLAN_VIEW	FILE: PENNECO-INJECTION
SCALE HORZ.: 1" = 500' VERT.:	BY: RLF CHK:	DATE: JAN. 11, 2016

SEAL

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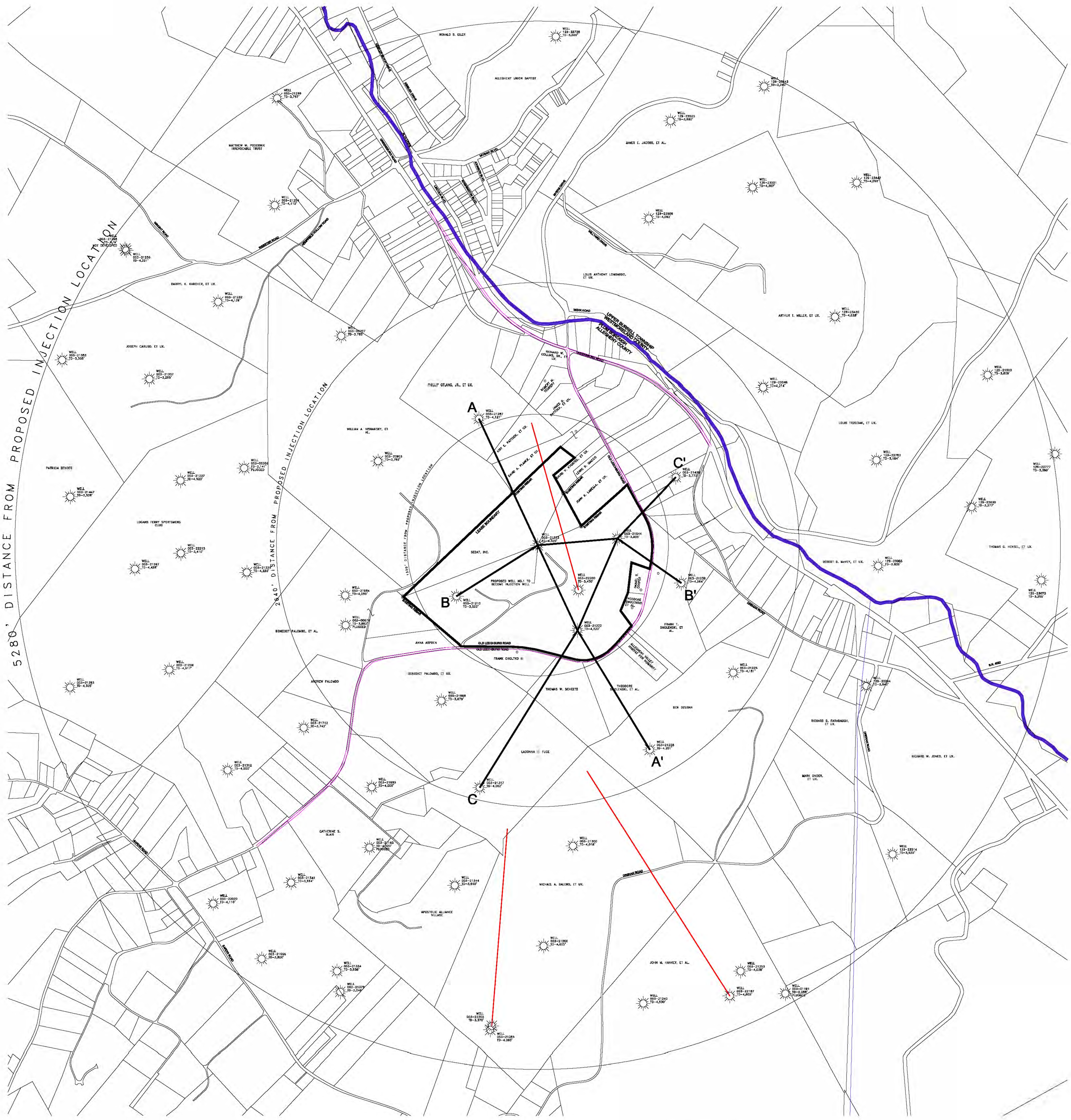

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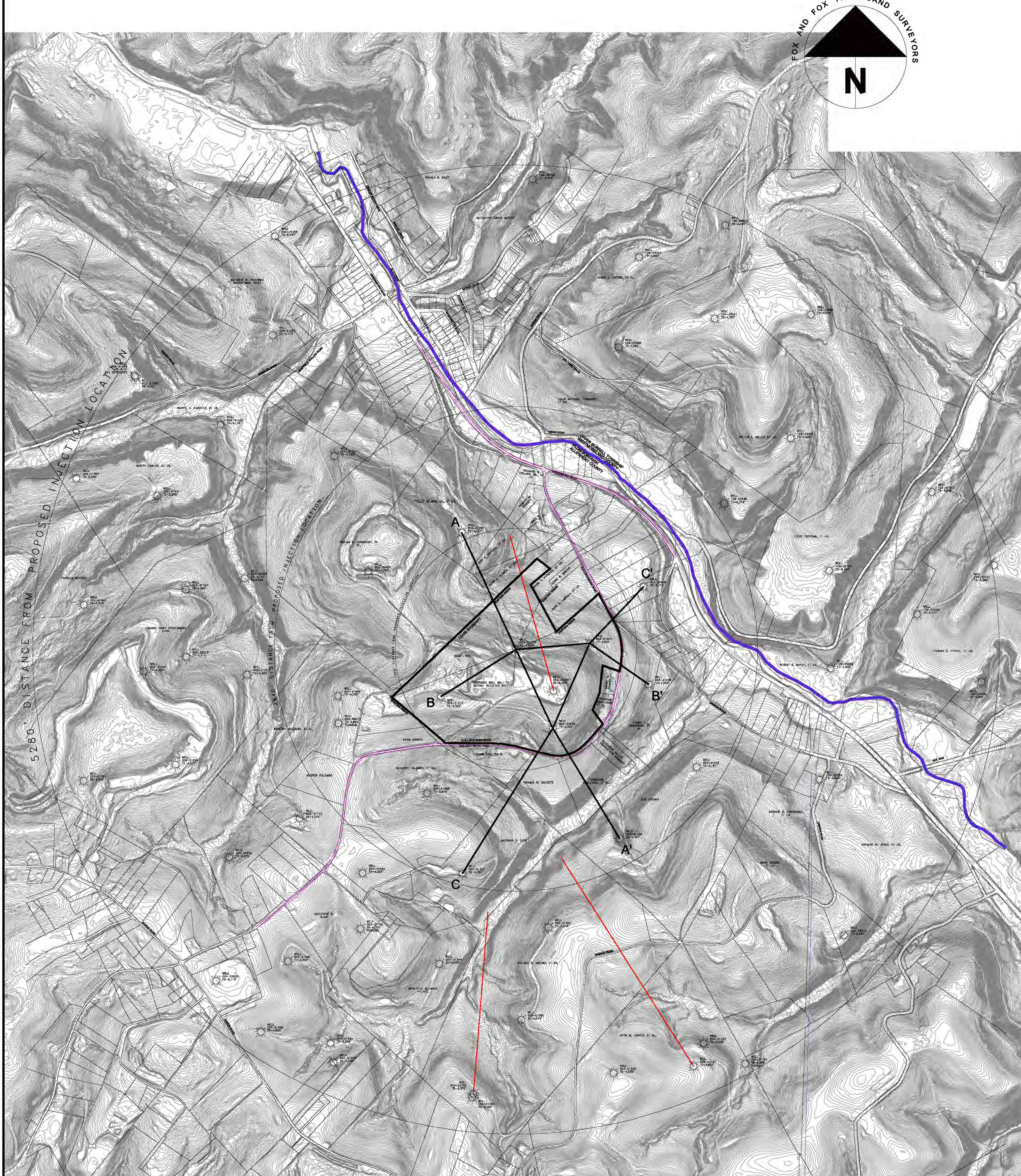

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FILE:	PENNECO-INJECTION
SCALE HORZ.:	1" = 500'
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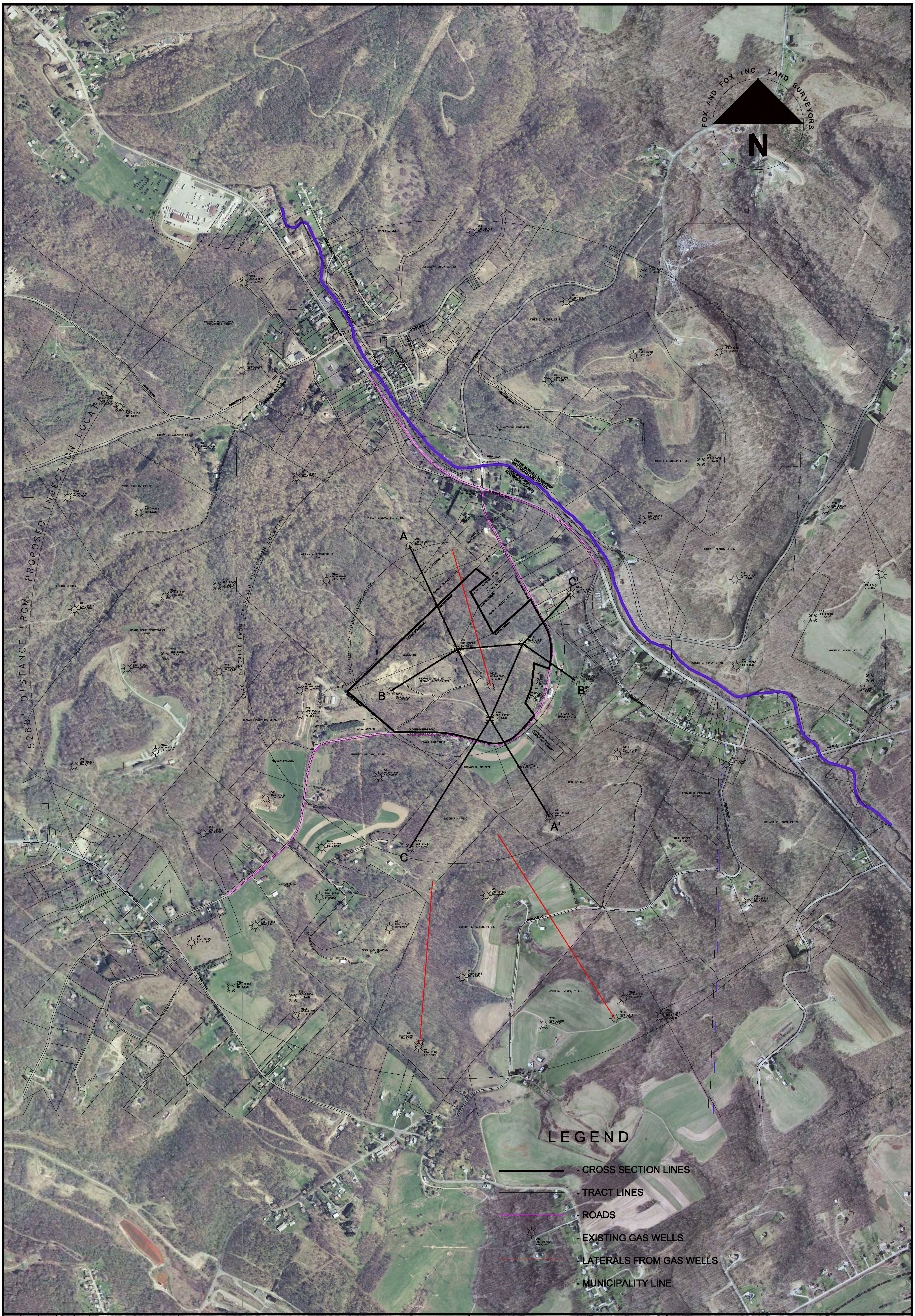
	DESCRIPTION



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REVISIONS

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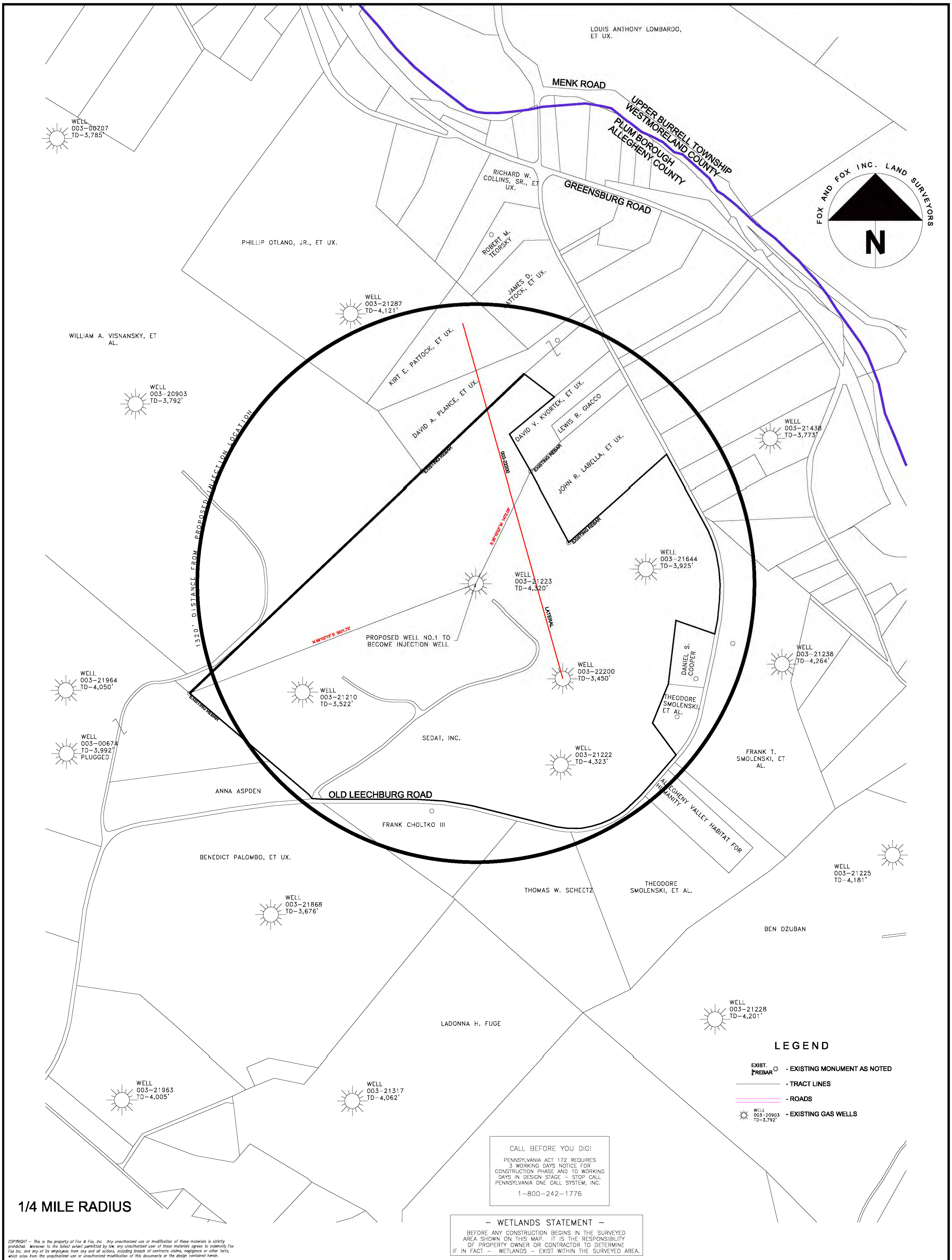

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FILE: PENNECO-INJECTION
SCALE HORZ.: 1" = 500' VERT.:
BY: RLF
CHK:
DATE: FEB. 12, 2016

SEAL: COMMONWEALTH OF PENNSYLVANIA — REGISTERED PROFESSIONAL — RONALD L. FOX — SURVEYOR

PROPOSED INJECTION WELL
FOR
PENNECO ENVIRONMENTAL SOLUTIONS, LLC

PLUM BOROUGH, ALLEGHENY COUNTY
PENNSYLVANIA

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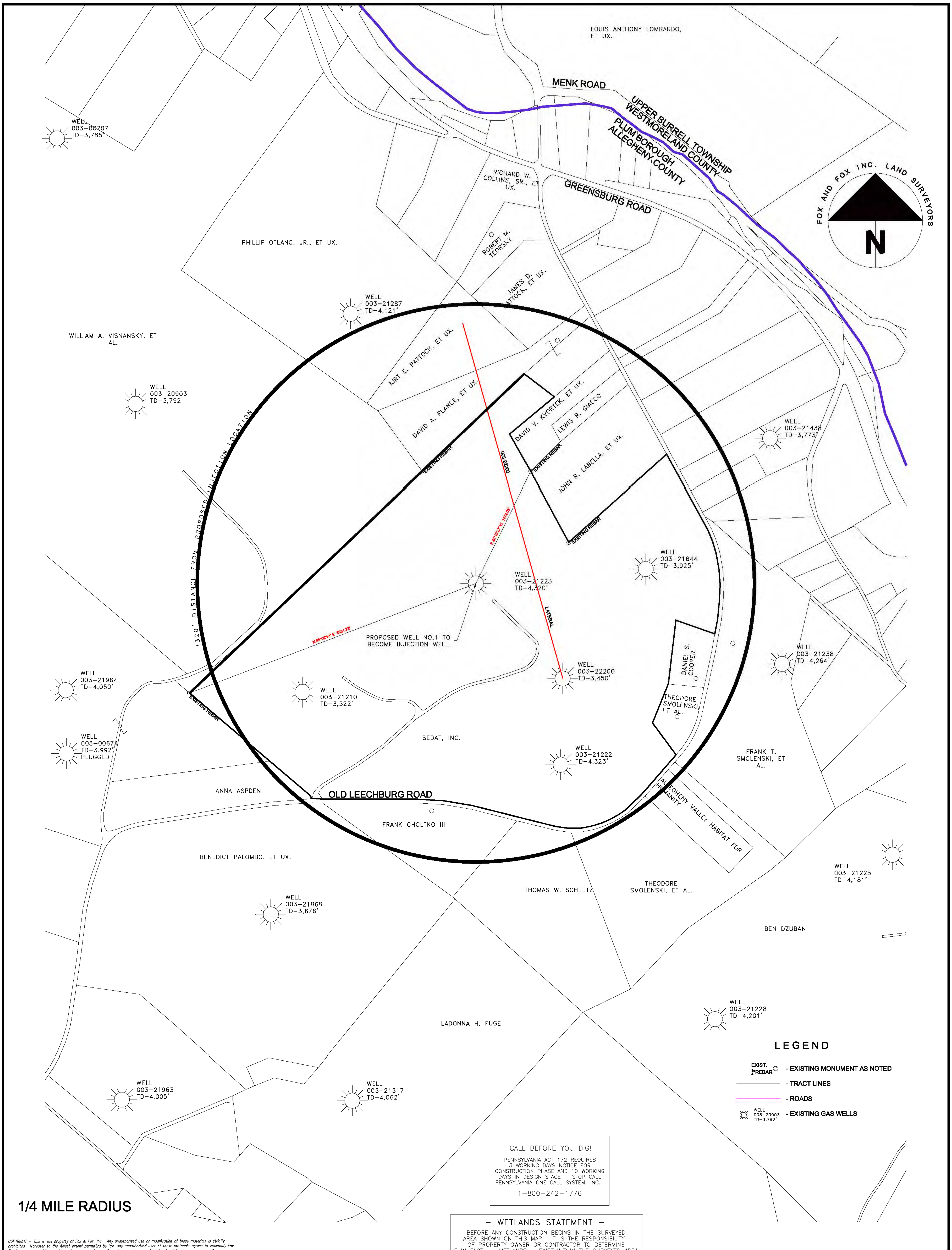

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FILE: PENNECO-INJECTION
SCALE HORZ.: 1" = 500' VERT.:
BY: RLF CHK:
DATE: JAN. 8, 2016

SEAL: COMMONWEALTH OF PENNSYLVANIA – REGISTERED PROFESSIONAL – RONALD L. FOX – SURVEYOR

PROPOSED INJECTION WELL FOR PENNECO ENVIRONMENTAL SOLUTIONS

PLUM BOROUGH, ALLEGHENY COUNTY
PENNSYLVANIA

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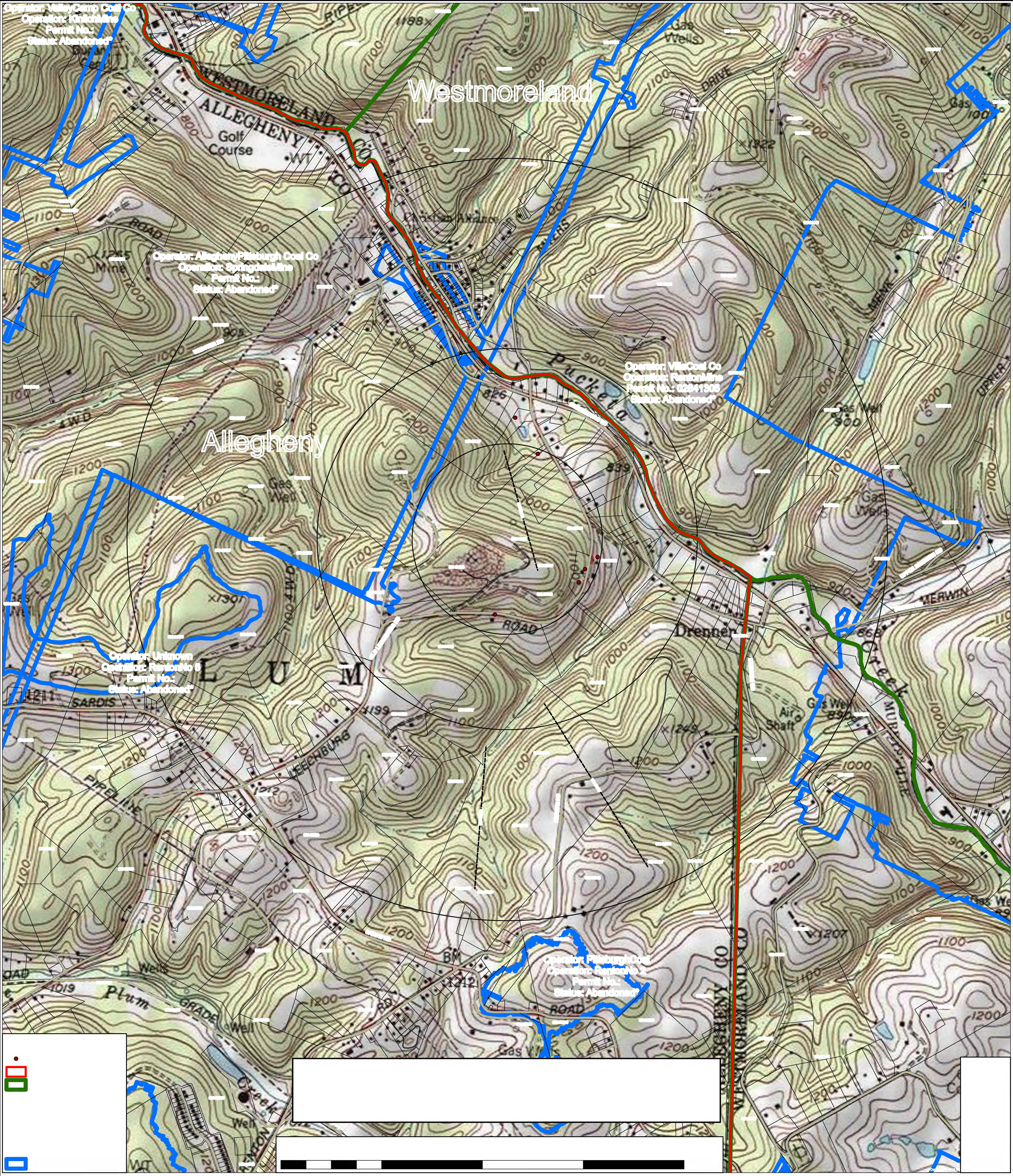
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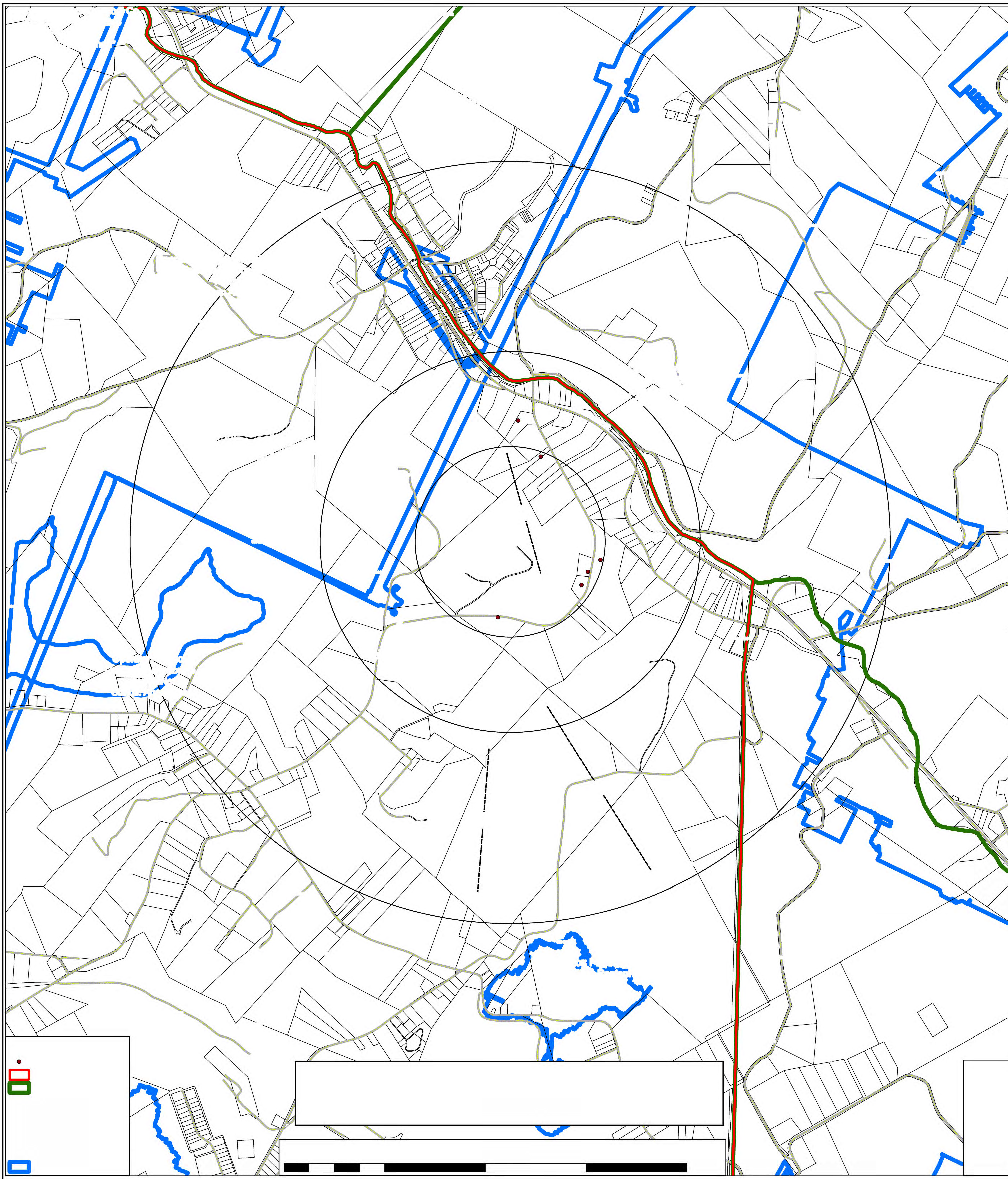
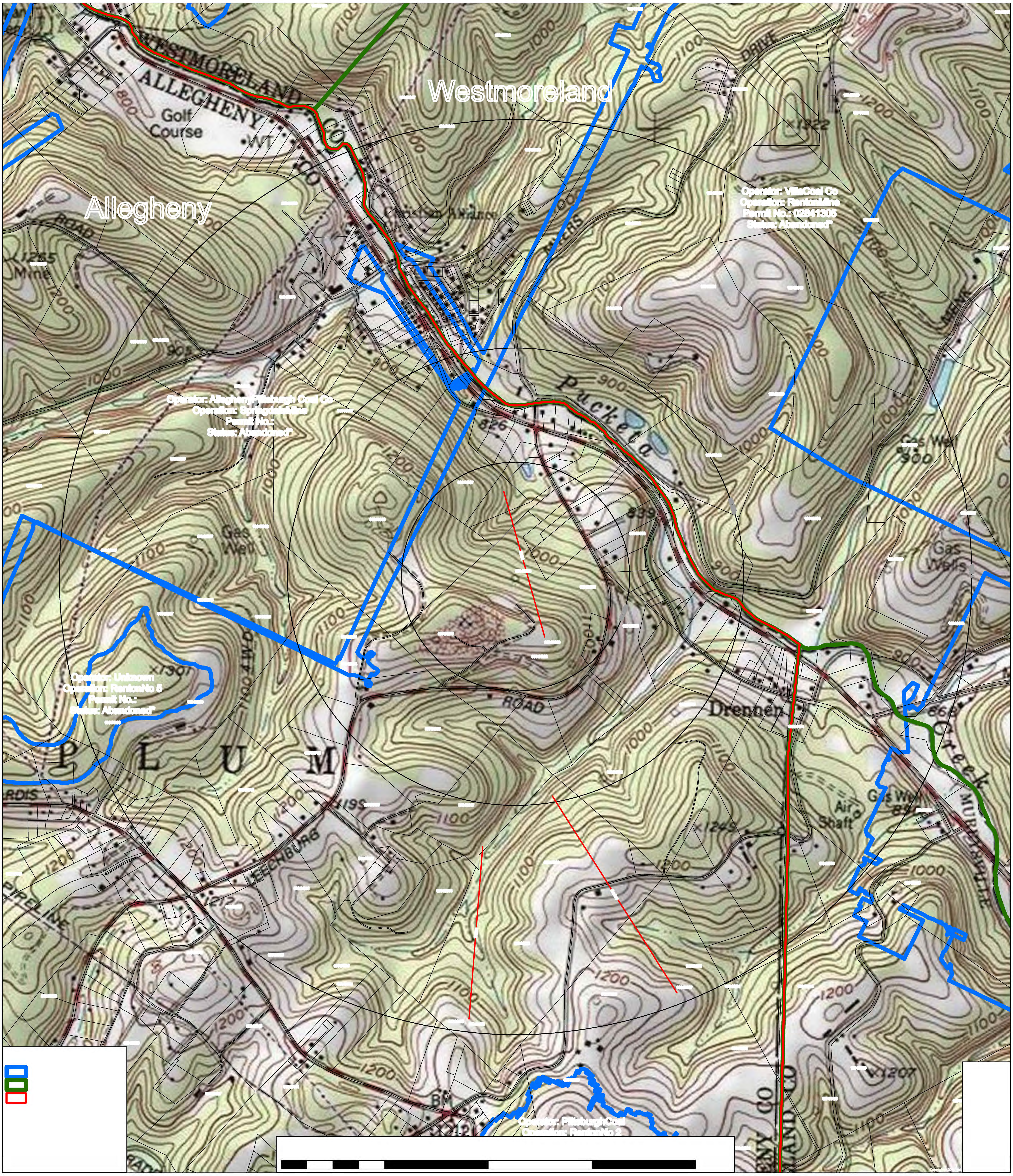
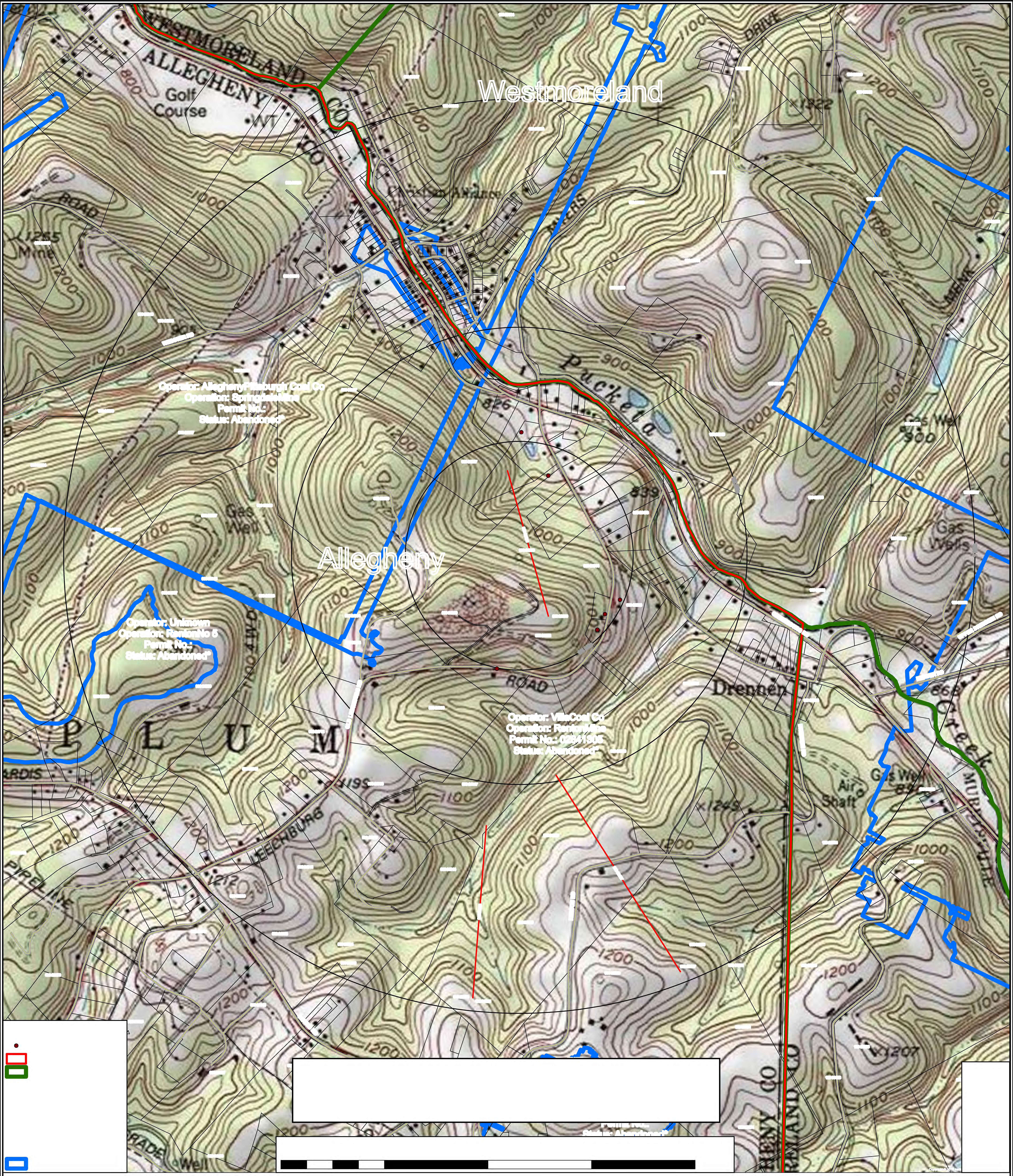
Operation: KinlochMine
Permit No.:
Status: Abandoned*
Westmoreland
Operator: AlleghenyPittsburgh Coal Co
Operation: SpringdaleMine
Permit No.:
Status: Abandoned*
Operator: VillaCoal Co
Operation: RentonMine
Permit No.: 02841305
Status: Abandoned*
Allegheny
Operator: Unknown
Operation: RentonNo 5
Permit No.:
Status: Abandoned*
Operator: PittsburghCoal
Operation: RentonNo 2
Permit No.:
Status: Abandoned*
Drenner
Golf Course
Sardis
Plum
Gas Well
Air Shaft
Merwin

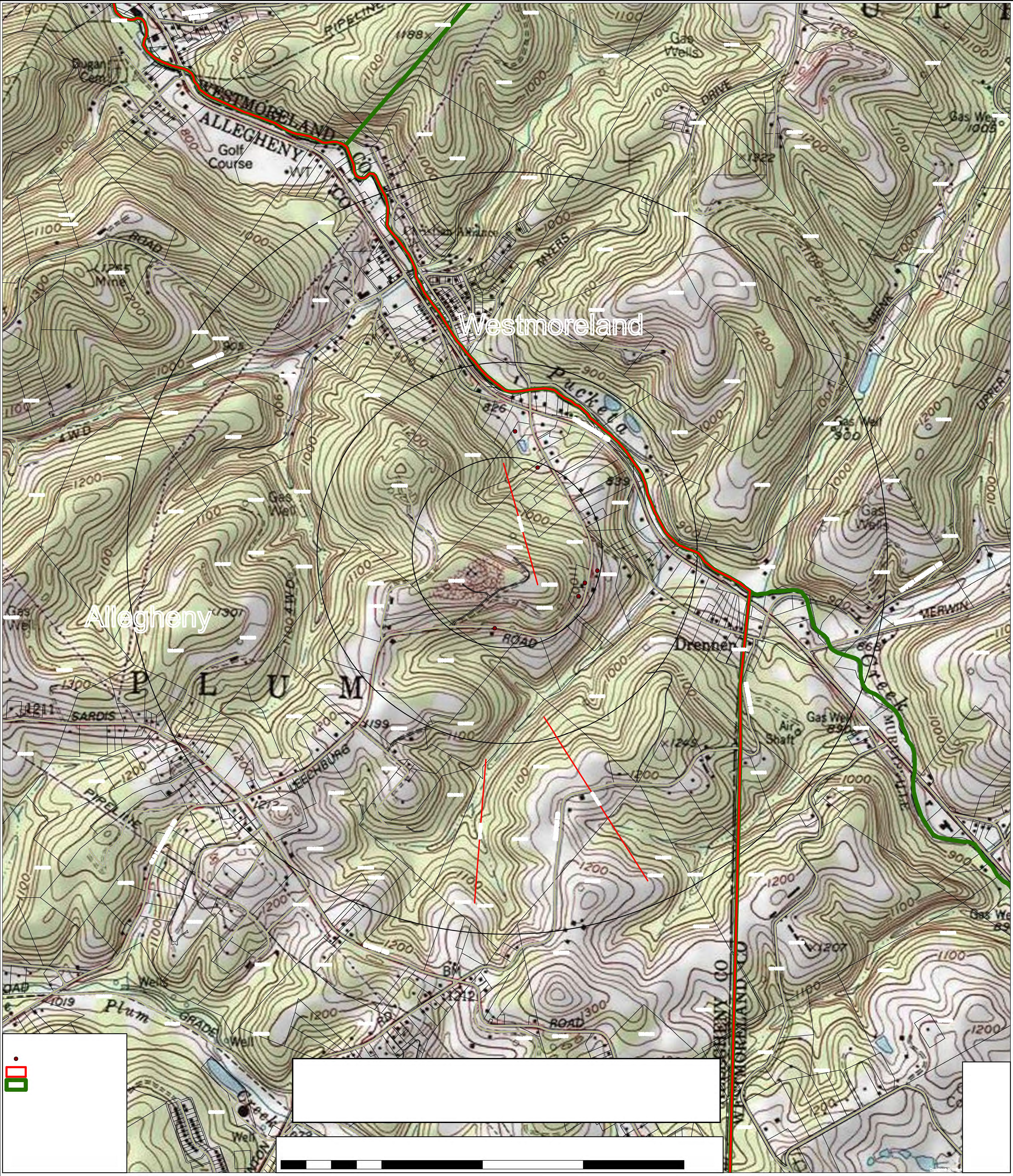




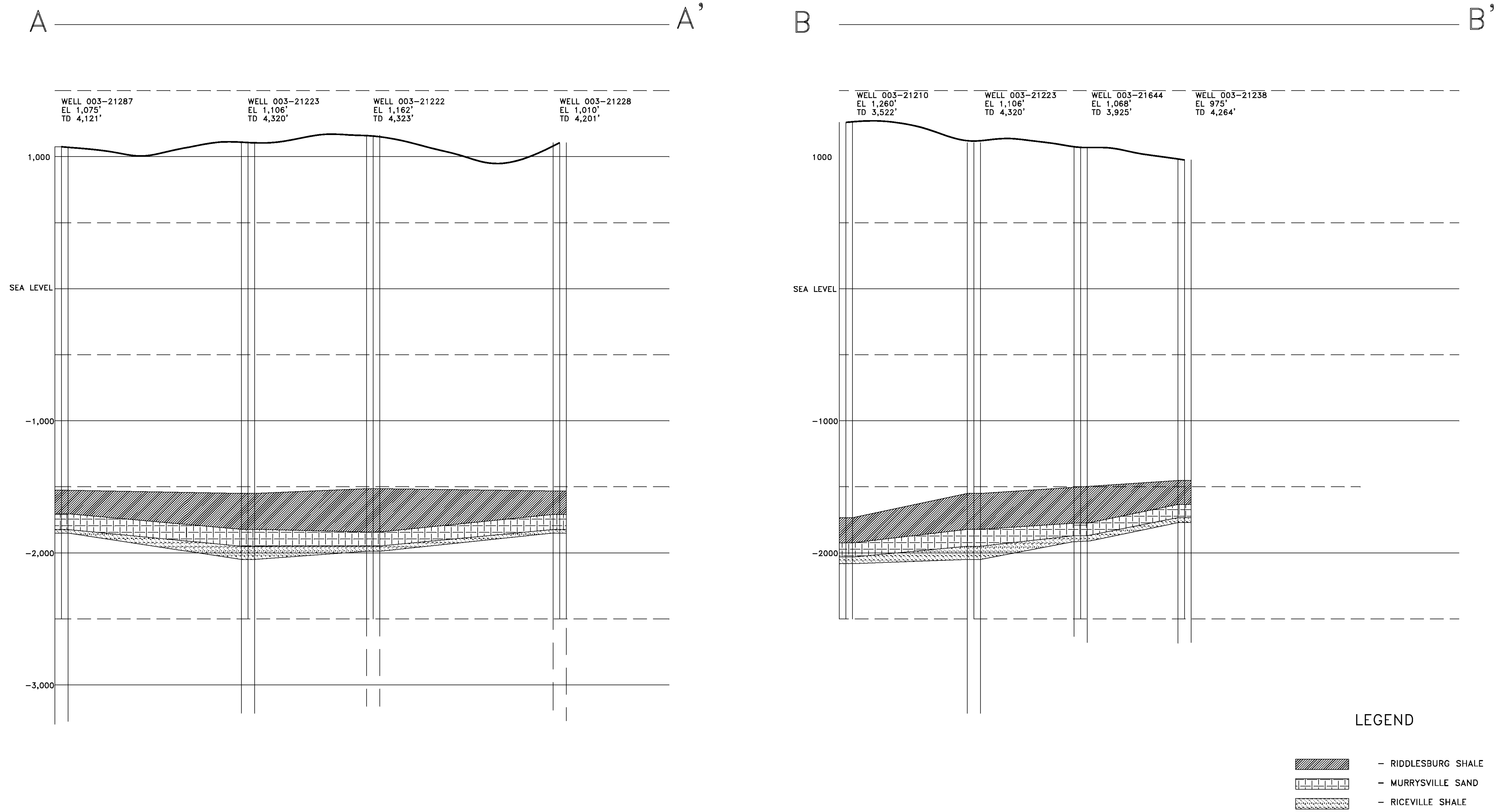
Westmoreland
Allegheny
WESTMORELAND CO
ALLEGHENY CO
Golf Course
Operator: VillaCoal Co
Operation: RentonMine
Permit No.: 02841305
Status: Abandoned*
Operator: AlleghenyPittsburgh Coal Co
Operation: SpringdaleMine
Permit No.:
Status: Abandoned*
Operator: Unknown
Operation: RentonNo 5
Permit No.:
Status: Abandoned*
Puckety
Drennen
P L U M
Gas Well
Gas Wells
Air Shaft
ROAD
LEECHBURG
Creek
Mine



Westmoreland
Allegheny
WESTMORELAND CO
ALLEGHENY CO
Golf Course
Pucketa
Drennen
P L U M
Gas Well
Gas Wells
Air Shaft
LEECHBURG
ROAD
Operator: AlleghenyPittsburgh Coal Co
Operation: SpringdaleMine
Permit No.:
Status: Abandoned*
Operator: Unknown
Operation: RentonNo 5
Permit No.:
Status: Abandoned*
Operator: VilleCoal Co
Operation: RentonMine
Permit No.: 02841305
Status: Abandoned*



Westmoreland
Allegheny
P L U M
WESTMORELAND CO
ALLEGHENY CO
Golf Course
Dugan Cem.
Mine
Puckety
Creek
Drenner
Air Shaft
Gas Wells
Gas Well
PIPELINE
ROAD
SARDIS
LEECHBURG
MYERS
MERWIN
DRIVE
Plum
GRADE
BM



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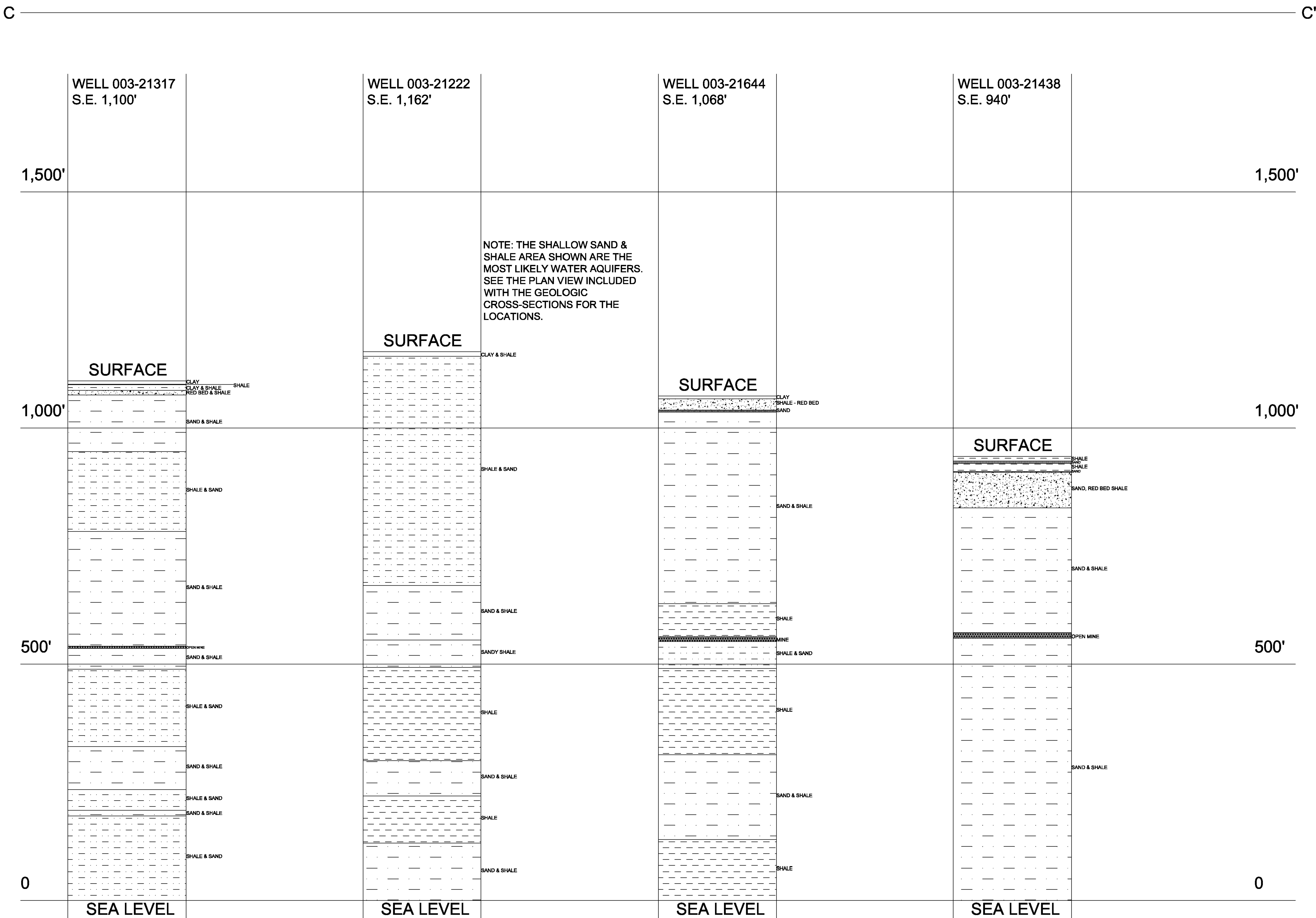
GEOLOGIC CROSS-SECTIONS PROPOSED INJECTION WELL
FOR
PENNECO ENVIRONMENTAL SOLUTIONS, LLC
PLUM BOROUGH, ALLEGHENY COUNTY
PENNSYLVANIA

SEAL

COMMONWEALTH OF PENNSYLVANIA
REGISTERED PROFESSIONAL
RONALD L. FOX
SURVEYOR

BY: RLF	DATE: FEB. 4, 2016
CHK:	
SCALE	HORZ.: 1" = 200' VERT.: 1" = 200'
FILE: PENNECO-INJECTION	
JOB NO.: 677415_GEOLOGIC_CROSS_AB	
SHEET: 2 OF 2	



CROSS SECTIONS SHOWING ROCK ZONES AS PER DRILLING LOGS.

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GEOLOGIC CROSS-SECTIONS PROPOSED INJECTION WELL
FOR
PENNECO ENVIRONMENTAL SOLUTIONS, LLC
PLUM BOROUGH, ALLEGHENY COUNTY
PENNSYLVANIA

SEAL
COMMONWEALTH OF PENNSYLVANIA
REGISTERED PROFESSIONAL
RONALD L. FOX
SURVEYOR
NO. 25729-E

BY: RLF	JAN 25, 2016
CHK:	DATE:
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FILE: PENNECO-INJECTION	
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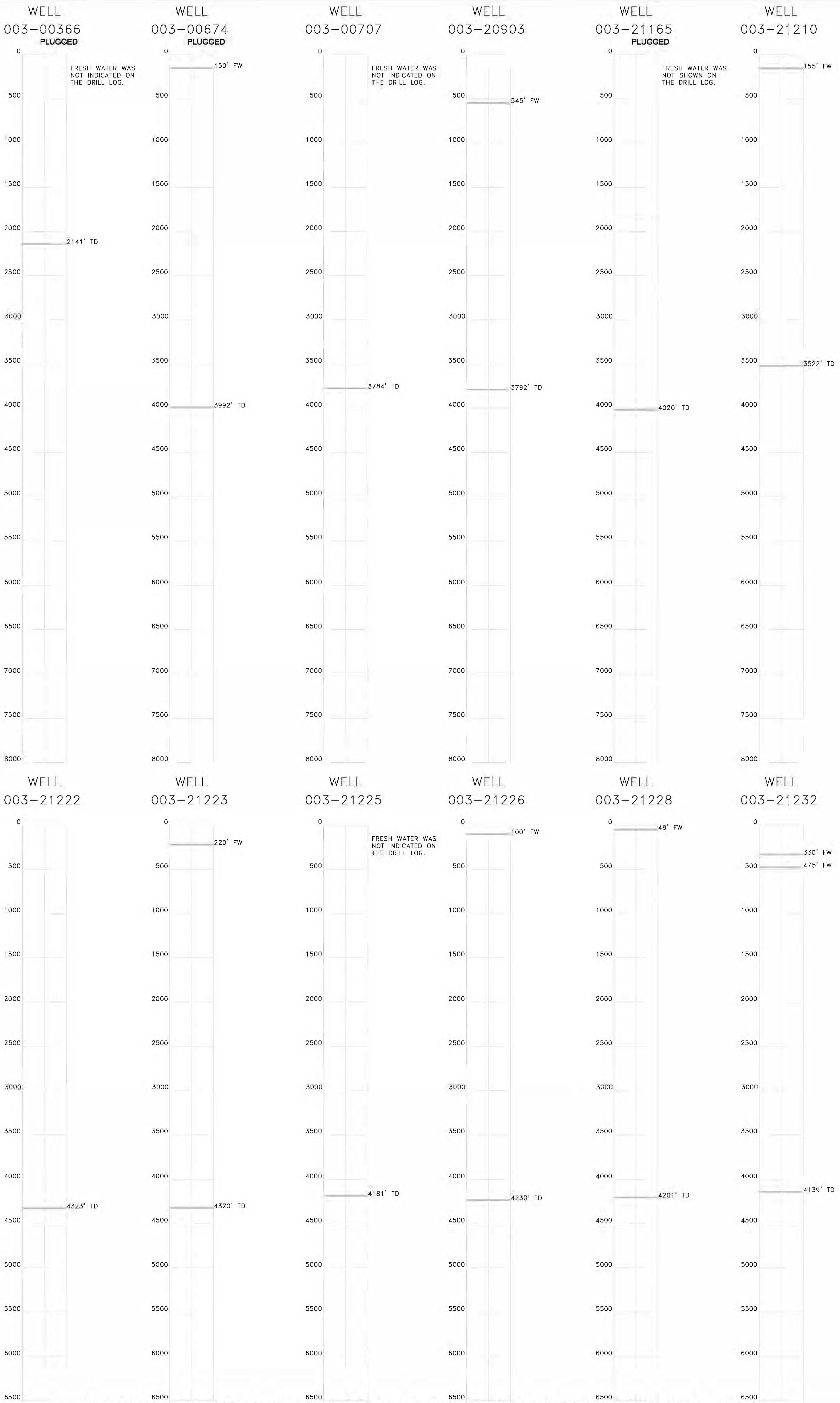

CROSS SECTIONS SHOWING WATER ZONES AS PER DRILLING LOGS

SHEET: 1 OF 6
JOB NO.: 677415_H2O_CROSS-1
FILE: PEN-INJ-1
SCALE HORZ.: 1" = 200'
VERT.:
BY: RLF
CHK:
DATE: FEB. 12, 2016

SEAL
COMMONWEALTH OF PENNSYLVANIA
REGISTERED PROFESSIONAL
RONALD L. FOX
SURVEYOR
NO. 25729-E

PROPOSED INJECTION WELL
FOR
PENNECO ENVIRONMENTAL SOLUTIONS, LLC
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PENNSYLVANIA

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REVISIONS

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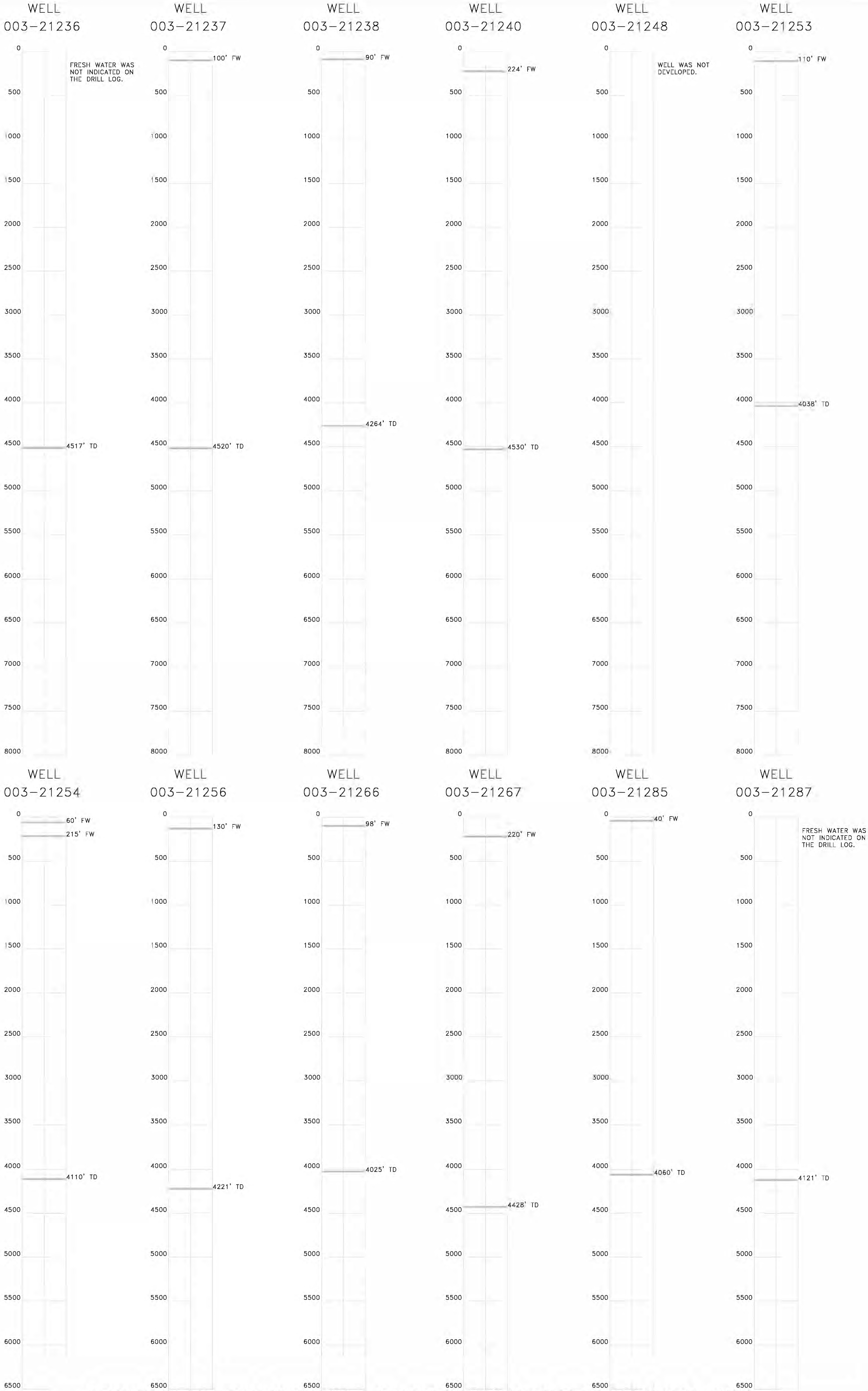

CROSS SECTIONS SHOWING WATER ZONES AS PER DRILLING LOGS

SHEET: 2 OF 6
JOB NO.: 677415_H2O_CROSS-2
FILE: PENNECO-INJECTION
SCALE HORZ.: 1" = 200'
VERT.:
BY: RLF
CHK:
DATE: FEB. 12, 2016

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COMMONWEALTH OF PENNSYLVANIA
REGISTERED PROFESSIONAL
RONALD L. FOX
SURVEYOR
NO. 25729-E

PROPOSED INJECTION WELL
FOR
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REVISIONS

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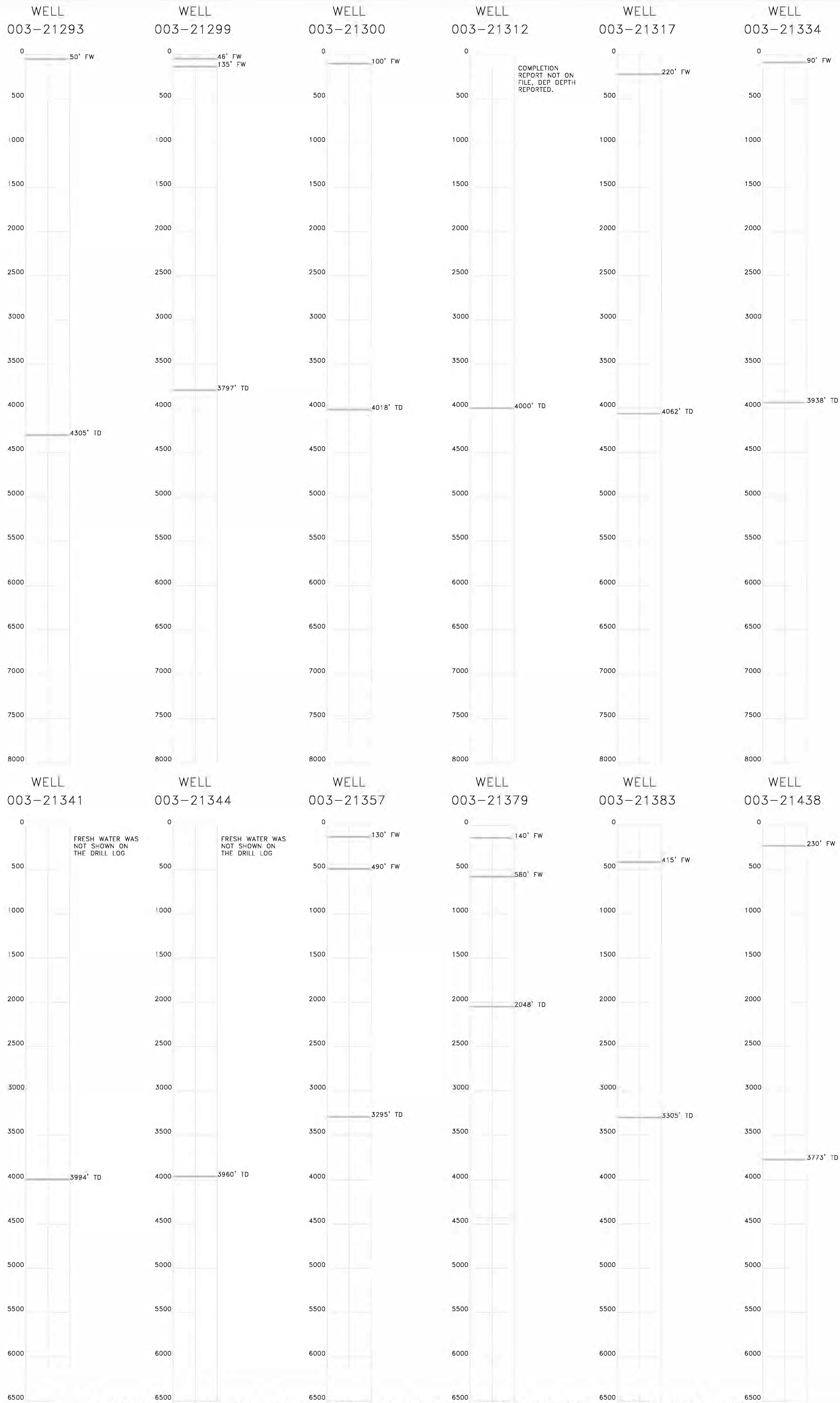

CROSS SECTIONS SHOWING WATER ZONES AS PER DRILLING LOGS

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FILE: PENNECO-INJECTION
SCALE: HORZ.: 1" = 200' VERT.:
BY: RLF CHK: DATE: FEB 12, 2016

SEAL: COMMONWEALTH OF PENNSYLVANIA — REGISTERED PROFESSIONAL SURVEYOR — RONALD L. FOX

PROPOSED INJECTION WELL
FOR
PENNECO ENVIRONMENTAL SOLUTIONS, LLC
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web: www.foxandfoxinc.us

REVISIONS

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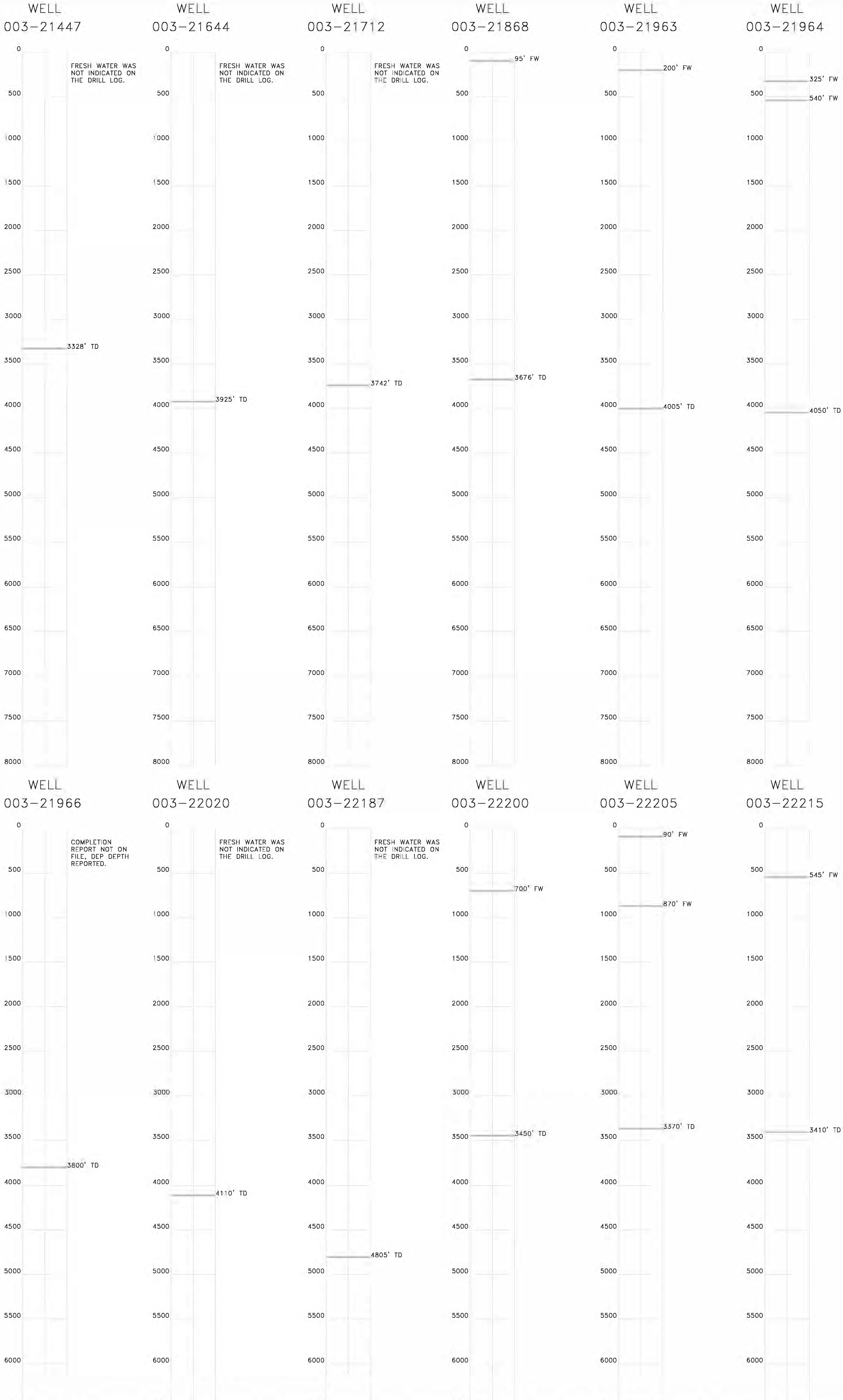

CROSS SECTIONS SHOWING WATER ZONES AS PER DRILLING LOGS

SHEET: 4 OF 6
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FILE: PENNECO-INJECTION
SCALE HORZ.: 1" = 200'
VERT.:
BY: RLF
CHK:
DATE: FEB. 12, 2016

SEAL

COMMONWEALTH OF PENNSYLVANIA
REGISTERED PROFESSIONAL
RONALD L. FOX
SURVEYOR
NO. 25729-E

PROPOSED INJECTION WELL
FOR
PENNECO ENVIRONMENTAL SOLUTIONS, LLC

PLUM BOROUGH, ALLEGHENY COUNTY
PENNSYLVANIA

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REVISIONS

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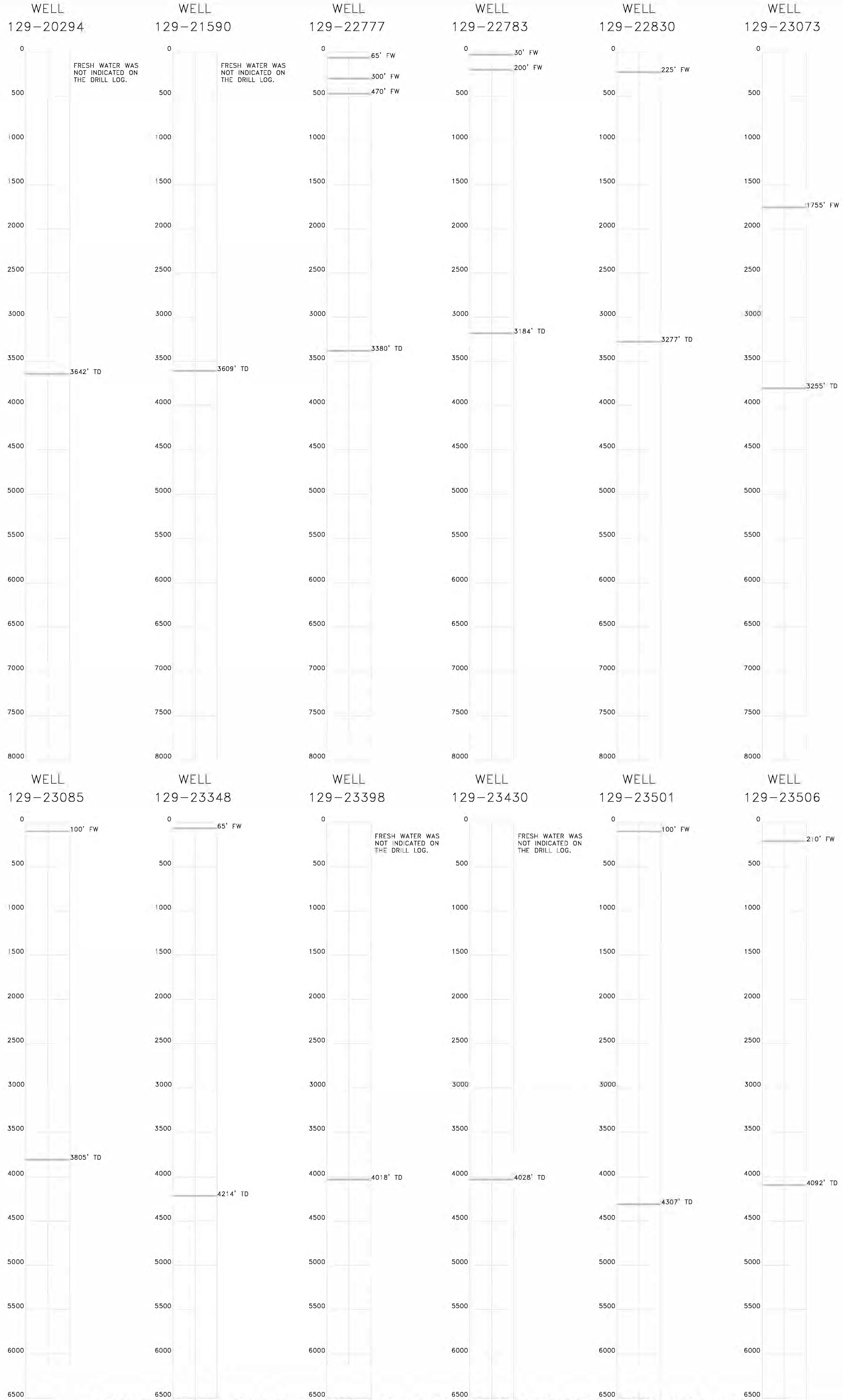

CROSS SECTIONS SHOWING WATER ZONES AS PER DRILLING LOGS

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FILE: PENNECO-INJECTION
SCALE HORZ.: VERT.: 1" = 200'
BY: RLF
CHK:
DATE: FEB. 12, 2016

COMMONWEALTH OF PENNSYLVANIA
REGISTERED PROFESSIONAL
RONALD L. FOX
SURVEYOR

SEAL:

PROPOSED INJECTION WELL
FOR
PENNECO ENVIRONMENTAL SOLUTIONS, LLC
MUNICIPALITY OF MURRYSVILLE & UPPER BURRELL TOWNSHIP, WESTMORELAND COUNTY, PENNSYLVANIA

FOX & FOX, INC.
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email: ronaldlfox@foxandfoxinc.us
web: www.foxandfoxinc.us

REVISIONS

		DESCRIPTION

CROSS SECTIONS SHOWING WATER ZONES AS PER DRILLING LOGS

SHEET: 6 OF 6

JOB NO.: 677415_H2O_CROSS-6

FILE: PENNECO-INJECTION

SCALE HORZ.: 1" = 200' VERT.:

BY: RLF

CHK:

DATE: FEB. 12, 2016

SEAL

COMMONWEALTH OF PENNSYLVANIA REGISTERED PROFESSIONAL RONALD L. FOX SURVEYOR NO. 25729-E

PROPOSED INJECTION WELL

FOR

PENNECO ENVIRONMENTAL SOLUTIONS, LLC

MUNICIPALITY OF MURRYSVILLE & UPPER BURRELL TOWNSHIP, WESTMORELAND COUNTY, PENNSYLVANIA

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REVISIONS

		DESCRIPTION

TOPOGRAPHIC AND GEOLOGIC SURVEY
Arthur A. Socolow, State Geologist

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF ENVIRONMENTAL RESOURCES

MAP #42, Plate 1

GREATER PITTSBURGH REGION GEOLOGIC MAP

COMPILED BY W. R. Wagner, J. L. Craft, L. Heyman and J. A. Harper

1975

GROUP	FORMATION	DESCRIPTION	GROUND WATER CHARACTERISTICS	ENVIRONMENTAL ASPECTS
	Alluvium			
	Terrace deposits			
DUNKARD	Greene			
	Washington			
	Waynesburg			
MONONGAHELA				
CONEMAUGH	Casselman			
	Ames			
	Glenshaw			
ALLEGHENY	Freeport			
	Kittanning			
POTTSVILLE				
	Mauch Chunk			
	Pocono			

SPECIFIC REFERENCES

REFERENCES TO PUBLISHED SOURCE MATERIAL

GENERAL REFERENCES

GEOLOGIC NOTES

STRATIGRAPHIC COLUMN

REPRESENTATIVE ROCK-TYPES

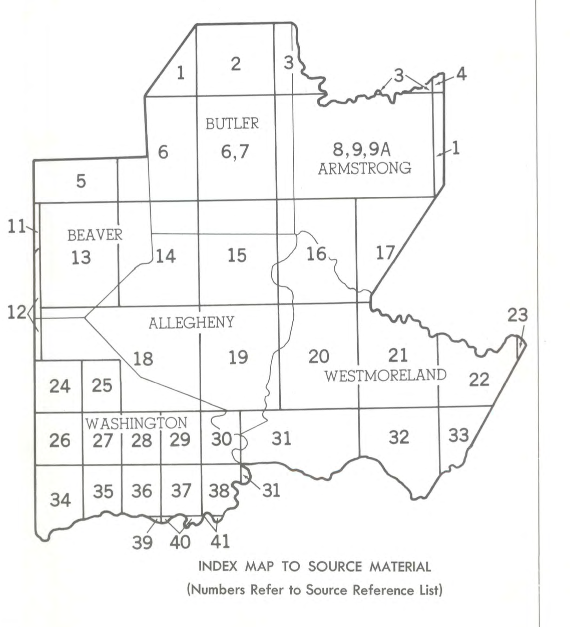
Sandstone

Shales, Claystones, Siltstones, Mudstones

Limestone

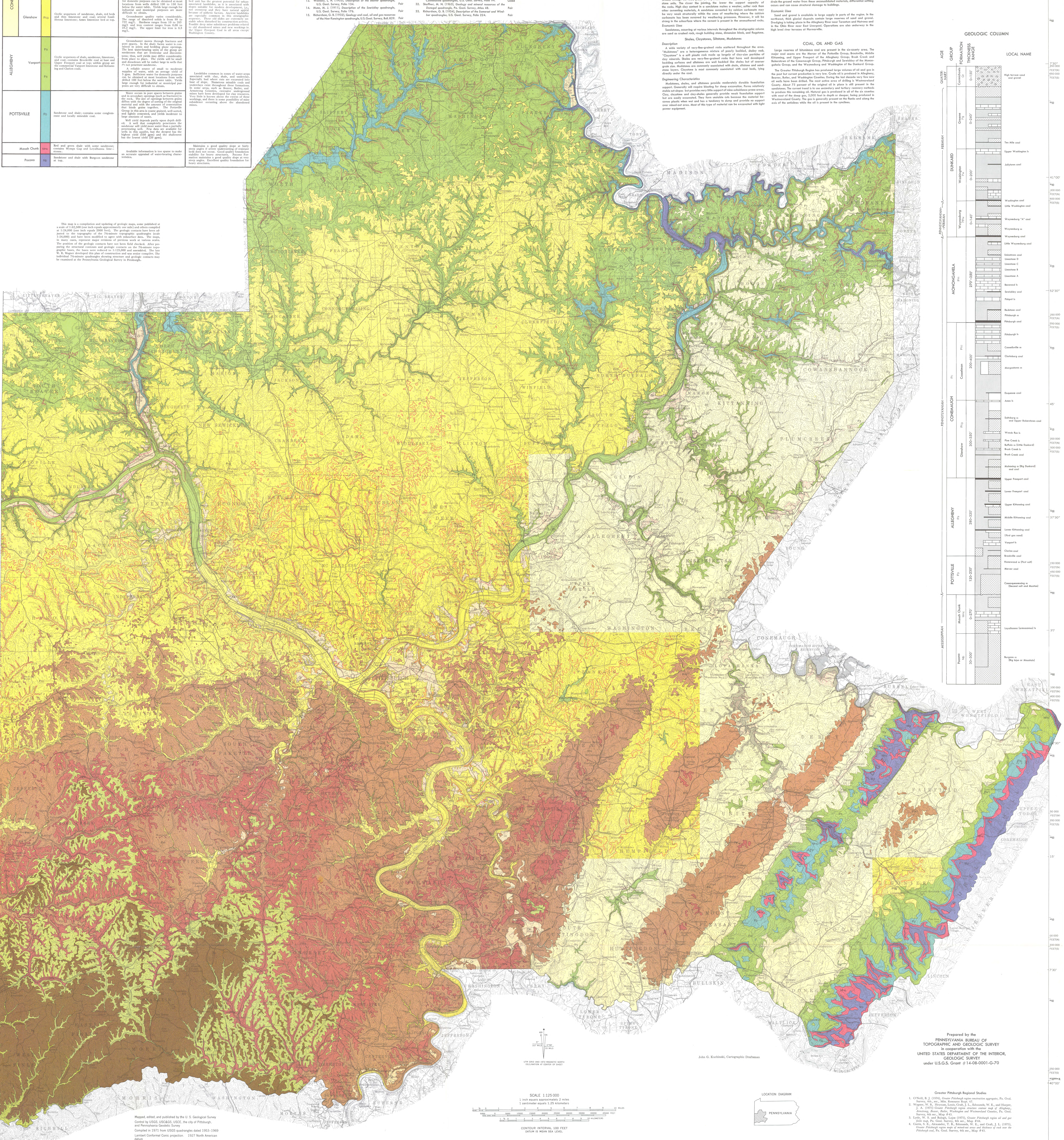
Alluvium, Glacial Outwash, Etc.

