

Water-Quality Monitoring and Research

- **New Long-Term Groundwater Quality Monitoring Network**
- **Intermediate-Depth Groundwater Monitoring in Test Holes**
- **Methane Sampling in Streams**

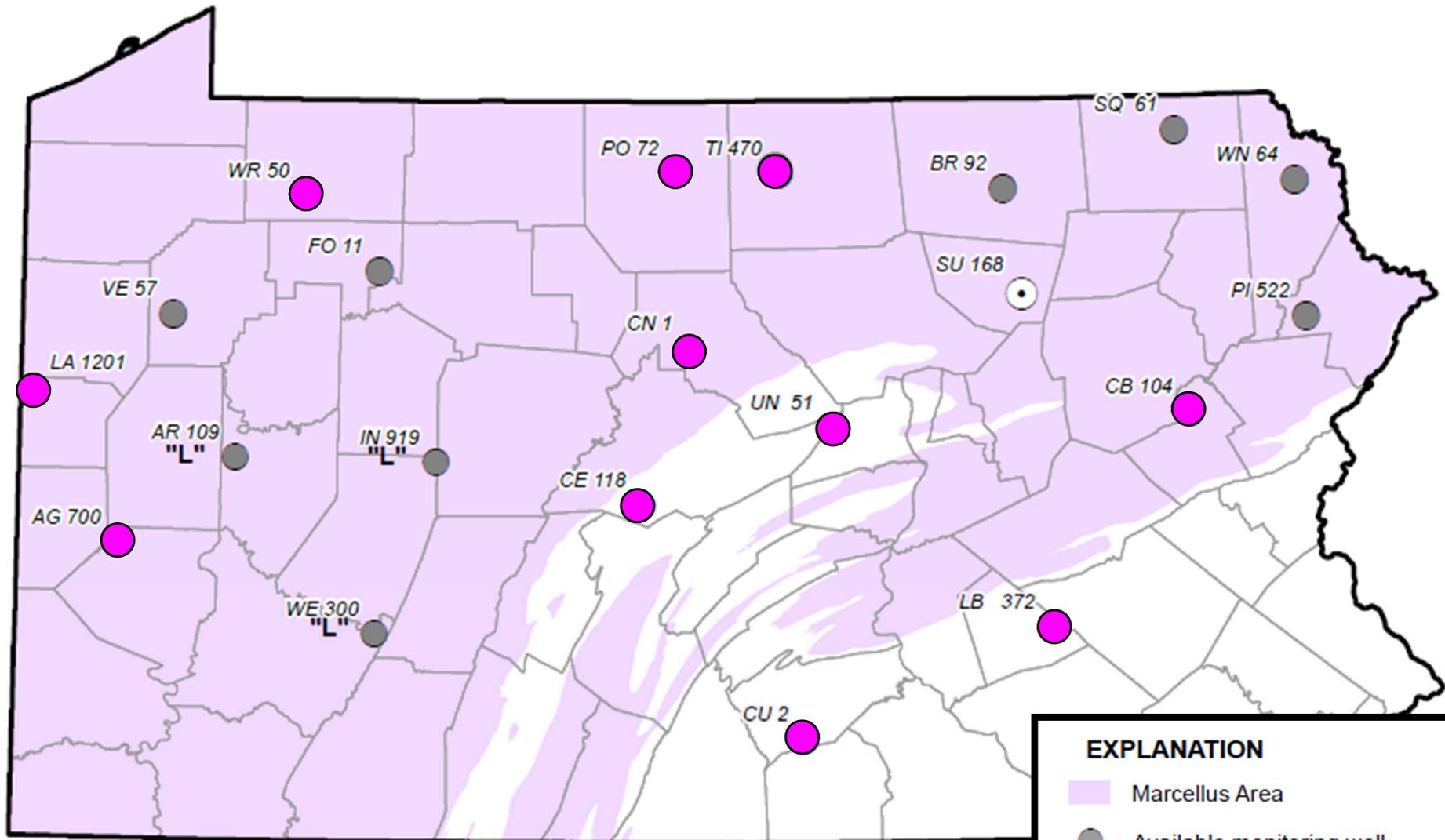


Long-Term Ambient/Fixed Station Groundwater Quality Monitoring Network

- 21 Wells -- most from current network
- Focus on shale-gas region
- Testing and installing dedicated sampling pumps
- Semi-annual samples
- Dissolved and totals
- DEP Lab



New Groundwater Quality Monitoring Network



EXPLANATION

- Marcellus Area
- Available monitoring well
- Planned for installation summer 2014

Analytes

FIELD PARAMS

pH
Alkalinity
Spec Conductance
Temp, air
Temp, water
DO
Turbidity
Headspace gas

MAJORS

Calcium
Magnesium
Potassium
Sodium
Chloride
Sulfate
Bicarbonate
Silica
TOC

TRACE METALS

Aluminum
Antimony
Arsenic
Barium
Beryllium
Boron
Bromide
Cadmium
Chromium
Cobalt
Copper
Cyanide
Fluoride
Iron
Lead
Lithium
Manganese
Molybdenum
Nickel
Selenium
Silver
Strontium
Thallium
Uranium
Zinc

NUTRIENTS

Nitrate
Nitrite
Total Kjeldahl
Ammonia
Orthophosphate
Total Phosphorus

HYDROCARBON GASES

Methane
Ethane
Propane

VOLATILES & RADCHEM

VOCs
SVOCs
Gross alpha
Gross beta
Radium-226
Radium-228
Radon-222

Intermediate-Depth Groundwater Monitoring in Te

Open-File Miscellaneous Investigation 13-01.0
Open-File MI – 13-01.0

Geohydrologic and Water-Quality Characterization of a Fractured-Bedrock Test Hole in an Area of Marcellus Shale Gas Development, Bradford County, Pennsylvania

