

Study of the Potential Impacts of Hydraulic Fracturing on Drinking Water Resources

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Study Background

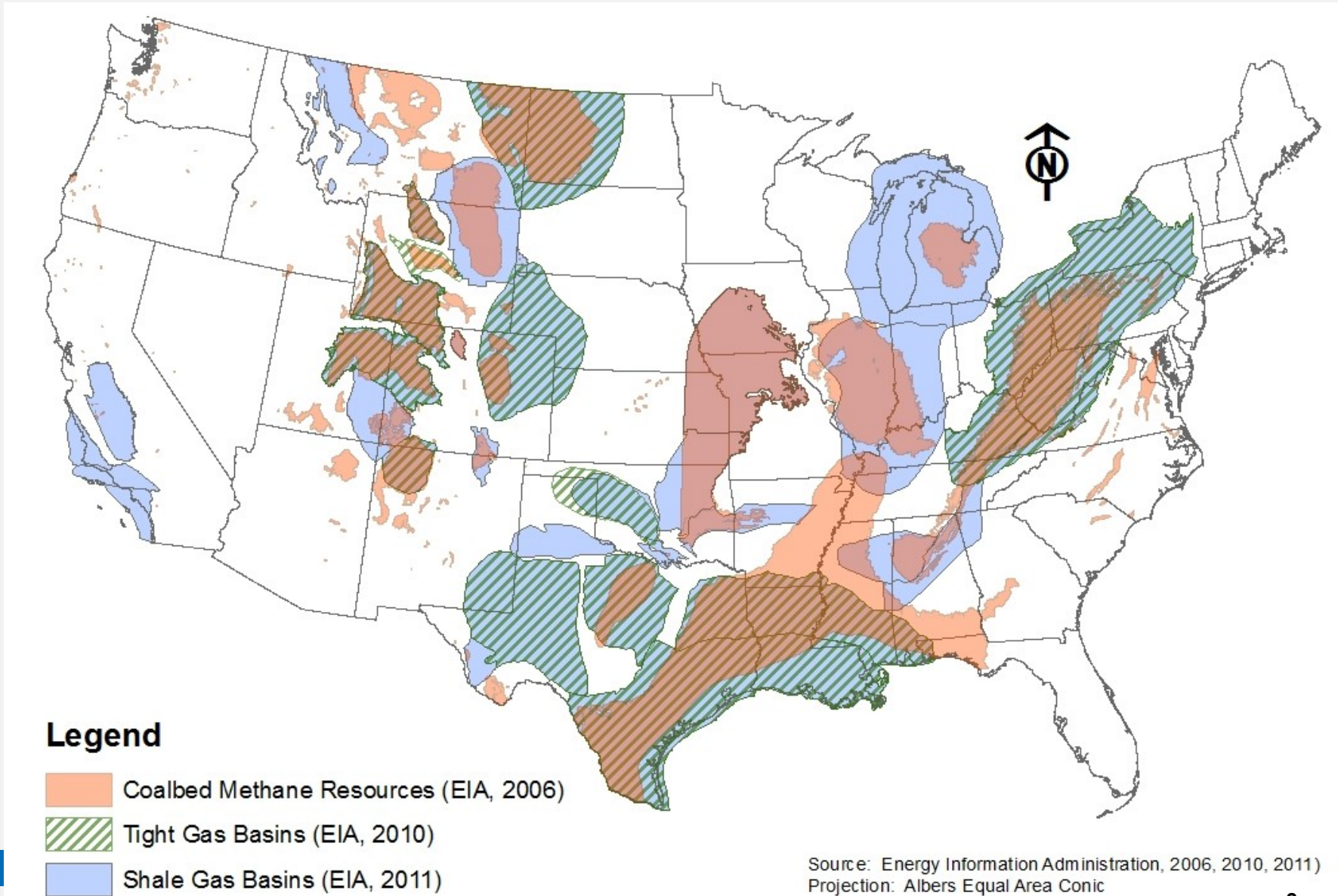
In 2010, Congress urged EPA to study the relationship between hydraulic fracturing and drinking water.

The study purpose is to:

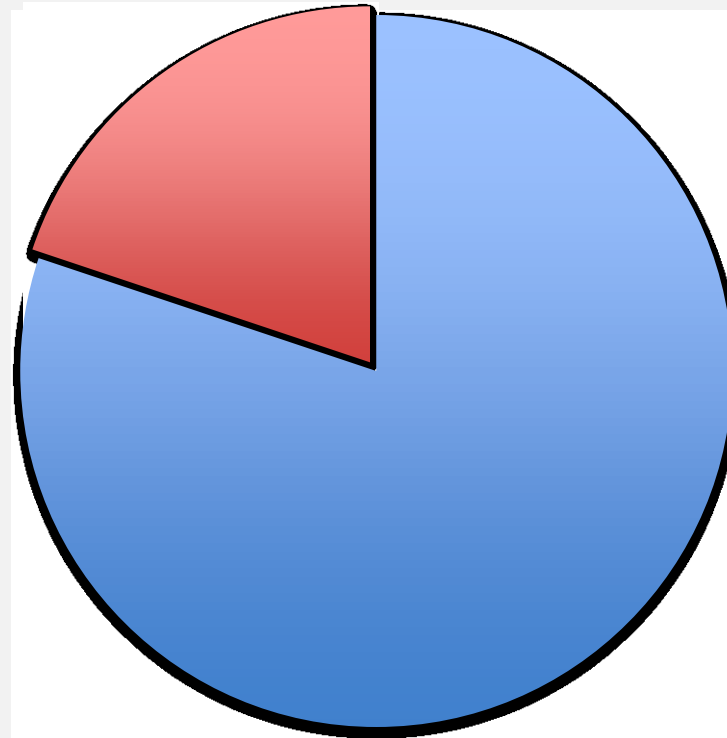
- Assess whether hydraulic fracturing can impact drinking water resources
- Identify driving factors that affect the severity and frequency of any impacts



