The Marcellus gas shale: Improving Regulations

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Department of Geosciences

The Pennsylvania State University

AAPG
March 2008

EXPLORER

10/07-11/09
26 months

Marcellus
Talk #117

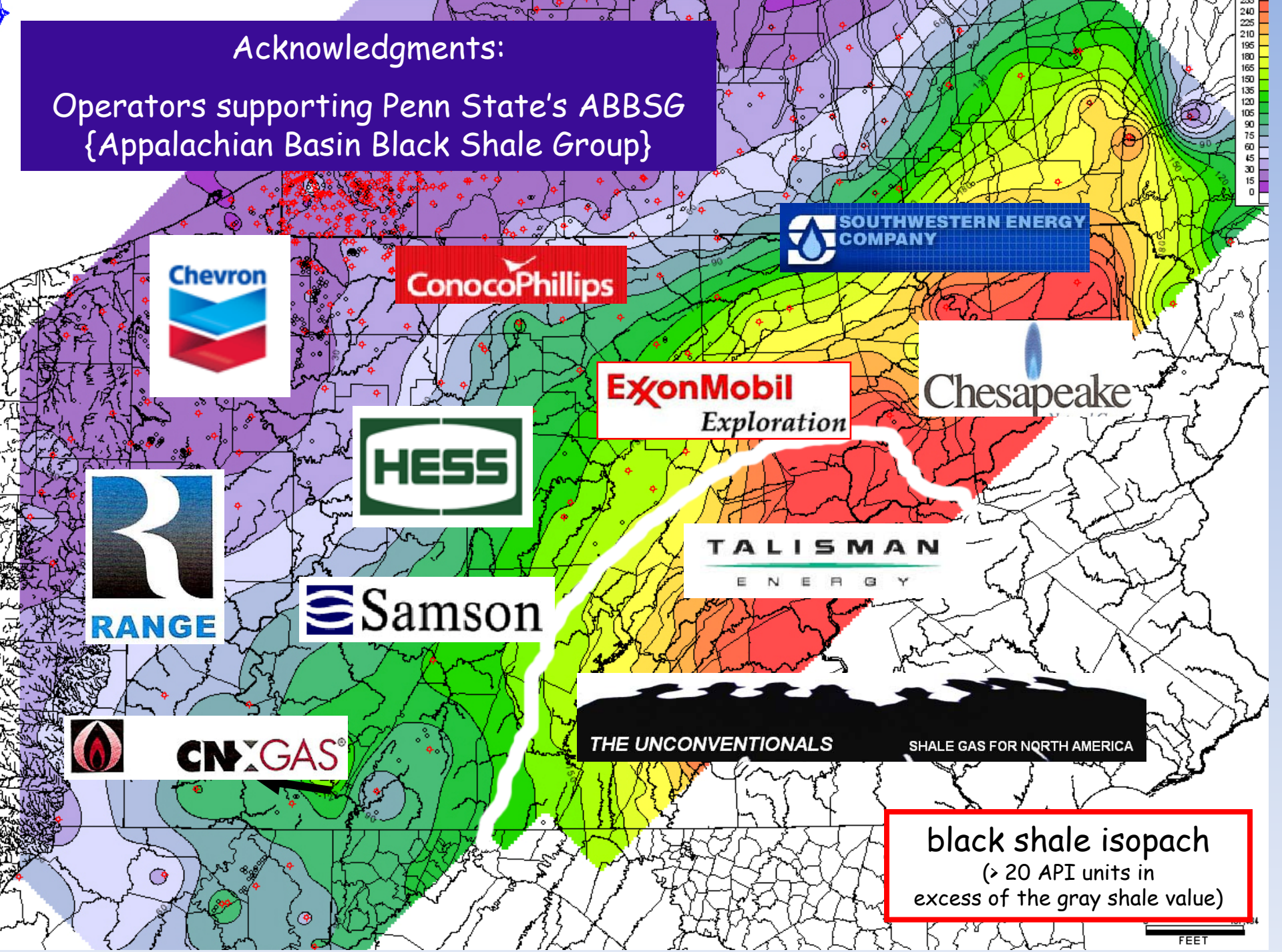
Cumulative
Attendance
6444

Appalachian Spring

A new shale play
emerges in the East

Acknowledgments:

Operators supporting Penn State's ABBSG
{Appalachian Basin Black Shale Group}



black shale isopach
(> 20 API units in
excess of the gray shale value)

Pennsylvania
Pittsburgh
Philadelphia
Image PA Department of Conservation and Natural Resources-PAMAP/USGS
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es: Apr 1, 2005 - Aug 25, 2007
41°01'36.64" N 77°36'34.26" W elev 1300 ft
Eye alt 278.29