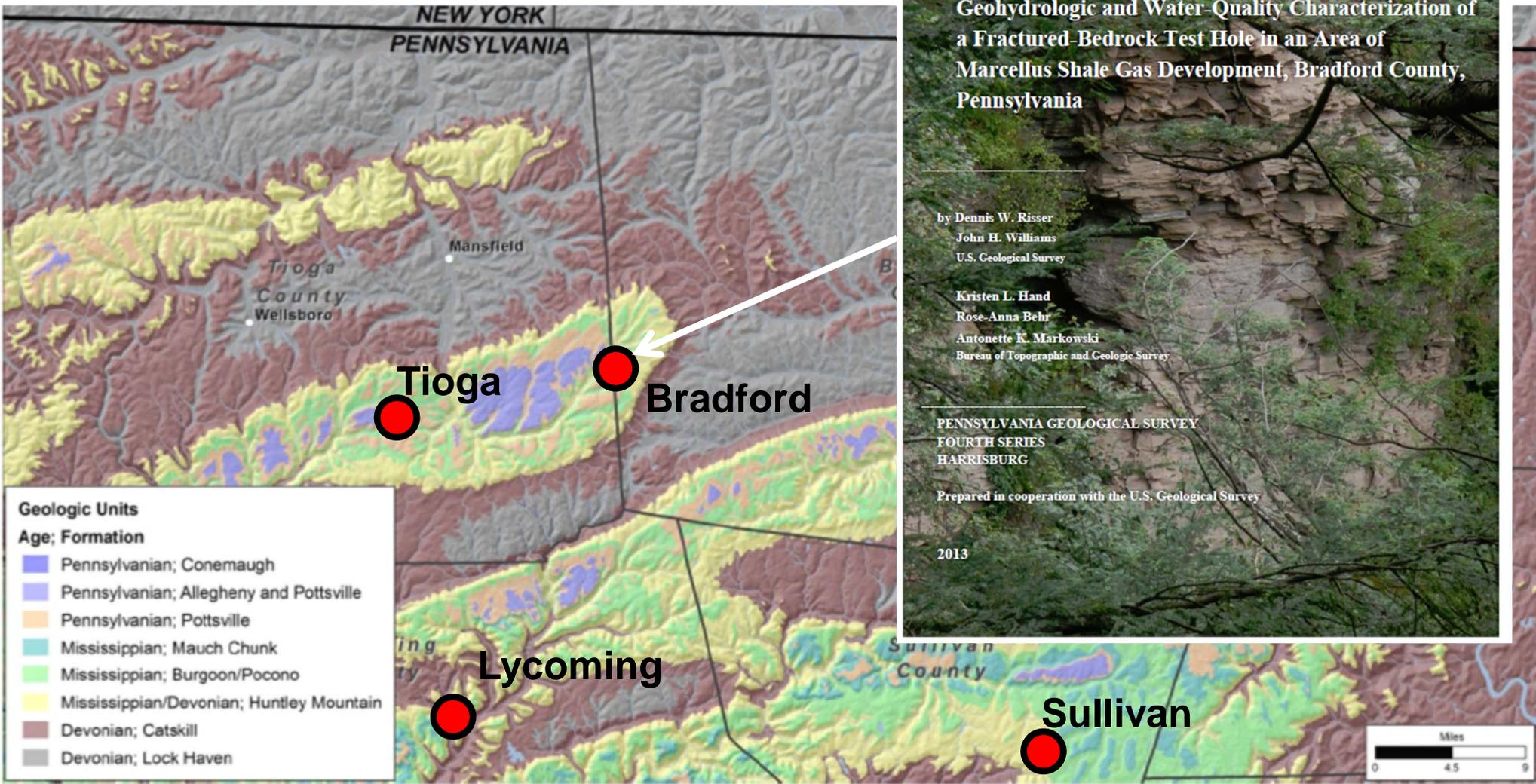
by Dennis W. Risser
 John H. Williams
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 Rose-Anna Behr
 Antonette K. Markowski
 Bureau of Topographic and Geologic Survey

