EPA
United States
Environmental Protection
Agency

Study of the Potential Impacts of Hydraulic Fracturing for Oil & Gas on Drinking Water Resources

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Regional Tribal Operations Committee
Summer Meeting – Tribal Caucus

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EPA United States Environmental Protection Agency

Presentation Outline

- Study Background
- Technical Goals: Hydraulic Fracturing Water Cycle
- Progress Report and Publications
- Stakeholder Engagement
- Draft Assessment Report

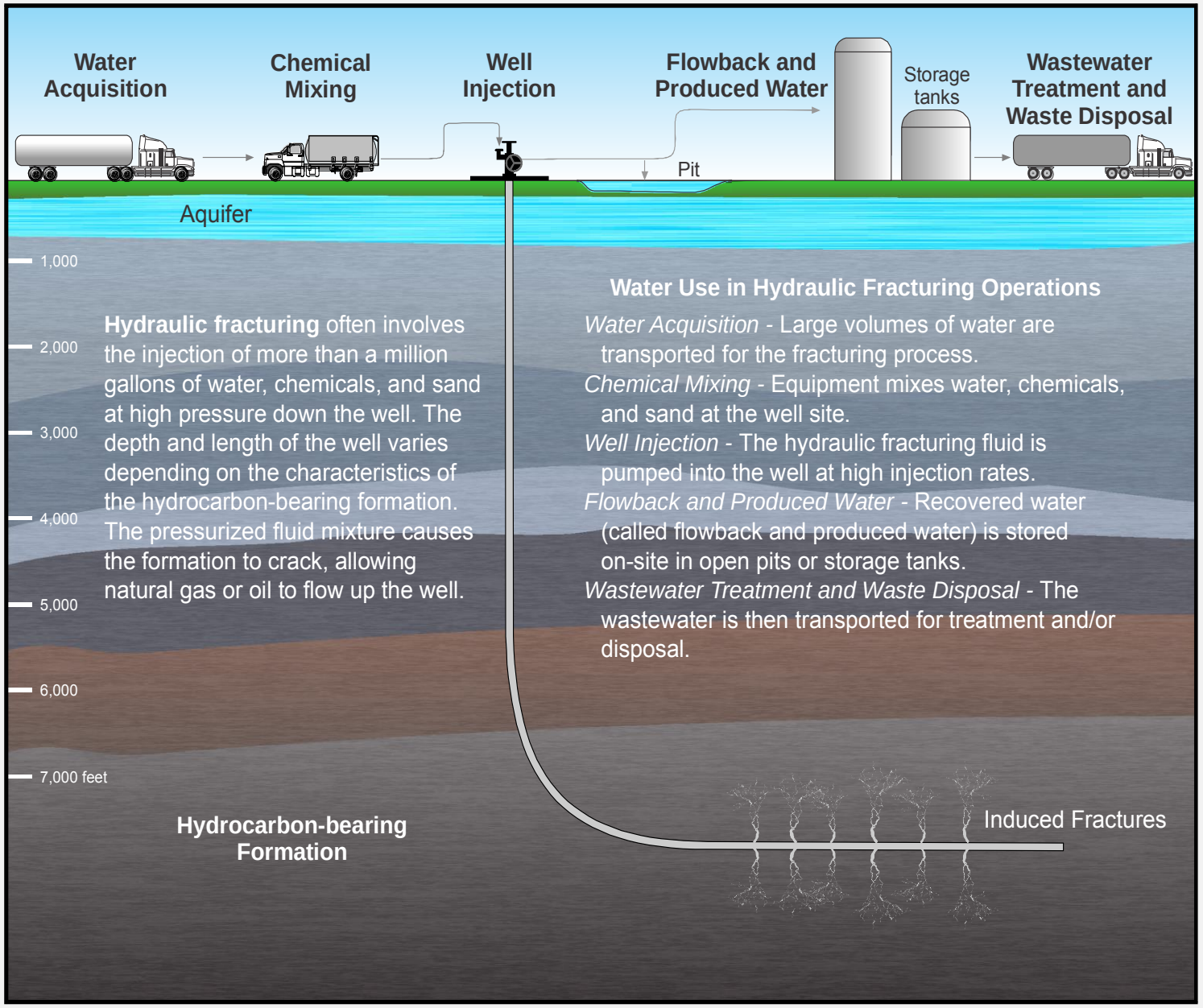
Study Background

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

Study Background



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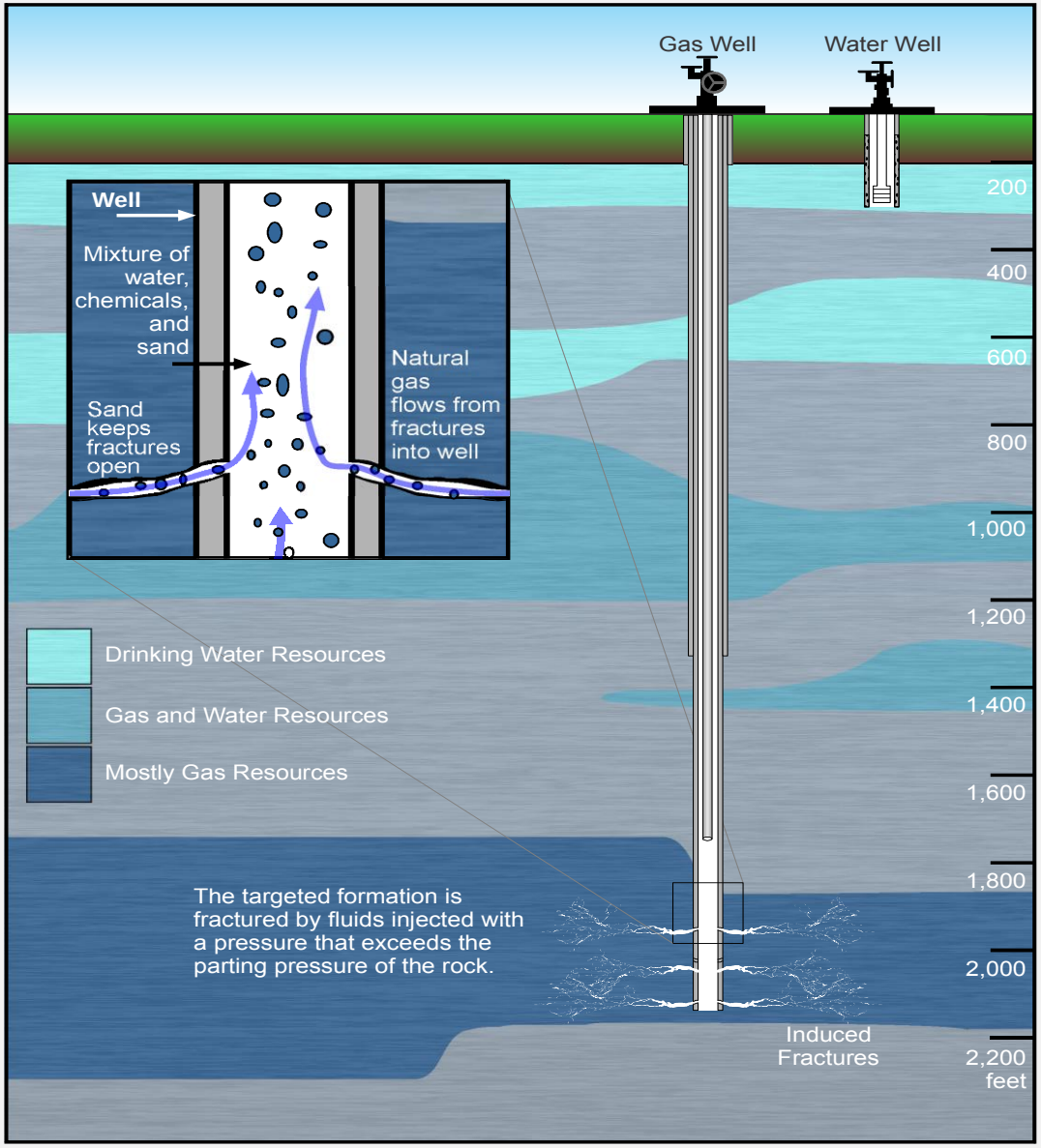
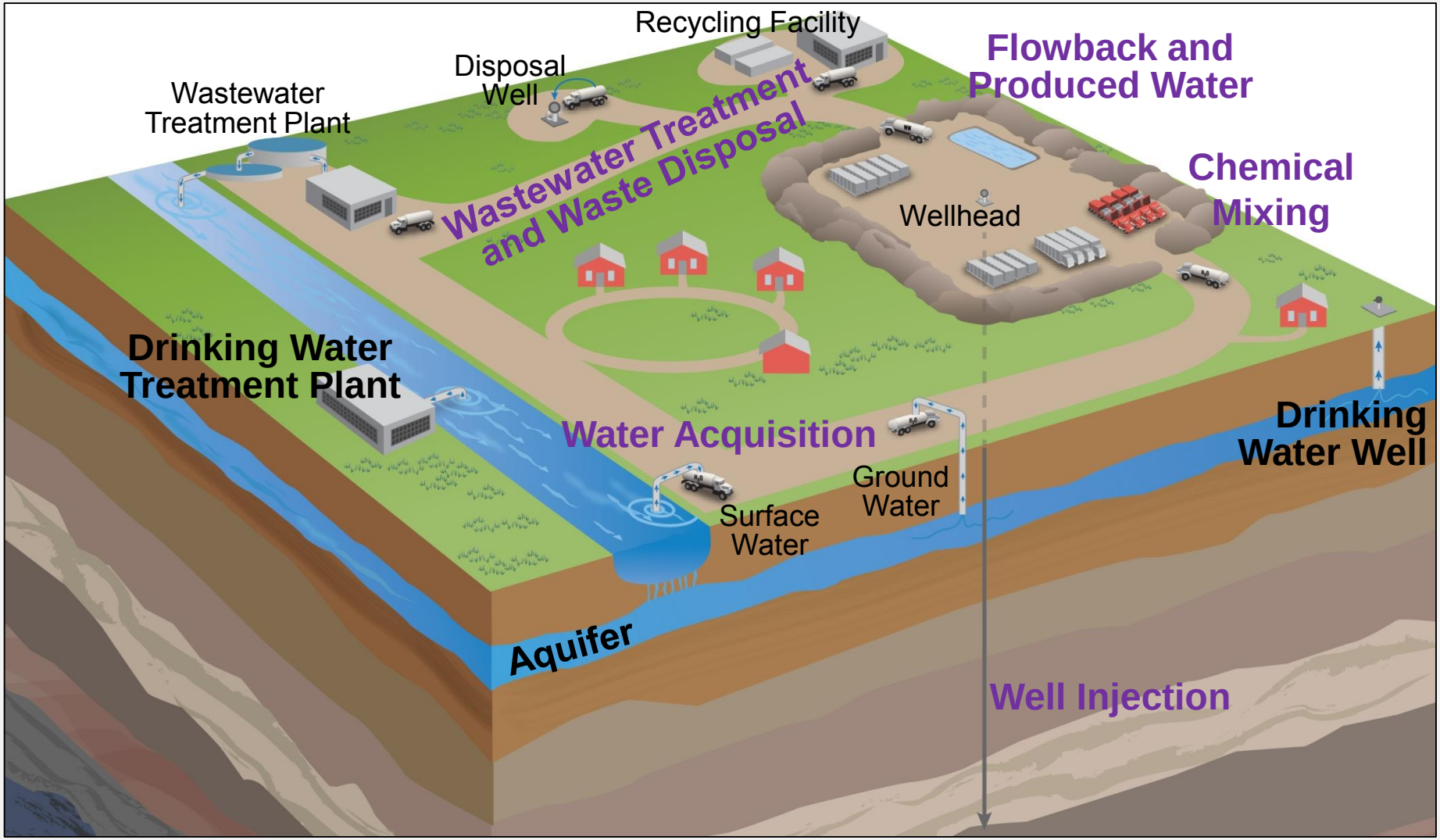
Study Background