Bradford
Troy
Towanda
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Image PA Department of Conservation and Natural Resources-PAMAP/USGS
41°46'59.08" N 76°31'03.30" W elev 955 ft
y Dates: Apr 1, 2005 - Apr 2006
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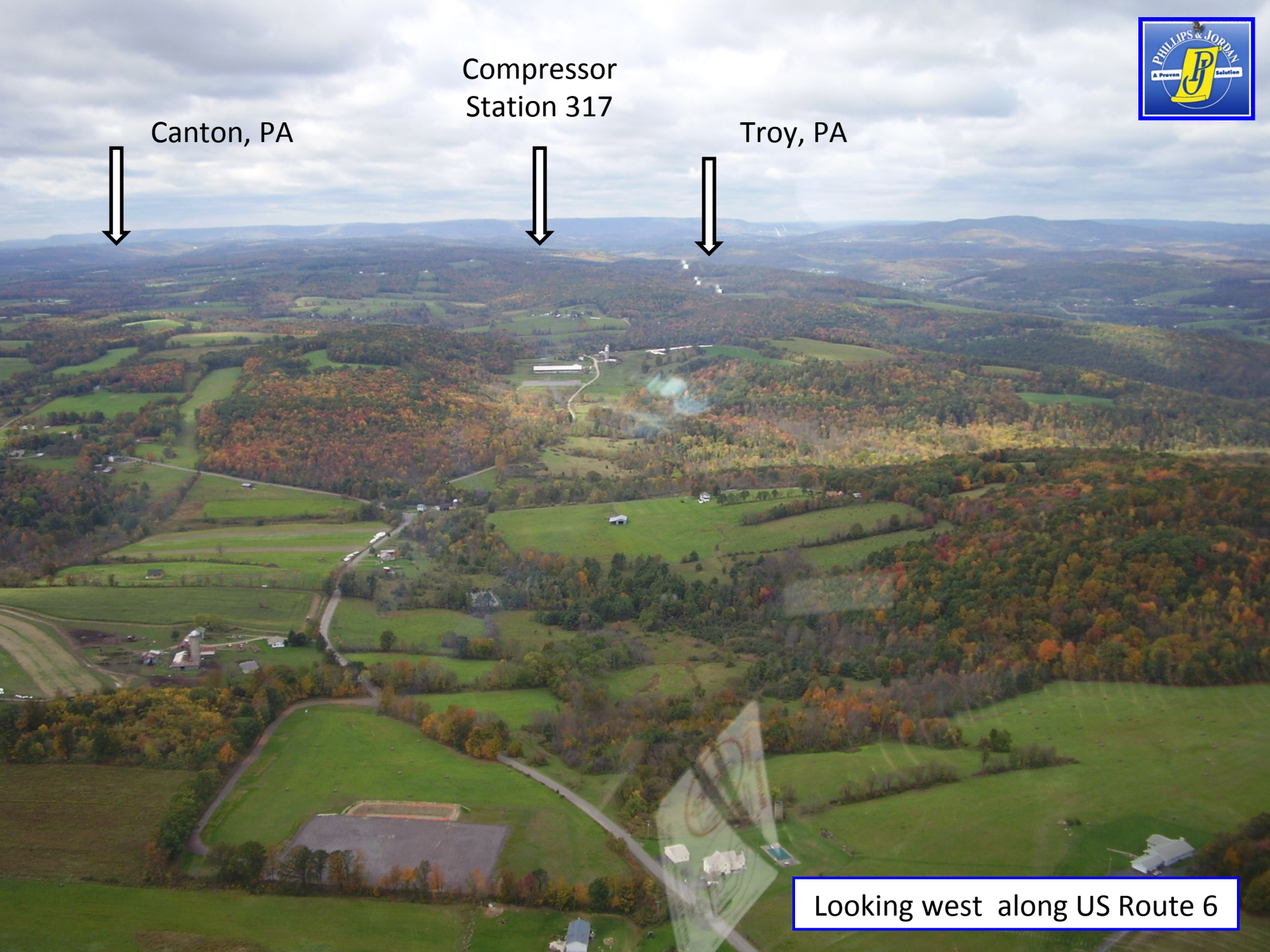
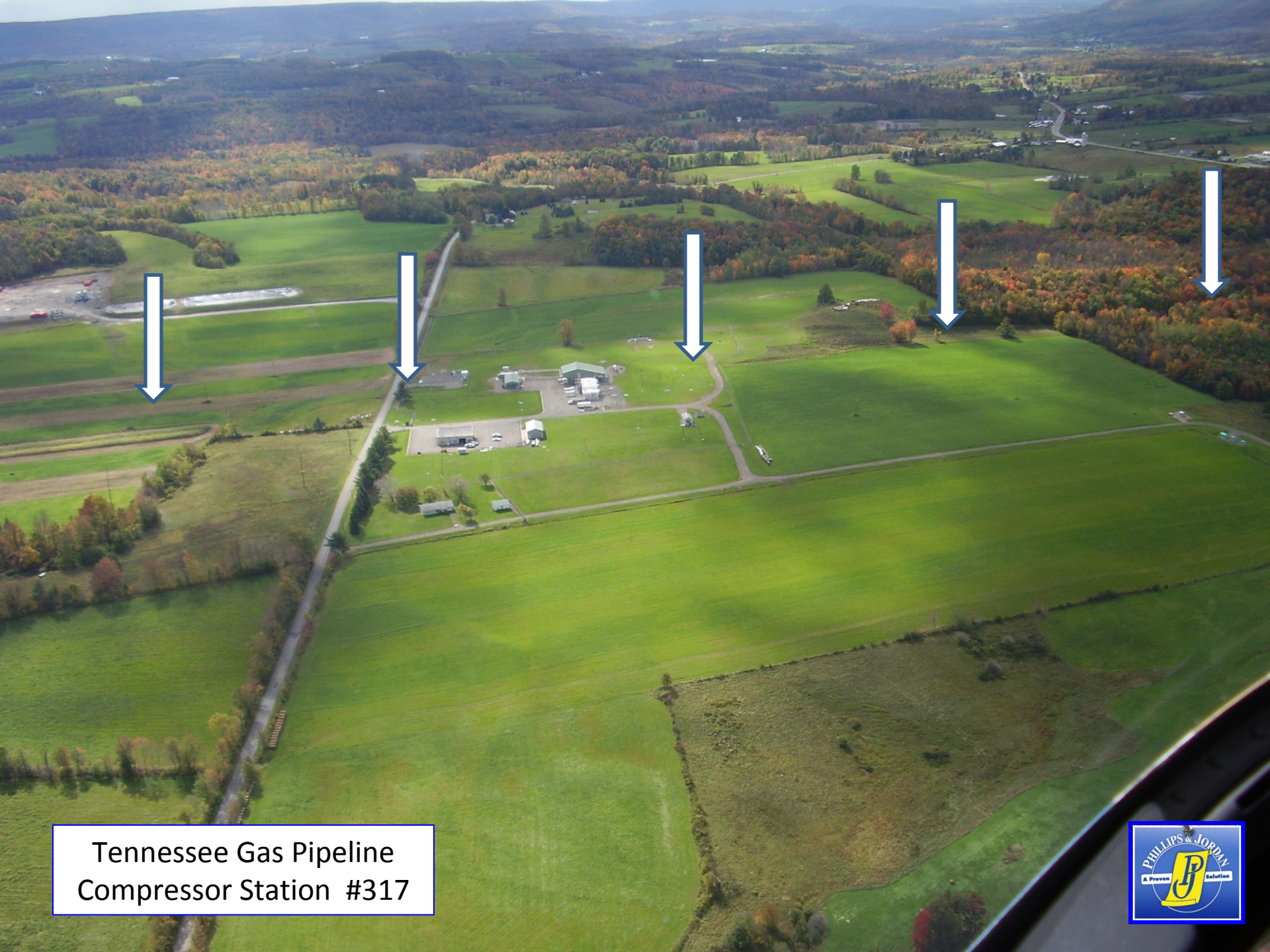