PENNSYLVANIA GEOLOGICAL SURVEY
 FOURTH SERIES
 HARRISBURG

Prepared in cooperation with the U.S. Geological Survey

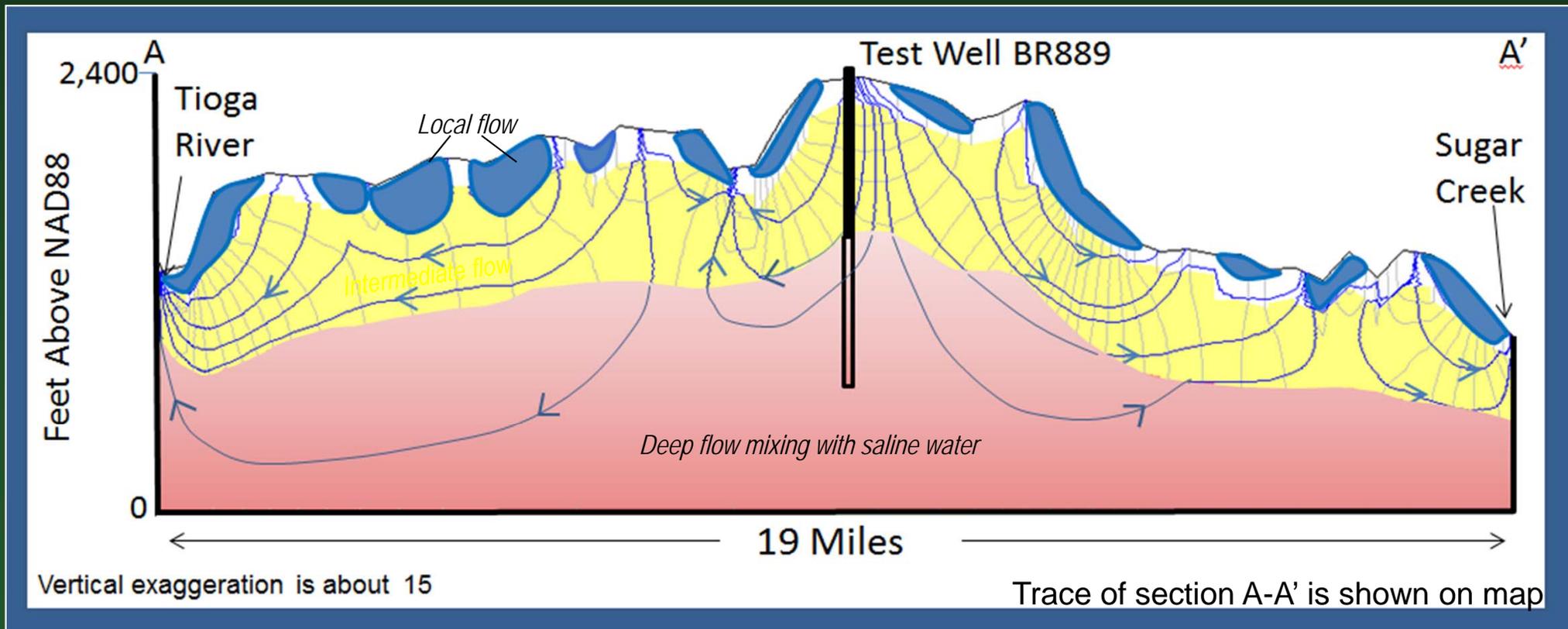
2013



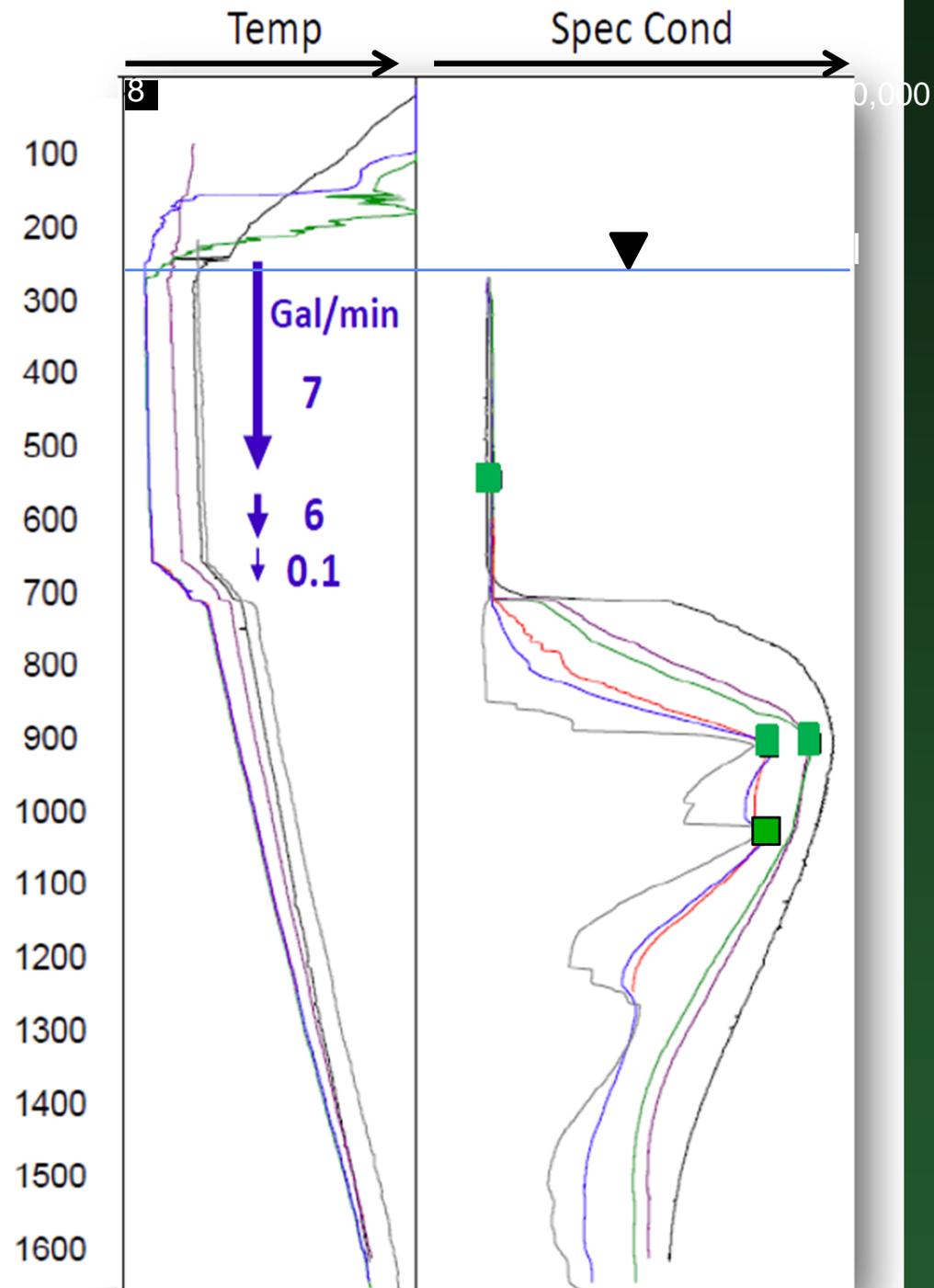
Bedrock geology from Berg and others (1980), Fisher and others (1970), and Wilson (2014)