Unconventional Oil and Gas Resources



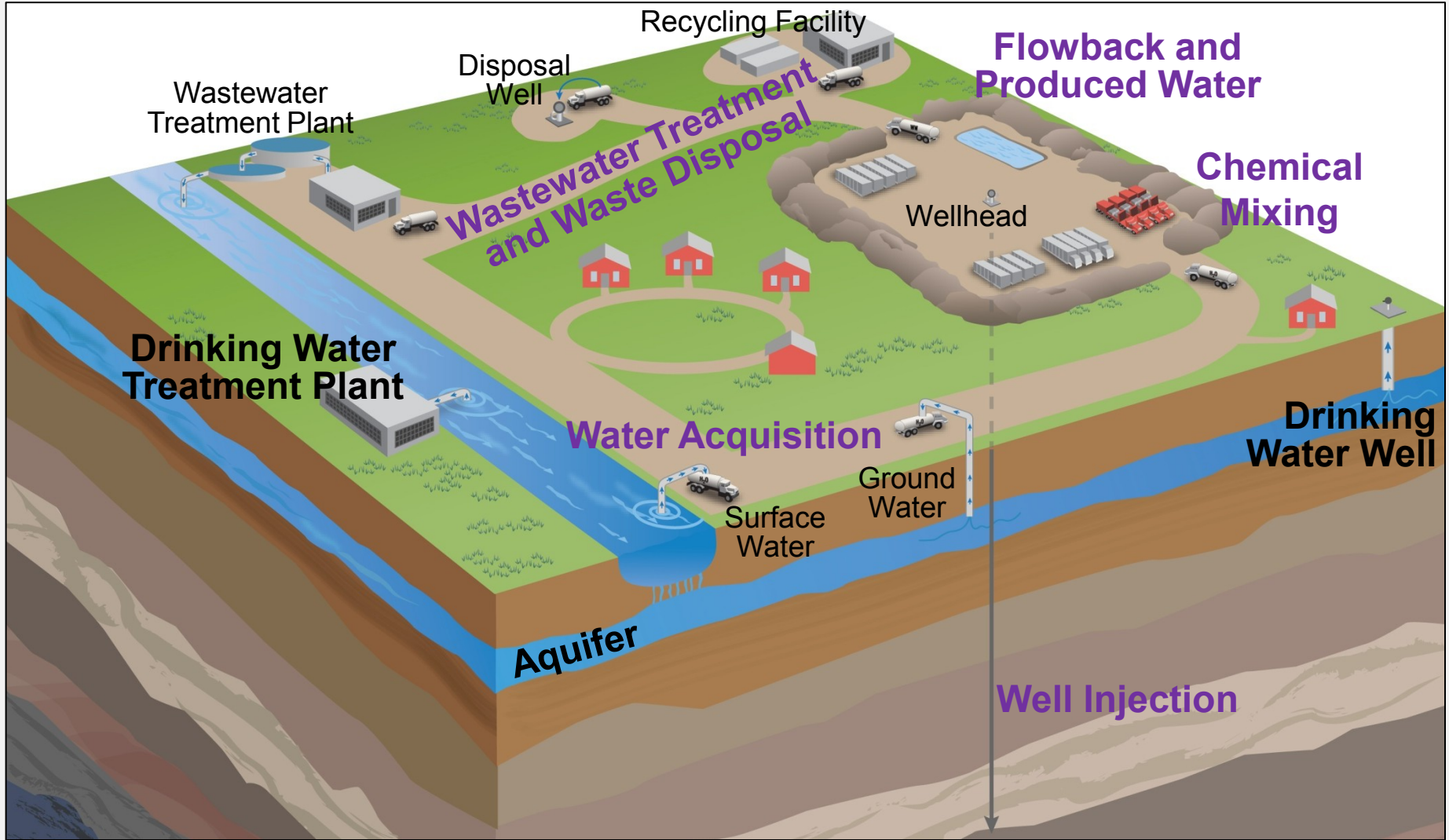
Hydraulic Fracturing by Resource



Oil 80% **Gas 20%**

Rig Count = 1,771
(Week of February 7, 2014)

