Building on Uncertain Ground: Strategizing for Environmental and Engineering Impacts

Presented By:
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2026 APPALACHIAN LAND INSTITUTE

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Learning Outcomes

- Obtain a basic understanding of engineering and environmental due diligence
- Awareness of the potential impacts to development associated with both civil engineering and environmental/ecological permitting needs

Derisk the Property!

- Hidden costs
- Schedule delays
- Limitations to operations
- Liability and Legacy issues

Site Feasibility

- To reduce risk, it's important to understand a developer's **intended use** of the site
- Site constraints can hinder the ability of a project to produce the needed result
- Identify factors ahead of time to reduce risk, delays and costs

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Site Feasibility Factors

- Local, State, and Federal Regulations
- Exclusion areas
- Streams and Wetlands
- Floodplains
- Landslides and Geologic Hazards
- Threatened and endangered species
- Hazardous materials or releases – Phase I and II Environmental Site Assessments
- Environmental Justice
- Cultural Resources
- Abandoned and Orphan Wells

Federal, State & Local Regulations

Statues, Regulations, Policies, and Ordinances

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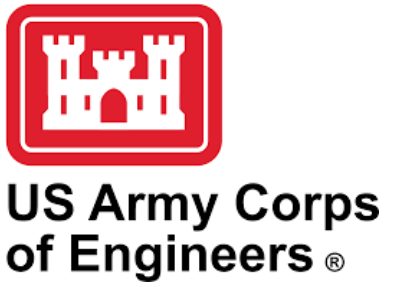
Laws and Regulations

- **Federal**
  - Statutes
  - Regulations
  - Policies, guidance, and other agency pronouncements
  - Agencies tend to have less involvement in permitting
- **State**
  - Statutes
  - Regulations
  - Policies, guidance, and other agency pronouncements
  - Agencies tend to play greater role in permitting
- **Regional and Local**
  - Municipal ordinances
  - Zoning requirements

Snapshot of Regulatory Agencies & Authorities



Environmental
Protection
Agency

+ Local Authorities

Division of Duties for Oil and Gas Activities

This is for visual reference/guide. See narrative for additional explanation and guidance. Permit requirements shown below are subject to regulatory requirements and may not be required in all situations.

BLUE –Delegated CD and DEP Regional Waterways and Wetlands Program (Permitting and Inspections/Compliance)

GREEN – DEP RPCO (Permitting Only)

RED – DEP District O&G Office (Permitting and Inspections/Compliance)