Canton, PA
Compressor Station 317
Troy, PA
Looking west along US Route 6

PHILLIPS & JORDAN
A Proven Solution


Tennessee Gas Pipeline
Compressor Station #317
PHILLIPS & JORDAN
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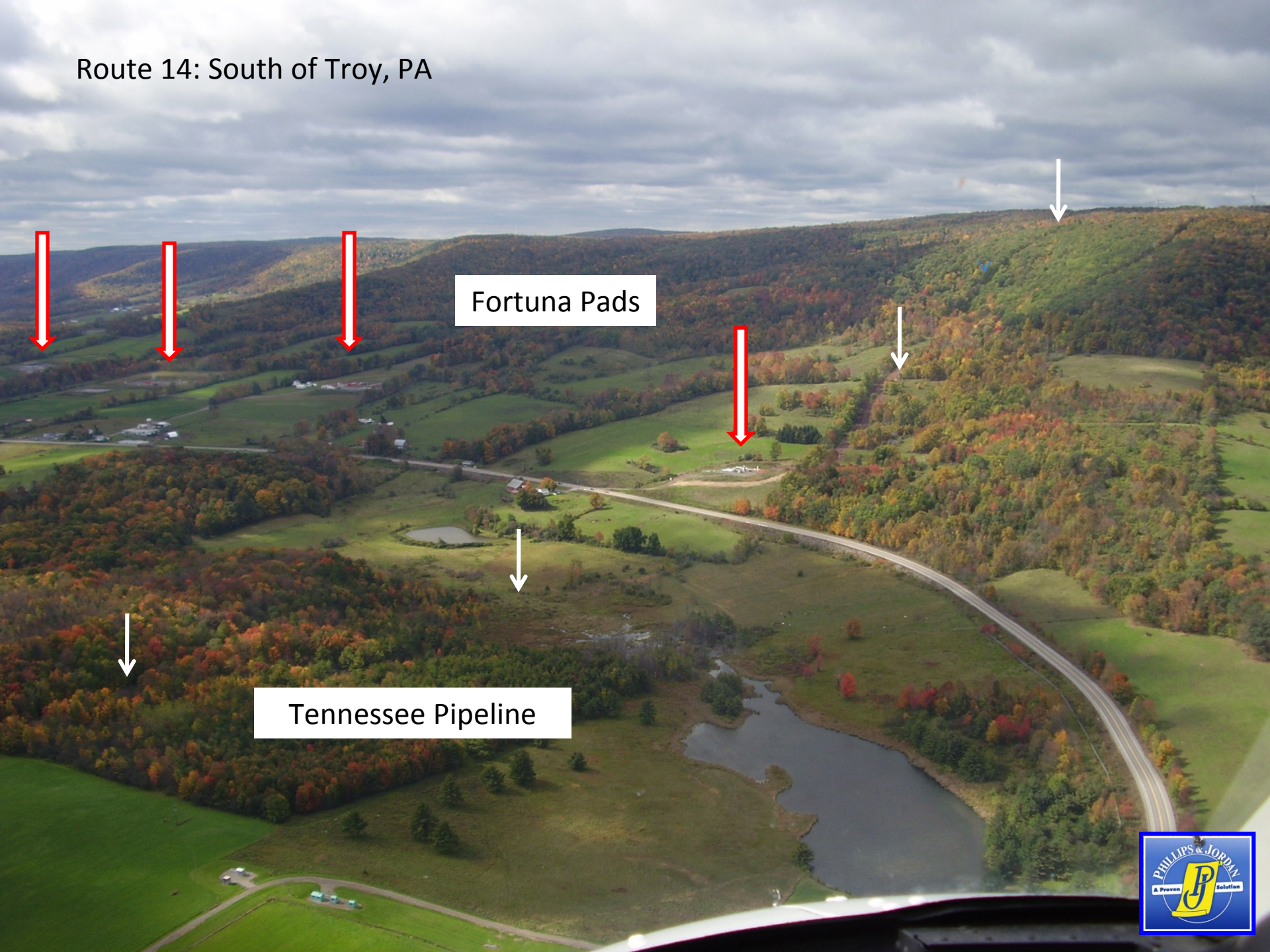
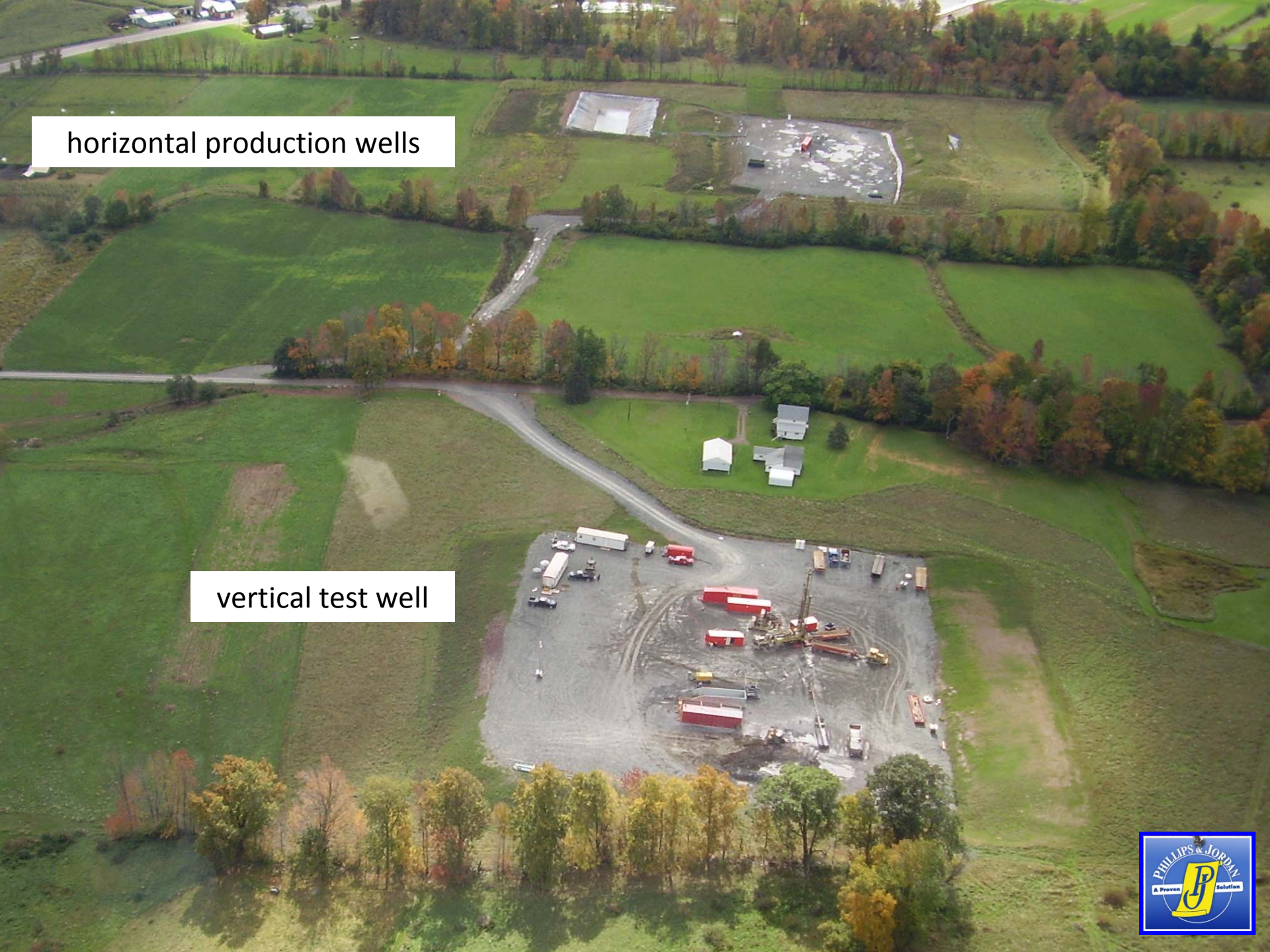
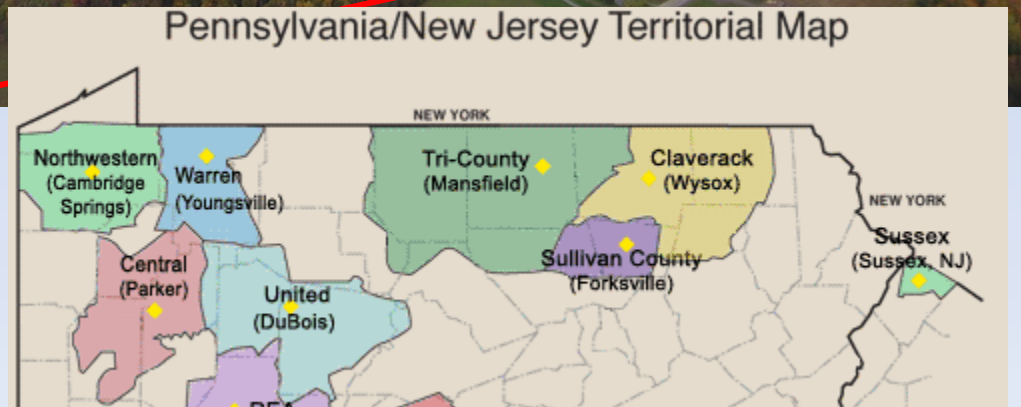
Tennessee Gas Pipeline