Hydraulic Fracturing Water Cycle



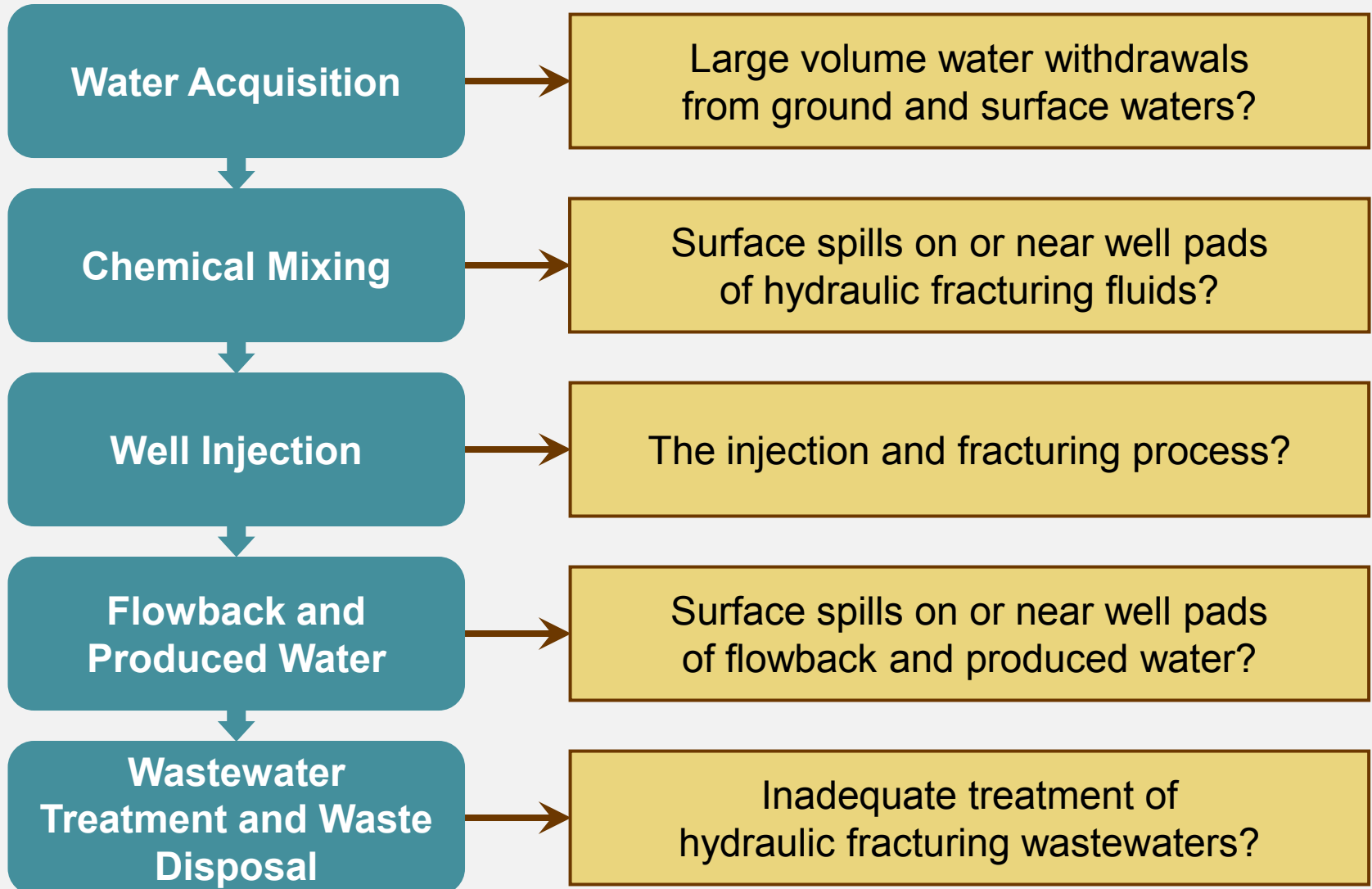
WATER CYCLE STAGES

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Water Acquisition → Chemical Mixing → Well Injection →
Flowback and Produced Water → Wastewater Treatment and Waste Disposal

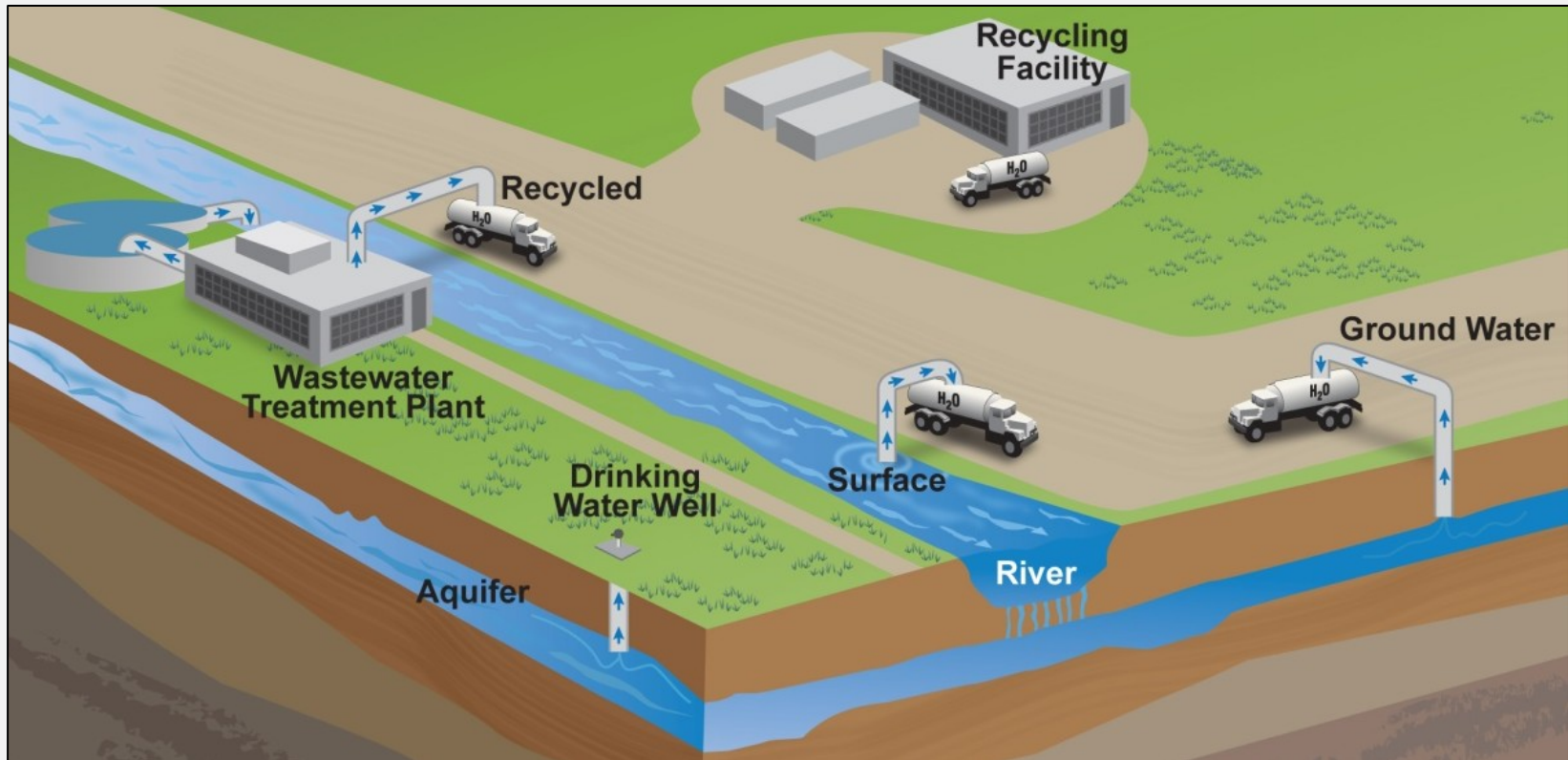
Hydraulic Fracturing Water Cycle

What are the potential impacts on drinking water resources of:



Water Acquisition

What are the potential impacts of large volume water withdrawals from ground and surface waters on drinking water resources?



