Regulatory Framework for Shale Development in Ohio

Division of Oil & Gas
Resources Management, ODNR

Licking County Energy Summit
03-22-12

On Behalf of ODNR

Director: James Zehringer

Assistant Director: Fred Shimp

Chief: Richard Simmers

Presenter: Mike McCormac

Today's Presentation

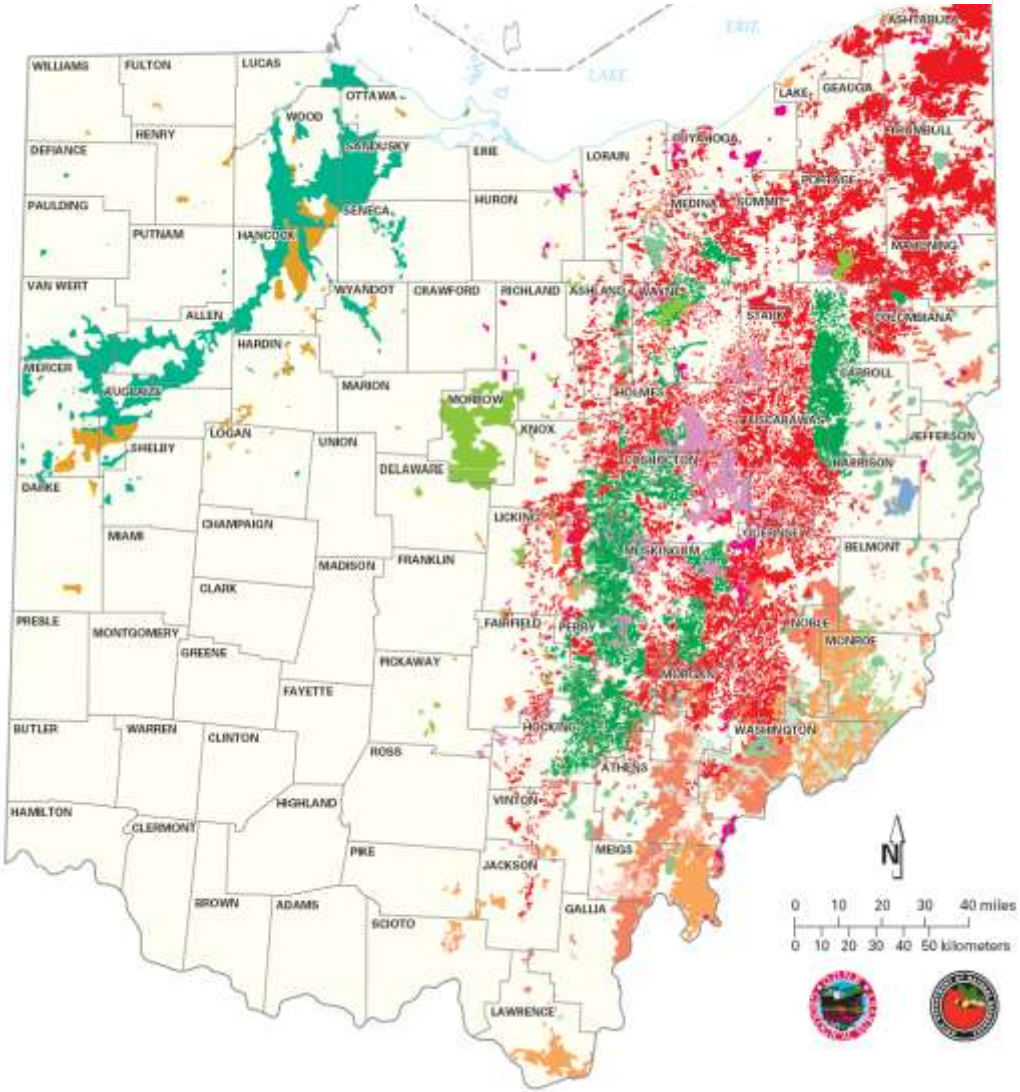
- Brief history of oil and natural gas development in Ohio
- Shale development to date
- Regulatory Framework
- Differences bet. Vertical & Horizontal Wells
- Hydraulic fracturing

ODNR Organization Changes

Oil & Gas program became a stand alone division Oct. 1, 2011

- **Acknowledgement of the importance for a direct focus on oil and natural gas development, in particular, shale development**

Oil and Gas Fields in Ohio



275,000 + wells drilled

Ohio's Historical Drilling Activity

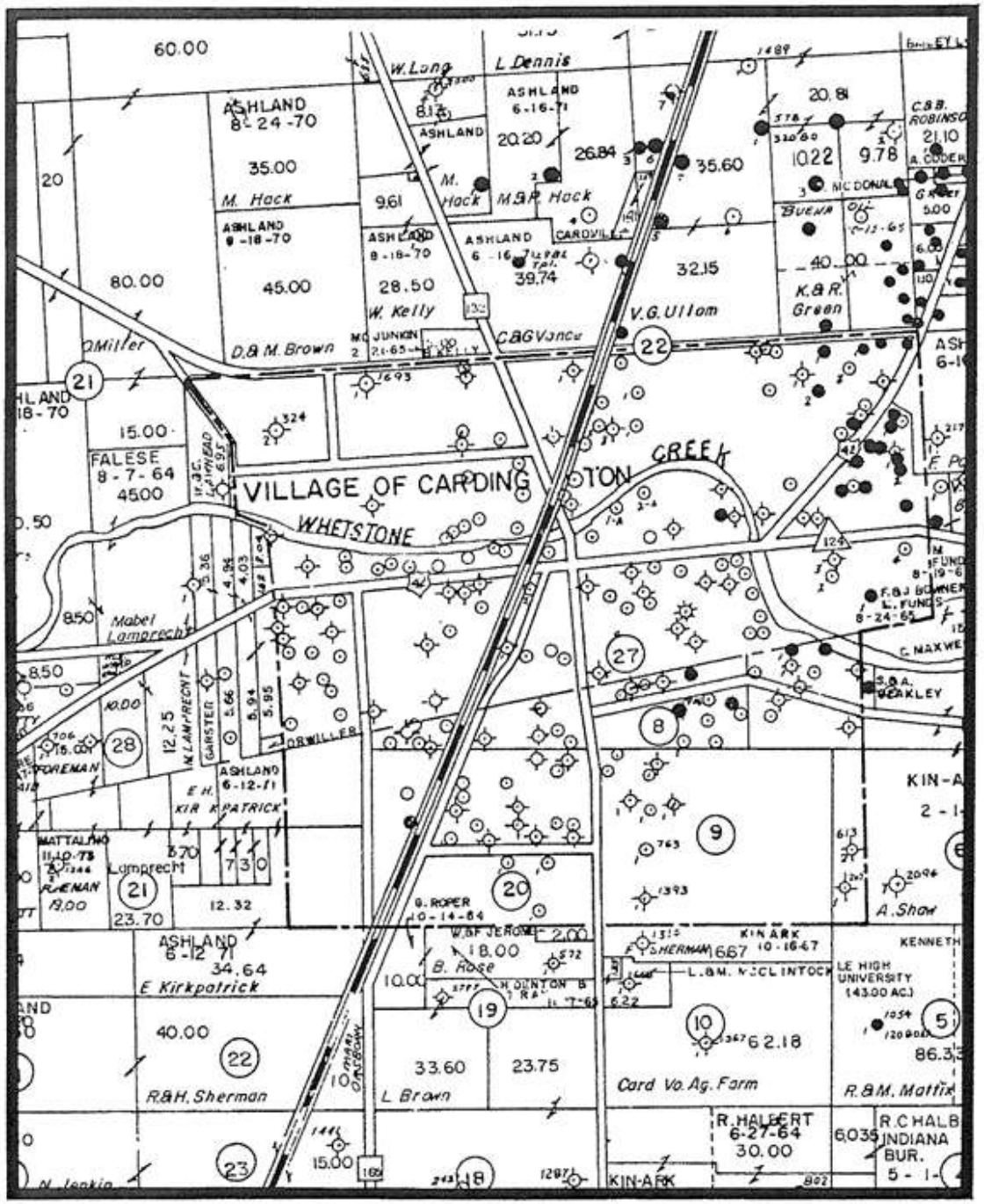
Year	Wells Drilled
1895	6,147
1930	2,134
1980-82	5,167 (avg)
2008	1,087
2010	431
2011	460