COAL, OIL AND GAS



INDEX MAP TO SOURCE MATERIAL
(Numbers Refer to Source Reference List)

GEOLOGIC COLUMN



SCALE 1:125 000

CONTOUR INTERVAL 100 FEET
DATUM IS MEAN SEA LEVEL

LOCATION DIAGRAM

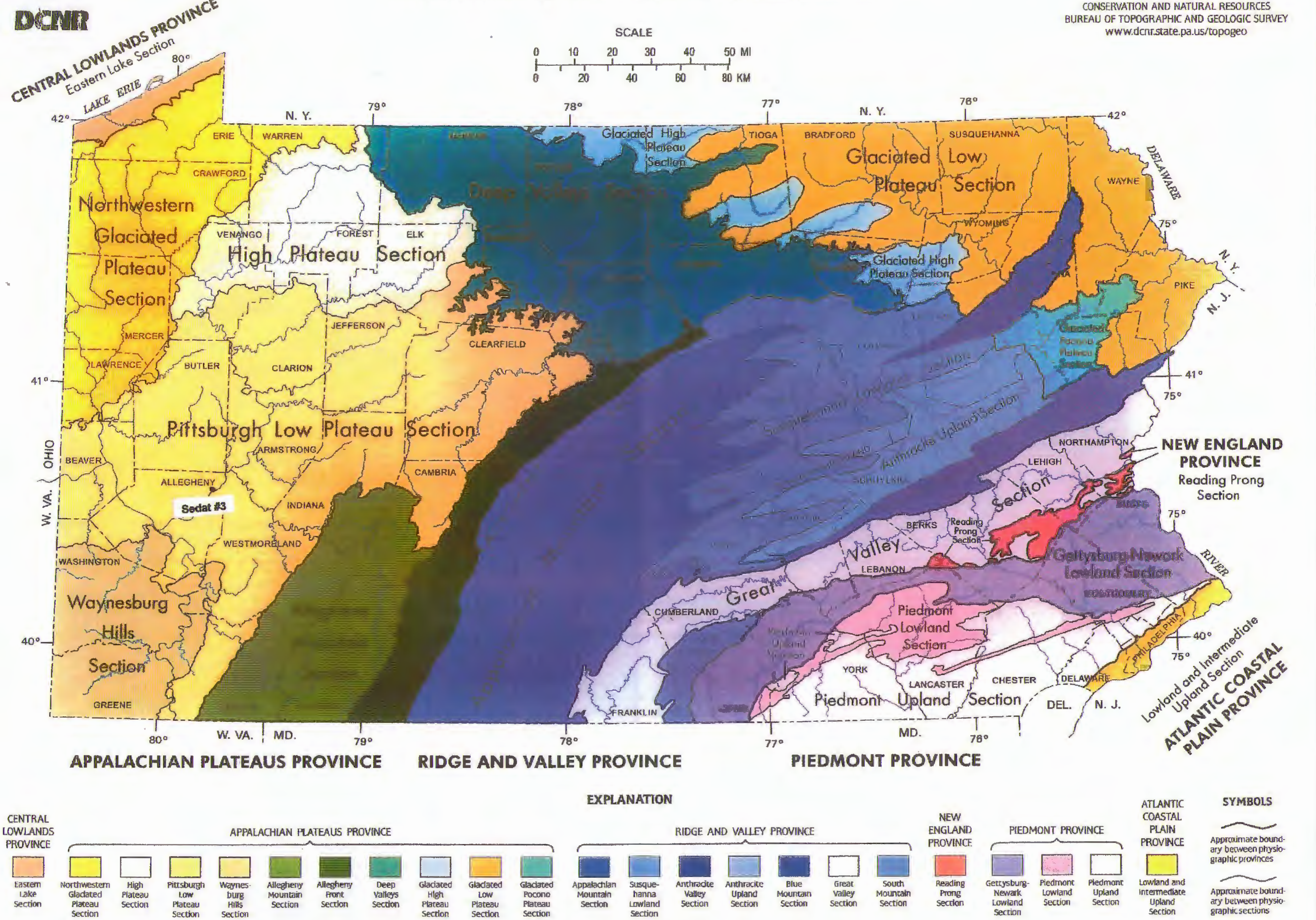
Prepared by the
PENNSYLVANIA BUREAU OF
TOPOGRAPHIC AND GEOLOGIC SURVEY
in cooperation with the
UNITED STATES DEPARTMENT OF THE INTERIOR,
GEOLOGIC SURVEY
under U.S.G.S. Grant #14-08-0001-G-70

Greater Pittsburgh Regional Studies

MAP 13

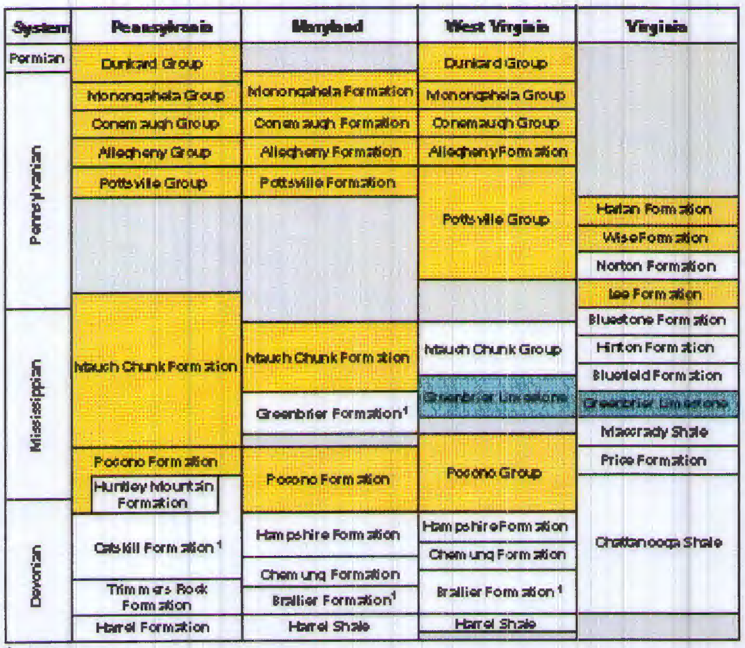
PHYSIOGRAPHIC PROVINCES OF PENNSYLVANIA

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF
CONSERVATION AND NATURAL RESOURCES
BUREAU OF TOPOGRAPHIC AND GEOLOGIC SURVEY
www.dcnr.state.pa.us/topogeo



Compiled by W. D. Sevon. Fourth Edition, 2000.

Figure 89. The principal aquifers in the Appalachian Plateaus 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.



¹Locally water-yielding

Modified from:
Patchen, 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

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 striped mined for coal (Pittsburgh Seam) and mined by underground methods for coal (Upper Freeport Seam); see the Area of Review map in Attachment B.

All six (6) wells within the ¼ mile Area of Review (ARO) penetrate the Murrysville sand, the state permit numbers for the wells are:

Permit #	Permit #	Permit #
003-21289	003-21210	003-22200
003-21223	003-21222	003-21644

All six wells were cased and cemented through the Murrysville, 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 where 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.

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 HFrac report at the end of this attachment. 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 in the AOR there are no apparent faults at shallower depths.

.

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.

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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~~

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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

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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
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Reservoir Transmissibility (kH/mu)	88 mD-ft/cP
Formation Capacity (kH)	88 mD-ft
Reservoir Permeability	1.8 mD
Fracture Extension Pressure	N/A

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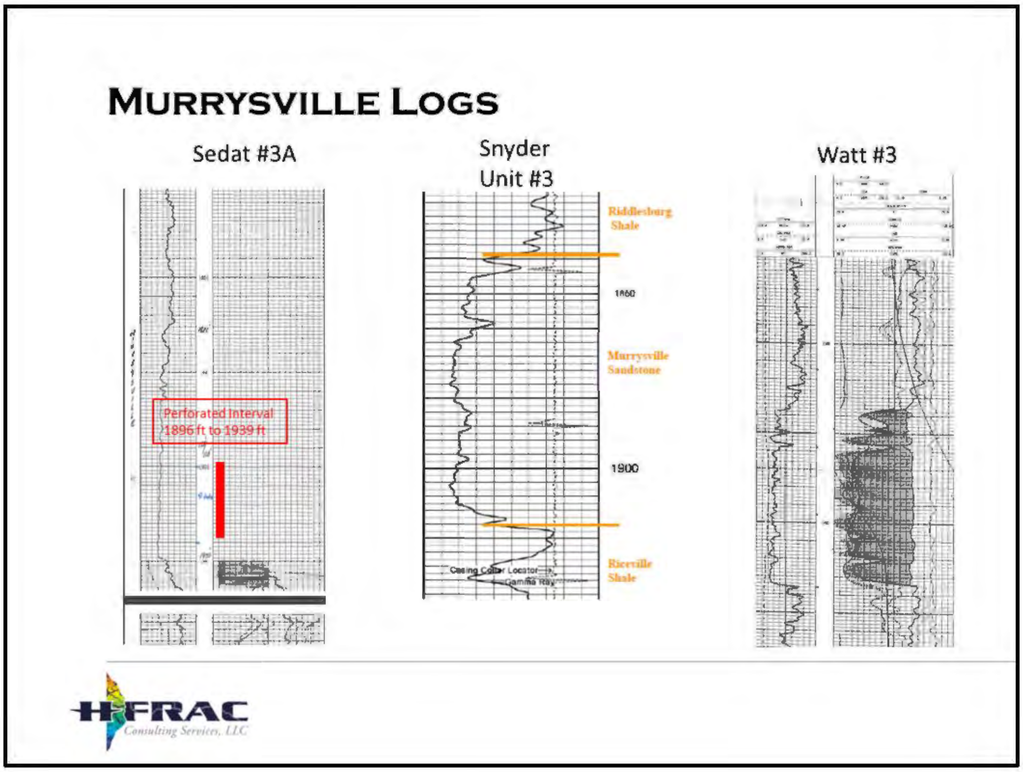
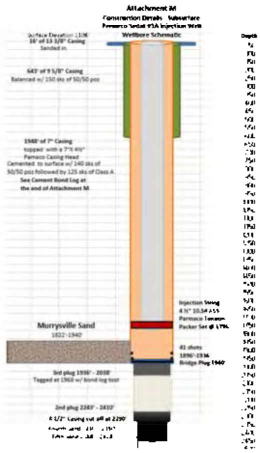


Murrysville type logs.

Sedat #3A
Wellbore Schematic



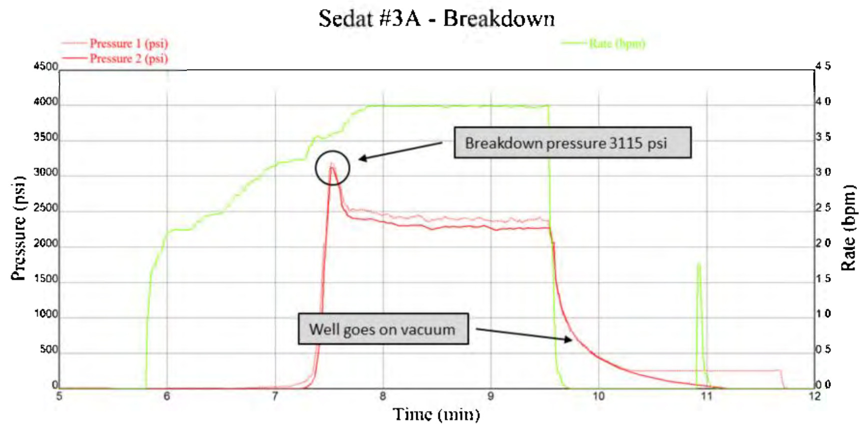
Consulting Services, LLC

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

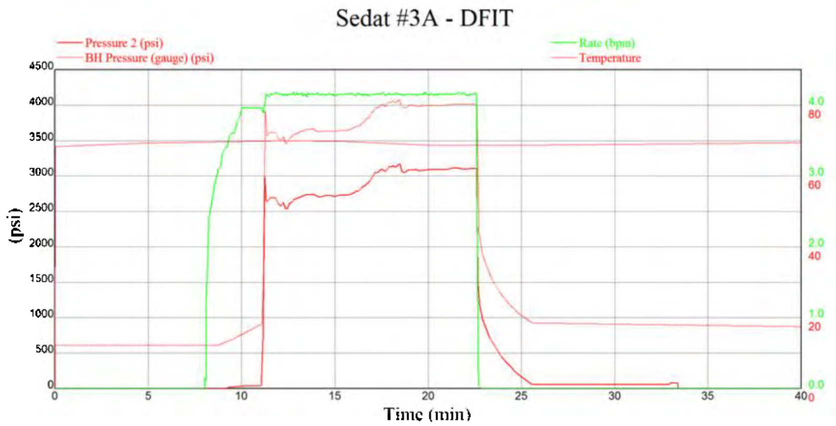
The Sedat #3A was perforated in the Murrysville from 1896 ft to 1939 ft with 41 0.58 in entry hole perforations. Perforation phasing was 60 degrees and the charge was 25 grams.

SEDAT #3A BREAKDOWN



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

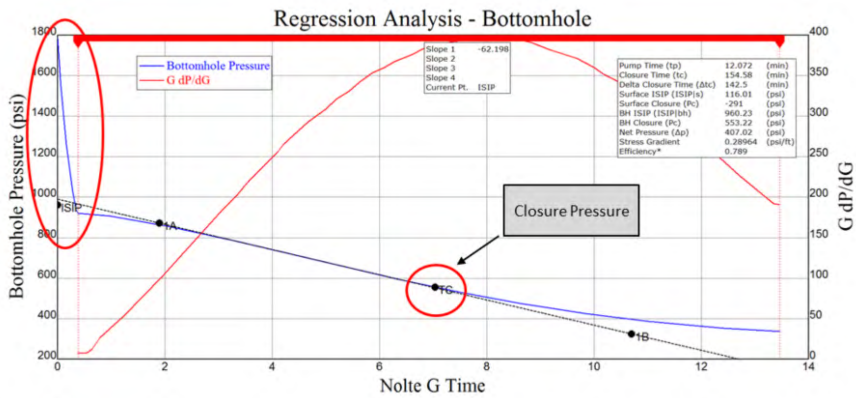


Following the formation breakdown a DFIT (diagnostic fluid injection test) was pumped in the Murrysville to determine closure stress, reservoir pressure, and reservoir transmissibility (kh/mu). Prior to starting the DFIT the whole was loaded with water. After the hole was loaded 1500 gals of water was 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.

SEDAT #3A
NOLTE G FUNCTION



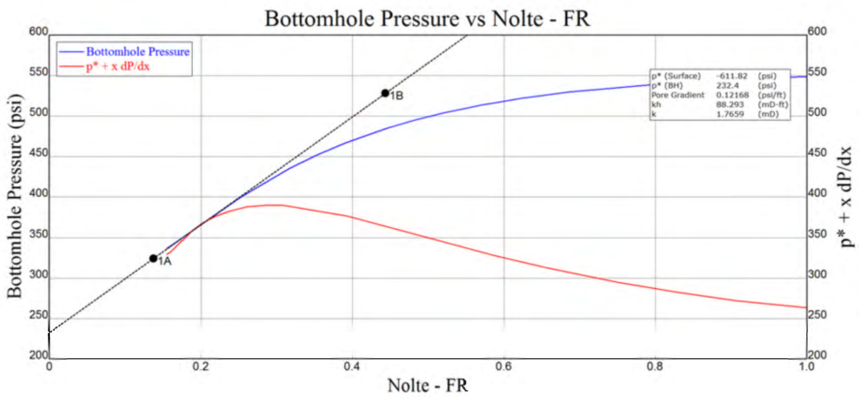
The bottomhole pressure from the DFIT was analyzed with the Nolte G function to determine the closure pressure and closure stress gradient.

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



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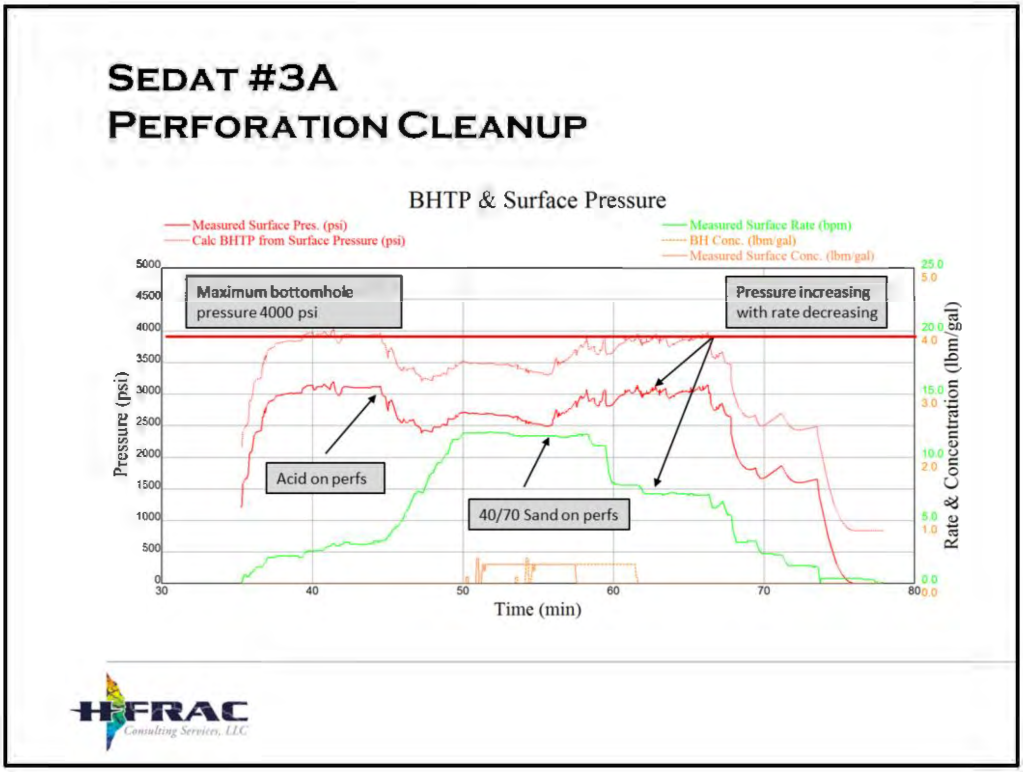
The bottomhole pressure after closure was analyzed using the Nolte FR function. If the late time data reaches pseudoradial flow estimates of reservoir transmissibility (kh/mu) and reservoir pressure can be determined.

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.



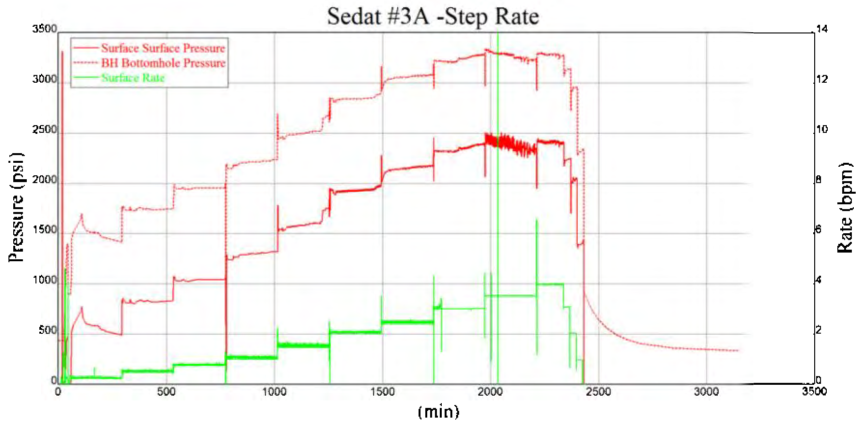
On September 29, 2015 an attempt was made to remove excess friction seen on the DFIT. 500 gals of 15% HCL was pumped. A decrease on the surface treating pressure was seen when the acid was on the perforations. The surface pressure decreased and the injection rate was increased to 12 bpm. The surface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

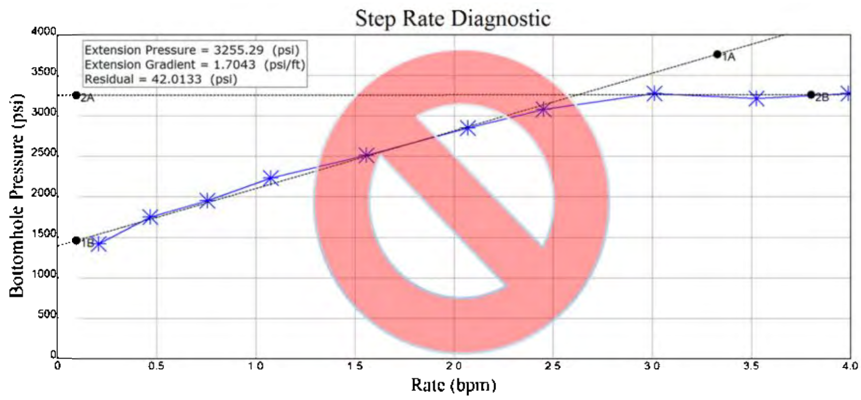


A Step Rate Test was pumped on October 1, 2015 to determine the fracture extension pressure. The initial rate was 0.25 bpm and increased in 0.25 bpm increments until 1 bpm where it was increased to 4 bpm in 0.5 bpm increments. Injection period for each rate stage was 4 hours.

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.

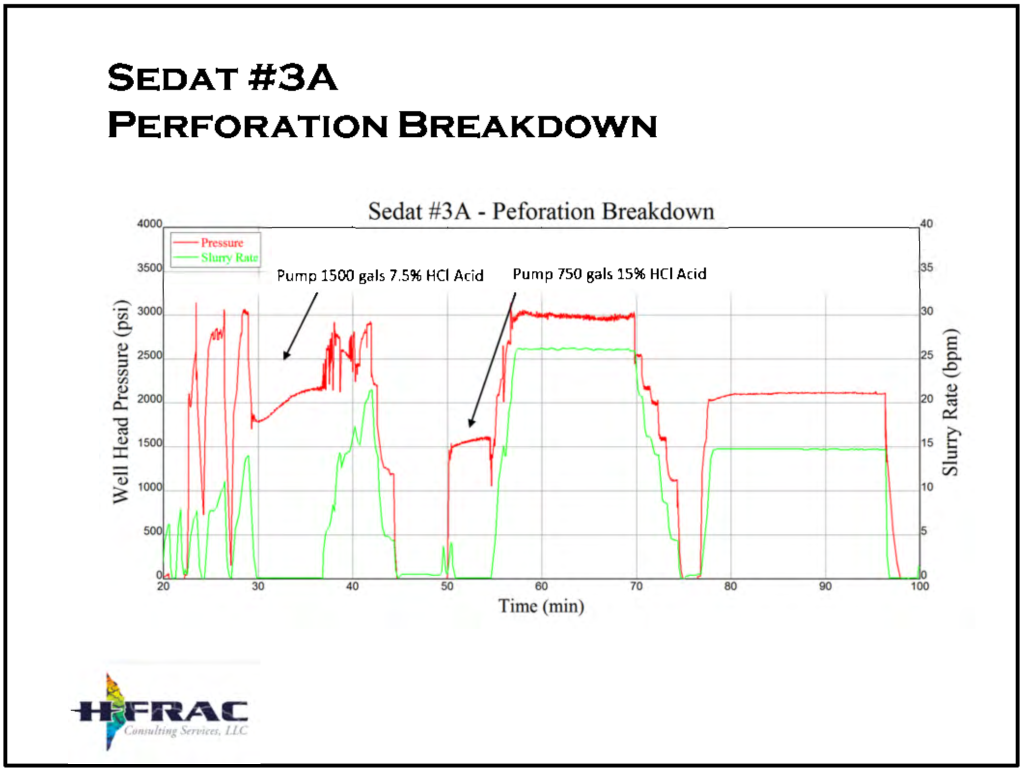
SEDAT #3A
STEP RATE



HIFRAC Consulting Services, LLC

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).



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.

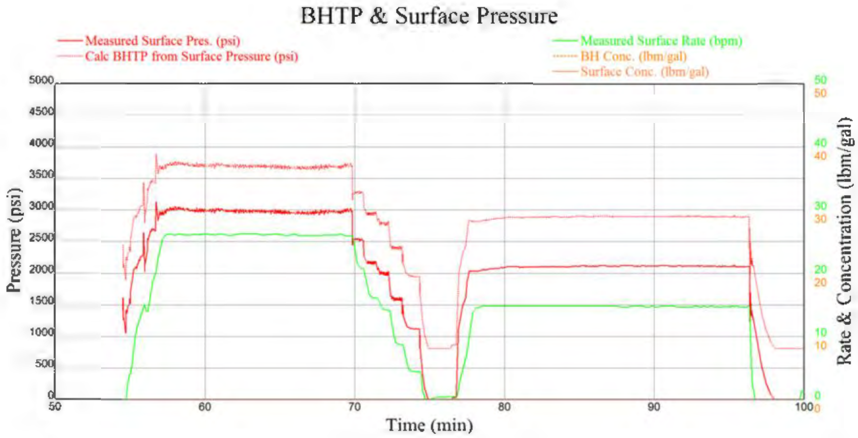
The first acid injection consisted of 1500 gals 7.5% HCl and the second acid injection was 750 gals 15% HCl acid.

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 breakown. An additional injection was pumped at 15 bpm to establish an ISIP.

The ISIP was 1441 psi.

SEDAT #3A
SURFACE & CALC'D BH PRESSURE



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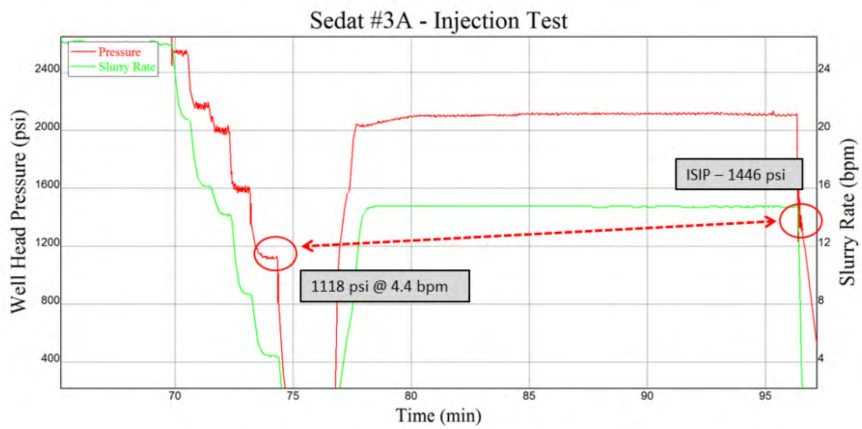
This plot shows the calculated bottomhole pressure from the acid breakdown.

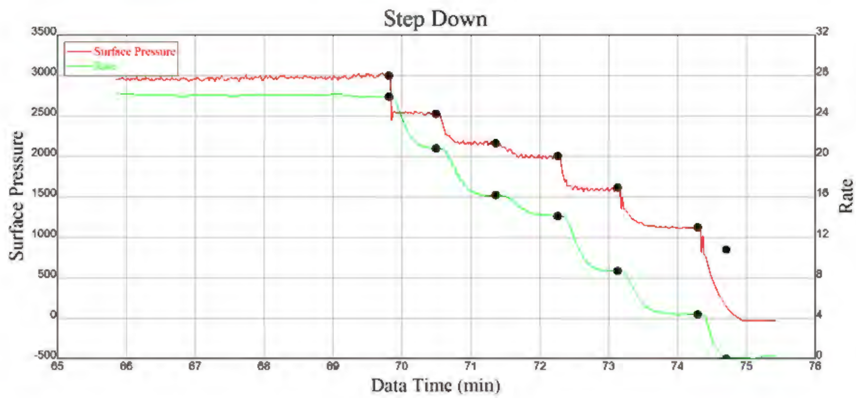
Sedat #3A
Injection Test (zoomed)



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

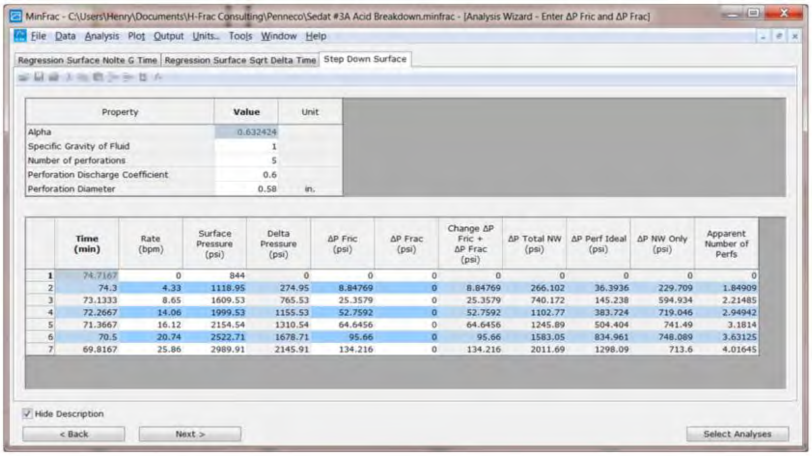
This high of fracture gradient may be caused by either a horizontal fracture or excess fracture complexity.

SEDAT #3A
STEPDOWN POINT SELECTION



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

Sedat #3A
Stepdown Table



Property	Value	Unit
Alpha	0.632424	
Specific Gravity of Fluid	1	
Number of perforations	5	
Perforation Discharge Coefficient	0.6	
Perforation Diameter	0.58	in.

	Time (min)	Rate (bpm)	Surface Pressure (psi)	Delta Pressure (psi)	ΔP Fric (psi)	ΔP Frac (psi)	Change ΔP Fric + ΔP Frac (psi)	ΔP Total NW (psi)	ΔP Perf Ideal (psi)	ΔP NW Only (psi)	Apparent Number of Perfs
1	74.7167	0	844	0	0	0	0	0	0	0	0
2	74.3	4.33	1118.95	274.95	8.84769	0	8.84769	266.102	36.3936	229.709	1.84909
3	73.1333	8.65	1609.53	765.53	25.3579	0	25.3579	740.172	145.238	594.934	2.21485
4	72.2667	14.06	1999.53	1155.53	52.7592	0	52.7592	1102.77	383.724	719.046	2.94942
5	71.3667	16.12	2154.54	1310.54	64.6456	0	64.6456	1245.89	504.404	741.49	3.1814
6	70.5	20.74	2522.71	1678.71	95.66	0	95.66	1583.05	834.961	748.089	3.63125
7	69.8167	25.86	2989.91	2145.91	134.216	0	134.216	2011.69	1298.09	713.6	4.01645

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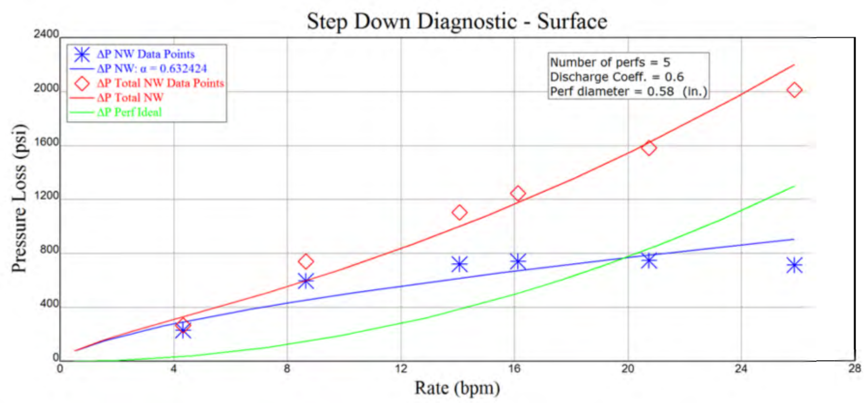
Stepdown Table showing the point selection and friction values.

SEDAT #3A
STEPDOWN ANALYSIS



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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 (permeahility), 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.

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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/mu) 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.

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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.

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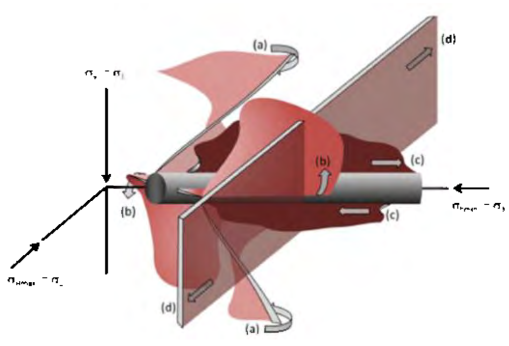
Appendix

Complex Fracture Propagation Horizontal Wellbore



Lucas W. Bazan – SPE 176919-MS

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 transmissibility 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.

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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

K.G. Nolte – SPE 38676

HIFRAC Consulting Services, LLC

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

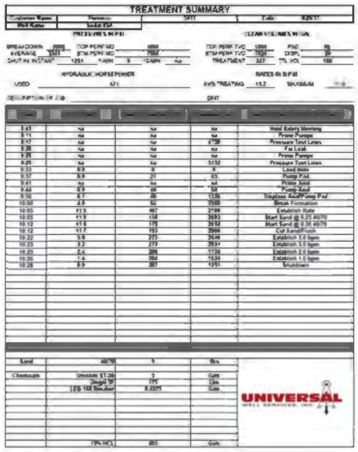
K.G. Nolte – SPE 38676

Consulting Services, LLC

TREATMENT SUMMARY
AUGUST 28, 2015

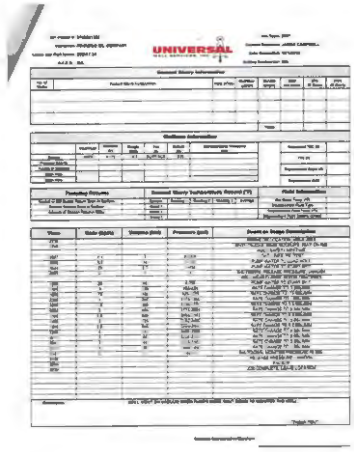
HFRAC
Consulting Services, LLC

Treatment Summary September 29, 2015



HI-FRAC
Consulting Services, LLC

Treatment Summary
October 1, 2015



HIFRAC Consulting Services, LLC

TREATMENT SUMMARY
NOVEMBER 17, 2015

HFRAC
Consulting Services, LLC

WATER ANALYSIS

CWM Environmental
11931 State Route 85
Kittanning, Pennsylvania 16201
724 543-3011
Lab # [illegible]
Lab Analysis Report

Sample Number: 09150656

Customer:	[illegible]	Collection Date:	[illegible]
Site:	[illegible]	Received Date:	[illegible]
Monitoring Pt:	[illegible]	Matrix:	[illegible]
Source Type:	Discharge	Collection Method:	Grab

09150656	Result	Reporting Limit	Method	Analysis Date	Analyst
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Total Dissolved Solids	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
pH	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

Sample Comments:

[illegible]

[illegible]

Analysis Reference: [illegible]

[illegible] Confidential Page 1 of 1

HI FRAC
Consulting Services, LLC

WATER ANALYSIS

CWM Environmental
11931 State Route 85
Kittanning, Pennsylvania 16201
724-543-3011
Lab # [illegible]
Lab Analysis Report

Sample Number: 09150657

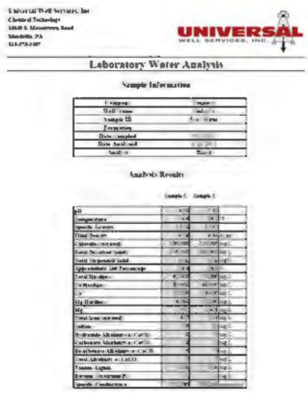
Customer:	[illegible] Oil Co., Inc.	Collection Date:	[illegible]
Site:	[illegible]	Received Date:	[illegible]
Monitoring Pt:	Tank Water	Matrix:	[illegible]
Source Type:	Discharge	Collection Method:	Grab

[illegible]	Result	Reporting Limit	Method	Analysis Date	Analyst
Specific Gravity	[illegible]	[illegible]	ASTM D-1298	[illegible]	[illegible]
pH	[illegible] SU	SU	[illegible]	[illegible]	[illegible]
Total Dissolved Solids	[illegible] mg/L	[illegible] mg/L	SM 2540 C	[illegible]	[illegible]

Sample Comments:

pH: [illegible]

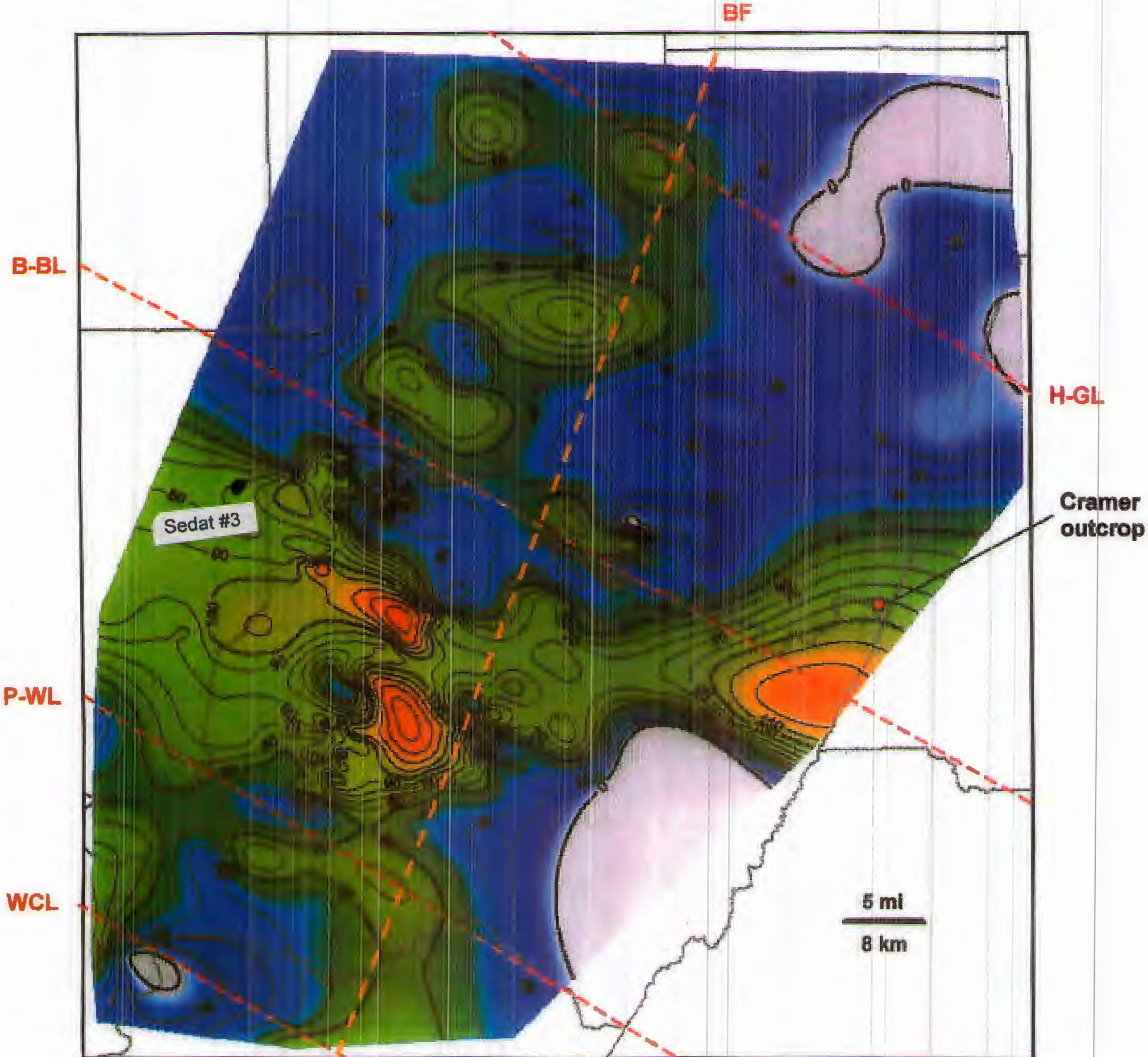
WATER ANALYSIS


Laboratory Water Analysis

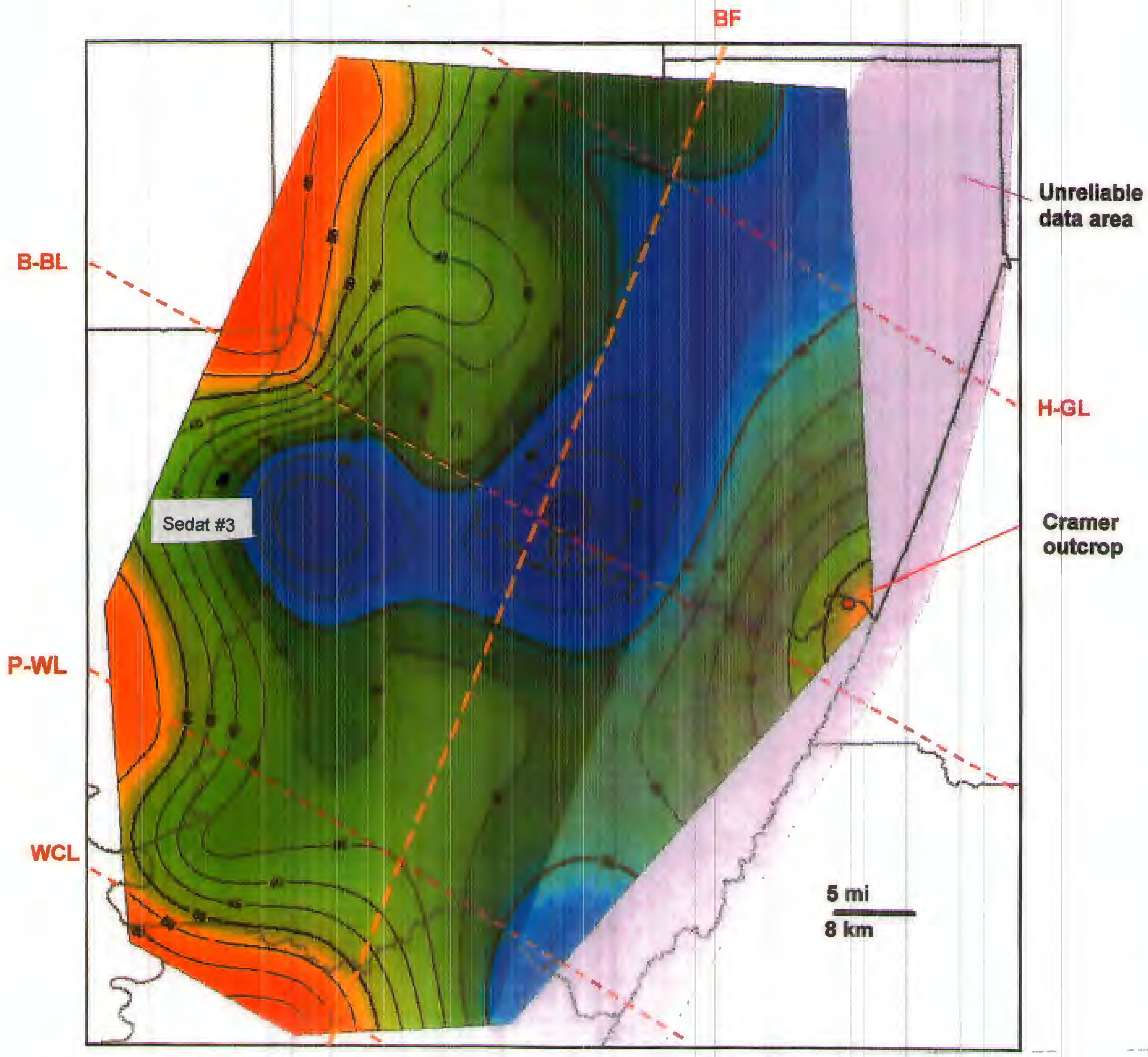
Sample Information

Analysis Results

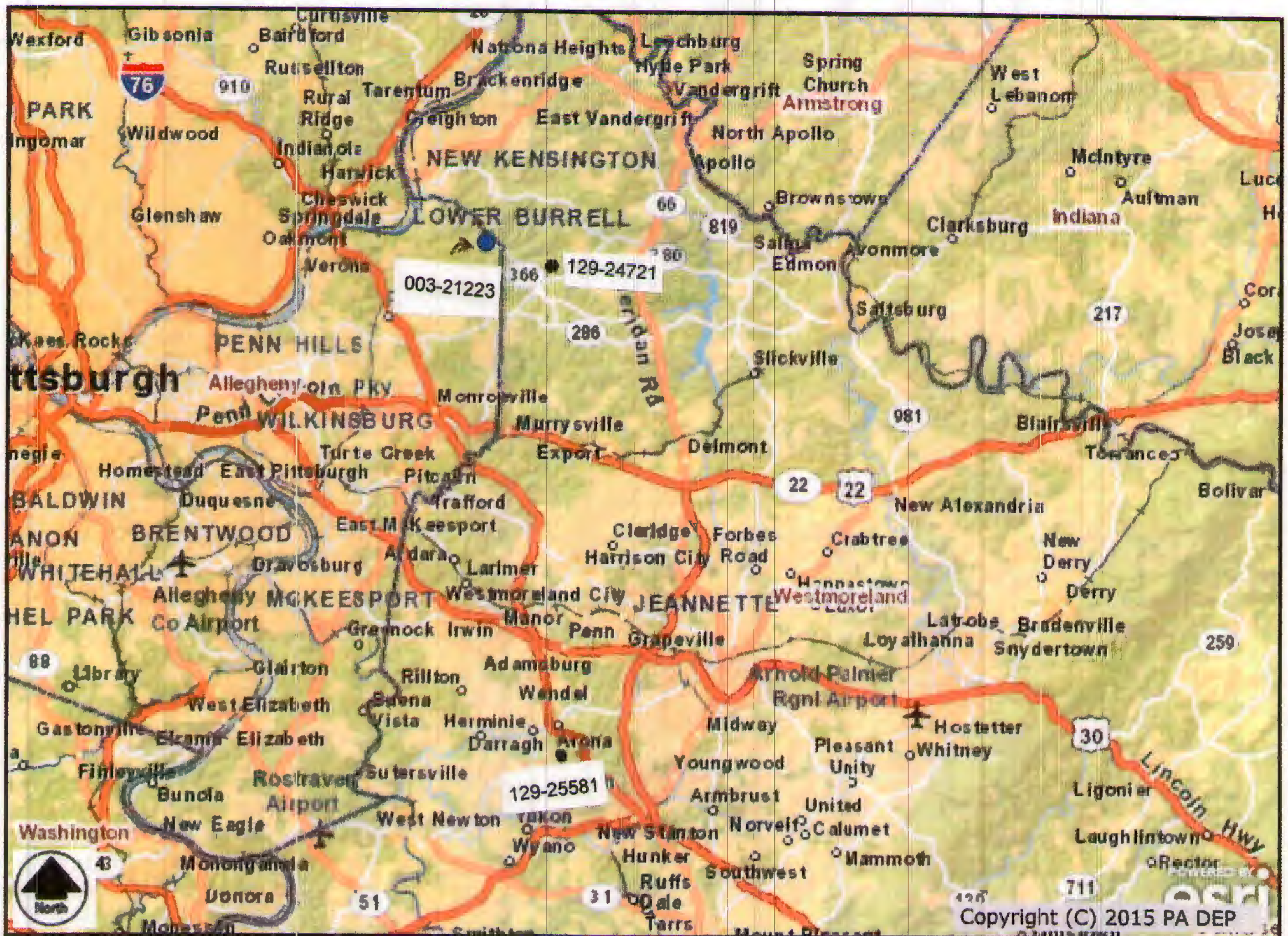
HFRAC Consulting Services, LLC



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

SUPERIOR WELL SERVICES

SUPERIOR
Black Lick, Pa
Mercer, Pa
Wooster, Ohio
Charleston, W Va

GAMMA RAY
NEUTRON
DENSITY
DUAL INDUC

CPNY PENNECO OIL COMPANY
WELL MARONDA HOMES #1 (PM-
FIELD MURRYSVILLE QUADRANG
CO. WESTMORELAND ST PA

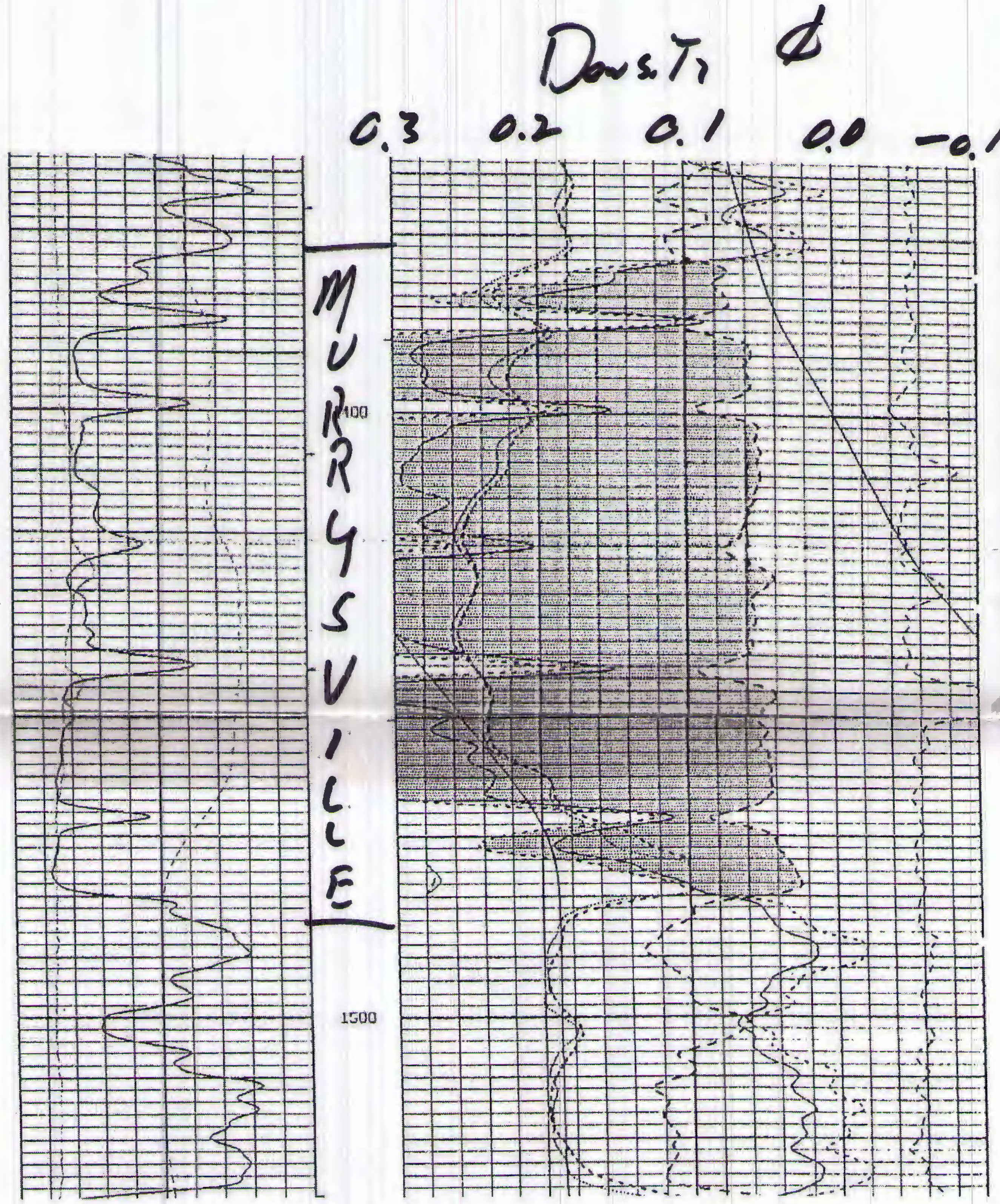
COMPANY PENNECO OIL COMPANY
WELL MARONDA HOMES #1 (PM-594)
FIELD MURRYSVILLE QUADRANGLE
COUNTY WESTMORELAND STA

LOCATION
PERMIT#37-129-24721
0' WEST LONG:79'37'58.2"
0' SOUTH LAT:40'29'24.5"

SEC.______ TWP. WASHINGTONE ,______

PERMANENT DATUM GROUND LEVEL ELEV. 1120 FT. EL
LOG MEASURED FROM TOP OF 7" ABOVE PERMANENT DATUM
DRILLING MEASURED FROM K.B.

DATE	06-14-02		
RUN NO.	ONE		
DEPTH-DRILLER	3550 FT.		
DEPTH-LOGGER	3537 FT.		
BTM. LOG INTER.			
TOP LOG INTER.	0 FT.		
CASING-DRILLER	1280 FT.		
CASING-LOGGER	1280 FT.		
BIT SIZE	6.25 IN.		
FLUID TYPE	AIR/GAS		
DENS. : VISC.	N/A		
PH : FLUID LOSS	N/A		
SOURCE OF SAMPLE	N/A		
RM @ MEAS. TEMP.	N/A		
RMF @ MEAS. TEMP.	N/A		
RMC @ MEAS. TEMP.	N/A		
SOURCE: RMF/RMC	N/A		
RM @ BHT	N/A		
TIME SINCE CIRC.	N/A		
MAX. REC. TEMP.	N/A		
EQUIP.: LOCATION	0058/BLKLCK		
RECORDED BY	JERRY MOORE		
WITNESSED BY	MR. JACOBS		



Dens. Tr ɸ
0.3 0.2 0.1 0.0 -0.1
MURRYSVILLE
1400
1500

LDT

Schlumberger

DOMINION EXPLORATION & PRODUCTION INC.

JACOB SNYDER UNIT #3 (WPA06512)
HEMPFIELD TWP
WESTMORELAND PENNSYLVANIA

COUNTY: WESTMORELAND
Field: HEMPFIELD TWP.
Location: LATITUDE: 40-15-34.2700
Well: JACOB SNYDER UNIT #3 (WP
Company: DOMINION EXPLORATION & PR

LITHO DENSITY
COMPENSATED NEUTRON / GR
ARRAY INDUCTION / TEMPERATURE

LOCATION

LATITUDE: 40-15-34.2700		Elev.:	K.B.
LONGITUDE: 79-40-1.3800			G.L. 1080 ft
11711' S & 108' W OF NE CORNER			D.F.
Permanent Datum:	GROUND LEVEL	Elev.:	1080 ft
Log Measured From:	KB	8.0 ft	above Perm. Datum
Drilling Measured From:	KB		

API Serial No	MAP SECTION:	TOWNSHIP:	QUAD:
37-129-25581-00	8	HEMPFIELD	IRWIN

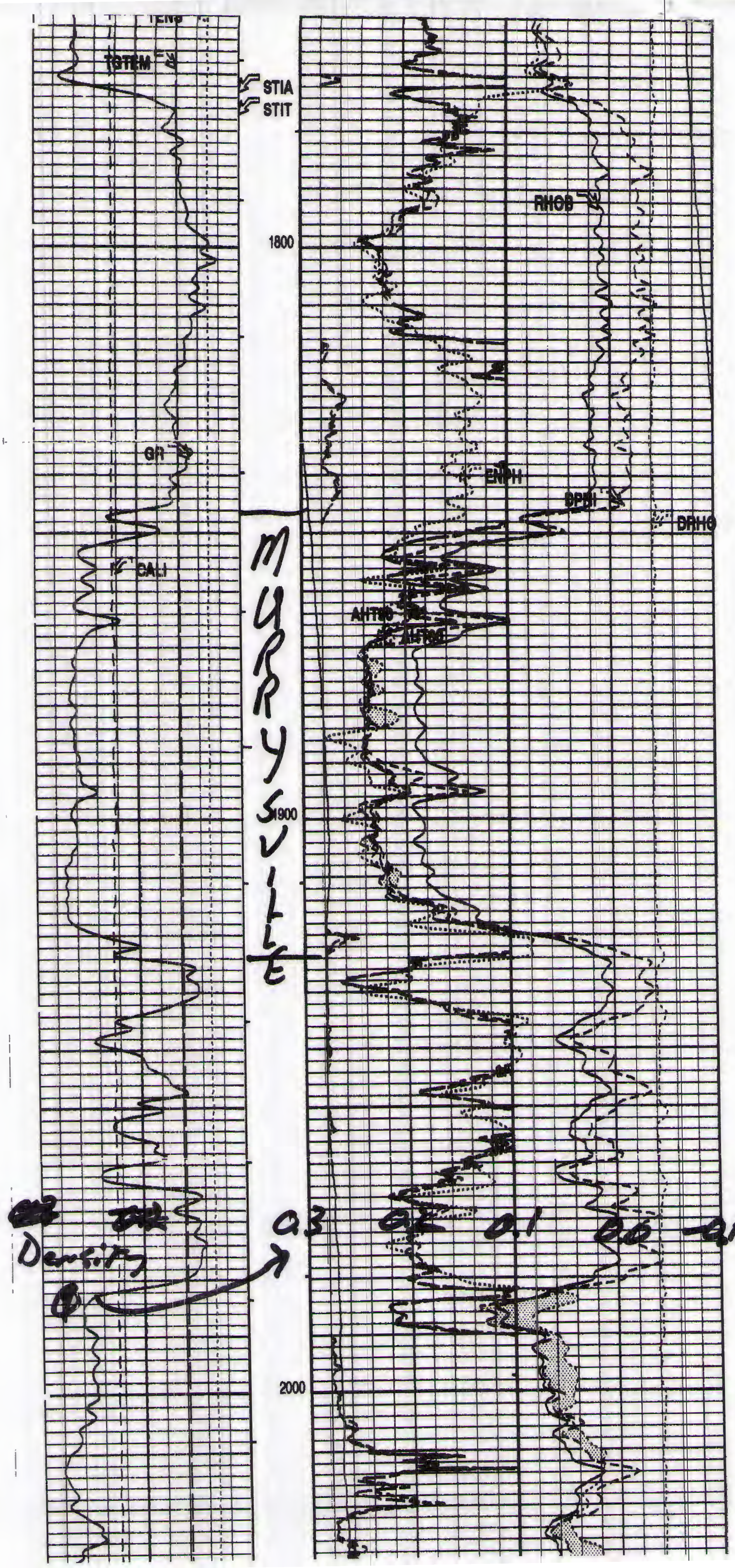
Logging Date	31-Aug-2005			
Run Number	1			
Depth Driller	2130 ft			
Schlumberger Depth	2135 ft			
Bottom Log Interval	2127 ft			
Top Log Interval	0 ft			
Casing Driller Size @ Depth	9.625 in @ 354 ft		@	
Casing Schlumberger	366 ft			
Bit Size	8.875 in			
Type Fluid In Hole	AIR / GAS / PRODUCED FLUIDS			
MUD Density / Viscosity	0 lbm/gal			
MUD Fluid Loss / PH				
MUD Source Of Sample				
RM @ Measured Temperature	@		@	
RMF @ Measured Temperature	@		@	
RMC @ Measured Temperature	@		@	
Source RMF / RMC				
RM @ MRT / RMF @ MRT	@ 70	@ 70	@	@
Maximum Recorded Temperatures	70 degF			
Circulation Stopped / Time				
Logger On Bottom / Time	31-Aug-2005	18:40		
Unit Number / Location	3069	BRADFORD		
Recorded By	TIM LYON, MIKE KORNACKI			
Witnessed By	NATE ZIMMERMAN, MELISSA THARP			

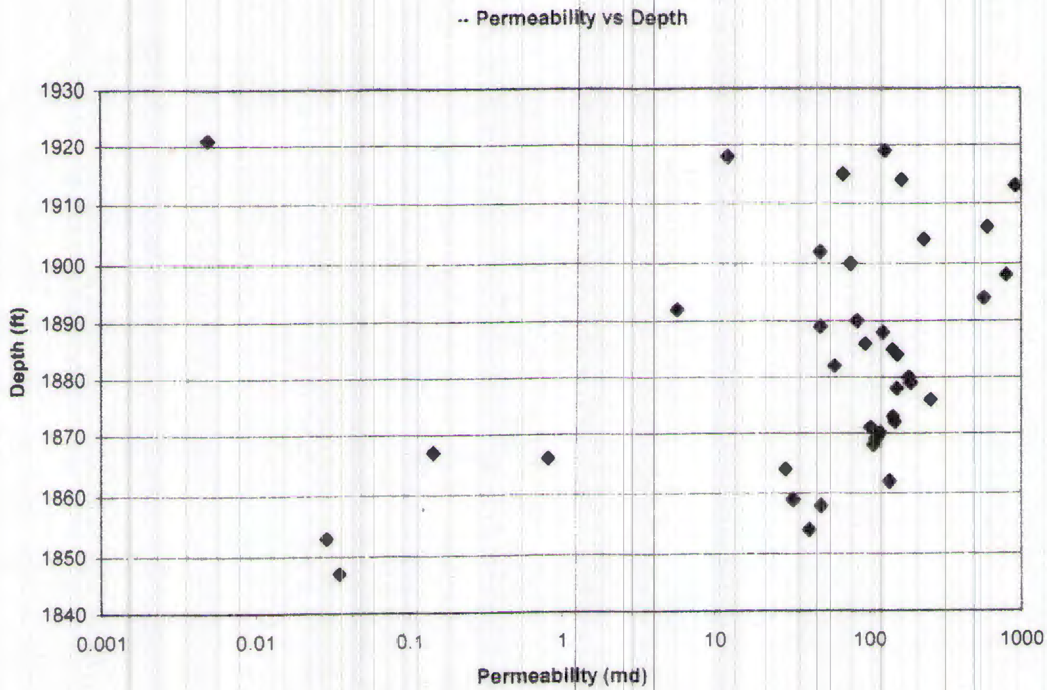
	Run 1	Run 2	Run 3	Run 4

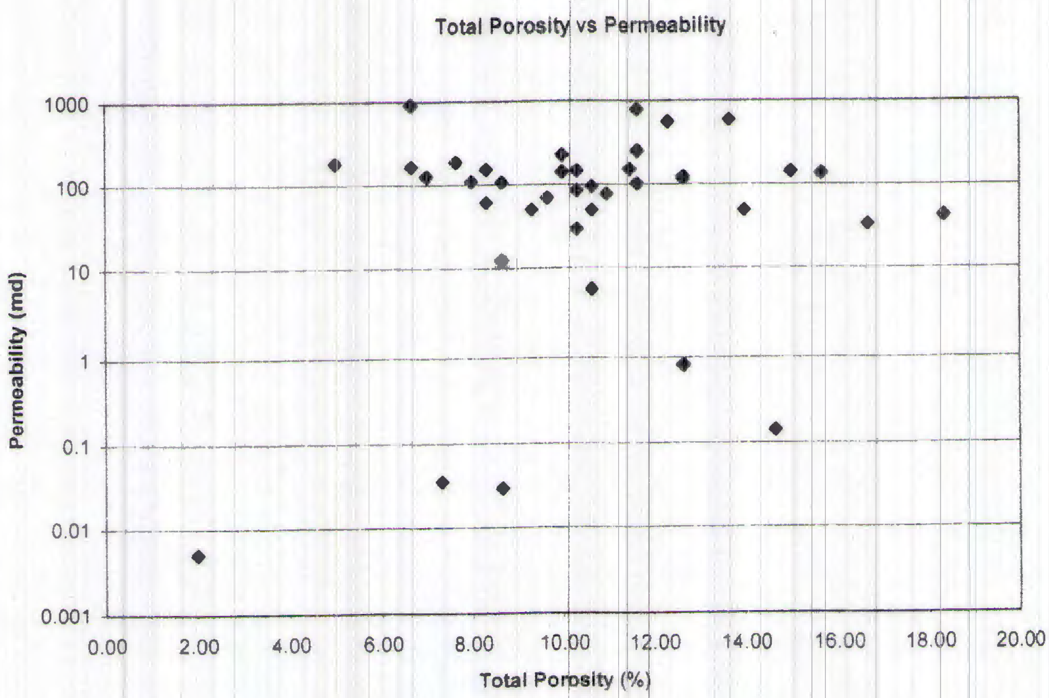
Logging Date				
Run Number				
Depth Driller				
Schlumberger Depth				
Bottom Log Interval				
Top Log Interval				
Casing Driller Size @ Depth	@		@	
Casing Schlumberger				
Bit Size				
Type Fluid In Hole				
MUD Density / Viscosity				
MUD Fluid Loss / PH				
MUD Source Of Sample				
RM @ Measured Temperature	@		@	
RMF @ Measured Temperature	@		@	
RMC @ Measured Temperature	@		@	
Source RMF / RMC				
RM @ MRT / RMF @ MRT	@	@	@	@
Maximum Recorded Temperatures				
Circulation Stopped / Time				
Logger On Bottom / Time				
Unit Number / Location				
Recorded By				
Witnessed By				

DISCLAIMER
... DATA BY THE HEREIN NAMED COMPANY (AND ANY OF ITS

Jacob Snyder Unit #3
129-25581







Sage, Melissa, 2007. Petrologic study of Murrysville sandstone in SW PA

ATTACHMENT “H”

Operating Data

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, Pm= [(FG – (0.433)(Sg)]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 Sg used was 1.11, the Sg of the produced brine water used in the formation study and a depth of 1,896’ the top perforation in the Sedat #3A. [Pm = (1.23 – 0.433 (1.11))1896]; Pm=1,420#.

Annulus Fluid

3) Fresh water will be in 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 produced water from oil and gas wells and flow back fluid from oil and gas well stimulation activities. 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.

Corrplex 300

Chemplex, Ltd.
506 CR 137
Snyder, TX 79549
(325) 573-7298

DATE PREPARED:...........07/16/2003
REVISION DATE:............. 1010/2011
EMERGENCY NUMBER:...800-633-8253
PRODUCT NUMBER:....... 01201

SECTION I – IDENTIFICATION

PRODUCT NAME: .... Corrplex 300
CHEMICAL FAMILY: . ... Amine Salt
PRODUCT USE: ....Petrochemical industry:
Preparing Oil Well Packer Fluids.

SECTION II – HAZARDOUS INGREDIENTS

HAZ INGREDIENT	*PERCENT*	*CAS NUMBER*	*PEL*
FATTY ALKYL AMINE SALT	3-7 %	61790-85-0	Not Available
Ammonium Bisulfite	<10%	10192-30-0	Not Available
Methanol	15%	67-56-1	Not Available

SECTION III – PHYSICAL DATA

APPEARANCE: ....Amber Liquid
ODOR: ....Sulfite-like
BOILING POINT: ....ND
FLASHPOINT: ....71°F Closed Cup
VAPOR DENSITY (AIR=1): ....ND
SPECIFIC GRAVITY (WATER=1): 0.98
pH (1% SOLN/WATER):.......................5
Density..8.16 # per gallon

SECTION IV – FIRE AND EXPLOSION DATA

FLASHPOINT: ....71°F Closed Cup
FLAMMABLE HAZARDS: ....When heated to decomposition, it emits acrid smoke and irritating fumes.

Corrplex 300

FIRE FIGHTING PROCEDURES: .... ***SMALL FIRE:*** Use DRY chemical, CO2 alcohol foam or water spray, as appropriate for surrounding materials.
LARGE FIRE: Use water spray, fog or foam. Cool containing vessels with water jet in order to prevent pressure build-up, auto ignition or explosion.

SECTION V – REACTIVITY DATA

STABILITY: .... This product is stable.
CORROSIVITY: .... ND
REACTIVITY: .... Highly reactive with oxidizing agents.
Slightly reactive to reactive with reducing agents, alkalis.
Very slightly to slightly reactive with organic materials, metals, acids.

SECTION VI A - HEALTH HAZARD DATA

ROUTE OF ENTRY: .... Ingestion. Skin Contact. Inhalation.
CHRONIC EFFECTS ON HUMANS: ... May cause nervous system depression, headaches, dizziness or confusion. The substance may be toxic to the nervous system.

SECTION VI B - FIRST AID

INHALATION: .... ***SLIGHT INHALATION:*** Allow the victim to rest in a well ventilated area. Seek immediate medical attention.
HAZARDOUS INHALATION: Evacuate the victim to a safe area as soon as possible. Loosen tight clothing such as a collar, tie, belt or waistband. If breathing is difficult, administer oxygen. If the victim is not breathing, perform mouth-to-mouth resuscitation. WARNING: It may be dangerous to the person providing aid to give mouth-to-mouth resuscitation when the inhaled material is toxic, infectious or corrosive. Seek medical attention.
INGESTION: .... ***SLIGHT INGESTION:*** Do not induce vomiting. Have conscious person drink several glasses of water or milk. Seek immediate medical attention.
HAZARDOUS INGESTION: Do NOT induce vomiting. Examine the lips and mouth to ascertain whether the tissues are damaged, a possible indication that the toxic material was ingested; the absence of such signs, however, is not conclusive. Loosen tight clothing such as a collar, tie, belt or waist band. If the victim is not breathing, perform mouth-to-mouth resuscitation. Seek medical attention.
EYE CONTACT: .... Check for and remove any contact lenses. Do not use an eye ointment. Seek medical attention.
SKIN CONTACT: .... If the chemical got onto the clothed portion of the body, remove the contaminated clothes as quickly as possible,

Corrplex 300

protecting your own hands and body. Place the victim under a deluge shower. If the chemical touches the victims exposed skin, such as the hands: Gently and thoroughly wash the contaminated skin with running water and non-abrasive soap. Be particularly careful to clean folds, crevices, creases and groin. COLD water may be used. Cover the irritated skin with an emollient. If irritation persists, seek medical attention. Wash contaminated clothing before reusing.

SECTION VII – SPILL, STORAGE AND DISPOSAL DATA

SPILL: .... ***SMALL SPILL:*** Absorb with an inert material and put the spilled material in an appropriate waste disposal. ***LARGE SPILL:*** Stop leak if without risk. Absorb with DRY earth, sand or other non-combustible material. Do not touch spilled material. Prevent entry into sewers, basements or confined areas; dike if needed. Eliminate all ignition sources.

WASTE DISPOSAL: .... Whatever cannot be saved for recovery or recycling should be managed in an appropriate and approved waste disposal facility. Processing, use or contamination of this product may change the waste management options. State and local disposal regulations may differ from federal disposal regulations. Dispose of container and unused contents in accordance with federal, state and local requirements.

HANDLING: .... Normal industrial hygiene procedures are appropriate. In case of insufficient ventilation, wear suitable respiratory equipment. If ingested, seek medical advice immediately and show the container or the label. Avoid contact with skin and eyes. Keep away from incompatibles such as oxidizing agents, reducing agents, alkalis.

STORAGE: .... Flammable materials should be stored in a separate safety storage cabinet or room. Keep away from heat. Keep away from sources of ignition. Keep container tightly closed. Keep in a cool, well-ventilated place. Ground all equipment containing material. A refrigerated room would be preferable for materials with a flash point lower than 37.8°C (100°F).

SECTION VIII – PROTECTIVE CLOTHING

RESPIRATORY PROTECTION: .... Use MSHA/NIOSH approved respirator or equivalent
PROTECTIVE CLOTHING/EQUIPMENT: .....Splash goggles, lab coat/apron, gloves

Corrplex 300

SECTION IX – TRANSPORTATION DATA

PROPER SHIPPING NAME: .... Flammable liquid, n.o.s.(contains Methanol)
HAZARD CLASS: 3
UN NUMBER: .... UN 1993
PACKAGING GROUP: II
RQ: .... 612 gallons (Methanol)
DOT SHIPPING: .... Flammable liquid, n.o.s.(contains Methanol)

SECTION X – OTHER REGULATORY INFORMATION

TSCA STATUS: .... All components of this product are listed on the TSCA inventory.
NFPA HEALTH: 1
NFPA FLAMMABILITY: 3
NFPA REACTIVITY: 0

SECTION XI - ADDITIONAL INFORMATION

PREPARED BY: .... Edward F. Vinson

EMERGENCY RESPONSE NUMBER: **800-633-8253**

ENVIRONMENTAL SERVICE LABORATORIES INC.