Intermediate-Depth Test Hole in Bradford County

Conceptual flow system

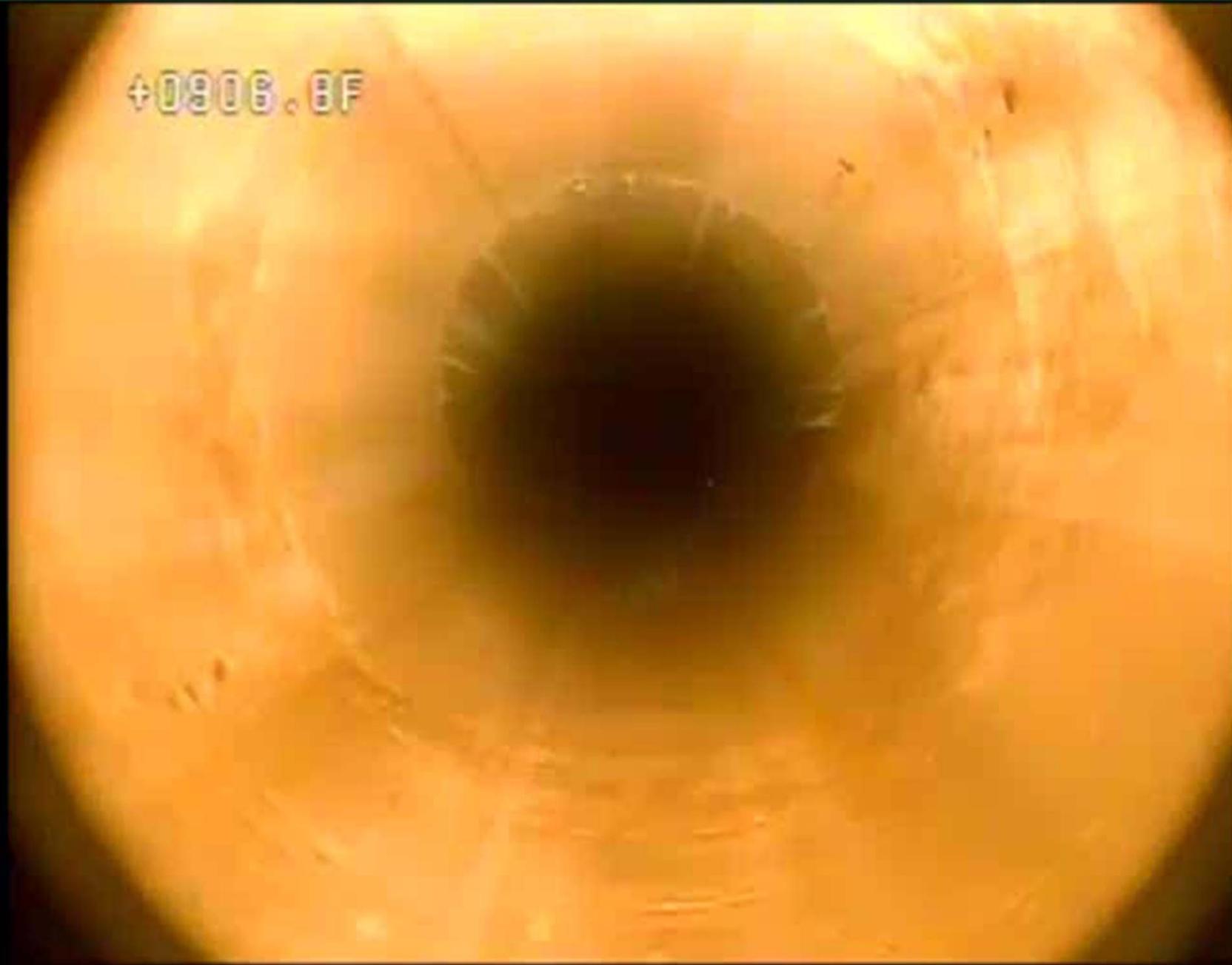


Fluid-Flow Zones



Bradford Co. Test Hole

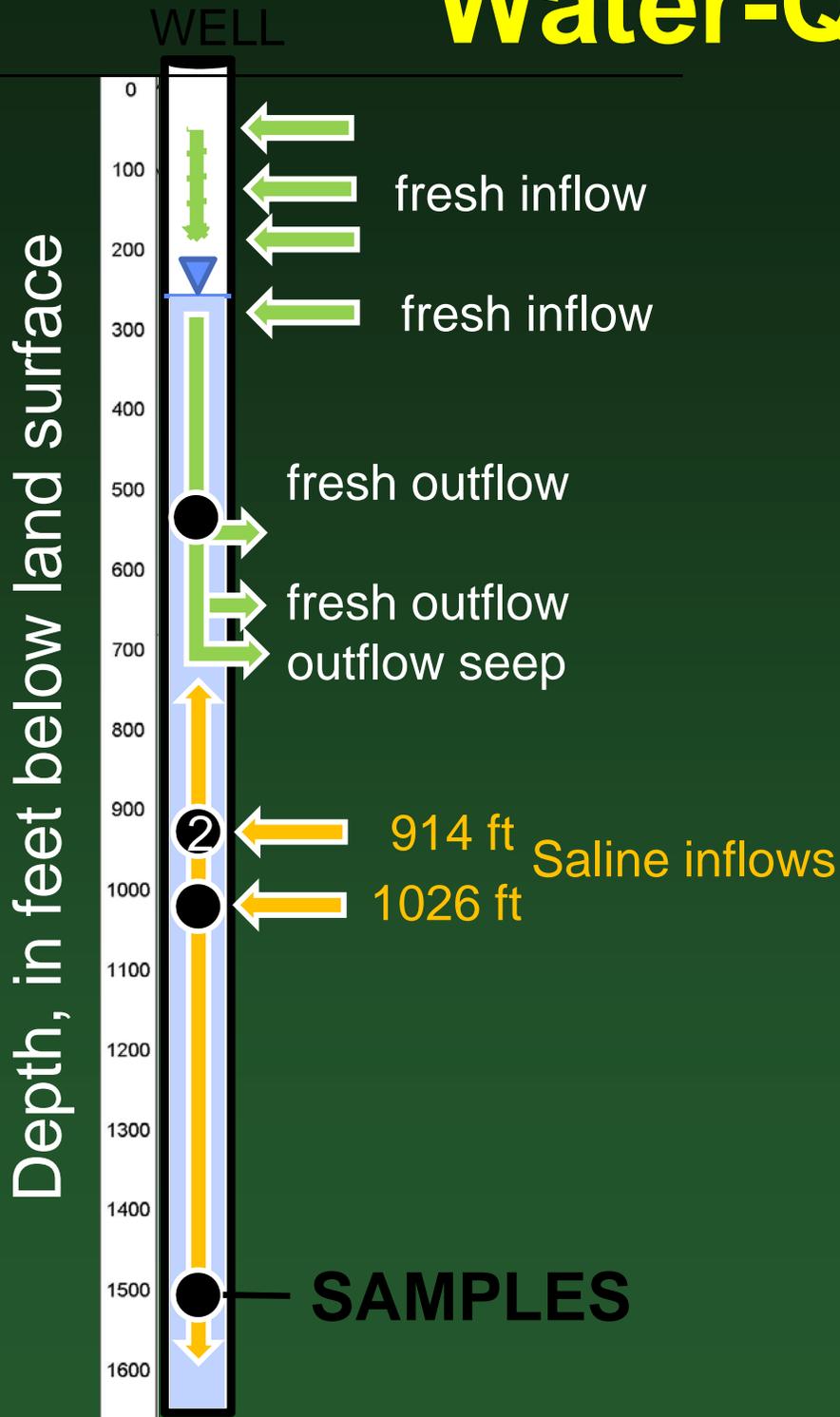
Saline Seep in Bradford Co. Test Hole



Methane Bubbles



Water-Quality Sampling



Inflow Valve

Outflow Valve



Collecting Water and Gas Samples

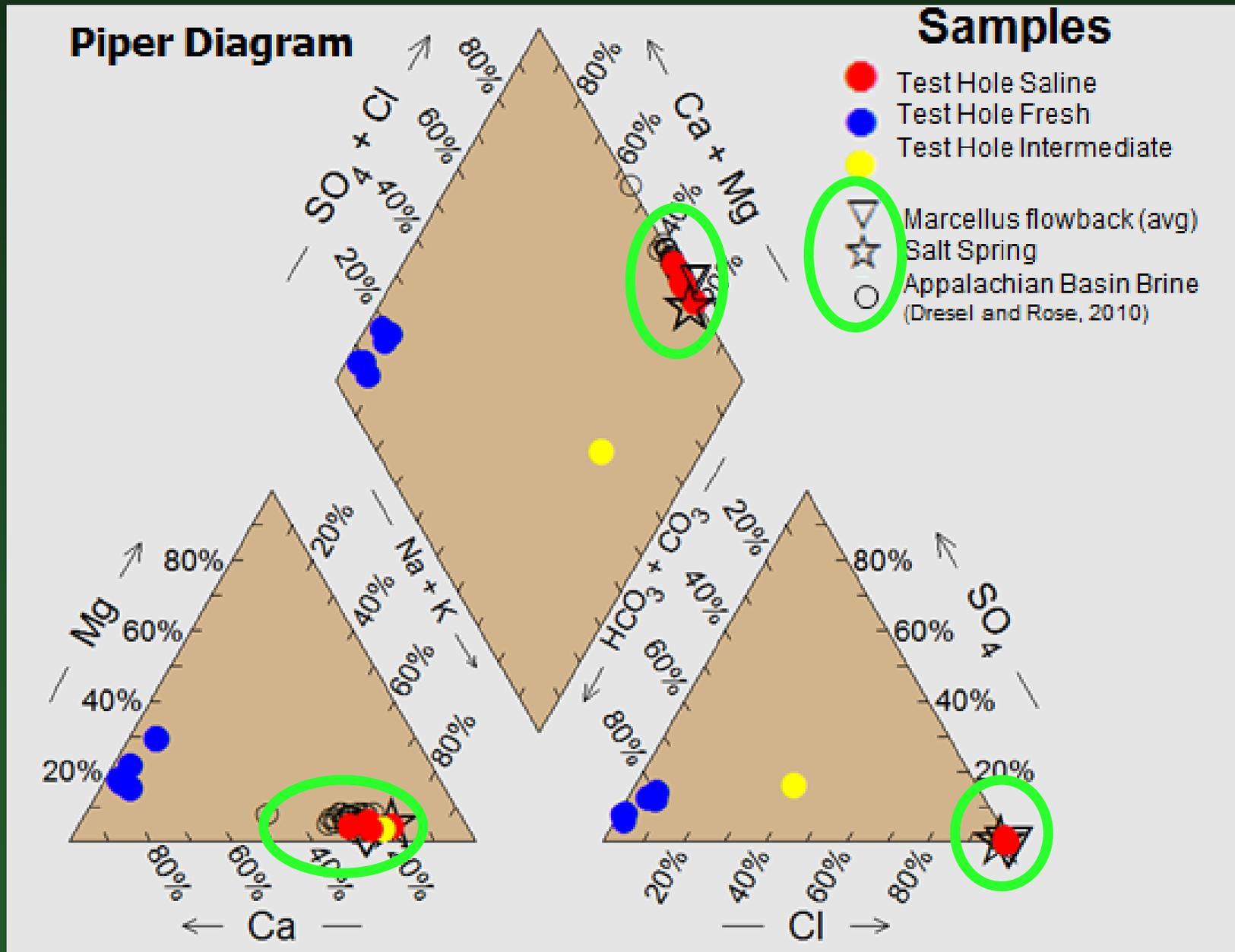


Filtered samples pushed through capsule with ultra-pure N₂ gas.