64,000 Well Exist in Ohio Today

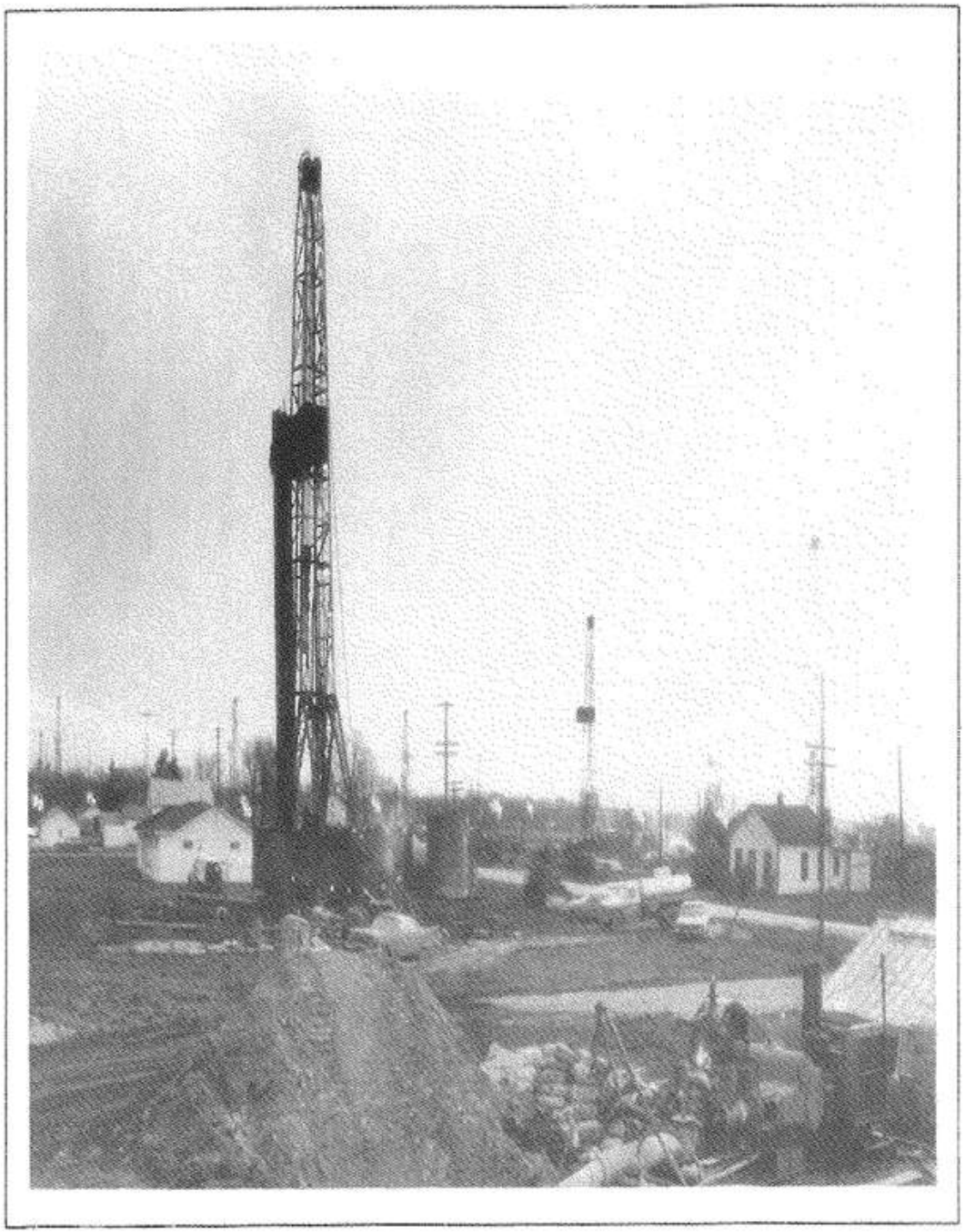
Legal Authority For The Regulation of Oil and Natural Gas Development

- Ohio Revised Code 1509
- Ohio Administrative Code 1501
- ORC 1509 effective in 1965:
- Major changes in 1985, 2004 and 2010

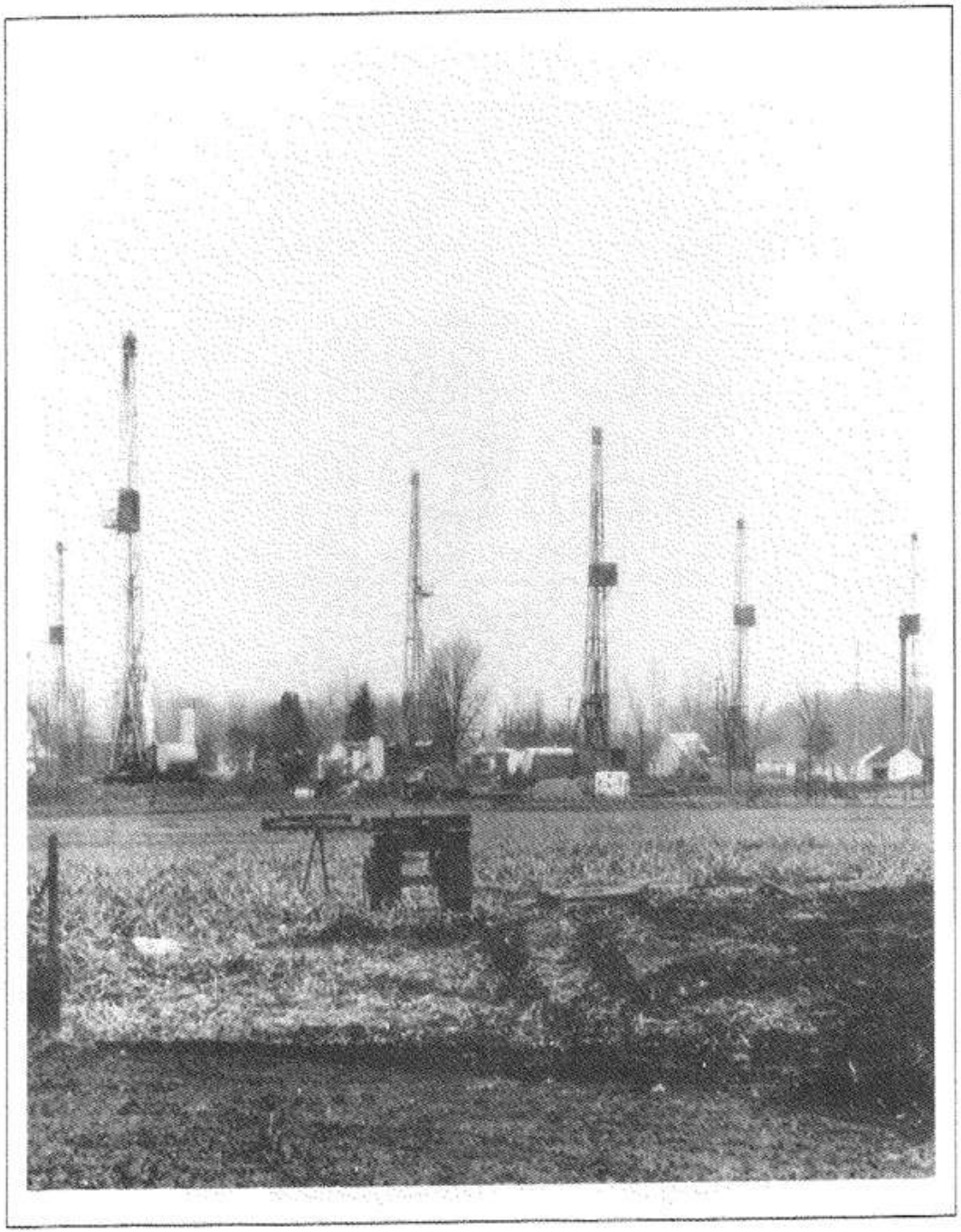
The Division has sole authority over the permitting, location and production of oil and natural gas in Ohio.



Cardington Township, Scale: 1 Inch = 1,320 Feet, Secs. 22 & 27, Lots 8, 9 & 20, The Village Of Cardington; Example Of Map Detail At Working Scale; Midcontinent-Wood, Inc., c. 1967; Courtesy Of Exhibit Pro, Columbus, Ohio.