1803 Philadelphia Street
Indiana, PA 15701
(724) 463-TEST
FAX (724) 465-4209

Sample Request & Chain of Custody

Sample Identification	ESL#	Sample Type: Comp Date on/off	Comp Time on/off	Grab Date	Grab Time	Matrix	Number of Containers	Container Type/ Preservative	Analysis Requested
PHC 26 H	11 24158	6/23/11	12:09	6/2/11					Brine List full + S.G.
	11 24279								Rad 226, 228

THE UNDERSIGNED PURCHASER HEREBY AGREES TO PAY SERVICE CHARGES ON ACCOUNTS OVER 31 DAYS OLD.
1. THESE SERVICE CHARGES WILL ACCRUE AT THE RATE OF 1 1/2% PER MONTH (18% PER ANNUM OR THE MAXIMUM ALLOWED BY LAW.)
2. THE UNDERSIGNED PURCHASER AGREES TO PAY, IN THE EVENT HIS ACCOUNT BECOMES DELINQUENT AND IS TURNED OVER TO ANY ATTORNEY FOR COLLECTION, REASONABLE ATTORNEY'S FEES PLUS ALL COURT AND ATTENDANT COLLECTION COSTS.

Sampled by: (Signature) Nina M. Catalucci — Date/ Time 6/2/11

David A. Shils 6/23/11 12:15

Relinquished By: (Signature) Nina M. Catalucci — Date/ Time 6/2/11 12:12
Received By: (Signature) [signature] — Date/ Time 6/23/11 1321

Relinquished By: (Signature) — Date/ Time
Received By: (Signature) — Date/ Time

Relinquished By: (Signature) — Date/ Time
Received By: (Signature) — Date/ Time

PRESERVATION Y / N CONTAINER Y / N TEMP ≤ 4°C Y / N / NA

Project ID: Please email to: NINA_CATALUCCI@eogresources.c

Company/Name: EOG RESOURCES INC.

Address:

Contact person: NINA M. CATALUCCI

Phone: 724-743-2688

Fax:

PWISD#

Sample Received in 5 Gallon Plastic Container

ENVIRONMENTAL
SERVICE LABORATORIES, INC.
1803 Philadelphia St., Indiana, PA 15701
(724) 463-TEST (724) 465-4209

Report of Analysis

Name:	EOG Resources Attn: Bill Burket 400 Southpointe Blvd, Southpointe Plaza 1 Canonsburg, PA 15317-8548	**Sample ID#:** **Sample Type:** **Sample Source:** **Sampler:**	11 24158 Water Grab CLIENT (Client)
Sample Start Date:	6/23/2011 12:09 PM	**Client Sample ID:**	PHC26H
Receipt Date:	6/23/2011 1:18 PM		
Report Date:	7/18/2011		

Analyte	Analyst	Analysis Date	Analysis Time	Sample Result	Units	Data Qualifier	Method	RPL
Acidity to pH=8.3	BF	06/24	n/a	345	mg/l as CaCO3	n/a	SM2310B	2
Alkalinity to pH=4.5	SR	06/27	n/a	ND	mg/l as CaCO3	n/a	SM2320B	20
Biological Oxygen Demand 05	BF	06/23	12:00 PM	10.3	mg/l	n/a	SM5210B	2.0
Chemical Oxygen Demand	AJD	07/11	n/a	1167.5	mg/l	n/a	SM5220 D	500.0
Ammonia as N / Distilled	ZTR	07/11	n/a	174.52	mg/l	D	SM4500NH3B & D	10.45
Bromide	AJD	07/01	n/a	2150.00	mg/l	D	D1246-99	100.00
Chloride	BF	07/06	n/a	101569.1	mg/l	n/a	SM4500ClC	5.0
Kjeldahl Nitrogen as N	AJD	07/08	n/a	ND	mg/l	n/a	SM4500Norg-C,D	5.6
pH (SM)	SR	06/27	n/a	4.90	SU	n/a	SM 4500H-B	0.01
Sulfate ASTM	ZTR	07/15	n/a	ND	mg/l	n/a	D516-02	5
Total Nitrate + Nitrite as N	SR	07/13	n/a	ND	mg/l	n/a	SM4500NO3E	0.05
Aluminum - ICP	DRM	07/05	n/a	ND	mg/l	D	200.7/6010	1.000
Arsenic-ICP	DRM	07/05	n/a	ND	mg/l	D	200.7/6010	1.000
Barium - ICP	DRM	07/05	n/a	45.700	mg/l	D	200.7/6010	0.500
Beryllium - ICP	GJT	07/06	n/a	ND	mg/l	D	200.7/6010	0.500
Boron	ZTR	06/28	n/a	30.0	mg/l	D	SM 4500B-B	12.5
Cadmium - ICP	DRM	07/05	n/a	ND	mg/l	D	200.7/6010	0.500
Calcium - ICP	DRM	07/05	n/a	16706.700	mg/l	D	200.7/6010	50.000
Chromium - ICP	DRM	07/05	n/a	ND	mg/l	D	200.7/6010	0.500
Cobalt - ICP	GJT	07/06	n/a	ND	mg/l	D	200.7/6010	0.500

ND=Not Detected

Note: DEP Certification #s 32-00382
D - Indicates an identified compound in an analysis that has been diluted

Approved By: ______________________
Laboratory Supervisor

ENVIRONMENTAL
SERVICE LABORATORIES, INC.
1803 Philadelphia St., Indiana, PA 15701
(724) 463-TEST (724) 465-4209

Report of Analysis

Name:	EOG Resources Attn: Bill Burket 400 Southpointe Blvd, Southpointe Plaza 1 Canonsburg, PA 15317-8548	**Sample ID#:** **Sample Type:** **Sample Source:** **Sampler:** **Client Sample ID:**	11 24158 Water Grab CLIENT (Client) PHC26H
Sample Start Date:	6/23/2011 12:09 PM		
Receipt Date:	6/23/2011 1:18 PM		
Report Date:	7/18/2011		

Analyte	Analyst	Analysis Date	Analysis Time	Sample Result	Units	Data Qualifier	Method	RPL
Copper - ICP	DRM	07/05	n/a	ND	mg/l	D	200.7/6010	0.500
Hardness	DRM	07/05	n/a	48118	mg/l	n/a	SM2340B	5
Iron - ICP	DRM	07/05	n/a	78.400	mg/l	D	200.7/6010	1.000
Iron,Dissolved-ICP	DRM	07/07	n/a	57.800	mg/l	D	200.7/6010	1.000
Lead-ICP	DRM	07/05	n/a	ND	mg/l	D	200.7/6010	0.500
Lithium - ICP	DRM	07/05	n/a	133.400	mg/l	D	200.7/6010	50.000
Magnesium-ICP	DRM	07/05	n/a	1554.600	mg/l	D	200.7/6010	50.000
Manganese - ICP	DRM	07/05	n/a	4.800	mg/l	D	200.7/6010	0.500
Mercury	WHM	07/01	n/a	ND	mg/l	n/a	245.1	0.0002
Molybedenum - ICP	DRM	07/05	n/a	ND	mg/l	D	200.7/6010	0.500
Nickel - ICP	DRM	07/05	n/a	ND	mg/l	D	200.7/6010	0.500
Selenium-ICP	DRM	07/05	n/a	ND	mg/l	D	200.7/6010	1.000
Silver-ICP	DRM	07/05	n/a	ND	mg/l	D	200.7/6010	0.500
Sodium - ICP	GJT	07/06	n/a	35397.000	mg/l	D	200.7/6010	500.000
Strontium - ICP	GJT	07/06	n/a	2015.800	mg/l	D	200.7/6010	1.000
Zinc - ICP	DRM	07/05	n/a	ND	mg/l	D	200.7/6010	0.500
Specific Gravity	LAW	06/27	n/a	1.1284	none	n/a	SM2710F	0.0000
Detergents, MBAS	LAW	06/24	11:15 AM	ND	mg/l	n/a	SM5540C	0.200
Ethylene Glycol	CL	06/27	n/a	ND	ug/L	n/a	SW846 8015B	50
Oil and Grease - HEM	LAW	06/28	n/a	ND	mg/l	n/a	1664A	5.0

ND=Not Detected

Note: DEP Certification #s 32-00382
D - Indicates an identified compound in an analysis that has been diluted

Approved By: Laboratory Supervisor

ENVIRONMENTAL
SERVICE LABORATORIES, INC.
1803 Philadelphia St., Indiana, PA 15701
(724) 463-TEST (724) 465-4209

Report of Analysis

Name:	EOG Resources Attn: Bill Burket 400 Southpointe Blvd, Southpointe Plaza 1 Canonsburg, PA 15317-8548	**Sample ID#:** **Sample Type:** **Sample Source:** **Sampler:**	11 24158 Water Grab CLIENT (Client)
Sample Start Date:	6/23/2011 12:09 PM	**Client Sample ID:**	PHC26H
Receipt Date:	6/23/2011 1:18 PM		
Report Date:	7/18/2011		

Analyte	Analyst	Analysis Date	Analysis Time	Sample Result	Units	Data Qualifier	Method	RPL
Phenolics, as Phenol	AJD	07/11	n/a	ND	mg/l	n/a	420.1	0.500
Specific Conductance	SR	06/27	n/a	187236	uS/cm	n/a	SM 2510B	1
Total Dissolved Solids (TDS)	LMB	06/27	n/a	209300	mg/l	n/a	SM2540C	25
Total Suspended Solids	RLG	06/24	n/a	69	mg/l	n/a	SM2540D	5
1) Benzene	JG	06/24	n/a	ND	ug/L	n/a	624/8260B	1.00
47) Toluene	JG	06/24	n/a	ND	ug/L	n/a	624/8260B	1.00

Comments:

ND=Not Detected

Note: DEP Certification #s 32-00382
D - Indicates an identified compound in an analysis that has been diluted

Approved By: Laboratory Supervisor

ENVIRONMENTAL SERVICE LABORATORIES, INC.
1803 Philadelphia St., Indiana, PA 15701
(724) 463-TEST (724) 465-4209

Report of Analysis

Name:	EOG Resources Attn: Bill Burket 400 Southpointe Blvd, Southpointe Plaza 1 Canonsburg, PA 15317-8548	**Sample ID#:**	11 24279
		Sample Type:	Water
		Sample Source:	Grab
		Sampler:	CLIENT (Client)
Sample Start Date:	6/23/2011 12:09 PM	**Client Sample ID:**	PHC26H
Receipt Date:	6/24/2011 9:55 AM		
Report Date:	7/19/2011		

Analyte	Analyst	Analysis Date	Analysis Time	Sample Result	Units	Data Qualifier	Method	RPL
Radium 226	Bnchmrk	07/14	n/a	*	pCi/L	n/a	RAD-CTDHS	0.000
Radium 228	Bnchmrk	07/07	n/a	*	pCi/L	n/a	RAD-CTDHS	0.000

Comments: Radiologicals done by Benchmark Analytical, PADEP Lab ID: 39-00401

ND=Not Detected

Note: DEP Certification #s 32-00382

Approved By: [signature]
Laboratory Supervisor

LAB ID: 39-00401 *CV

BENCHMARK ANALYTICS, INC.
4777 Saucon Creek Road
Center Valley, PA 18034-9004

PHONE (610) 974-8100
FAX (610) 974-8104

SEND DATA TO:

NAME: Kathy Brown
COMPANY: Environmental Service Laboratories, Inc
ADDRESS: 1803 Philadelphia St
Indiana, PA 15701

PHONE: (724) 463-8378
FAX: (724) 465-4209

WO#: 11064840
PAGE: 1 of 6
PO#:
PWS ID#

TEST REPORT

11 24279-24476-24479-24492-24489-24490

RECEIVED FOR LAB BY: MAK DATE: 06/28/2011 9:30

SAMPLE: **11 24279** Lab ID: 11064840-001A Grab
SAMPLED BY: Client Sample Time 06/23/2011 12:09

Test	Result	Uncert.	MDA	Units	Method	MCL	Analysis Start	Analysis End	Analyst *
Radium-226	1576	± 75.31	184.40	pCi/L	EPA 903.0		06/28/11 11:00	07/14/11	BH-CV
Radium, Combined (Ra226 + Ra228)	1691			pCi/L	Calculation		07/19/11 10:59		BH-CV

SAMPLE: **11 24279** Lab ID: 11064840-001B Grab
SAMPLED BY: Client Sample Time 06/23/2011 12:09

Test	Result	Uncert.	MDA	Units	Method	MCL	Analysis Start	Analysis End	Analyst *
Radium-228	114.6	± 67.09	140.00	pCi/L	EPA 904.0		06/29/11 19:10	07/07/11	MJS-CV

REMARKS:

Where the analytical method has been performed under NELAP certification, the analysis has met all of the requirements of the NELAC standard unless otherwise noted on the Analytical Report.
* CV = Benchmark Analytics, Inc. Center Valley, PA; SA = Benchmark Analytics, Inc. Sayre, PA

MANAGER Chi Meh DATE: 7/19/2011

CLEARWATER
Engineered Chemistry

Material Safety Data Sheet
ALPHA 3207

HEALTH	2
FLAMMABILITY	4
REACTIVITY	0
PERSONAL PROTECTION	G

24 hr. Emergency Contact (CHEMTREC) US Tel: 1- 800 - 424-9300 - Int'l. Tel. 703 - 527 - 3887

1. CHEMICAL PRODUCT AND COMPANY IDENTIFICATION

SUPPLIER: CLEARWATER INTERNATIONAL L.L.C.
515 POST OAK BLVD., SUITE 600
HOUSTON, TX 77027

MANUFACTURER: CLEARWATER INTERNATIONAL L.L.C.
4420 SOUTH FLORES RD
ELMENDORF, TEXAS 78112

PRODUCT NAME: ALPHA 3207
PRODUCT CODE: XFP0477B
PRODUCT USE/CLASS: CORROSION INHIBITOR

MSDS REVISION DATE: 06/15/04 **PREPARER:** MJW **PHONE:** 724-318-1050

2. COMPOSITION/INFORMATION ON INGREDIENTS

COMPONENT	EXPOSURE LIMITS	CAS#	% BY WEIGHT
ISOPROPANOL	ACGIH TLV – 400 ppm TWA , 500 ppm STEL OSHA PEL – 400 ppm TWA,	67-63-0	10-30 %

3. HAZARD IDENTIFICATION

EYE: Liquid, aerosols and vapors of this product may be irritating and can cause pain, tearing, reddening and swelling accompanied by a stinging sensation and/or a feeling like that of fine dust in the eyes.

SKIN: May cause skin irritation. Allergic reactions are possible.

INGESTION: This material may be harmful if swallowed. May be irritating to mouth, throat, and stomach. .

INHALATION: Prolonged inhalation may be harmful and can cause headaches, dizziness, nausea, anesthesia, narcosis, decreased blood pressure, changes in heart rate and cyanosis. May be irritating to mucous membranes and lung tissue.

CHRONIC INFORMATION: None Known

PRIMARY ROUTE(S) OF ENTRY: Inhalation, Ingestion

4. FIRST AID MEASURES

EYE CONTACT: Immediately flush eyes with plenty of water for at least 15 minutes while holding eyelids open. Get medical attention, if irritation persists.

SKIN CONTACT: Wash with soap and water. Get medical attention if irritation develops or persist.

INHALATION: Remove victim to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Get immediate medical attention.

INGESTION: Place victim on left side with head down to prevent aspiration into lungs. Induce vomiting as directed by medical personnel. Never give anything by mouth to an unconscious person. Call a physician or poison control center immediately.

5. FIRE FIGHTING MEASURES

FLASH POINT: 70 F
(TAGLIABUE CLOSED CUP)

LOWER EXPLOSIVE LIMIT: N.D.
UPPER EXPLOSIVE LIMIT: N.D.

AUTOIGNITION TEMPERATURE: N.D.

EXTINGUISHING MEDIA: ALCOHOL FOAM CO2 DRY CHEMICAL

UNUSUAL FIRE AND EXPLOSION HAZARDS: Can release vapors that form explosive mixtures at temperatures at or above the flash point. Empty containers retain product residue (liquid and/or vapor) and can be dangerous.

SPECIAL FIRE FIGHTING PROCEDURES: Containers can build up pressure if exposed to heat (fire). As in any fire, wear a self-contained breathing apparatus pressure-demand (MSHA/NIOSH approved or equivalent) and full protective gear. Apply alcohol-type foam or all purpose foam by manufacturers recommended techniques for large fires. Use carbon dioxide or dry chemical for small fires. Use water spray to keep containers cool.

6. ACCIDENTIAL RELEASE MEASURES

STEPS TO BE TAKEN IN CASE MATERIAL IS RELEASED OR SPILLED: Extinguish any possible ignition source until the area is determined to be free from fire or explosion hazard. Absorb spill with inert material (e.g. dry sand or earth), then place in a chemical waste container. (See exposure controls / personal protection section) Spilled material should be disposed of according to applicable regulations.

7. HANDLING AND STORAGE

HANDLING: Handle all chemicals with care. Ground and bond containers when transferring materials.

STORAGE: Keep away from heat, sparks, and flames. Keep container closed when not in use. Store in a cool, dry, well ventilated place away from incompatible materials.

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

ENGINEERING CONTROLS: Local exhaust ventilation may be necessary to control any air contaminants to within their exposure limits.

RESPIRATORY PROTECTION: No protection needed under normal use and conditions. Use a NIOSH/MSHA approved air purifying respirator with an organic vapor cartridge when airborne concentrations are expected to exceed exposure limits. Protection by air purifying respirators is limited.

SKIN PROTECTION: When contact is likely wear chemical resistant gloves and boots.

EYE PROTECTION: Wear safety glasses with side shields or goggles.

OTHER PROTECTIVE EQUIPMENT: Emergency eye wash stations and deluge showers should be available in the work area.

HYGIENIC PRACTICES: Wash hands before eating. Use only with adequate ventilation. Remove contaminated clothing and wash before reuse. Ground and bond containers when transferring material.

9. PHYSICAL AND CHEMICAL PROPERTIES

APPEARANCE: Dark amber
ODOR: Sl alcohol
BOILING POINT (RANGE): N.D.
FREEZE POINT: N.D.
VAPOR DENSITY: Heavier than air
VAPOR PRESSURE: N.D.
PHYSICAL STATE: Liquid
SOLUBILITY IN WATER: Soluble
PH (AS IS): 4.5-6.0
SPECIFIC GRAVITY: 0.94-1.00

10. STABILITY AND REACTIVITY DATA

CONDITIONS TO AVOID: Avoid temperature extremes. Excessive heat causes the vapor pressure to increase rapidly.

INCOMPATIBILITY: Avoid contact with strong oxidizers.

HAZARDOUS DECOMPOSITION PRODUCTS: Oxides of carbon and nitrogen.

HAZARDOUS POLYMERIZATION: Will not occur under normal use and storage conditions.

CHEMICAL STABILITY: This product is stable under normal storage conditions.

11. TOXICOLOGICAL INFORMATION

ORAL: No product information is available.

DERMAL: No product information is available.

INHALATION: No product information is available.

12. ECOLOGICAL INFORMATION

ECOTOXICITY: No product information is available.

CHEMICAL FATE INFORMATION: No product information is available.

13. DISPOSAL CONSIDERATIONS

WASTE DISPOSAL: Consult local, state, or federal regulatory agencies for acceptable disposal procedures and disposal locations. Disposal in streams or sewers may be prohibited by federal, state, and local regulations.

RCRA STATUS: DOO1 –Characteristic of ignitability

14. TRANSPORTATION INFORMATION

(NON-BULK SHIPMENTS)
D.O.T. PROPER SHIPPING NAME: Isopropanol Solution
D.O.T. TECHNICAL NAME:
D.O.T. HAZARD CLASS: 3 **HAZARD SUBCLASS:** N/A
D.O.T. UN NUMBER: UN1219 **PACKING GROUP:** II **RESP. GUIDE PAGE:** 129

(BULK SHIPMENTS)
D.O.T. PROPER SHIPPING NAME: Isopropanol Solution
D.O.T. TECHNICAL NAME:
D.O.T. HAZARD CLASS: 3 **HAZARD SUBCLASS:** N/A
D.O.T. UN NUMBER: UN1219 **PACKING GROUP:** II **RESP. GUIDE PAGE:** 129

T.D.G. PROPER SHIPPING NAME: Isopropanol Solution
T.D.G. TECHNICAL NAME:
T.D.G. HAZARD CLASS: 3 **HAZARD SUBCLASS:** N/A
T.D.G. UN NUMBER: UN1219 **PACKING GROUP:** II **RESP. GUIDE PAGE:** 129

IMDG PROPER SHIPPING NAME: Isopropanol Solution
IMDG TECHNICAL NAME:
IMDG HAZARD CLASS: 3.2 **HAZARD SUBCLASS:** N/A
IMDG UN NUMBER: UN1219 **PACKING GROUP:** II **EmS No:** F-E, S-C

15. REGULATORY INFORMATION

CERCLA – SARA HAZARD CATEGORY:

Material Safety Data Sheet
ALPHA 3207

SECTION 311/312: This product has been reviewed according to the EPA 'Hazard Categories' promulgated under Sections 311 and 312 of the Superfund Amendments and Reauthorization Act of 1986 (SARA Title III) and is considered, under applicable definitions, to meet the following categories:

IMMEDIATE HEALTH HAZARD   FIRE HAZARD

SARA SECTION 313: This product contains the following substances subject to the reporting requirements of Section 313 of Title III of the Superfund Amendments and Reauthorization Act of 1986 and 40 CFR Part 372:

COMPONENT	CAS#	% BY WEIGHT

TSCA STATUS:

All components of this product are listed on the Toxic Substance Control Act Inventory or are excluded from the listing requirements.

INTERNATIONAL REGULATIONS:

CANADIAN WHMIS: This MSDS has been prepared in compliance with Controlled Product Regulations except for the use of the 16 headings.

CANADIAN WHMIS CLASS: B-2, D-2B

CANADIAN ENVIRONMENTAL PROTECTION ACT:

All components of this product are listed on the Canadian Domestic Substance List (DSL).

16. OTHER INFORMATION

HMIS RATING – HEALTH: 2   FLAMMABILITY: 4   REACTIVITY: 0   PERSONAL PROTECTIVE RATING: G

LEGEND: N.A. – NOT APPLICABLE, N.E. - NOT ESTABLISHED, N.D. – NOT DETERMINED

THIS PRODUCT'S HEALTH AND SAFETY INFORMATION IS PROVIDED TO ASSIST OUR CUSTOMERS IN ASSESSING COMPLIANCE WITH HEALTH, SAFETY AND ENVIRONMENTAL REGULATIONS. THE INFORMATION CONTAINED HEREIN IS BASED ON DATA AVAILABLE TO US, AND IS BELIEVED TO BE ACCURATE, ALTHOUGH NO GUARANTEE OR WARRANTY IS PROVIDED OR IMPLIED BY THE COMPANY IN THIS RESPECT. SINCE THE USE OF THIS PRODUCT IS WITHIN THE EXCLUSIVE CONTROL OF THE USER, IT IS THE USER'S RESPONSIBILITY TO DETERMINE THE CONDITIONS OF SAFE USE. SUCH CONDITIONS MUST COMPLY WITH ALL GOVERNMENTAL REGULATIONS.

ENVIRONMENTAL SERVICE LABORATORIES, INC.

1803 Philadelphia St.
Indiana, PA 15701
P: (724) 463-TEST
F: (724) 465-4209
PADEP: 32-00382

1276 Bentleyville Rd.
Van Voorhis, PA 15366
P: (724) 258-TEST
F: (724) 258-8376
PADEP: 63-04247

1200 River Avenue
Williamsport, PA 17701
P: (570) 321-9002
F: (570) 321-1957
PADEP: 41-04880

21 January 2016

Penneco Oil Company
Attn: David Smail
6608 Route 22
Delmont, PA 15626

Work Order: 5123132
Project: Water

Report of Analysis

Client Sample ID	Lab Sample ID	Matrix	Date Sampled	Date Received	Sample Notes
Sedat # 3A Brine Water	5123132-01	Water	12/31/2015 11:00	12/31/2015 16:35	

Report Narrative

The results contained in this report are only representative of the samples received. Environmental Service Laboratories, Inc. is not responsible for use or interpretation of the data included herein.

Definitions

R	Received out of recommended hold time.
D	The reported value is from a dilution.
RL	Reporting Limit
CFU	Colony Forming Units

Certifications

Analyses performed by Environmental Service Laboratories, Inc., Indiana PA unless otherwise specified.

Environmental Service Laboratories, Inc., Indiana, PA/TNI Certification #32-00382

Z = Environmental Service Laboratories, Inc., Indiana, PA is not accredited for analysis in the specified matrix.

Approved By

Gabe Taylor
Laboratory Director

NELAP ACCREDITED TNI LABORATORY

ENVIRONMENTAL SERVICE LABORATORIES, INC.

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PADEP: 41-04880

Penneco Oil Company
6608 Route 22
Delmont, PA 15626

Reported: 01/21/2016 14:23

Lab Sample ID#: 5123132-01
Sample Type: Water
Sample Source: Grab
Sampler: Client
Client Sample ID: Sedat # 3A Brine Water

Sample Date: 12/31/2015 11:00
Receipt Date: 12/31/2015 16:35

Analyte	Sample Result	Units	Data Qualifier	RL	Analyst/ Certification	Prep Date/Time	Analysis Date/Time
Field Analysis	**Analytical Method: HACH**			**Prep Method: No Prep**			
Hydrogen Sulfide	0.0	ppm			BPL	12/31/15 11:00	12/31/15 11:00
General Chemistry	**Analytical Method: -**			**Prep Method: No Prep - WetChem**			
Specific Gravity	1.10				CAL/Z	01/04/16 10:24	01/04/16 10:25
General Chemistry	**Analytical Method: SM2320 B-97**			**Prep Method: No Prep - WetChem**			
Alkalinity to pH 4.5	243	mg CaCO3/L		20.0	TSS	01/12/16 15:30	01/12/16 15:37
General Chemistry	**Analytical Method: SM2510 B-97**			**Prep Method: No Prep - WetChem**			
Specific Conductance	176300	umhos/cm		1.0	TSS	01/15/16 10:20	01/15/16 10:20
General Chemistry	**Analytical Method: SM2540 C-97**			**Prep Method: No Prep - WetChem**			
Total Dissolved Solids	176000	mg/L		25	LMB	01/04/16 08:30	01/04/16 09:30
General Chemistry	**Analytical Method: SM4500-Cl D-97**			**Prep Method: Chloride Automated**			
Chloride	91400	mg/L	D	5.00	TSS	01/14/16 15:12	01/14/16 15:16
General Chemistry	**Analytical Method: SM4500-H B-00**			**Prep Method: No Prep - WetChem**			
pH	5.59	S.U.	R	1.00	TSS	01/12/16 15:27	01/12/16 15:35
General Chemistry	**Analytical Method: SM4500-O G-01**			**Prep Method: No Prep - WetChem**			
Dissolved Oxygen	0.10	mg/L	R		WWS	12/31/15 17:09	12/31/15 17:09
General Chemistry	**Analytical Method: SM5310 C-00**			**Prep Method: No Prep - WetChem**			
Total Organic Carbon	519	mg/L	D	50.0	RLG	01/06/16 11:15	01/06/16 11:15

ENVIRONMENTAL SERVICE LABORATORIES, INC.

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F: (570) 321-1957
PADEP: 41-04880

Penneco Oil Company
6608 Route 22
Delmont, PA 15626

Reported: 01/21/2016 14:23

Lab Sample ID#: 5123132-01
Sample Type: Water
Sample Source: Grab
Sampler: Client
Client Sample ID: Sedat # 3A Brine Water

Sample Date: 12/31/2015 11:00
Receipt Date: 12/31/2015 16:35

Analyte	Sample Result	Units	Data Qualifier	RL	Analyst/ Certification	Prep Date/Time	Analysis Date/Time
Total Metals	**Analytical Method: EPA200.7 4.4**			**Prep Method: EPA 200.7 4.4**			
Barium	14.6	mg/L	D	0.500	SFS	01/07/16 08:49	01/11/16 15:03
Calcium	14900	mg/L	D	50.0	SFS	01/07/16 08:49	01/11/16 15:03
Iron	215	mg/L	D	2.00	SFS	01/07/16 08:49	01/11/16 15:03
Magnesium	1920	mg/L	D	50.0	SFS	01/07/16 08:49	01/11/16 15:03
Manganese	28.8	mg/L	D	0.500	SFS	01/11/16 16:56	01/12/16 13:01
Sodium	41200	mg/L	D	250	SFS	01/07/16 08:49	01/11/16 17:33
Total Metals	**Analytical Method: SM2340 B-97**			**Prep Method: [CALC]**			
Hardness	45000	mg/L		125	SFS	01/07/16 08:49	01/11/16 15:03

ENVIRONMENTAL SERVICE LABORATORIES, INC.

SAMPLE REQUEST & CHAIN OF CUSTODY

PAGE ______ OF ______

HEADQUARTERS
1803 Philadelphia St.
Indiana, PA 15701
(724) 463-TEST
FAX: (724) 465-4209

SOUTHERN DIVISION
1276 Bentleyville Road
Van Voorhis, PA 15366
(724) 258-TEST
FAX: (724) 258-8376

NORTHERN DIVISION
1200 River Avenue
Williamsport, PA 17701
(570) 321-9003
FAX: (570) 321-1957

5123132

FOR INTERNAL LABORATORY USE ONLY

Sample Identification	ESL# 5123132	Composite Date on/off	Composite Time on/off	Grab Date	Grab Time	Matrix	# of Containers	Container Type / Preservative	Analysis Requested
Sedat 3A Brine Water	-01			12-31	11:00A	W	2 ✓	Poly Liter None	pH, Specific Gravity, SC, Chloride, TDS, Alkalinity
						W	1 ✓	Poly Pint HNO3 <2	Iron, Magnesium, Manganese, Barium, Sodium, Hardness
						W	1 ✓	250 Amber Glass H3PO4	TOC
						W	1 ✓	Clear Glass None	Dissolved Oxygen
						W	1 ✓	Amber Vial None	Hydrogen Sulfide

THE UNDERSIGNED PURCHASER HEREBY AGREES TO PAY SERVICE CHARGES ON ACCOUNTS OVER 31 DAYS OLD.
1. THESE SERVICE CHARGES WILL ACCRUE AT THE RATE OF 1 1/2% PER MONTH (18% PER ANNUM OR THE MAXIMUM ALLOWED BY LAW.)
2. THE UNDERSIGNED PURCHASER AGREES TO PAY, IN THE EVENT HIS ACCOUNT BECOMES DELINQUENT AND IS TURNED OVER TO ANY ATTORNEY FOR COLLECTION, REASONABLE ATTORNEY'S FEES PLUS ALL COURT AND ATTENDANT COLLECTION COSTS.

Project Notes: ***Water***

Sampled By: (Signature) [signature] Date/ Time 12-31 11:00AM

Relinquished By: (Signature) [signature] Date/ Time 12-31 16:35 — Received By: (Signature) Vanessa Deemer Date/ Time 12-31-15 ~~1435~~ 1635 VD 12-31-15

Relinquished By: (Signature) Date/ Time — Received By: (Signature) Vanessa Deemer Date/ Time 12-31-15 1650

Relinquished By: (Signature) Date/ Time — Received By: (Signature) Date/ Time

Company/Name:	**Penneco Oil Co.**
Contact Person:	David Smail
Address:	6608 Rte 22 Delmont, PA 15626
Phone:	724-468-8232
Fax:	
PWSID#:	dtsmail@penneco.com

Lab Use Only: *Correct Preservation: Y / N / N/A* *Correct Container: Y / N / N/A* *TEMPERATURE:* 1.8 I

ATTACHMENT “J”

Stimulation Program

Attachment J
Stimulation Program
Sedat #3A Injection Well

Stimulation Program for Sedat #3A Injection Well

There are currently no plans to stimulate the Sedat #3A Injection Well.

3/2/2015

ATTACHMENT “K”
Injection Procedures

Attachment K
Injection Procedures
Sedat #3A Well

Injection Procedures:

Injection fluid will be brought in by trucks and a sample taken from each load prior to unloading. Company personnel will measure the specific gravity of the sample with a hydrometer or some other appropriate method, along with ph and conductivity. If the measured specific gravity of the injection fluid is above the value set by permit the specific gravity will be adjusted by adding diluting fluid consisting of produced fluid to the injection fluid until the specific gravity is less than the value set by permit. The produced fluids will then be unloaded through a discharge manifold into storage tanks. The fluid will then be treated with an oxygen scavenging agent and corrosion control additives.

The fluid will be pulled from the off loading tanks through a 20 micron filter to remove large suspended solids and transported through connecting pipes to additional tanks to hold the filter fluid until injection. From the tanks holding the filtered water the fluid will be transported by pipeline to high pressure pumps for transportation to the injection point where the rate of injection and pressure will be monitored and regulated so as not to exceed the maxim injection pressure and rate stated in the permit. The fluids will be pumped through a checkvalve at the wellhead down the 4 ½" injection string to the Murrysville injection zone.

The specific gravity will be continuously monitored by a recording meter. Should the specific gravity exceed the value set by permit at the well head P-max will be automatically adjusted to a lower P-max by installed logic controls to compensate for the change in specific gravity or if unable to compensate for the change in specific gravity, automatically shut in the injection well until the specific gravity of the fluid can be adjusted or the P-max is adjusted manually.

Surface casing and the injection string casing annulus pressures will be monitored and recorded by a 2 pen recorder. A minimum of 100 psi of positive pressure, or the pressure required by permit, will be maintained on the annulus. Installed logic controls connected to the recorder will automatically shut in the injection well if a 15% increase in annular pressure is detected.

Fluid levels will be checked in all monitoring wells on a quarterly schedule or more frequently if required by permit by either running a bailer from a service rig or a wireline with a float/bobber on the end. Results will be reported to the EPA quarterly or as required by permit.

ATTACHMENT “L”

Construction Procedures

Attachment L
Construction Procedures
Sedat #3A Injection Well

Construction Details For:

Well Name: Sedat #3A
Location: Plum Boro, Allegheny Co, PA
(See AOR Map for Well Location)

Drilling Program:

The Sedat #3A injection well will be a repurposed depleted natural gas well that was drilled through the Upper Devonian Bradford Sands to a total depth of 4,320' and after depletion plugged back to 1,940' to just below the Murrysville injection zone.

The Sedat #3A was rotary air drilled with drilling operations starting on 1/25/1989 and finishing on 2/1/1989 on reaching a Total Depth of 4,350'. The company installed 16' of 13 3/8" casing as conductor pipe which was sanded in, 643' of 9 5/8" casing cemented to surface, 1,948' of 7 " casing cemented to surface, and 3,903' of 4 ½" casing cemented to 2,310'. Three sand formations were hydrofracked and the well was produced until 2015 through the 4 ½" casing when the well was taken out of service because of low production. The company plugged back the Sedat #3 to a depth of 1940' in accordance with Pennsylvania Department of Environmental Protection regulations. The uncemented portion of the 4 ½" casing was removed, three cement plugs were then placed through and above the fracked sands and a 7" cast iron solid bridge plug was set at 1,940' in the 7" casing just below the Murrysville injection zone. The injection string will be made up of 4 ½" 10.5# J55 casing set on a Parmaco Standard Upside Down Pressure Packer at 1,792' See original well record and completion report, wellbore diagram showing the wellbore configuration, and the casing cement data chart at the end of this Attachment.

The annulus between the 4 ½" injection string and the 7" casing will be filled with fresh water mixed with a small amount of corrosion inhibitor and bacteria growth preventer.

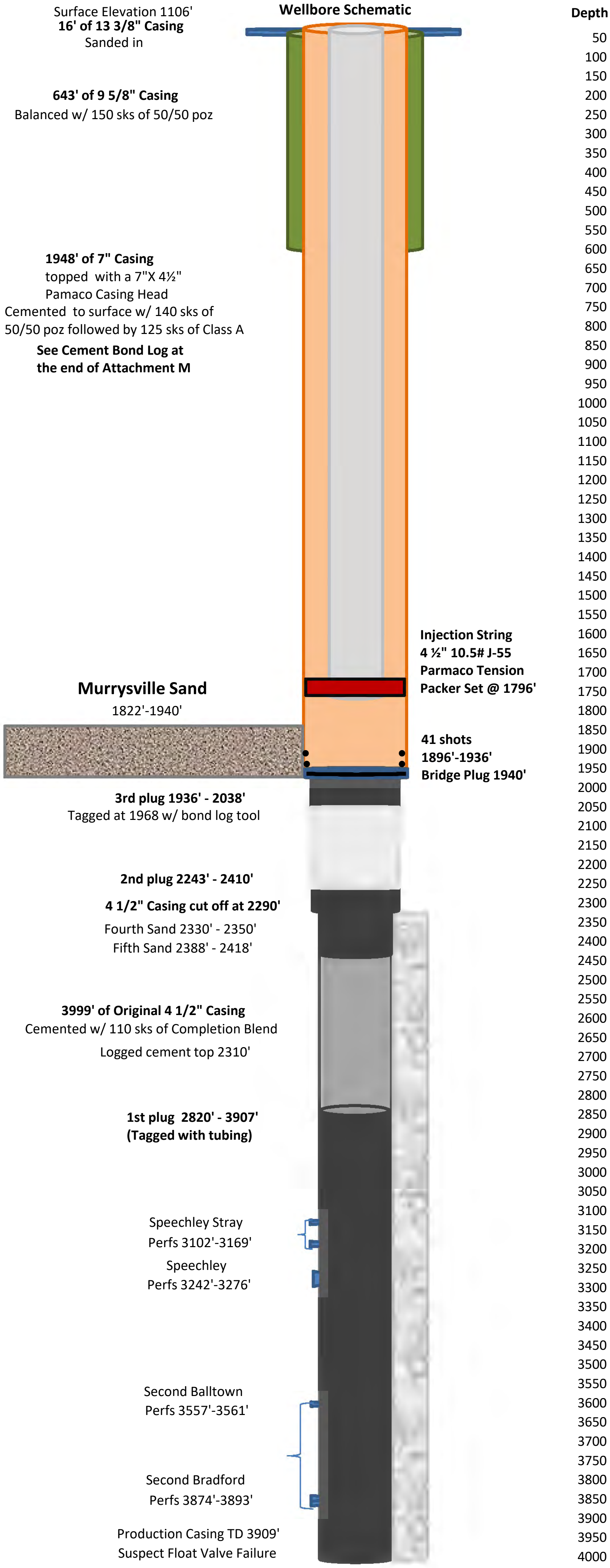
Logging Program:

The following open hole well logs were run: Gamma Ray, Compensated Density, Neutron, Dual Induction, Temperature and Caliper. The logs were run from TD to the bottom of the 7" with the Gamma Ray run to surface.

A cement bond log was run on the 7" casing showing a good cement bond to surface and is included with Attachment M.

Attachment L

Construction Details - Subsurface
Sedat #3A Injection Well
Wellbore Schematic



Attachment L
Casing and Cement Data
Penneco Sedat #3A Injection Well

Casing	Size Inches	Type	Weight Lbs/Ft	Grade	Set Depth Feet	Internal Yield Pressure PSI	Collapse Pressure PSI	Joint Yield Lbs	Body Yield Lbs
Conductor	13 3/8		48	H-40	16	1730	740	322000	541000
Surface	9 5/8	ST&C	32	H-40	643	2270	1370	254000	365000
Long String	7	LT&C	20	J-55	1948	3740	2270	257000	316000
Injection String	4 ½	LT&C	10.5	J-55	1792	4790	4010	203000	166000

Cement Data

Casing	Size Inches	Class	Amount Sacks	Volume BBLs	Top of Cement
Conductor	13 3/8	Sanded in			
Surface	9 5/8	50/50 Pozmix	150	26.7	Surface
Long String	7	A	265	47.2	Surface*
Injection String	4 ½				

*See cement bond log included in Attachment M

ATTACHMENT “M”
Construction Details

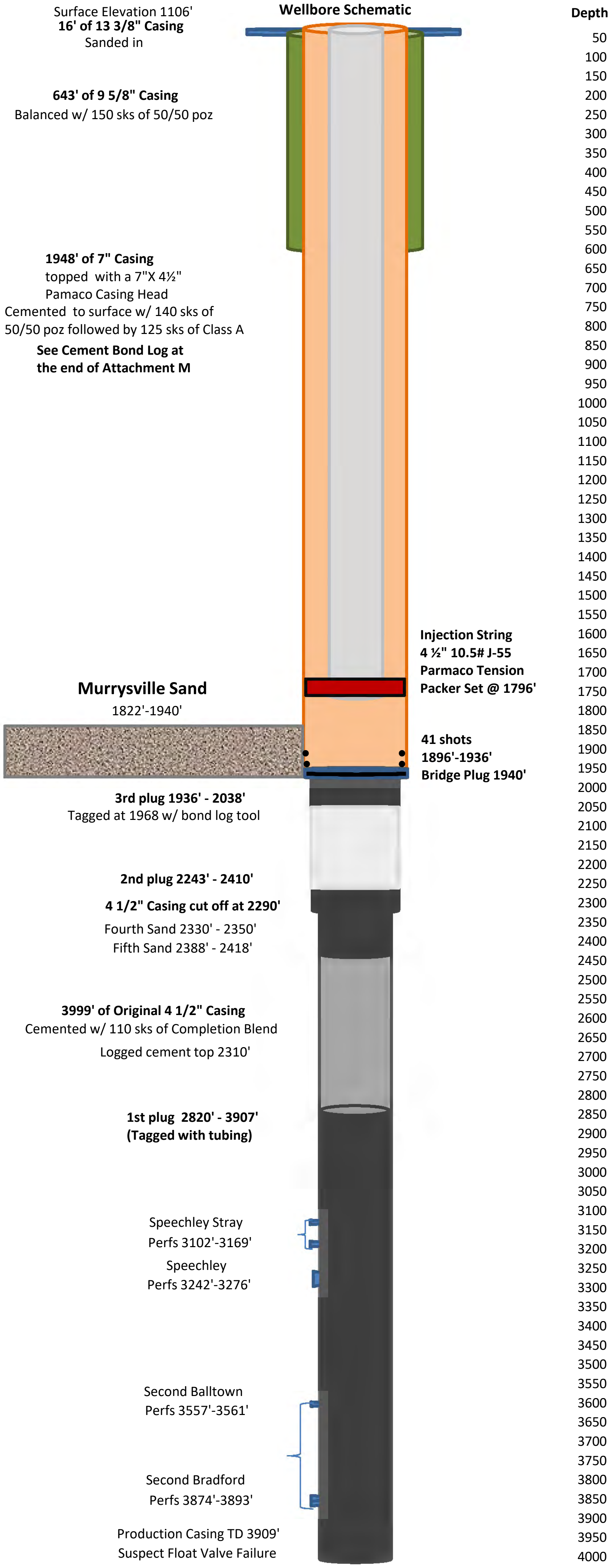
Attachment M
Formation Tops and Bottoms
Penneco Sedat #3A Injection Well

Formation	Top	Bottom	Thickness
*Riddlesburg Shale	1652’	1821’	169’*
Murrysville Sand	1822’	1950’	128’
Riceville/Oswayo Shale	1951’	1992’	41’
Hundred Foot (Venango)	1993’	2056’	63’

*The top of the Riddlesburg is difficult to determine from the well log, so the 169’ interval of low permeability shale/slit section from 1,652 to 1,821 shown on the gamma ray log is included as part of the upper confining zone.

Attachment M

Construction Details - Subsurface
Penneco Sedat #3A Injection Well
Wellbore Schematic



Attachment M
Casing and Cement Data
Penneco Sedat #3A Injection Well

Casing	Size Inches	Type	Weight Lbs/Ft	Grade	Set Depth Feet	Internal Yield Pressure PSI	Collapse Pressure PSI	Joint Yield Lbs	Body Yield Lbs
Conductor	13 3/8		48	H-40	16	1730	740	322000	541000
Surface	9 5/8	ST&C	32	H-40	643	2270	1370	254000	365000
Long String	7	LT&C	20	J-55	1948	3740	2270	257000	316000
Injection String	4 ½	LT&C	10.5	J-55	1792	4790	4010	203000	166000

Cement Data

Casing	Size Inches	Class	Amount Sacks	Volume BBLs	Top of Cement
Conductor	13 3/8	Sanded in			
Surface	9 5/8	50/50 Pozmix	150	26.7	Surface
Long String	7	A	265	47.2	Surface*
Injection String	4 ½				

*See cement bond log included in this Attachment and well record in Attachment B

Packers

Parmaco Packers

Parmaco Packers are made of the highest quality American made materials. Our packers are made with 1026 hot rolled and J55ERW steel tubing. All machining is done in house to insure the quality of our product. The element is also made in house from 65-70 durometer neoprene rubber. Parmaco's various packers are all made with the same materials and attention to detail.

We stock our packers in many different sizes and styles. We can also custom make almost any size packer you may need. Our packers are available with some of the following options- Threaded shoe, weld on connection, swab attachment, shear pins, cast iron disk, different element lengths, and many different thread options.

Our hookwall and tension packers all have slips that are made from 1026 hot rolled tubing that has been heat treated to 45 Rockwell.

Not all of our Packers are listed, contact us for more info.

Standard Upside Down Pressure Packer: Figure (C-301)

- TENSION SET PACKER
- MATERIAL- 1026 HOT ROLL SEAMLESS TUBING
- MANDREL MATERIAL- J55 ERW
- SLIPS HARDENED TO 45 ROCKWELL
- ELEMENT MATERIAL- NEOPRENE RUBBER
- ELEMENT DUROMETER- 65-70
- ELEMENT LENGTH- 16"

SureFire WIRELINE LLC

Company	PENNECO OIL COMPANY
Well	SEDAT #3A
Field	PLUM BORO
County	ALLEGHENY
State	PA
Country	U.S.A.

GAMMA RAY \ CCL CEMENT BOND LOG

Company	PENNECO OIL COMPANY
Well	SEDAT #3A
Field	PLUM BORO
County	ALLEGHENY
State	PA
Country	U.S.A.

Location: API # : 37-003-21223

Other Services

SEC TWP RGE

Permanent Datum	G.L.	Elevation	1106'
Log Measured From	TOP OF 7" CASING		
Drilling Measured From	G.L.		

Elevation: K.B. 1113', D.F. 1113', G.L. 1106'

Date	8-7-15	PERFORATIONS	1896'-1936' (20)
Run Number	ONE		
Depth Driller	NA		
Depth Logger	1965'		
Bottom Logged Interval	1965'		
Top Log Interval	SURFACE		
Open Hole Size	NA		
Type Fluid	WATER		
Density / Viscosity	NA		
Max. Recorded Temp.	NA		
Estimated Cement Top	SURFACE		
Time Well Ready	NA		
Time Logger on Bottom	NA		
Equipment Number	201		
Location	KITTANNING		
Recorded By	R. WEISS	J. SIMMONS	C. HARKLEROAD
Witnessed By	MR. JACOBS		

Borehole Record / Tubing Record

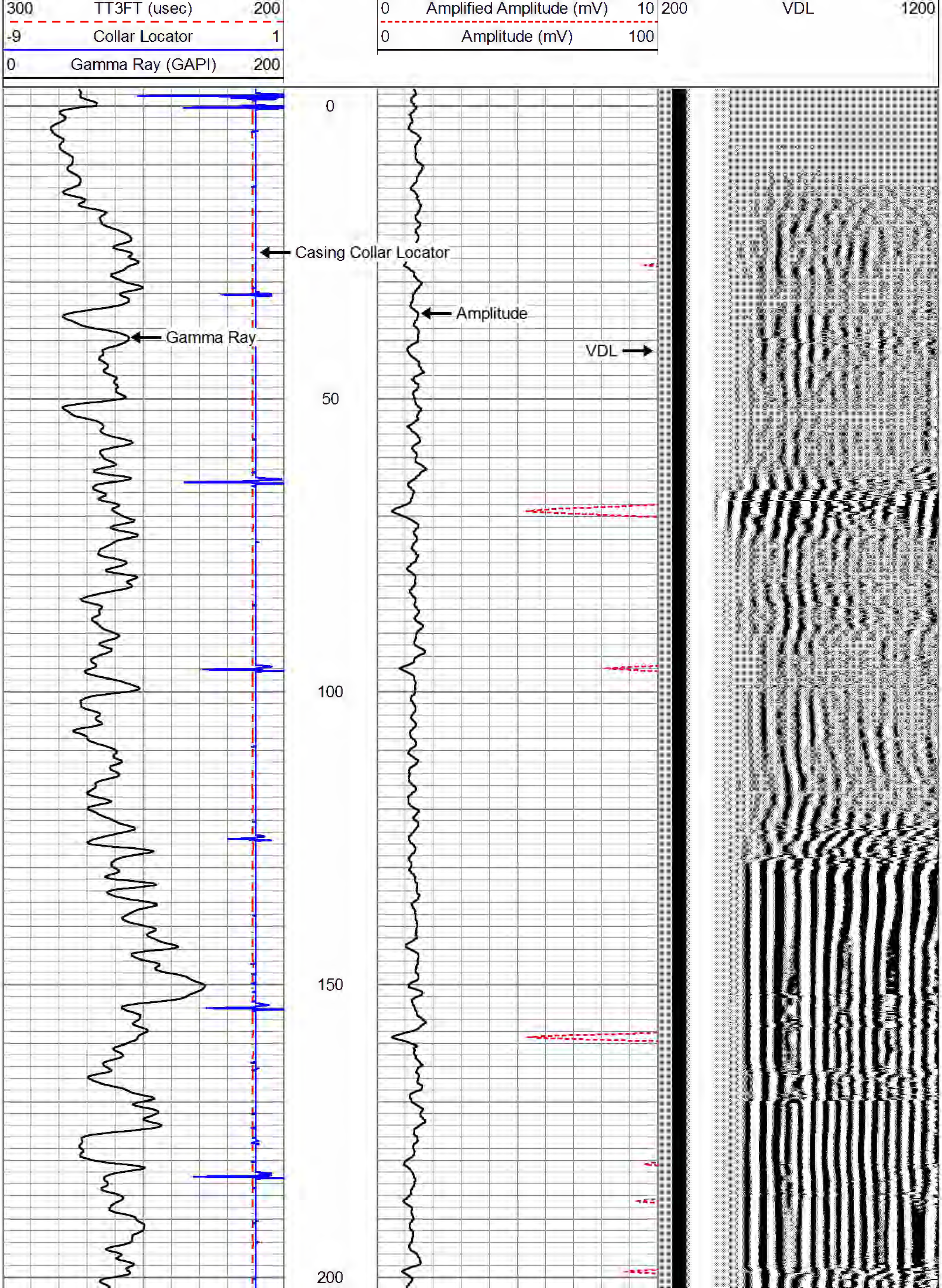
Run Number	Bit	From	To	Size	Weight	From	To

Casing Record	Size	Wgt/Ft	Top	Bottom
Surface String				
Prot. String				
Production String				
Liner				

<<< Fold Here >>>

Comments

Database File	8-7-15pennecosedat3.db
Dataset Pathname	pass5
Presentation Format	scbl_dr
Dataset Creation	Fri Aug 07 08:18:23 2015
Charted by	Depth in Feet scaled 1:240



300 TT3FT (usec) 200
-9 Collar Locator 1
0 Gamma Ray (GAPI) 200
0 Amplified Amplitude (mV) 10
0 Amplitude (mV) 100
200 VDL 1200
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150
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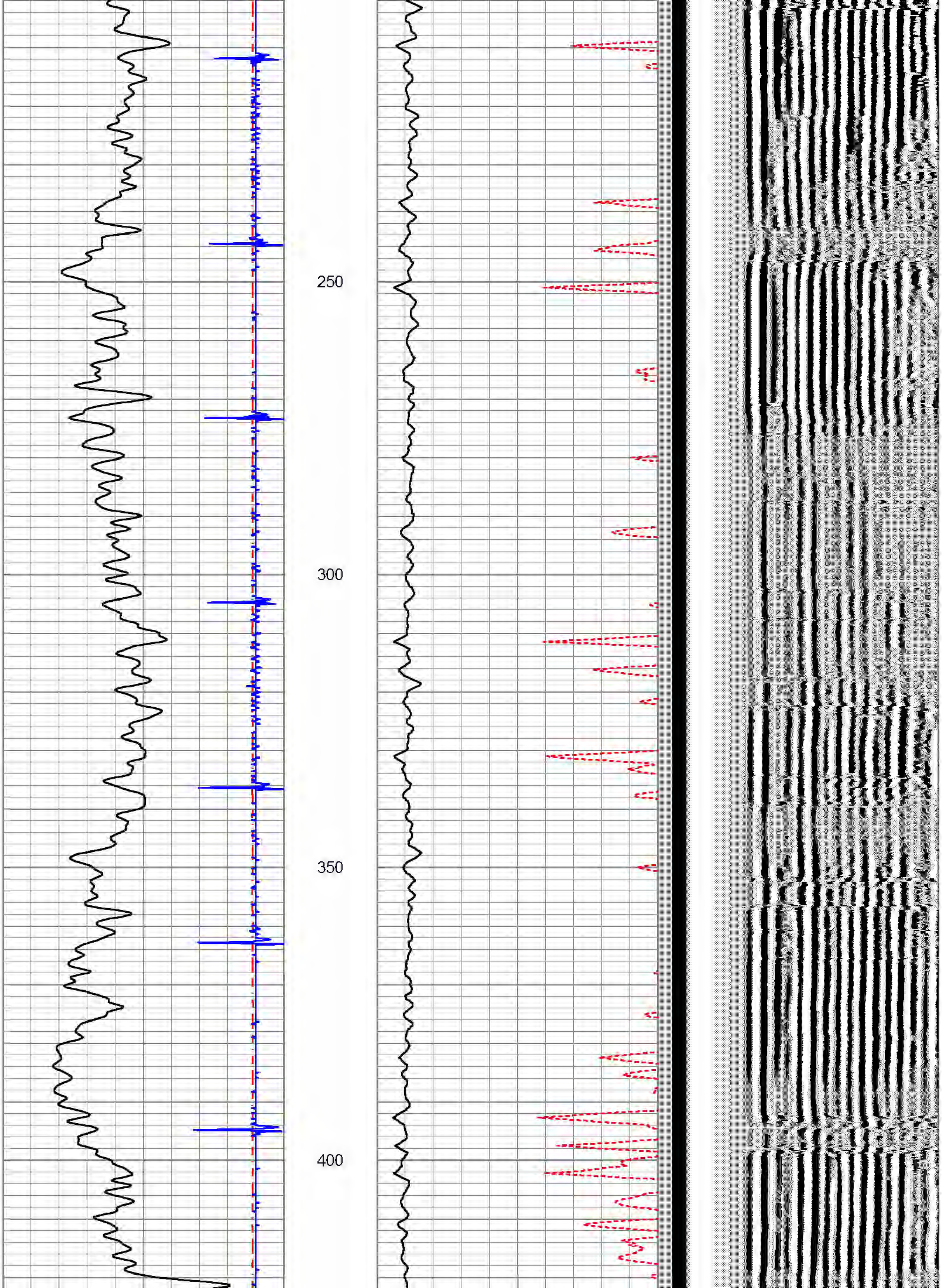
Casing Collar Locator
Gamma Ray
Amplitude
VDL



250
300
350
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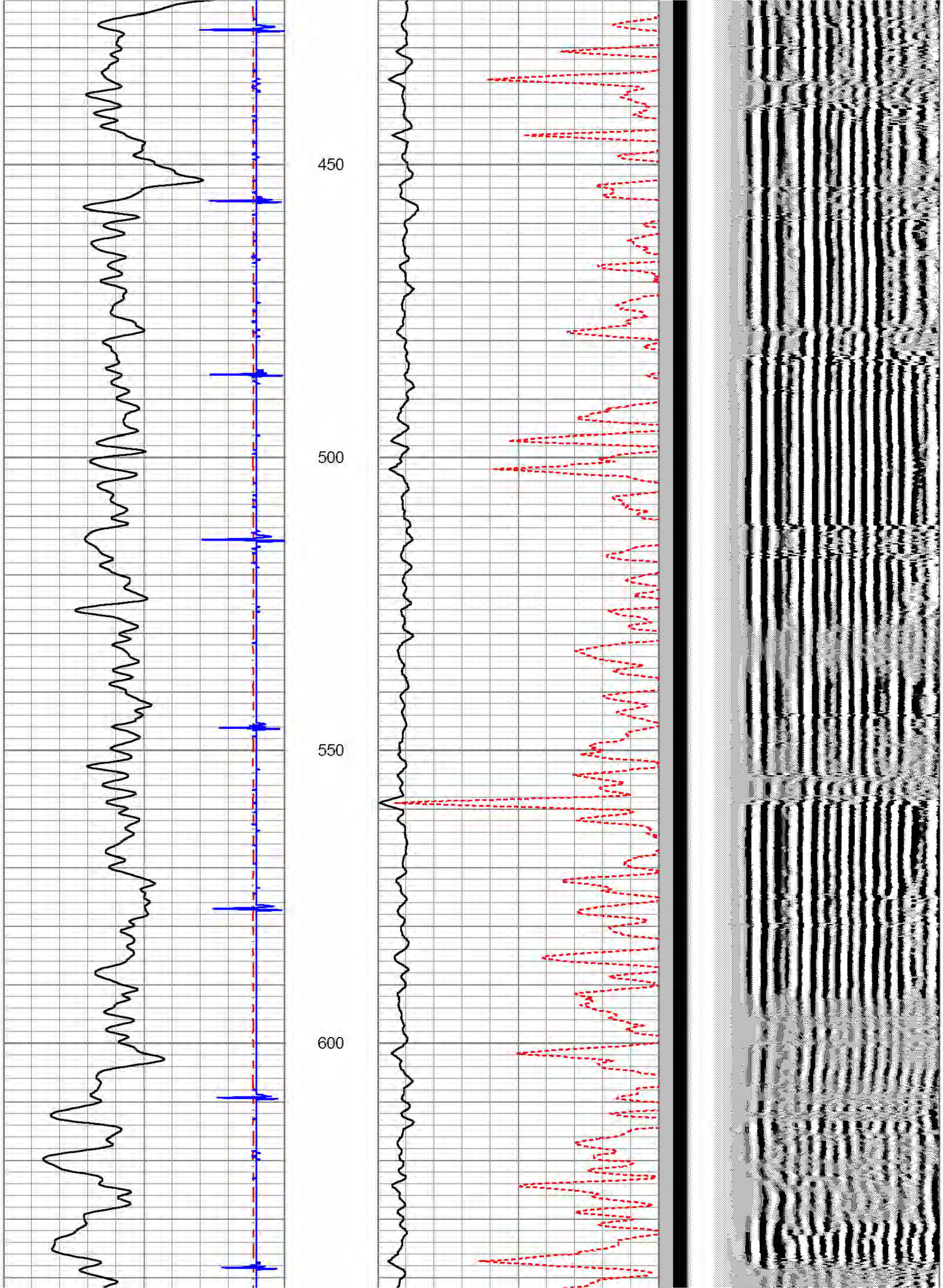

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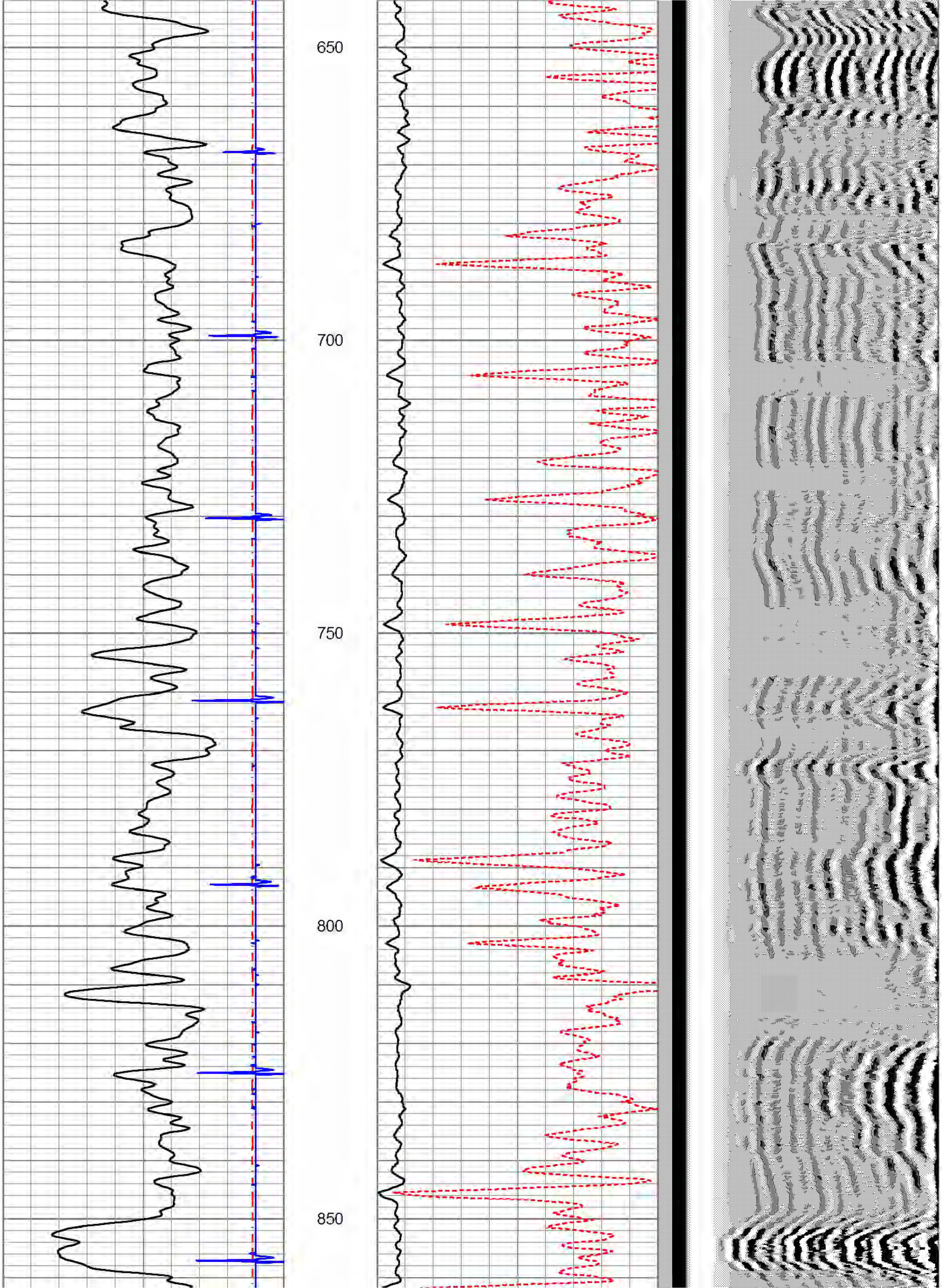
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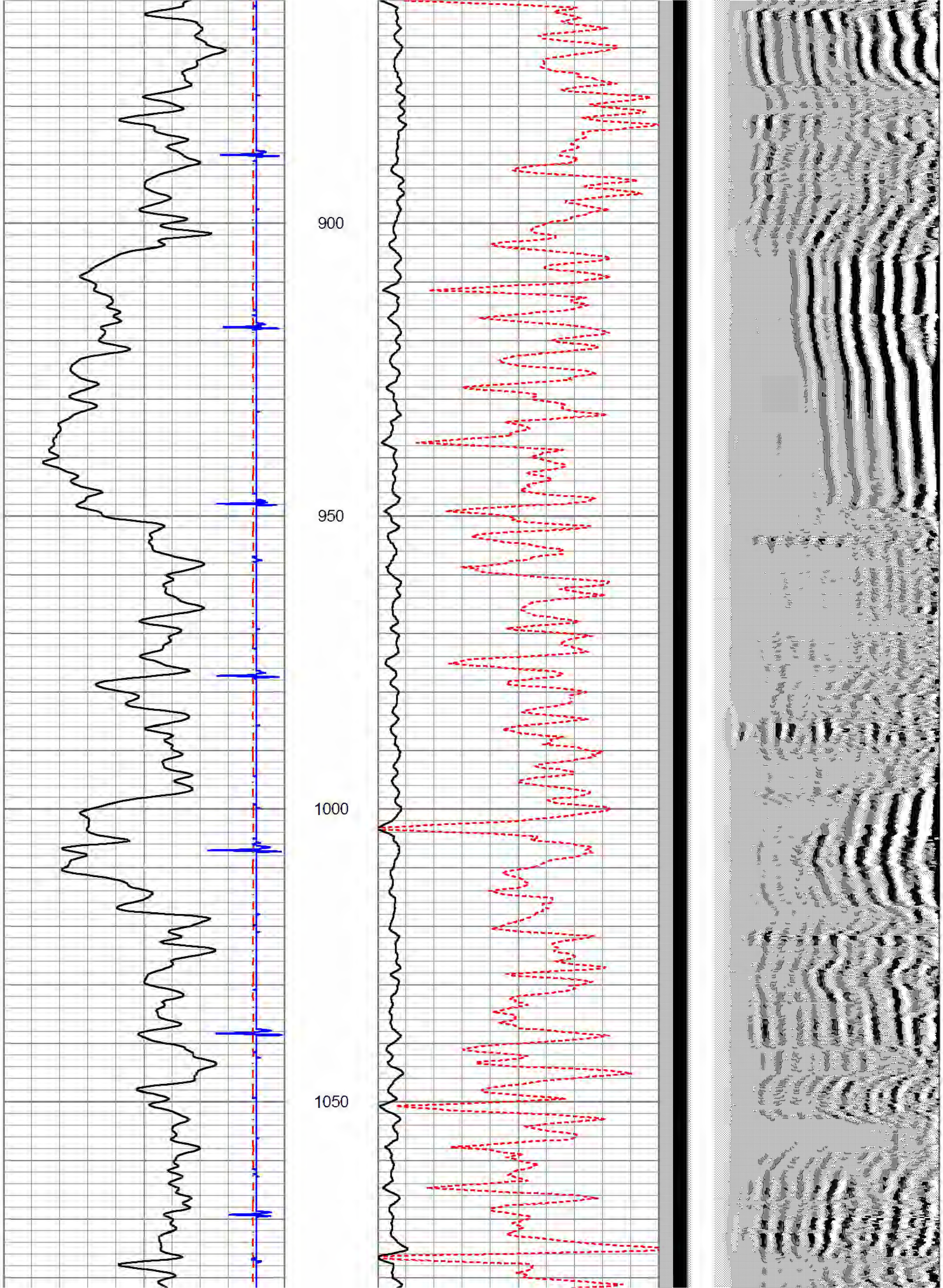
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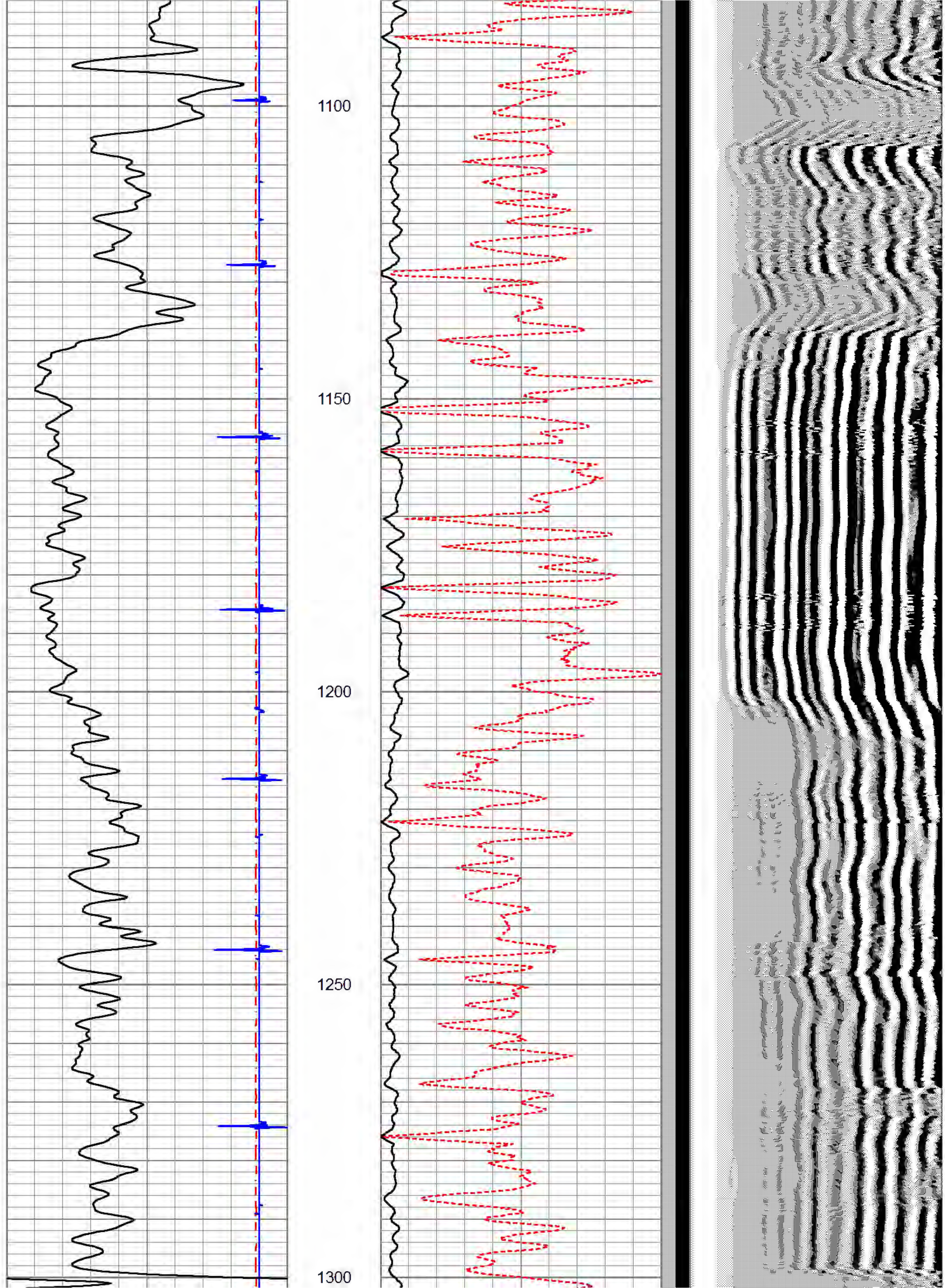
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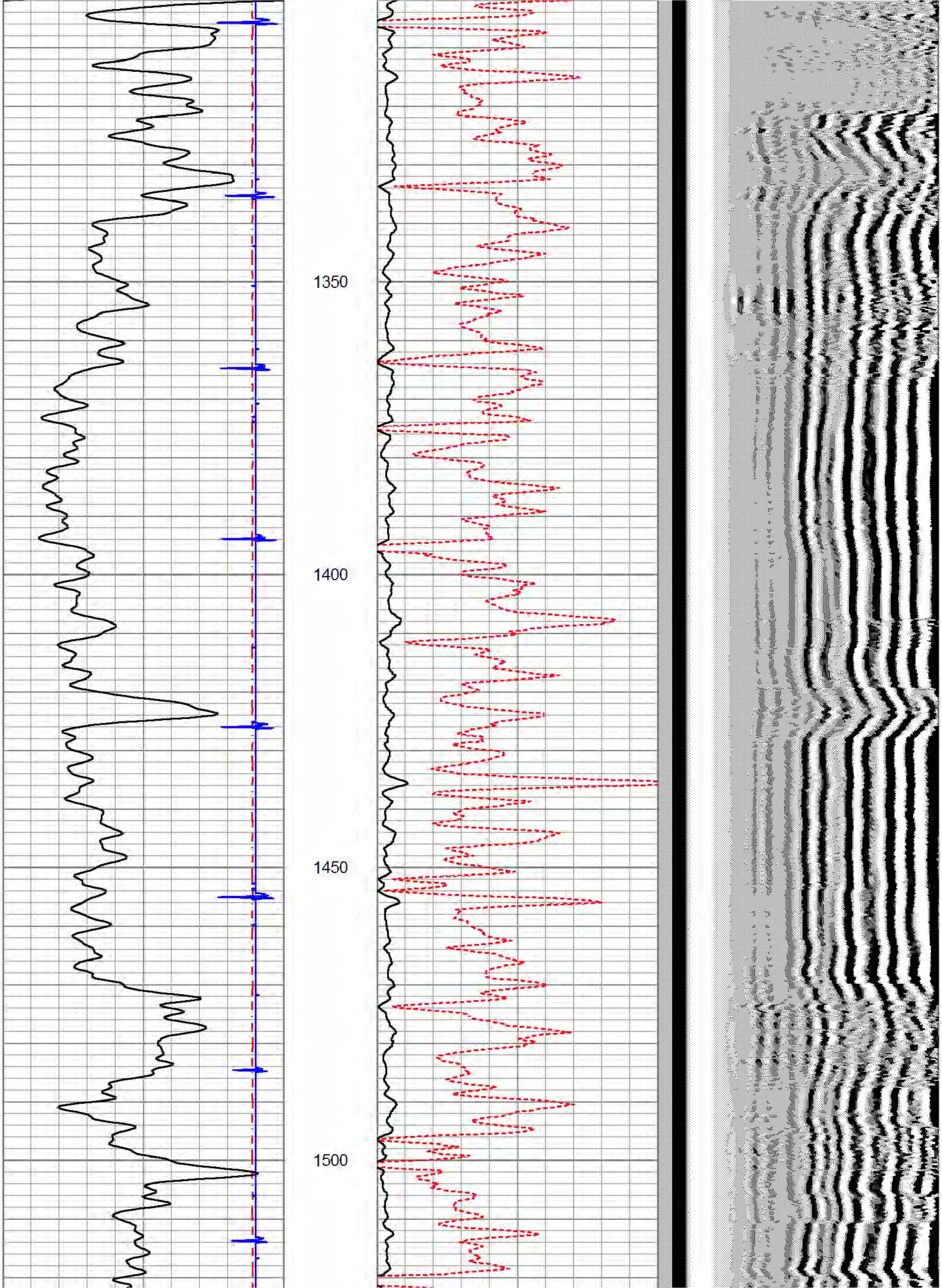

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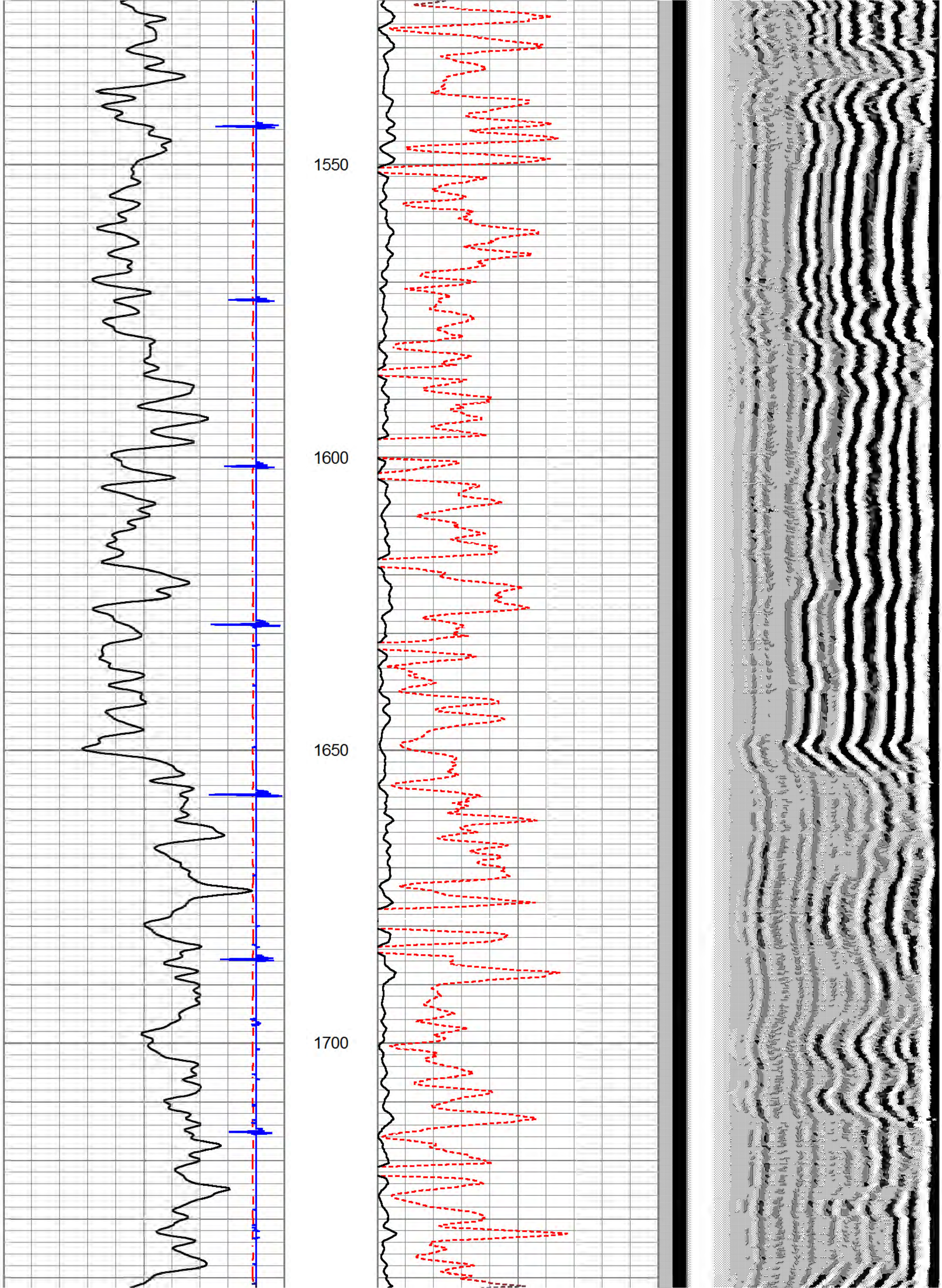

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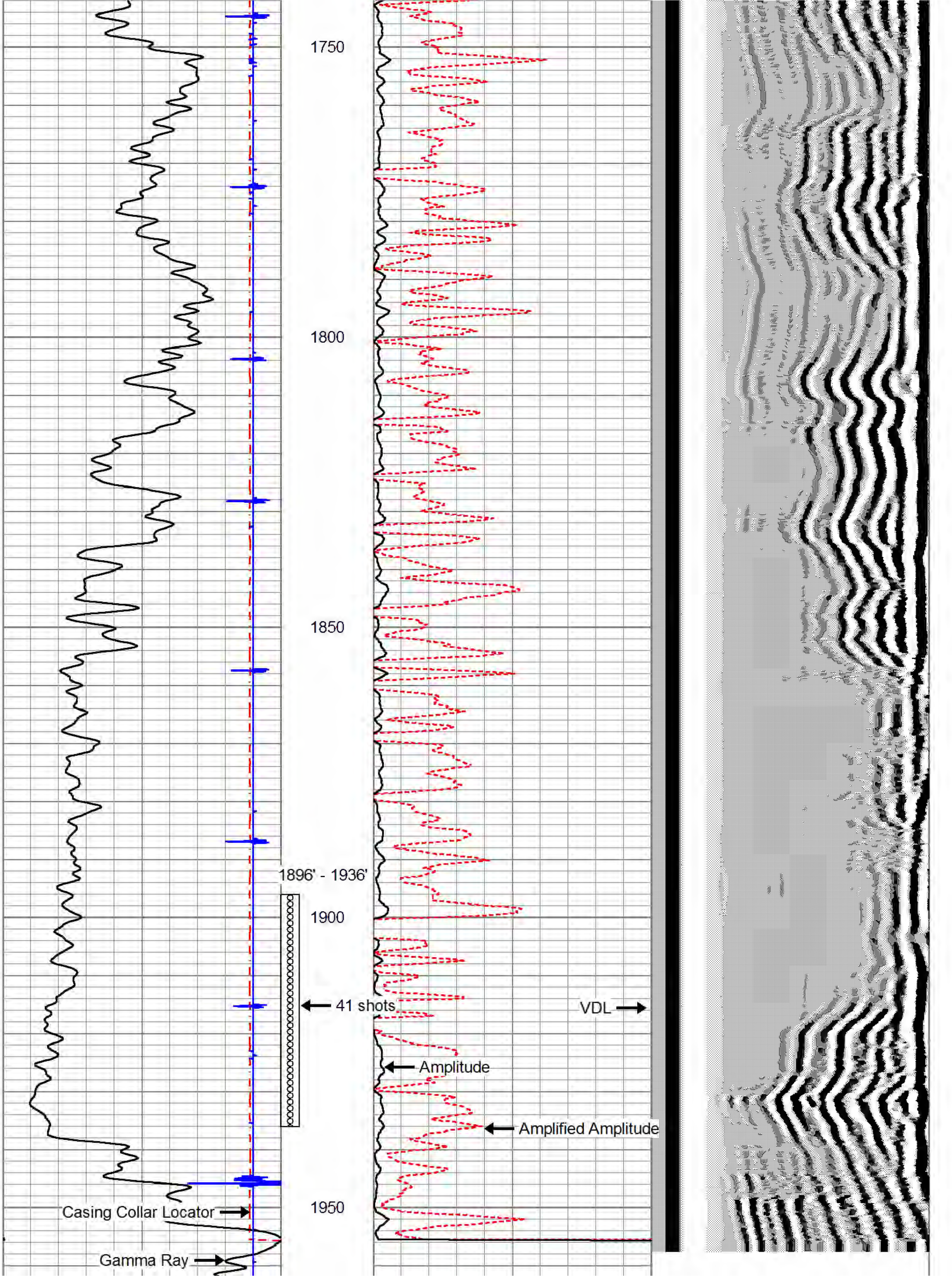

1750
1800
1850
1896' - 1936'
1900
41 shots
VDL
Amplitude
Amplified Amplitude
1950
Casing Collar Locator
Gamma Ray

First Reading 1965'

300	TT3FT (usec)	200	0	Amplified Amplitude (mV)	10	200	VDL	1200
-9	Collar Locator	1	0	Amplitude (mV)	100			
0	Gamma Ray (GAPI)	200						

Sensor	Offset (ft)	Schematic	Description	Length (ft)	O.D. (in)	Weight (lb
			CENT-PTS275	2.83	2.75	
HEADVOLT	16.52					
			CBL-Probe (FW1411-22) Probe Digital CBL	8.92	2.75	60.00
WVF3FT	11.79					
WVF5FT	10.79					
HEADVOLT	7.61					
			CENT-PTS275	2.83	2.75	
CCL	3.88					
GR	2.54		GR-GC (FW1503-55) GR-CCL CORROSION	4.77	2.75	30.00

Dataset:	8-7-15pennecosedat3.db: field/well/run1/pass5
Total length:	19.35 ft
Total weight:	90.00 lb
O.D.:	2.75 in

ATTACHMENT “O”
Plan for Well Failures

Attachment O
Plans for Well Failures
Sedat #3A Injection Well

<u>Plans for Well Failures for Sedat #3A Injection Well</u>

If there is a well failure that involves equipment the well will be shut-in until the faulty equipment is repaired or replaced. If the failure poses no environmental or operational hazard, and the well has been returned to a safe operating condition, the well will be placed back into operation and nothing further will be done.