Collecting water directly from point sampler into isobag containing bactericide.

Major Ions in Saline Water from Test Holes



Intermediate Zone at Oil/Gas Well

ov/of/2014/1194/pdf/ofr2014-1194.pdf



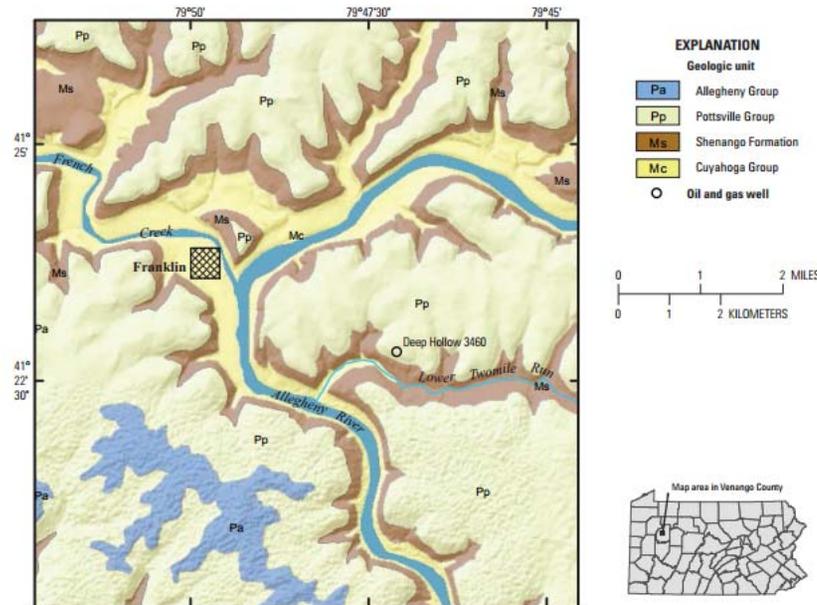
Prepared in cooperation with the Pennsylvania Department of Conservation and Natural Resources, Bureau of Topographic and Geologic Survey

Drilling and Geophysical Logs of the Tophole at an Oil- and-Gas Well Site, Central Venango County, Pennsylvania