Route 14: South of Troy, PA
Fortuna Pads
Tennessee Pipeline


horizontal production wells
vertical test well

Troy, PA


Pennsylvania/New Jersey Territorial Map
NEW YORK
Northwestern (Cambridge Springs)
Warren (Youngsville)
Tri-County (Mansfield)
Claverack (Wysox)
NEW YORK
Sussex (Sussex, NJ)
Central (Parker)
United (DuBois)
Sullivan County (Forksville)

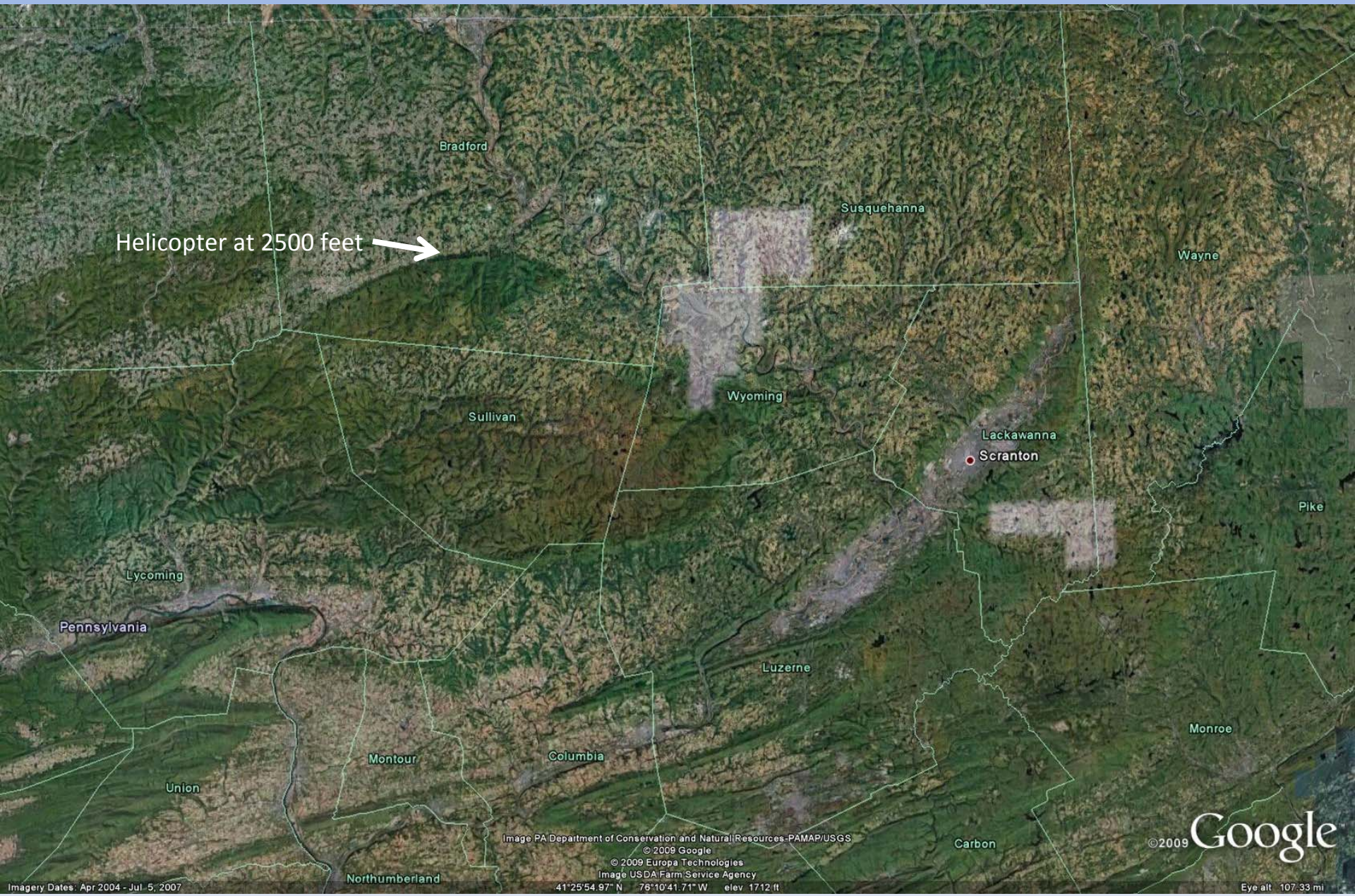

Helicopter at 2500 feet
Bradford
Susquehanna
Wayne
Wyoming
Sullivan
Lackawanna
Scranton