10. Cardington, Ohio, U. S. Route 42, looking southwest, c. February 1964.



13. Cardington, Ohio, U. S. Route 42, looking east-southeast, c. February 1964. A companion to Photograph Number 10.

Basis for Oil & Gas Laws and Rules

- Protection of the environment
- Conservation
- Public health & safety

Permit Conditions - Examples

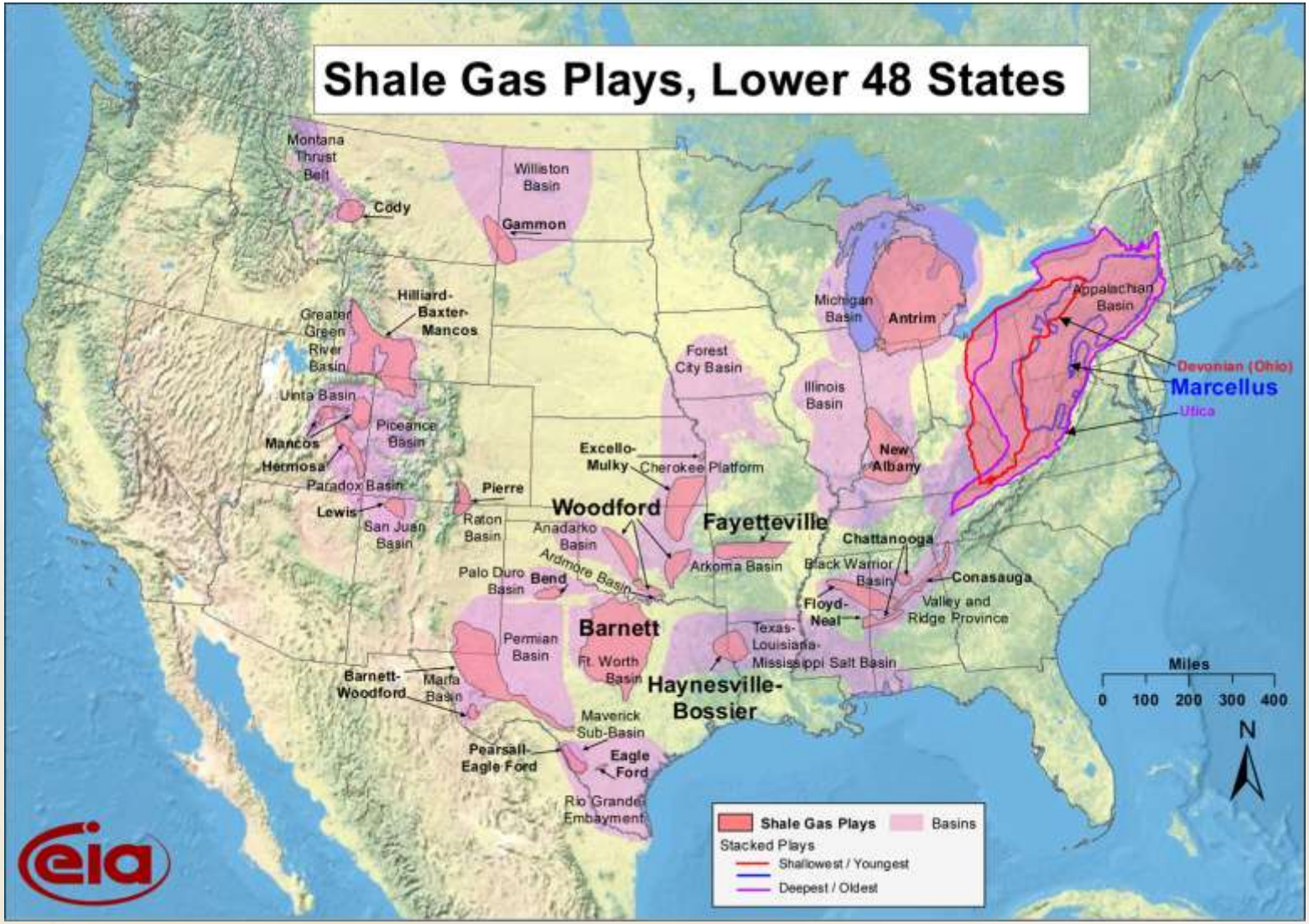
- Pre-site review
- As drilled surveys

Shale Development in the United States and Ohio

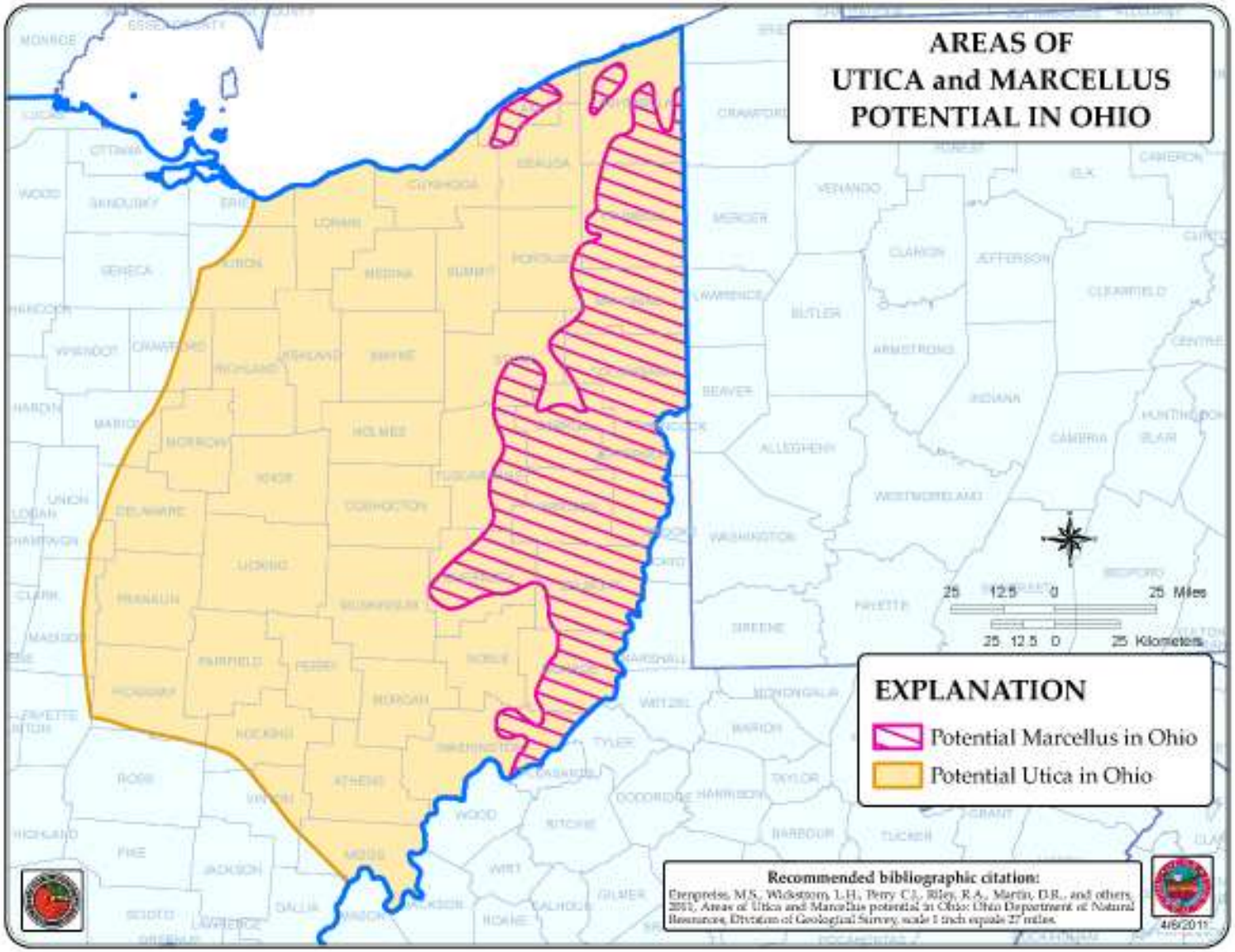
Application of Two Established Technologies

- Directional Drilling
- Hydraulic Fracturing

Location of Shale Development



Utica and Marcellus Shale



The Game Changer

- **The Utica Shale may contain <u>significant</u> quantities of natural gas liquids**