Hydraulic Fracturing Water Cycle



WATER CYCLE STAGES

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

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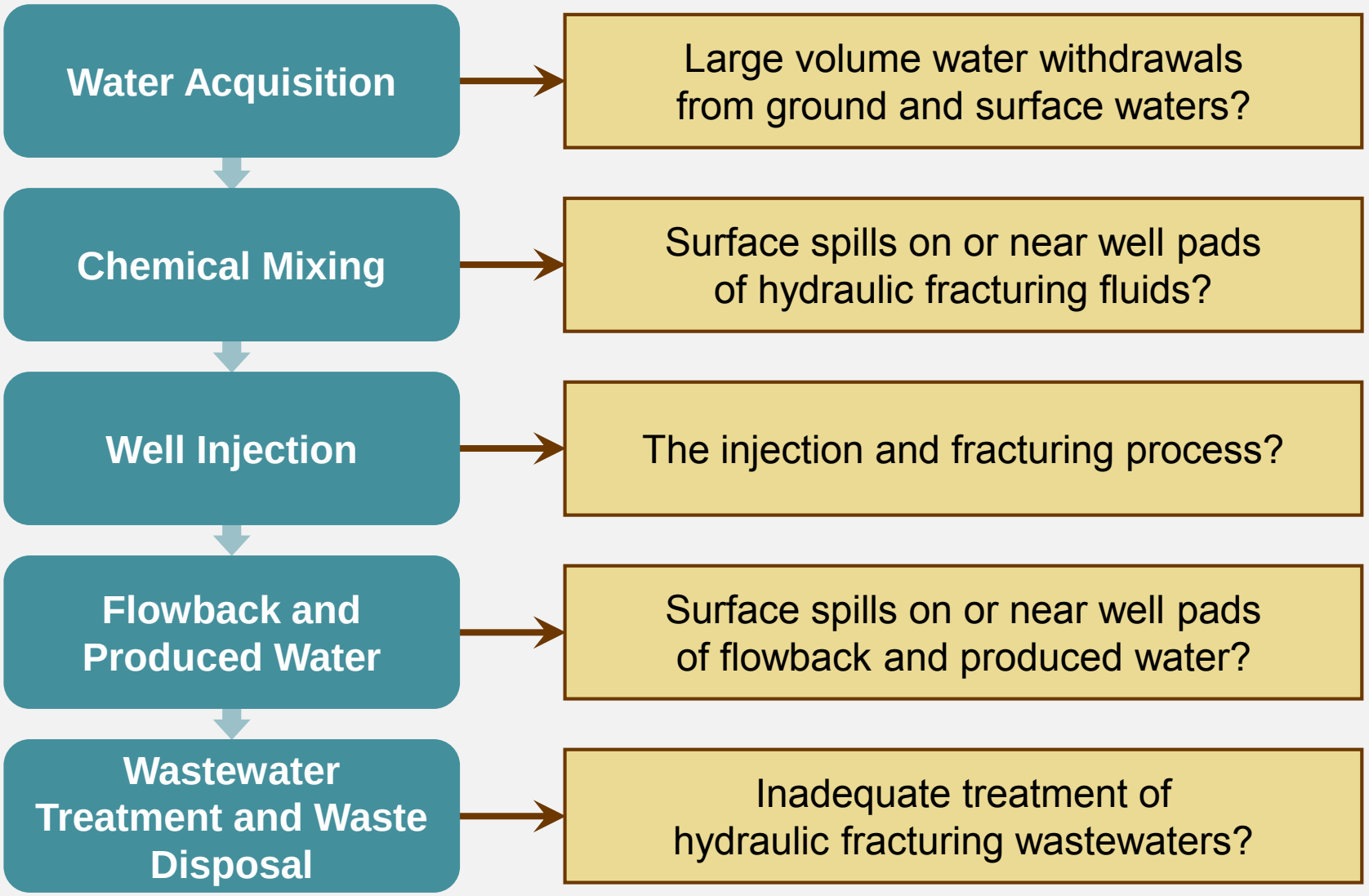
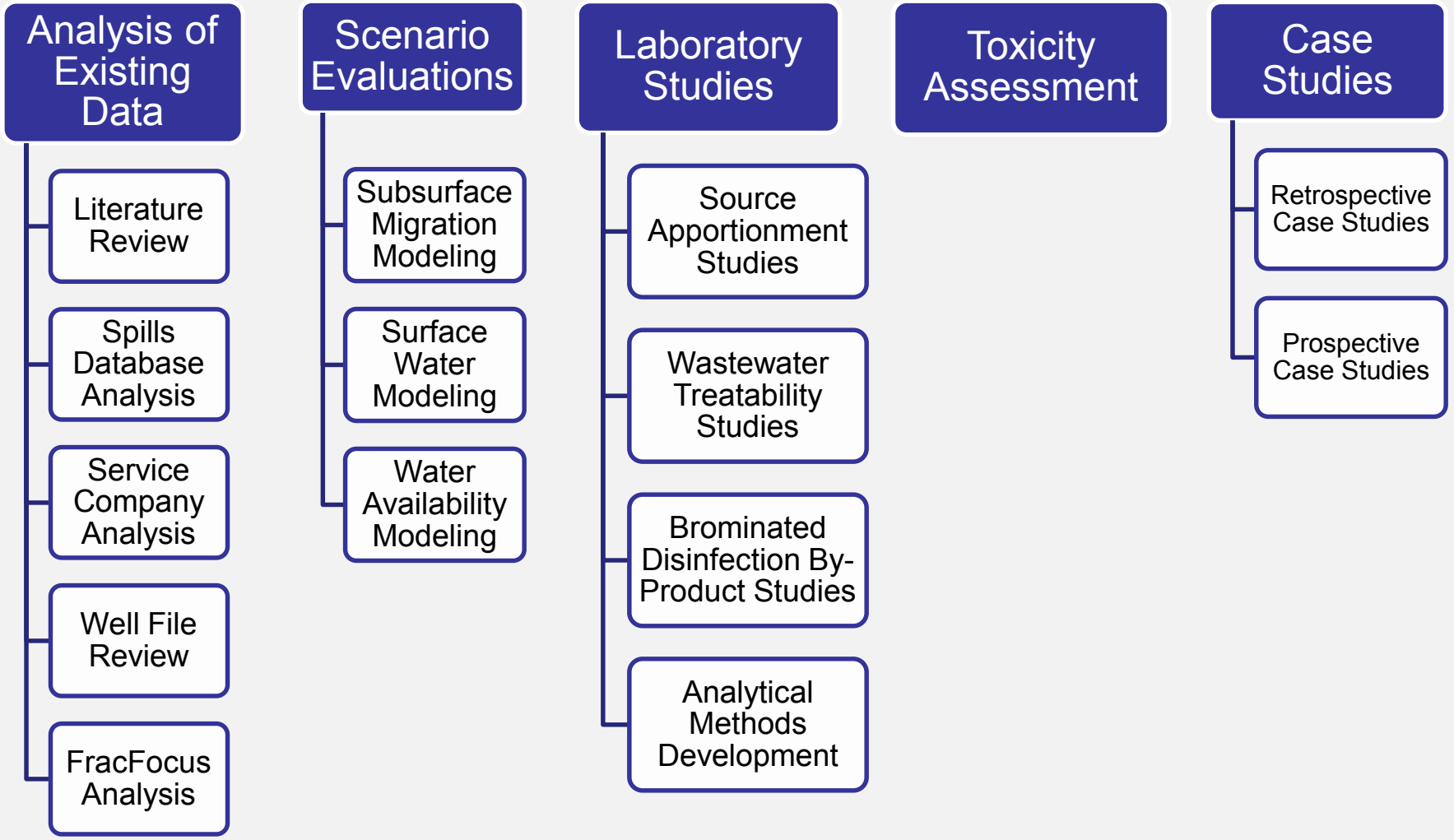
Hydraulic Fracturing Water Cycle