Abstract

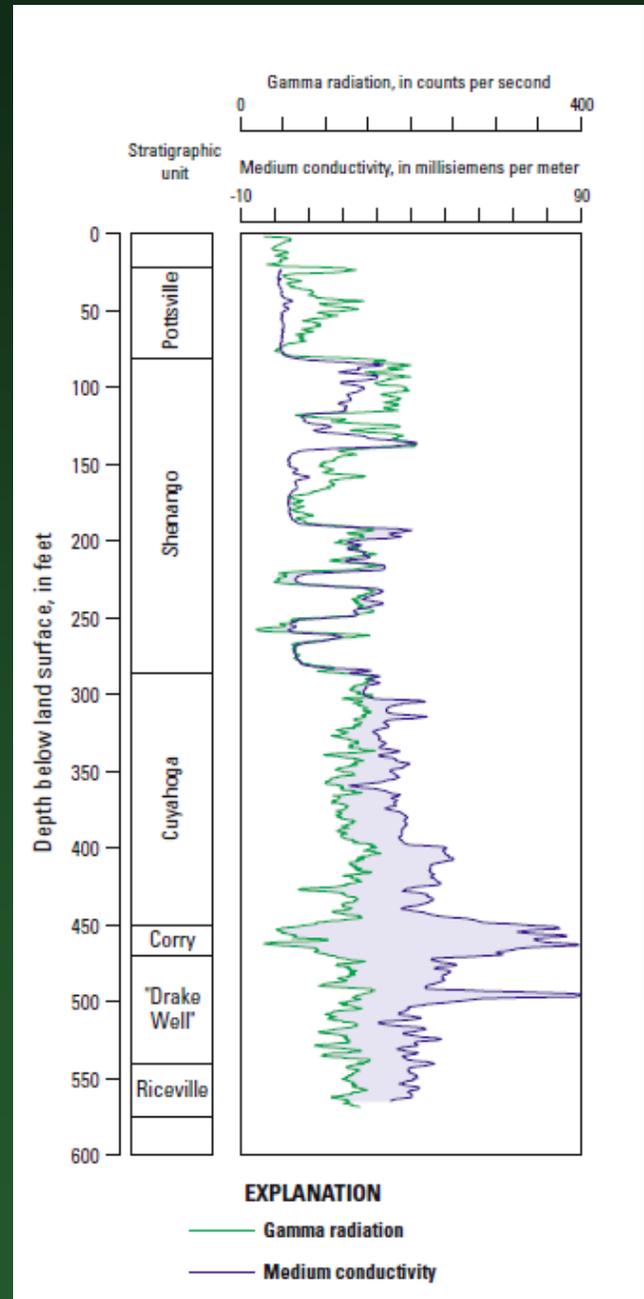
In a study conducted by the U.S. Geological Survey, in cooperation with the Pennsylvania Department of Conservation and Natural Resources, Bureau of Topographic and Geologic Survey, drilling and geophysical logs were used to characterize the geohydrologic framework and the freshwater and saline-water zones penetrated by the tophole at an oil-and-gas well site in central Venango County, Pennsylvania. The geohydrologic setting of the well site is typical of the dissected Appalachian

Plateau underlain by Pennsylvanian and Mississippian sandstone and shale. The drilling, gamma, and acoustic-televiwer logs collected from the 575-foot deep tophole define the penetrated Pennsylvanian and Mississippian stratigraphic units and their lithology. The caliper, video, and acoustic-televiwer logs delineate multiple bedding-related and high-angle fractures in the lower Pottsville Group and Shenango Formation from 22 to 249 feet below land surface. The caliper and acoustic-televiwer logs indicate a sparsity of fractures below 249 feet below land surface in the lowermost Shenango Formation, Cuyahoga



Shaded relief and streams from U.S. Geological Survey, 2014
Geology from Miles and Whitfield, 2001

Figure 1. Bedrock geology and location of the Deep Hollow 3460 oil-and-gas well site, central Venango County,



EXPLANATION

- Gamma radiation
- Medium conductivity

Methane Sampling in Streams

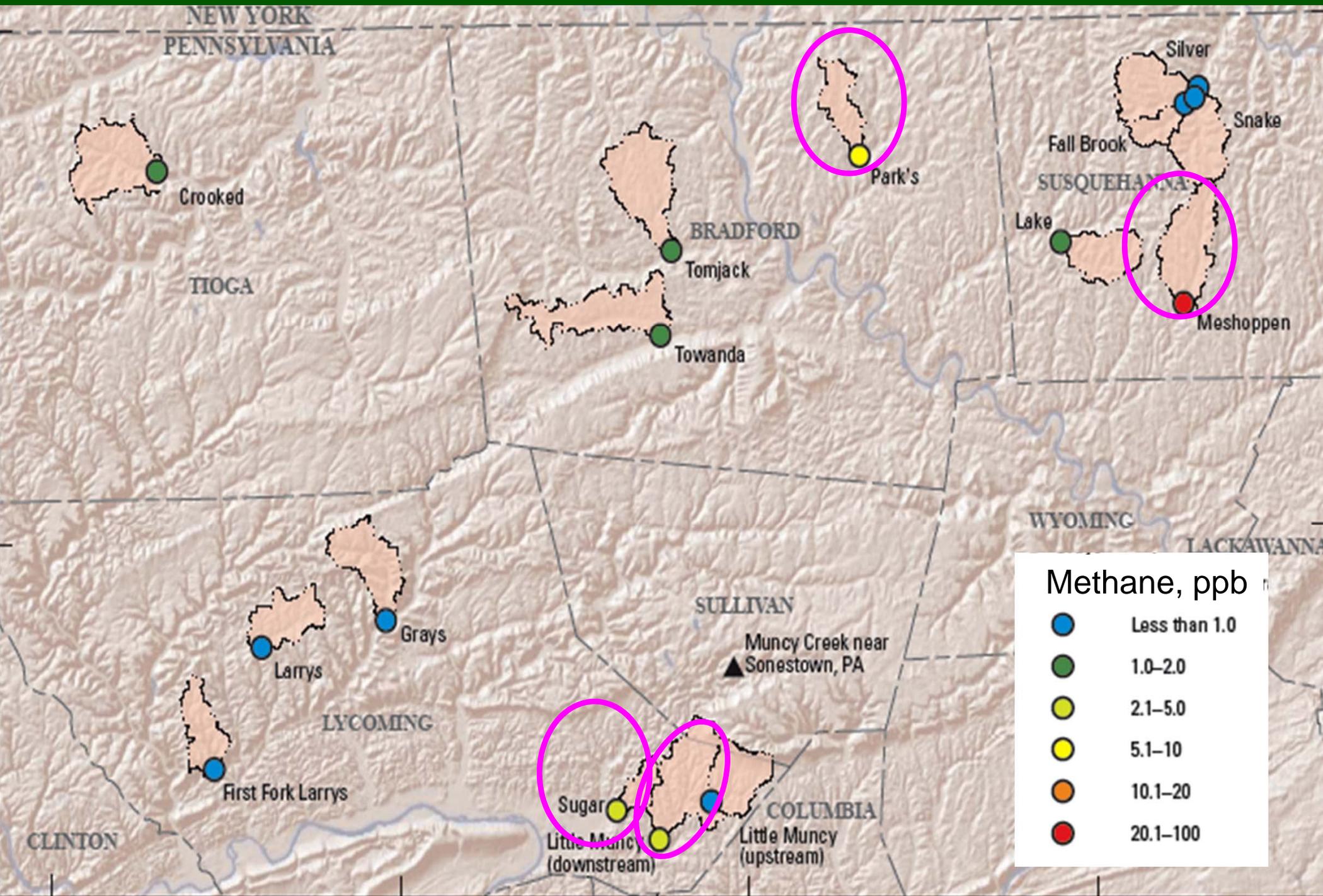
Utah Study

- Methane persists
- Integrated sample of multiple GW paths
- Wells not needed
- Easy to sample stream