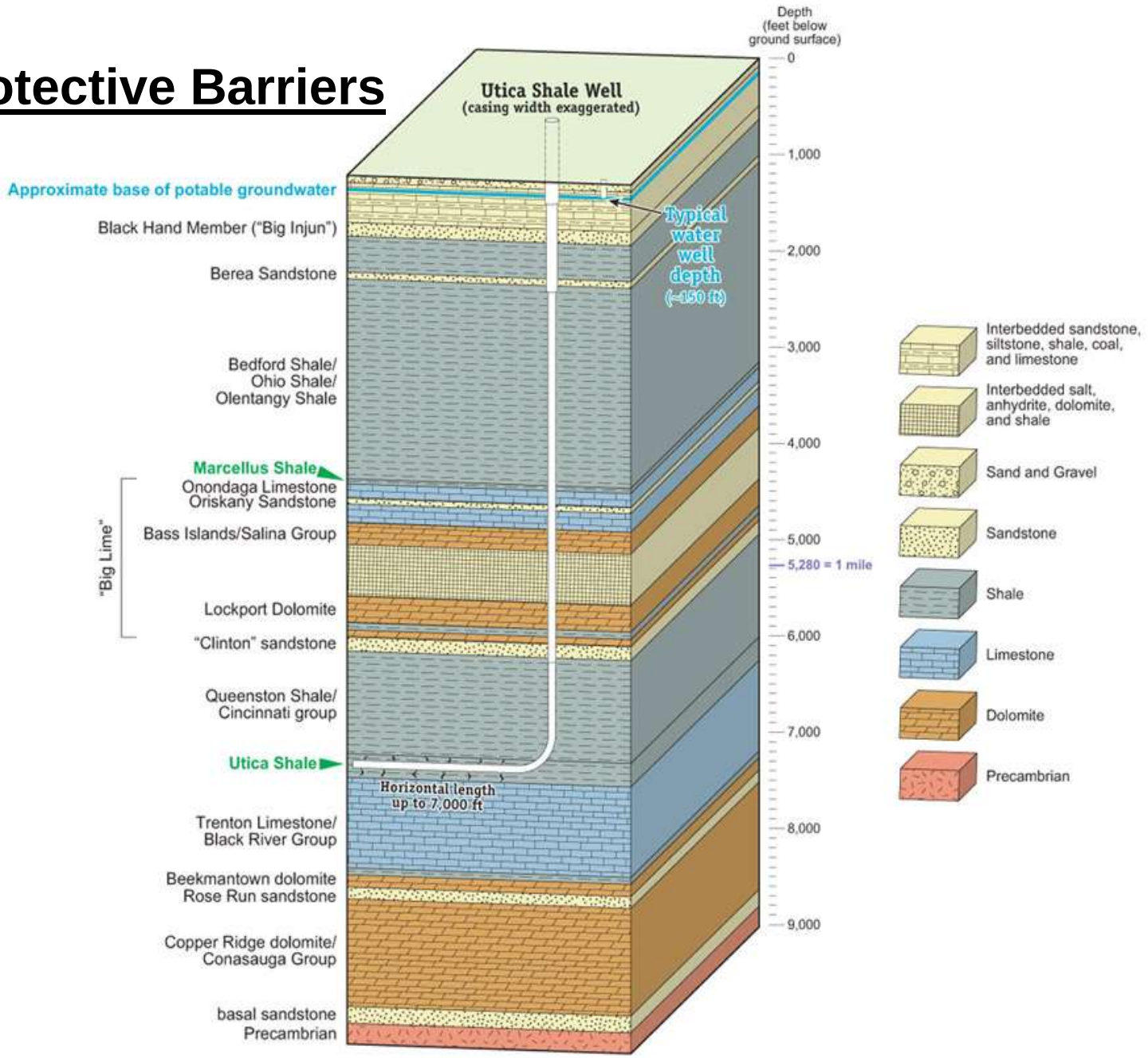
- **It appears the liquids potential increases as you move westward toward central Ohio**

Shale – Possible Productive Extent

- **Geologically: 40 + counties**
- **10,000,000 + acres**
- **14,000 + sq mi**

Productive areas - still being defined

Protective Barriers



Marcellus Shale Drilling in Ohio through 03/04/12

- **Horizontal Permits Issued: 13**
- **Horizontal Wells Drilled: 7**

No Change for weeks

Utica Shale Drilling in Ohio through 03/11/12

- **Horizontal permits issued: 159**
- **Horizontal wells drilled: 50**
- **Producing wells: 7**

Oil & Gas
Shale Development
Coal Mining
Industrial Minerals
Mine Safety
Abandoned Mine Land

FAQs
- About Oil and Gas
- Leasing and Drilling

Public Information
- Shale Development Activity & Web Resources
- Shale Development Fact Sheets
- Best Management Practices for Pre-Drilling Water Sampling
- Protecting Groundwater
- Senate Bill 165 Updates
- Material Safety Data Sheets (MSDS)

Oil and Natural Gas Well and Shale Development Resources

Effective immediately, the vertical permits (stratigraphic test well permits) have been removed from this listing. In the initial phases of both Marcellus and Utica exploration, they were listed to reflect exploratory activity. They are no longer necessary with the increase of horizontal permitting activity. As always, they are available through the Oil & Gas On-line Well Search.

The following table reflects the shale activity to date.

Marcellus Shale - Ohio Activity (for week of 3/4/2012)
View Spreadsheet *View PDF*
Horizontal Permits: 13
Horizontal Wells Drilled: 7

Recent* Utica Shale - Ohio Activity (for week of 3/4/2012)
View Spreadsheet *View PDF*
Horizontal Permits: 150
Horizontal Wells Drilled: 50
** permits issued since December 2009*

Marcellus Shale - Weekly Permitting Activity (for week of 3/4/2012)
View PDF

Recent* Utica Shale - Weekly Permitting Activity (for week of 3/4/2012)
View PDF

The following link provides a listing of web resources (with hyperlinks) that explain or depict the process receiving attention in Ohio, Pennsylvania, New York, West Virginia and in the other shale development regions across the United States.

➤ Public Web Resources

Click Here To Enter Your Content

Ohio Department of Natural Resources - Division of Oil and Gas Resources Management

UTICA/POINT PLEASANT SHALE WELLS - WEEK OF 3/11/2012

	Do	
Drilling		
In Transit		
Total		

Horizontal permits to date:	159
Total Horizontal Wells Drilled To Date:	50
Total Horizontal Wells Producing:	7

Horizontal permits to date:	159
Total Horizontal Wells Drilled To Date:	50
Total Horizontal Wells Producing:	7

Oh gement

U

izontal permits issued this week

Dr

In Transit	2	0
Total	13	8

12/15/2011	Carroll	Lee	34019221050000	Drilling	Horizontal	Chesapeake Exploration LLC	Snoddy 11-3-5 6H	Intermediate string set.
1/25/2012	Carroll	Perry	34019221190100	Drilling	Horizontal	Chesapeake Exploration LLC	Scott 24-12-15 3H	Drilling lateral.
10/31/2011	Carroll	Lee	34019220970000	Drilled	Horizontal	Chesapeake Exploration LLC	Snoddy 11-13-5 5H	Waiting to frac well.
10/31/2011	Carroll	Lee	34019220980000	Drilled	Horizontal	Chesapeake Exploration LLC	Snoddy 11-13-5 1H	Waiting to frac well.
11/14/2011	Carroll	Lee	34019220990000	Drilled	Horizontal	Chesapeake Exploration LLC	Houyouse 15-13-5 1H	Drilling lateral.
10/26/2011	Carroll	Lee	34019220960000	Drilled	Horizontal	Chesapeake Exploration LLC	Houyouse 15-13-5 8H	Waiting to frac well.
11/25/2011	Carroll	Lee	34019221000000	Drilled	Horizontal	Chesapeake Exploration LLC	Houyouse 15-13-5 6H	Waiting to frac well.
11/30/2011	Carroll	Lee	34019221020000	Drilled	Horizontal	Chesapeake Exploration LLC	Bailey 35-1254 1H	On site to frac.
11/30/2011	Carroll	Lee	34019221010000	Drilled	Horizontal	Chesapeake Exploration LLC	Bailey 35-1254 3H	On site to frac.
12/6/2011	Carroll	East	34019221030000	Drilled	Horizontal	Chesapeake Exploration LLC	Bucey 21-14-4 5H	On site to frac.
12/6/2011	Carroll	East	34019221040000	Drilled	Horizontal	Chesapeake Exploration LLC	Bucey 21-14-4 6H	Waiting to frac well.
9/20/2011	Carroll	Lee	34019220900100	Drilled	Horizontal	Chesapeake Exploration LLC	Tanner 24-12-4-10H	Waiting to frac well.
10/14/2011	Carroll	Lee	34019220950000	Drilled	Horizontal	Chesapeake Exploration LLC	White 17-13-5 3H	Waiting to frac well.
9/27/2011	Carroll	Lee	34019220920000	Drilled	Horizontal	Chesapeake Exploration LLC	White 17-3-5 10H	Well completed.
9/20/2011	Carroll	Lee	34019220880100	Drilled	Horizontal	Chesapeake Exploration LLC	White 17-13-5-8H	Drilling lateral.
6/8/2011	Carroll	Augusta	34019220820000	Drilled	Horizontal	Chesapeake Exploration LLC	West 4-15-5 3H	
2/2/2012	Columbiana	Washington	34029217060100	Drilling	Horizontal	Chesapeake Exploration LLC	Janie Trust 5-12-3 1H	Surface casing set.
2/16/2012	Columbiana	Madison	34029217130000	Drilling	Horizontal	Chesapeake Exploration LLC	Rosebud 16-10-2 8H	Conductor casing set.
3/6/2012	Columbiana	Washington	34029217160000	Drilling	Horizontal	Chesapeake Exploration LLC	Janie Trust 5-12-3 10H	Waiting to frac well.
11/21/2011	Columbiana	West	34029217010000	Drilled	Horizontal	Chesapeake Exploration LLC	Ayrview Acres 27-16-5 1H	Waiting to frac well.