Research Projects Underway

ANALYSIS OF EXISTING DATA

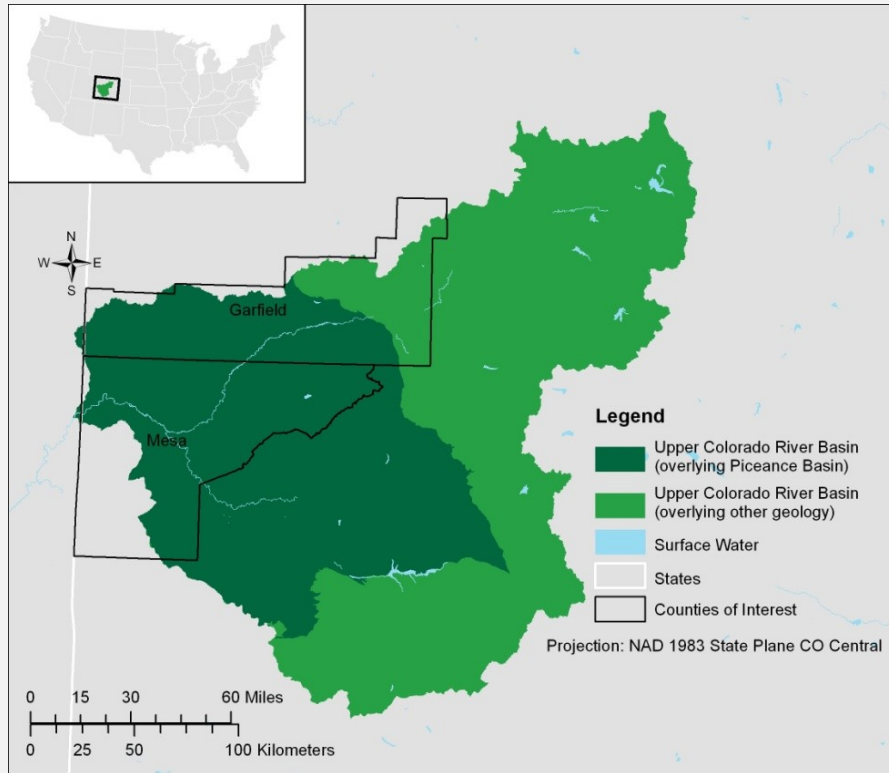
Literature Review | Service Company Analysis
Well File Review | FracFocus Analysis