What are the potential impacts on drinking water resources of:

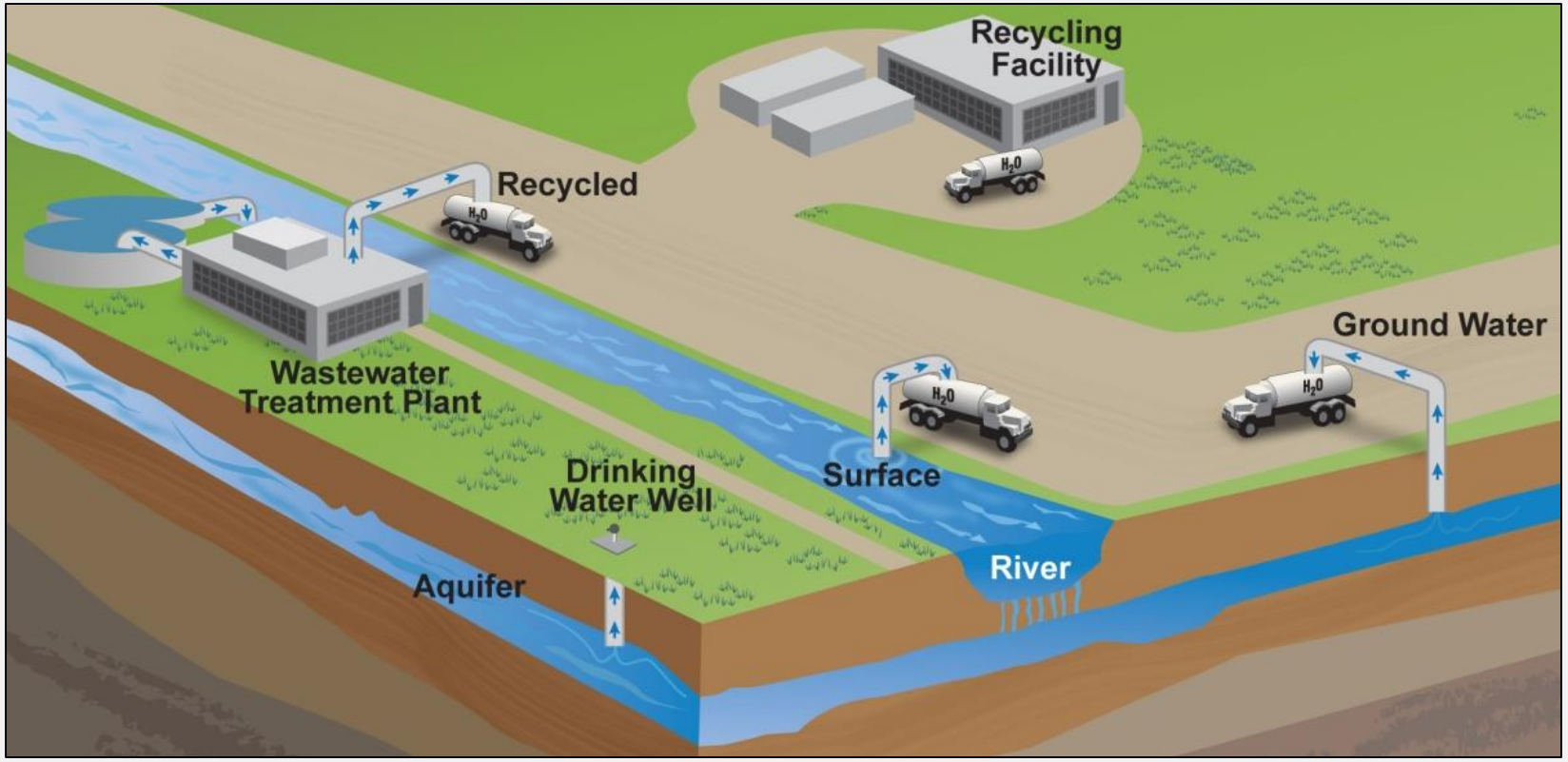


Types of Research Projects



Water Acquisition

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



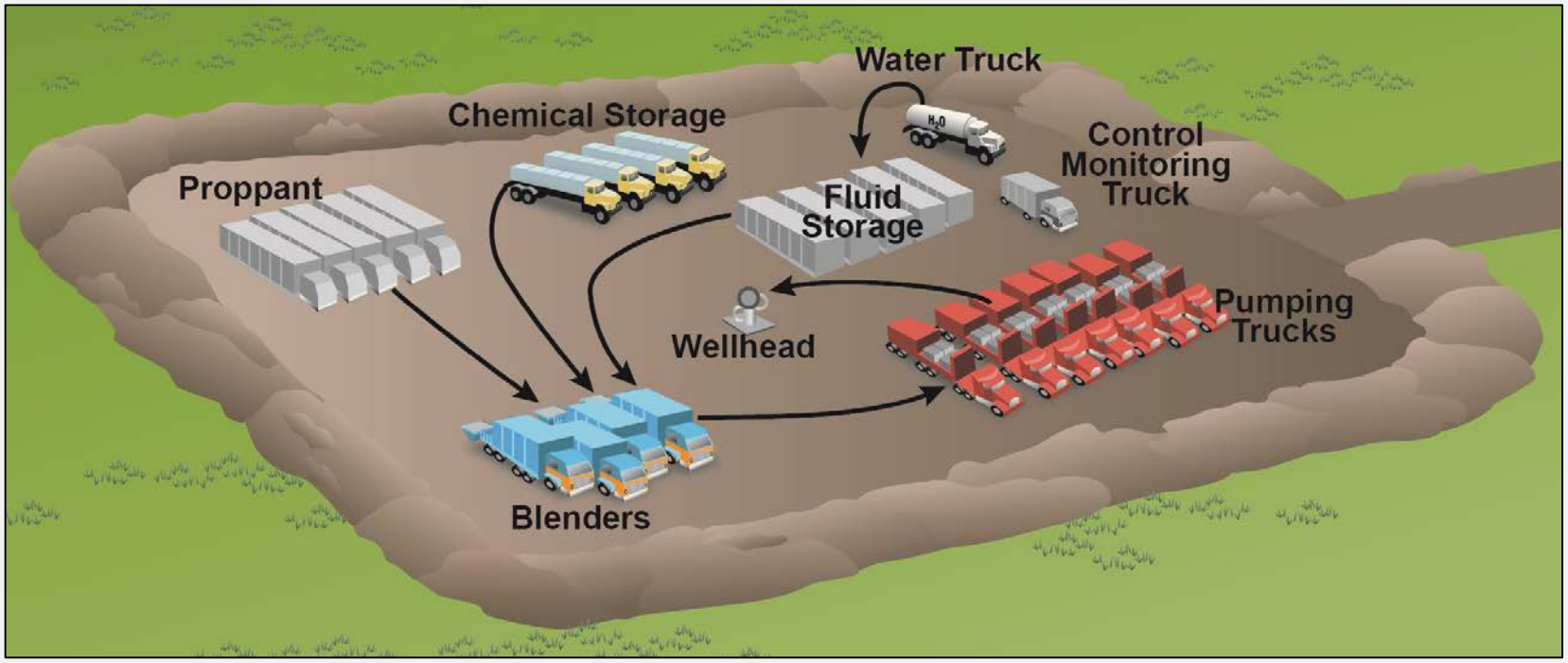
Research Projects Underway

ANALYSIS OF EXISTING DATA
Literature Review | Service Company Analysis
Well File Review | FracFocus Analysis