Where in Ohio - Now

Carroll	Noble
Columbiana	Ashland
Guernsey	Stark
Jefferson	Knox
Mahoning	Tuscarawas
Belmont	Medina
Harrison	Geauga
Monroe	Portage
Muskingum	

Shale Companies Currently in Ohio

- Chesapeake
- Devon Energy
- Enervest
- Anadarko E&P
- Gulfport Energy
- CNX Gas
- Hess Ohio Resources
- HG Energy
- Eclipse Resources
- XTO Energy Inc.
- R E Gas Dev.

What to Expect

- **2012 - steady drilling growth & infrastructure building:**

  <u>200</u> Shale wells will be drilled

- **2013 - exponential drilling growth**

- **2014 - drilling at maximum until…?**

Differences Between a Horizontal Well and Traditional Vertical Well

- Everything is bigger – It takes longer
  - Well site 3-5 acres vs. 1-2 acres
  - Shale rig is much larger
  - Associated equipment – more of it


Carroll County - Utica Shale Horizontal Drilling

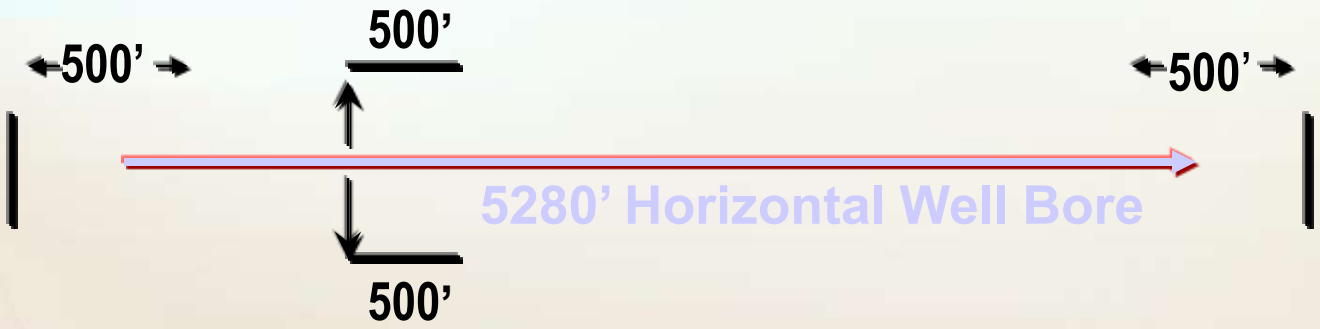
Differences Between a Horizontal Well and Traditional Vertical Well

- One month/well to drill vs. one week
- 6 or more wells can be drilled from one well site pad
- $5 million (and higher) vs. $400,000

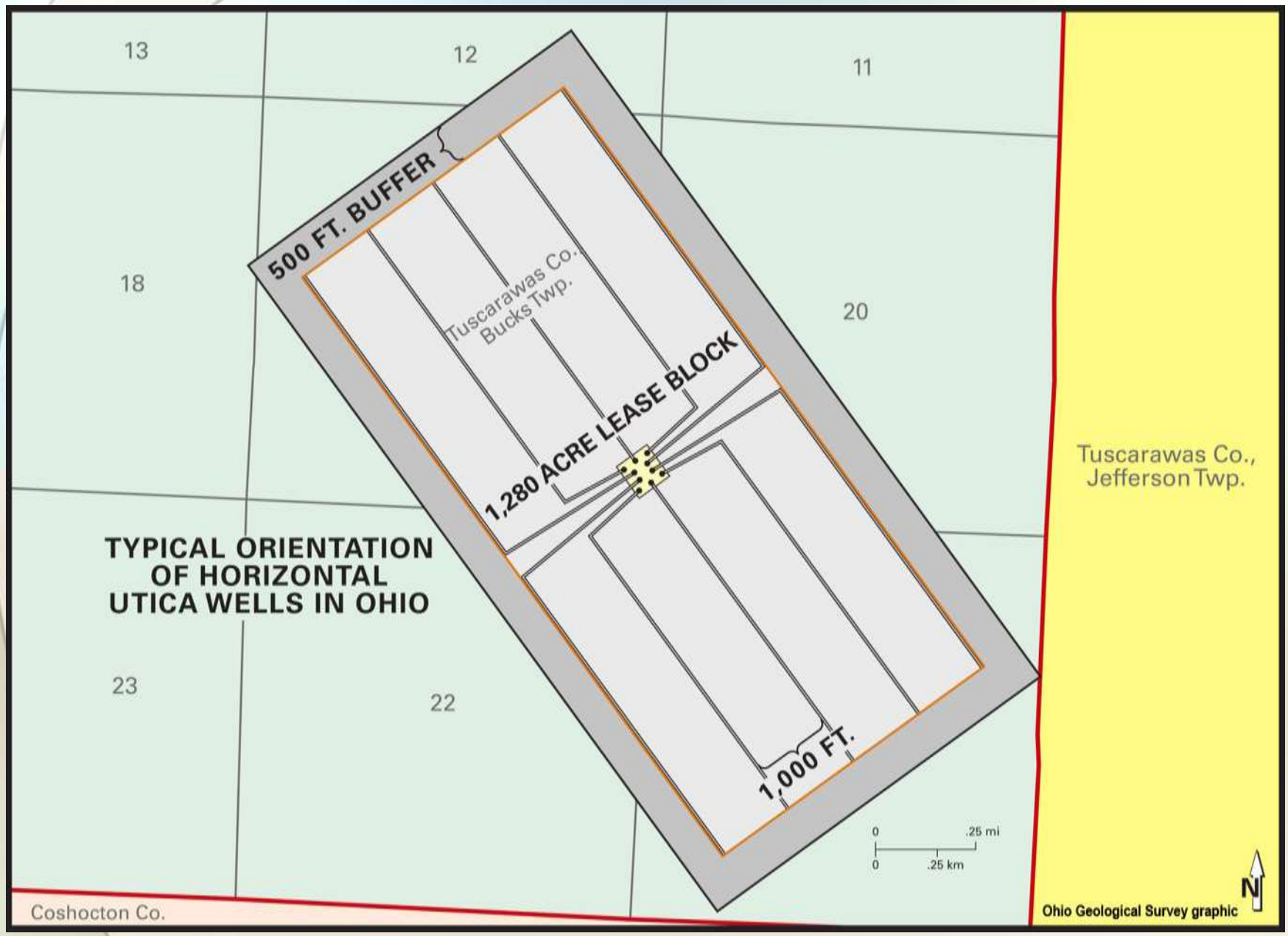
Spacing Categories

Depth	Acres	Unit Lines	Distance Bet. Wells
0 to 1,000’	1	100’	200’
1 to 2K	10	230’	460’
2 to 4K	20	300’	600’
4,000 +	40	500’	1,000’

Minimum Acreage Needed for a One Mile Horizontal Well



6,280’ * 1,000’/43,560 = 144.16 acres


13
12
11
18
20
23
22
500 FT. BUFFER
Tuscarawas Co.
Bucks Twp.
1,280 ACRE LEASE BLOCK
1,000 FT.
TYPICAL ORIENTATION
OF HORIZONTAL
UTICA WELLS IN OHIO
Tuscarawas Co.,
Jefferson Twp.
0 .25 mi
0 .25 km
N
Coshocton Co.
Ohio Geological Survey graphic

Positive Change:
Increased Staffing
Ability to Oversee the Coming Shale Activity

Current FTE: 53

Within 16 Months:

150 FTE

Focus of expansion:

- **Field staff**
  Boots-on-the-ground

Positive Change Cont.:

Enhancement of current regulations

- Well construction rules
- Injection Well
- Coordination between state agencies – unlike any time over the last 30+ years (OEPA, Dept. Health PUCO, Commerce, Ohio EMA, Dept. Pub Safety…..)