SCENARIO EVALUATIONS

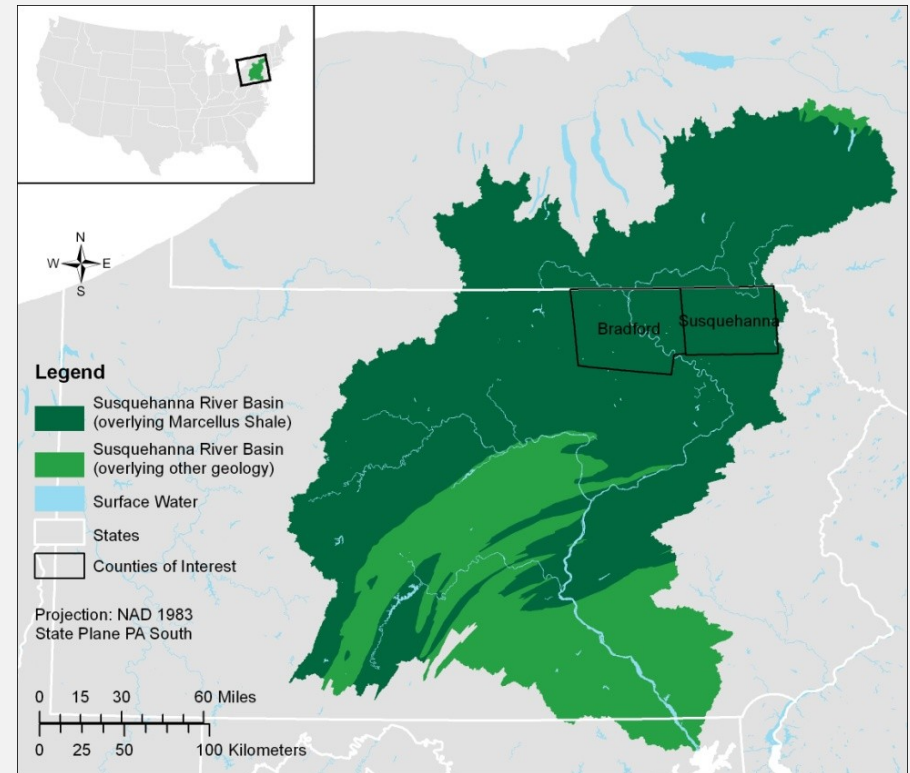
Water Availability Modeling

Water Availability Modeling

Semi-Arid: Upper Colorado River Basin



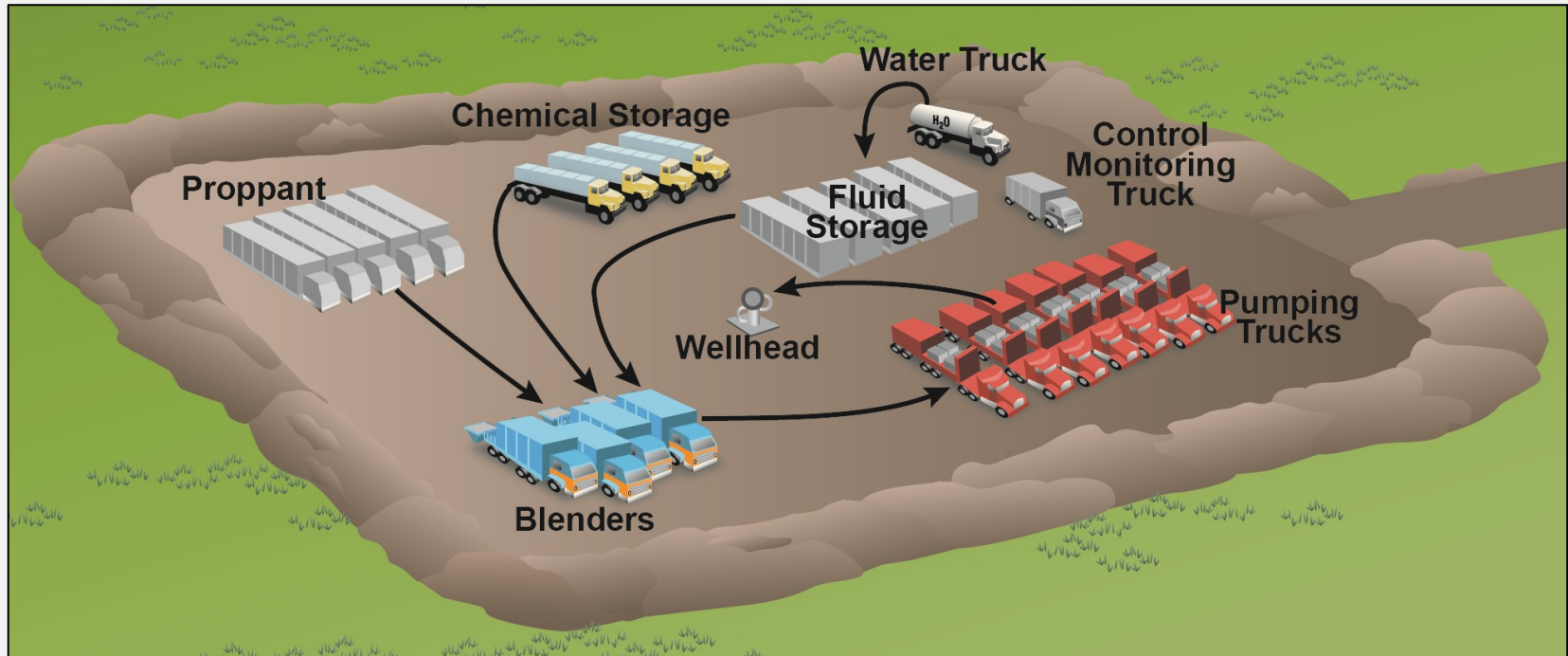
Humid: Susquehanna River Basin



- Modeling the potential impact of hydraulic fracturing on drinking water availability in semi-arid and humid river basins under different water usage scenarios
- Future water use scenarios include: business-as-usual, full development and “recycling plus”

Chemical Mixing

What are the possible impacts of surface spills on or near well pads of hydraulic fracturing fluids on drinking water resources?



Research Projects Underway

ANALYSIS OF EXISTING DATA

Literature Review | Spills Database Analysis
Service Company Analysis
Well File Review | FracFocus Analysis

LABORATORY STUDIES

Analytical Method Development

TOXICITY ASSESSMENT

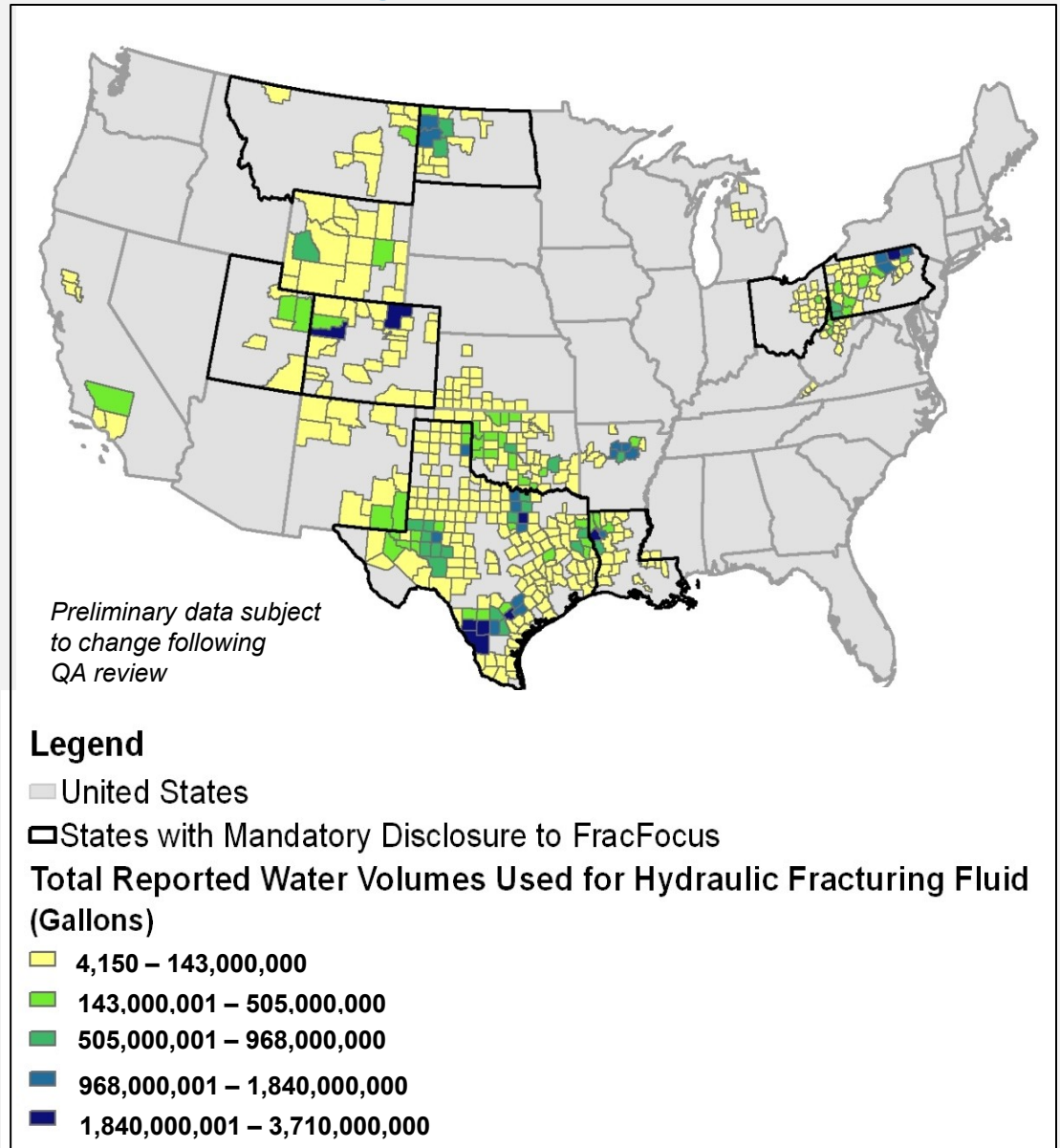
RETROSPECTIVE CASE STUDIES

FracFocus Analysis

- Data submitted to FracFocus with fracture dates between January 1, 2011, and February 28, 2013 will be summarized
- Main topics expected to be described in report
 - Water use
 - Proppants
 - Chemical use
- Summary statistics are expected to be calculated for nationwide data and selected counties