Pike
Lycoming
Pennsylvania
Luzerne
Monroe
Montour
Columbia
Union
Carbon
Northumberland
Image PA Department of Conservation and Natural Resources-PAMAP/USGS
© 2009 Google
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Image USDA Farm Service Agency
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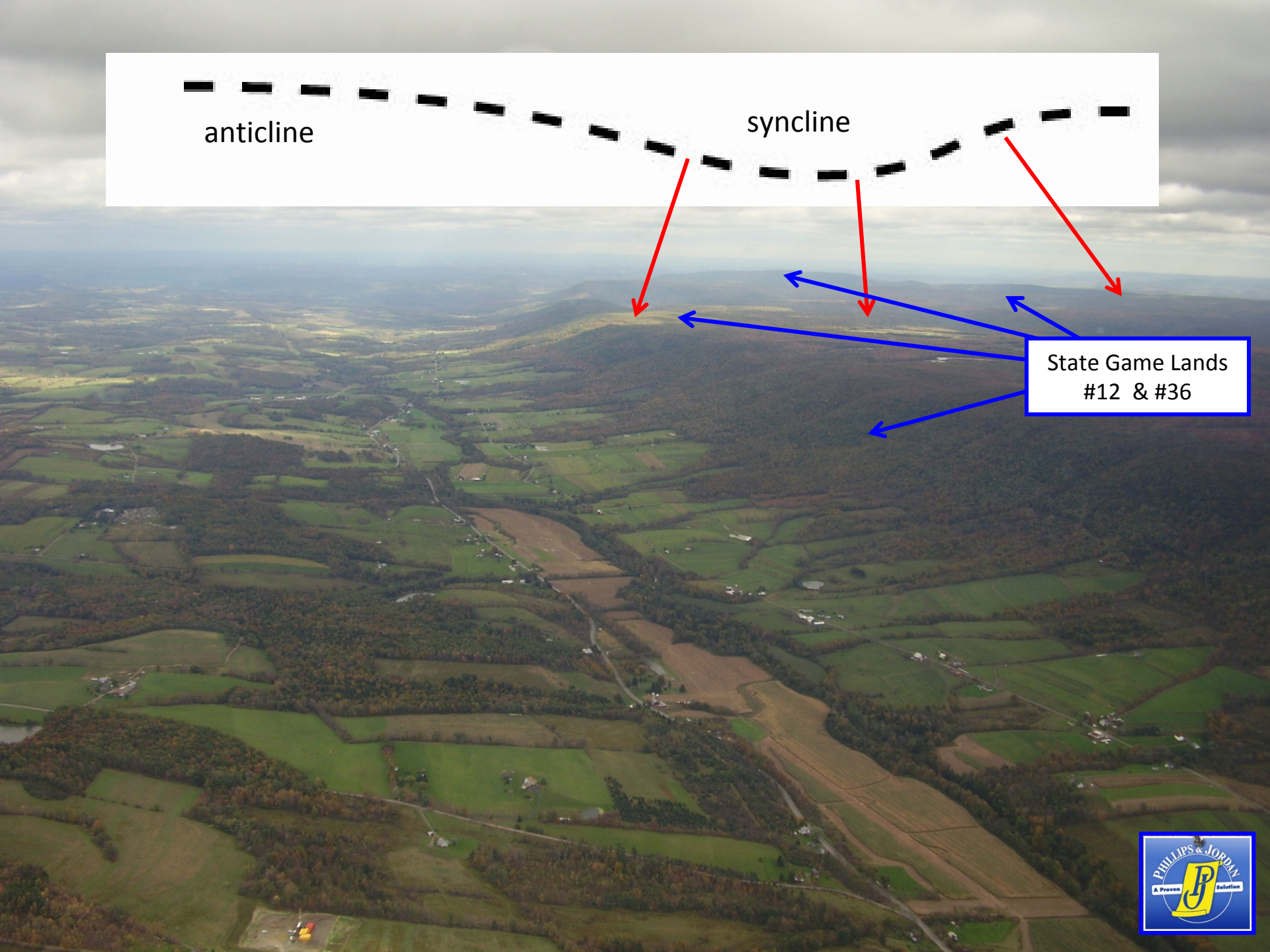
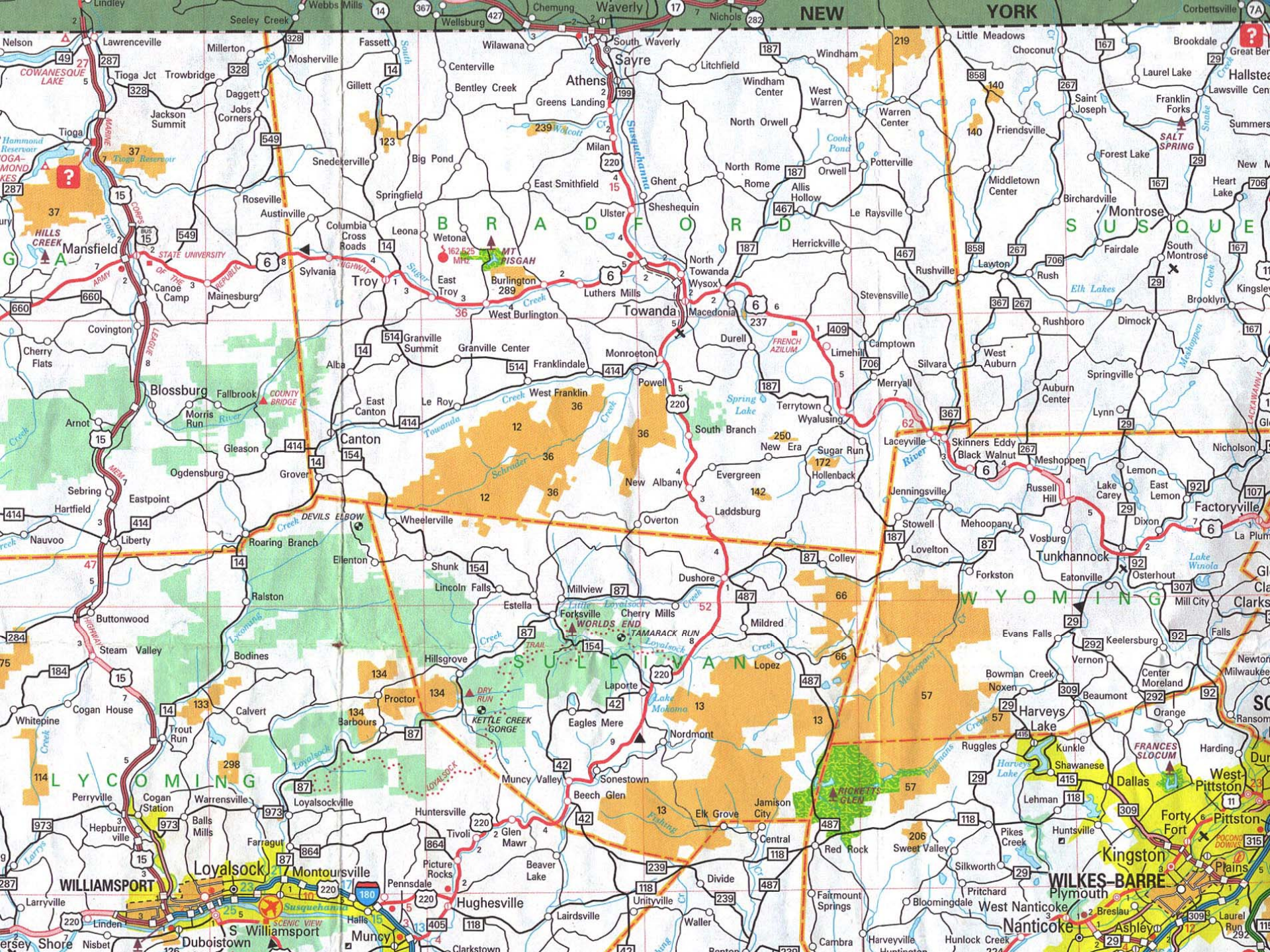
Imagery Dates: Apr 2004 - Jul 5, 2007
41°25'54.97" N 76°10'41.71" W elev 1712 ft
Eye alt 107.33 mi