Positive Change Cont.:

Enhancement of current regulations

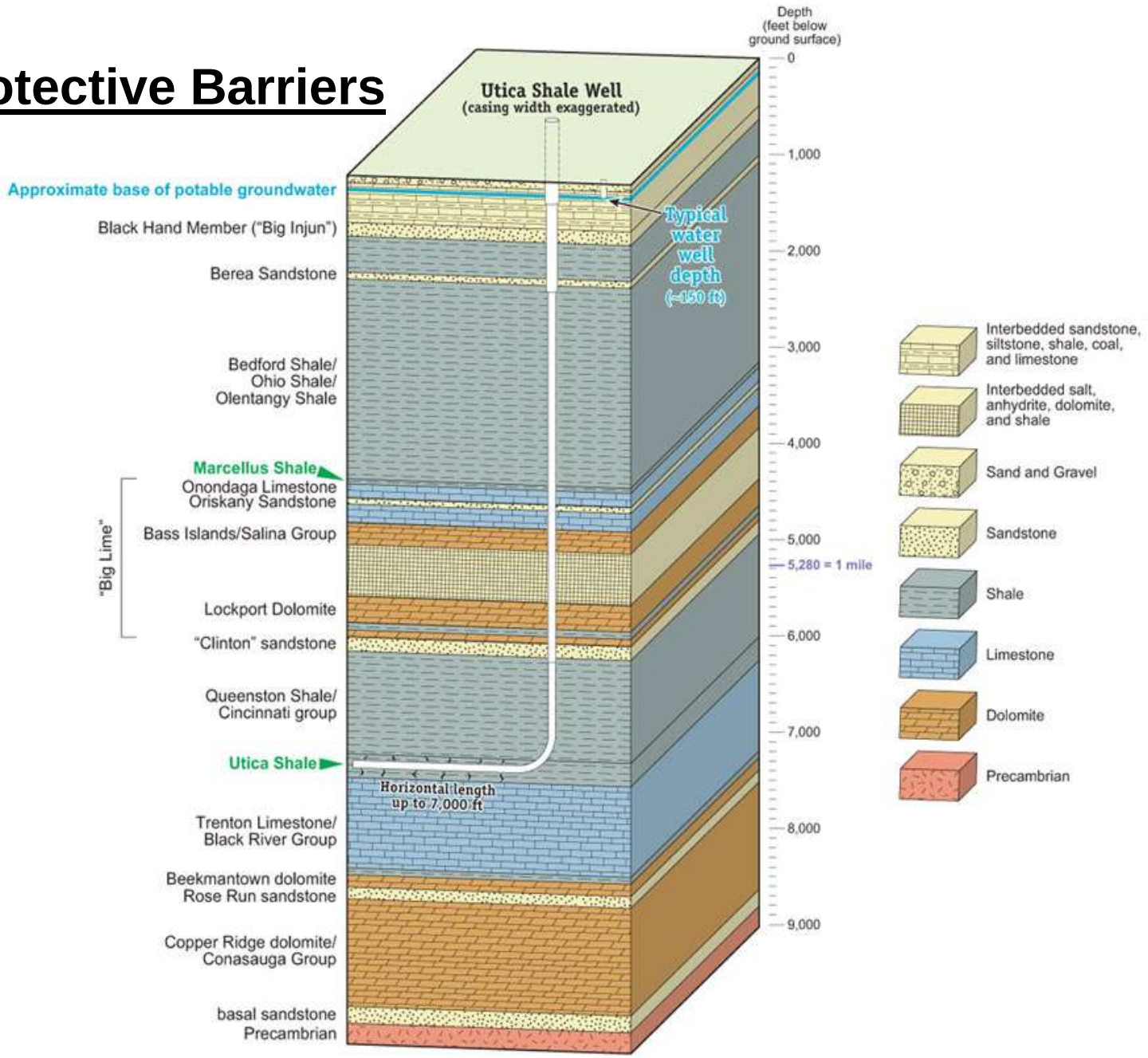
- Spill Prevention (SPCC) Rules
- Pipeline development – close coordination with PUCO
- Coordination between other ODNR Divisions (Geo. Survey. Wildlife, Soil and Water, Engineering)

Positive Change Cont.:

- Coordination with other states active with shale development across the nation – lessons learned

We are ahead of the coming increased shale drilling activity

Protective Barriers

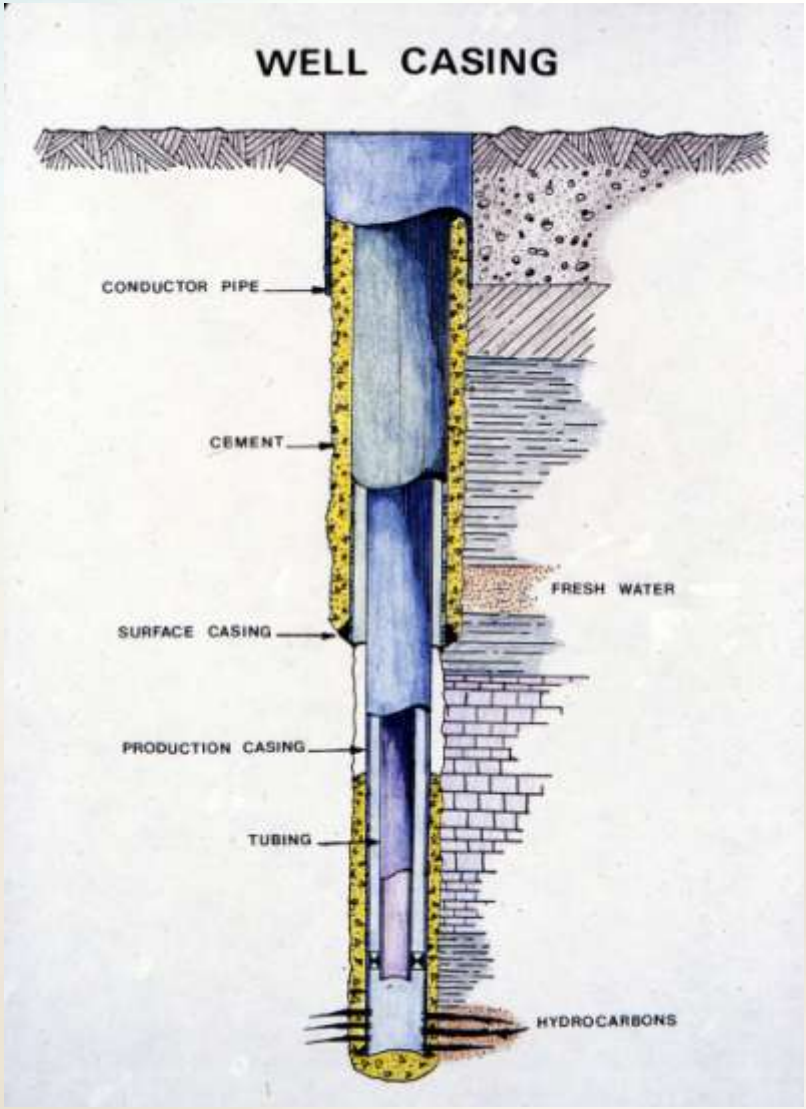


Proper Well Construction

- **Well construction rules**
  - Requires operators to set and cement surface casing to isolate and protect all Underground Sources of drinking Water
  - Fresh water based drilling system

GROUNDWATER PROTECTION WELL CONSTRUCTION

- **Surface casing set at least 50 feet below the USDW**
- **Protect up to 10,000 ppm TDS**