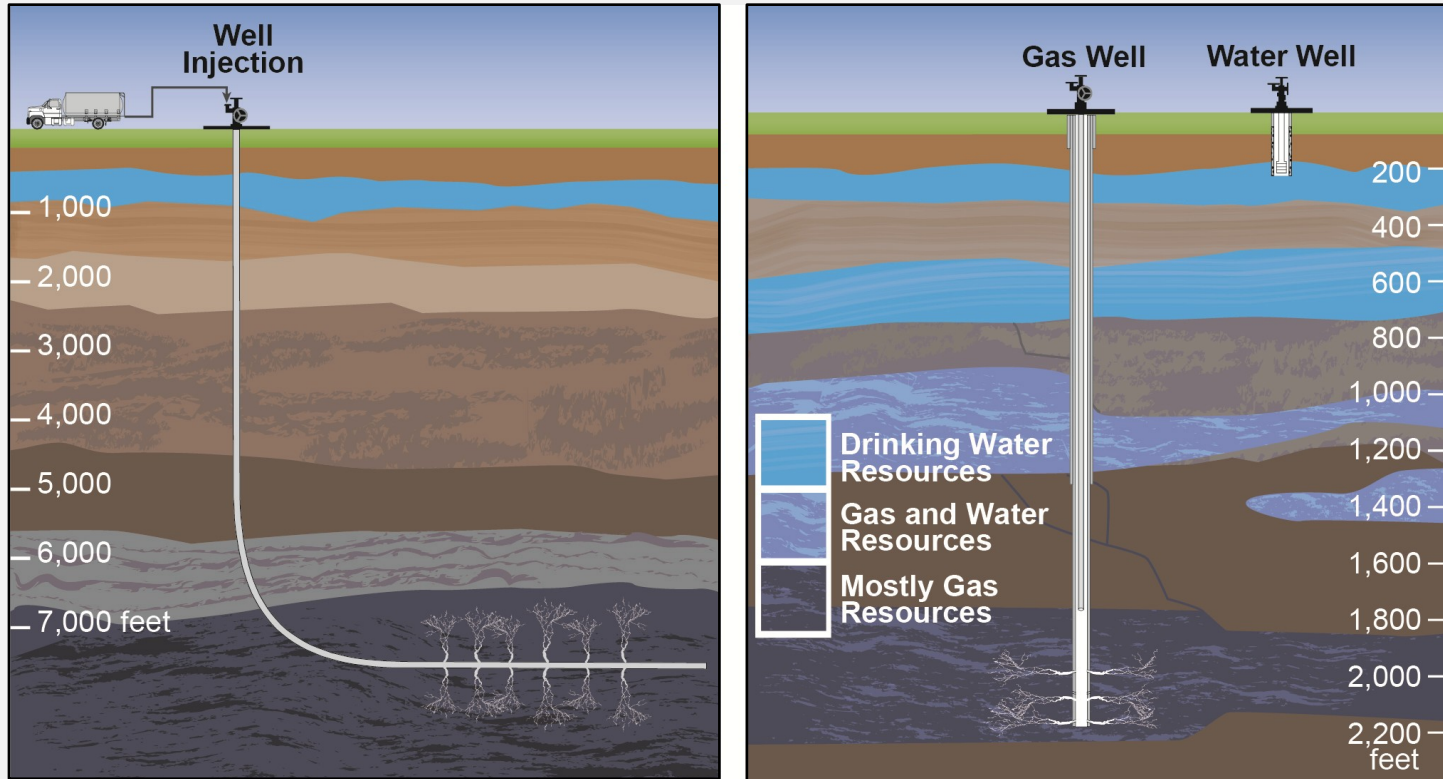
FracFocus Analysis

- Counties will be selected that show diversity in water use and chemical use as a function of geography, geology, and production type
 - Tabular data and GIS data used to select “example” counties



Well Injection

What are the possible impacts of the injection and fracturing process on drinking water resources?