anticline
syncline
State Game Lands
#12 & #36


NEW YORK
B R A D F O R D
S U S Q U E
S U L L I V A N
W Y O M I N G
L Y C O M I N G
Towanda
Sayre
Athens
Waverly
Troy
Mansfield
Canton
Loyalsock
WILLIAMSPORT
WILKES-BARRE
Kingston
Nanticoke
Montoursville
Muncy
Hughesville
Dushore
Laporte
Forksville
Mildred
Evergreen
Wyalusing
Factoryville
Tunkhannock
Meshoppen
Monroeton
Powell
Ralston
Buttonwood
Steam Valley
Bodines
Proctor
Barbours
Eagles Mere
Nordmont
Sonestown
Muncy Valley
Beech Glen
Elk Grove
Jamison City
Central
Red Rock
Sweet Valley
Dallas
West Pittston
Pittston
Forty Fort
Plains
Plymouth
Ashley
Harveys Lake
Ricketts Glen
Worlds End
Tamarack Run
Kettle Creek Gorge
Cowanesque Lake
Hills Creek
Susquehanna
Loyalsock Creek
Towanda Creek
Wyalusing Creek
Meshoppen Creek
Sugar Creek
Schrader Creek
Roaring Branch
Devils Elbow
Lake Mokoma
Spring Lake
Elk Lakes
Fishing
Scenic View
Pocono Downs
Frances Slocum
Salt Spring
Mt Pisgah
French Azilum
Corps of the Army
Veterans Highway
Susquehanna Trail
Endless Mountains Scenic Byway
Lackawanna Trail
Pennsylvania Grand Canyon
Nelson
Lawrenceville
Tioga
Tioga Jct
Trowbridge
Millerton
Mosherville
Seeley Creek
Webbs Mills
Lindley
Wellsburg
Chemung
Nichols
Corbettsville
Fassett
Wilawana
Centerville
Bentley Creek
Gillett
Greens Landing
Litchfield