SCENARIO EVALUATIONS
Water Availability Modeling

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

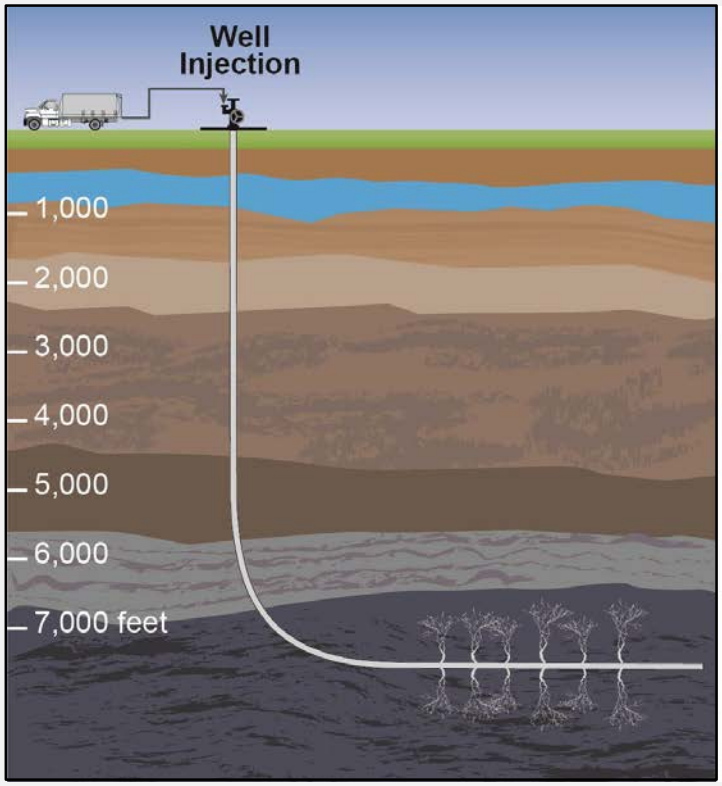
Analytical Method Development

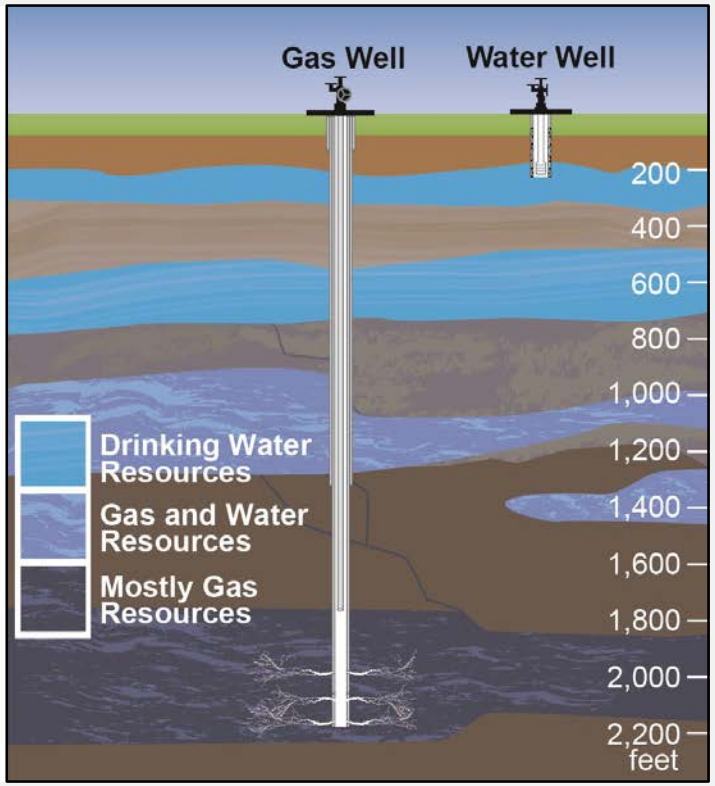
TOXICITY ASSESSMENT

RETROSPECTIVE CASE STUDIES

Well Injection

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





Research Projects Underway

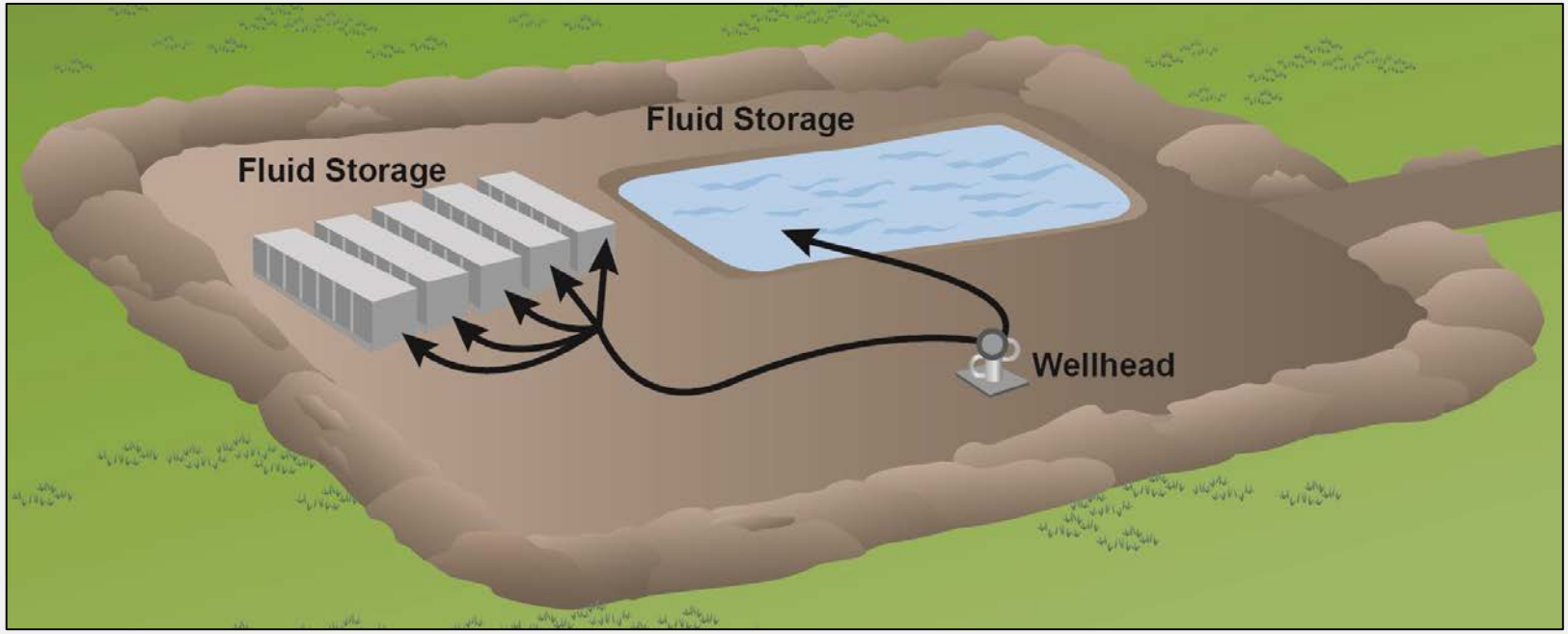
ANALYSIS OF EXISTING DATA
Literature Review
Service Company Analysis
Well File Review