Research Projects Underway

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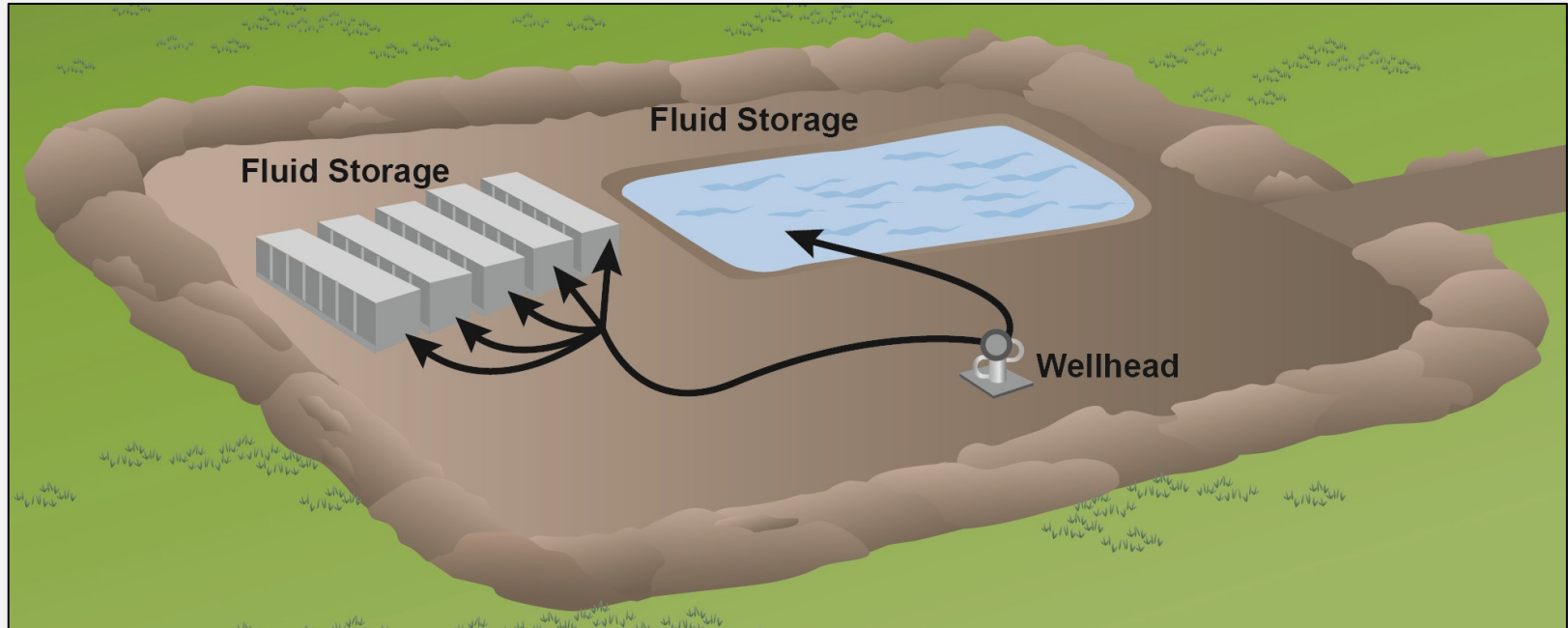
SCENARIO EVALUATIONS

Subsurface Migration Modeling

RETROSPECTIVE CASE STUDIES

Flowback and Produced Water

What are the possible impacts of surface spills on or near well pads of flowback and produced water on drinking water resources?



Research Projects Underway

ANALYSIS OF EXISTING DATA

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LABORATORY STUDIES

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RETROSPECTIVE CASE STUDIES

Spills Database Analysis

Federal

National Response Center

Source

National Response Center (NRC) Freedom of Information Act (FOIA) Data

States*

Pennsylvania

Source

Pennsylvania Department of Environmental Protection Compliance Reporting Database

Colorado

Colorado Oil and Gas Conservation Commission COGIS - Spill/Release Database

New Mexico

New Mexico Energy, Minerals and Natural Resources Department Spills and Pit Data

Wyoming

Wyoming Oil and Gas Conservation Commission Spill Database

Texas

Texas Railroad Commission H8 Spill Records

Louisiana

Louisiana Department of Environmental Quality

Arkansas

Arkansas Department of Environmental Quality Complaints and Inspections Database

Oklahoma

Oklahoma Corporation Commission

Utah

Utah DERR Division of Drinking Water

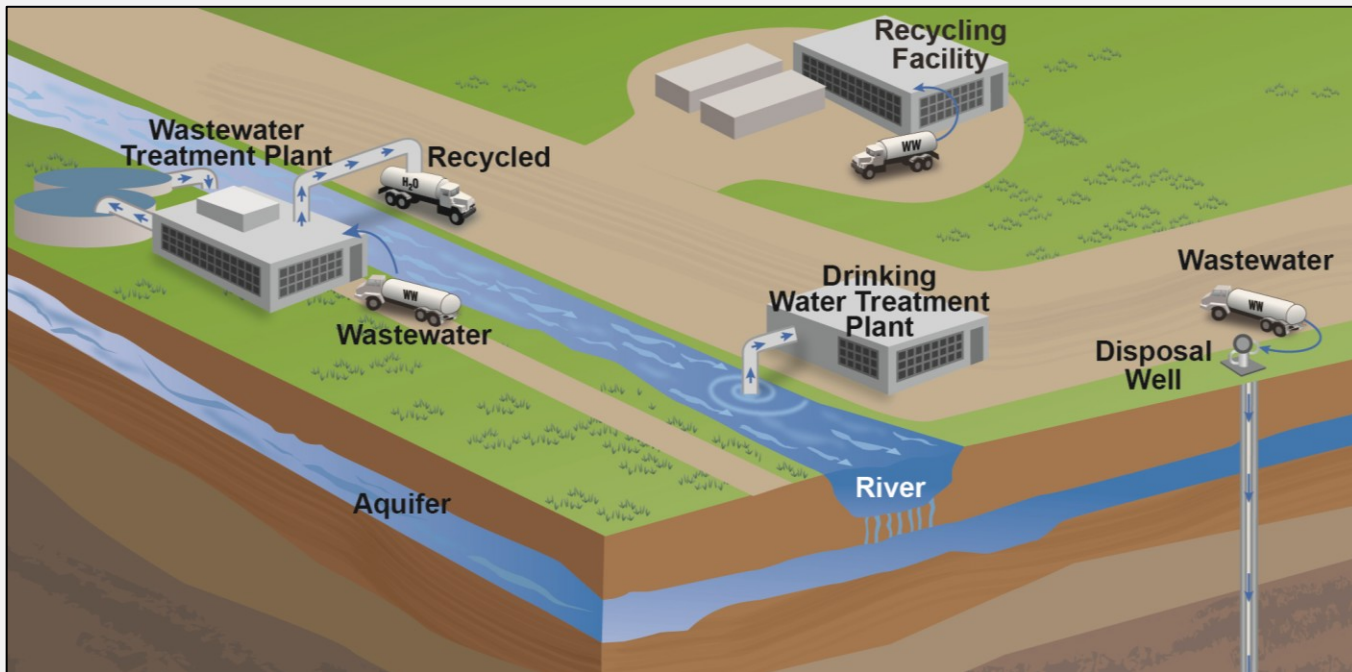
North Dakota

No publically available spills database

Additional Data obtained from 9 HF service companies and 9 oil and gas operators by EPA

Wastewater Treatment and Waste Disposal

What are the possible impacts of inadequate treatment of hydraulic fracturing wastewater on drinking water resources?