If there is a casing leak or some other major failure the well will be immediately shut-in and the Pennsylvania DEP and the EPA notified of the problem. Depending on the condition, the corrective action may include squeezing off the leak with cement or running an additional string of casing. The well will not be placed into service until it has been determined that the problem has been corrected and approval is received from the EPA to resume operation. Any fluid produced during the shut-in will be stored on site or disposed of at another approved facility.

2/12/2016

ATTACHMENT “P”

Monitoring Program

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.

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 monitored to ensure the specific gravity of the fluid to be injected does not exceed the allowed value.

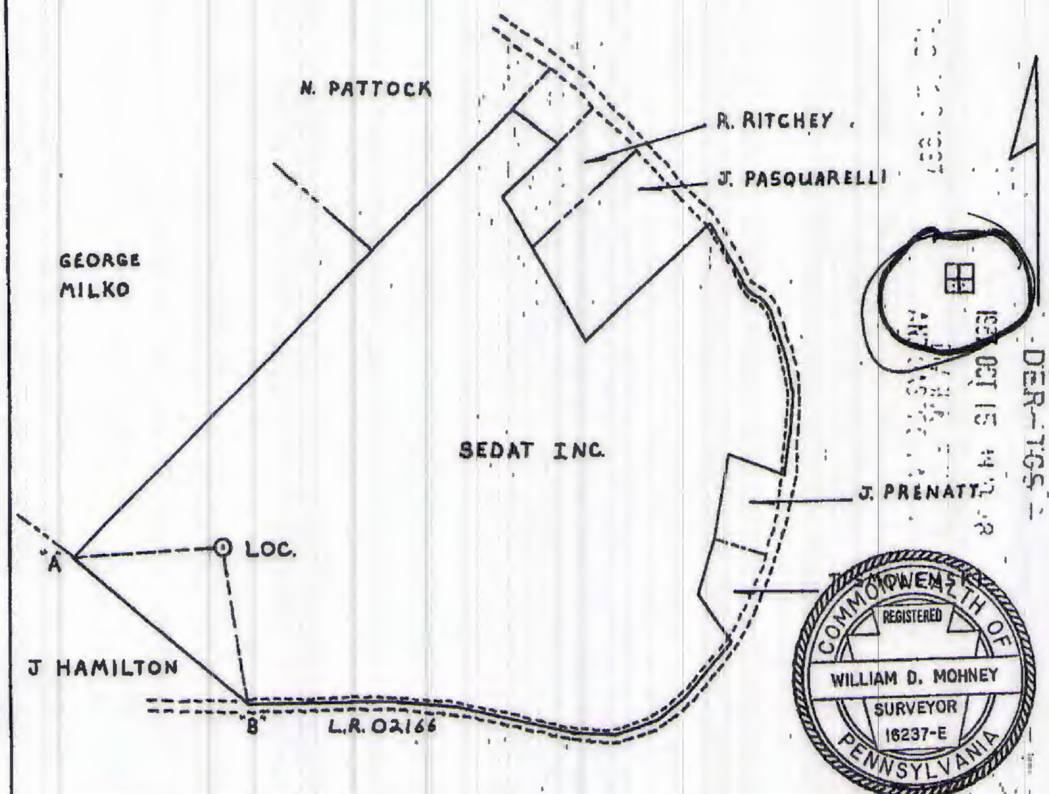
Injection fluids will be sampled and analyzed quarterly with the sample taken at the injection site (wellhead). The results will be reported as required by the permit or according to EPA guidelines.

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

ER-OG-2: Rev. 3/85 — WELL LOCATION PLAT — 42313

Well is located on topo map 5950' feet south of LATITUDE 40 ° 32 ' 30

Well is located on topo map 2,380' feet west of LONGITUDE 79 ° 42 ' 30 "



———— LIMIT OF LEASE

– – – PROPERTY LINE

SCALE: 1" = 500'

LOC TO "A" S 86° 52' 41" W 524.02'

LOC TO "B" S 9° 14' 09" E 531.90'

"A" TREE ON CORNER

"B" CENTER LINE OF ROAD CORNER

Include description of the property and courses and distances of the well(s) location to two or more permanent identifiable points or land marks, all buildings and water supplies within 200', all springs, bodies of water and streams within 100' identified on the most current 7½" topographic map and wetlands within 100'. Reference to buildings, springs, bodies of water and wetlands is not required for well plugging.

⊞ Denotes location of well on 7½" topo map Permit # 37-003-21810-00 Project # —

Well Operator: Penneco Oil Company Inc.

Address: U.S. Route #22, Delmont, PA 15626

Surface Owner: Sedat Inc.

Surface Lessor (if any): N/A

Farm Name: Sedat

Well No.: #1 — Serial No.: PS-7

Acres: 69.5 — Ground Elevation: 1260'

Topo Quadrangle: New Kensington East 1408 — Section: 7

County: Allegheny — Political Subdivision: Plum

Angle of Deviation: None — Anticipated TD: 3,500'

Commonwealth of Pennsylvania
Department of Environmental Resources
Bureau of Oil and Gas Management

- ☐ Revision
- ☐ Re-Issue
- ☐ Alteration
- ☐ Storage Recondition
- ☒ New Location
- ☐ Drill Deeper
- ☐ Abandonment
- ☐ Registration
- ☐ Plugging

Surveyor/Engineer: W.D. Mohney

Drawing Number: S-1

Date: 11/1/86

Date:

Surface landowner and water purveyor with water supply within 1,000'	Approximate course and distance to water supply
Frank Choltko	S 45° E 850'
Ferdinand Palombo	S 55° W [illegible]

RECEIVED

DEC 3 1 1987

Workable Coal Seams

Owner/Operator	Name of Seam
Villa Coal Company	Upper Freeport
Sedat Inc.	All others

RENTON MINE

10-21-87

ATTACHMENT “Q”
Plugging and Abandonment Plan

Attachment Q
Plugging and Abandonment Plan
Sedat #3A Injection Well

Plugging and Abandonment Plan:

The company will plug the Sedat #3A in accordance with the Pennsylvania Bureau of Oil and Gas Management and the EPA regulations in place at the time of abandonment. The following actions will be taken:

*Move in service rig
*Retrieve injection string and packer
*Run 2 3/8" tubing to TD of 1,940'
*Load hole with saltwater gel (if necessary a cast iron bridge plug will be placed in 7" casing, at 1,890' to put well in static state prior to setting cement plugs).
* Balance a 170' cement plug from 1,940' to 1,770'
* Balance a 200' cement plug from 743' to 543'.
* Lay down tubing string
*Bail 7" casing
*Install Vent
*Install monument with well name and permit number

Form 7520-14 and cost estimate is attached.

12/06/2015

Prepared for
PENNECO OIL COMPANY
6608 RT 22
DELMONT, PA 15626-2408
Printed: December 14, 2015
Prepared: December 14, 2015
Bid #0015917
Stages: 0

Prepared by
Joseph Snyder
114 Universal Dr.
Punxsutawney, PA 15767
(814) 938-2051
Joseph.Snyder@univwell.com

Plug to Abandon Sedat 3
TD - 1940'

Product #	Description	Qty	Units of Sale	Unit Price	Disc	Total Price
860000	Unit Mileage Charge - Trucks and Vans (Except Bulk Units), Per Unit Mile	70.0	Mi	$8.25	45.0%	$317.63
860010	Pickup Mileage Charge, Per Unit Mile	70.0	Mi	$4.00	45.0%	$154.00
860051	Minimum Cement Delivery Charge	1.0	Ea	$525.00	45.0%	$288.75
861311	Cement Pump Casing, Area 1, 1,001'-2,000', 1st 4 Hrs	1.0	Ea	$2,500.00	45.0%	$1,375.00
872000	Blending Charge	82.0	CU FT	$2.50	45.0%	$112.75
872205	Cement - Type I	70.0	Sack	$18.50	45.0%	$712.25
873025	Salt	547.0	Lb	$0.45	45.0%	$135.38
873100	Bentonite	600.0	Lb	$0.51	45.0%	$168.30

Total Price: **$3,264.06**

Price Per Stage: **$3,264.06**

Comments:

- Overtime charges will begin after the first 4 hours on location and be charged at $1160.00 per hour less 45% discount.
- Type 1, 18% Salt - Y-1.22 cuft/sk, W-5.2 gal/sk, D-15.9 lb/gal.
- Payment Terms: Net 30 Days.
- This price quote is valid through 06/30/2016. Actual job scheduling is based upon equipment availability.

MULTI PRODUCTION SYSTEMS, INC.

OIL AND GAS PRODUCERS

134 MILL RUN DRIVE
INDIANA, PENNSYLVANIA 15701
(724) 465-6663 FAX (724) 465-7375

Penneco Oil Company, Inc.

6608 Route 22

Delmont, PA 15626-2408

ESTIMATED COSTS FOR PLUGGING SERVICES

Operator: **Penneco Oil Company**

Well Name: **Sedat #3**

Location: **Plum Borough, Westmoreland County**

Day 1 – Trip out and lay down packer. Trip back in hole to set bottom hole plugs.

Day 2 – Set plugs and pull tubing.

Day 3 – Bail 7 inch casing dry.

Rig Time	**30 hours @ $225.00/hr = $6,750.00**
Trucking	**12 hours @ $125.00/hr. = $1,500.00**
Misc. Labor	**20 hours @ $50.00/hr. = $1,000.00**

TOTAL ESTIMATED COSTS: $9,250.00

OMB No. 2040-0042 Approval Expires 11/30/2014

EPA

United States Environmental Protection Agency
Washington, DC 20460

PLUGGING AND ABANDONMENT PLAN

Name and Address of Facility	Name and Address of Owner/Operator
Penneco Environmental Solutions, LLC 1800 Old Leechburg Road, Pittsburgh, PA 15239	Penneco Environmental Solutions, LLC 6608 Route 22, Delmont, PA 15626

Locate Well and Outline Unit on Section Plat - 640 Acres

N W E S

State	County	Permit Number
PA	Allegheny	37-003-21223

Surface Location Description

___ 1/4 of ___ 1/4 of ___ 1/4 of ___ 1/4 of Section ___ Township ___ Range ___

Locate well in two directions from nearest lines of quarter section and drilling unit

Surface Location ___ ft. frm (N/S) ___ Line of quarter section
and ___ ft. from (E/W) ___ Line of quarter section.

TYPE OF AUTHORIZATION

- [x] Individual Permit
- [ ] Area Permit
- [ ] Rule

Number of Wells ___

Lease Name: Sedat #3A

WELL ACTIVITY

- [ ] CLASS I
- [x] CLASS II
  - [x] Brine Disposal
  - [ ] Enhanced Recovery
  - [ ] Hydrocarbon Storage
- [ ] CLASS III

Well Number: PS-46

CASING AND TUBING RECORD AFTER PLUGGING

SIZE	WT (LB/FT)	TO BE PUT IN WELL (FT)	TO BE LEFT IN WELL (FT)	HOLE SIZE
7"	20		1948	8 3/4
9 5/8	32		643	12 1/4
13 3/8	48		34	15

METHOD OF EMPLACEMENT OF CEMENT PLUGS

- [x] The Balance Method
- [ ] The Dump Bailer Method
- [ ] The Two-Plug Method
- [ ] Other

CEMENTING TO PLUG AND ABANDON DATA:	PLUG #1	PLUG #2	PLUG #3	PLUG #4	PLUG #5	PLUG #6	PLUG #7
Size of Hole or Pipe in which Plug Will Be Placed (inche	7	7					
Depth to Bottom of Tubing or Drill Pipe (ft.	1940	743					
Sacks of Cement To Be Used (each plug)	32	38					
Slurry Volume To Be Pumped (cu. ft.)	38.5	45.5					
Calculated Top of Plug (ft.)	1770	543					
Measured Top of Plug (if tagged ft.)							
Slurry Wt. (Lb./Gal.)	15.6	15.6					
Type Cement or Other Material (Class III)	1	1					

LIST ALL OPEN HOLE AND/OR PERFORATED INTERVALS AND INTERVALS WHERE CASING WILL BE VARIED (if any)

From	To	From	To
1896	1936		

Estimated Cost to Plug Wells

$12,515 see attached bid sheets

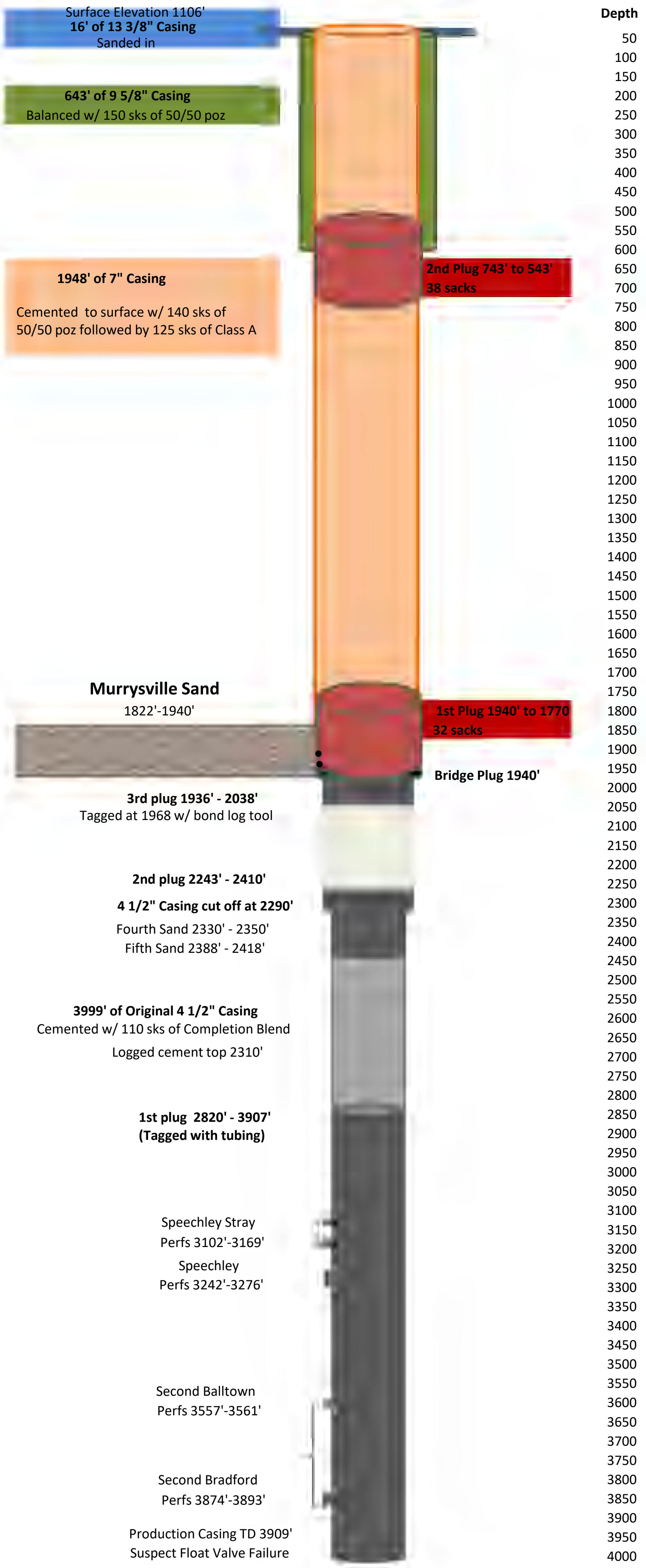
Certification

I certify under the penalty of law that I have personally examined and am familiar with the information submitted in this document and all attachments and that, based on my inquiry of those individuals immediately responsible for obtaining the information, I believe that the information is true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment. (Ref. 40 CFR 144.32)

Name and Official Title (Please type or print)	Signature	Date Signed
D. Marc Jacobs, Jr. Senior Vice President		02/26/2016

EPA Form 7520-14 (Rev. 12-11)

Attachment Q
Plugging and Abandonment Plan
Penneco Sedat #3A Injection Well
Wellbore Schematic
With Orignial Construction Shown



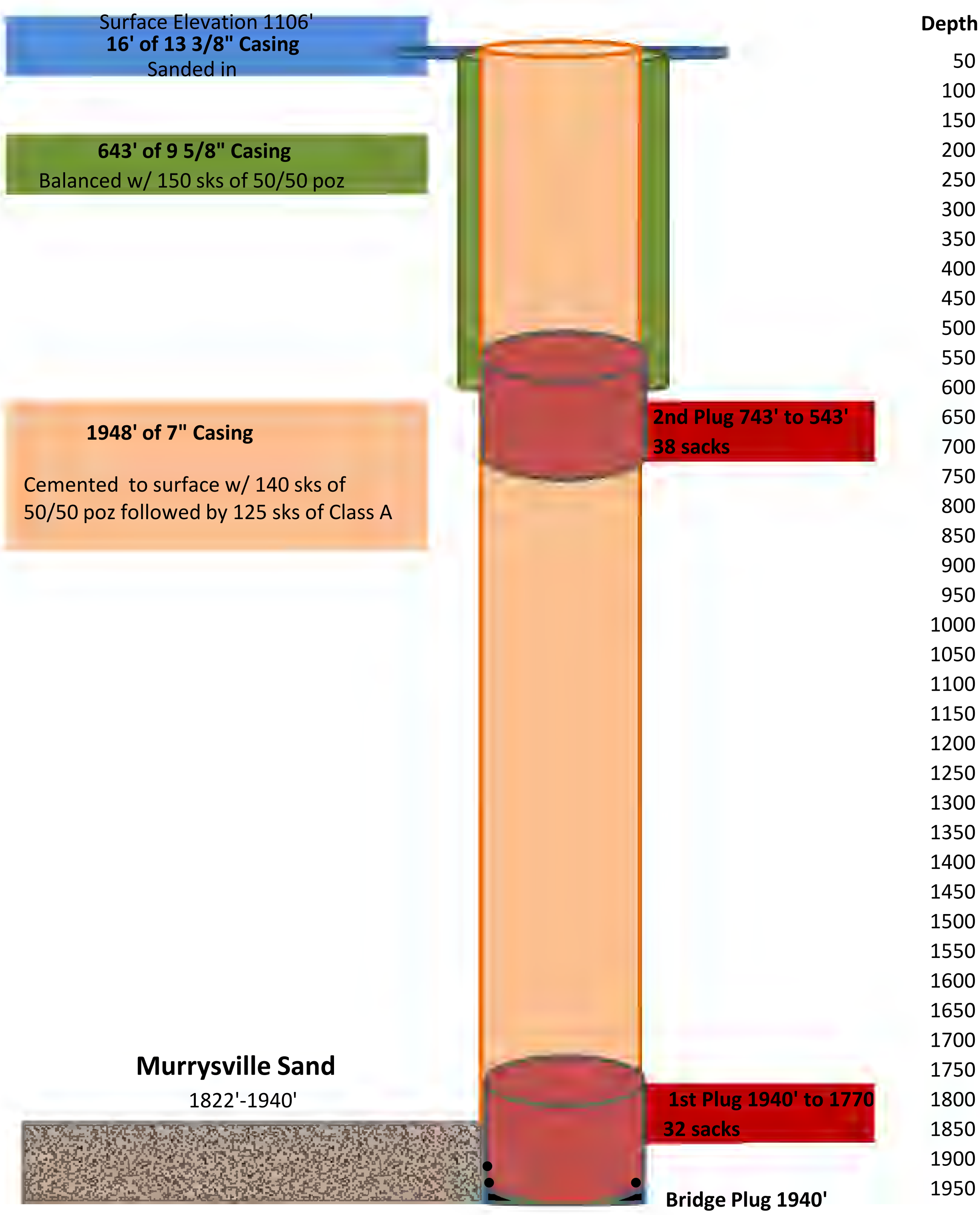
Attachment Q

Plugging and Abandonment Plan

Penneco Sedat #3A Injection Well

Wellbore Schematic

With only New Plugging work shown



ATTACHMENT “R”

Necessary Resources

STANDBY TRUST AGREEMENT

U.S. Environmental Protection Agency
Underground Injection Control
Financial Responsibility Requirement

THIS TRUST AGREEMENT (the "Agreement") is entered into as of the 23 day of March, 2016, by and between **PENNECO ENVIRONMENTAL SOLUTIONS, LLC**, owner or operator, a Pennsylvania limited liability company of 6608 State Route 22 Delmont, PA 15626 (the "Grantor"), and **FIRST COMMONWEALTH BANK**, of 600 Philadelphia Street, Indiana, Pennsylvania 15701, a Pennsylvania business corporation (the "Trustee").

WHEREAS, the United States Environmental Protection Agency ("EPA"), an agency of the United States Government, has established certain regulations applicable to the Grantor, requiring that an owner or operator of an injection well shall provide assurance that funds will be available when needed for plugging and abandonment of the injection well or wells; and

WHEREAS, the Grantor has elected to establish a trust to provide all of part of such financial assurance for the facility or facilities identified herein; and

WHEREAS, the Grantor, acting through its duly authorized officers, has selected the Trustee to be the trustee under this Agreement, and the Trustee is willing to act as trustee.

NOW THEREFORE, the Grantor and the Trustee agree as follows:

Section 1. Definitions. As used in this Agreement: (a) The term "Grantor" means the owner or operator who enters into this Agreement and any successors or assigns of the Grantor; (b) The term "Trustee" means the Trustee who enters into this Agreement and any successor Trustee; and (c) Facility or activity means any "underground injection well" or any other facility or activity that is subject to regulation under the Underground Injection Control Program.

Section 2. Identification of Facilities and Cost Estimates. This Agreement pertains to the facilities and cost estimates identified on attached Schedule A.

Section 3. Establishment of Fund. The Grantor and the Trustee hereby establish a trust fund (the "Fund") for the purpose of assuring compliance with the plugging and abandonment requirements established by EPA for the facilities identified on Schedule A. The Underground Injection Control regulations which govern the authorization to inject include a requirement for such financial assurance that the well or wells shall be plugged and abandoned at the time designated by EPA. The Grantor and the Trustee acknowledge that the Fund and all expenditures from the Fund shall be to fulfill the legal obligations of the Grantor under such regulations, and not any obligation of EPA. The Grantor and the Trustee intend that no third party have access to the Fund except as herein provided. The Fund is established initially as consisting of the property, which is acceptable to the Trustee, described in Schedule B attached hereto. Such property and any other property subsequently transferred to the Trustee is referred to as the Fund, together with all earnings and profits thereon, less any payments or distributions made by the Trustee pursuant to this Agreement. The Fund shall be held by the Trustee, IN TRUST, as hereinafter provided. The Trustee shall not be responsible, nor shall it undertake any responsibility, for the amount or adequacy of any additional payments necessary to discharge any liabilities of the Grantor established by EPA, nor shall the Trustee have any duty to collect such additional amounts from the Grantor.

Section 4. Payment for Plugging and Abandonment. The Trustee shall make payments from the Fund only for the costs of plugging and abandonment ("P&A") of the injection wells covered by this Agreement and the associated P&A Plan, only after EPA has advised the Trustee that work has been completed under the P&A Plan that complies with 40 C.F.R. § 144.28 and/or § 144.52. The Trustee shall not refund to the Grantor any amounts from the Fund unless and until EPA has advised the Trustee that the P&A Plan has been successfully completed. The Trustee shall not release any funds to the Grantor that are necessary to cover liability for any injection wells covered by this Agreement that remain unplugged.

Section 5. Payments Comprising the Fund. Payments made to the Trustee for the Fund shall consist of cash or securities acceptable to the Trustee.

Section 6. Trustee Management. The Trustee shall invest and reinvest the principal and income of the Fund and keep the Fund invested as a single fund, without distinction between principal and income, in accordance with general investment policies and guidelines which the Grantor may communicate in writing to the Trustee from time to time, subject, however, to the provisions of this Section. In investing, rein vesting, exchanging, selling, and managing the Fund, the Trustee shall discharge his duties with respect to the trust fund solely in the interest of the beneficiary and with the care, skill, prudence, and diligence under the circumstances then prevailing which persons of prudence, acting in a like capacity and familiar with such matters, would use in the conduct of an enterprise of a like character and with like aims; *except that:* (i) Securities or other obligations of the Grantor, or any other owner or operator of the facilities, or any of their affiliates as defined in the Investment Company Act of 1940, as amended, 15 U. S.C. 80a-2.(a), shall not be acquired or held, unless they are securities or other obligations of the Federal or a State government; (ii) The Trustee is authorized to invest the Fund in time or demand deposits of the Trustee, to the extent insured by an agency of the Federal or State government; and (iii) The Trustee is authorized to hold cash awaiting investment or distribution uninvested for a reasonable time and without liability for the payment of interest thereon.

Section 7. Commingling and Investment. The Trustee is expressly authorized in its discretion: (a) To transfer from time to time any or all of the assets of the Fund to any common, commingled, or collective trust fund created by the Trustee in which the Fund is eligible to participate, subject to all of the provisions thereof, to be commingled with the assets of other trusts participating therein; and (b) To purchase shares in any investment company registered under the Investment Company Act of 1940, 15 U.S. C. 80a-I *et seq.*, including one which may be created, managed, underwritten, or to which investment advice is rendered or the shares of which are sold by the Trustee. The Trustee may vote shares in its discretion.

Section 8. Express Powers a/Trustee. Without in any way limiting the powers and discretions conferred upon the Trustee by the other provisions of this Agreement or by law, the Trustee is expressly authorized and empowered: (a) To sell, exchange, convey, transfer, or otherwise dispose of any property held by it, by public or private sale. No person dealing with the Trustee shall be bound to see to the application of the purchase money or to inquire into the validity or expediency of any such sale or other disposition; (b) To make, execute, acknowledge, and deliver any and all documents of transfer and conveyance and any and all other instruments that may be necessary or appropriate to carry out the powers herein granted; (c) To register any securities held in the Fund in its own name or in the name of a nominee and to hold any security in bearer form or in book entry, or to combine certificates representing such securities with certificates of the same issue held by the Trustee in other fiduciary capacities, or to deposit or arrange for the deposit of such securities in a qualified central depository even though, when so deposited, such securities may be merged and held in bulk in the name of the nominee of such depositary with other securities deposited therein by another person, or to deposit or arrange for the deposit of any securities issued by the United States Government, or any agency or instrumentality thereof, with a Federal Reserve bank, but the books and records of the Trustee shall at all times show that all such securities are part of the Fund; (d) To deposit any cash in the Fund in interest-bearing accounts maintained or savings certificates issued by the Trustee, in its separate corporate capacity, or in any other banking institution affiliated with the Trustee, to the extent insured by an agency of the Federal or State government; and (e) To compromise or otherwise adjust all claims in favor of or against the Fund.

Section 9. Taxes and Expenses. All taxes of any kind that may be assessed or levied against or in respect of the Fund and all brokerage commissions incurred by the Fund shall be paid from the Fund. All other expenses incurred by the Trustee in connection with the administration of this Trust, including fees for legal services rendered to the Trustee, the compensation of the Trustee to the extent not paid directly by the Grantor, and all other proper charges and disbursements of the Trustee shall be paid from the Fund.

Section 10. Annual Valuation. The Trustee shall annually, at least 30 days prior to the anniversary date of establishment of the Fund, furnish to the Grantor and to the appropriate EPA Regional Administrator a statement confirming the value of the Trust. Any securities in the Fund shall be valued at market value as of no more than 60 days prior to the anniversary date of establishment of the Fund. The failure of the Grantor to object in writing to the Trustee within 90 days after the statement has been furnished to the Grantor and the EPA Regional Administrator shall constitute a conclusively binding assent by the Grantor, barring the Grantor from asserting any claim or liability against the Trustee with respect to matters disclosed in the statement.

Section 11. Advice of Counsel. The Trustee may from time to time consult with counsel, who may be counsel to the Grantor, with respect to any question arising as to the construction of this Agreement of any action to be taken hereunder. The Trustee shall be fully protected, to the extent permitted by law, in acting upon the advice of counsel.

Section 12. Trustee Compensation. The Trustee shall be entitled to reasonable compensation for its services as agreed upon in writing from time to time with the Grantor.

Section 13. Successor Trustee. The Trustee may resign or the Grantor may replace the Trustee, but such resignation or replacement shall not be effective until the Grantor has appointed a successor trustee and this successor accepts the appointment. The successor trustee shall have the same powers and duties as those conferred upon the Trustee hereunder. Upon the successor trustee's acceptance of the appointment, the Trustee shall assign, transfer, and pay over to the successor trustee the funds and properties then constituting the Fund. If for any reason the Grantor cannot or does not act in the event of the resignation of the Trustee, the Trustee may apply to a court of competent jurisdiction for the appointment of a successor trustee or for instructions. The successor trustee shall specify the date on which it assumes administration of the trust in a writing sent to the Grantor, the EPA Regional Administrator, and the present Trustee by certified mail 10 days before such change becomes effective. Any expenses incurred by the Trustee as a result of any of the acts contemplated by this Section shall be paid as provided in Section 9.

Section 14. Instructions to the Trustee. All orders, requests, and instructions by the Grantor to the Trustee shall be in writing, signed by such persons as are designated in the attached Exhibit A or such other designees as the Grantor may designate by amendment to Exhibit A. The Trustee shall be fully protected in acting without inquiry in accordance with the Grantor's orders, requests, and instructions. All orders, requests, and instructions by the EPA Regional Administrator to the Trustee shall be in writing, signed by the EPA Regional Administrators of the Regions in which the facilities are located, or their designees, and the Trustee shall act and shall be fully protected in acting in accordance with such orders, requests, and instructions. The Trustee shall have the right to assume, in the absence of written notice to the contrary, that no event constituting a change or a termination of the authority of any person to act on behalf of the

Grantor or EPA hereunder has occurred. The Trustee shall have no duty to act in the absence of such orders, requests, and instructions from the Grantor and/or EPA, except as provided for herein.

Section 15. Notice of Nonpayment. The Trustee shall notify the Grantor and the appropriate EPA Regional Administrator, by certified mail within 10 days following the expiration of the 30-day period after the anniversary of the establishment of the Trust, if no payment is received from the Grantor during that period. After the pay-in period is completed, the Trustee shall not be required to send a notice of nonpayment.

Section 16. Amendment of Agreement. This Agreement may be amended by an instrument in writing executed by the Grantor, the Trustee, and the appropriate EPA Regional Administrator, or by the Trustee and the appropriate EPA Regional Administrator if the Grantor ceases to exist.

Section 17. Irrevocability and Termination. Subject to the right of the parties to amend this Agreement as provided in Section 16, this Trust shall be irrevocable and shall continue until terminated at the written agreement of the Grantor, the Trustee, and the EPA Regional Administrator, or by the Trustee and the EPA Regional Administrator if the Grantor ceases to exist. Upon termination of the Trust, all remaining trust property, less final trust administration expenses, shall be delivered to the Grantor.

Section 18. Immunity and Indemnification. The Trustee shall not incur personal liability of any nature in connection with any act or omission, made in good faith, in the administration of this Trust, or in carrying out any directions by the Grantor or the EPA Regional Administrator issued in accordance with this Agreement. The Trustee shall be indemnified and saved harmless by the Grantor or from the Trust Fund, or both, from and against any personal liability to which the Trustee may be subjected by reason of any act or conduct in its official capacity, including all expenses reasonably incurred in its defense in the event the Grantor fails to provide such defense.

Section 19. Choice of Law. This Agreement shall be administered, construed, and enforced according to the laws of the Commonwealth of Pennsylvania.

Section 20. Interpretation. As used in this Agreement, words in the singular include the plural and words in the plural include the singular. The descriptive headings for each Section of this Agreement shall not affect the interpretation or the legal efficacy of this Agreement.

[The remainder of this page is intentionally left blank. Signatures follow.]

SCHEDULE A

Identification of Facilities and Cost Estimates

Schedule A is referenced in the Standby Trust Agreement dated March 23, 2016, by and between PENNECO ENVIRONMENTAL SOLUTIONS, LLC, the "Grantor" and FIRST COMMONWEALTH BANK, the "Trustee."

EPA identification number	API# 37-003-21223
Name of facility	Sedat 3A Injection Well
Address of facility	1800 Old Leechburg Road Pittsburgh, PA 15239
Current plugging and abandonment cost estimate	$12,515.00
Date of estimate	December 6, 2015

SCHEDULE B
Identification of Fund

Schedule B is referenced in the Standby Trust Agreement dated March 23, 2016 by and between PENNECO ENVIRONMENTAL SOLUTIONS, LLC, the "Grantor" and FIRST COMMONWEALTH BANK, the "Trustee."

The fund consists of: (Check one and provide identification number)

(√) Irrevocable Letter of Credit No. #430R1167

( ) Surety Performance Bond No. ______

( ) Other (Describe) ______

IN WITNESS WHEREOF the parties below have caused this Agreement to be executed by their respective representatives duly authorized and their seals to be hereunto affixed and attested as of the date first above written.

GRANTOR:
PENNECO ENVIRONMENTAL SOLUTIONS, LLC

By:______________________

Name: Terrence S Jacobs

Title: President

Before me came the individual whose identity I confirmed as Terrence S. JACOBS and whose true signature is set forth above; wherefore have I set my hand and seal this 18th day of MARCH, 2016.

Eileen M. Staub
Notary Public

[Seal] COMMONWEALTH OF PENNSYLVANIA
Notarial Seal
Eileen M. Staub, Notary Public
Salem Twp., Westmoreland County
My Commission Expires May 15, 2017
MEMBER, PENNSYLVANIA ASSOCIATION OF NOTARIES

TRUSTEE:
FIRST COMMONWEALTH BANK

By:______________________

Name: Douglas I. Sako

Title: Senior Vice President

Before me came the individual whose identity I confirmed as Douglas I Sako and whose true signature is set forth above; wherefore have I set my hand and seal this 23rd day of March, 2016.

Heidi M Holt
Notary Public

[Seal] COMMONWEALTH OF PENNSYLVANIA
NOTARIAL SEAL
HEIDI M. HOLT, NOTARY PUBLIC
BROCKWAY BORO, JEFFERSON COUNTY
MY COMMISSION EXPIRES APRIL 24, 2019

( ) This bank/institution has the authority to act as trustee and its trust activities are examined and regulated by a State or Federal agency.

CERTIFICATE OF ACKNOWLEDGMENT
FOR
STANDBY TRUST FUND AGREEMENT

STATE OF Pennsylvania)
) SS:
COUNTY OF Jefferson)

On this, the 23rd day of March, 2016, before me personally came Douglas I Sako, to me known, who, being by me duly sworn, did depose and say that he/she resides at 654 Philadelphia St. Indiana, PA 15701
(Address)
that he/she is the Senior Vice President of FIRST COMMONWEALTH BANK
(Title) (Corporation)
the corporation described in and which executed the above instrument; that he/she knows the seal of said corporation; that the seal affixed to such instrument in such corporate seal; that it was so affixed by order of the Board of Directors of said corporation, and that he/she signed his/her name thereto by like order.

Heidi M Holt
(Notary Public)

(Seal) COMMONWEALTH OF PENNSYLVANIA
NOTARIAL SEAL
HEIDI M. HOLT, NOTARY PUBLIC
BROCKWAY BORO, JEFFERSON COUNTY
MY COMMISSION EXPIRES APRIL 24, 2019

IN WITNESS WHEREOF the parties below have caused this Agreement to be executed by their respective representatives duly authorized and their seals to be hereunto affixed and attested as of the date first above written.

GRANTOR:
PENNECO ENVIRONMENTAL SOLUTIONS, LLC

By:____________________

Name:____________________

Title:____________________

Before me came the individual whose identity I confirmed as ____________________ and whose true signature is set forth above; wherefore have I set my hand and seal this _____ day of ____________________, 2016.

____
Notary Public

[Seal]

TRUSTEE:
FIRST COMMONWEALTH BANK

By: [signature]

Name: Danny Diveley

Title: Trust Officer

Before me came the individual whose identity I confirmed as Danny Diveley and whose true signature is set forth above; wherefore have I set my hand and seal this 24th day of March, 2016.

[signature] Kelly Perney
Notary Public

[Seal]

COMMONWEALTH OF PENNSYLVANIA
NOTARIAL SEAL
KELLY PERNEY, NOTARY PUBLIC
CITY OF GREENSBURG, WESTMORELAND C...
MY COMMISSION EXPIRES NOV. 25, 2018

(X) This bank/institution has the authority to act as trustee and its trust activities are examined and regulated by a State or Federal agency.

CERTIFICATE OF ACKNOWLEDGMENT
FOR
STANDBY TRUST FUND AGREEMENT

STATE OF Pennsylvania)
) SS:
COUNTY OF Westmoreland)

On this, the 24th day of March, 2016, before me personally came Danny Diveley, to me known, who, being by me duly sworn, did depose and say that he/she resides at 654 Philadelphia Street, Indiana, PA 15601
(Address)
that he/she is the Trust Officer of FIRST COMMONWEALTH BANK
(Title) (Corporation)
the corporation described in and which executed the above instrument; that he/she knows the seal of said corporation; that the seal affixed to such instrument in such corporate seal; that it was so affixed by order of the Board of Directors of said corporation, and that he/she signed his/her name thereto by like order.

COMMONWEALTH OF PENNSYLVANIA
NOTARIAL SEAL
KELLY PERNEY, NOTARY PUBLIC
CITY OF GREENSBURG, WESTMORELAND CTY.
MY COMMISSION EXPIRES NOV. 25, 2018

Kelly Perney
(Notary Public)

(Seal)

FIRST Commonwealth Bank.
Time to be first.

First Commonwealth Bank
Central Offices:
Philadelphia and Sixth Streets
P.O. Box 400
Indiana, PA 15701-0400
800.711.2265
fcbanking.com

IRREVOCABLE STANDBY LETTER OF CREDIT # 430R1167

Issue Date: March 11, 2016

Beneficiary:
U.S. Environmental Protection Agency
Underground Injection Control
Financial Responsibility Requirement

Applicant:
Penneco Environmental
Solutions, LLC
6608 Route 22, PO Box 300
Delmont, PA 15626

Regional Administrator
Environmental Protection Agency Region 111
1650 Arch Street, Philadelphia, PA 19103

Dear Beneficiary:

We hereby establish our Irrevocable Standby Letter of Credit No.430R1167 in your favor, at the request and for the account of, Penneco Environmental Solutions, LLC, up to the aggregate amount of twelve thousand five hundred fifteen and 00/100 U.S. Dollars ($12,515.00), available upon presentation of

1. your sight draft, bearing reference to this letter of credit No. 430R1167

AND

2. your signed statement reading as follows: "I certify that the amount of the draft is payable pursuant to regulations issued under authority of the Safe Drinking Water Act."

"This letter of credit is effective as of March 11, 2016 and shall expire on March 11, 2017, but such expiration date shall be automatically extended for a period of one year on March 11, 2017 and each successive expiration date at least 120 days before the current expiration date, we notify both you and Penneco Environmental Solutions, LLC by certified mail that we have decided not to extend this letter of credit beyond the current expiration date. In the event you are so notified, any unused portion of the credit shall be available upon presentation of your sight draft for 120 days after the date of receipt by both you and Penneco Environmental Solutions, LLC, as shown on the signed return receipts.

First Commonwealth Bank.
Time to be first.

Whenever this letter of credit is drawn on under and in compliance with the terms of this credit, we shall duly honor such draft upon presentation to us, and we shall deposit the amount of the draft directly into the standby trust fund of Penneco Environmental Solutions, LLC in accordance with your instructions.

We certify that the wording of this letter of credit is identical to the wording specified in 40 CFR 264.151(d) as such regulations were constituted on the date shown immediately below.

Sincerely,
First Commonwealth Bank

By: Karen E. Martin

Name: Karen E. Martin

Title: Loan Operations Mgr

Date: 3/29/16

This Letter of Credit is subject to and shall be governed in accordance with the terms of the Uniform Commercial Code, Article 5, Letters of Credit, 13 Pa.C.S.A. § 5101 *et seq*. ("Article 5"); and shall not be subject to or governed by the provisions of the Uniform Customs and Practice for Documentary Credit (2007 Revision) International Chamber of Commerce Publication No. 600 (the "UCP 600") or International Standby Practices Publication No. 590 (1998 Edition) (the "ISP 98"), except that where Article 5 is silent as to any issue which is addressed by the UCP 600, then the UCP 600 shall govern as to that issue only.

SECRETARY'S CERTIFICATE
(Letters of Credit)

The undersigned, being the duly appointed Secretary of First Commonwealth Bank, a Pennsylvania bank and trust company (the "Bank"), hereby certifies on behalf of the Bank as follows: (1) each person whose name appears below is the duly elected, qualified and acting incumbent in the office of the Bank set forth opposite his or her name, (2) the signature opposite the name of such person is his or her genuine signature, and (3) each person whose name appears below has been duly authorized by the Board of Directors of the Bank to execute and deliver on behalf of the Bank (a) letters of credit and (b) applications for standby letters of credit, documentary collections, bankers' acceptances and other loans and extensions of credit relating to letters of credit from one or more correspondent banks under a master letter of credit agreement:

Name	Title	Signature
T. Michael Price	Chief Executive Officer	T Michael Price
Jane Grebenc	President	Jane Grebenc
I. Robert Emmerich	Chief Credit Officer	
Tony E. Kallsen	Senior Credit Officer	
Linda A. Larotonda	Consumer Credit Services Manager	
James A. Boyle	Loan Operations Manager	James A. Boyle
Karen E. Martin	Loan Operations Manager	Karen E. Martin
Mona M. Straw	Loan Operations Manager	

IN WITNESS WHEREOF, the undersigned has signed this Secretary's Certificate as of the 26th day of July, 2013.

FIRST COMMONWEALTH BANK

By: ______________________
Matthew C. Tomb, Secretary

ATTACHMENT “U”

Description of Business

Attachment U
Description of Business
Sedat #3A Injection Well

Business Description for Sedat #3A Injection Well

The Company's business is the treatment and disposal of oil and gas well produced fluids by injection of the fluid into an underground formation via an injection well constructed by the company for this purpose.

1/4/2016

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION III
1060 Chapline Street
Wheeling, West Virginia 26003

July 8, 2016

Mr. D. Marc Jacobs, Jr., Senior Vice President
Penneco Oil Company
6608 Route 22, P.O. Box 300
Delmont, Pennsylvania 15626-0300

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

Dear Mr. Jacobs:

On April 12, 2016, the U. S. Environmental Protection Agency (EPA) received from Penneco Environmental Solutions, LLC, a permit application for a brine disposal injection well (Class IID) in Plum Borough, Allegheny County, Pennsylvania. EPA has assigned UIC facility identification number PAS2D701BALL to this well.

We have completed our initial review of the permit application. The application is comprehensive and addresses the majority of the critical permitting issues. However, there are a few items which require further explanation before we can finalize a Draft Permit and a Statement of Basis which summarizes the proposed brine disposal well operation. Specifically, please provide a response to the items described in Attachment 1.

Please send your response to me. Once we have received the necessary information we will continue with development of a draft permit, statement of basis and preparations for public participation including a public notice. Thank you for your cooperation with this matter. Please contact me at 304 234-0286 with any questions.

Sincerely,

Mark Nelson

Mark Nelson, Hydrologist
Water Protection Division

Attachment

Attachment

Comments and Questions

Item 1. <u>Application Page</u>

The location provided (latitude/longitude) in the application cover page does not match the location provided in the half mile and other Area of Review (AOR) maps. On the maps provided in the AOR attachment, the proposed injection well is southwest of the location specified on the application cover page. Please verify the correct coordinates of the well, and if incorrect, adjust the Area of Review accordingly. Should this change any wells captured in the Area of Review, update all records accordingly.

Item 2. <u>Attachment B – Area of Review</u>

40 CFR 144.31(e)(7) requires a topographic map (or other map if a topographic map is unavailable) extending one mile beyond the property boundaries of the source depicting the facility and each of its intake and discharge structures; each of its hazardous waste treatment, storage, or disposal facilities; each well where fluids from the facility are injected underground; and those wells, springs, and other surface water bodies, and drinking water wells listed in public records or otherwise known to the applicant within a quarter mile of the facility property boundary.

Past practice has been to require applicants to include this information for ½ mile from the injection well. The definition of ¼ mile from the facility property boundary has been challenged and Region 3 has used ¼ mile past the area of review (1/2 mile total) in past permits. Applicant provided a map showing water wells, however a narrative explaining that the search was done within a ½ mile should be included. Depths of these water wells should be included in the table. Also, a list of all landowners within this expanded area and their addresses must be submitted.

Item 3. <u>Attachment E – USDWs</u>

Pennsylvania Geological Report #37 states, "The Conemaugh Group is a reliable source of small to moderate supplies of water. Some wells yield more than 100 gpm, but the median yield for wells in this aquifer is 20 gpm. The deepest water well reported in the Conemaugh Group was drilled 640 feet and produced 25 gpm. Chemical analyses of ground water in the Conemaugh Group show a wide range in chemical character. The range of dissolved solids is from 99 to 722 mg/1. Data are available for one well in the Mauch Chunk Formation. This well is 615 feet deep and yields 254 gpm."

Several well logs show fresh water below the proposed injection well surface casing depth. Well 003-22200 indicated fresh water at a depth of 700 feet, Well 003-22205 indicated fresh water at 870 feet, and Well 129-23073 indicated fresh water at 1,755 feet. Applicant needs to clarify their definition of "fresh" water. The UIC regulations protect USDWs, which are all aquifers with water quality less than 10,000 mg/L and capable of supplying a public water supply (1 gallon per minute).

Based on this information, further data is needed in order to determine the depth of the lowermost USDW. Include the geological name and depth of bottom of all USDWs in the AOR. USDWs include all aquifers with water quality less than 10,000 milligrams per liter of total dissolved solids (TDS) and capable of yielding 1 gallon per minute of water. These aquifers need not presently supply drinking water to be considered a USDW. Additionally, any zone currently supplying drinking water regardless of quality is a USDW.

The depths of the USDWs are to be determined, if possible, from evaluation of the borehole electric log and, in some case, the porosity log in combination with available information on the geologic formations present in the area. The water resistivity of the deepest USDW is to be calculated by the static spontaneous potential method and converted to TDS (mg/l) or sodium chloride equivalent to verify that the zone in question has less than 10,000 mg/1 TDS. It may be necessary to calculate TDS in lower geologic units to verify that the overlying unit is the lowest USDW. Where information is available on USDWs in an area, it may not be necessary to calculate TDS. However, the site-specific depths of the USDWs should be determined from the borehole logs. The entire log should be provided in the permit application and the depth and name of all formations should be indicated on the log. The water resistivity calculations and TDS conversion factors should also be provided.

If an electric log is unavailable or not useable for the well, a log from a nearby well (preferably within the AOR) may be substituted. If no log is available from the well or any well in the vicinity, the USDWs are to be identified on the basis of the best available information (i.e. geologic references; driller's logs; etc.).

For existing wells or proposed well conversions: The permit application for any existing well or any well convened after the effective date of the UIC program must provide an electric log through the entire wellbore unless logs are available from a well within the AOR. Per 40 CFR §146.22(f), the logs should be evaluated by a knowledgeable log analyst. All formations should be identified on the log or a separate listing provided with the names and depths to bottom.

Item 4. Attachment G – Geologic Data

The table in Attachment G lists a well with permit #003-21289 as being captured within the ¼ mile Area of Review. This well number does not exist in any records provided. Based upon the mapping and locational data provided, it is assumed that the well intended to be referenced is #003-21287 (Howard 1). If this is the case please provide an update to Attachment G reflecting the correct well number in the table.

Item 5. Attachment G – Geologic Data

Provide additional details of the methodology for arriving at an injection zone Fracture Gradient (FG) of 1.23 including the Specific Gravity of the fluid used during the well stimulation/injection tests.

Item 6. Attachment G – Geologic Data

Pages 29 through 35 of the HFRAC Report in application Attachment G are illegible. Provide a legible copy of these pages.

Item 7. Attachment G – Geologic Data

Justify why 1.8mD was chosen as the permeability value for the injection zone. The permeability table, total porosity vs. permeability, and the geologic report indicate permeability values as highly variable in the Murrysville Sandstone layer.

Item 8. Attachment G – Geologic Data

The permit application states, "While there are some deep seated basement faults associated with the Rome Trough in the AOR there are no apparent faults at shallower depths." Please expand in detail the mapping and review done to determine the absence of faults and folds in the lease. Provide the sources of information used to determine the absence of faults.

Please also submit a seismic evaluation of the area. This evaluation can include published geologic reports and other available information including: surrounding geologic quadrangle maps in the vicinity of the injection well, the United States Geologic Survey (USGS) Hazard Maps, and boring logs generated during drilling operations for comparison to the geologic quadrangle maps. The evaluation should include a narrative supported by evidence of why the proposed injection will not induce seismicity. Also included in this section would be a summary of the history of production from the Murrysville in the project area and a discussion on any seismic activity that has occurred in the area.

Attachment D of the permit application includes a cross section. Please include a narrative discussing whether there is or is not geologic displacement in the area to further substantiate information on whether faulting does or does not exist in the area.

Item 9. Attachment H – Operating Data

Provide additional details on the source of the injection fluid including a more specific description of the locations of the producing wells and the producing formations. Confirm that all produced fluids originate from Penneco owned wells.

Item 10. <u>Attachment P – Monitoring Program</u>

Provide additional details for the monitoring/sampling program, including the frequency, for proposed monitoring well Sedat # 1 003-21210. Describe the observations which will be conducted at this well and the criteria/parameters for evaluating the results.

PENNECO

Notice of Deficiency Response

Penneco Environmental Solutions, LLC

Underground Injection Control Program
Class IID Injection Well Permit Application

Sedat #3A

PENNECO
YOUR ENERGY EXPLORATION PARTNER

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 ¼ mile to ½ 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 ¼ mile to ½ 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.

6608 Route 22, P.O. Box 300
Delmont, PA 15626-0300
Ph: (724) 468-8232
Fax: (724) 468-8230
Email: penneco@penneco.com
Web: Penneco.com

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

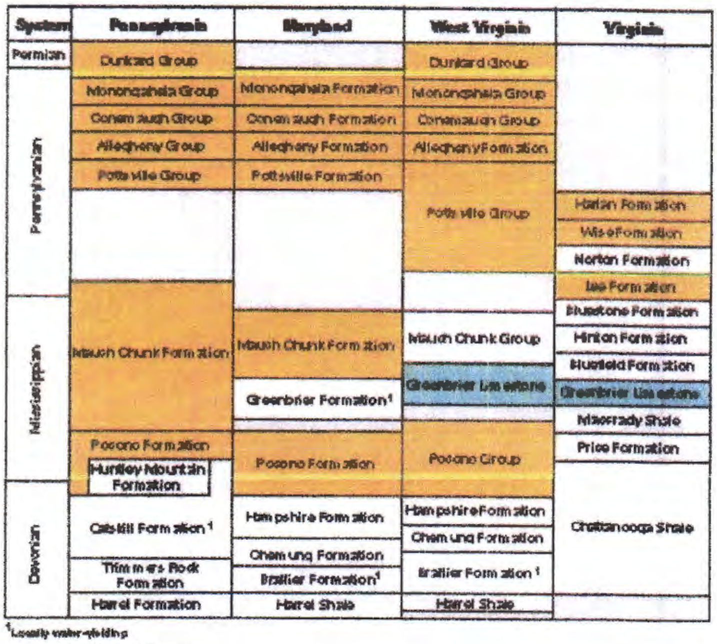
The Sedat #3A AOR is located in the Pittsburgh Low Plateau Section of the Appalachian Plateau physiographic province (refer to map at the end of this attachment). Underlying rock types are shale, siltstone, sandstone, limestone and coal. Aquifers in the AOR are mainly sandstones of the Conemaugh Group 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 Plateaus 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.



Modified from:

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

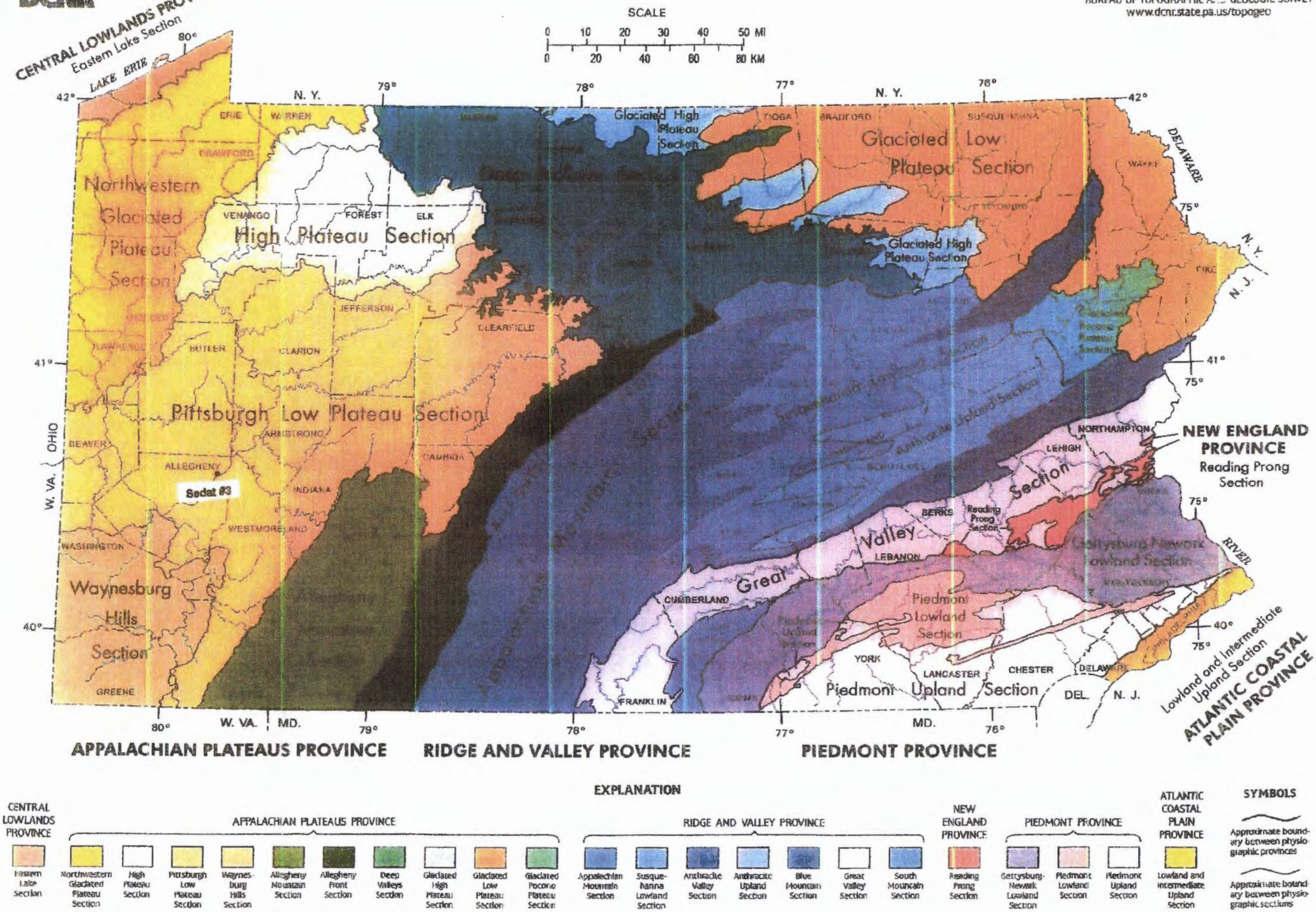
______1985b, Correlation of stratigraphic units of North America (COSUNA) Project, northern Appalachian region: American Association of Petroleum Geologists, 1 sheet.

MAP 13

DCNR

PHYSIOGRAPHIC PROVINC[illegible] OF PENNSYLVANIA

COMMONWEALTH OF PE[illegible]NSYLVANIA
DEPARTME[illegible]
CONSERVATION AND N[illegible] RESOURCES
BUREAU OF TOPOGRAPHIC A[illegible] GEOLOGIC SURVEY
www.dcnr.state.pa.us/topogeo



Compiled by W. D. Sevon Fourth Edition, 2000.

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 #	
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 where 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.

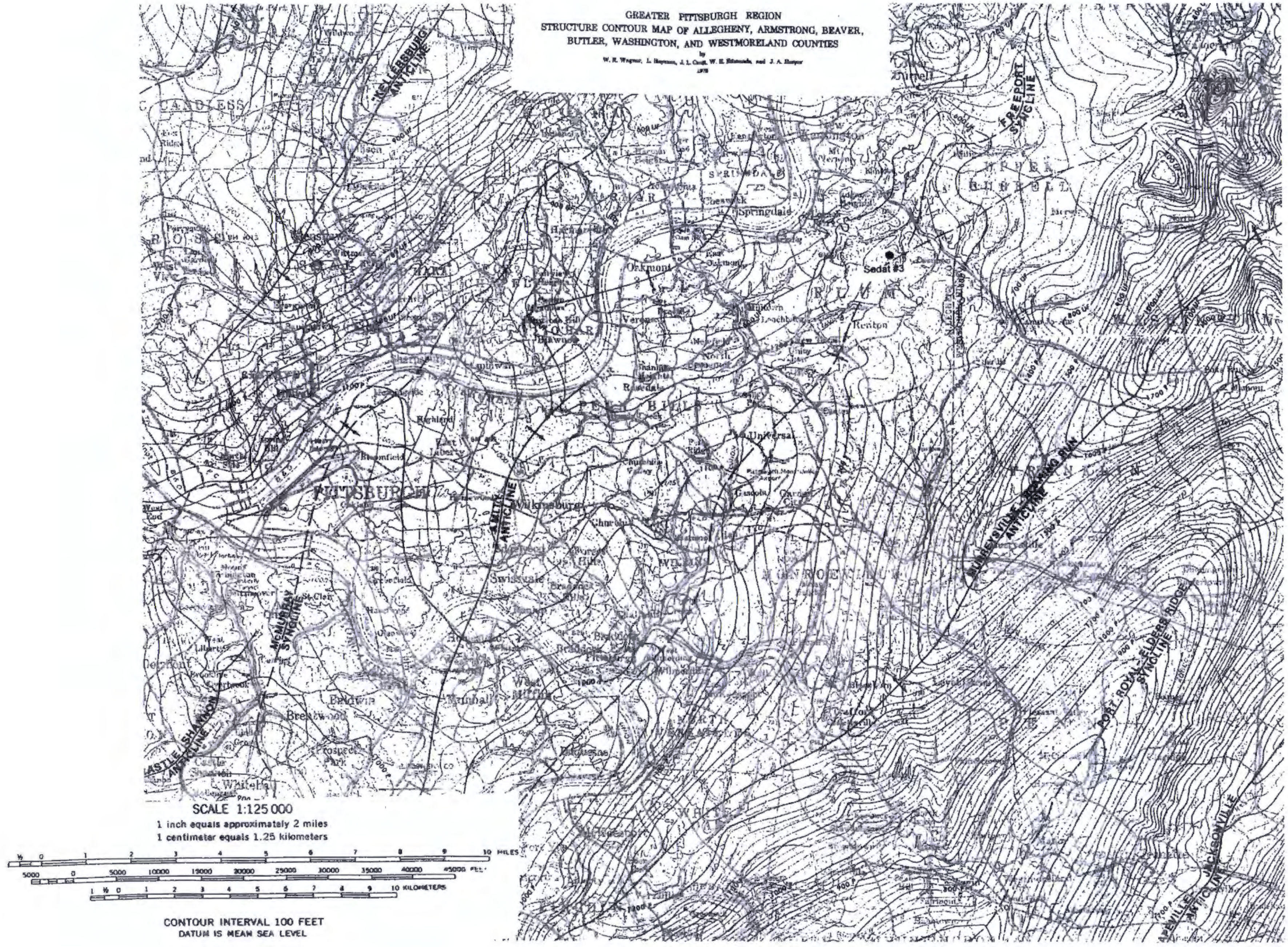
The U.S.G.S rates the probability of seismic activity in SW Pennsylvania with sufficient intensity to cause damage as low. A series of four earthquake maps from the U.S.G.S earthquake hazards program website are found at the end of this attachment.

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.

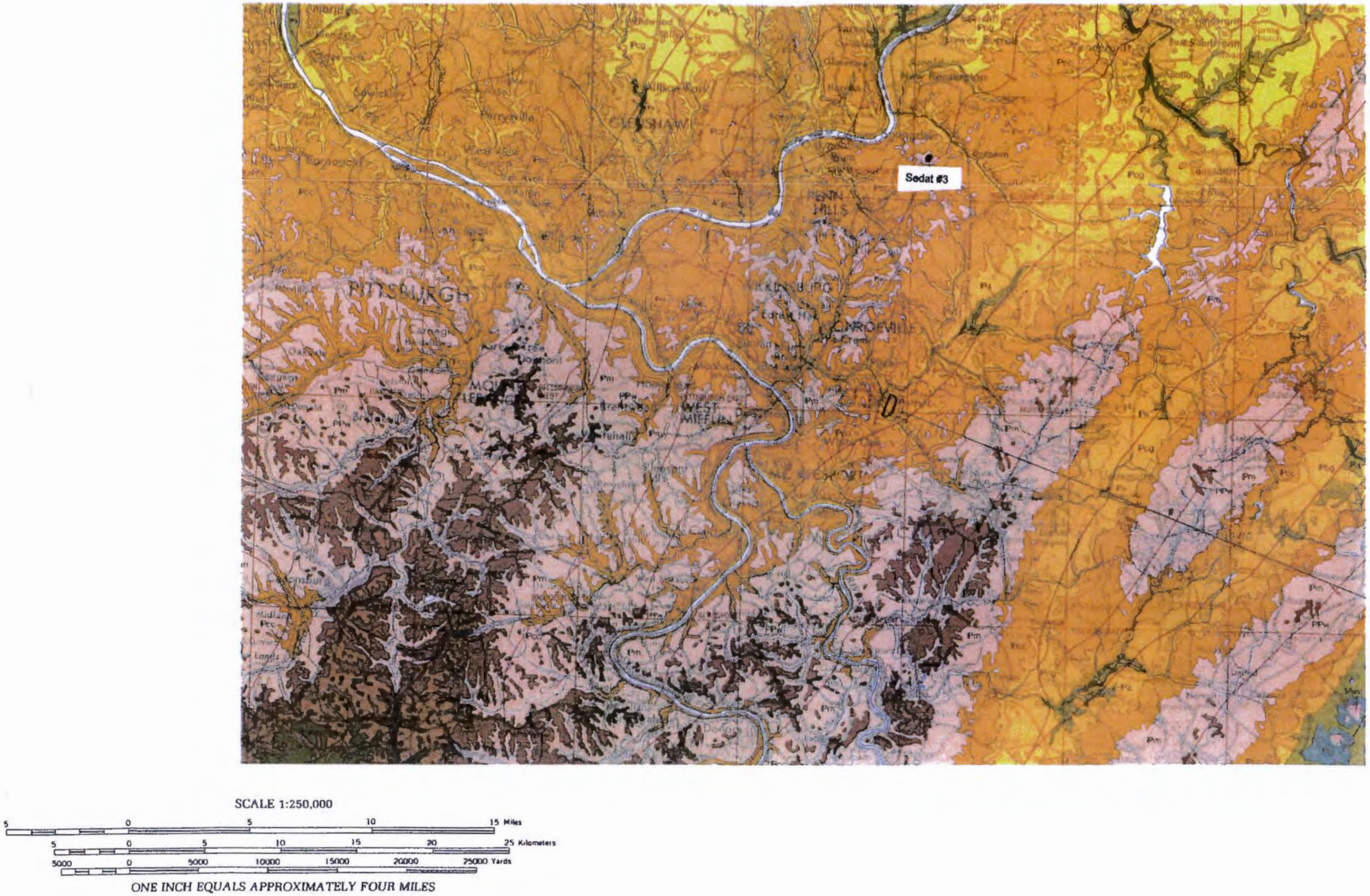
Earthquake Maps 3 and 4 are from U.S.G.S. open file report <u>2016 One Year Seismic Hazard Forecast for the Central and Eastern United States from Induced and Natural Earthquakes OFR-2016-1035</u>. Map 3 shows there is a small chance (one percent) that ground shaking greater then IV on the Modified Mercalli 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.