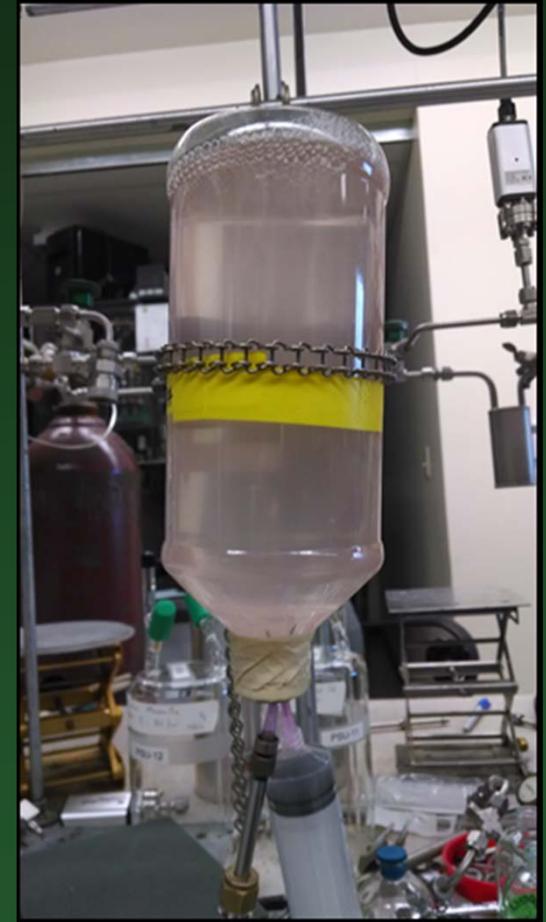


<http://ut.water.usgs.gov/projects/methanestream/>

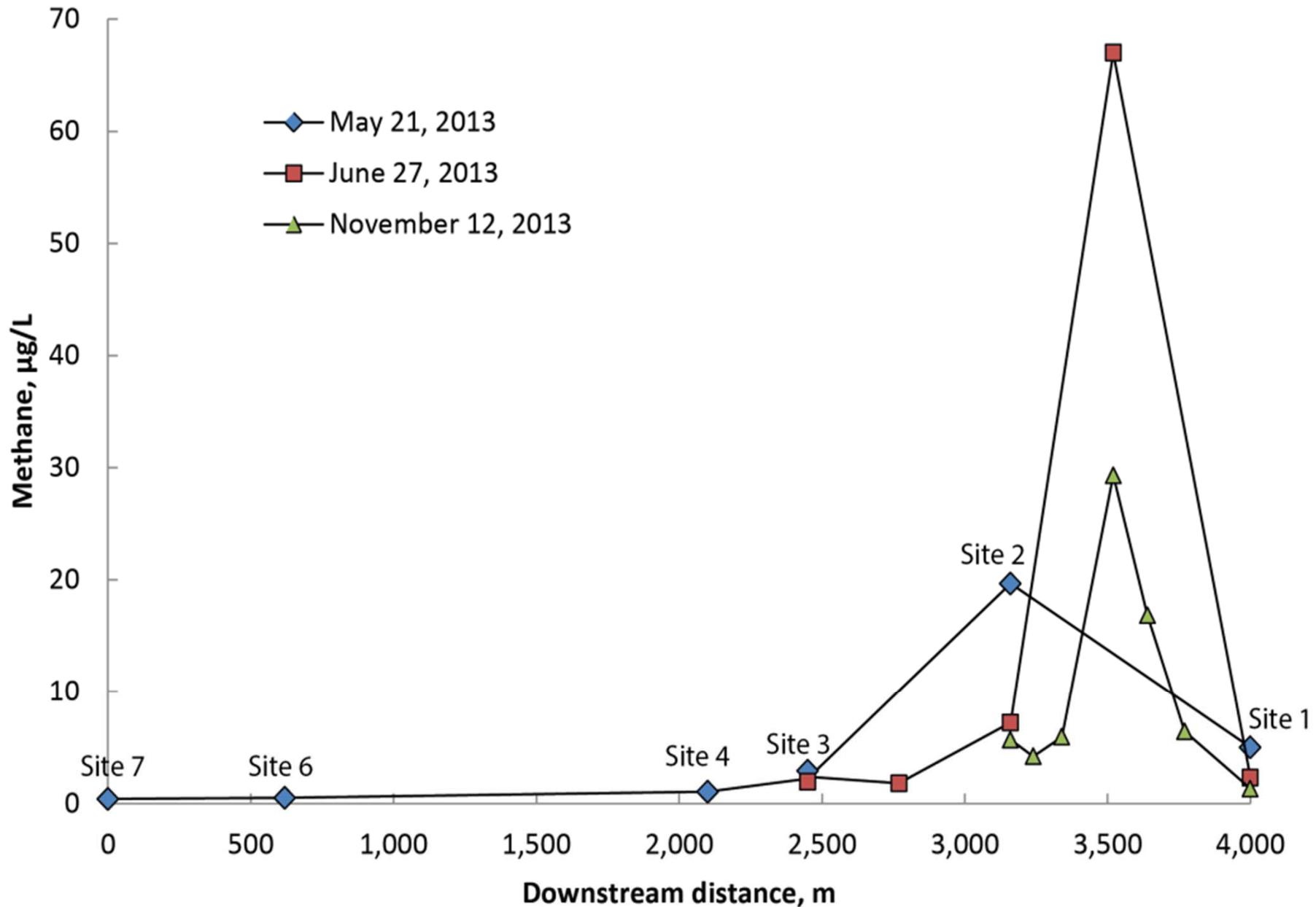
Methane Reconnaissance



Gaging, Sampling, and Analysis Sugar Run, PA



Methane Anomaly in Sugar Run



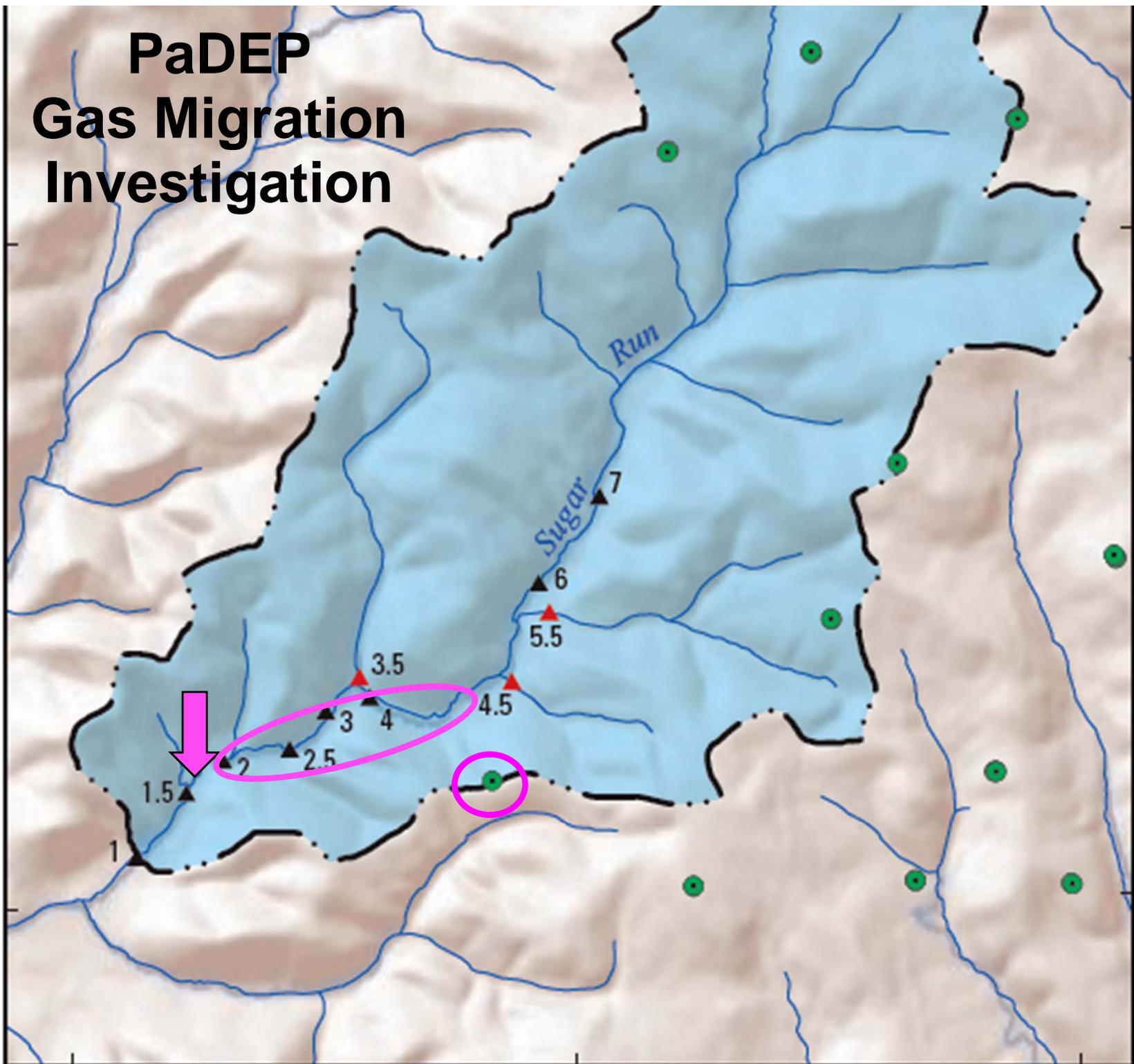
Methane Seep in Sugar Run



PaDEP Gas Migration Investigation