Research Projects Underway

ANALYSIS OF EXISTING DATA

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FracFocus Analysis

SCENARIO EVALUATIONS

Surface Water Modeling

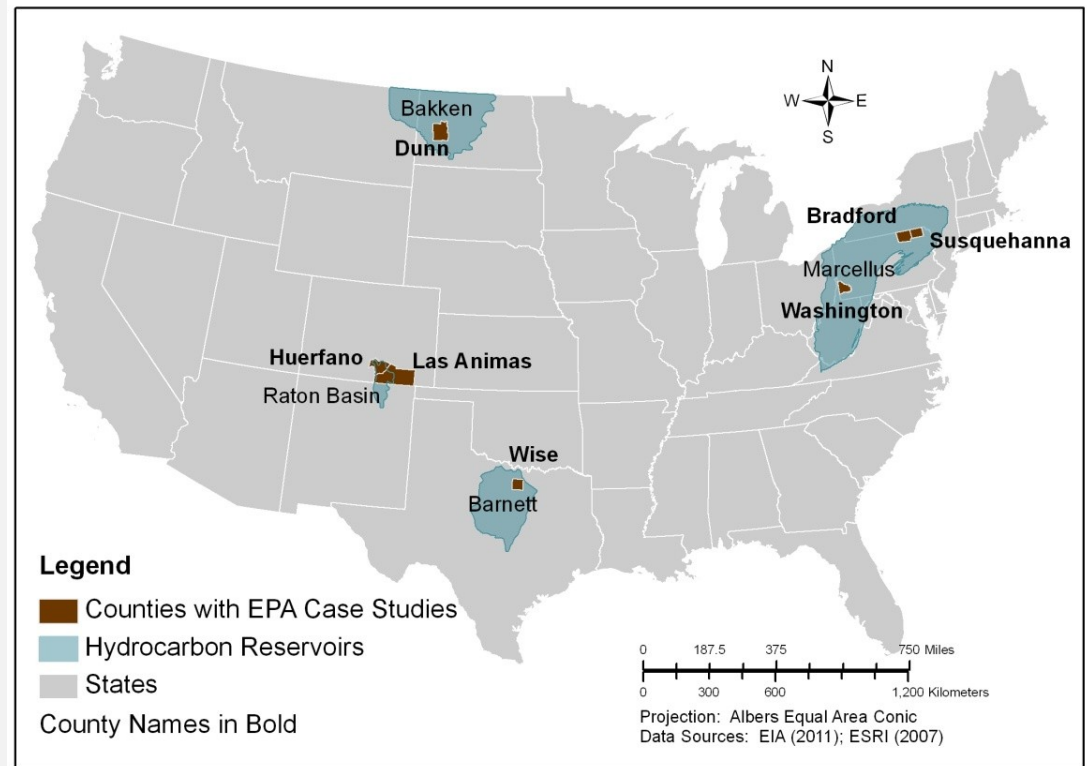
LABORATORY STUDIES

Source Apportionment Studies
Wastewater Treatability Studies
Br-DBP Precursor Studies

Retrospective Case Studies

Case study locations

- Bradford County, PA
- Las Animas/Huerfano Counties, CO
- Dunn County, ND
- Washington County, PA
- Wise County, TX



Case Studies

Retrospective Case Studies

Investigation of potential drinking water impacts from...

Las Animas and Huerfano Counties, Colorado

Coalbed methane extraction in the Raton Basin

Dunn County, North Dakota

A well blowout during hydraulic fracturing for oil in the Bakken Shale

Bradford County, Pennsylvania

Shale gas development in the Marcellus Shale

Washington County, Pennsylvania

Shale gas development in the Marcellus Shale

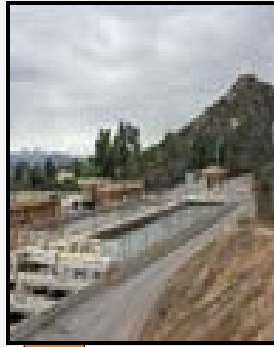
Wise County, Texas

Shale gas development in the Barnett Shale

Source Apportionment

Discharge Point

Discharge includes hydraulic fracturing wastewater, coal-fired power plant effluents, mining effluent, and road salt



ISCO Sampler

Sample Upstream

Sample Discharge

Sample Downstream

Sample Drinking Water Intake



Surface Water Modeling

OBJECTIVE:

Use established surface water transport models and theory to identify generic conditions that may lead to elevated concentrations of bromide and radium chemical at public water supply intakes.

APPROACH:

- Collect model inputs to assure generic simulations reflect actual conditions
 - Wastewater treatment facility effluent data from the NPDES monitoring reported to states.
 - USGS stream water quality and flow rate data.
- Confirm accuracy of models using existing tracer data and models.
- Use Monte Carlo methods for uncertainty analysis:
 - Steady-state release scenarios
 - Transient releases using a hybrid numerical/empirical model
- Run models with different discharge scenarios and stream flow scenarios based on data collected.

Progress Report

- Includes project-specific updates
 - Research approach
 - Status as of Sept. 2012
 - Next steps
- Does not include research results
- Available at www.epa.gov/hfstudy



Study Timeline

US Congress urges the EPA to conduct a study

Peer review of draft study plan*
(February – August 2011)

Release progress report*
(December 2012)

Release final study plan
(November 2011)

Peer review of
draft report

Individual reports
and papers

Final report

Planning

Conduct Research

Report of
Results

Technical workshops
(February – March 2011)

Meetings with stakeholders to identify
concerns and study scope
(July – August 2010)

Technical workshops*
(Spring/Summer 2013)

Technical roundtables* / information request
(November 2012)

Technical roundtable*
(December 2013)

Continued stakeholder
engagement

***Webinars conducted to
provide updates**

Next Steps

EPA will continue to conduct research, analyze information and literature, and engage stakeholders

- Exchange information with industry, academia, states, NGOs, tribes, and public
- Completed research will undergo peer review
- Release draft report in late 2014
 - The SAB Panel will peer review the draft report
 - The public will have an opportunity to provide written and oral comments

Questions?

**For more information:
www.epa.gov/hfstudy**