Map 1


GREATER PITTSBURGH REGION
STRUCTURE CONTOUR MAP OF ALLEGHENY, ARMSTRONG, BEAVER, BUTLER, WASHINGTON, AND WESTMORELAND COUNTIES
KELLERSBURG ANTICLINE
FREEPORT SYNCLINE
AMITY ANTICLINE
McMURRAY SYNCLINE
CASTLE SHANNON ANTICLINE
BURRELLSVILLE ANTICLINE
PORT ROYAL-ELDERS RIDGE SYNCLINE
JACKSONVILLE ANTICLINE
PITTSBURGH
Wilkinsburg
Springdale
Oakmont
Renton
Sedat #3
Universal
Swissvale
West Mifflin
Baldwin
Brentwood
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 WELL SERVICES

SUPERIOR
Black Lick, Pa.
Mercer, Pa.
Wooster, Ohio
Charleston, W Va

GAMMA RAY
NEUTRON
DENSITY
DUAL INDUC

CPNY PENNECO OIL COMPANY
WELL MARDMDA HOMES #1 (PM-
FIELD MURRYSVILLE QUADRANG
CO. WESTMORELAND ST.PA

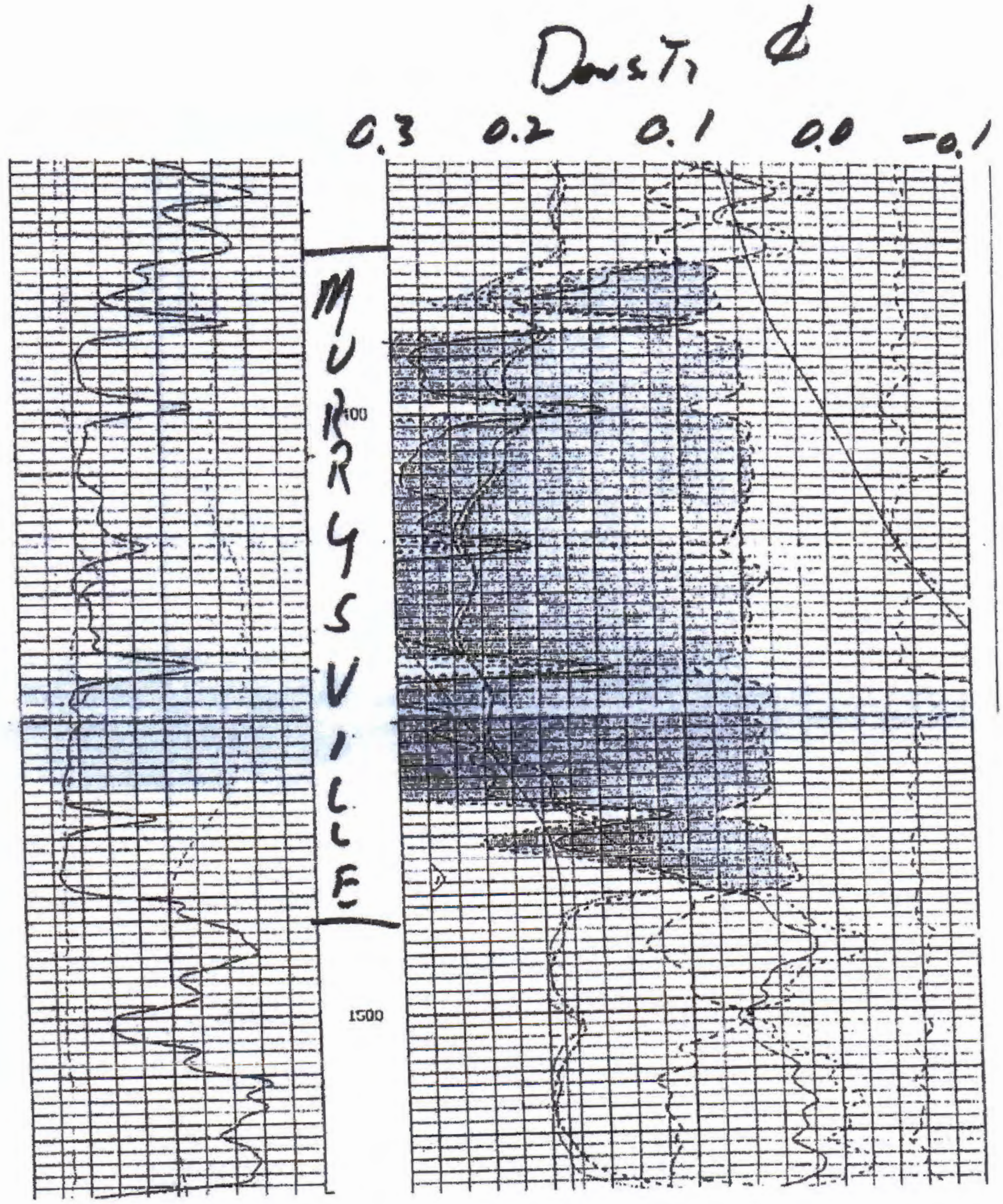
COMPANY PENNECO OIL COMPANY
WELL MARDMDA HOMES #1 (PM-594)
FIELD MURRYSVILLE QUADRANGLE
COUNTY WESTMORELAND STAT

LOCATION
PERMIT#37-129-24721
0° WEST LONG:79°37'58.2"
0° SOUTH LAT:40°29'24.5"

SEC. ______ TWP. WASHINGTONE, ______

PERMANENT DATUM GROUND LEVEL ELEV. 1120 FT.
LOG MEASURED FROM TOP OF 7" ABOVE PERMANENT DATUM
DRILLING MEASURED FROM K.B.

DATE	06-14-02		
RUN NO.	ONE		
DEPTH-DRILLER	3550 FT.		
DEPTH-LOGGER	3537 FT.		
BTM. LOG INTER.			
TOP LOG INTER.	0 FT.		
CASING-DRILLER	1200 FT.		
CASING-LOGGER	1200 FT.		
BIT SIZE	6.25 IN.		
FLUID TYPE	AIR/GAS		
DENS. : VISC.	N/A		
PH : FLUID LOSS	N/A		
SOURCE OF SAMPLE	N/A		
RM @ MEAS. TEMP.	N/A		
RMF @ MEAS. TEMP.	N/A		
RMC @ MEAS. TEMP.	N/A		
SOURCE: RMF/RMC	N/A		
RM @ BHT	N/A		
TIME SINCE CIRC.	N/A		
MAX. REC. TEMP.	N/A		
EQUIP.: LOCATION	D058/BLKLCK		
RECORDED BY	JERRY MOORE		
WITNESSED BY	MR. JACOBS		


Density φ
0.3 0.2 0.1 0.0 -0.1
MURRYSVILLE
1400
1500

LDT

Schlumberger

DOMINION EXPLORATION & PRODUCTION, INC.

JACOB SNYDER UNIT #3 (WPA06512)
HEMPFIELD TWP
WESTMORELAND PENNSYLVANIA

COUNTY: WESTMORELAND
Field: HEMPFIELD TWP
Location: LATITUDE: 40-15-34.2700
Well: JACOB SNYDER UNIT #3 (WP
Company: DOMINION EXPLORATION & P

LITHO DENSITY
COMPENSATED NEUTRON / GR
ARRAY INDUCTION / TEMPERATURE

LOCATION

LATITUDE: 40-15-34.2700	Elev.:	K.B.	
LONGITUDE: 79-40-1.3600		G.L.	1080 ft
11711' S & 106' W OF NE CORNER		D.F.	
Permanent Datum: GROUND LEVEL	Elev.:	1080 ft	
Log Measured From: KB	8.0 ft	above Perm. Datum	
Drilling Measured From: KB			

API Serial No	MAP SECTION:	TOWNSHIP:	QUAD:
37-129-25581-00	8	HEMPFIELD	IRWIN

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	9.625 in @ 354 ft	@
Casing Schlumberger	398 ft	
Bit Size	8.875 in	
Type Fluid In Hole	AIR / GAS / PRODUCED FLUIDS	
MUD Density / Viscosity	0 lbm/gal	
MUD Fluid Loss / PH		
MUD Source Of Sample		
RM @ Measured Temperature	@	@
RMF @ Measured Temperature	@	@
RMC @ Measured Temperature	@	@
Source RMF / RMC		
RM @ MRT / RMF @ MRT	@ 70 / @ 70	@ / @
Maximum Recorded Temperatures	70 degF	
Circulation Stopped / Time		
Logger On Bottom / Time	31-Aug-2005 / 18:40	
Unit Number / Location	3069 / BRADFORD	
Recorded By	TIM LYON, MIKE KORNACKI	
Witnessed By	NATE ZIMMERMAN, MELISSA THARP	

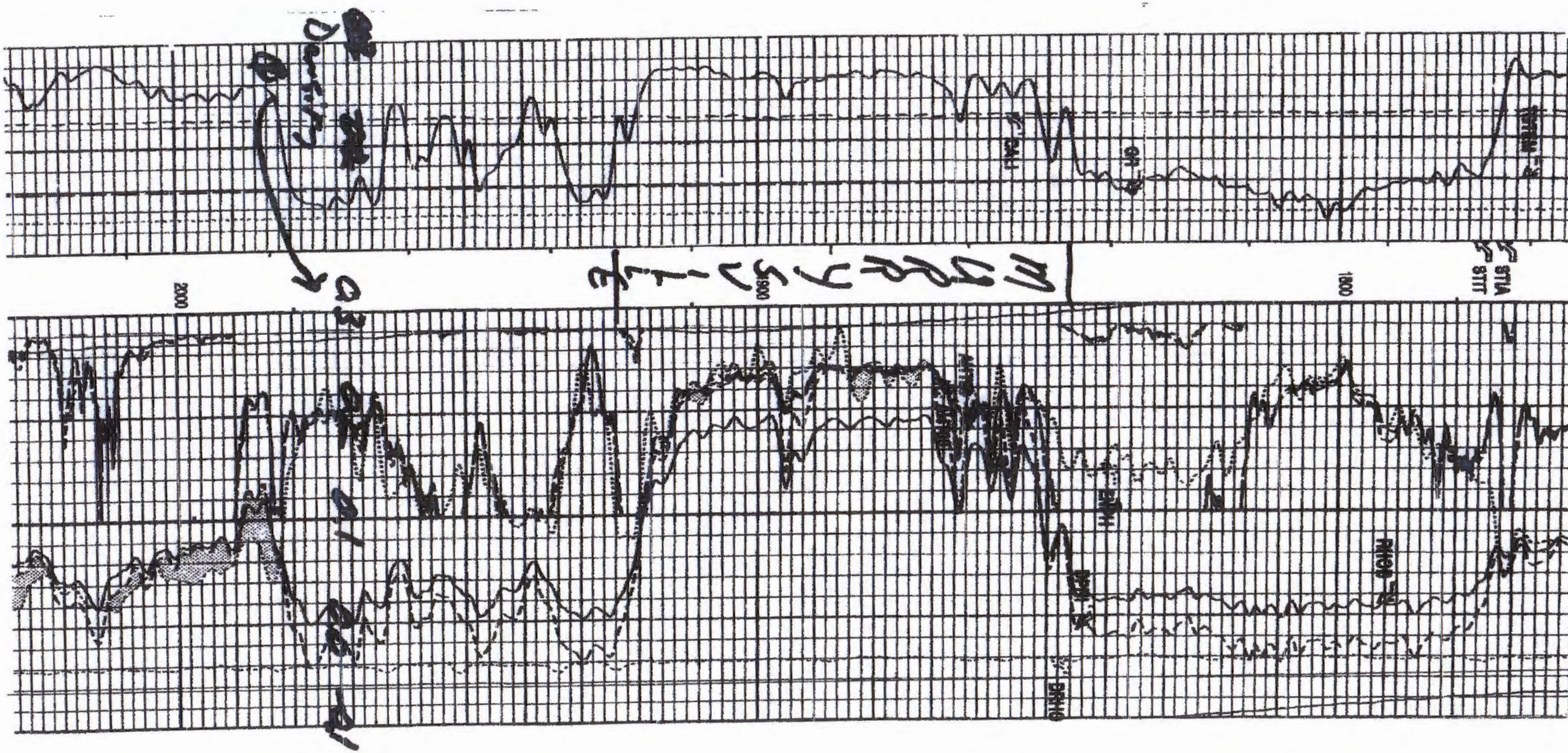
	Run 1	Run 2	Run 3	Run 4

Logging Date				
Run Number				
Depth Driller				
Schlumberger Depth				
Bottom Log Interval				
Top Log Interval				
Casing Driller Size @ Depth	@		@	
Casing Schlumberger				
Bit Size				
Type Fluid In Hole				
MUD Density / Viscosity				
MUD Fluid Loss / PH				
MUD Source Of Sample				
RM @ Measured Temperature	@		@	
RMF @ Measured Temperature	@		@	
RMC @ Measured Temperature	@		@	
Source RMF / RMC				
RM @ MRT / RMF @ MRT	@	@	@	@
Maximum Recorded Temperatures				
Circulation Stopped / Time				
Logger On Bottom / Time				
Unit Number / Location				
Recorded By				
Witnessed By				

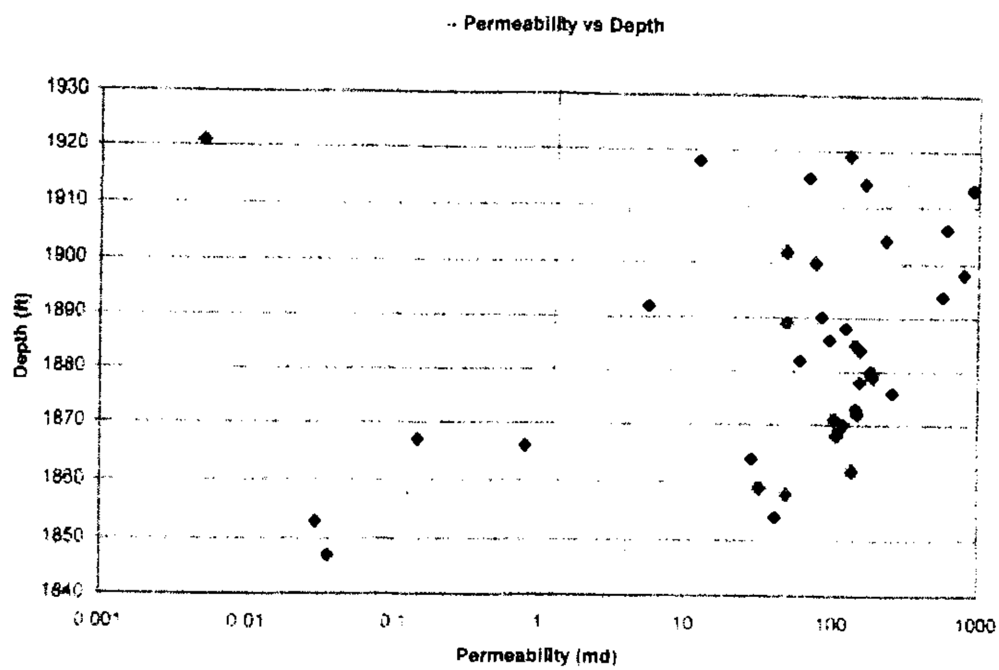
DISCLAIMER

Jacob Snyder Unit #3

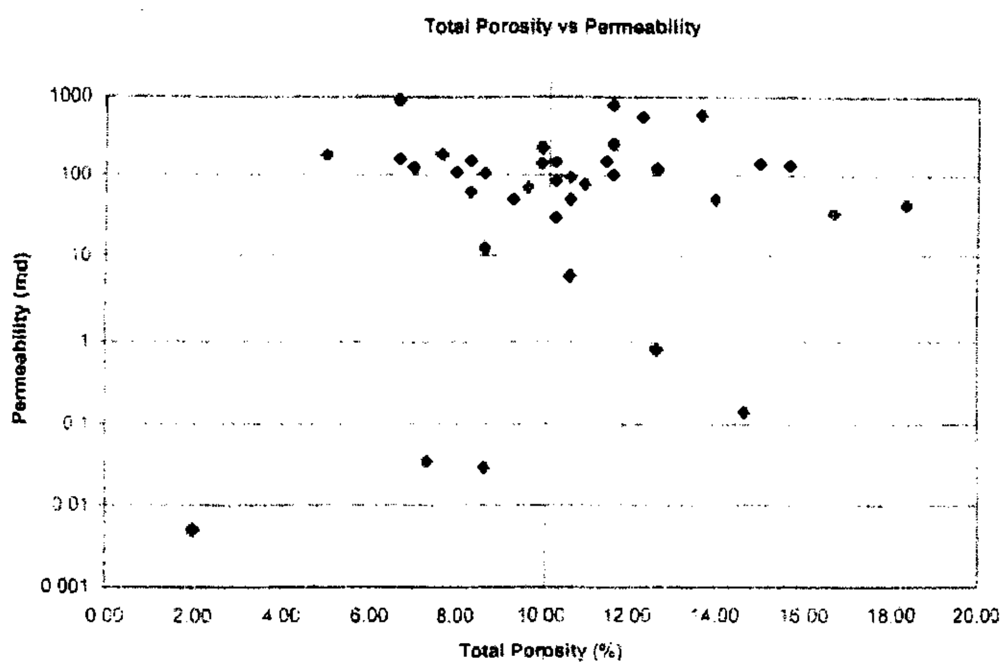
129-25521



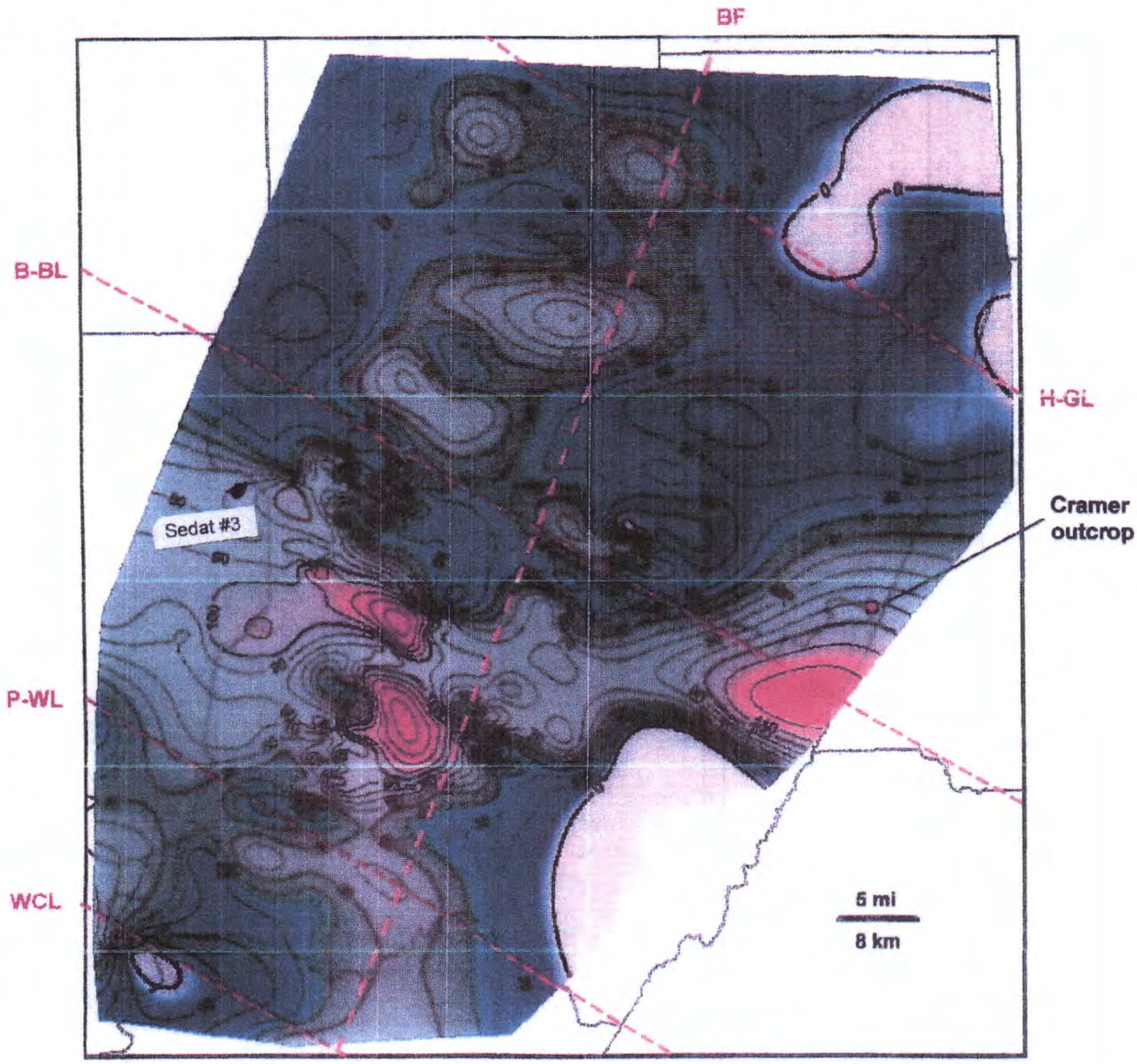
Permeability vs Depth



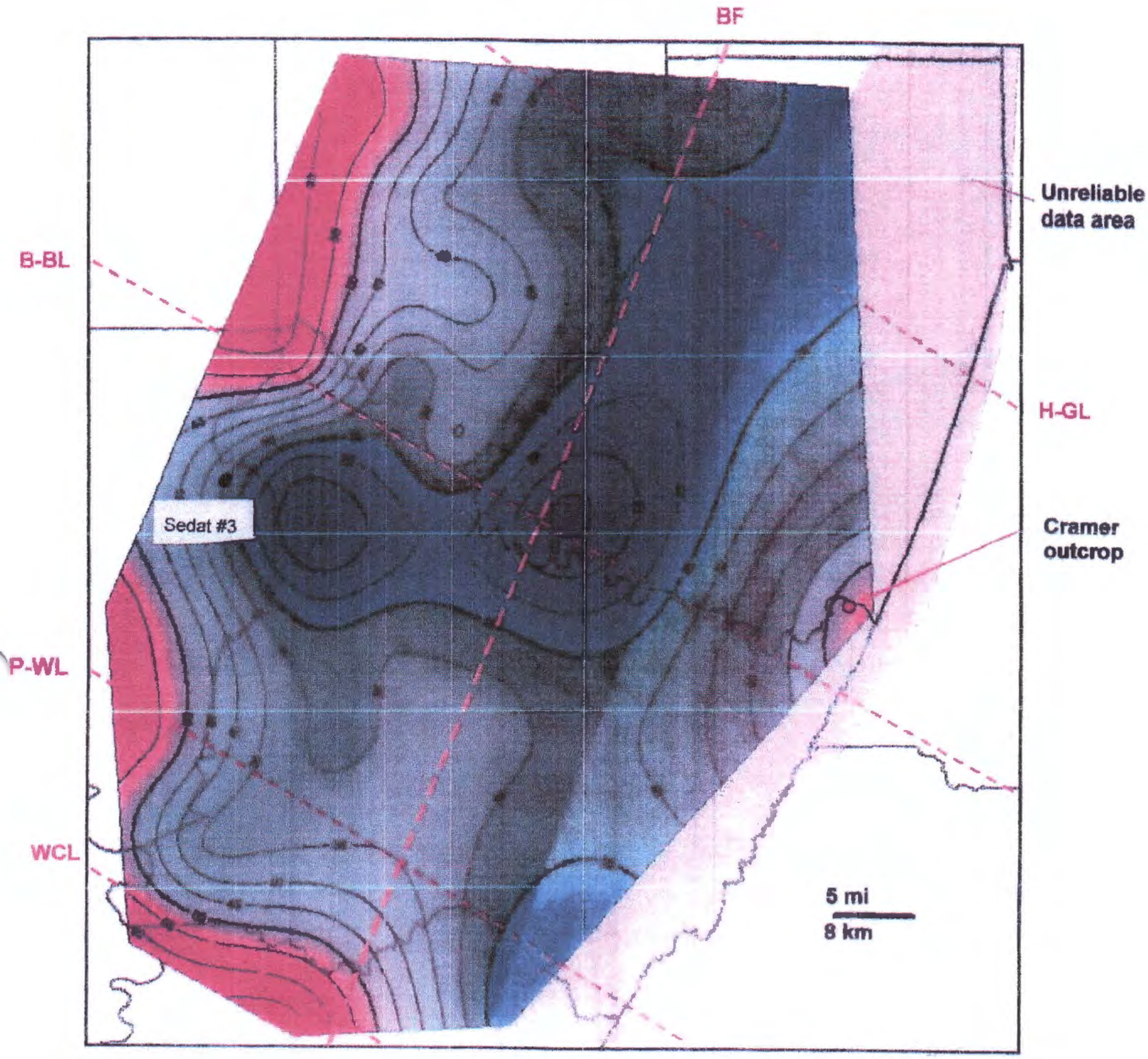
Total Porosity vs Permeability



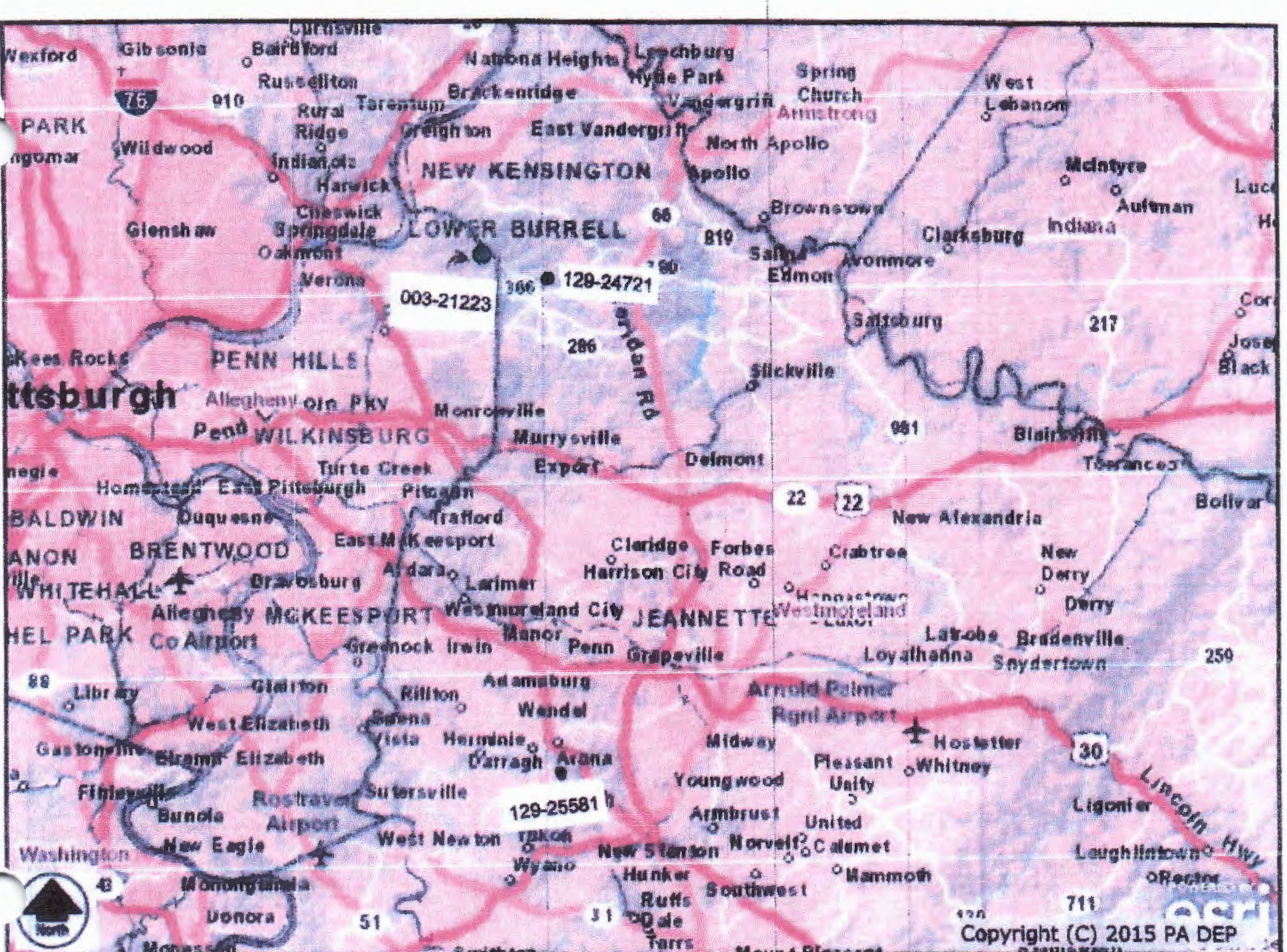
Sage, Melissa, 2007. Petrologic study of Murrysville sandstone in SW PA



Map 3. Riddlesburg Shale Isopach Map
McDaniel, Bret, 2006. Subsurface Stratigraphy and Depositional Controls on Late Devonian-Early Mississippian Sediments in SW PA



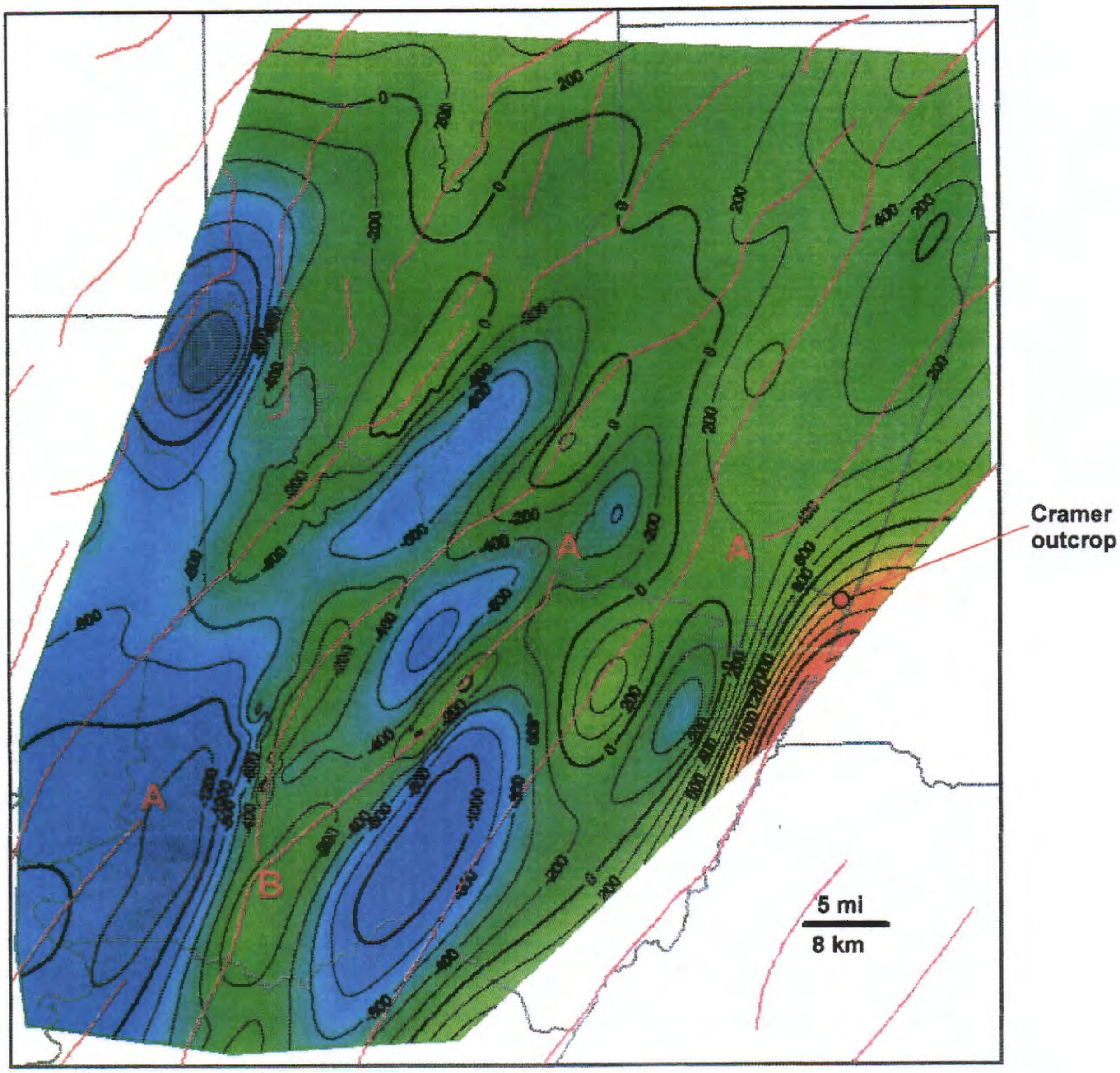
Map 4. Riceville-Oswayo Shale Isopach Map
McDaniel, Bret, 2006. Subsurface Stratigraphy and Depositional Controls on Late Devonian-Early Mississippian Sediments in SW PA.



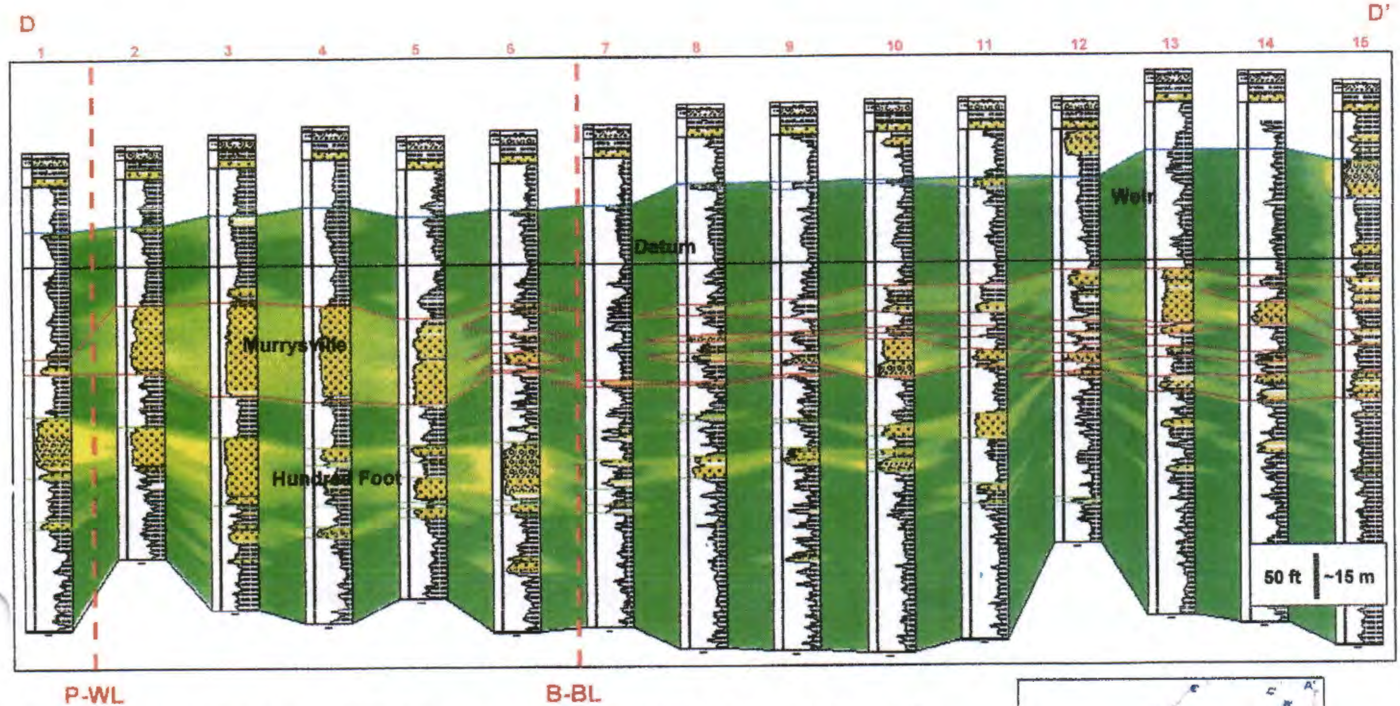
10 Miles

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



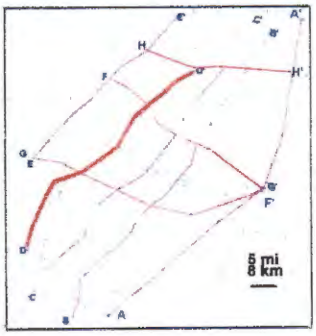


Figure 34. Cross section along D-D'. The most dramatic thinning occurs along this line as the Murrysville crosses the Blairsville-Broadtop Lineament (B-BL). Also evident is that there are two thick sequences of Murrysville, one thick and blocky in the southwest and another that lies to the northeast. 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

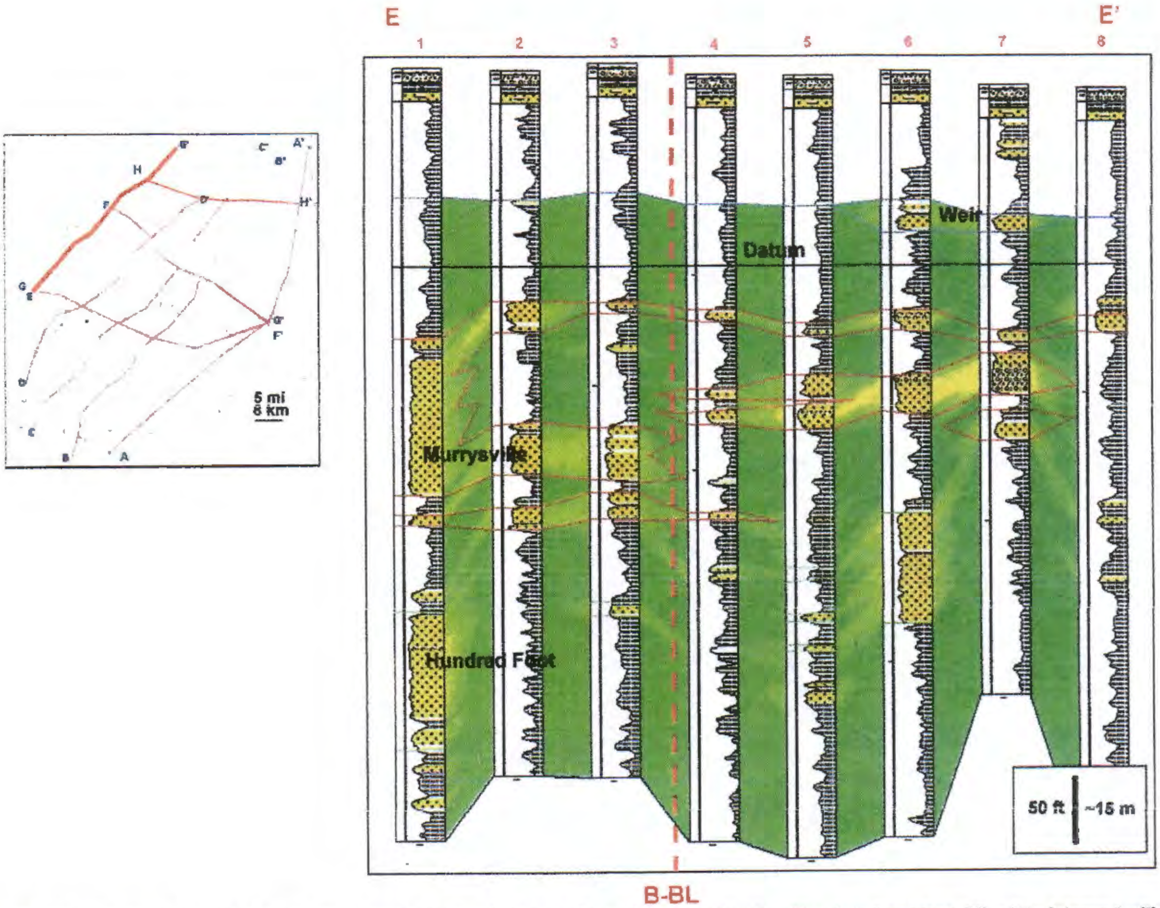


Figure 35. Cross-section along E-E'. This is the most erratic section in terms of correlative sand units. The data becomes difficult to interpret within this section, but there is still some evidence that the Blairsville-Broadtop Lineament (B-BL) may have had some influence on deposition of the Murrysville. 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

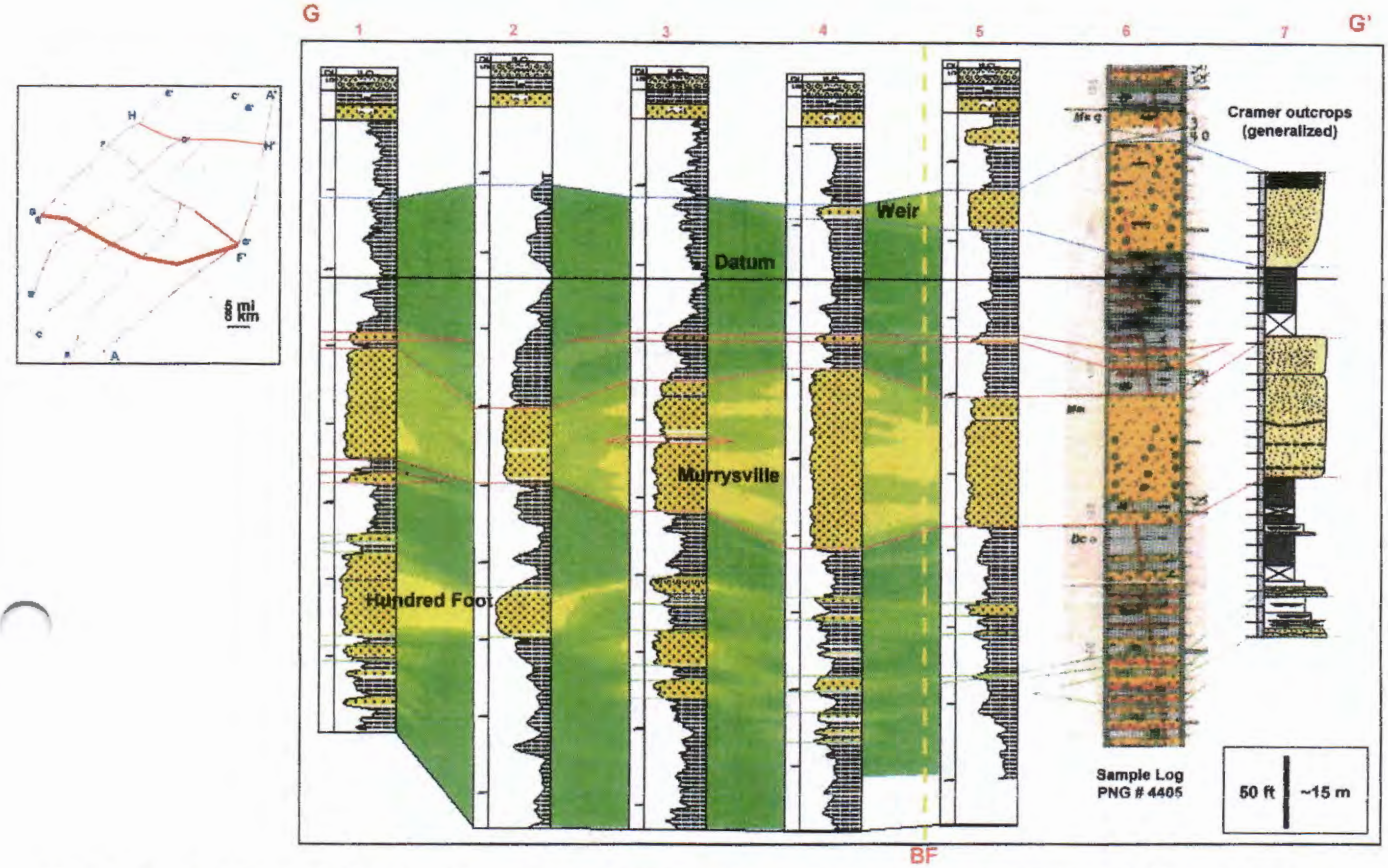


Figure 37. Cross section along G-G' section. This section attempts to tie the well log section to the outcrop data along the major Murrysville trend. Three things are evident from the section. (1)The Weir dramatically thins to the west across the proposed basement fault. (2)The Murrysville displays a 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.

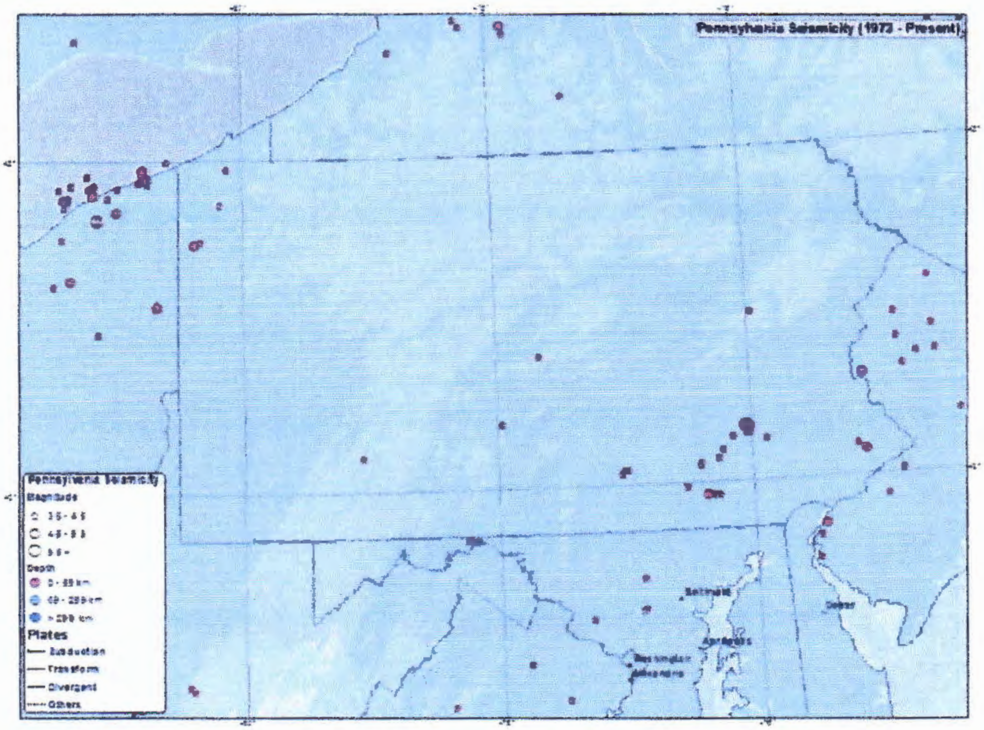
Cross Section G-G'

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

Earthquake Hazards Program

Pennsylvania

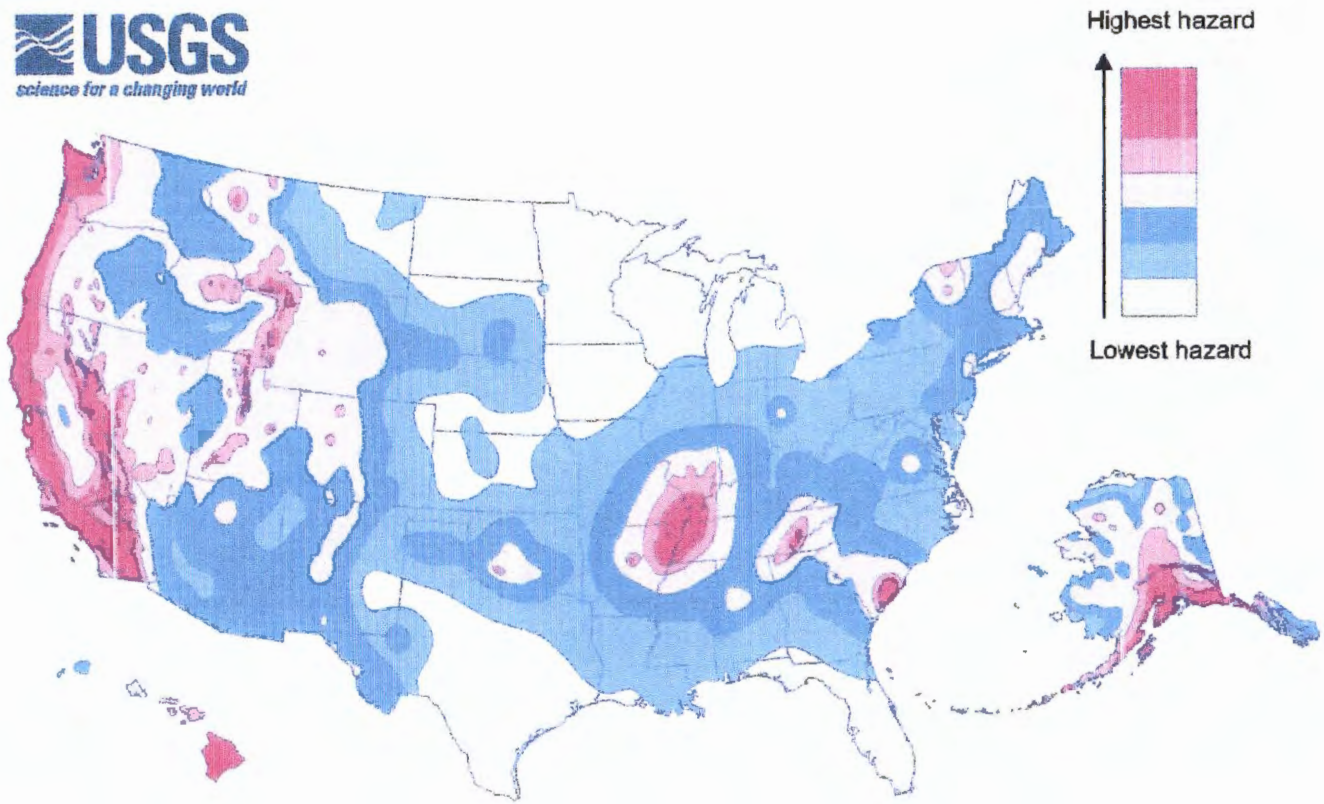
Seismicity Map - 1973 to March 2012



Share this page: Facebook Twitter Google Email

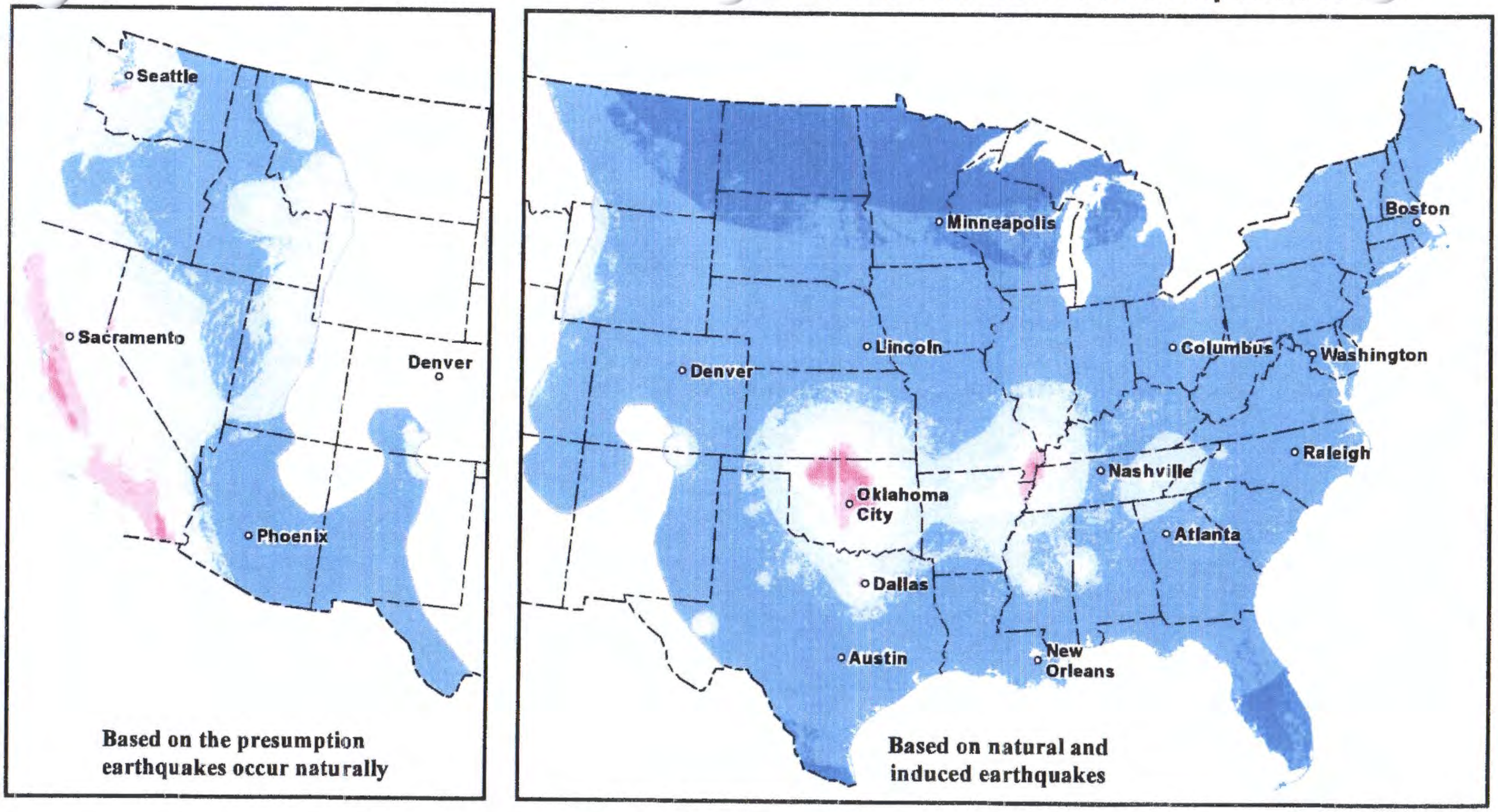
Earthquake Map 1

USGS
science for a changing world



Earthquake Map 2

JSGS Forecast for Ground Shaking Intensi rom Natural and Induced Earthquakes in

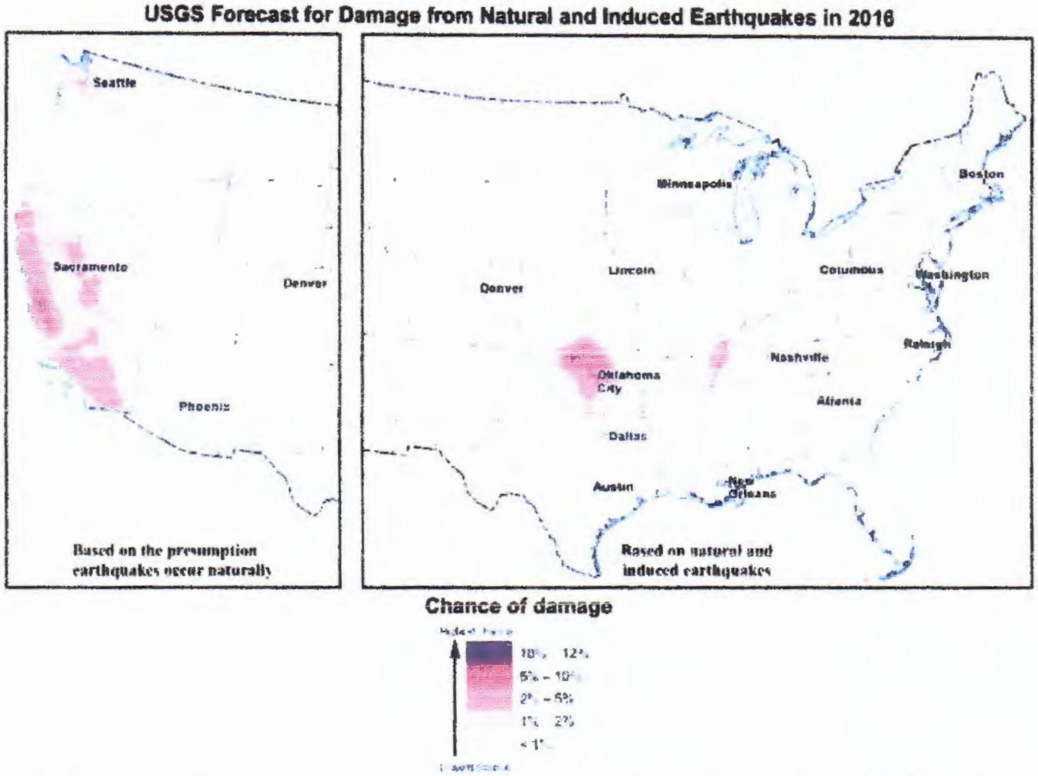


Modified Mercalli Intensity

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 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

PennState Extension

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

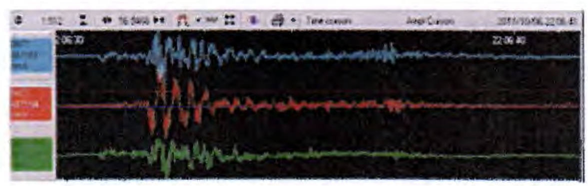
14:29 Review of building the PA Seismic network

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

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

Andy Nyblade
Department of Geosciences, Penn State University
May 19, 2016

PennState

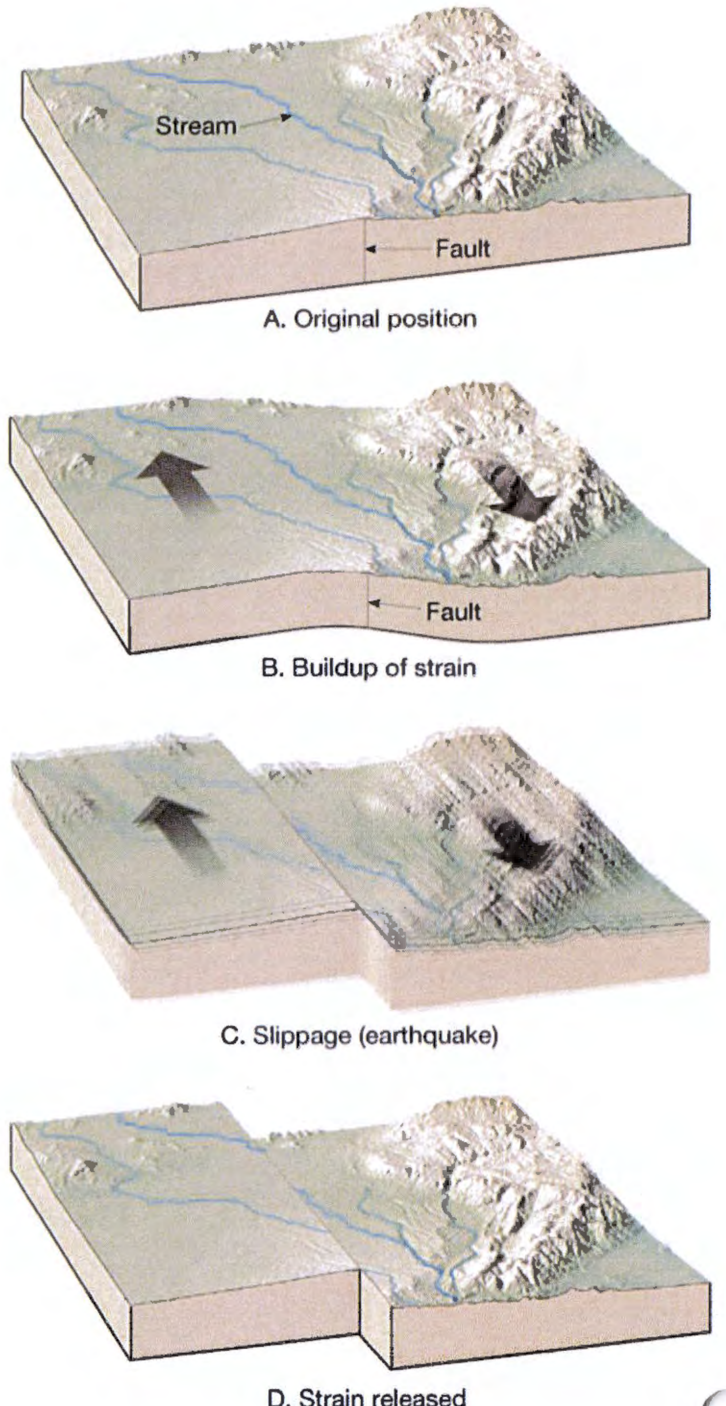
pennsylvania
DEPARTMENT OF CONSERVATION AND NATURAL RESOURCES

pennsylvania
DEPARTMENT OF ENVIRONMENTAL PROTECTION

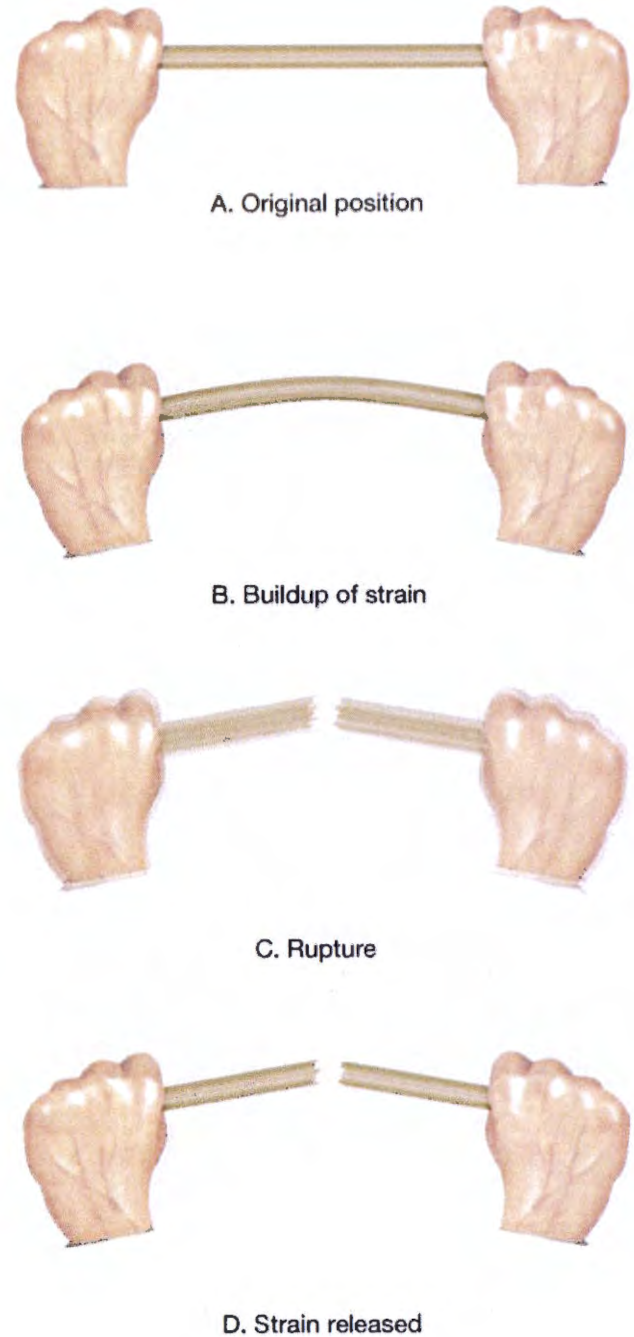
Introduction

- 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

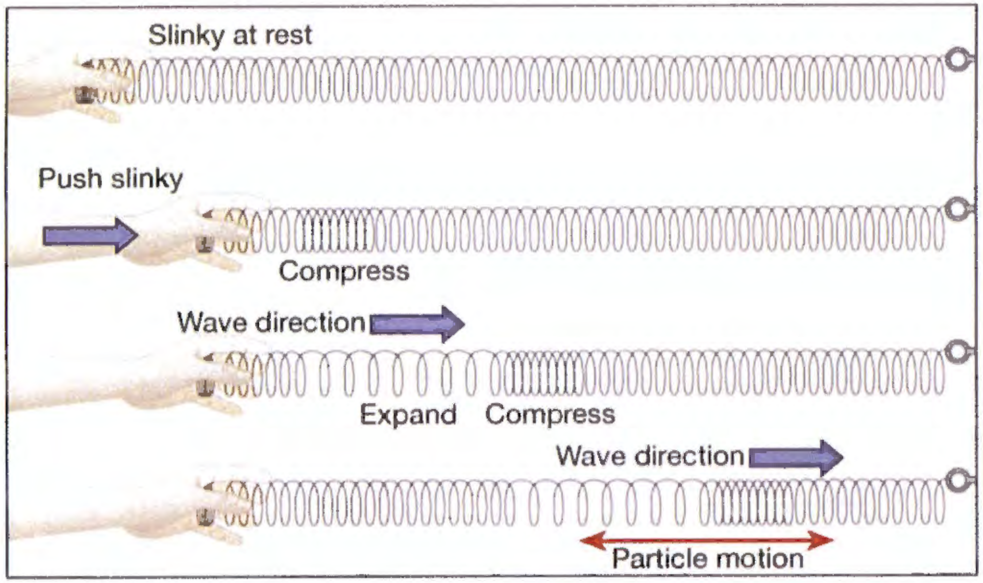
Deformation of rocks



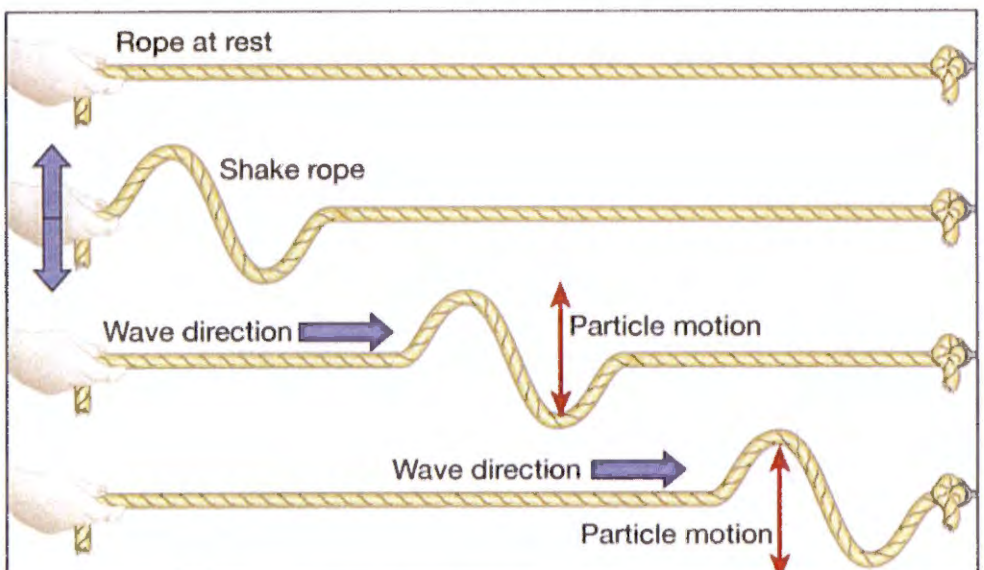
Deformation of a limber stick



Body Waves:

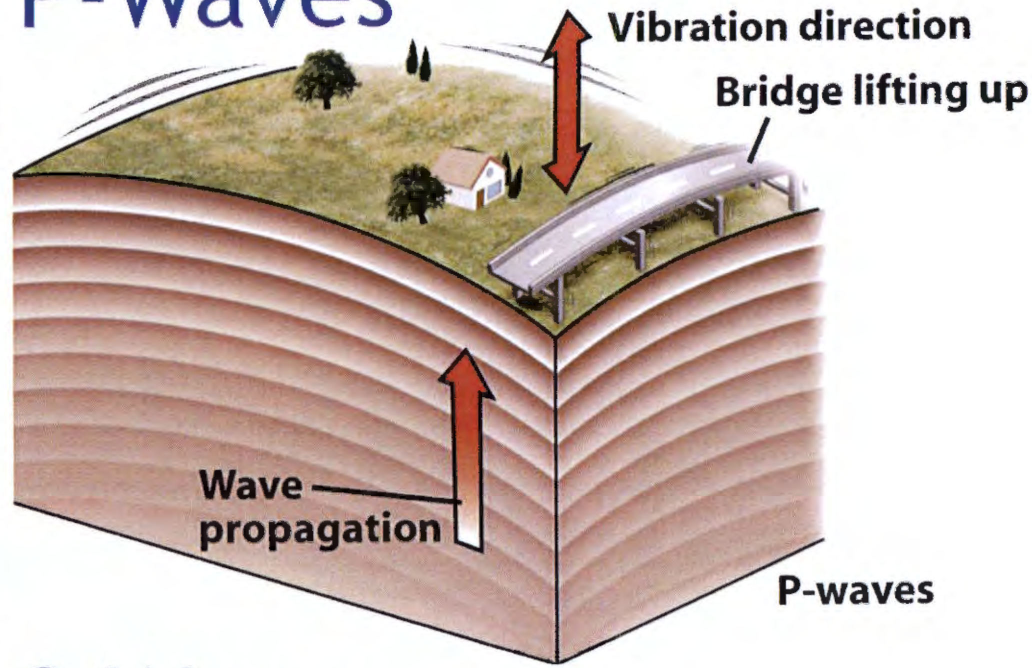


A. P waves generated using a slinky

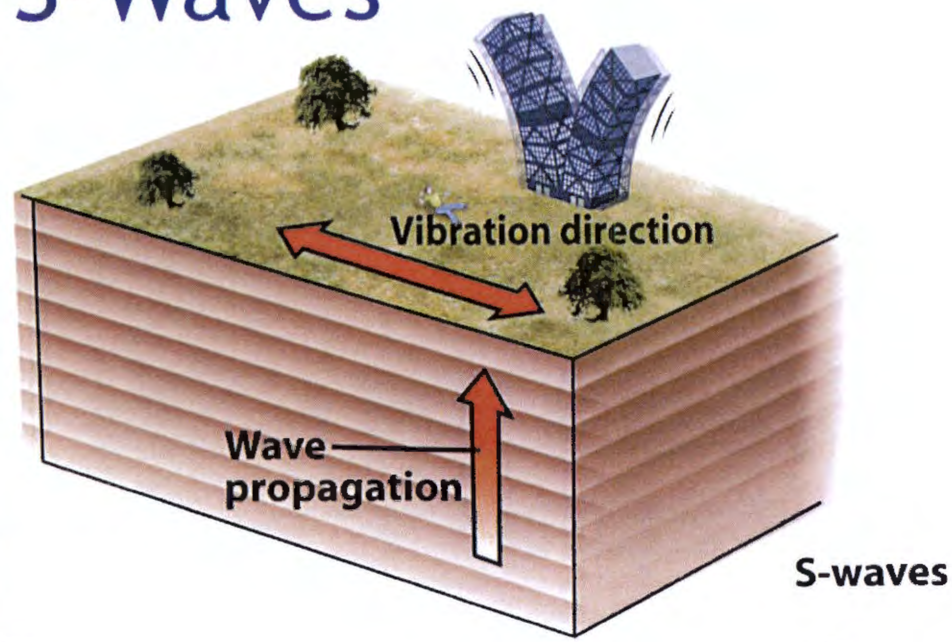


C. S waves generated using a rope

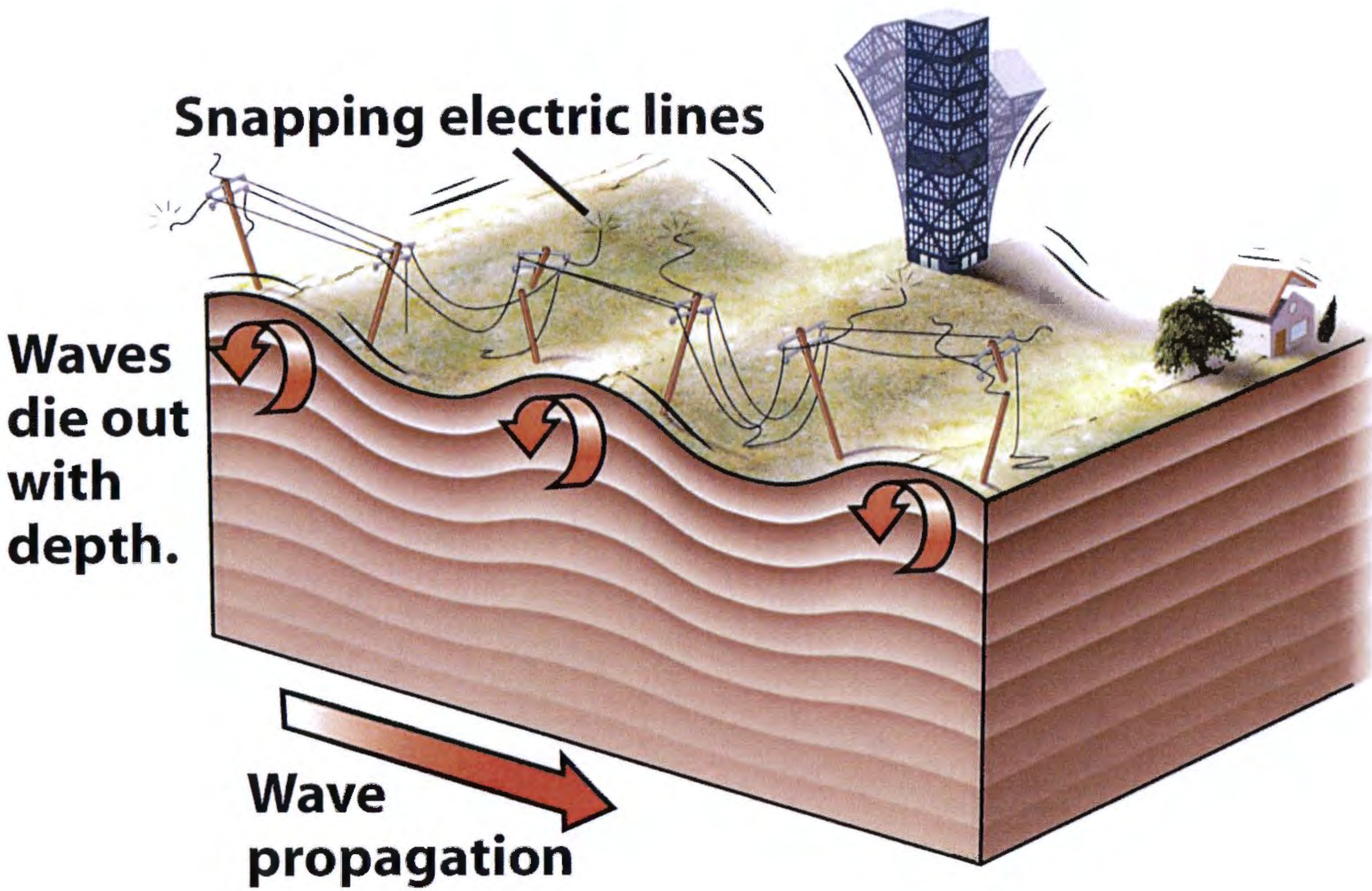
P-Waves



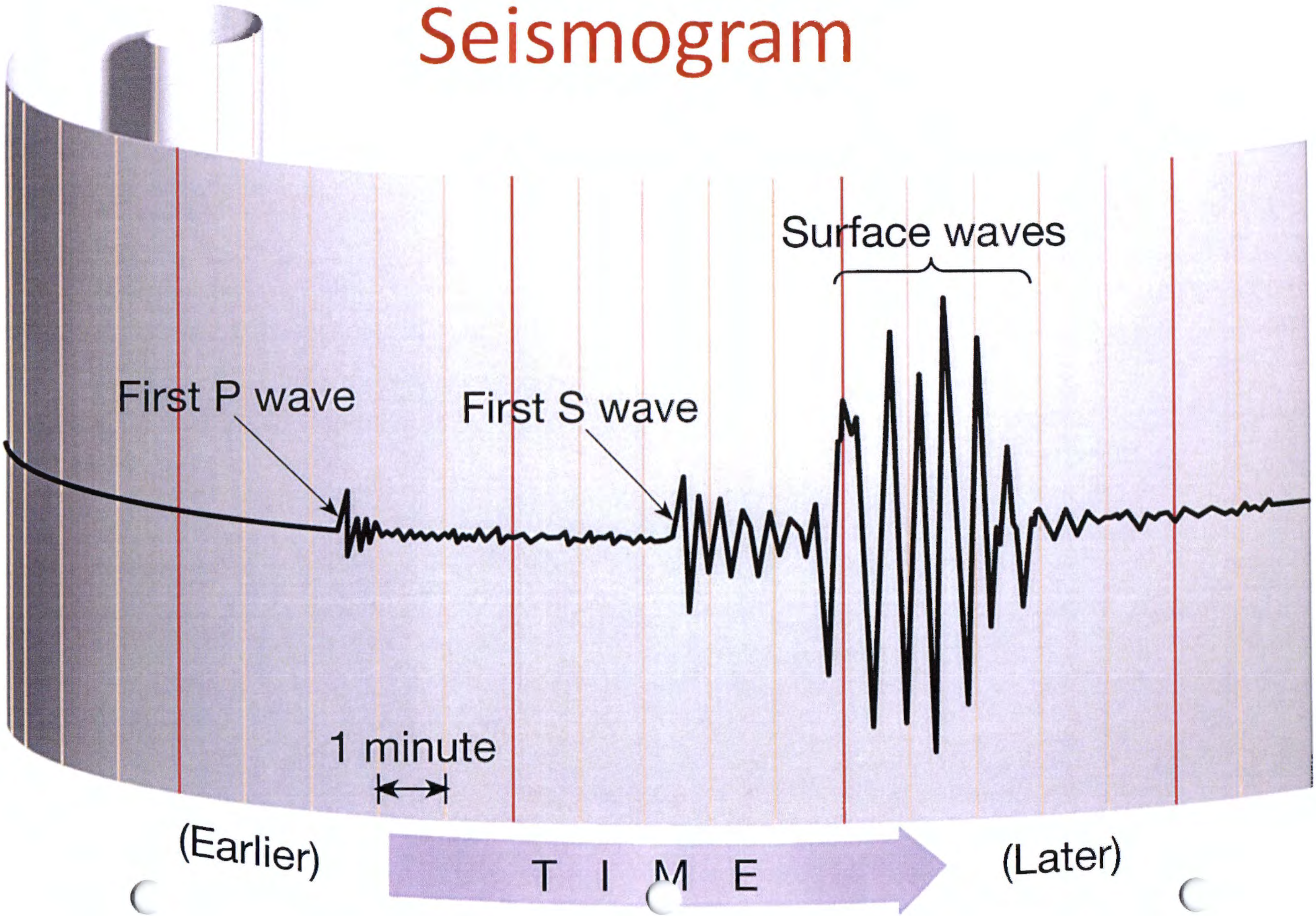
S-Waves



Surface Waves:

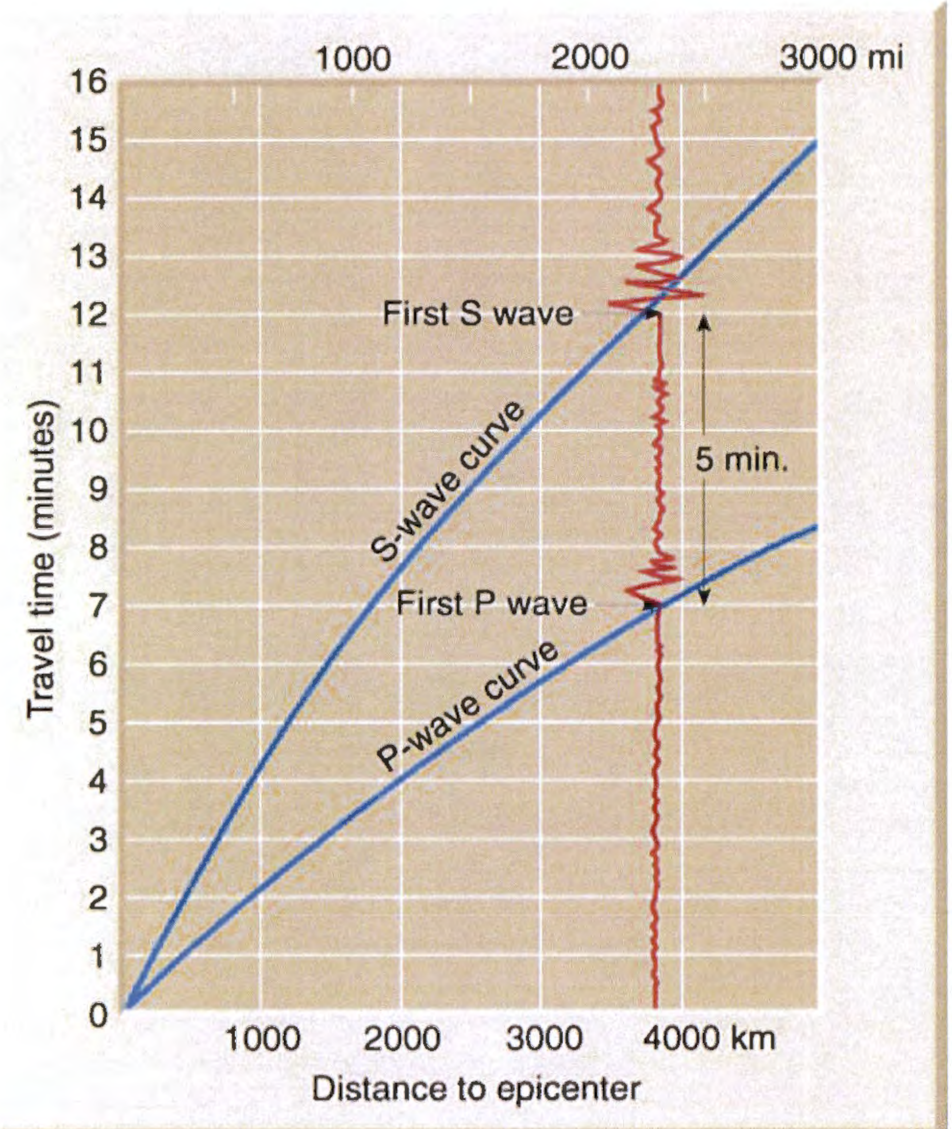


Seismogram

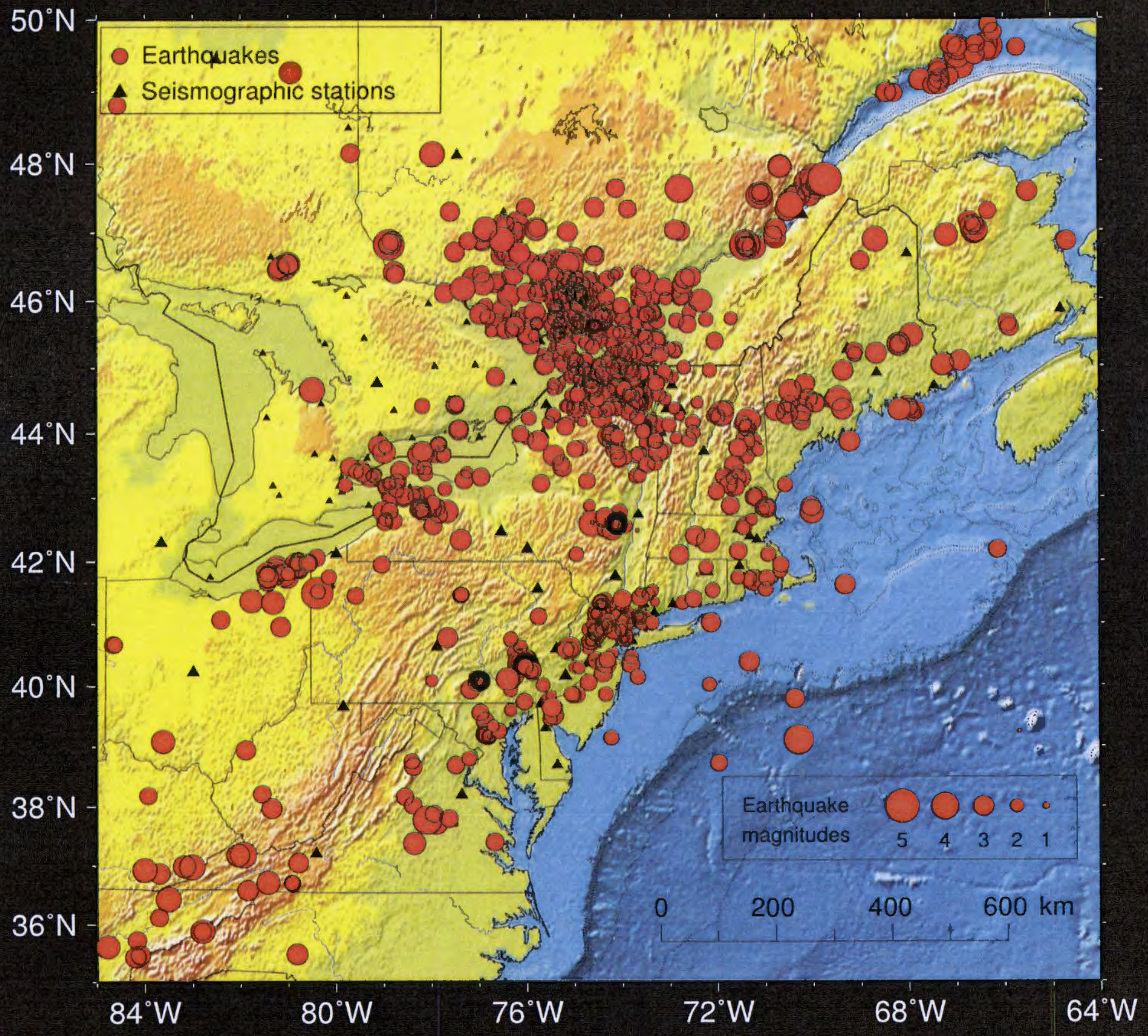


Surface waves
First P wave
First S wave
1 minute
(Earlier)
T I M E
(Later)

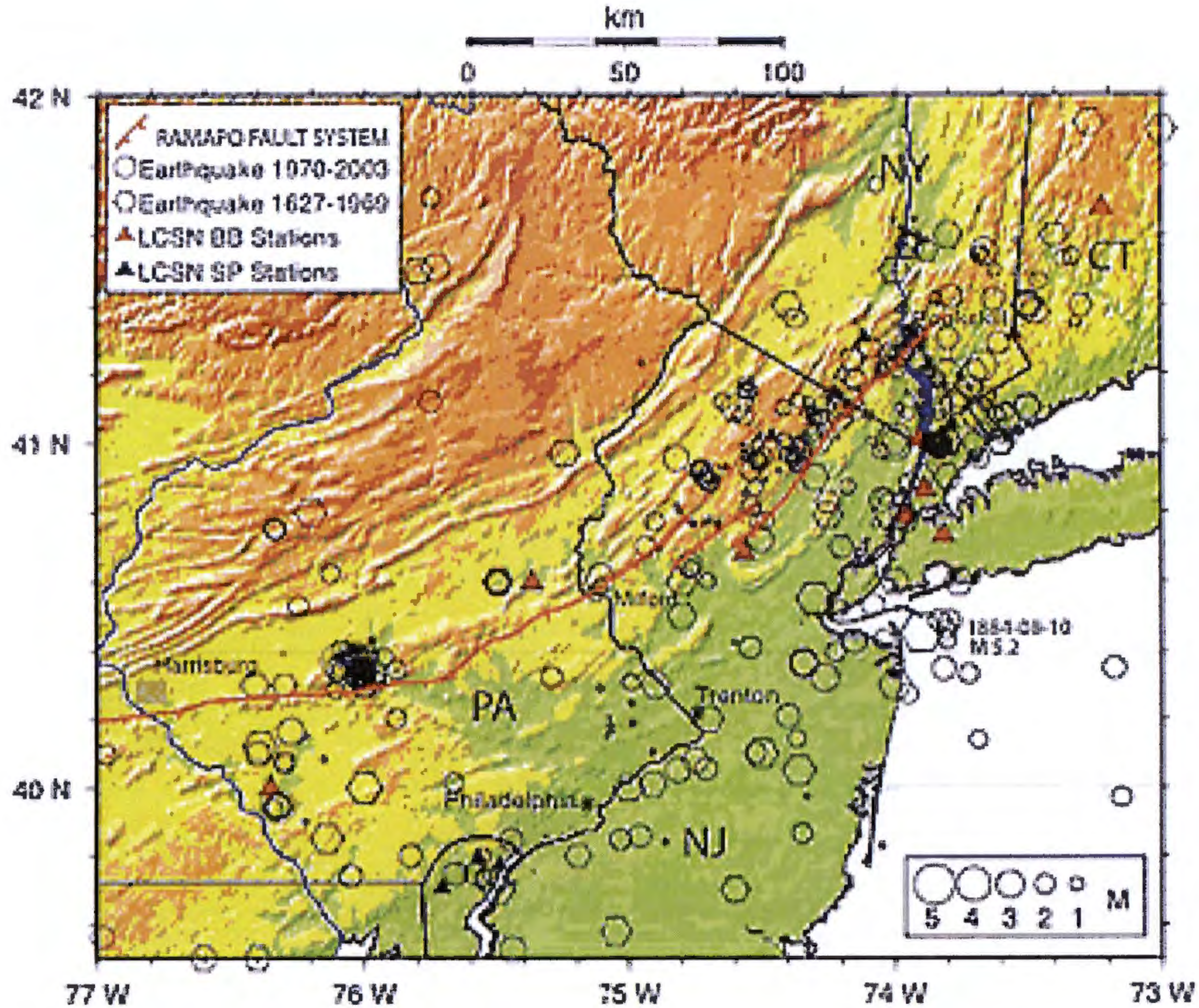
Earthquake Location



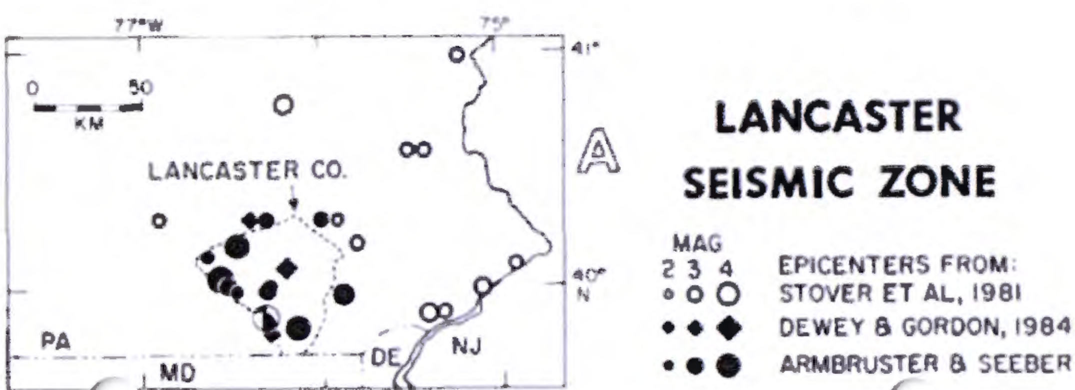
Earthquakes in NE United States and Canada 1990 - 2010



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 Observat[illegible] of Columbia University, <www.ldeo.columbia.edu/LCSN>.

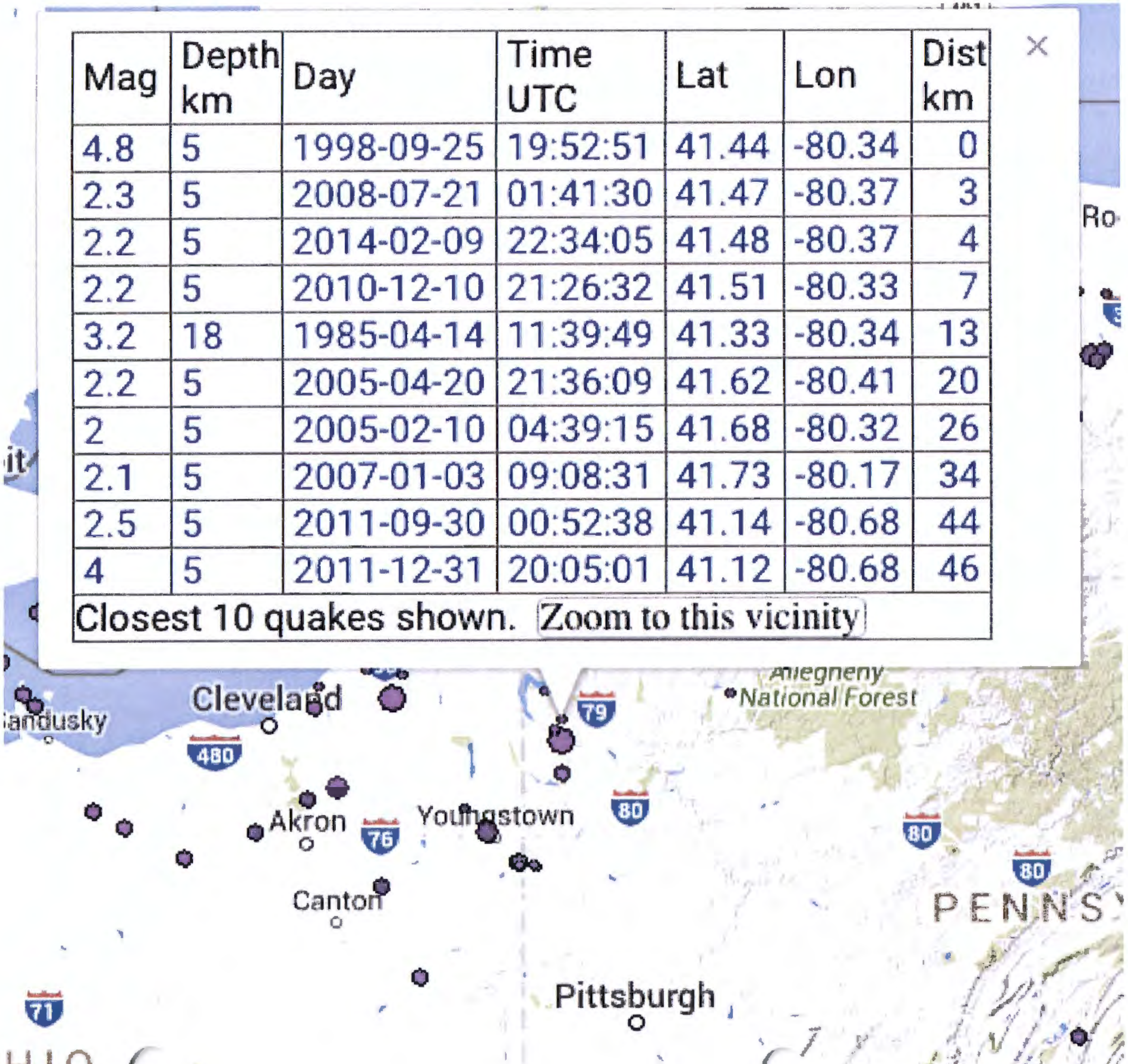


www.earthinstitute.columbia.edu/news/2004/story04-30-04b.html)



Armbruster and Seeber (1987)

IRIS Earthquake Browser

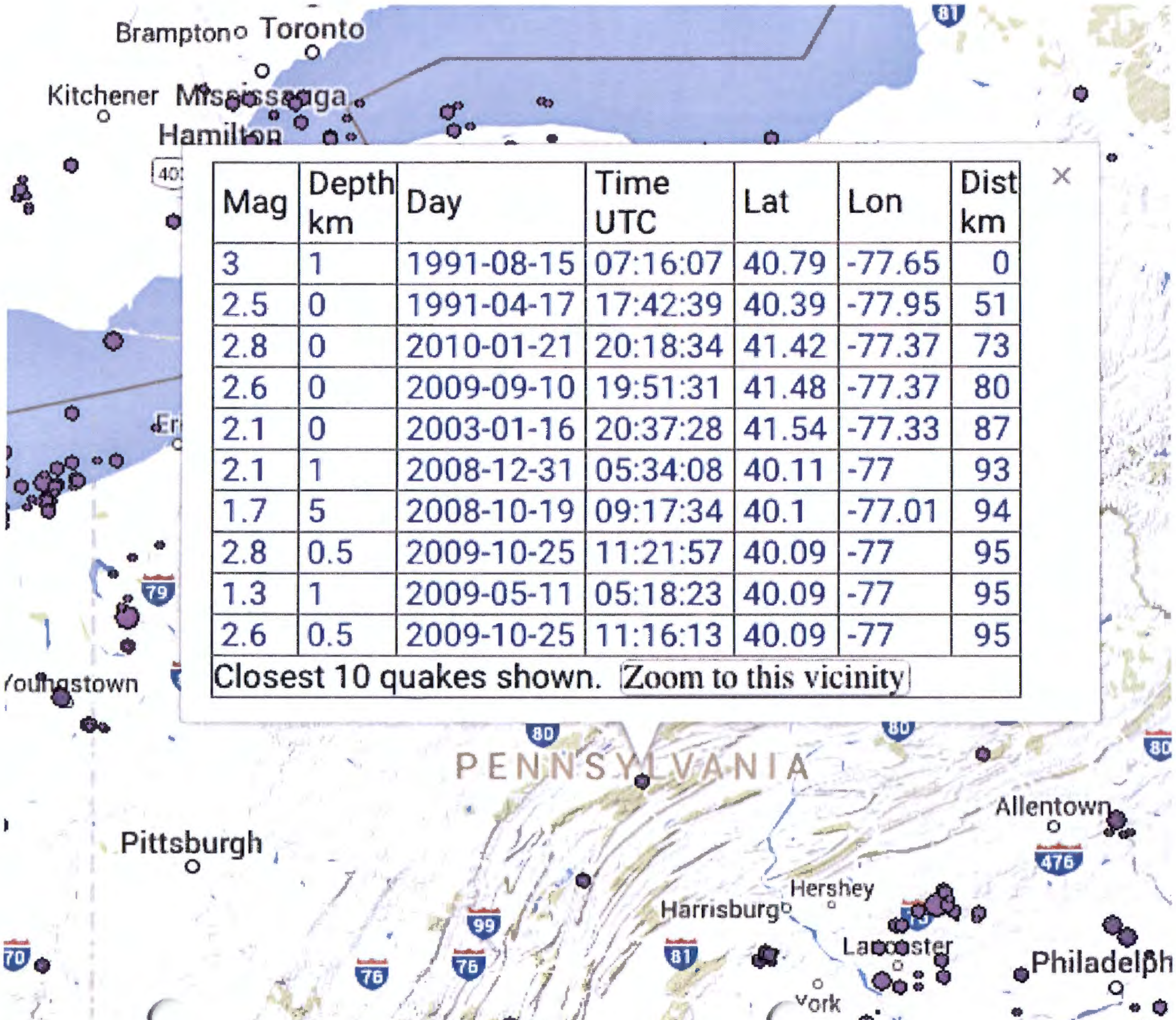


Mag	Depth km	Day	Time UTC	Lat	Lon	Dist km
4.8	5	1998-09-25	19:52:51	41.44	-80.34	0
2.3	5	2008-07-21	01:41:30	41.47	-80.37	3
2.2	5	2014-02-09	22:34:05	41.48	-80.37	4
2.2	5	2010-12-10	21:26:32	41.51	-80.33	7
3.2	18	1985-04-14	11:39:49	41.33	-80.34	13
2.2	5	2005-04-20	21:36:09	41.62	-80.41	20
2	5	2005-02-10	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



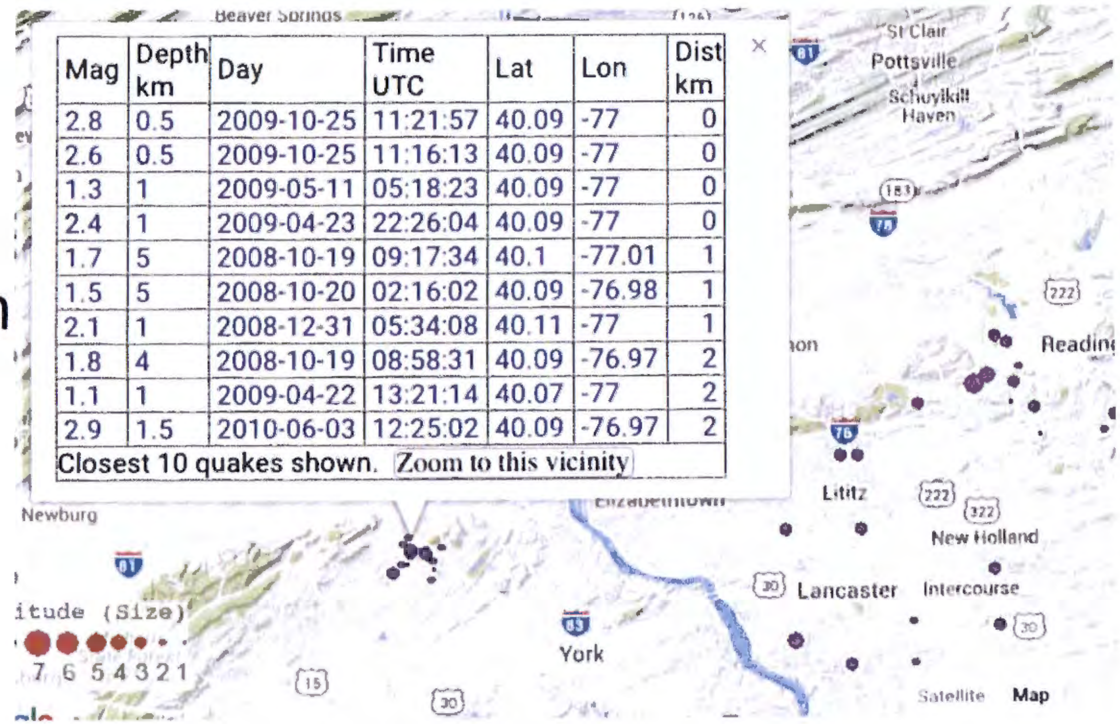
Mag	Depth km	Day	Time UTC	Lat	Lon	Dist km
3	1	1991-08-15	07:16:07	40.79	-77.65	0
2.5	0	1991-04-17	17:42:39	40.39	-77.95	51
2.8	0	2010-01-21	20:18:34	41.42	-77.37	73
2.6	0	2009-09-10	19:51:31	41.48	-77.37	80
2.1	0	2003-01-16	20:37:28	41.54	-77.33	87
2.1	1	2008-12-31	05:34:08	40.11	-77	93
1.7	5	2008-10-19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

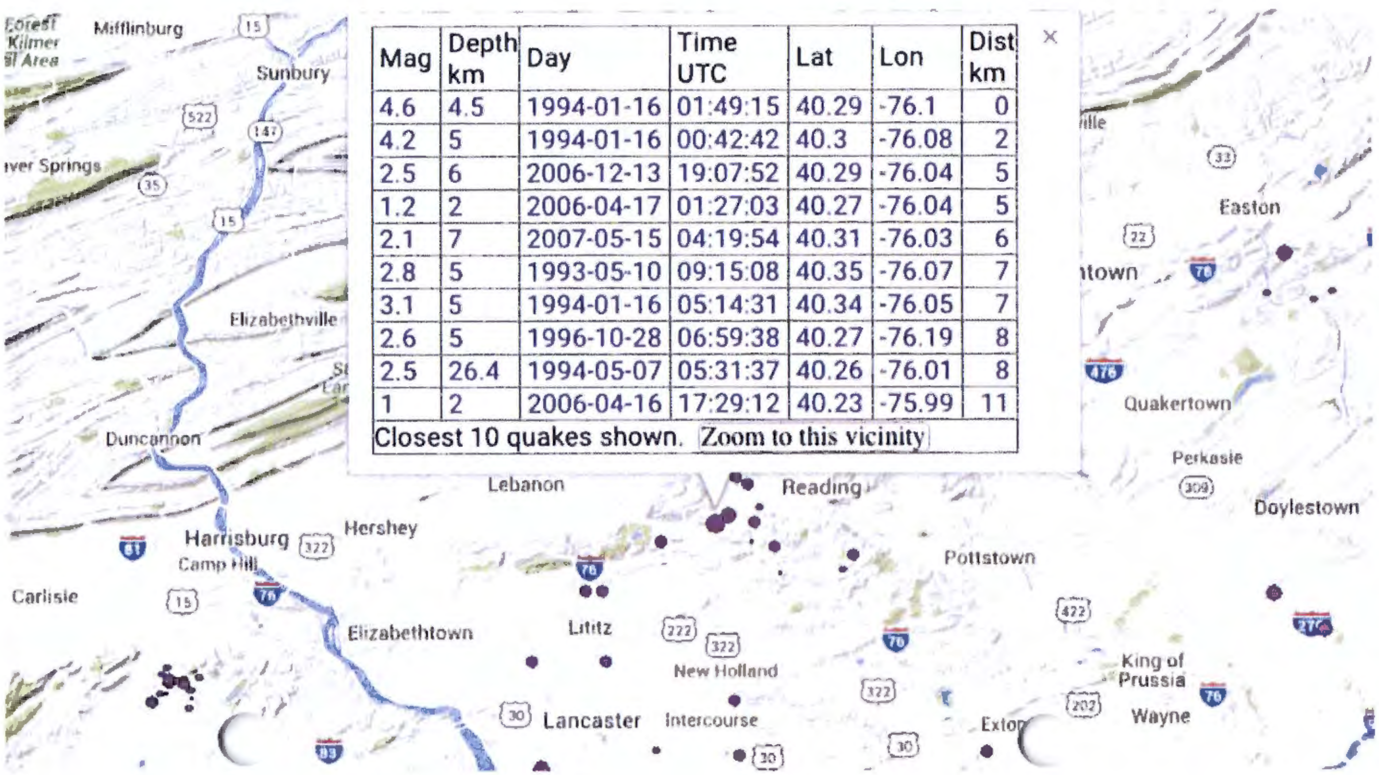
IRIS Earthquake Browser

Dillsburg swarm



Mag	Depth km	Day	Time UTC	Lat	Lon	Dist km
2.8	0.5	2009-10-25	11:21:57	40.09	-77	0
2.6	0.5	2009-10-25	11:16:13	40.09	-77	0
1.3	1	2009-05-11	05:18:23	40.09	-77	0
2.4	1	2009-04-23	22:26:04	40.09	-77	0
1.7	5	2008-10-19	09:17:34	40.1	-77.01	1
1.5	5	2008-10-20	02:16:02	40.09	-76.98	1
2.1	1	2008-12-31	05:34:08	40.11	-77	1
1.8	4	2008-10-19	08:58:31	40.09	-76.97	2
1.1	1	2009-04-22	13:21:14	40.07	-77	2
2.9	1.5	2010-06-03	12:25:02	40.09	-76.97	2

Closest 10 quakes shown. Zoom to this vicinity



Mag	Depth km	Day	Time UTC	Lat	Lon	Dist km
4.6	4.5	1994-01-16	01:49:15	40.29	-76.1	0
4.2	5	1994-01-16	00:42:42	40.3	-76.08	2
2.5	6	2006-12-13	19:07:52	40.29	-76.04	5
1.2	2	2006-04-17	01:27:03	40.27	-76.04	5
2.1	7	2007-05-15	04:19:54	40.31	-76.03	6
2.8	5	1993-05-10	09:15:08	40.35	-76.07	7
3.1	5	1994-01-16	05:14:31	40.34	-76.05	7
2.6	5	1996-10-28	06:59:38	40.27	-76.19	8
2.5	26.4	1994-05-07	05:31:37	40.26	-76.01	8
1	2	2006-04-16	17:29:12	40.23	-75.99	11

Closest 10 quakes shown. Zoom to this vicinity

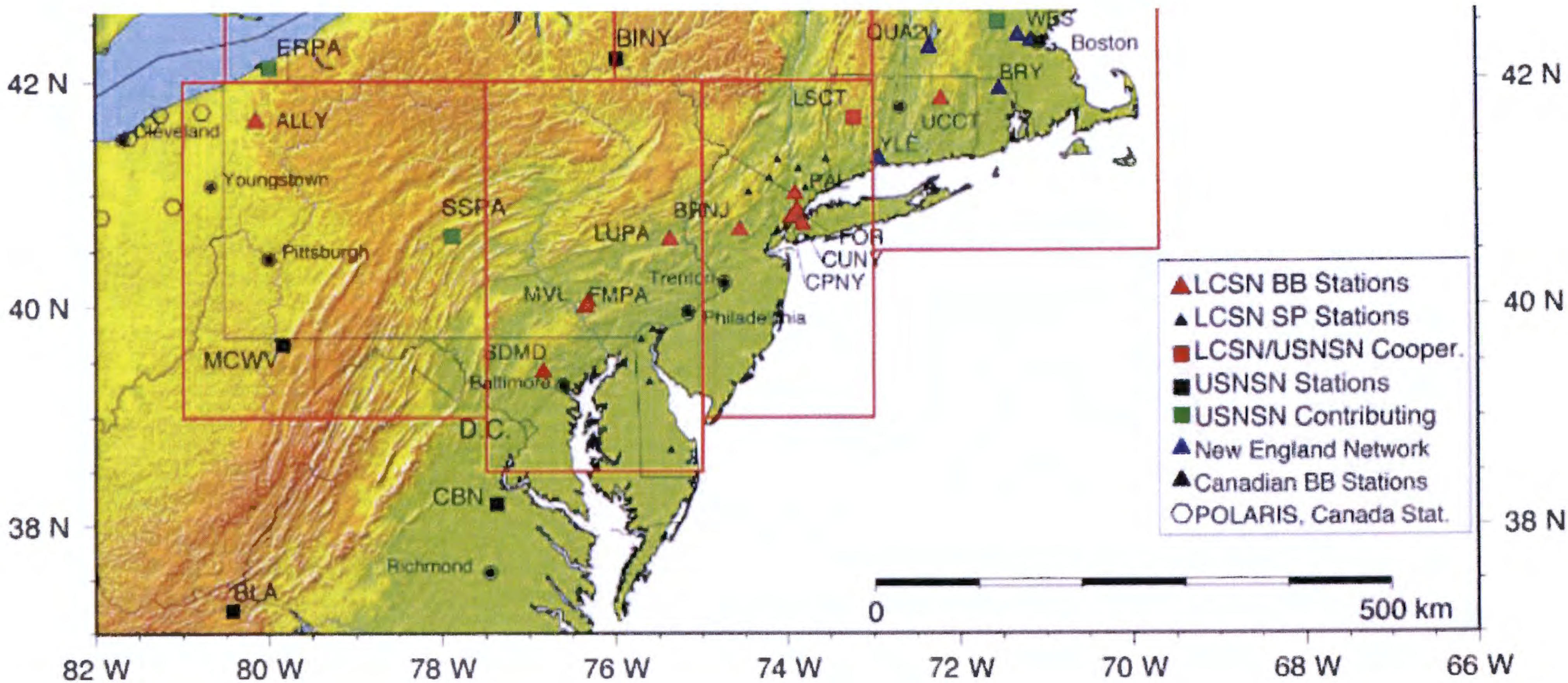
1994 Wyomissing Hills earthquakes (Mag. 4.0 foreshock and 4.6 mainshock)

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

USGS and LCSN Stations



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*

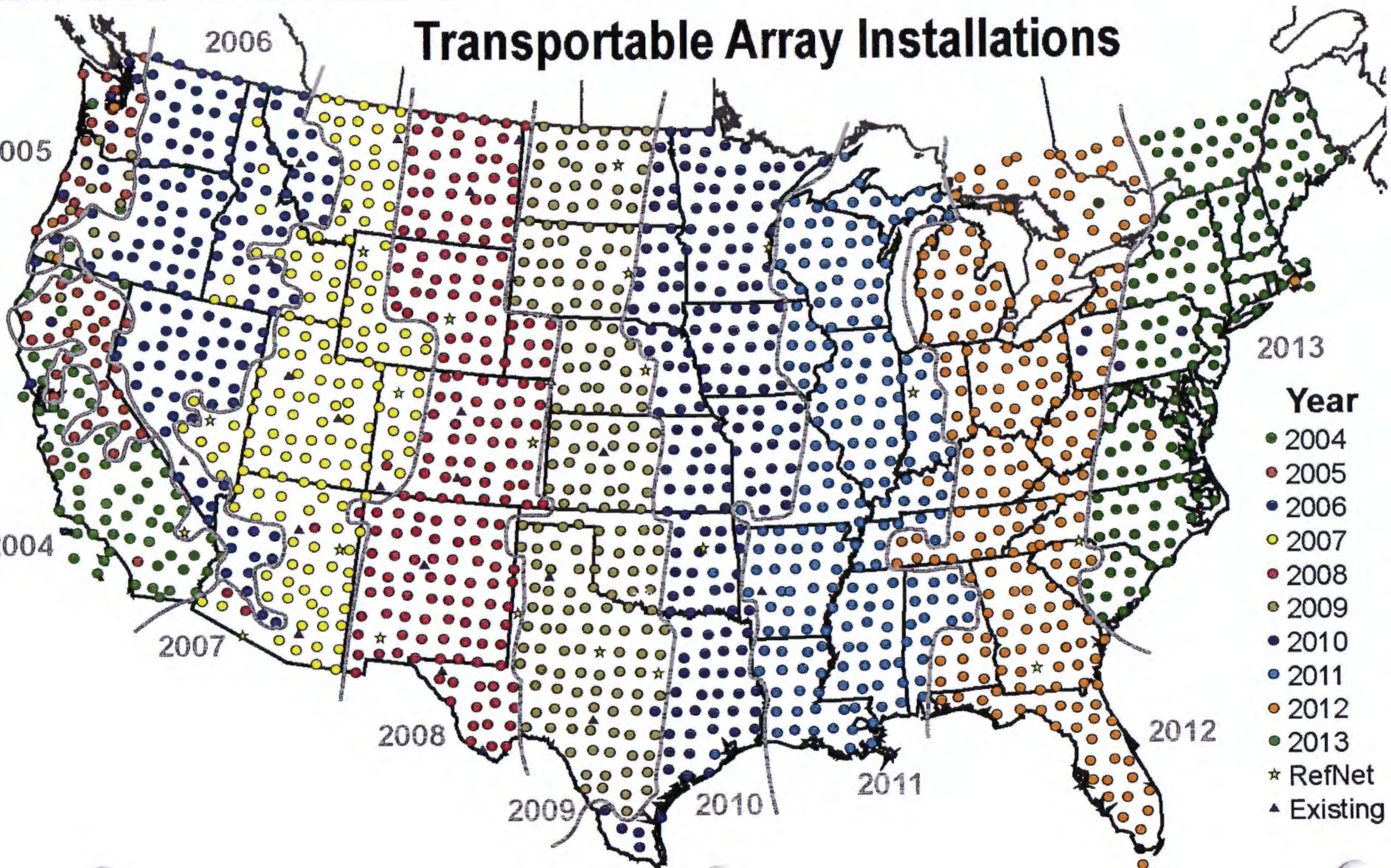
- 2010 Purchase of 4 USArray stations from IRIS – DCNR

- 2013 Earthquake monitoring during USArray - DCNR
  - *Support for temporary network to densify the USArray network, develop seismicity catalog*

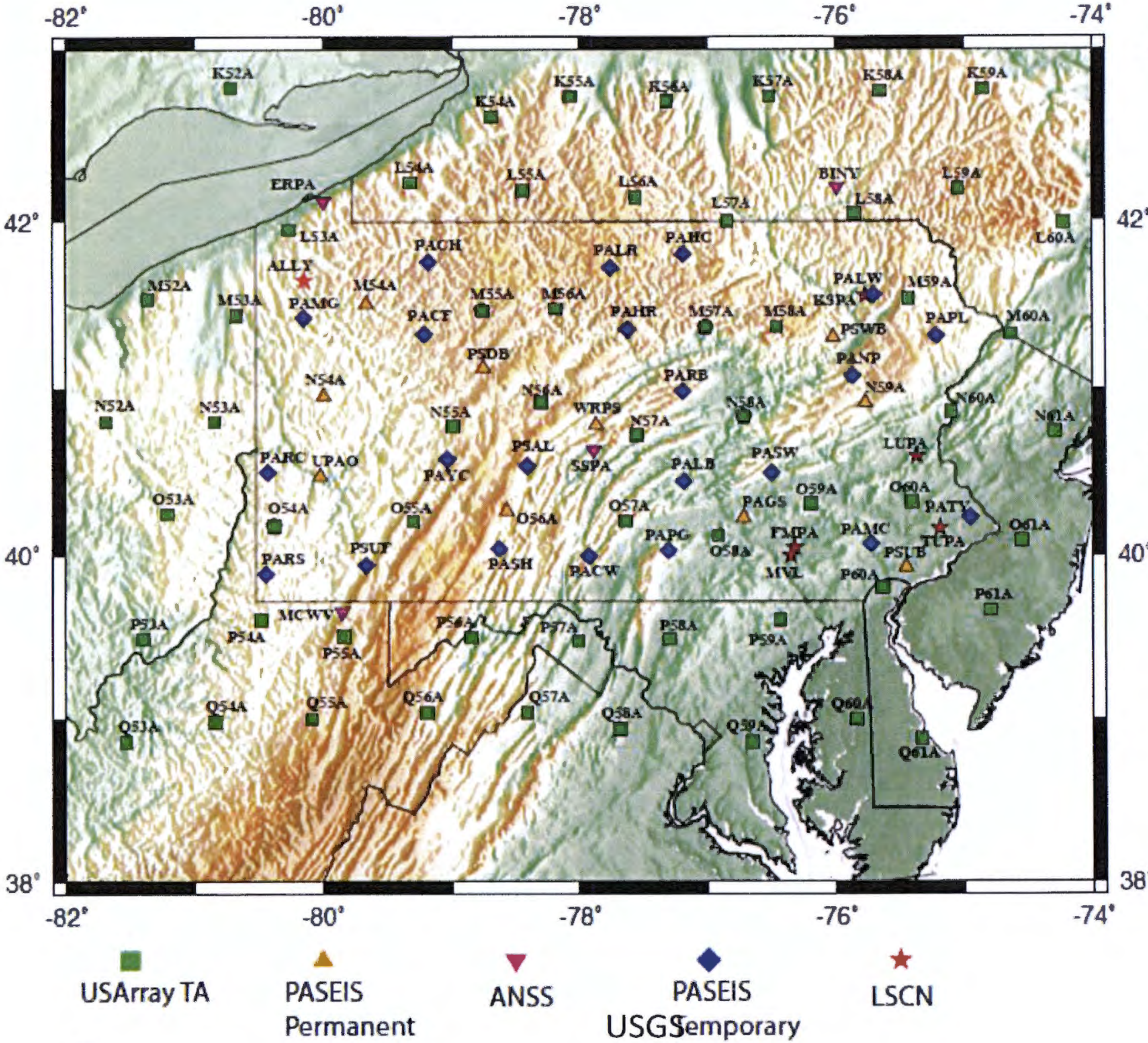
- 2015 Expand the 10-station permanent network to 30 stations and provide seismic event information – DCNR and DEP

USArray

Transportable Array Installations



Stations 2/2013 to 12/2014



- Over 100 3-component high quality (broadband) stations
- Recording continuously
- Sample rates of between 40 and 100 samples per second

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

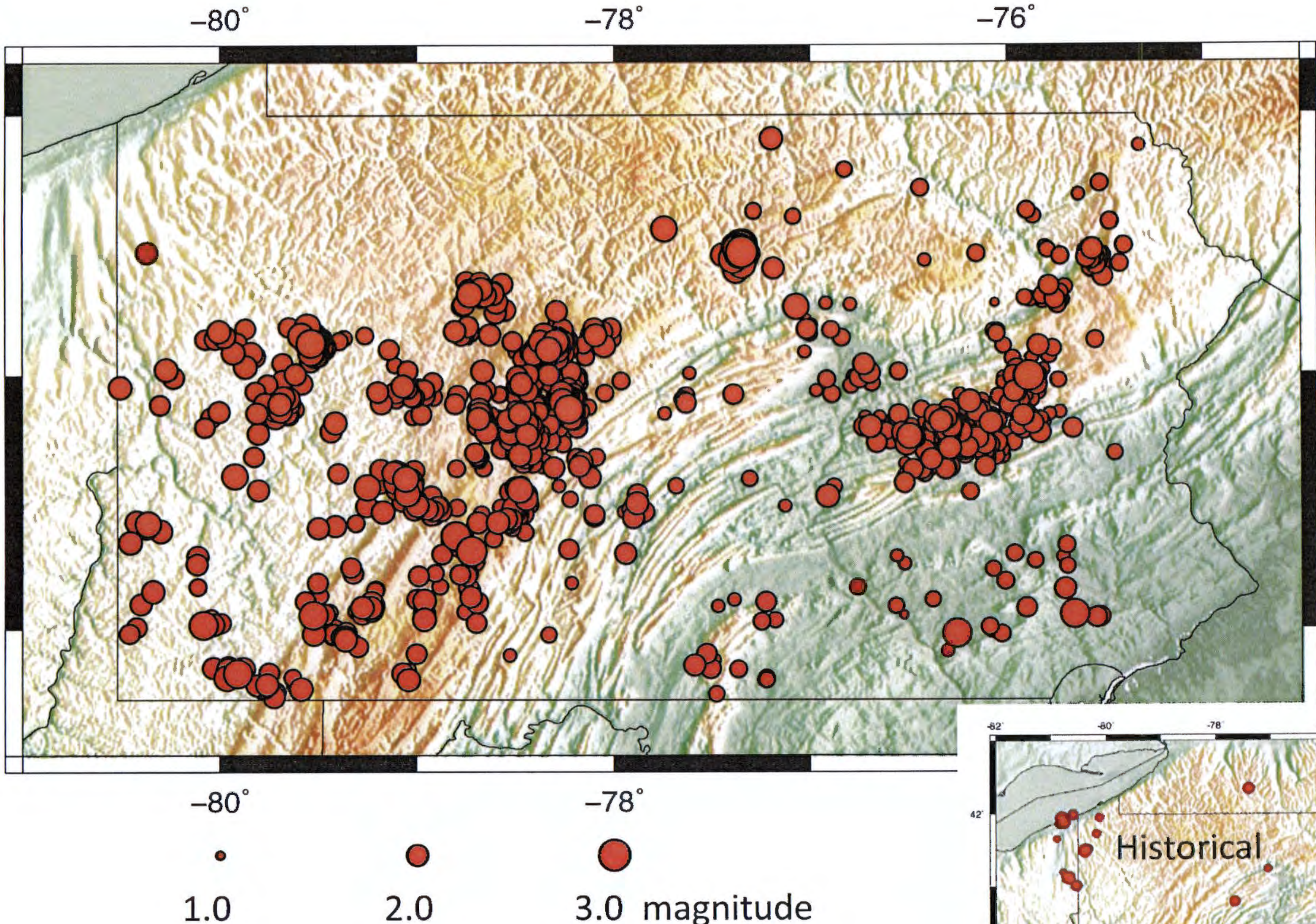
- Average number of stations used for each event: 10
- Minimum number of stations used was 4
- 1568 events with 1355 located in Pennsylvania

Picking and Locating Events

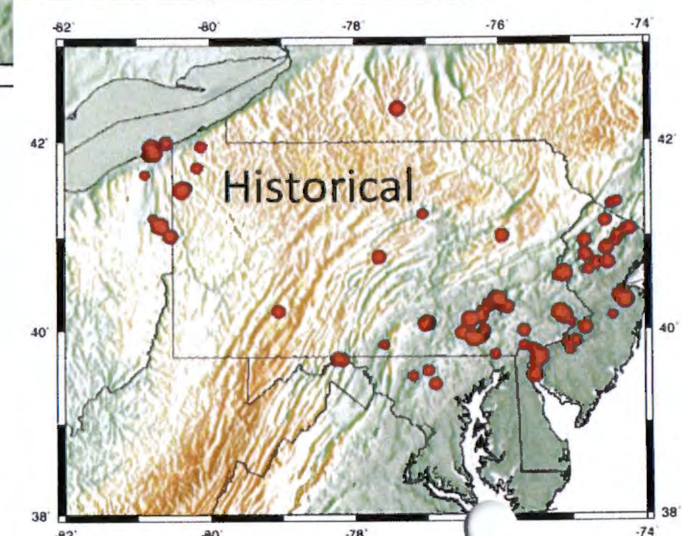
- Used Antelope Software package
- Manually picked arrival times
- Filtered with a 1-5 Hz bandpass filter
- Preliminary locations from Antelope using IASP91 velocity model
- Relocated using HYPOELLIPSE and a velocity model for Pennsylvania
- Magnitudes determined using Richter's method for local magnitude

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)



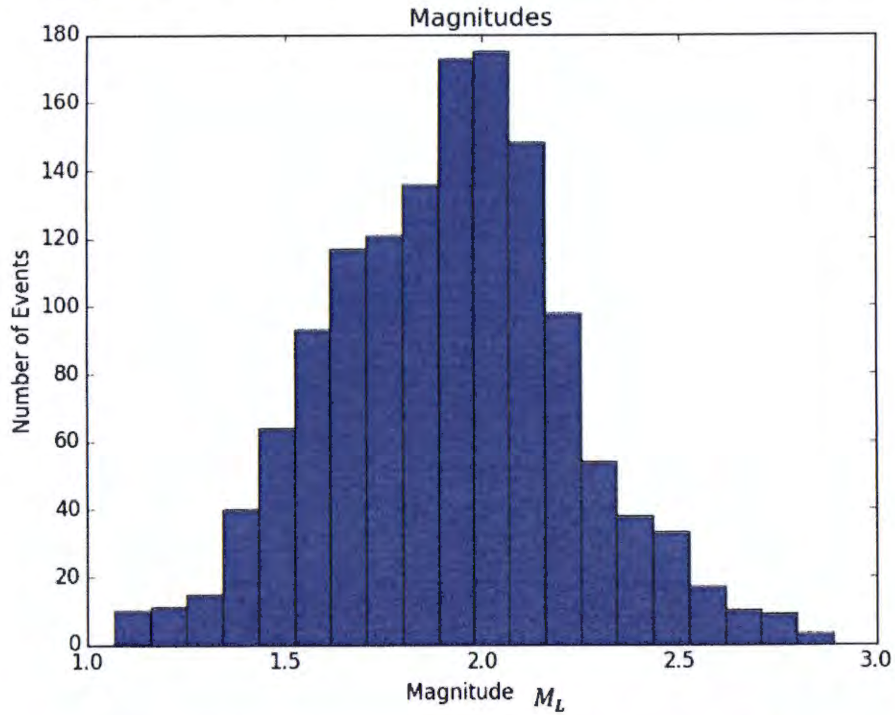
-80°
-78°
-76°
42°
40°
1.0
2.0
3.0 magnitude



Historical

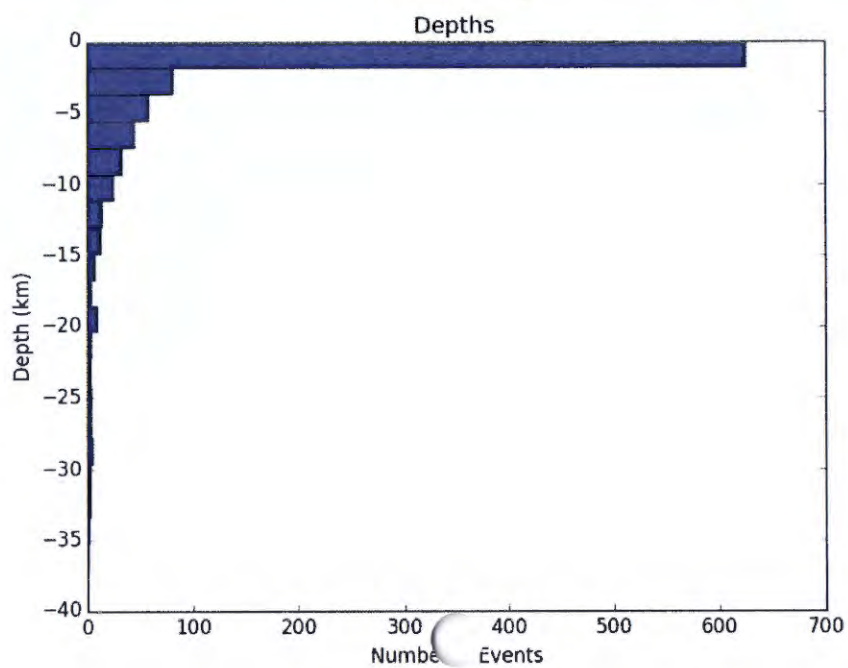
Magnitudes and Depths

- Local magnitudes range from 1.07 to 2.89



Catalog is complete to magnitude 2

- Depths mostly < 1 km

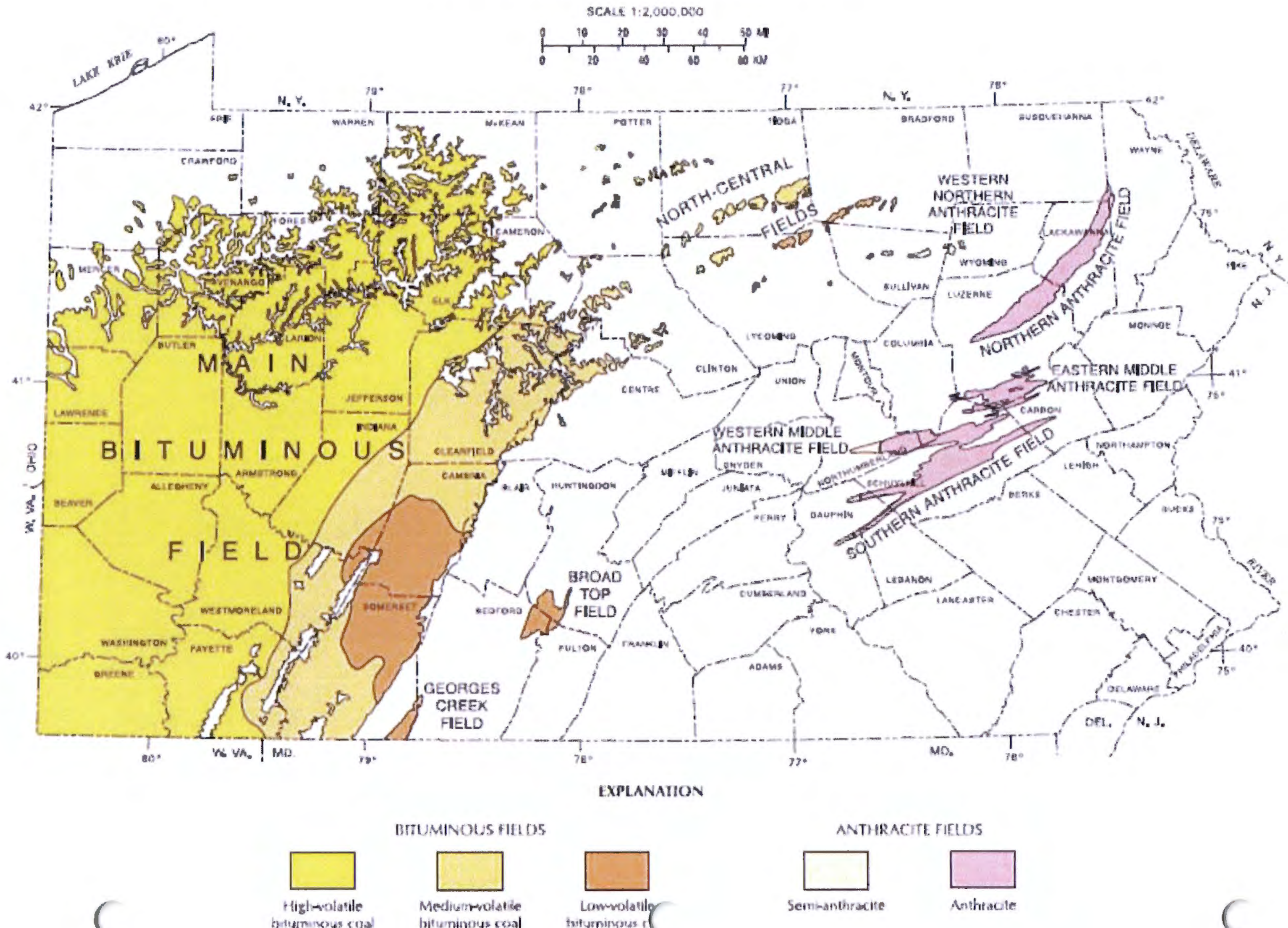


What are the sources of the seismic events?

Several possibilities

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

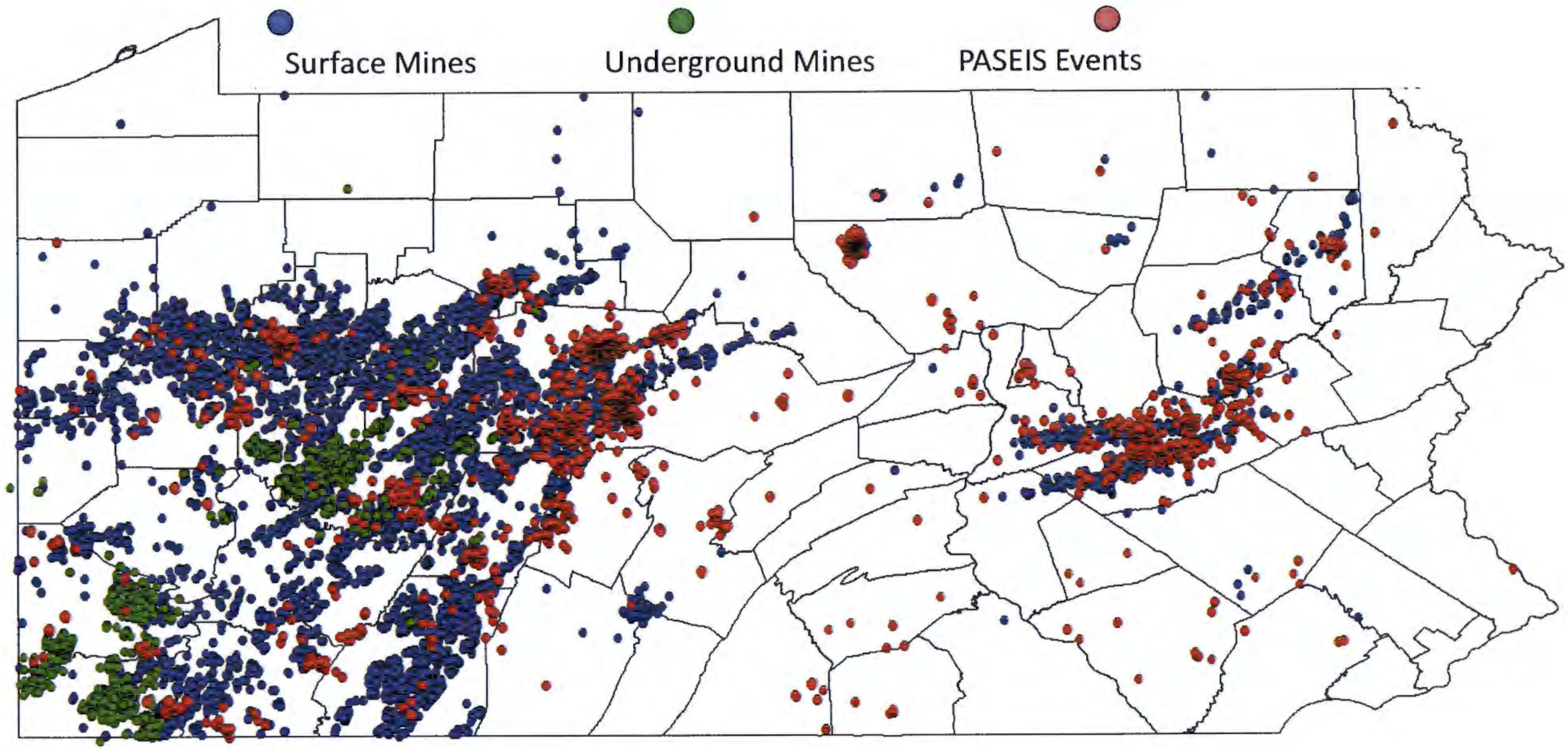
DISTRIBUTION OF PENNSYLVANIA COALS



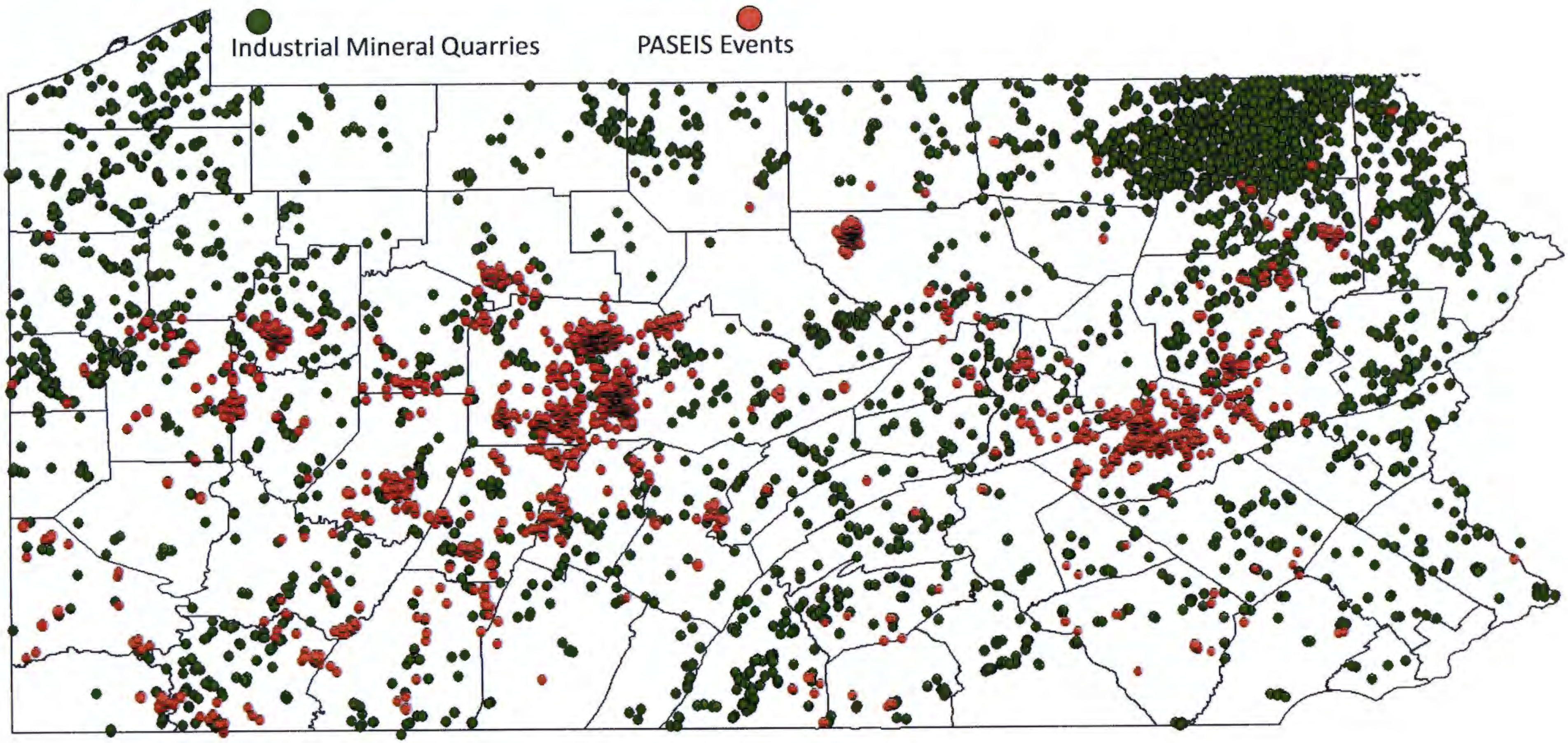
USGS Event Classification for Blasts

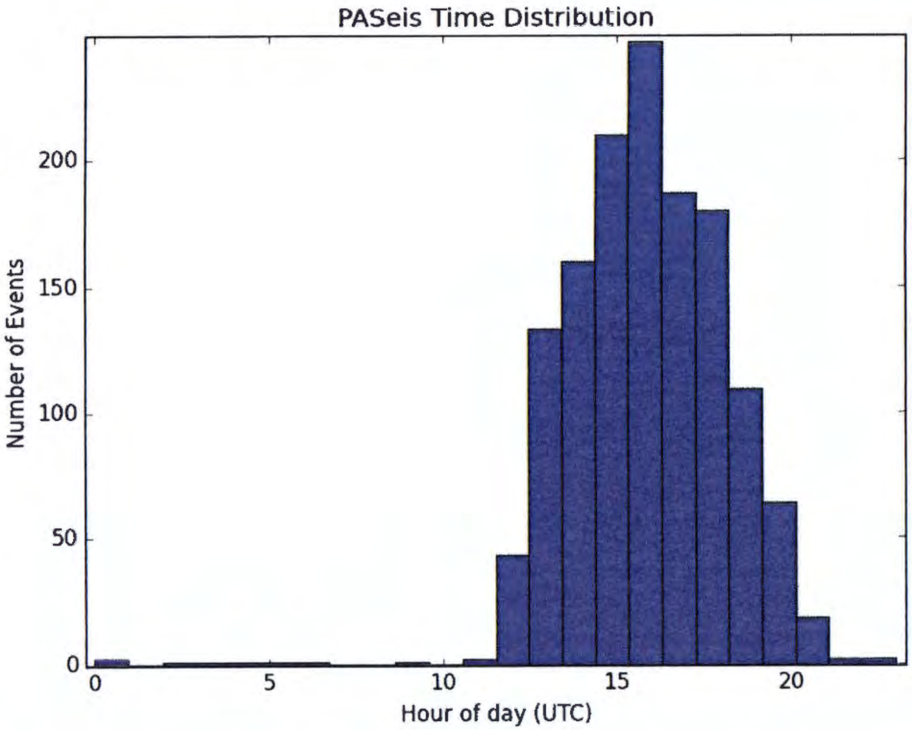
- Time of event (during working hours)
- Location of events relative to mines and quarries (within 5 km)
- Emergent phase arrivals
- Lack of clear S-wave arrivals
- Excessive low-frequency signal
- Presence of a short period surface wave

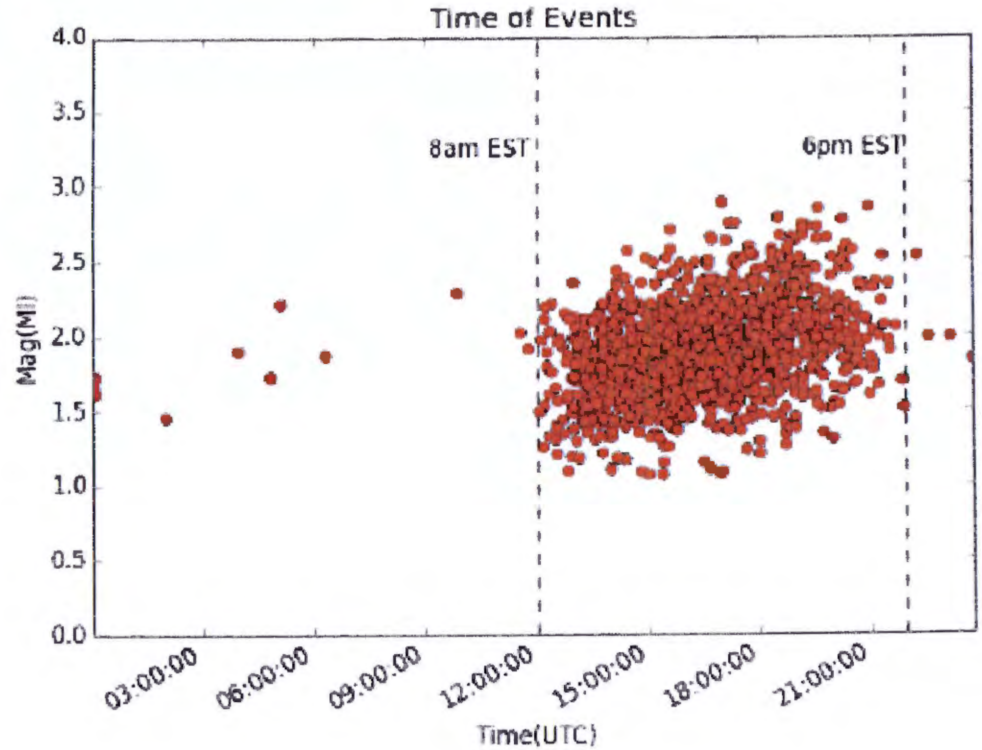
Spatial correlation with coal mines

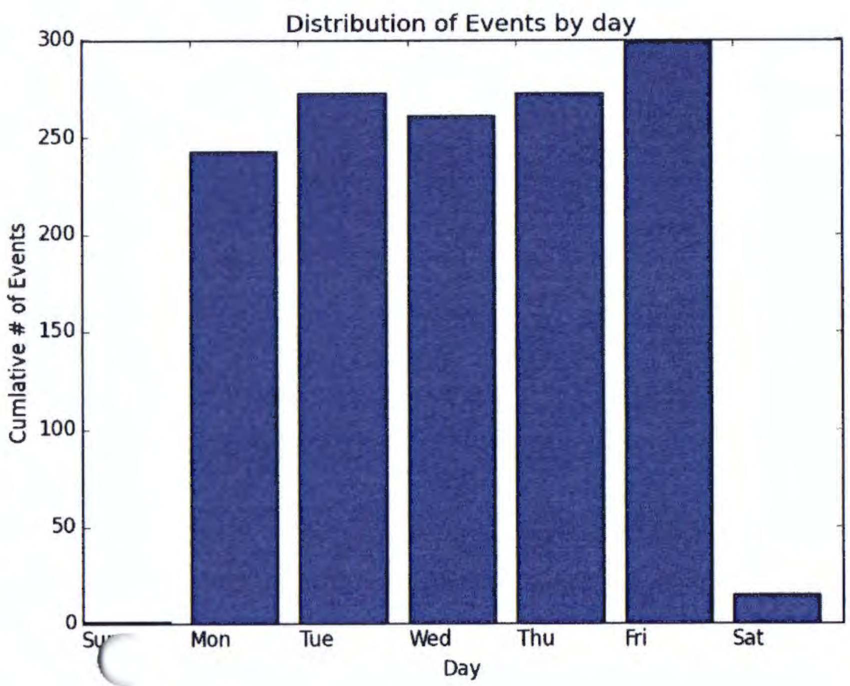


Spatial correlation with other mines

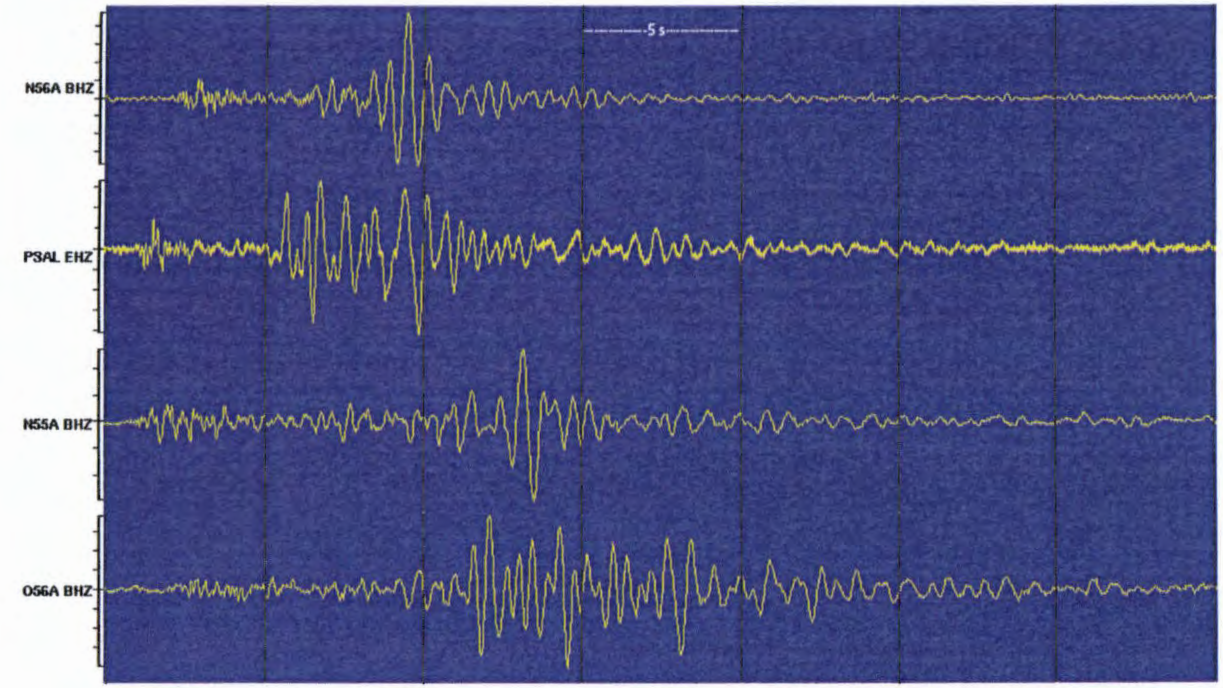








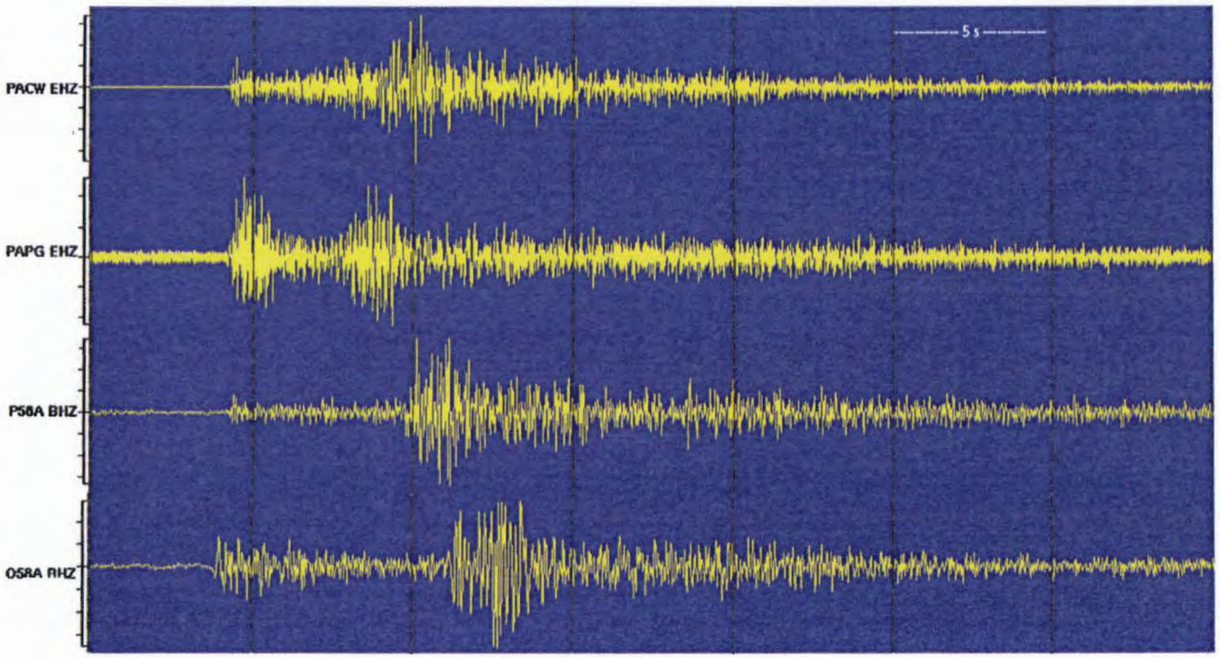
Timing of Events



Blasting event

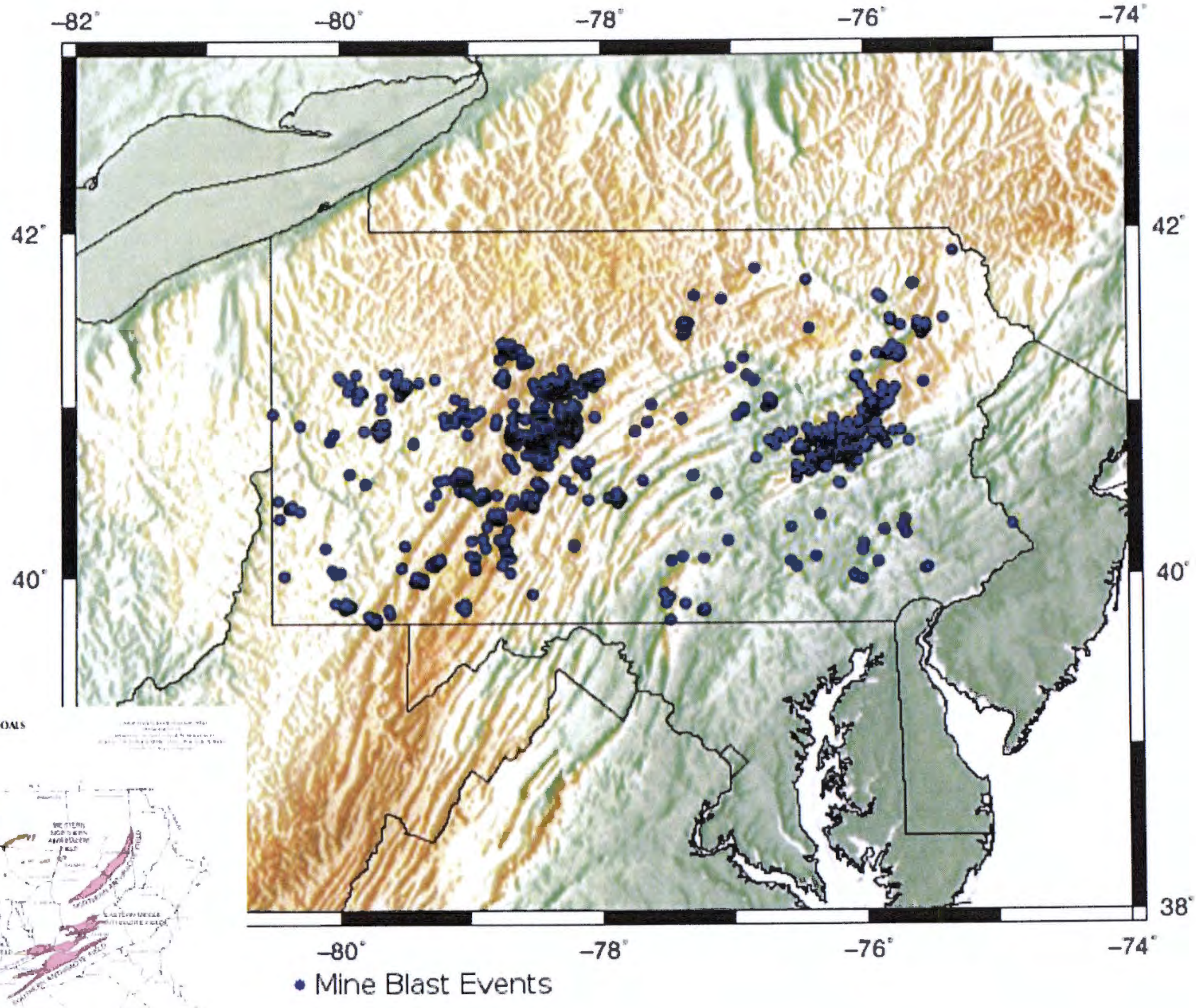
Waveform characteristics

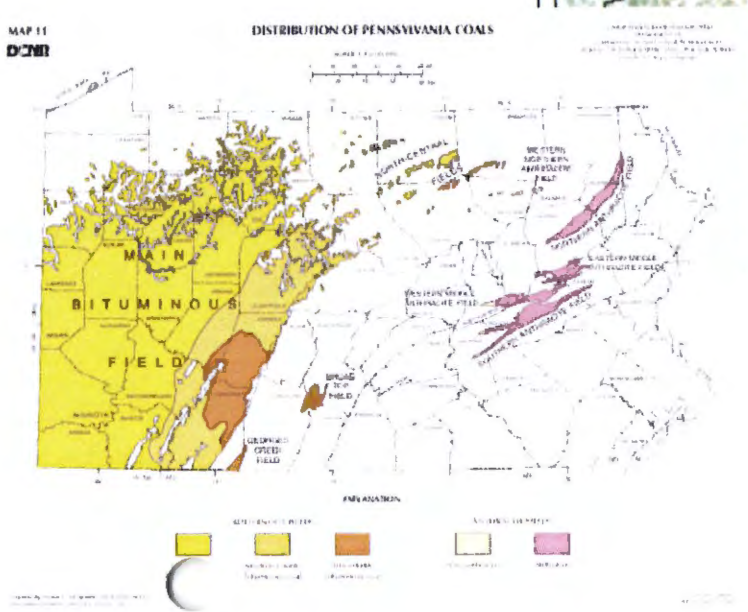
- Emergent phase arrivals
- Lack of clear S-wave arrivals
- Excessive low-frequency signal
- Presence of a short period surface wave