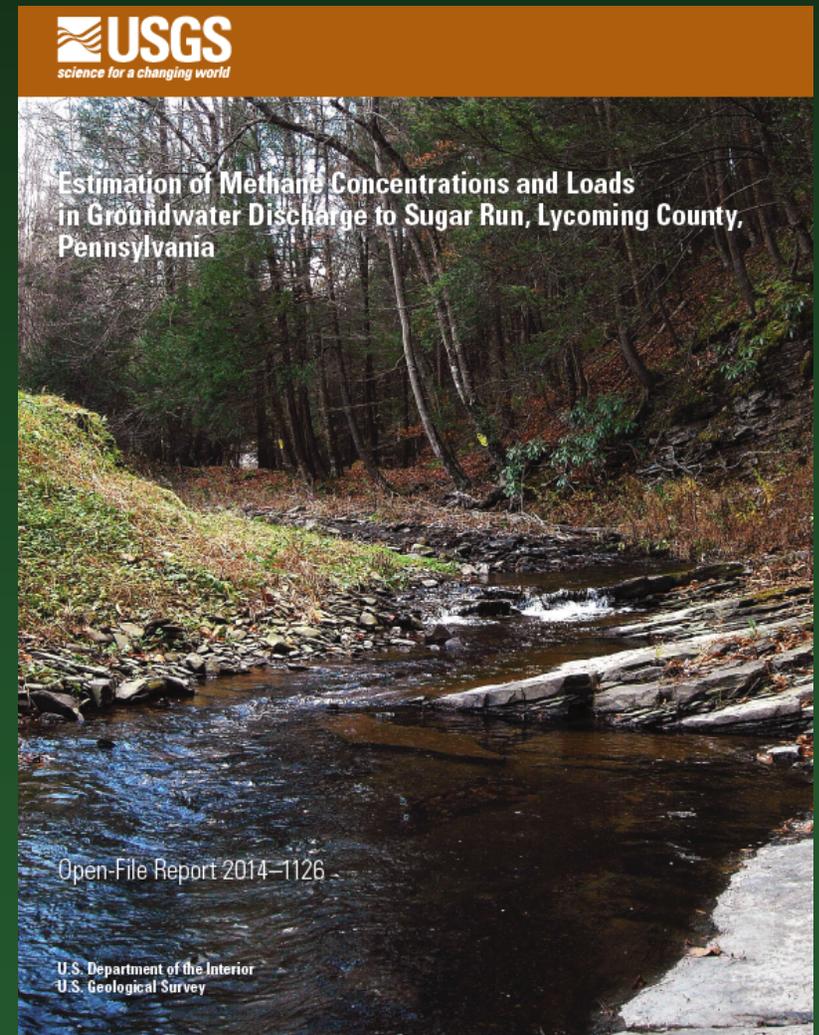
41°16'

41°14'



So what about Stream-Methane Monitoring?

- Were results in Sugar Run a fluke?
- What about other 3 basins with elevated methane?
- Is method useful to scan for methane problems?
- Would method be most useful in areas w/o domestic wells?
- What are limitations of method?



<http://pubs.usgs.gov/of/2014/1126/>