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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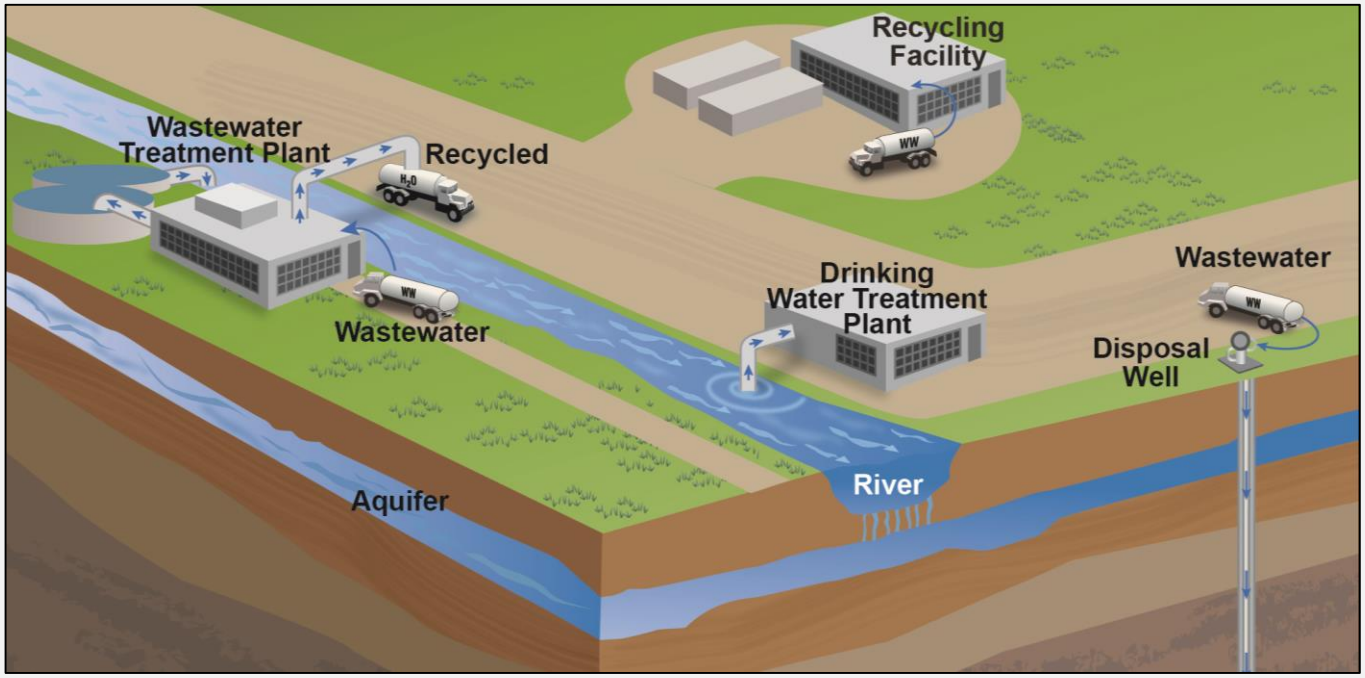
LABORATORY STUDIES
Analytical Method Development

TOXICITY ASSESSMENT

RETROSPECTIVE CASE STUDIES

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
Literature Review | Well File Review
FracFocus Analysis

SCENARIO EVALUATIONS
Surface Water Modeling

LABORATORY STUDIES
Source Apportionment Studies
Wastewater Treatability Studies
Br-DBP Precursor Studies

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

Research Projects and Products

- 17 research projects are expected to produce >30 peer-reviewed journal papers or EPA reports
  - Most will undergo an internal (EPA) and external (journal or letter peer review)
  - To date, 6 papers have been released:
    - Subsurface migration modeling (3)
    - Analytical method development (3)

- These products will be considered together with scientific literature in the draft assessment report
  - Draft assessment report is a Highly Influential Scientific Assessment

Papers

Analytical Method Development

"Characterization of liquid chromatography-tandem mass spectrometry method for the determination of acrylamide in complex environmental samples"
Patrick DeArmond and Amanda DiGoregorio. *Analytical and Bioanalytical Chemistry*. May 2013.

"Rapid liquid chromatography–tandem mass spectrometry-based method for the analysis of alcohol ethoxylates and alkylphenol ethoxylates in environmental samples"
Patrick DeArmond and Amanda DiGoregorio. *Journal of Chromatography* A. August 2013.

The Verification of a Method for Detecting and Quantifying Diethylene Glycol, Triethylene Glycol, Tetraethylene Glycol, 2-Butoxyethanol and 2-Methoxyethanol in Ground and Surface Waters Brian A. Schumacher and Lawrence Zintek. *EPA Report*. July 2014

Subsurface Migration Modeling

"Modeling of fault reactivation and induced seismicity during hydraulic fracturing of shale gas reservoirs"
Rutqvist et al. *Journal of Petroleum Science and Engineering*. July 2013.

"Development of the T+M coupled flow-geomechanical simulator to describe fracture propagation and coupled flow-thermal-geomechanical processes in tight/shale gas systems"
Jihoon Kim and George Moridis. *Computers and Geosciences*. October 2013.

"The RealGas and RealGasH2O options of the TOUGH+ code for the simulation of coupled fluid and heat flow in tight/shale gas systems"
George Moridis and Craig M. Freeman. *Computers and Geosciences*. October 2013.