Windham
Windham Center
West Warren
Warren Center
Little Meadows
Choconut
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Great Bend
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Lawsville Center
Saint Joseph
Franklin Forks
Summers
Friendsville
Forest Lake
Heart Lake
New Milford
Middletown Center
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Elk Lakes
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Dimock
Springville
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Silvara
Camptown
Limehill
Merryall
Terrytown
Lynn
Nicholson
Laceyville
Skinners Eddy
Black Walnut
Lemon
East Lemon
Lake Carey
Russell Hill
Jenningsville
Dixon
La Plume
Stowell
Mehoopany
Vosburg
Lovelton
Eatonville
Osterhout
Lake Winola
Forkston
Colley
Overton
Laddsburg
New Albany
Hollenback
Sugar Run
New Era
South Branch
Durell
Macedonia
North Towanda
Wysox
Luthers Mills
Burlington
East Troy
West Burlington
Sylvania
Canoe Camp
Mainesburg
Columbia Cross Roads
Leona
Wetona
Springfield
Roseville
Austinville
Snedekerville
Big Pond
Milan
East Smithfield
Ghent
Sheshequin
Ulster
North Rome
Rome
Allis Hollow
Orwell
Potterville
Le Raysville
Herrickville
North Orwell
Cooks Pond
Jackson Summit
Daggett
Jobs Corners
Gillett
Centerville
Bentley Creek
Greens Landing
Cherry Flats
Covington
Blossburg
Fallbrook