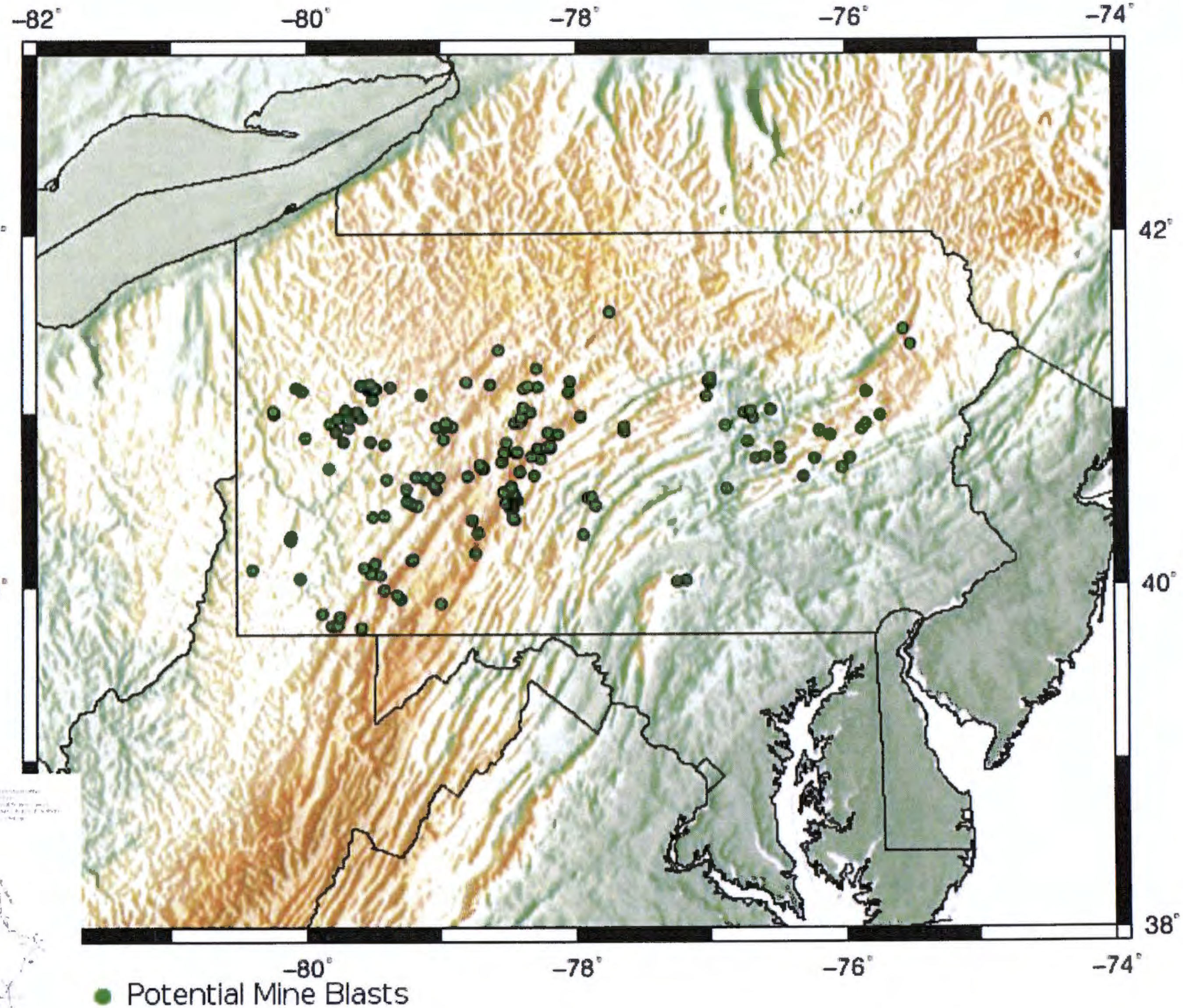
Earthquake

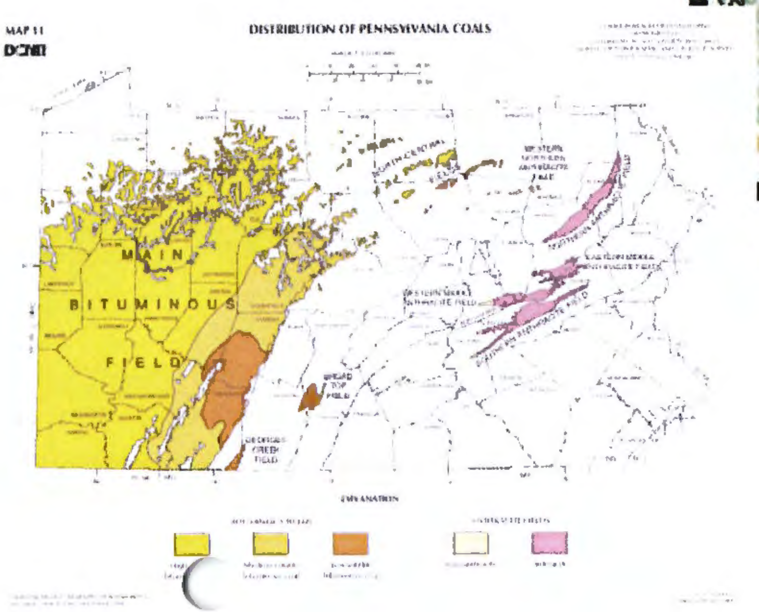
Mine or Quarry Blasts (1117 events)



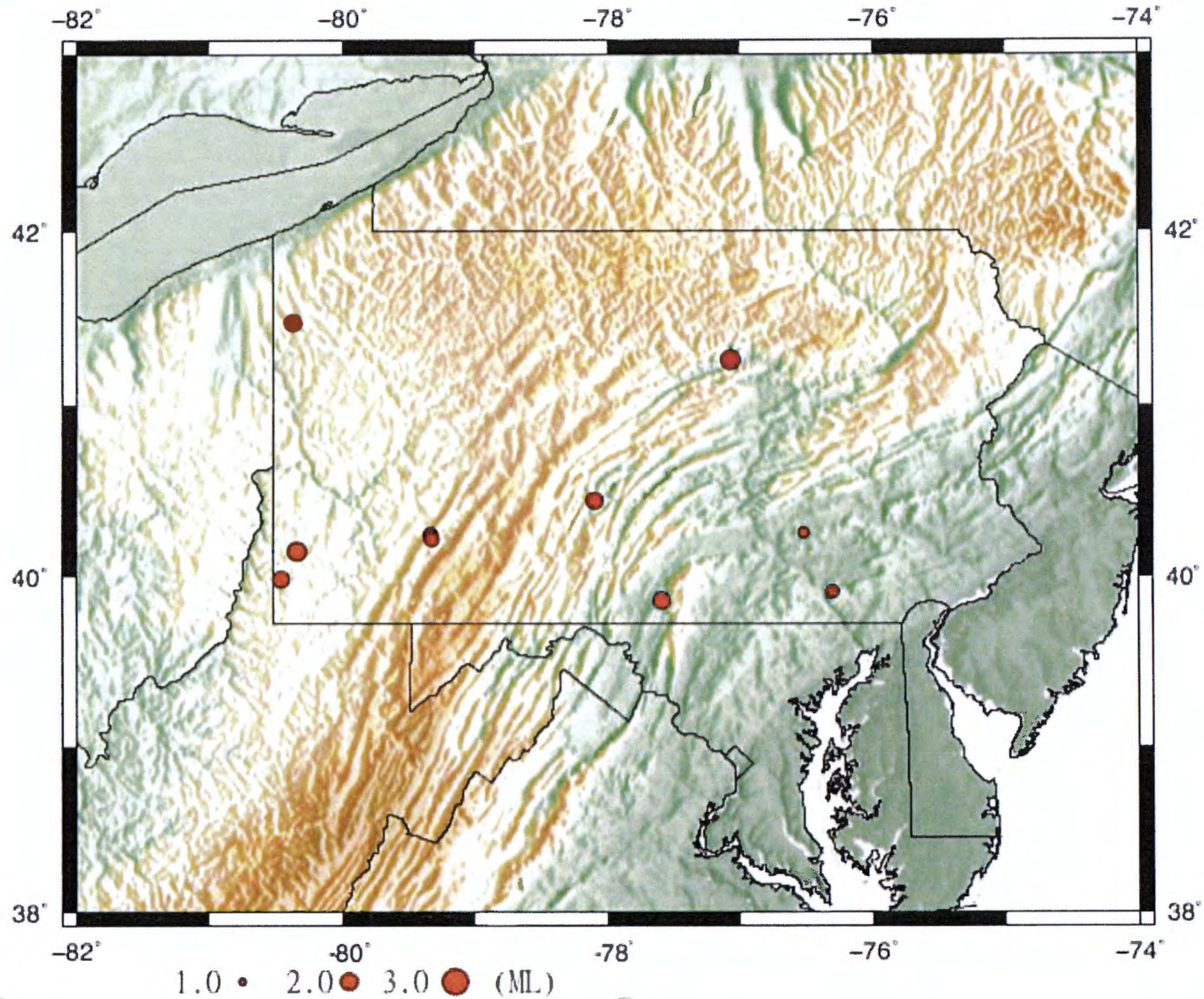


Potential Mine or Quarry Blasts (165 events)





Non-mining events – 11 of them.



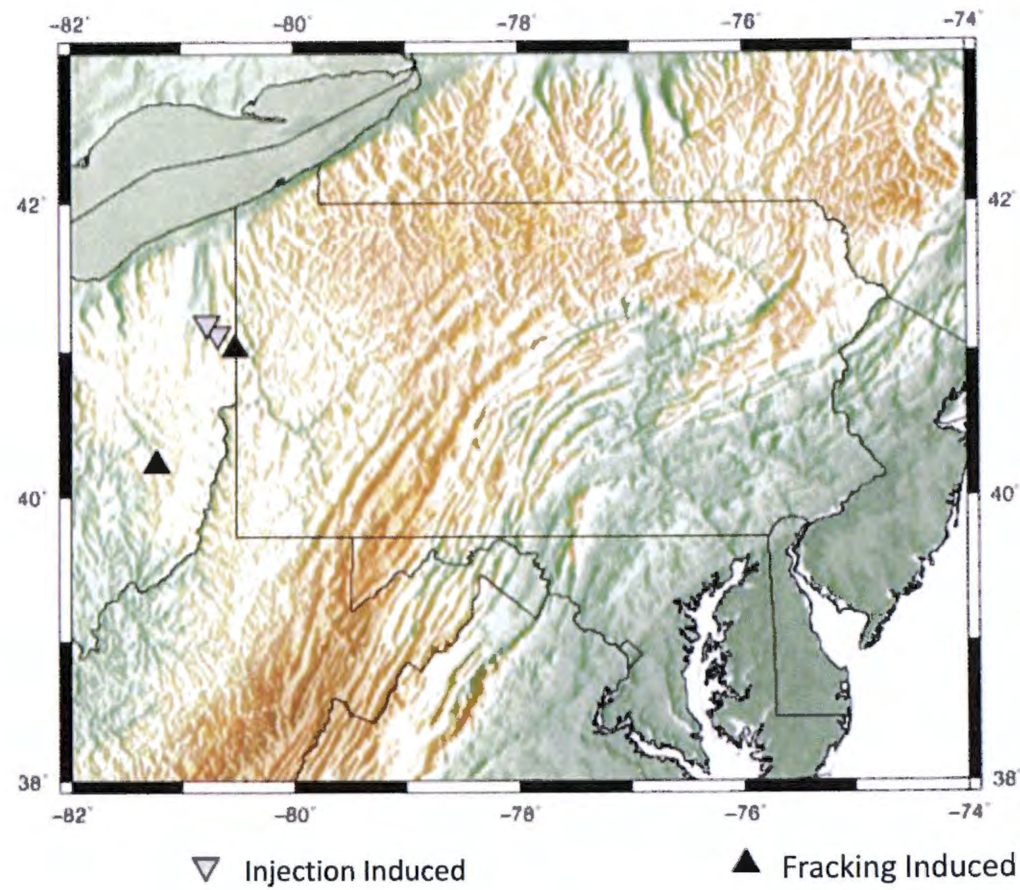
What are the sources of the non-mining seismic events?

Several possibilities

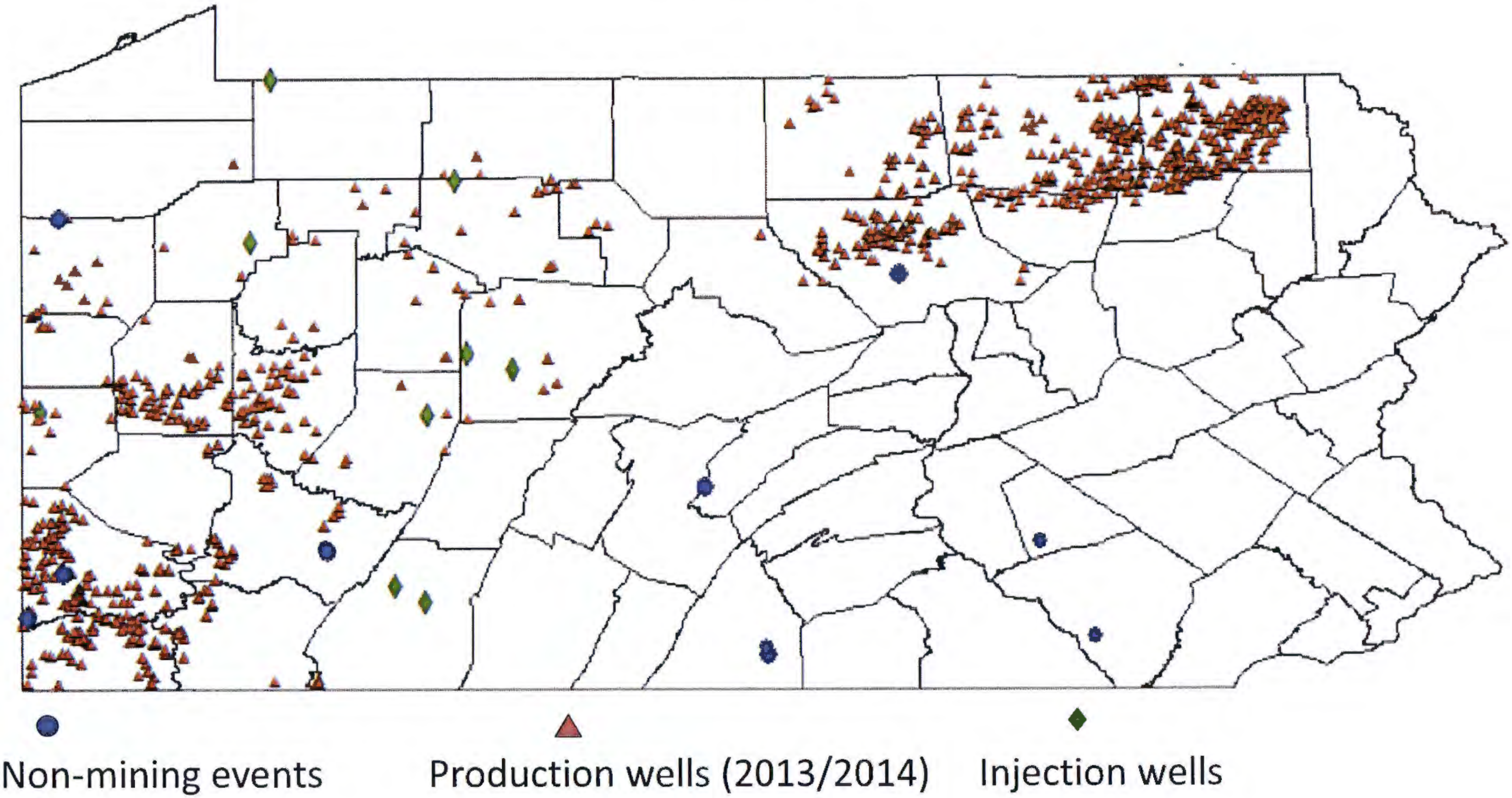
- tectonic earthquakes
-induced seismicity from wastewater disposal wells
- induced seismicity from hydraulic fracking

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



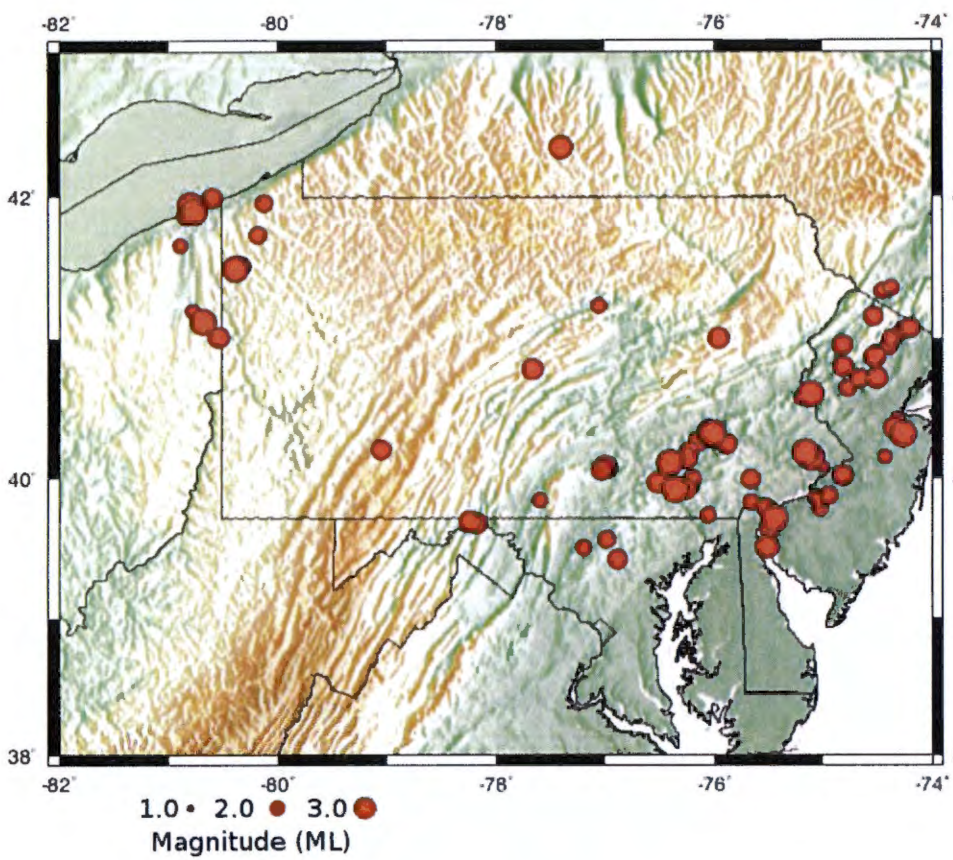
Are there spatial and temporal correlations with well activity?



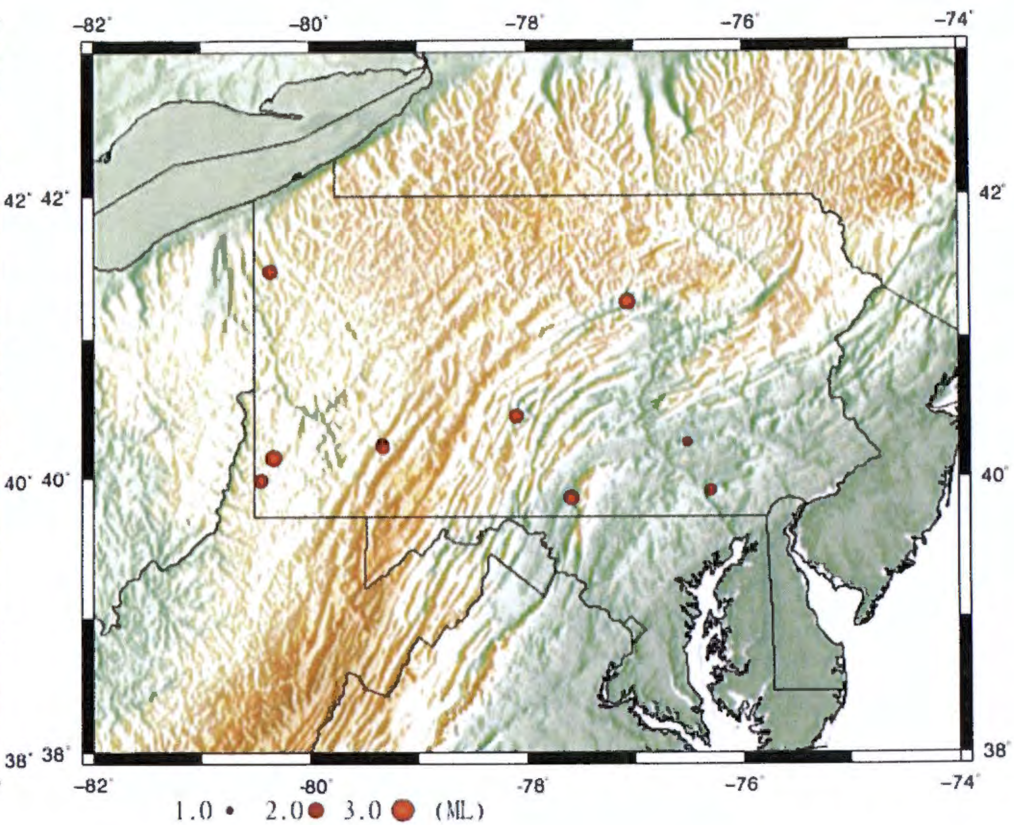
-No correlation has been found with either injection wells or fracked wells

Summary of findings: 1344 mining related events

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



Historical

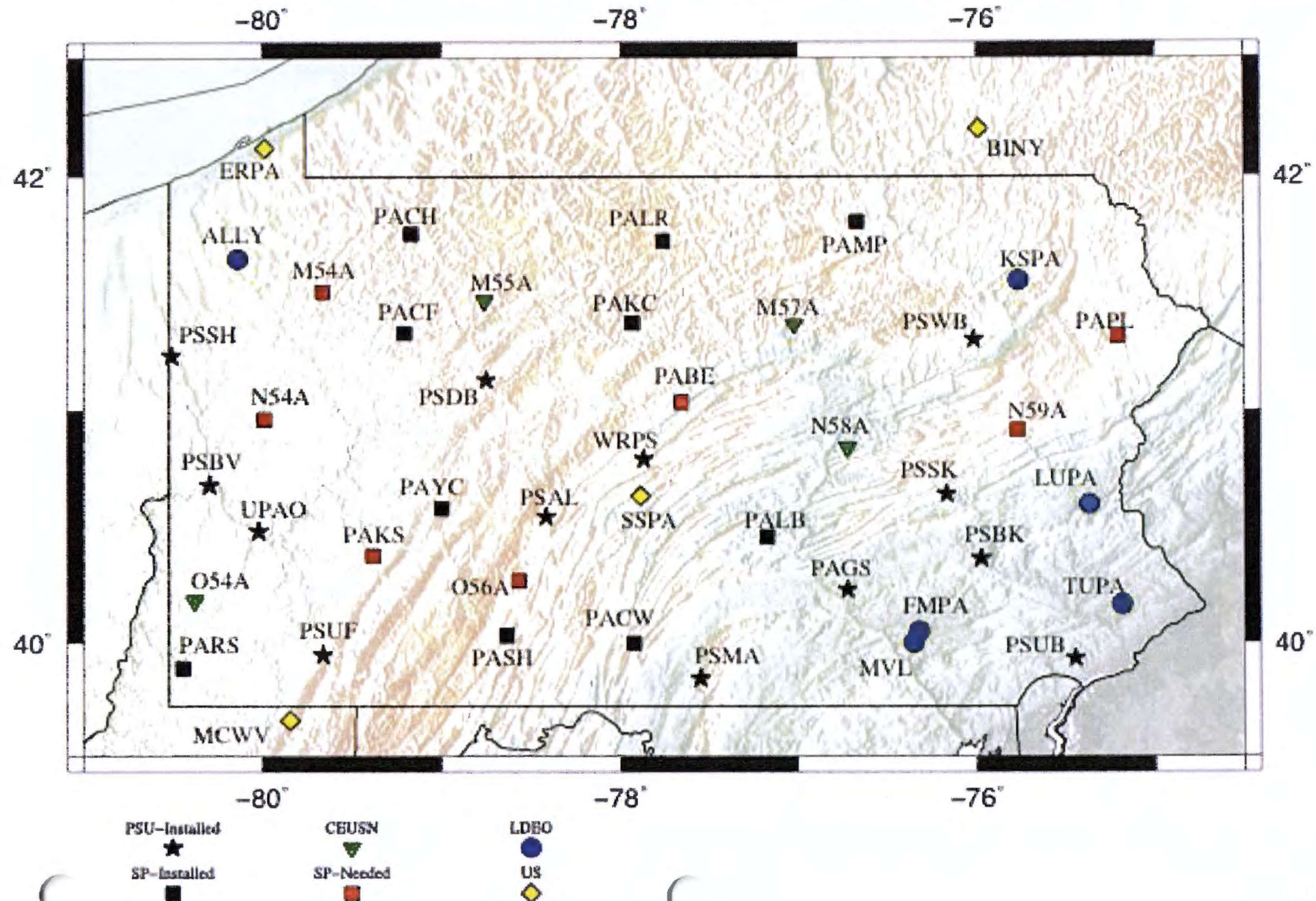


2013-2014

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

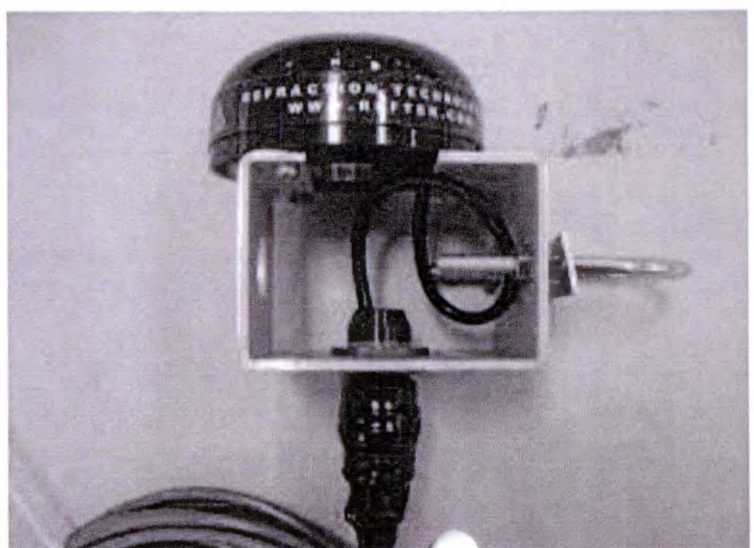


PASEIS Seismic Equipment

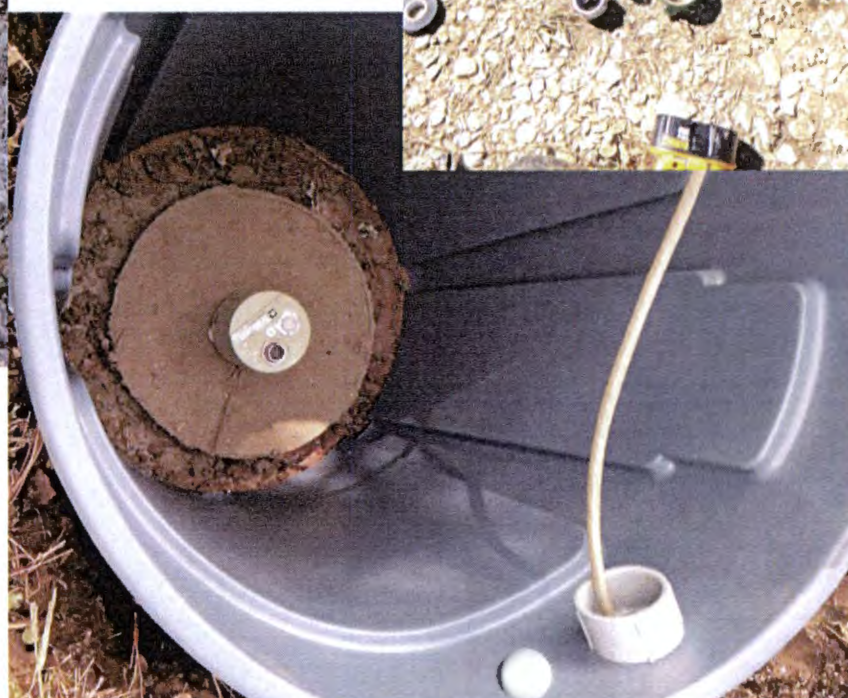
Data logger/Digitizer

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)

IRIS MDA Usage

IRIS DMC MetaData Aggregator

Legend: R A R P

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) R A, HHN (100) R A, HHZ (100) R A, 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

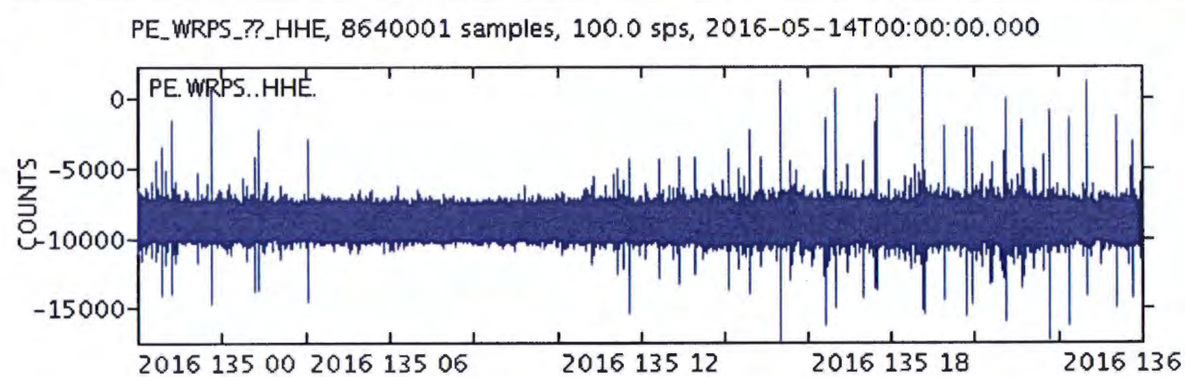
WRPS - PSU, University Park, PA, USA

Network: PE - Penn State Network
Location: 40.79°N - 77.87°W

Daily Data

Day: 2016-05-14 Location/Channels: --:HHE/HHN/HHZ Update

--.HHE



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

Minor earthquake measures near city

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

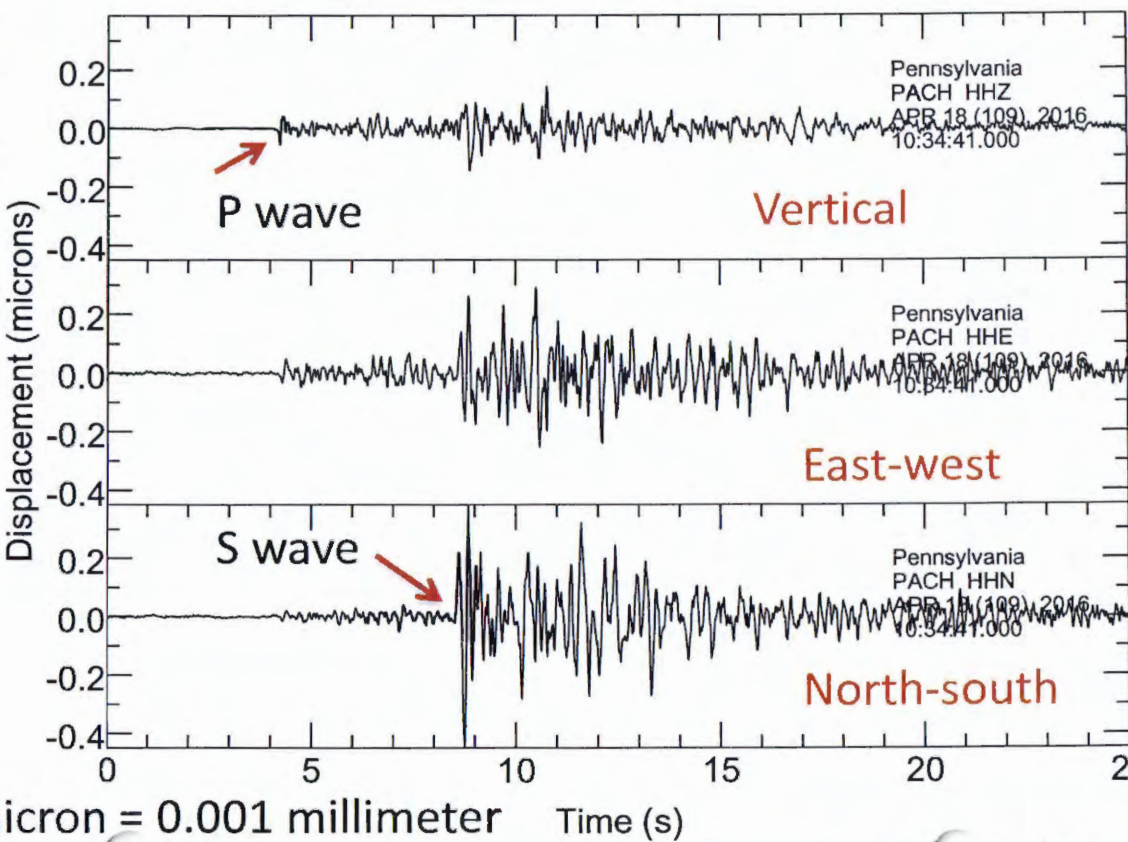
By Stella Ruggiero sruggiero@titusvilleherald.com | 0 comments

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

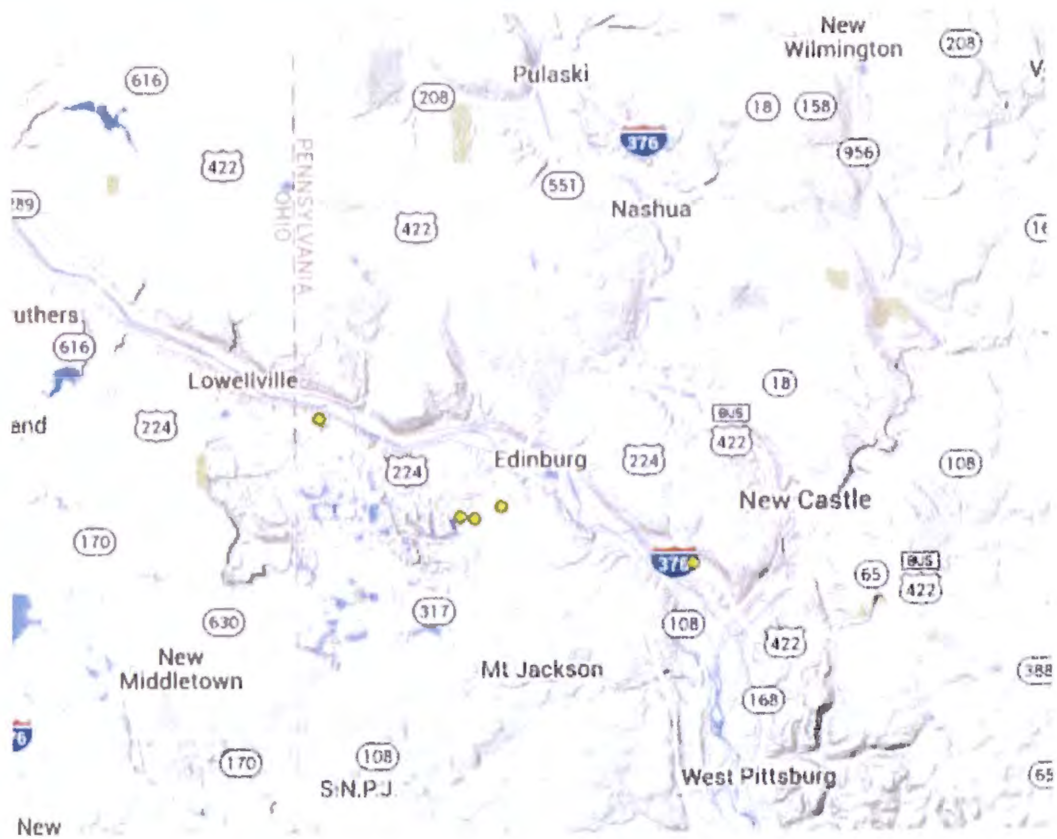
State studying link between fracking, Lawrence County earthquakes

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.

	EARTHQUAKE MAGNITUDE	TIME OCCURRED
A	1.9	12:05:25 AM
B	1.7	4:16:55 AM
C	1.8	5:03:02 AM
D	1.9	10:54:26 AM
E	1.8	10:10:23 PM

Source: Esri, Pennsylvania Department of Environmental Protection, Un[illegible]d States Geological Survey   Post-Gazette

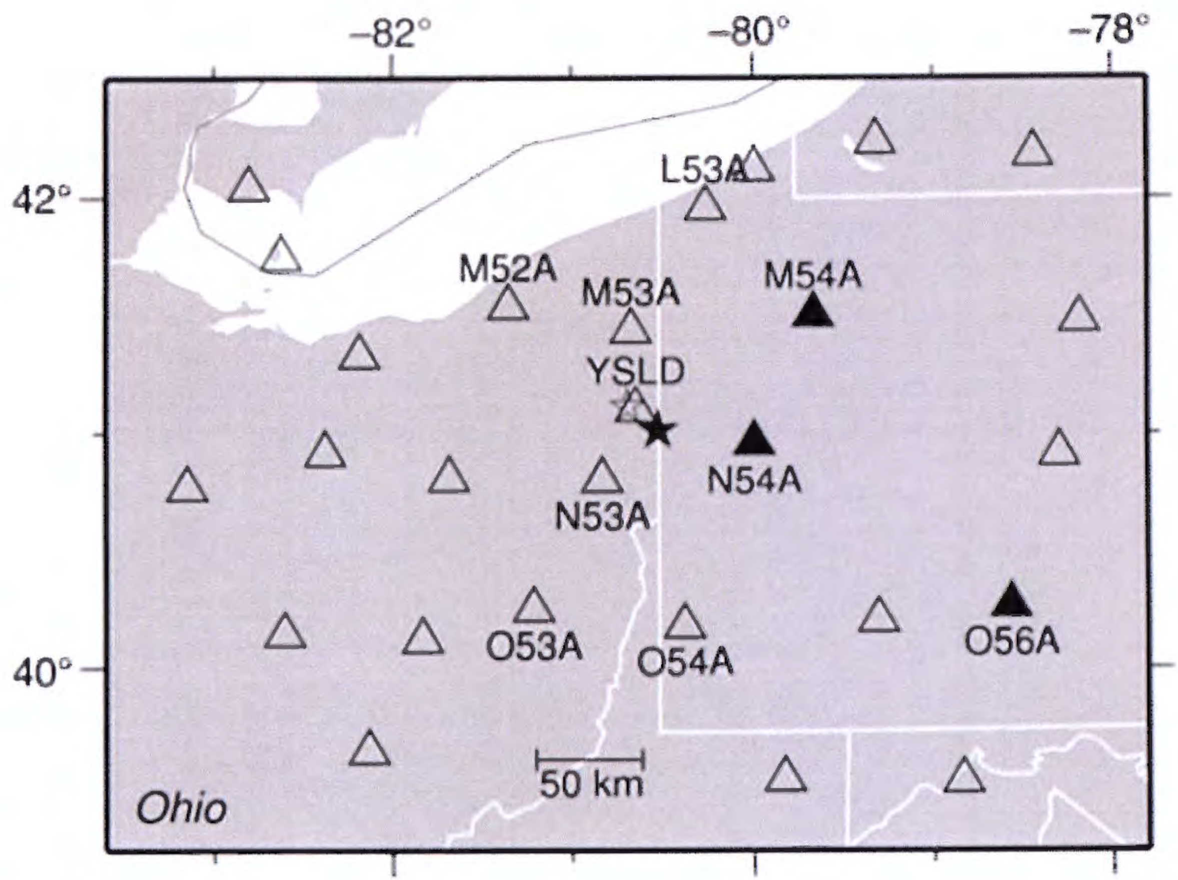


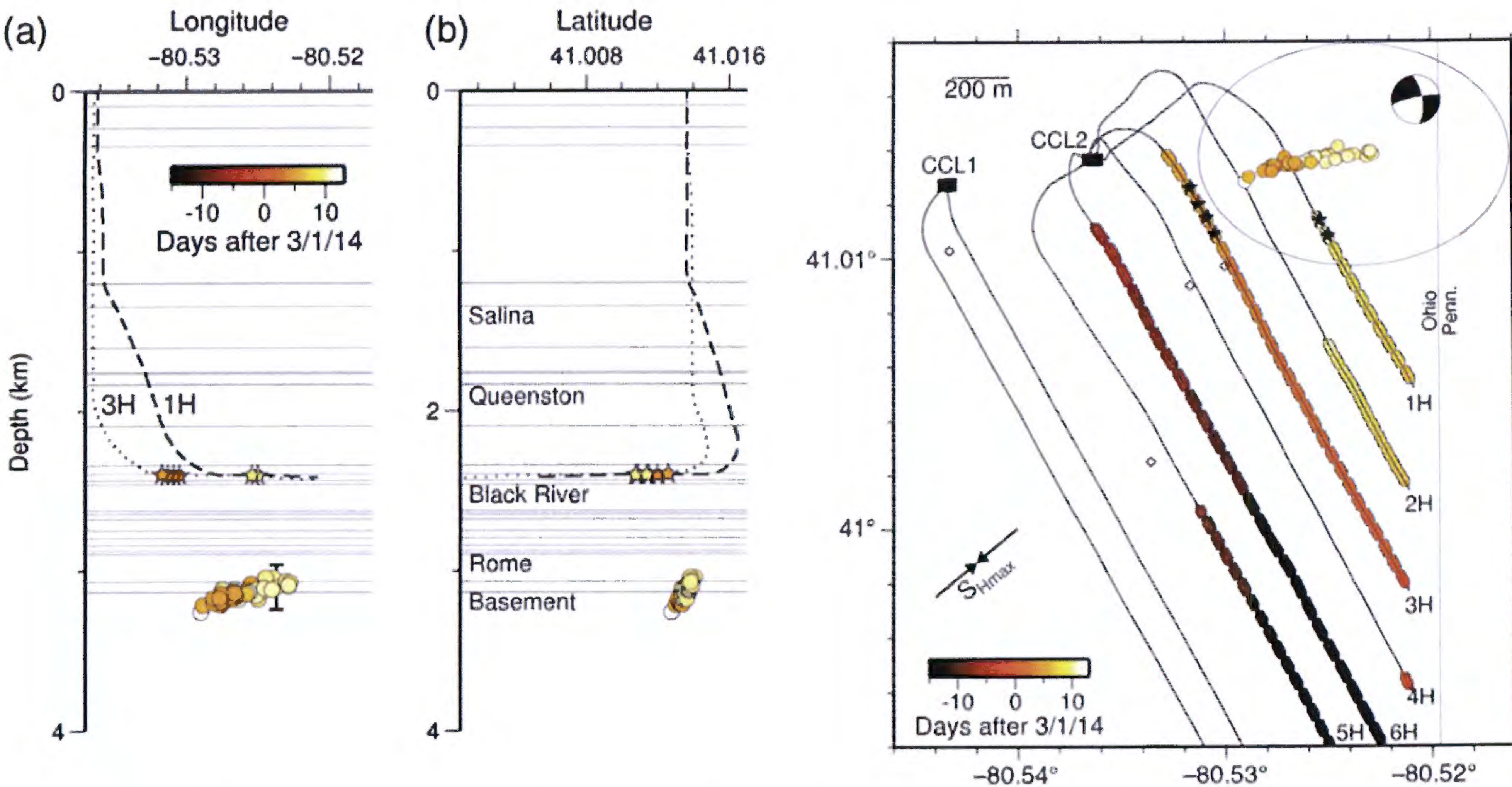
Bulletin of the Seismological Society of America, Vol. 105, No. 1, pp. –, February 2015, doi: 10.1785/0120140168

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.

(((

Thanks to DCNR and DEP for promoting open data access!

DCNR pennsylvania
DEPARTMENT OF CONSERVATION AND NATURAL RESOURCES

pennsylvania
DEPARTMENT OF ENVIRONMENTAL PROTECTION

Thanks to IRIS for providing data archiving and distribution!

IRIS

HFRAC
Consulting Services, LLC

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 201[illegible]

HIFRAC

TEST OBJECTIVES

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

HiFRAC

TIME LINE

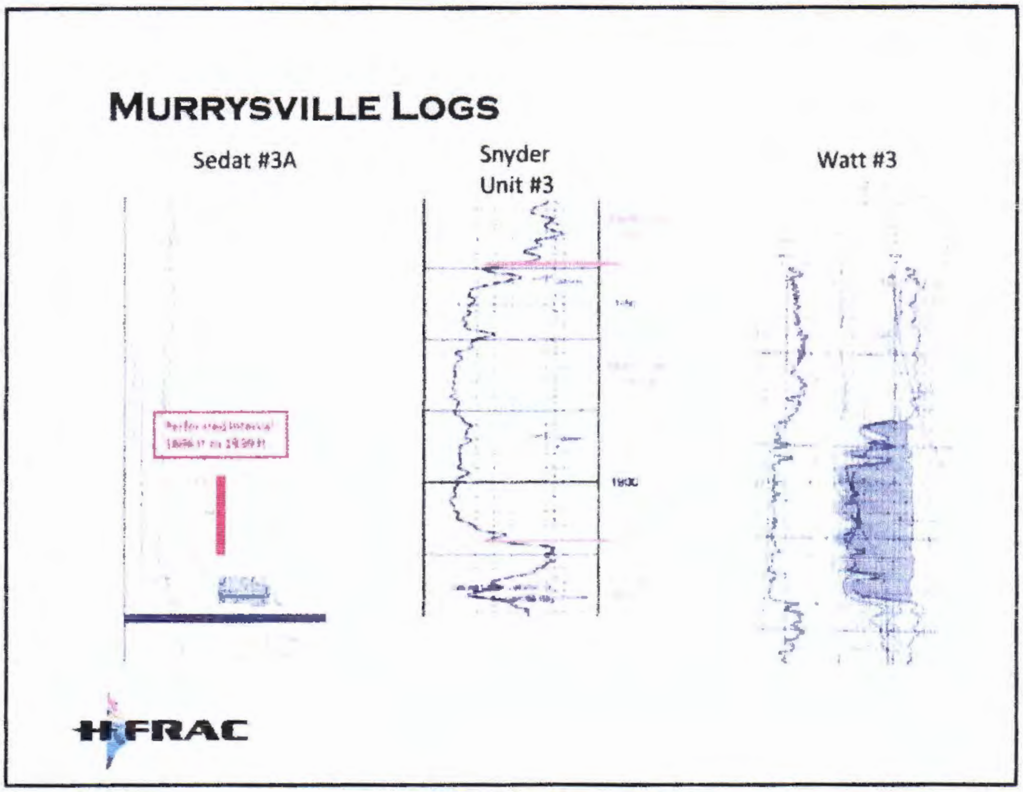
Activity	Date
Perforate	August 7, 2015
Spot Acid and Pull Tubing	August 28, 2015
Break Formation/Pump DFIT	September 1, 2015
Perforation Cleanup	September 29, 2015
Step Rate	October 1, 2015
Perforation Breakdown	November 17, 2015

HIFRAC

TEST RESULTS

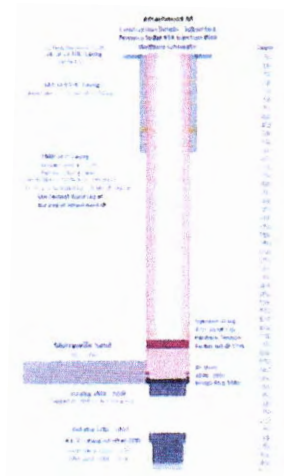
Parameter	Value
Breakdown Pressure	3115 psi
Closure Stress	553 psi
Closure Stress Gradient	0.29 psi/ft
ISIP	1446 psi
Fracture Gradient	1.23 psi/ft
Reservoir Pressure	232 psi
Reservoir Transmissibility (kH/mu)	88 mD-ft/cP
Formation Capacity (kH)	88 mD-ft
Reservoir Permeability	1.8 mD
Fracture Extension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

HFRAC



Murrysville type logs.

SEDAT #3A
WELLBORE SCHEMATIC



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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

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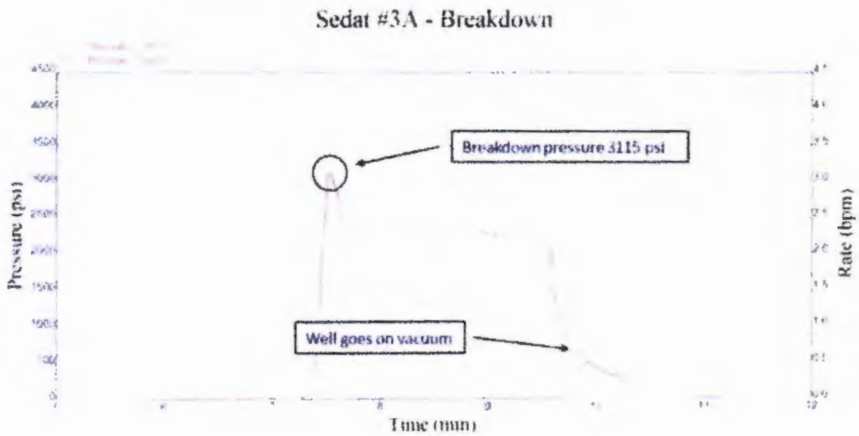
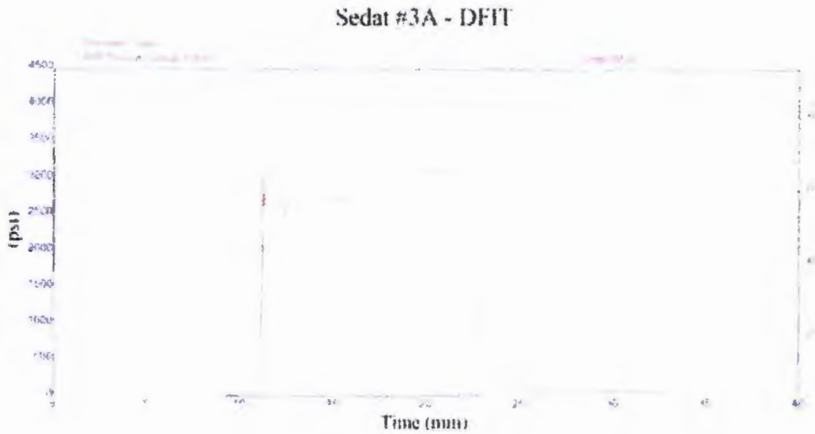
The Sedat #3A was perforated in the Murrysville from 1896 ft to 1939 ft with 41 0.58 in entry hole perforations. Perforation phasing was 60 degrees and the charge was 25 grams.

SEDAT #3A
BREAKDOWN



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



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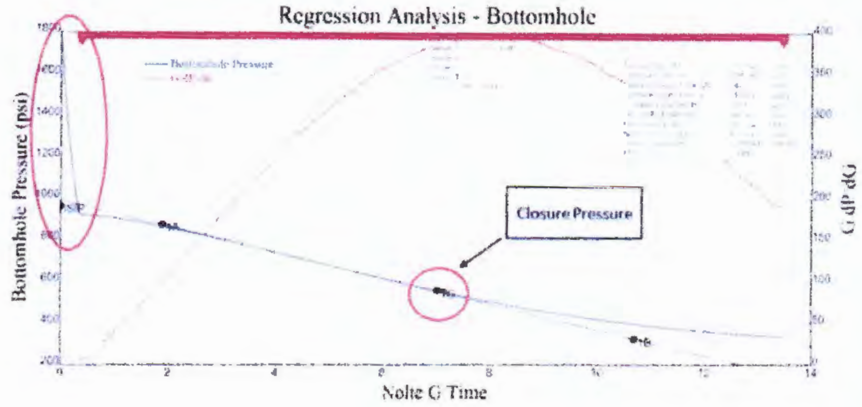
Following the formation breakdown a DFIT (diagnostic fluid injection test) was pumped in the Murrysville to determine closure stress, reservoir pressure, and reservoir transmissibility (kh/mu). Prior to starting the DFIT the whole was loaded with water. After the hole was loaded 1500 gals of water was 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.

SEDAT #3A
NOLTE G FUNCTION



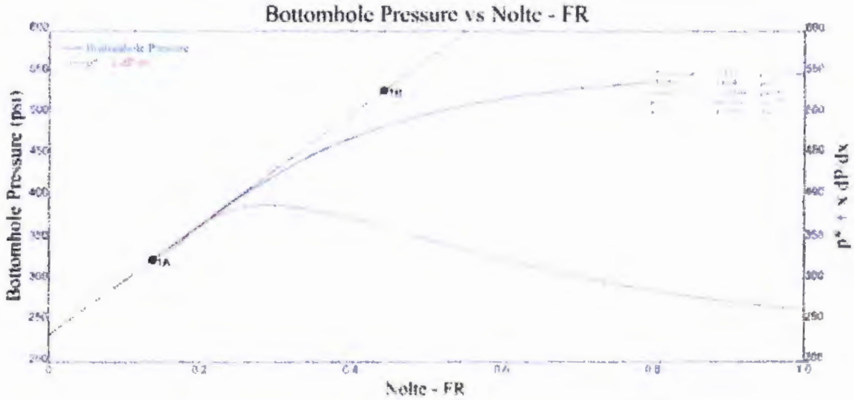
The bottomhole pressure from the DFIT was analyzed with the Nolte G function to determine the closure pressure and closure stress gradient.

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.

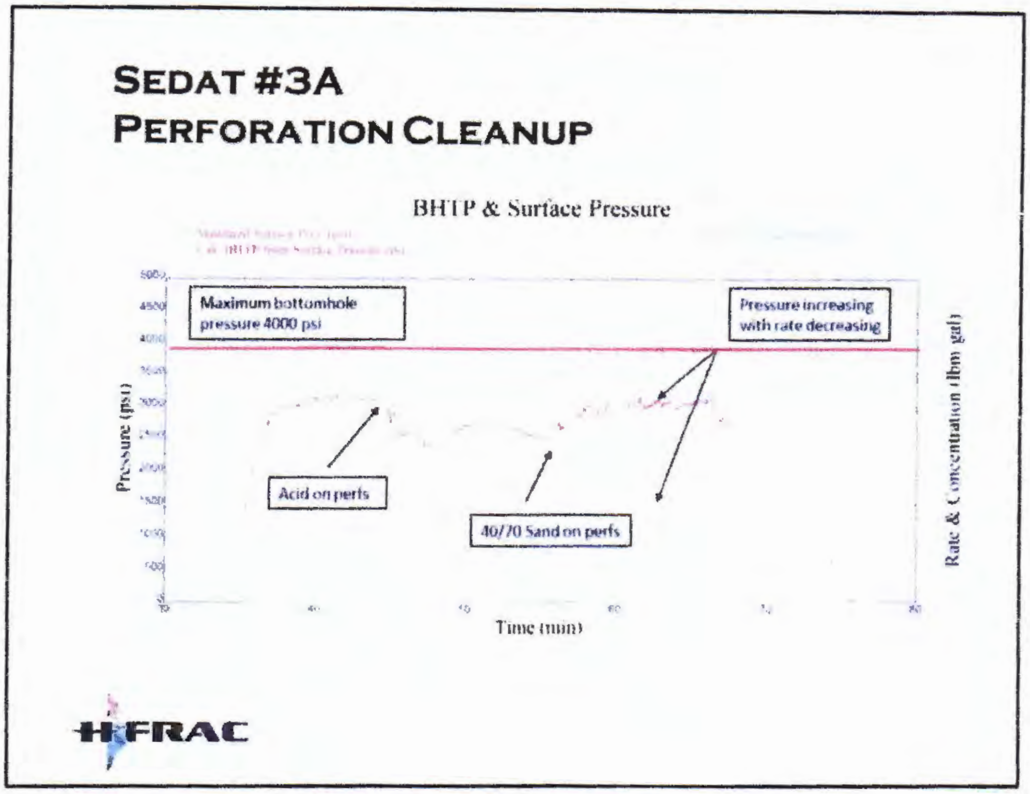
Closure occurred at a Nolte G time of 7.2 giving a bottomhole closure of 553 psi. The closure stress gradient is 0.29 psi. The net pressure was 407 psi and the fluid efficiency was 79 percent.

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.



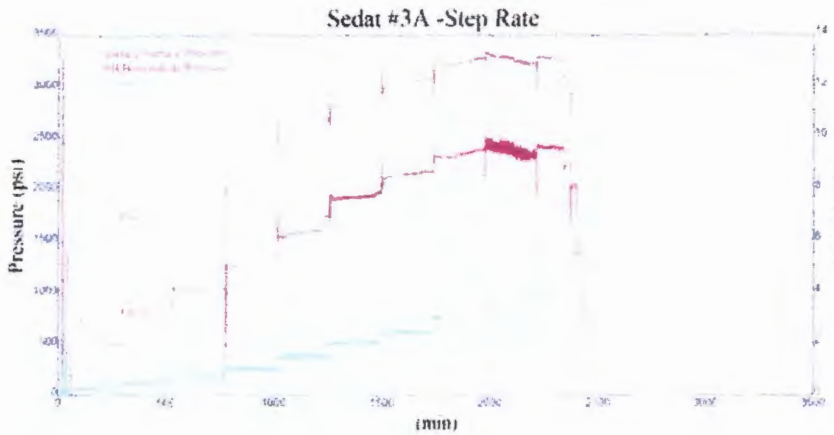
On September 29, 2015 an attempt was made to remove excess friction seen on the DFIT. 500 gals of 15% HCL was pumped. A decrease on the surface treating pressure was seen when the acid was on the perforations. The surface pressure decreased and the injection rate was increased to 12 bpm. The surface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



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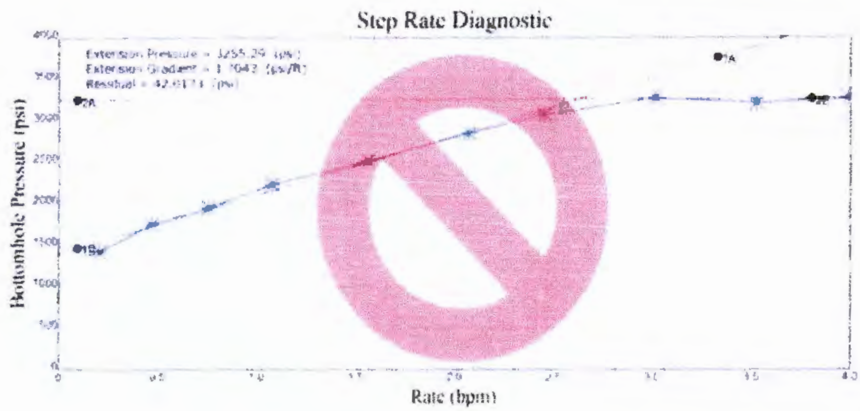
A Step Rate Test was pumped on October 1, 2015 to determine the fracture extension pressure. The initial rate was 0.25 bpm and increased in 0.25 bpm increments until 1 bpm where it was increased to 4 bpm in 0.5 bpm increments. Injection period for each rate stage was 4 hours.

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.

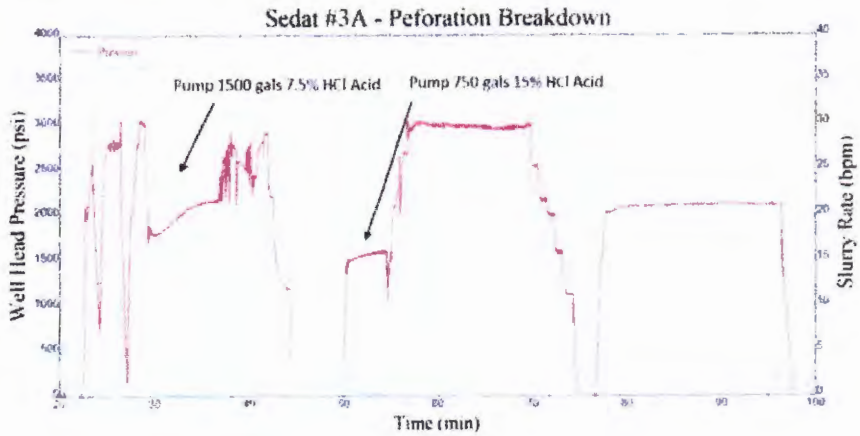
SEDAT #3A
STEP RATE



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.

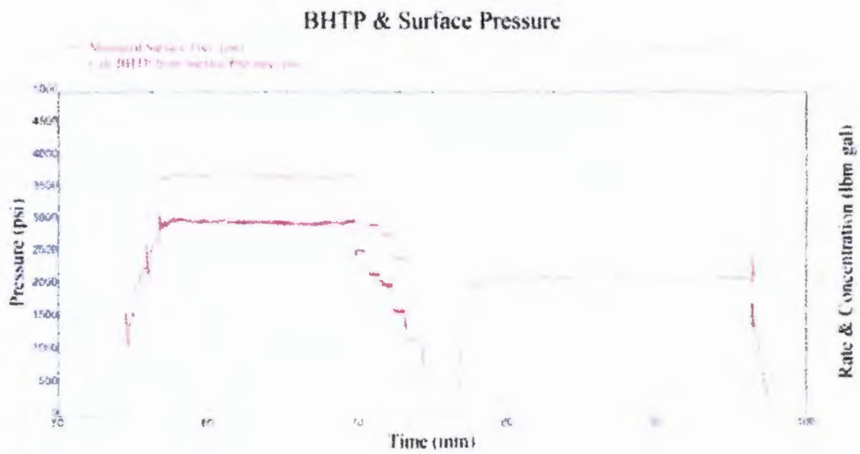
The first acid injection consisted of 1500 gals 7.5% HCl and the second acid injection was 750 gals 15% HCl acid.

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 breakown. An additional injection was pumped at 15 bpm to establish an ISIP.

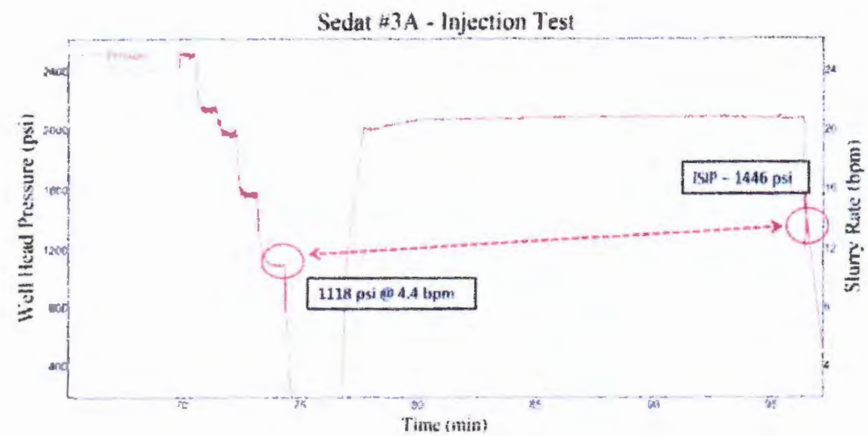
The ISIP was 1441 psi.

SEDAT #3A
SURFACE & CALC'D BH PRESSURE



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

SEDAT #3A
INJECTION TEST (ZOOMED)



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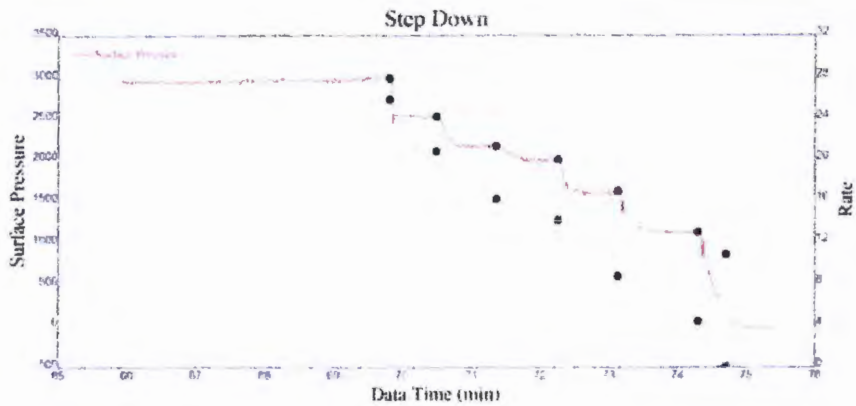
This plot zooms in on the rate stepdown and final injection. The final rate on the stepdown was 4.4 bpm and the pressure was 1118 psi. The final ISIP was 1446 psi giving a fracture gradient of 1.23 psi/ft

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

SEDAT #3A
STEPDOWN POINT SELECTION



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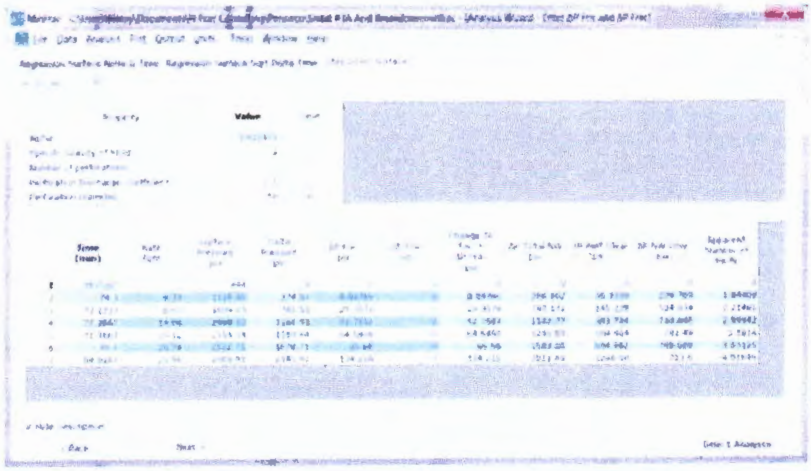
A Stepdown Analysis was conducted to determine the cause of the excess near wellbore friction.

SEDAT #3A
STEPDOWN TABLE



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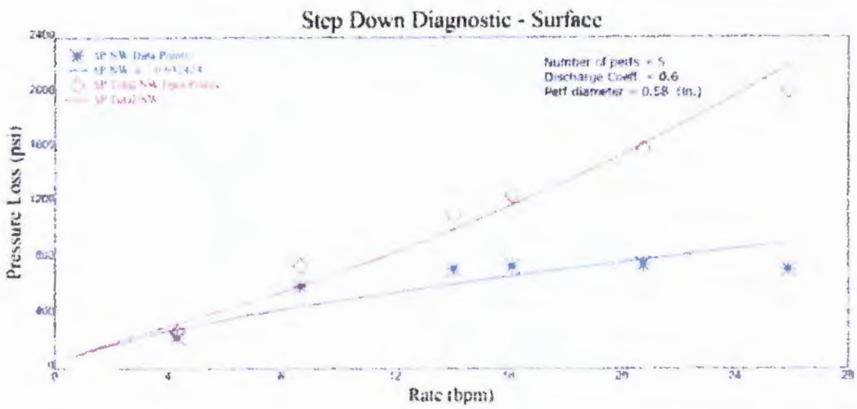
Stepdown Table showing the point selection and friction values.

SEDAT #3A
STEPDOWN 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 Sedar #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.

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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/mu) 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.

HIFRAC

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.

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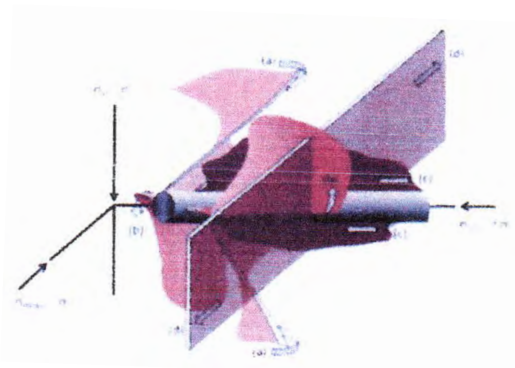
APPENDIX

HIFRAC

COMPLEX FRACTURE PROPAGATION HORIZONTAL WELLBORE



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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 transmissibility 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.

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RADIAL FLOW TIME FUNCTION

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

[illegible]

[illegible]

t_c = time to closure, min

t = time, min

F_R – radial flow function

HIFRAC

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

HIFRAC

API Permit #: 37-003-21223

Customer: PENNECO

Lease and Well Name: SEDAT #3A

A.F.E #: N/A

UNIVERSAL WELL SERVICES, INC.

Job Type: MISC. PUMP PTA

Cement Operator: LANCE SHIREY

Date Cemented: 8/28/2015

Drilling Contractor: SERVICE RIG

Cement Slurry Information

No. of Sacks	Cement Blend Composition	Yield (ft^3/sk)	MixWater (gal/sk)	Density (lb/gal)	(bbl) Mix Water	(ft3) Of Slurry	(bbl) Of Slurry
				Totals			

Wellbore Information

	New/Used	Diameter (In)	Weight (lb/ft)	Top (ft)	Bottom (ft)	Collapse/Burst Pressures (psi)
Casing	Used	4 1/2	10.5	SURFACE	1,941	
Previous Casing						
Tubing or Drillpipe	Used	1 1/2	4.6	SURFACE	1,930	
Open Hole						
Open Hole						

Requested TOC (ft)	SURFACE
TVD (ft)	N/A
Displacement Depth (ft)	
Displacement (bbl)	

Pumping Returns

Spacer or Gel Sweep Return Seen At Surface	
Cement Returns Seen at Surface	
Amount of Cement Returns (BBL)	

Cement Slurry Temperature Record (°F)

Cement	Reading 1	Reading 2	Reading 3	Average
Blend 1				
Blend 2				
Blend 3				

Fluid Information

Mix Water Temp (°F)	
Displacement Fluid Type	Brine
Displacement Fluid Temp (°F)	
Displacement Fluid Density (lb/gal)	8.3

Time	Rate (bpm)	Volume (bbl)	Pressure (psi)	Event or Stage Description
12:15				Arrive On Location, Wait for Rig to Run Casing
				Spot Trucks, Hold JSEA,
				Hold Safety Meeting
				Load Lines, Test Lines
13:00	0-2	1	0-25	PUMP WATER
13:02	2	4.8	25	PUMP ACID 7.5%IRON CHEK
13:04	2	4	25	PUMP WATER
13:06				SHUT DOWN PULL TUBING
				FILL 4.5 W/ RIG
15:09-15:27	0-4	6	0-3000	PUMP WATER TO PUSH ACID BACK IN FORMATION
15:27				SHUT DOWN
				RACK UP
16:00				LEAVE LOCATION

Comments:

Thank You for your Business

UWS Cement Operator Signature: LANCE SHIREY

Customer Representative Signature:

TREATMENT SUMMARY

Customer Name:	Penneco	DFIT	Date: 9/29/15
Well Name:	Sedat #3A		

PRESSURES IN PSI

BREAKDOWN 2900 TOP PERF MD 1896
AVERAGE 2341 BTM PERF MD 1936
SHUT IN: INSTANT 1251 5-MIN 0 10-MIN na

CLEAN VOLUMES IN GAL

TOP PERF TVD 1896 PAD 70
BTM PERF TVD 1936 DISPL 30
TREATMENT 247 TTL VOL 100

HYDRAULIC HORSEPOWER

USED 671

RATES IN B.P.M.