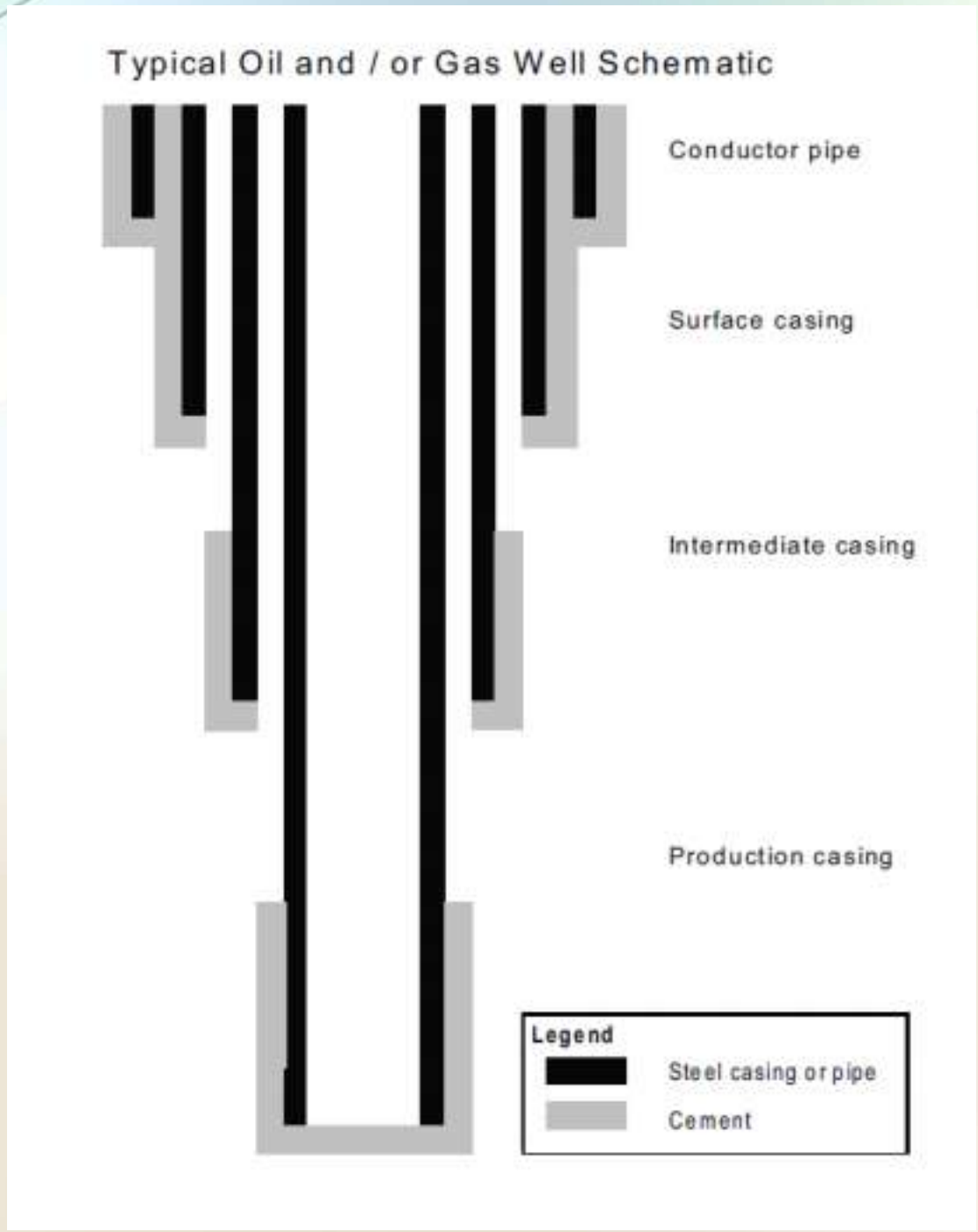


Proper Well Construction

- Requires operators notify the O & G inspector at least 24 hours prior to every cement job

Proper Well Construction

- **<u>Casing</u>**
  - Multiple cemented casing strings to protect groundwater
  - Conductor, Surface, Intermediate, Production


Typical Oil and / or Gas Well Schematic
Conductor pipe
Surface casing
Intermediate casing
Production casing
Legend
Steel casing or pipe
Cement

Hydraulic Fracturing

- “Fracking”
- “Fracing”
- “Hydrofracing”
- “Well Stimulation”
- “Frac Wells” [no such thing]

Hydraulic Fracturing

A process of using water, sand and chemicals under pressure to fracture a geologic formation to create pathways for oil and natural gas to migrate back to the wellbore

- Without hydraulic fracturing, few oil/gas producing reservoirs in Ohio would be economically viable

Hydraulic Fracturing

Is this a new process ?

- **No**
- **Developed in Texas oilfields in the 1940's**
- **Used in Ohio since the 1950's**
- **80,000 + wells in Ohio have been hydraulically fractured**

  1,000,000+ across the nation

"Hydraulic Process Used In Developing New Oil Well On Rohrer Farm"

September 3, 1954

East Sparta
July 1952

The Hartville News

HARTVILLE, OHIO, FRIDAY, SEPTEMBER 3, 1954

HYDRAULIC PROCESS USED IN DEVELOPING NEW OIL WELL ON ROHRER FARM

Upper left: Workmen are busy manipulating controls and keeping an eye on gauges as they run the injection test.

Lower left: A view of trucks and tanks needed in the process.

Upper right: (left to right) - Brady Johnson, Petroleum Engineer, National Gas & Oil Corp., Newark, Ohio; W. P. Hambleton, Hartville, Ohio; Buck Shannon, field sup't. Belden Oil & Gas Co.; H. S. Belden III, vice-president & general manager, Belden Oil & Gas Co.; Louis Mitchell, field superintendent, Halliburton Co.; Wm. N. Tipka, geologist, National Gas & Oil Co., Wooster and R. E. Grey, oil well supply representative.

Lower right: Three of the trucks pumping oil into the well during the process.

A comparatively new process in this area to develop oil wells was used by the Belden Oil & Gas Co. in developing the well on the Ethan Rohrer farm, 3 miles southeast of Hartville. This process, "hydraulic fracturing," was first used in the West Texas oil fields in September of 1949 and the first well in the Appalachian area to use the method was a Belden well near East Sparta in July of 1952.

The process, which was developed by the Standard Oil Company of Indiana, involves the pumping of oil, in which is mixed a coarse sand, into the well under a terrific pressure. This pressure produces cracks in the underground rocks and the sand and oil mixture flows into these openings. Later the oil is removed leaving the sand to keep the cracks expanded thus allowing the natural oil supply to flow to the well. In some instances it is possible to extend these cracks a distance of 500 to 1500 feet from the well.

Pumping pressure usually runs from 3,000 to 3,500 pounds per square inch at the equipment and increasing according to depth of the well, may run upward of 5,000 pounds per square inch.

This hydraulic fracture process requires a lot of equipment and manpower. When the well on the Rohrer farm was fractured last Thursday, 40,000 pounds of sand and 1,200 barrels of oil were used. This required days of preparation in hauling in the oil, erecting the tanks for storage, etc. Three large trucks pumped oil during the operation, two others handled the sand and another fed the sand into the oil. This work was handled by the Halliburton company, working out of Zanesville, Ohio, whose equipment specializes in this process the world over. The equipment involved in the process at this one well was valued in excess of $350,000.00.

During the injection test, at which time all five pumps were in operation pumping oil only, to see how the well would take the oil it was possible to put in 16 barrels per minute.

This well, which had two definite showings of oil, was drilled to a depth of 4,655 feet. The top of the Clinton sand was reached at 4,635 feet.

Following the fracturing process of last Thursday the well was closed until Monday of this week at which time it was opened.

It was reported that there was a flow of oil but recordings are kept over a period of time and until the oil is returned which was pumped into the well no definite indication as to the natural flow will be available.