Morris Run
Arnot
Gleason
Ogdensburg
Sebring
Eastpoint
Hartfield
Nauvoo
Liberty
Grover
Alba
East Canton
Le Roy
West Franklin
Granville Summit
Granville Center
Franklindale
Cogan House
Whitepine
Trout Run
Calvert
Hillsgrove
Lopez
Shunk
Lincoln Falls
Estella
Millview
Cherry Mills
Ellenton
Wheelerville
Overton
Colley
Dushore
Perryville
Cogan Station
Warrensville
Loyalsockville
Huntersville
Tivoli
Glen Mawr
Farragut
Balls Mills
Hepburnville
Larryville
Linden
Duboistown
S Williamsport
Picture Rocks
Pennsdale
Beaver Lake
Lairdsville
Unityville
Divide
Waller
Cambra
Fairmount Springs
Pritchard
Bloomingdale
West Nanticoke
Harveyville
Hunlock Creek
Huntsville
Pikes Creek
Silkworth
Lehman
Kunkle
Shawanese
Harding
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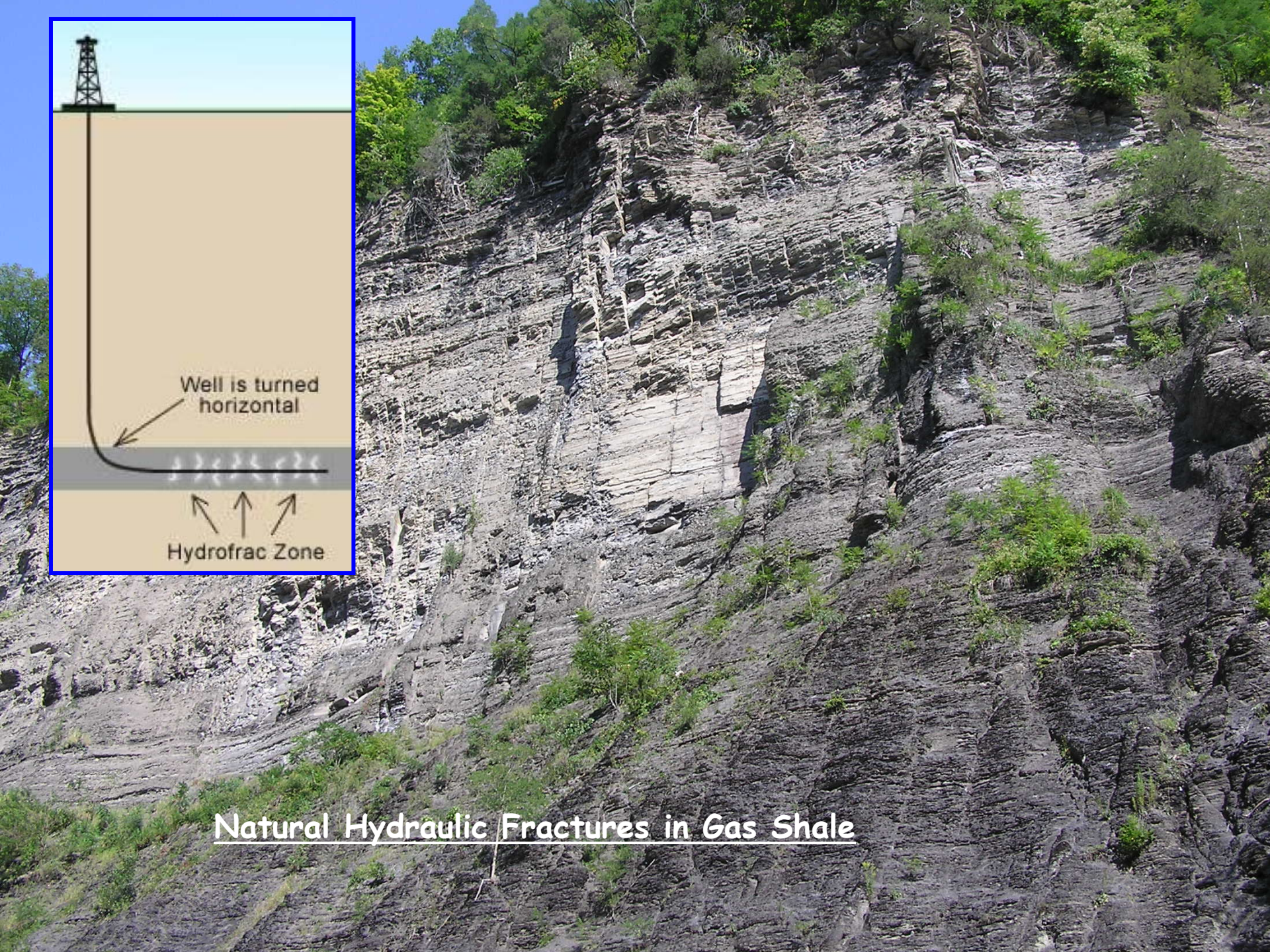
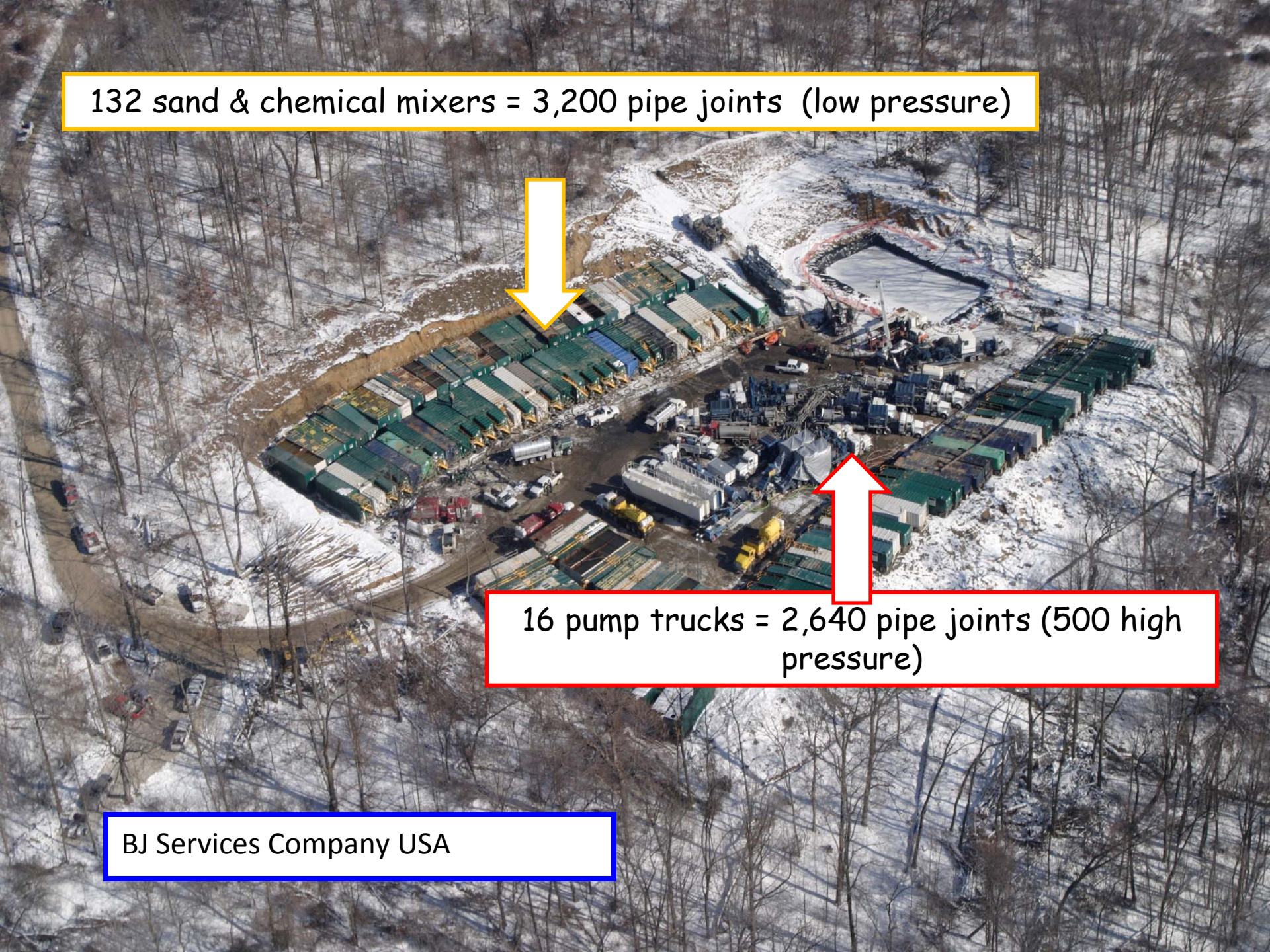
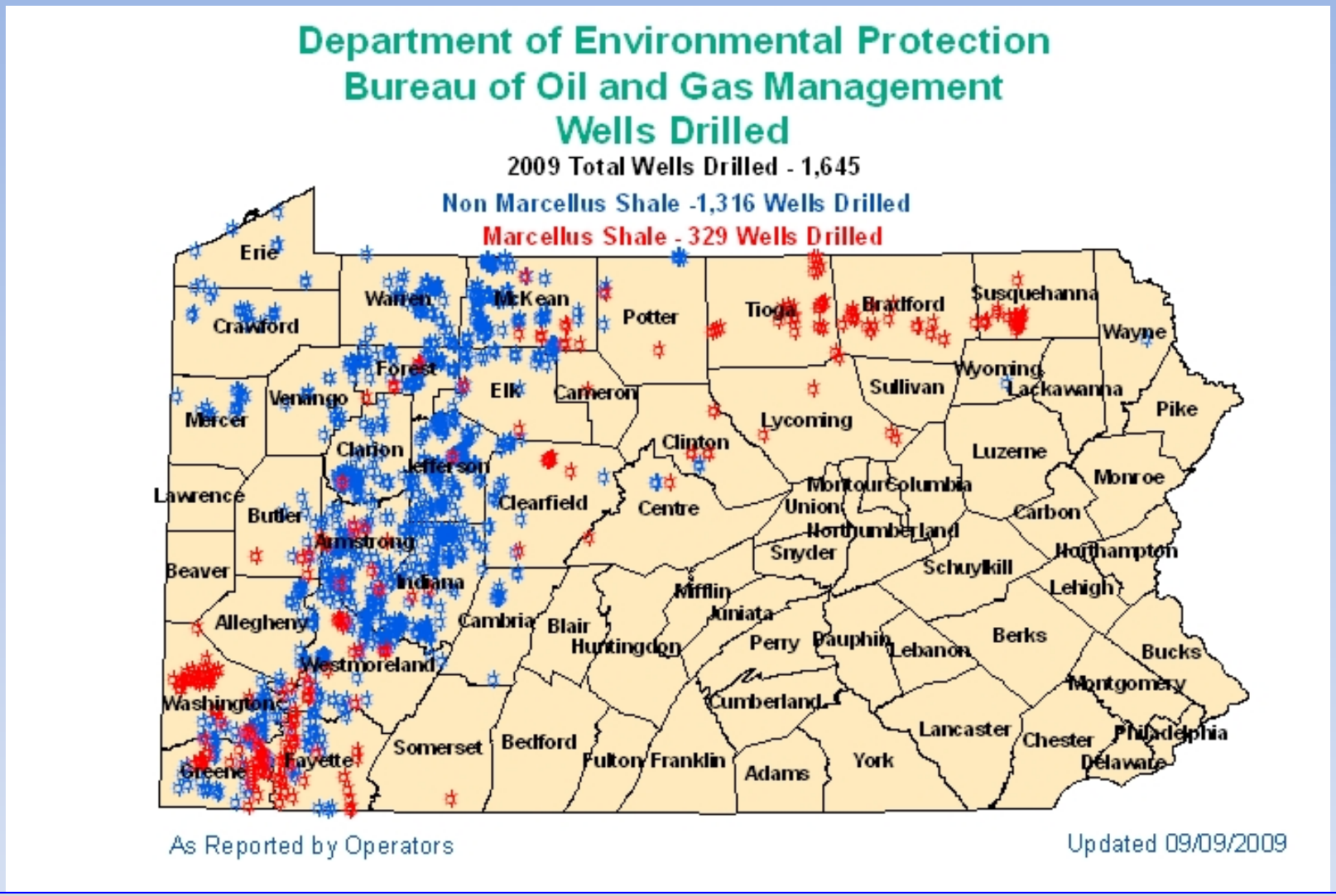


Natural Hydraulic Fractures in Gas Shale


132 sand & chemical mixers = 3,200 pipe joints (low pressure)
16 pump trucks = 2,640 pipe joints (500 high pressure)
BJ Services Company USA

A pipe joint like these broke in the Dimock spill of Sept 2009!



Suppose 50% of 329 Marcellus wells were hydraulically fractured during first 8 months of 2009!

$\Rightarrow$ 957,776 pipe joints have the potential to fail