Draft Assessment Report

The Draft Assessment Report will:

- Answer primary research questions through synthesis of:
  - Available results from study's research projects
  - Peer reviewed reports and scientific literature related to the study
  - Government reports and technical papers
  - Knowledge gained through technical stakeholder
  - Information submitted by stakeholders
    - EPA docket
    - Comments submitted to the Science Advisory Board

Draft Assessment Report

Impacts evaluated:

- Impacts related to normal operations reflecting modern typical practices
- Potential and actual accidents or unintended events
- Potential immediate, short-term, and long-term impacts

Spatial Scope:

- National: Evaluating available information for multiple regions
- Evaluating potential impacts at multiple scales:
  - Single well
  - Cluster of wells
  - Watershed
  - Shale plays

Intended Use:

- Contribute to understanding of potential impacts of hydraulic fracturing for oil and gas on drinking water resources
- Identify pathways of greatest concern
- Inform and promote dialogue among federal, tribal, state, and local government entities, industry, NGOs and other stakeholders
- Identify knowledge gaps and information needs

The Assessment

What it is

- A state-of-the-science **integration and synthesis** of information
- Based upon EPA research results, a robust literature review, and other information
- Information addresses questions identified in the *Study Plan* and *Progress Report*
- Provides policy-relevant information

What it is not

- Not a human health or exposure assessment
- Not site specific
- Does not identify or evaluate best management practices
- Not designed to inform specific policy decisions
- Does not identify or evaluate policy options

Stakeholder Engagement

EPA has received input through a variety of mechanisms at different stages of the study:

- Public meetings
- One-on-one meetings
- Technical meetings (workshops and roundtables)
- Public dockets
- Responses to information requests

Increased interactions with states through current and future outreach activities

Technical Meetings

EPA conducted a series of five technical roundtables and a series of in-depth technical workshops to address specific topics related to the study's research questions

Technical Roundtables

- **Consult with technical representatives from key stakeholder groups:**
  - State/local governments, tribes, oil and gas industry, water industry, non-governmental organizations, academia
- **November 2012**
- **December 2013**

Technical Workshops

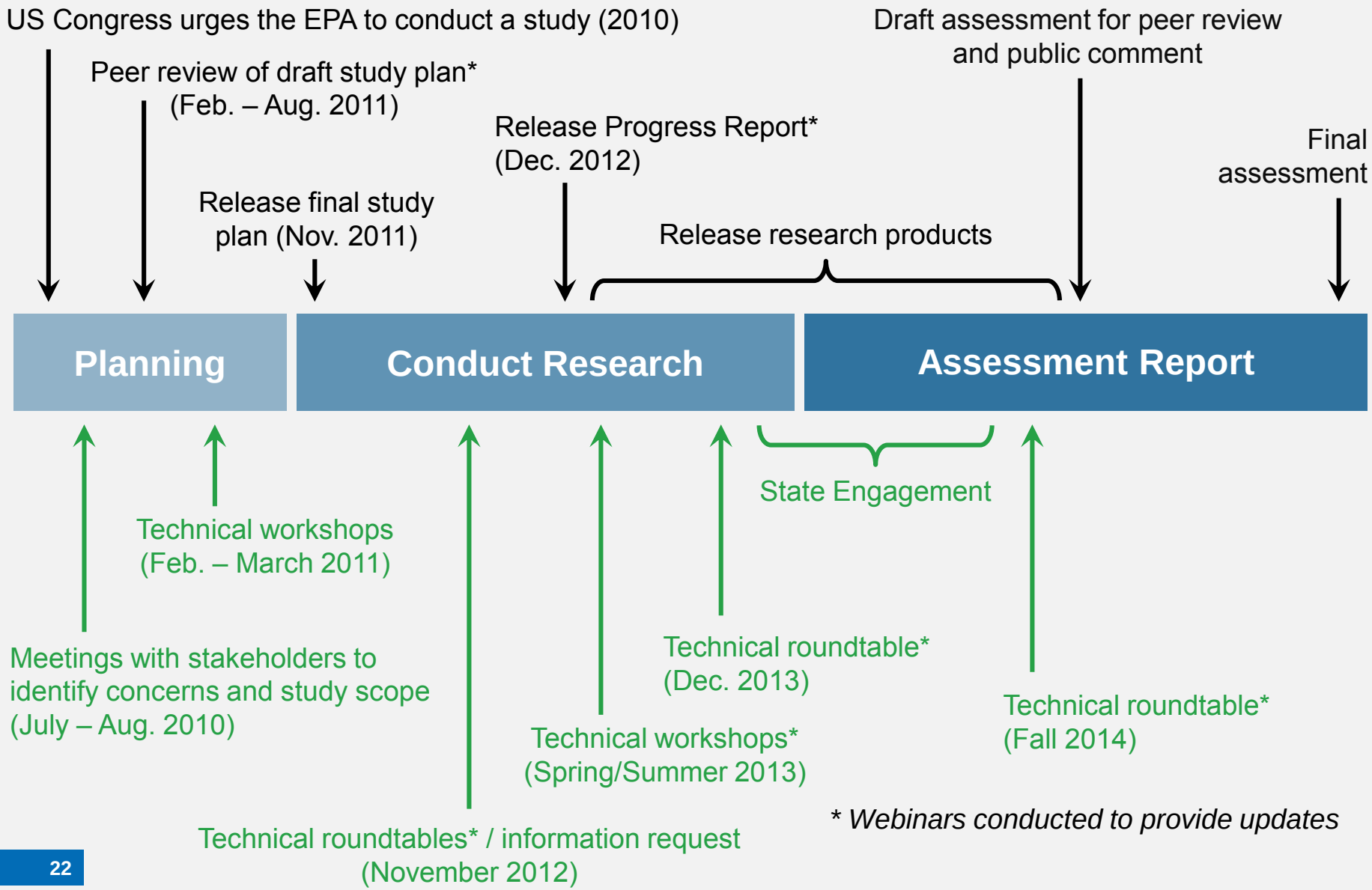
- **Engage with subject-matter experts on specific topics:**
  - Analytical chemistry methods
  - Well construction/operation and subsurface modeling
  - Wastewater treatment and related modeling
  - Water acquisition modeling
  - Case studies
- **Winter/Spring/Summer 2013**

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
- Draft assessment report will go to the Science Advisory Board for peer review
  - The public will have an opportunity to provide written and oral comments

Study Timeline



** Webinars conducted to provide updates*

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Questions?

For more information:
www.epa.gov/hfstudy

Specific links:

Webinars	http://www2.epa.gov/hfstudy/how-get-involved-epas-study-hydraulic-fracturing
Recent Workshops	http://www2.epa.gov/hfstudy/2013-technical-workshops **Zambrana.Jose@epa.gov**