AVG TREATING 11.7 MAXIMUM 11.9

DESCRIPTION OF JOB DFIT

Time	Rate (bpm)	Slurry Volume (gal)	Pressure (psi)	Description of Stage or Event
8:45	na	na	na	Hold Safety Meeting
9:11	na	na	na	Prime Pumps
9:17	na	na	4752	Pressure Test Lines
9:20	na	na	na	Fix Leak
9:28	na	na	na	Prime Pumps
9:29	na	na	5132	Pressure Test Lines
9:33	0.0	0	0	Load Hole
9:37	0.0	21	45	Pump Pad
9:41	na	na	na	Prime Acid
9:44	0.0	40	68	Pump Acid
9:50	0.1	40	1328	Displace Acid/Pump Pad
10:00	4.0	64	2900	Break Formation
10:05	11.9	107	2700	Establish Rate
10:05	11.9	110	2693	Start Sand @ 0.25 40/70
10:12	11.6	175	2852	Start Sand @ 0.30 40/70
10:12	11.7	193	2885	Cut Sand/Flush
10:22	5.0	273	2640	Establish 5.0 bpm
10:23	3.2	275	2031	Establish 3.0 bpm
10:25	2.4	280	1755	Establish 2.0 bpm
10:26	1.4	284	1624	Establish 1.0 bpm
10:28	0.0	287	1251	Shutdown

Totals

Sand	40/70	9	Sks
Chemicals	Unislick ST-50	5	Gals
	Unigel 5F	175	Lbs
	LEB 10X Breaker	0.4375	Gals
	15% HCL	495	Gals

UNIVERSAL WELL SERVICES, INC.

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 (ft³/sk)	MixWater (gal/sk)	Density (lb/gal)	(bbl) Mix Water	(ft3) Of Slurry	(bbl) Of Slurry
				Totals			

Wellbore Information

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

Requested TOC (ft)	
TVD (ft)	
Displacement Depth (ft)	
Displacement (bbl)	

Pumping Returns

Spacer or Gel Sweep Return Seen At Surface	
Cement Returns Seen at Surface	
Amount of Cement Returns (BBL)	

Cement Slurry Temperature Record (°F)

Cement	Reading 1	Reading 2	Reading 3	Average
Blend 1				
Blend 2				
Blend 3				

Fluid Information

Mix Water Temp (°F)	
Displacement Fluid Type	
Displacement Fluid Temp (°F)	
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
0927	.1-1	1	0-3300	LOAD LINES, PSI TEST
0932	.3-2	14	0-100	PUMP WATER TO LOAD HOLE
0944	.25	2.7	0-450	PUMP WATER TO START DFIT
0955	0	0	0	SHUTDOWN, RELEASE PRESSURE, UNHOOK
				WELL HEAD FLANGE NEEDS TIGHTENED
1005	.25	60	0-700	PUMP WATER TO START DFIT
1405	.5	120	450-825	RATE CHANGE TO .5 BBL/MIN
1805	.75	180	825-1075	RATE CHANGE TO .75 BBL/MIN
2206	1	240	1075-1330	RATE CHANGE TO 1 BBL/MIN
0205	1.5	360	1330-1770	RATE CHANGE TO 1.5 BBL/MIN
0605	2	480	1770-2004	RATE CHANGE TO 2 BBL/MIN
1005	2.5	600	2004-2162	RATE CHANGE TO 2.5 BBL/MIN
1406	3	720	2162-2400	RATE CHANGE TO 3 BBL/MIN
1806	3.5	840	2300-2600	RATE CHANGE TO 3.5 BBL/MIN
2205	4	512	2450-2500	RATE CHANGE TO 4 BBL/MIN
0011	3	90	2200-2250	RATE CHANGE TO 3 BBL/MIN
0041	2	60	2025-2050	RATE CHANGE TO 2 BBL/MIN
0111	1	30	1400-1450	RATE CHANGE TO 1 BBL/MIN
0141	0	0	1427-0	SHUTDOWN, MONITOR PRESSURE 10 MIN.
0155				RELEASE PRESSURE, UNHOOK
0200				RACKUP
0230				JOB COMPLETE, LEAVE LOCATION

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

"THANK YOU"

Customer Representative Signature:

TREATMENT SUMMARY

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

PRESSURES IN PSI

BREAKDOWN 3114 TOP PERF MD 1896
AVERAGE 2506 BTM PERF MD 1936
INSTANT 1401 5-MIN 0 10-MIN 0

CLEAN VOLUMES IN GAL

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

HYDRAULIC HORSEPOWER

USED 1130

RATES IN B.P.M.

AVG TREATING 18.4 MAXIMUM 26.3

DESCRIPTION OF JOB Slickwater Fracture

Time	Rate (bpm)	Slurry Volume (bbl)	Pressure (psi)	Description of Stage or Event
5:00				Arrive on location, rig up
7:06				Hold Safety Meeting
7:31			4160	Test Lines
7:33				Fix Leak
7:37			4665	Re-Test Lines, Good Test
8:09				Open Well
8:17	2.7	0	1766	Pump Water
8:19				Shutdown, Re-Prime Pump
8:21	2.7			Pump Water
8:23				Shutdown, Replace Hose
8:27				Re-Prime Pump, Inspect Pump
8:52	5	32	2320	Pump Water
8:55	7.2	40	3114	Break Formation
8:57	10.7	55	3058	Pump Tripped Out, Resume Pumping
8:58	14.1	68	3031	Establish Rate
8:59	4.0	75	1815	Pump Acid
9:07	6.4	110	2167	Displace Acid
9:09	14.1	126	2733	Acid to Perfs
9:12	20.1	171	2802	Establish Rate
9:13	16.0	183	2236	Stepdown Rate
9:14	5.1	198	1279	Stepdown Rate
9:15	0.0	203	261	Shut Down
9:21	3.7	204	1401	Pump Water
9:21	4.0	204	1520	Pump Acid
9:25	4.0	239	1385	Displace Acid
9:28	26.0	284	3005	Establish Rate
9:41	20.8	609	2541	Stepdown Rate - 20 BPM
9:41	16.1	620	2164	Stepdown Rate - 15 BPM
9:42	14.2	636	2006	Stepdown Rate - 14 BPM
9:43	8.6	650	1387	Stepdown Rate - 10 BPM
9:45	4.4	656	1117	Stepdown Rate - 5 BPM
9:46	0.0	664	0	Shut Down

Totals

Chemicals	Unigel 5F	0	Lbs
	LEB 10X Breaker	0	Qts
	FRP 121	110	Lbs
Acid	15% HCL	750	Gals
	7.5% HCL	1,500	Gals

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.	**Collection Date:**	07/29/16 13:00
Site:	Gas Well	**Received Date:**	07/29/16 15:43
Monitoring Pt:	DeSimone #3	**Matrix:**	Non Potable Water (NPW)
Source Type:	Discharge	**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

Ryan C Shafer, Vice President of Operations

Analyst Reference: 33-325 - G & C Laboratory

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

Ryan C Shafer, Vice President of Operations

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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

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).

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

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

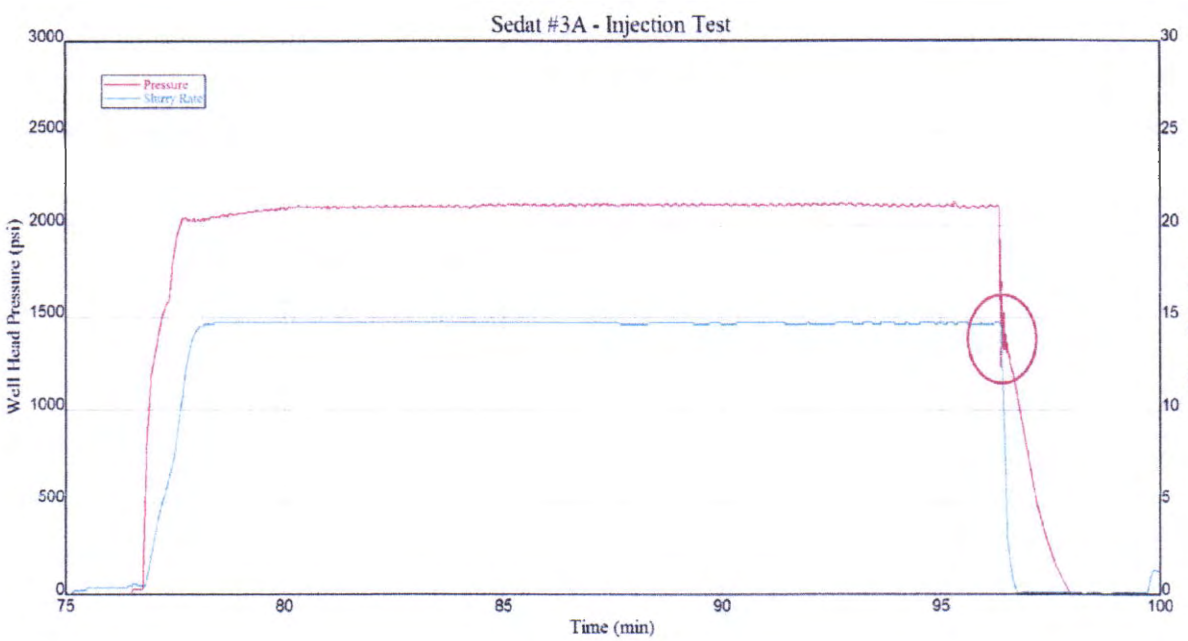


Figure 1 - Sedat 3A Injection Test pumped on November 17, 2015. ISIP 1446 psi.

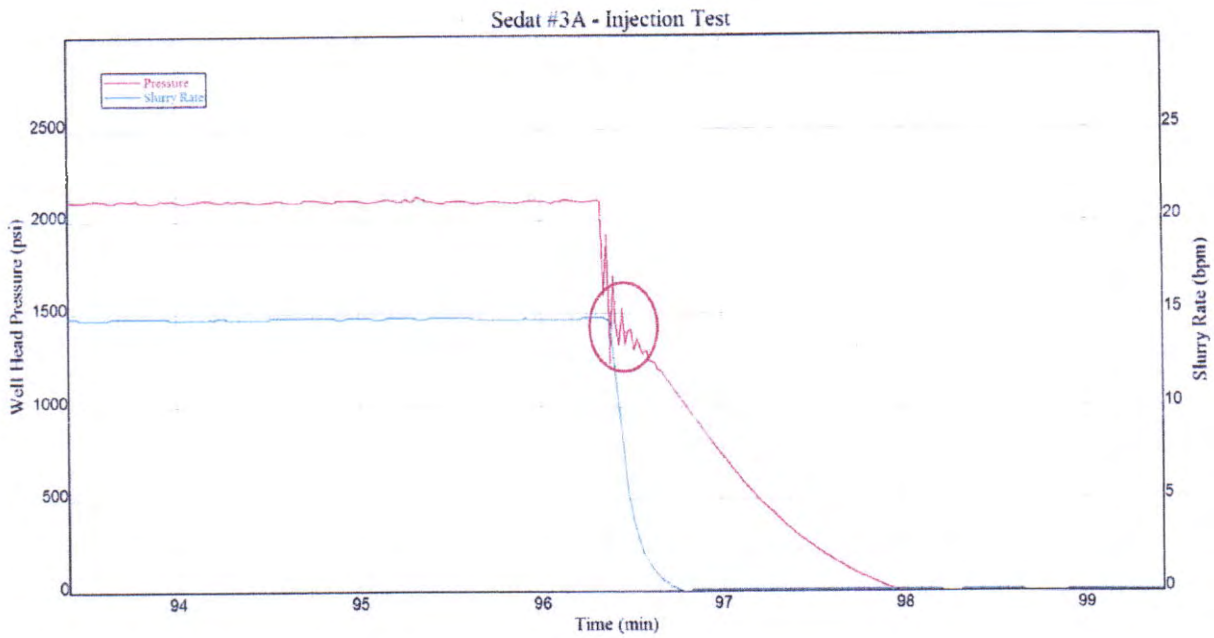


Figure 2 - Sedat #3A Injection Test pumped on November 17, 2015 (zoomed). ISIP 1446 psi

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.

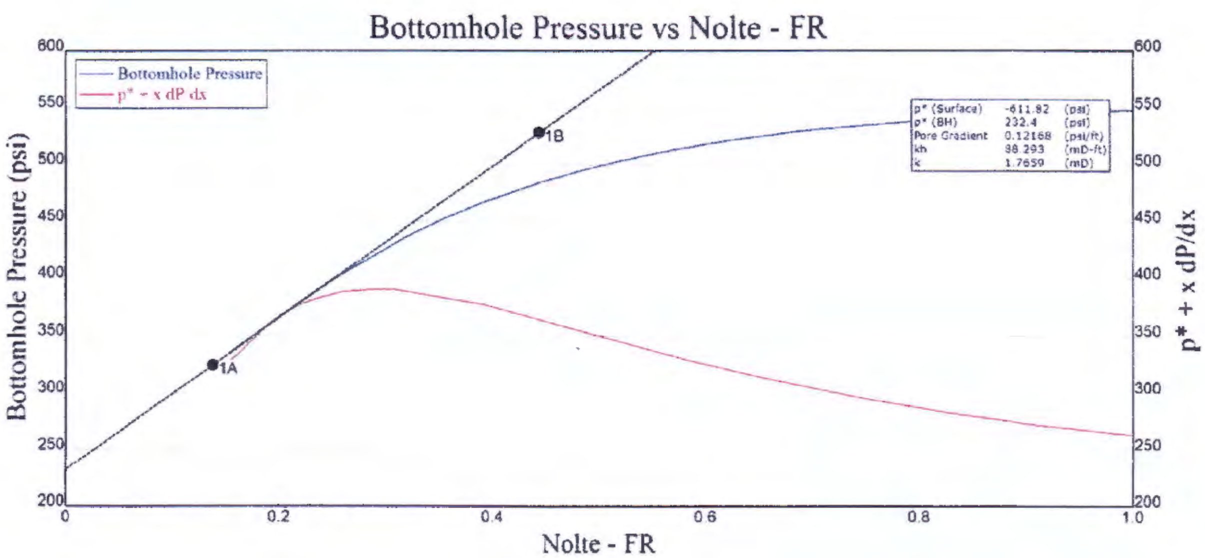


Figure 3 - Sedot #3A After Closure Analysis (ACA)

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

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, Pm= [(FG – (0.433)(Sg)]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 Sg used was 1.11, the Sg of the produced brine water used in the formation study and a depth of 1,896' the top perforation in the Sedat #3A. [Pm = (1.23 – 0.433 (1.11))1896]; Pm=1,420#.

Annulus Fluid

3) Fresh water will be in 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.

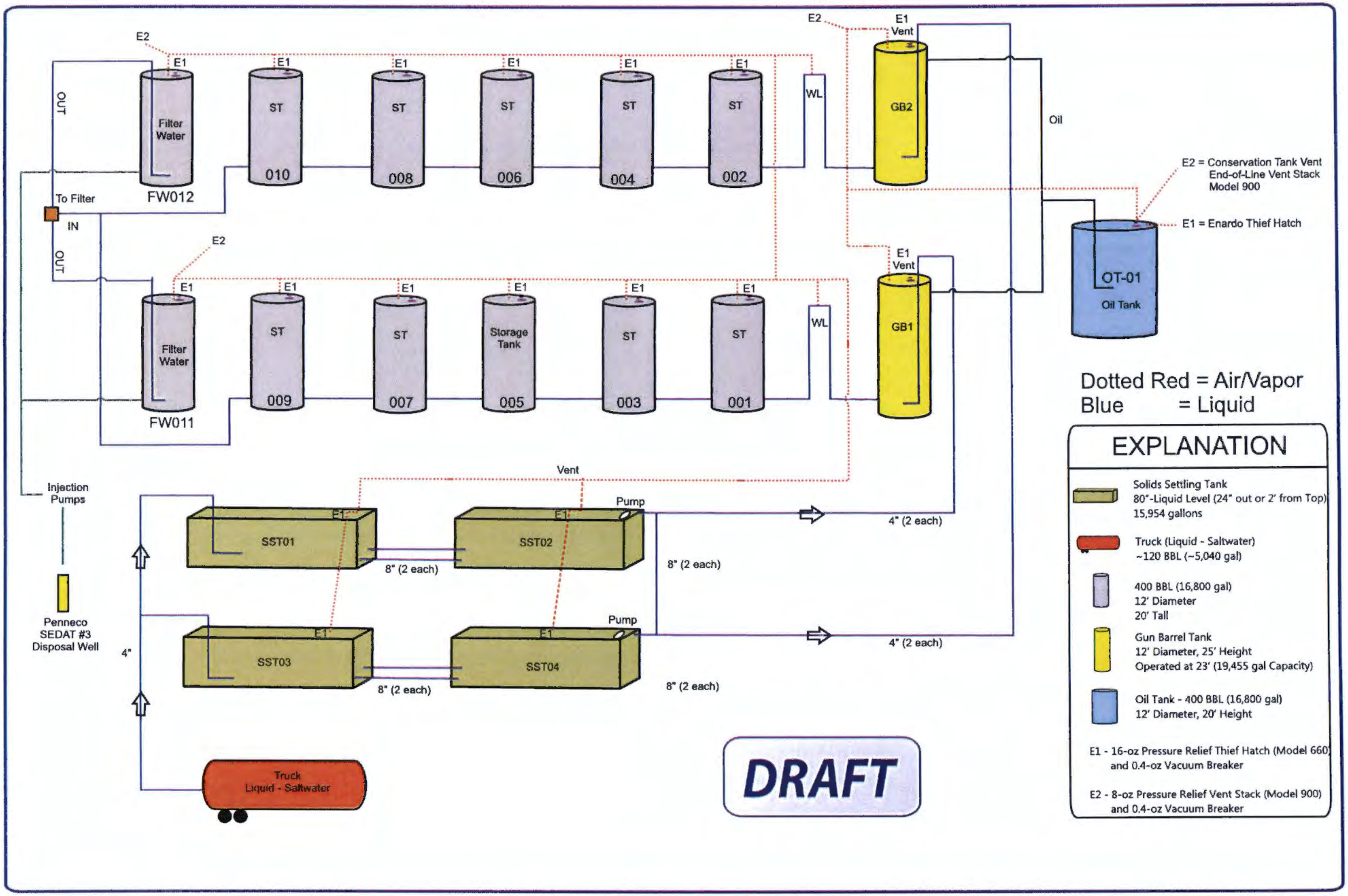
There will be one (1) monitoring well, identified by its Pennsylvania issued permit number, 003-21210. This is a depleted gas well that will be adapted for use as an observation well and is 1,010' to the south west of the Sedat #3A, see well plat map at end of Attachment. The well has satisfactory spacing 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.



TITANIUM ENVIRONMENTAL SERVICES, LLC
PO Box 4029 • Longview, Texas 75606
Phone (903) 234-8443 • Fax (903) 234-1641
www.titaniumenvironmental.com

CLIENT	PROJECT DESCRIPTION	FIGURE 1
Penneco Environmental Solutions LLC	**SEDAT #3 Salt Water Disposal Well Surface Facility**	Process Flow Diagram

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.

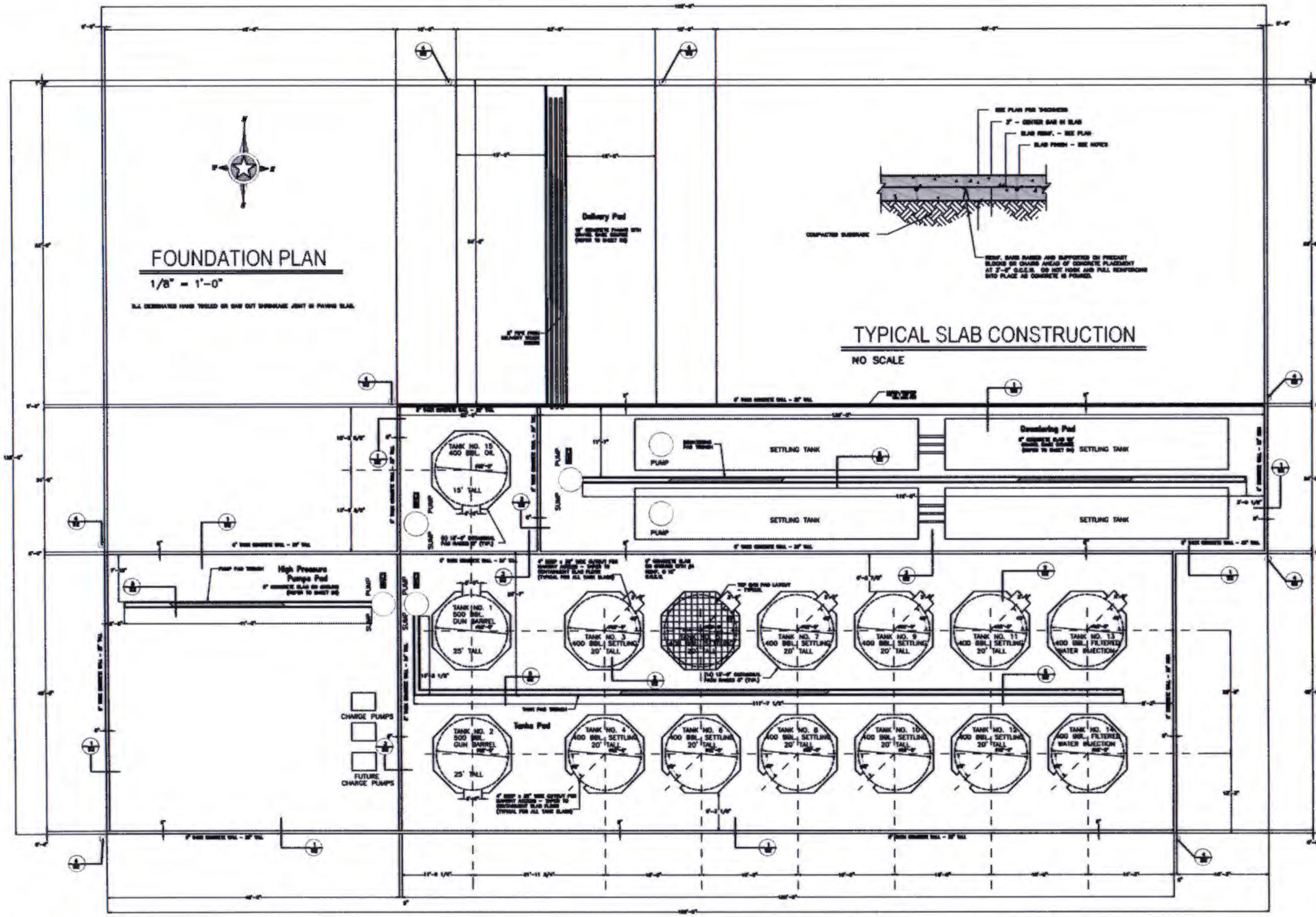
Notice the truck unloading pad is built to prevent rainwater run on and all rainwater or truck leakage will be collected by the truck bay collection system which empties into the solids settling tank containment which can hold all the trucks that could be in the truck bays. All sump pumps automatically 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.



GENERAL NOTES

GENERAL:

THE DESIGN PROFESSIONAL WAIVES ANY AND ALL RESPONSIBILITY AND LIABILITY FOR PROBLEMS WHICH ARISE FROM FAILURE TO FOLLOW THESE PLANS, SPECIFICATIONS AND THE DESIGN INTENT THEY CONVEY, OR FOR PROBLEMS WHICH ARISE FROM OTHERS' FAILURE TO OBTAIN AND/OR FOLLOW THE DESIGN PROFESSIONAL'S GUIDANCE WITH RESPECT TO ANY ERRORS, OMISSIONS, INCONSISTENCIES, AMBIGUITIES OR CONFLICTS WHICH ARE ALLEGED.

ALL WORK TO CONFORM TO 2011 OHIO BUILDING CODE, 2011 OHIO MECHANICAL CODE AND 2011 OHIO PLUMBING CODE.

CONTACT PROPER AUTHORITIES TO LOCATE EXISTING UNDERGROUND UTILITIES PRIOR TO EXCAVATION FOR FOOTINGS.

EARTHWORK: ALL EARTHWORK, INCLUDING EXCAVATIONS, FILLS, PROOFROLLING, TESTING, COMPACTION, ETC., TO BE PERFORMED IN ACCORDANCE WITH RECOMMENDATIONS CONTAINED IN THE SOILS REPORT AND/OR THE SPECIFICATIONS. ALL EARTHWORK SHALL BE INSPECTED FOR CONFORMANCE WITH THE SOILS REPORT AND CONTRACT DOCUMENTS.

CONTROLLED COMPACTED FILL: ALL SOFT MATERIAL THAT CANNOT BE COMPACTED AND MATERIAL THAT CANNOT SUPPORT THE REQUIRED THICKNESS OF CONTROLLED COMPACTED FILL AND/OR FOUNDATION LOADS WITHOUT DETRIMENTAL SETTLEMENT, MUST BE REMOVED PRIOR TO PROOFROLLING.

AFTER STRIPPING AND GENERAL EXCAVATIONS, THE ENTIRE BUILDING AREA SHALL BE PROOFROLLED WITH A PNEUMATIC TIRED ROLLER OR EARTHMOVING UNIT HEAVY ENOUGH TO DETECT CAVITIES, SINKHOLES, SOFT SPOTS OR IRREGULARITIES IN THE SUBGRADE. TESTING LABORATORY REPRESENTATIVE TO OBSERVE AND MAKE RECCOMENDATIONS DURING PROOFROLLING OPERATIONS. TRACK MOUNTED EQUIPMENT SUCH AS BULLDOZERS, FRONT END LOADERS, ETC. ARE NOT TO BE USED FOR PROOFROLLING OR SOIL COMPACTION.

AFTER PROOFROLLING AND CORRECTIVE MEASURES AS REQUIRED BY THE TESTING REPRESENTATIVE ARE ACCOMPLISHED, GENERAL FILL SHALL BE PLACED PRIOR TO CONSTRUCTION OF FOUNDATIONS. ALL FILL WITHING 5'-0" BEYOND THE BUILDING LINES SHALL BE CONTROLLED, PLACED AND COMPACTED TO 98% STANDARD PROCTOR DENSITY (ASTM D698). FILL SHALL BE PLACED IN LAYERS OF APPROPRIATE THICKNESSES REQUIRED BY THE NATURE OF THE SOIL OR AS DIRECTED SO THAT THE MATERIAL WILL BE COMPACTED THOROUGHOUT THE ENTIRE LAYER. SPECIAL CARE SHALL BE TAKEN TO ADEQUATELY COMPACT FILL AND BACKFILL IN AREAS EXCAVATED FOR PIPE TRENCHES, FOOTINGS AND FOUNDATION WALLS. ALL FILL SHALL BE SELECT MATERIAL WITH A LIQUID LIMIT LESS THAN 30 AND A PLASTICITY INDEX (PI) NO GREATER THAN 15.

FOUNDATIONS: FOUNDATION WORK HAS BEEN DESIGNED AND ELEVATIONS ESTABLISHED ON THE BASIS OF THE GEOTECHNICAL REPORT WRITTEN FOR THE USE OF THE OWNER, ARCHITECT AND ENGINEER. FOOTINGS HAVE BEEN DESIGNED TO BEAR ON UNDISTURBED RESIDUAL SOILS OR COMPACTED STRUCTURAL FILL CAPABLE OF SAFELY SUPPORTING A NET PRESSURE OF 2,000 PSF. IF FOUNDATION CONDITIONS PROVE UNACCEPTABLE AT ELEVATIONS SHOWN, FOOTINGS SHALL BE CARRIED DEEPER OR OTHER REDESIGN OF FOUNDATIONS WILL BE REQUIRED AT THE DIRECTION OF THE ARCHITECT/ENGINEER.

CONCRETE: MINIMUM 28 DAY CYLINDER STRENGTH OF 3,000 PSI AND MAXIMUM SLUMP OF 4" PRIOR TO ADDITION OF SUPERPLASTIZERS. REINFORCING STEEL ASTM A615, GRADE 60. LAPS 32 DIAMETER UNLESS NOTED. ALL BARS SECURELY HELD IN ACCURATE POSITION BY SUITABLE ACCESSORIES, TIE BARS, SUPPORT BARS, ETC. EXCEPT AS NOTED OR SPECIFIED. ALL CONCRETE WORK TO COMPLY WITH ACI BUILDING CODE (ACI-318), DETAILING MANUAL (ACI-SP66) AND ACI SPECIFICATIONS FOR STRUCTURAL CONCRETE FOR BUILDINGS (ACI-301), STANDARD TOLERANCES FOR CONCRETE CONSTRUCTION AND MATERIALS (ACI-117). HOT WEATHER CONCRETE TO COMPLY WITH ACI-305. COLD WEATHER CONCRETE TO COMPLY WITH ACI-306.1. PROVIDE ADEQUATE BARRIERS TO PROTECT CONCRETE FROM DRYING PREMATURELY.

SLAB ON GROUND: FLOAT FINISH THEN BROOM FINISH EXTERIOR SLABS.

ALL CONCRETE SHALL BE CURED, EITHER BY APPLICATION OF AN APPROVED CURING COMPOUND OR BY WATER CURING FOR 7 DAYS MINIMUM. CURING COMPOUND SHALL BE CLEAR STYRENE ACRYLATE TYPE, 30% SOLIDS CONTENT MINIMUM. SUBMIT MANUFACTURERS LITERATURE MEETING THESE REQUIREMENTS FOR APPROVAL. WATER CURING SHALL CONSIST OF PONDING, BURLAP, CONTINUOUS SPRAYING OR COMPLETE POLYETHYLENE COVER. THOROUGHLY SOAK CONCRETE WITH ADDITIONAL WATER PRIOR TO COVERING WITH POLYETHYLENE AND SEAL ALL JOINTS WITH TAPE. REPAIR ANY TEARS AND MAINTAIN A MOIST CURING CONDITION FOR ENTIRE CURING PERIOD.

EMPLOY A TESTING AGENCY, ACCEPTABLE TO THE OWNER, WHO WILL PERFORM INSPECTIONS AND TESTING OF CONCRETE. MAKE ONE SET OF FOUR CONCRETE CYLINDERS FROM EACH 50 CUBIC YARDS WITH A MINIMUM OF ONE SET FROM EACH DAYS OPERATIONS FOR EACH CLASS OF CONCRETE. TEST SPECIMENS SHALL BE MADE IN ACCORDANCE WITH ASTM C31. MAKE ONE SLUMP TEST ON THE CONCRETE AT THE BEGINNING OF THE POUR AND FOR EACH SET OF CYLINDERS TAKEN IN ACCORDANCE WITH ASTM C143. MAKE ONE ENTRAINED AIRE TEST WITH EACH SLUMP TEST IN ACCORDANCE WITH ASTM SPECIFICATION FOR ALL AIR-ENTRAINED CONCRETE. CYLINDER SHALL BE TESTED IN ACCORDANCE WITH ASTM C39, TWO CYLINDERS AT 7 DAYS AND TWO AT 28 DAYS OLD. THE TESTING AGENCY SHALL SUBMIT, IN A TIMELY MANNER, THE RESULTS OF THEIR INSPECTIONS AND TESTS TO THE ARCHITECT/ENGINEER FOR REVIEW.

NO CALCIUM CHLORIDE OR ADMIXTURE CONTAINING CHLORIDES SHALL BE USED IN ANY CONCRETE WITHOUT SPECIFIC APPROVAL BY THE ARCHITECT/ENGINEER.

PROVIDE CORNER BARS IN EXTERIOR CORNERS OF GRADE BEAMS AND WALLS, TO MATCH HORIZONTAL REINFORCING.

THOROUGHLY COMPACT ALL SUBGRADE MATERIAL PRIOR TO PLACING CRUSHED STONE. REMOVE ANY LOOSE MATERIAL AND DEBRIS THAT CANNOT BE ADEQUATELY COMPACTED.

REVISIONS

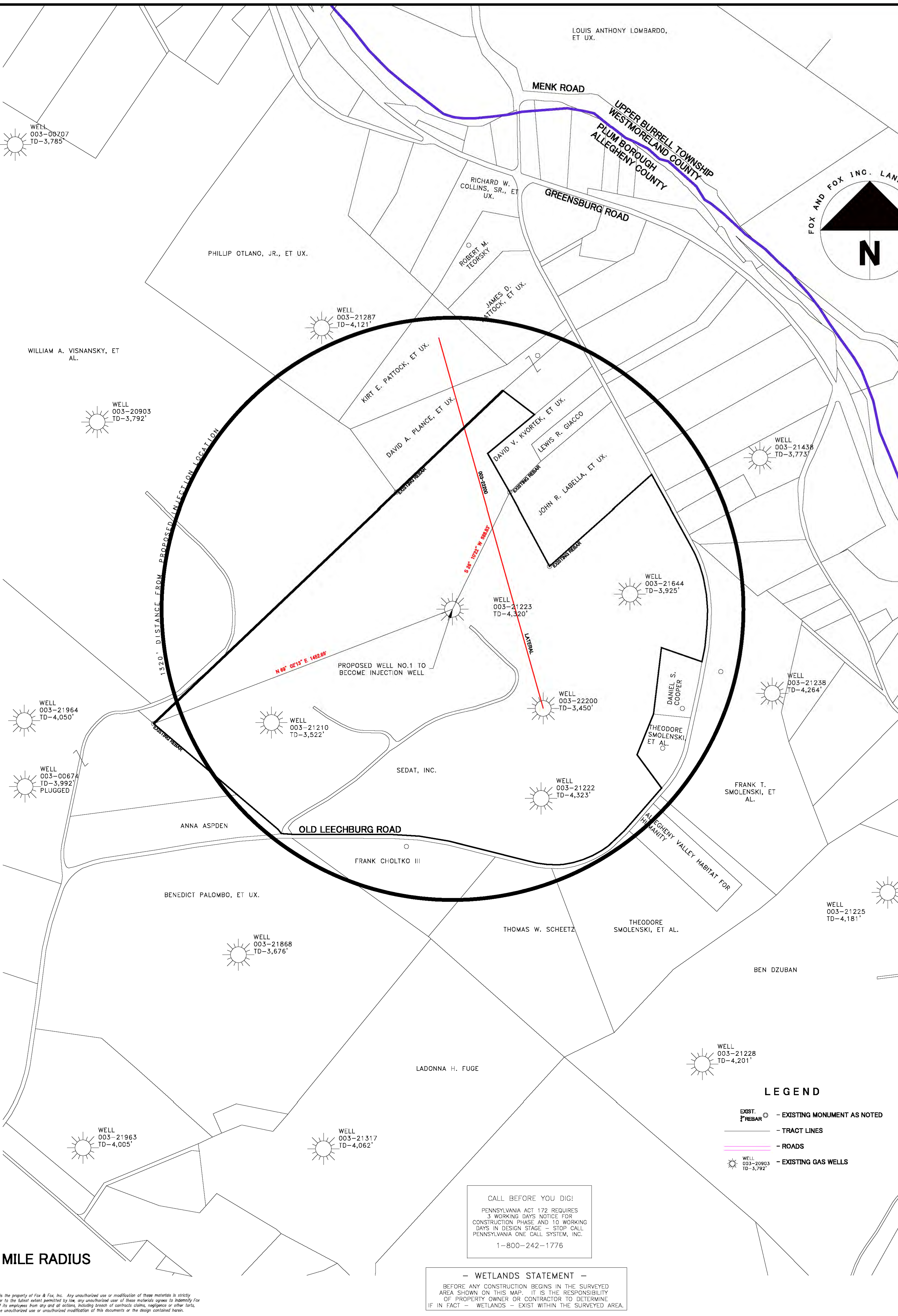
House Engineering & Construction, Inc.
2614 LANSING SWITCH ROAD
LONGVIEW, TEXAS 75602
(903)660-1020 FAX (903)668-4199

DRAFT

PROPOSED FOUNDATION PLAN

PENNECO ENVIRONMENTAL SOLUTIONS, LLC

DATE 7/24/16
SCALE AS NOTED
SHEET NO. S1



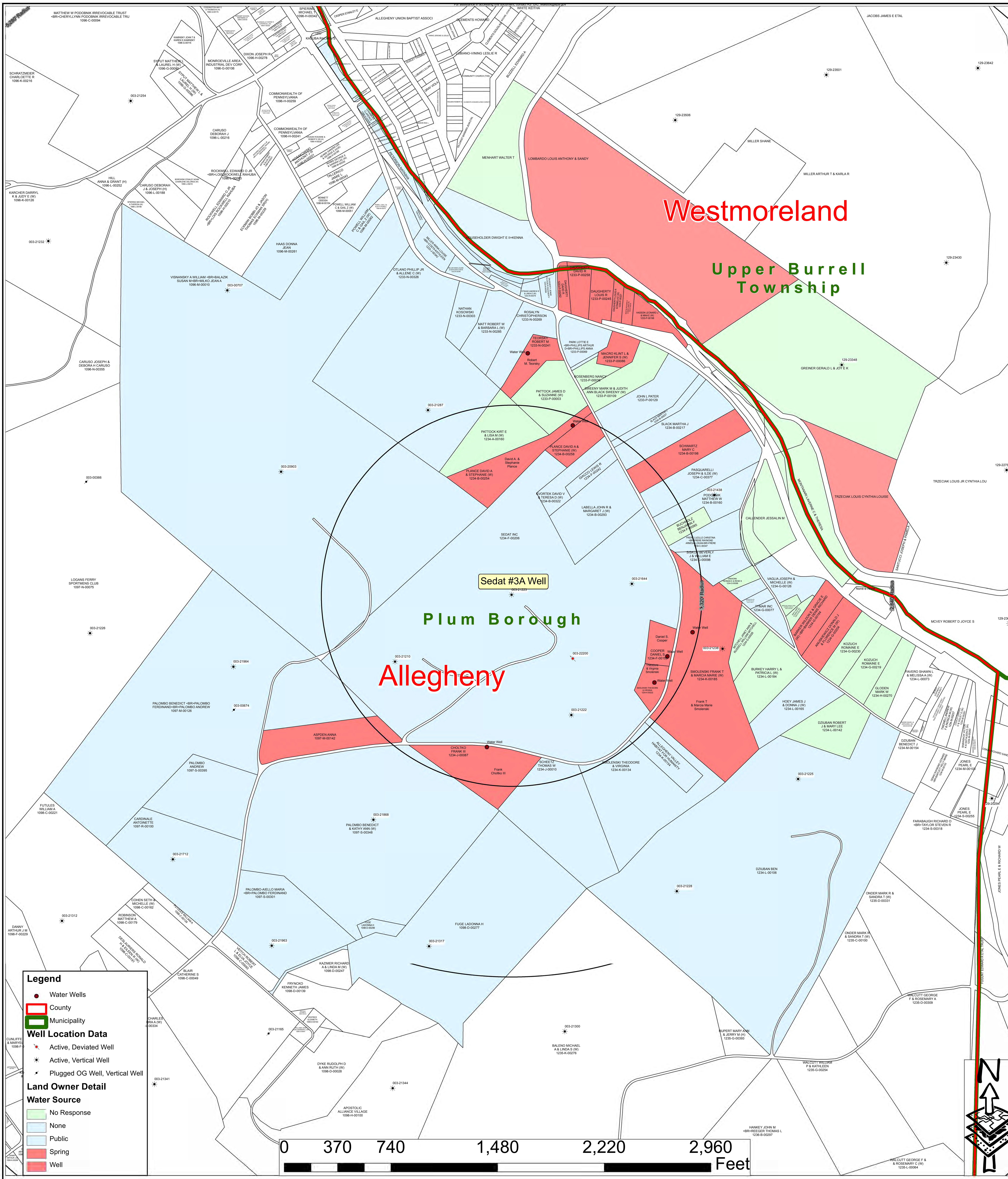
SHEET: 1 OF 1
JOB NO.: 67415_QUARTER_MILE
FILE: PENNECO-INJECTION
SCALE: HORZ.: 1" = 200' VERT.:
CHK: DATE: FEB. 12, 2016
BY: RLF
SEAL
COMMONWEALTH OF PENNSYLVANIA REGISTERED PROFESSIONAL RONALD L. FOX SURVEYOR

PROPOSED INJECTION WELL
FOR
PENNECO ENVIRONMENTAL SOLUTIONS, LLC
PLUM BOROUGH, ALLEGHENY COUNTY
PENNSYLVANIA

FOX & FOX, INC.
58 Timber Bridge Road, Suite 20
Clarion, Pa. 16214
Phone: 814-745-2861 Fax: 814-745-2248
email: ronaldlfox@foxandfoxinc.us
web: www.foxandfoxinc.us

REVISIONS

		DESCRIPTION
1	8-31-16	Revise scale.



BY: MEC

CHK:

DATE: 9-20-16

Scale: 1" = 200'

FILE: Final Water Purveyor Map

JOB NO: 677415

WATER SUPPLY SURVEY FOR PENNECO ENVIRONMENTAL SOLUTIONS, LLC

Plum Borough, Allegheny County
Commonwealth of Pennsylvania

FOX & FOX, INC.
58 Timber Bridge Rd.
Clarion, PA 16214
Phone: 814-745-2861
Fax: 814-745-2248
email: ronaldlfox@foxandfoxinc.us
web: www.foxandfoxinc.us

REVISIONS:

WATER SUPPLY SURVEY

MUNICIPALITY	COUNTY	STATE	OWNER	Address	City, State, Zip	PIN	Water	Well Details	Mailed Assessment Adress	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	Residentual	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	Wildon 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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New Kensington, Pa 15068

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Updated Delivery Day: **Friday, July 29, 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

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Jessalin M. Callender
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Updated Delivery Day: **Friday, July 29, 2016**

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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

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

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Updated Delivery Day: **Friday, July 29, 2016**

Product & Tracking Information

Postal Product:

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

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Tracking Number: **9114999944313758419947**

Updated Delivery Day: **Saturday, July 30, 2016**

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

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Lewis R Giacco
Po Box 327
West Sunbury, Pa 16061

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Tracking Number: **9114999944313758433417**

Updated Delivery Day: **Friday, July 29, 2016**

Product & Tracking Information

Postal Product:

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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

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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

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Romaine E Kozuch
229 5Th Ave
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Updated Delivery Day: **Friday, July 29, 2016**

Product & Tracking Information

Postal Product:

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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

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

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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

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Walter T Menhart
109 Myers Dr
New Kensington Pa 15068

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Updated Delivery Day: **Friday, July 29, 2016**

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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

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Janet Ann & Russell William Mitchell
504 Clarendon St
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Updated Delivery Day: **Friday, July 29, 2016**

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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

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Kirt E & Lisa M Pattock
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Updated Delivery Day: **Friday, July 29, 2016**

Product & Tracking Information

Postal Product:

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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

DATE & TIME	STATUS OF ITEM	LOCATION
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

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Nancy Rosenberg
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Updated Delivery Day: **Friday, July 29, 2016**

Product & Tracking Information

Postal Product:

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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

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James & Shirley Smith
1933 Drennen Rd
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Updated Delivery Day: **Friday, July 29, 2016**

Product & Tracking Information

Postal Product:

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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

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Updated Delivery Day: **Friday, July 29, 2016**

Product & Tracking Information

Postal Product:

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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

Available Actions

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From: Marc Jacobs
To: Scavello, Grant
Cc: Nelson, Mark
Subject: RE: Clarifications/Additions needed for Sedat #3A Permit
Date: Tuesday, March 21, 2017 3:39:21 PM
Attachments: image001.png
image002.png
Well Schematic - Sedat #1A.xlsx
Attachment L Sedat #3.docx
Sedat 3A Attachment G Geological Data Injection and Confining Zone for Sedat #1 Injection Well.docx
Injection String Schematic - Sedat #3a.xlsx

Grant,

Please note the following responses to your requests for clarification.

1) Attached is a construction diagram of the Sedat #1A proposed monitor well. The intention is to plug the lower perfs and perforate the 4½" and 7" casings at Murrysville depth for monitoring. The 4½" has a logged cement top at 1,740' and the 7" is cemented to surface.
2) The difference in referenced packer depths must have been related to the length of the packer which is 56¼". One was probably referencing the top of the packer and the other likely the bottom. Attachment L (attached) has been changed to match the packer depth on the diagram and include the length of the packer (1,796'). I noticed another discrepancy in the Attachment G (attached) narrative relating to the packer depth and changed it accordingly to read *approximately 1,800'*. I also changed the Murrysville Sand depth (1,822'-1,950') on the Attachment M diagram (attached) to better reflect the full sand body as detailed by the gamma.
3) According to our engineering consultants, is has been recommended to us to use the lower specific gravity of 1.11 and keep our max injection pressure as stated in the application.

I will forward 3 hard copies of each changed document and a flash drive containing the same through the US Postal Service to your Philadelphia office.

Please do not hesitate to call or email if you need anything else.

Sincerely,

Marc

D. Marc Jacobs, Jr.
Senior Vice President

6608 Route 22 • Delmont, PA 15626-2408
Ph: (724) 468-8232 • Fax: (724) 468-8230
Web: www.penneco.com

From: Scavello, Grant [mailto:Scavello.Grant@epa.gov]
Sent: Thursday, March 16, 2017 3:20 PM
To: Marc Jacobs
Cc: Nelson, Mark
Subject: Clarifications/Additions needed for Sedat #3A Permit

Mr. Jacobs,

Thank you for working with us to provide an update to the three pieces of information noted below. Your application has been very informative and detailed throughout, which has been greatly helpful to our review process. As we discussed when we met in person, most of these things are to clarify a

small discrepancy in details for a part of the application such as, for example, a diagram which could be misinterpreted by someone reviewing the application. If you have any questions to help further clarify our needs as described below, please feel free to reach out to me via email.
Again, we appreciate you working with us to get all necessary information prior to the public notice period.
Sincerely,
Grant

-Please provide a construction diagram of monitoring well Sedat #1, similar to the diagram provided for Sedat #3A,that includes specific notation showing where top of cement is and correlates where the Murraysville Sand layer is located as it pertains to Sedat #1. Permit provisions for monitoring wells require shut in of Sedat #3A if the monitoring well level rises to 100’ of top of cement, and having an accurate diagram of the current depth, perfs, etc. can better help us define the ability of Sedat #1 to monitor within our permit provision. Please provide three physical copies of the diagram and one electronic copy to add to the permit application.
-Confirm depth of Sedat #3A packer. Attachment L notes as 1792, diagram shows as 1796. If packer accounts for additional 4’ we will use depth of 1796 in permit and permit calculations. Also confirm depths of Murraysville Sand layer in the area of Sedat #3A so that both geologic description and well diagram match correct depth. Make sure this is reflected in well construction diagram. If updates need to be made to either the well diagram or the geologic description, please provide three physical copies of the diagram or any updated geologic description and one electronic copy to add to the permit application.
-Please confirm that the maximum specific gravity value you’d like to be included in your permit condition is 1.2. Our commercial permits are written to allow for blending of fluid to bring SG below a maximum value, but your permitted SG value will impact other permit conditions and I wanted to reconfirm with you since the characteristic fluid sample you provided has a value of 1.1284 and your max injection pressure was calculated using a value of 1.11. If you would like to keep your SG value as 1.11, max injection pressure will be as stated in the application. With an SG of 1.2, MIP will be lowered to 1346psi and bottom hole pressure will be 2467psi.

Grant Scavello
Physical Scientist
Ground Water & Enforcement Branch
US EPA, Region 3
1650 Arch Street
Philadelphia, PA 19103
(215)-814-5498

PENNECO

YOUR ENERGY EXPLORATION PARTNER

March 22, 2017

Mr. Grant Scavello
US EPA, Region 3
1650 Arch Street
Philadelphia, PA 19103

RE: Sedat #3A UIC Permit - Request for Clarification and Additional Information

Dear Mr. Scavello,

The following detail and attached triplicate documentation is in response to your March 21st email request.

1) Attached is a construction diagram of the Sedat #1A proposed monitor well. The intention is to plug the lower perfs and perforate the 4½" and 7" casings at Murrysville depth for monitoring. The 4½" has a logged cement top at 1,740' and the 7" is cemented to surface.

2) The difference in the referenced packer depths must have been related to the length of the packer which is 56¼". One was probably referencing the top of the packer and the other likely the bottom. Attachment L (attached) has been changed to match the packer depth on the diagram and include the length of the packer (1,796'). I noticed another discrepancy in the Attachment G (attached) narrative relating to the packer depth and changed it accordingly to read *approximately 1,800'*. I also changed the Murrysville Sand depth (1,822'-1,950') on the Attachment M diagram (attached) to better reflect the full sand body as detailed by the gamma.

3) According to our engineering consultants, is has been recommended to us to use the lower specific gravity of 1.11 and keep our max injection pressure as stated in the

6608 Route 22, P.O. Box 300
Delmont, PA 15626-0300
Ph: (724) 468-8232
Fax: (724) 468-8230
Email: penneco@penneco.com
Web: penneco.com

application. If you believe that a change would be in our best interest, we would be very interested to consider your reasoning.

Please do not hesitate to contact me if you need anything else.

Sincerely,

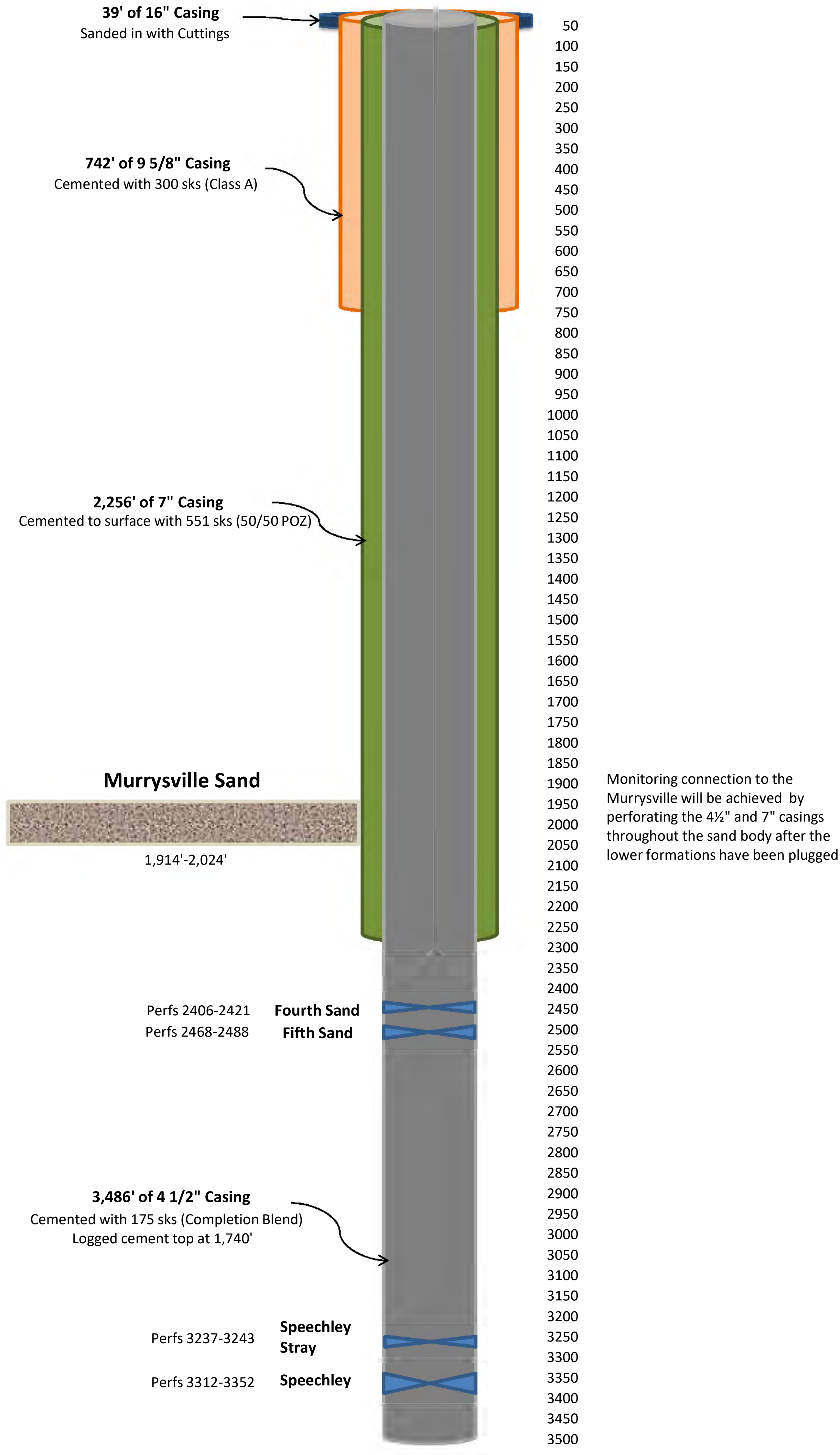
PENNECO ENVIRONMENTAL SOLUTIONS, LLC

D. Marc Jacobs, Jr.
Senior Vice President

Penneco Oil Company

Sedat #1A - Proposed Monitor Well

37-003-21210



July 21, 2021

Mr. D. Marc Jacobs, Jr.
Senior Vice President
Penneco Environmental Solutions, LLC
6608 Route 22
Delmont, PA 15626-2408

Subject: Zone of Endangering Influence (ZEI) Modeling
Underground Injection
Penneco - Sedat #3A and Sedat 4A Wells
Allegheny County, PA

Dear Mr.Jacobs:

This letter report summarizes the analytical modeling performed by Tetra Tech, Inc. (Tetra Tech) for the Area of Review (AOR) /Zone of Endangering Influence (ZEI) analysis for the Penneco Environmental Solutions, LLC (Penneco) Sedat #3A and #4A wells. Sedat #3A has received its UIC Class IID well permits from US EPA and PADEP and is operational, while Sedat #4A has not yet received its UIC well permits from US EPA and PADEP. Both wells are located in Plum Borough of Allegheny County, Pennsylvania and target the Murrysville Sand as the injection zone. We understand that as part of the permit application review process, US EPA has requested a ZEI analysis be performed under the condition of both the Sedat #3A and Sedat #4A injecting. As such, the scenario we have modeled involved injecting simultaneously at both wells. The relevant parameters for our analysis were obtained from existing permit-related documents and information provided by Penneco or estimated/based on literature values in the absence of any well-specific information. Our analysis is described in more detail below.

OVERVIEW AND METHODOLOGY

There are several methods proposed for calculating the ZEI of an injection well. The most simplistic method is the use of a fixed radius, based on the type of injection well being permitted. Other methods involve calculation of the radius based on well and formation properties. Most regulatory agencies require the use of calculations to determine the ZEI. The method used here is the graphical method first used by US EPA Region 6. It involves the calculation of the increase of pressure in the formation due to injection, then converting that pressure into equivalent feet of head. The increase in head in the formation due to injection is then compared to the equivalent head of the lowest most underground source of drinking water (USDW). When plotted graphically, the intersection of those two curves at some radial distance, r, determines the radius of the ZEI.

The increase in pressure in the formation due to injection depends on the properties of the injection fluid and the formation, the rate of fluid injection, and the length of time of injection. The most common mathematical expression to describe this increase in pressure was developed by Matthews and Russell (1967). Matthews and Russell assume that, for a single well injecting into an infinite, homogeneous and isotropic, non-leaking formation, the increase in pressure (delta p) can be described as:

delta p = 162.6 Qμ / kh * [(log(kt / ΦμCr^2) – 3.23] where:

delta p = pressure change (psi) at radius, r and time, t

Q = injection rate (barrels (bbls)/day)

μ = injectate viscosity (centipoise)

k = formation permeability (millidarcies (md))

h = formation thickness (feet)

t = time since injection began (hours)

C = compressibility (total, sum of water and rock compressibility) (psi^{-1})

r = radial distance from wellbore to point of investigation (feet)

Φ = average formation porosity (decimal)

PARAMETERS USED IN THE ANALYSIS

The following parameters were used in the ZEI analysis. For injection rate, we used a daily rate of 3,600 bbls/day for the Sedat #3A well (based on the permitted monthly rate of 108,000 bbls divided by 30 days) and the proposed daily rate of 1,800 bbls/day for the Sedat #4A well (based on the proposed monthly rate of 54,000 bbls divided by 30 days). For this analysis, permeability was assigned a value of 100 md, which is based on literature values which state that permeability of the Murrysville Sand in southwest Pennsylvania ranges from 0.005 to 1,000 md, with an average of 100 md (Sager, 2007; Smosna and Sager, 2008). The literature shows that permeability is related to porosity, with higher porosity values corresponding to higher permeability values (Figure 1). As indicated in the US EPA Statement of Basis for the Sedat #3A draft UIC Class IID well permit, average porosity for Murrysville Sand in the Sedat #3A area averages 24%. The 100 md average permeability value is also referenced in the US EPA Statement of Basis document. It is noted that HFRAC, as part of formation testing on the Sedat #3A well, estimated a permeability value of 1.8 md; however, as indicated in the attached technical memo from HFRAC, the result is considered to not be representative of formation conditions primarily due to only a small percentage of perforations being accessed during the test and near well bore tortuosity. The initial pressure at the top of the injection formation was based upon observed measurements during the formation test for the Sedat #3A well conducted by HFRAC. The above input parameters and others required for the modeling are provided below for each well along with the basis for the assigned input parameter value.

<u>Sedat #3A Murrysville Sand Well</u>

Q = 3600 barrels/day (Permitted monthly injection rate / 30 days)

t = 10 years = 87,600 hours (Modeled scenario)

μ = 1 centipoise (Default)

k = 100 md (Based on average Murrysville permeability per Sager (2007))

h = 81 feet (Thickness of proposed perforated interval)

C = 3.0e-06 psi^{-1} (Default)

Φ = 0.24 (Porosity log value)

Specific gravity of injectate = 1.23 (Anticipated specific gravity of injected brine)

Surface elevation = 1106 feet (Well Completion Report)

Depth to injection formation = 1896 feet (EPA UIC Well Permit)

Base of lowest most USDW (MSL) = 656 feet (Surface elevation – 450 feet (depth to lowest most USDW from Sadat #3A USEPA Statement of Basis document))

Initial pressure at top of injection formation = 232 psi (Initial reservoir pressure reported by HFRAC for the Sadat #3A well as part of formation testing)

<u>Sedat #4A Murrysville Sand Well</u>

Q = 1800 barrels/day (Proposed monthly injection rate / 30 days)

t = 10 years = 87,600 hours (Modeled scenario)

μ = 1 centipoise (Default)

k = 100 md (Based on average Murrysville permeability per Sager (2007))

h = 60 feet (Thickness of proposed perforated interval)

C = 3.0e-06 psi^{-1} (Default)

Φ = 0.24 (Porosity log)

Specific gravity of injectate = 1.23 (Anticipated specific gravity of injected brine)

Surface elevation = 1068 feet (Well Completion Report)

Depth to injection formation = 1740 feet (UIC Well Permit Application)

Base of lowest most USDW (MSL) = 656 feet (Surface elevation – 412 feet (depth to lowest most USDW elevation from Sadat #3A USEPA Statement of Basis document)

Initial pressure at top of injection formation = 232 psi (Initial reservoir pressure reported by HFRAC for the Sadat #3A well as part of formation testing)

RESULTS

The Matthews and Russell equation was solved for the distance from the wells based on the parameters listed above. The distance between the Sedat #3A and Sedat #4A wells is approximately 815 ft.

The Matthews and Russell equation was used to calculate the increase in pressure in the formation with only one well injecting. This was done for both wells. Then, this value was added to the value of existing pressure in the injection formation to obtain the total pressure in the formation when both wells are injecting.

These values were then converted to feet of head of formation brine. The values are plotted against distance from the wellbore and are shown in Figure 2 for the Sedat #3A well and Figure 3 for the Sedat #4A well. The plot shows the calculated pressure surface within the injection formation, measured as feet of head of formation brine above the top of the injection formation. Also shown is the head of the lowest most USDW. Where the two lines intersect, the radius of the ZEI can be estimated. The results indicate that the radial distance of the ZEI is approximately 360 feet for the Sedat #3A well and approximately 250 feet for the Sedat #4A well. These distances are well within the ¼ mile standard fixed radius for AOR/ZEI.

CONCLUSIONS

Our analysis of the AOR/ZEI for the Sedat #3A and #4A wells (injecting together) is based on a methodology typically used by US EPA. Based on the results, we believe the Sedat #3A and #4A wells are excellent candidates for use as brine disposal wells from a ZEI perspective. The analysis indicates that the AOR of ¼ mile is sufficiently protective given the ZEI results of 360 feet for Sedat #3A and 250 feet for Sedat #4A.

REFERENCES

Matthews, C.S., Russell, D.G., (1967) Pressure Buildup and Flow Test in Wells, SPE Monograph Series, Volume1, New York.

Sager, M., (2007) Petrologic Study of the Murrysville Sandstone in Southwestern Pennsylvania, West Virginia University Libraries.

Smosna, R., Sager, M., (2008) The Making of a High-Porosity, High-Permeability Reservoir – The Murrysville Sandstone of Pennsylvania, AAPG Eastern Section Meeting, Pittsburgh, PA.

Please feel free to contact me at 724-766-5987 or by email at dale.skoff@tetratech.com with any questions or comments.

Respectfully submitted,
Tetra Tech, Inc.

Dale E. Skoff, PG, CHMM
Account Manager

cc: Jeff Benegar – Tetra Tech

Figures

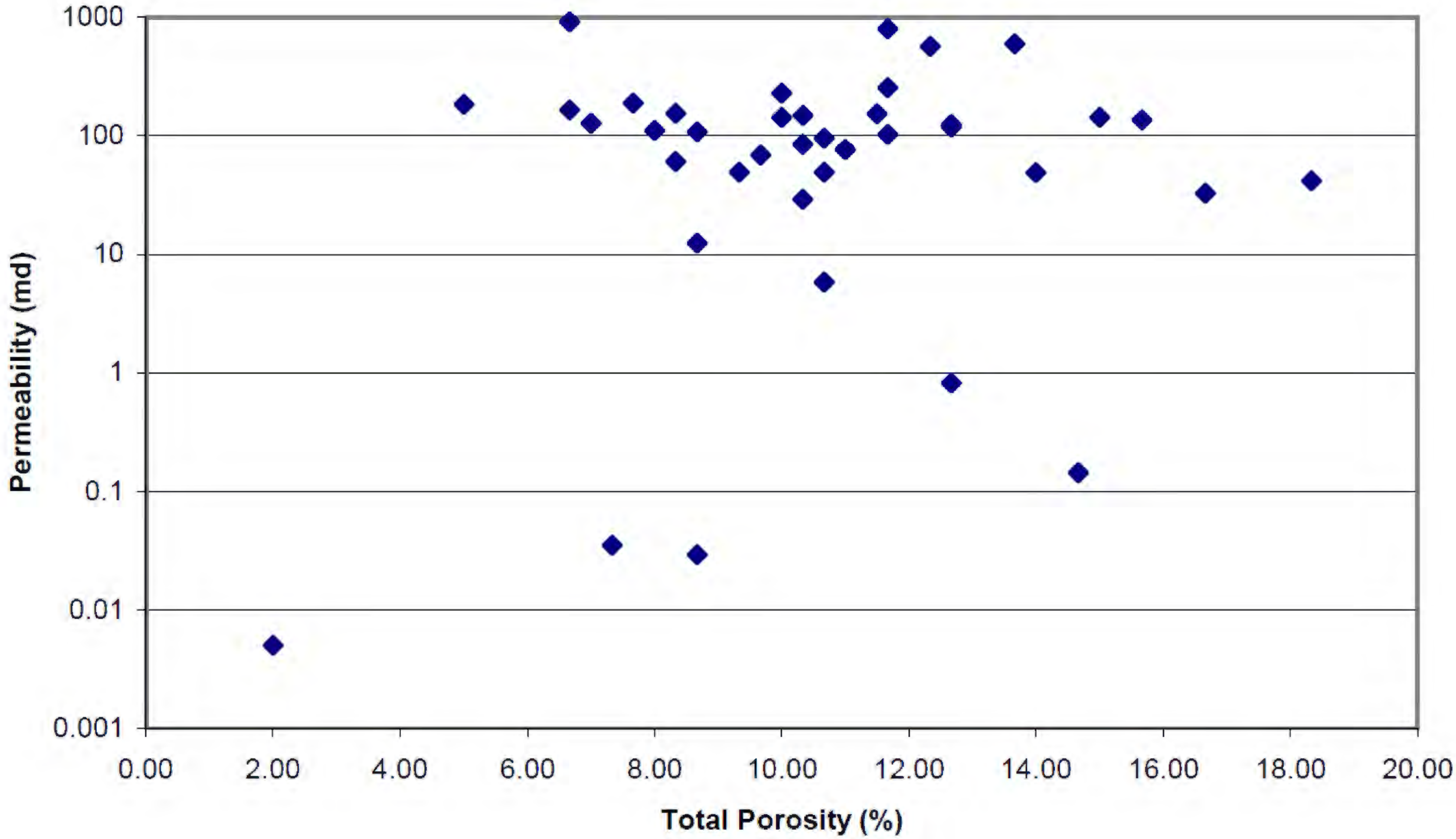


Figure 1. Porosity vs. permeability for the Murrysville Sand (from Sager, 2007)

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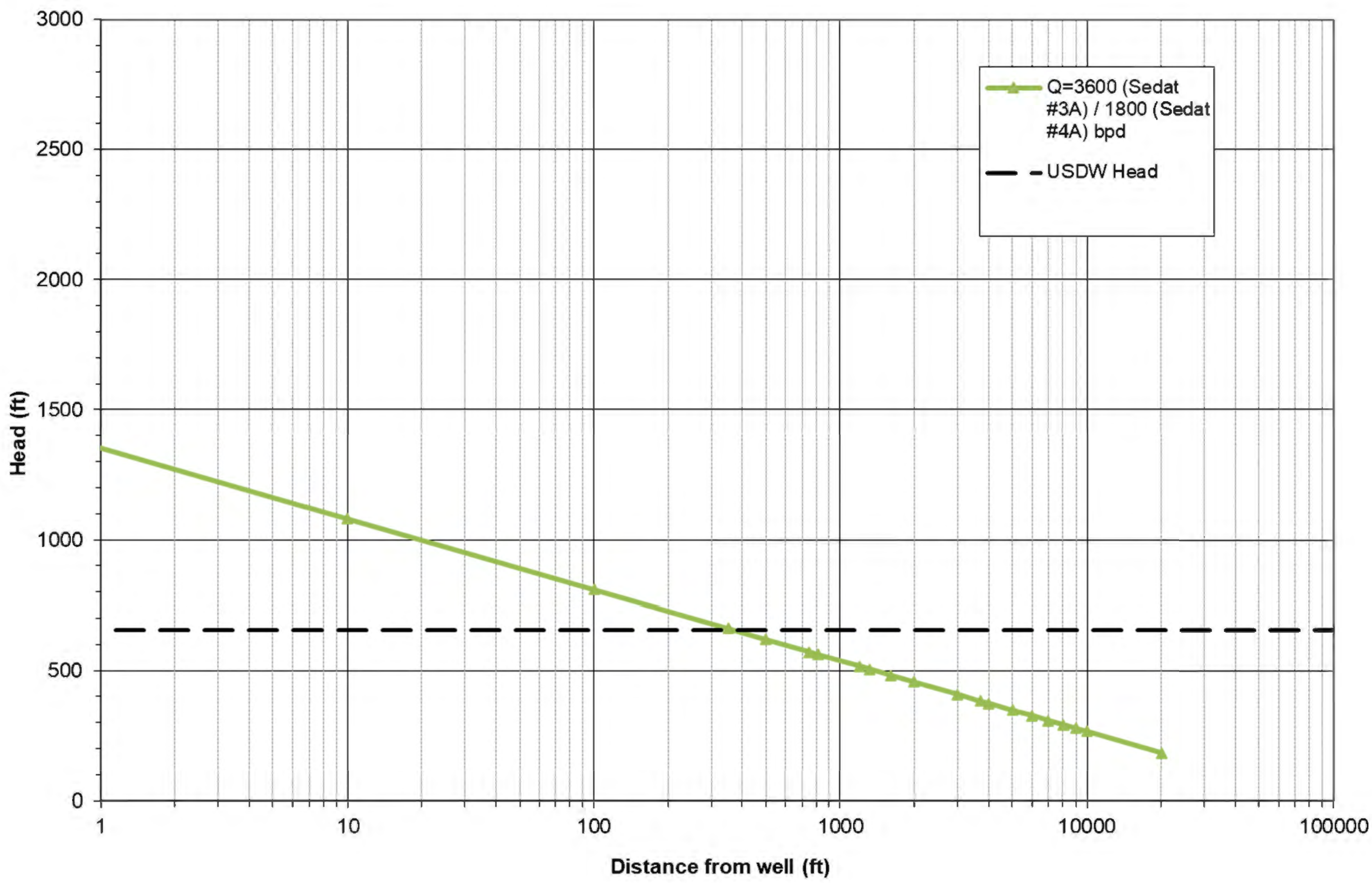

Figure 2. Feet of head of injection formation and USDW vs. distance for Sedat #3A when both wells (Sedat #3A and #4A) are injecting, K = 100 md

TETRA TECH, INC.

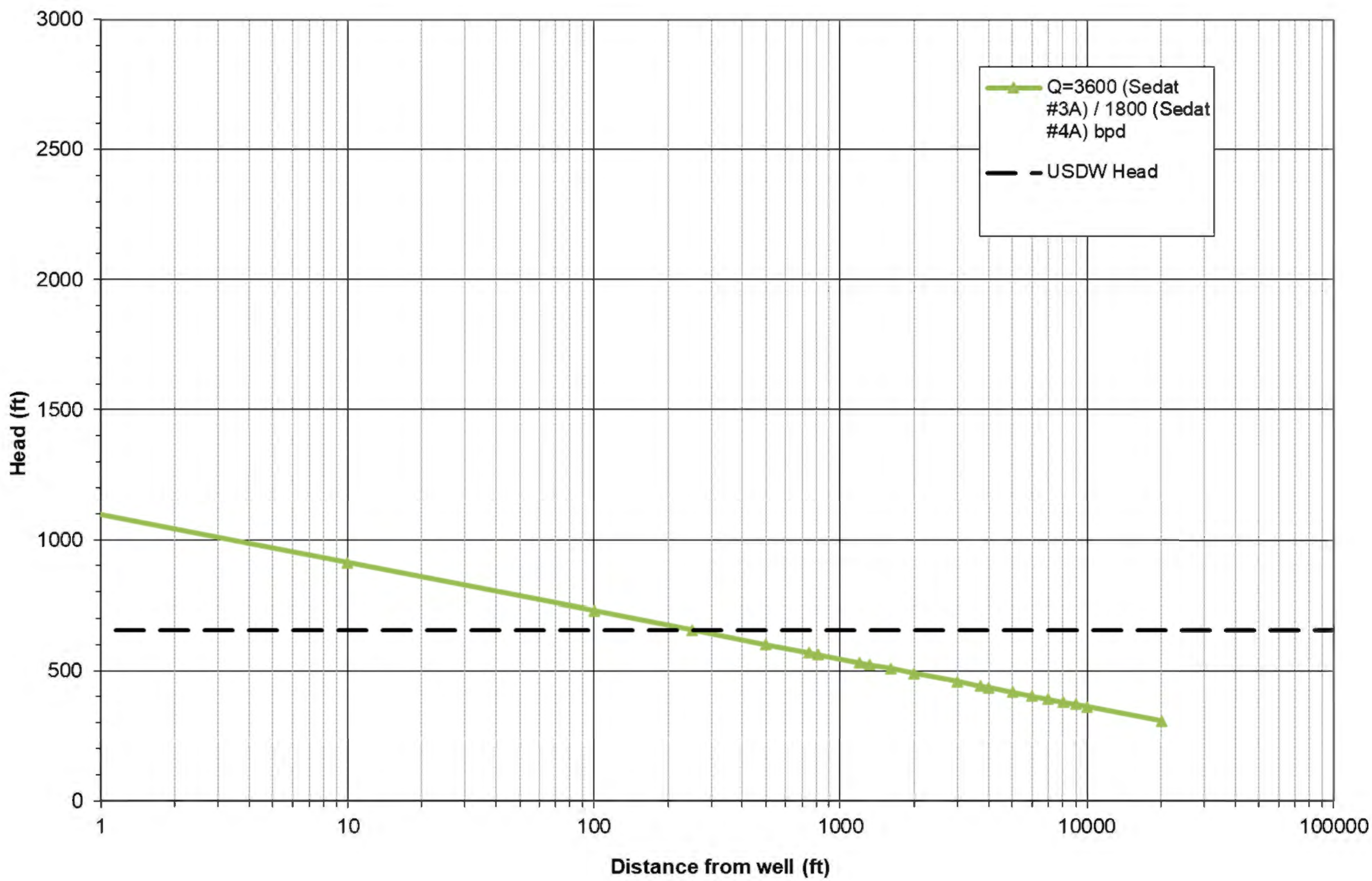

Figure 3. Feet of head of injection formation and USDW vs. distance for Sedat #4A when both wells (Sedat #3A and #4A) are injecting, K = 100 md

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HFRAC January 14, 2019 Letter

Sedat #3A (Murrysville) – Permeability Determination

HFRAC Consulting Services, LLC

January 14, 2019

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

Re: Sedat #3A (Murrysville) – Permeability Determination

Dear Marc,

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. 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.

The reservoir permeability of 1.8 mD is less than the reported permeability values for the Murrysville formation. The permeability values reported in the “Petrologic Study of the Murrysville Sandstone in Southwestern PA” are shown to be closer to 100 mD.

A possible reason for the difference in the permeability determined from the DFIT and the permeability reported in the study is a poor connection between the wellbore and reservoir. The injection test was the first injection into the formation. Subsequent injections were conducted to breakdown additional perforations and remove near wellbore tortuosity.

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The rate stepdown test indicated only five out of forty perforations open.

As a result of the poor connection between the wellbore and the reservoir the reservoir permeability of 1.8 mD may not be representative of the actual Murrysville reservoir permeability which may be closer to 100 mD as stated in the "Petrologic Study of the Murrysville Sandstone in Southwestern Pennsylvania".

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

Depth to Top Perf = 1896

FG = 1.23 SG Fluid 1.11

$P_{MAX} = [FG - (0.433)(SG)] \times D$

$P_{MAX} = [1.23 - (0.433)(1.11)] \times 1896$

$= [1.23 - 0.48063] \times 1896$

$= (0.74937)(1896)$

$P_{MAX} = 1420\#$