MYTHS ABOUT HYDRAULIC FRACTURING

- There is a lot of misinformation regarding hydraulic fracturing
- You cannot propagate fractures back to the surface or to aquifers
- 700 + Chemicals used on each hydraulic fracture

Chemicals Used in Hydraulic Fracturing

Product	Purpose
Acids	Dissolve minerals and initiate cracks
Friction reducers	Minimize friction
Scale inhibitors	Prevents scale deposits
Surfactants	Increase viscosity
Biocides	Eliminates bacteria
Clay stabilizers	Prevents swelling
Breakers	Delays breakdown of gel
Crosslinker	Viscosity control

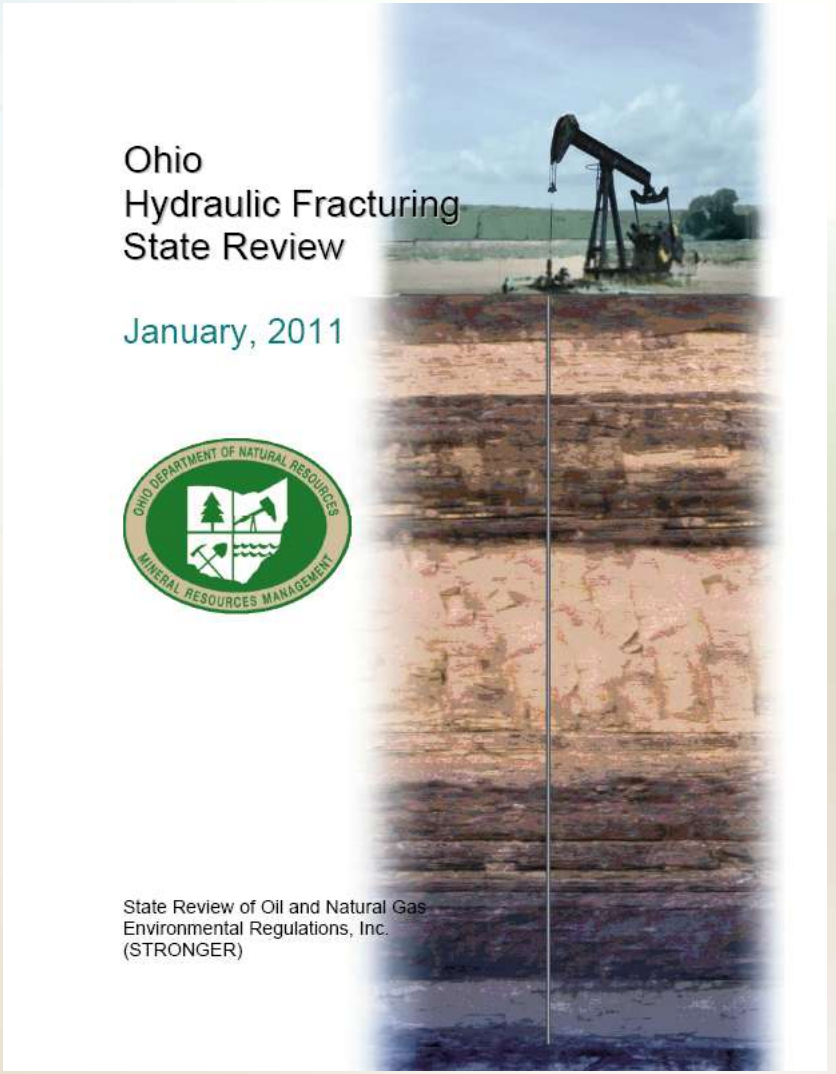
Jefferson County Hydraulic Fracture 12-19-11

Water	85.99% (4.04 mill gal)
Sand	12.91% sand
Acid	0.4% HCL
Friction Reducer	0.109%
Scale inhibitor	0.001%
Gelling+Ph agent	0.3295%
Biocides	0.01%
Clay stabilizers	0.10%
Breakers	0.0045%
Crosslinkers	0.058%

Approx. 14 different products and 32 sub-products including sand and water, *not 700*

Hydraulic Fracturing

January 2011 the "*Ohio Hydraulic Fracturing State Review*" report was released by State Review of Oil and Natural Gas Regulations, Inc. (STRONGER)



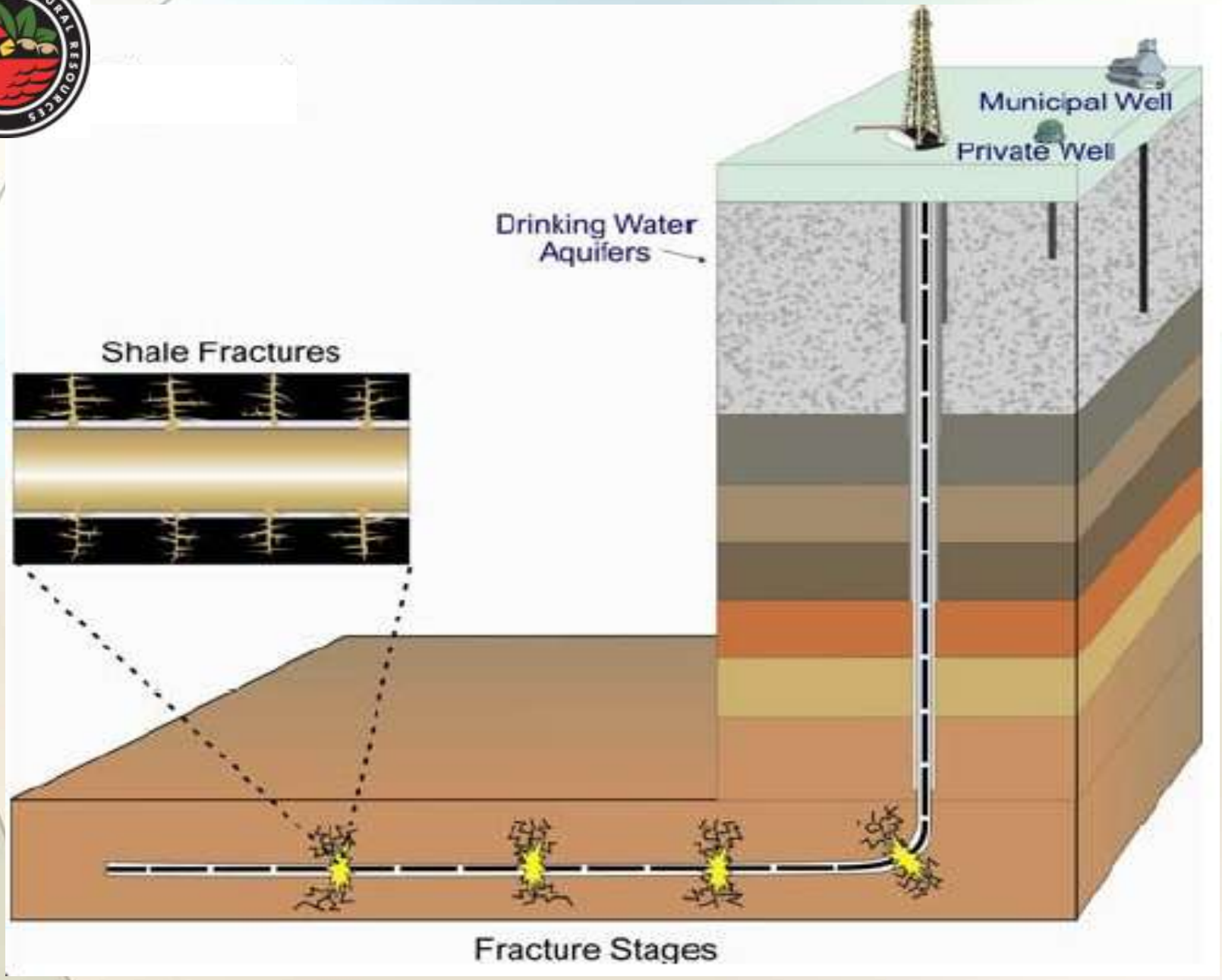
Hydraulic Fracturing

- **Eight industry, regulatory, and environmental officials reviewed Ohio's hydraulic fracturing regulatory program and found:**

Hydraulic Fracturing

“Ohio’s program is overall:

- **well-managed**
- **professional and;**
- **is meeting it’s program objectives.”**


Municipal Well
Private Well
Drinking Water Aquifers
Shale Fractures
Fracture Stages


Frac Tanks/ Fluid Storage
Chem Truck
Blender
Sand Storage Units
Wellhead
Data Van
Pump Trucks

Other Important Considerations

- **Proper Fluid Containment**
- **Proper Fluid Disposal**

Disposal of Waste

- **Brine**
- **Flow-back Fluids**

Disposal of Oil-Field Wastes by Class II Injection

- Under a primacy agreement with USEPA – Since the early 1980's
- Ohio's laws and rules for underground injection are as stringent or more so than the USEPA

What to Expect – A Visual Depiction


Ashland County
02/13/2012 16:23


Portage County

Portage County

Harrison County – First Productive Utica Shale Well

Spill Prevention Controls
Harrison County


Carroll County

Guernsey County Pad Development


Medina County


Medina County