GREY – Call DEP District O&G Office

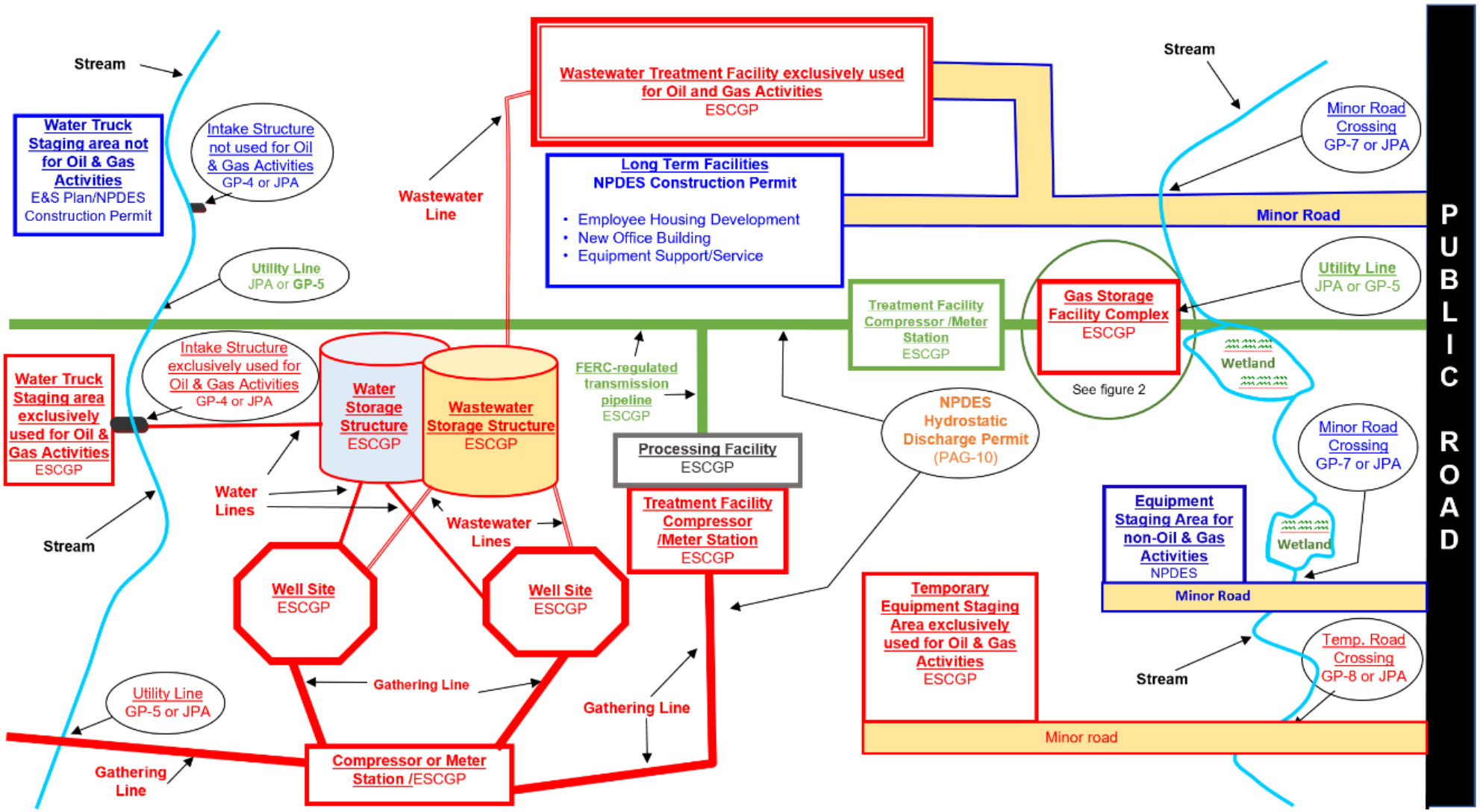
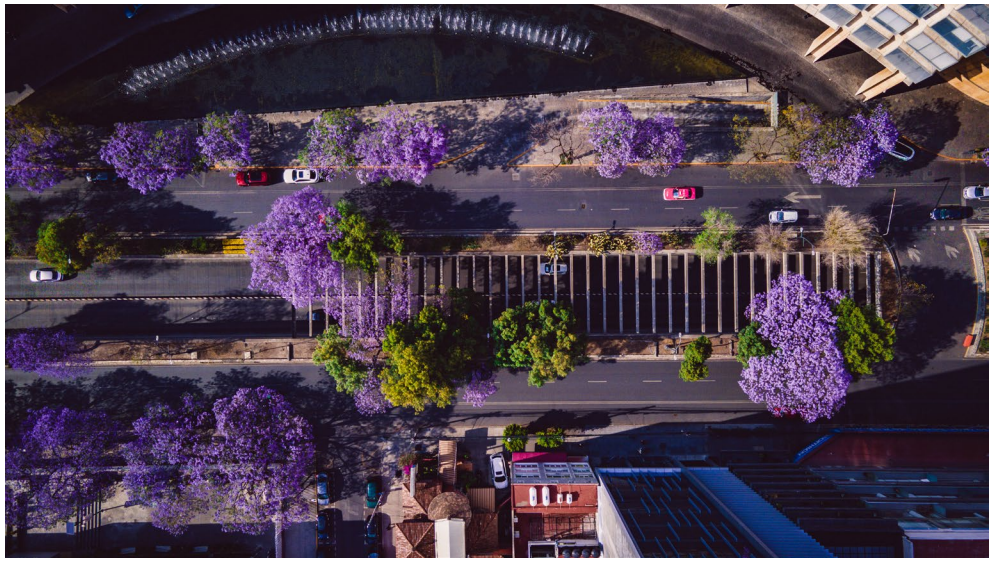


Figure 1: Illustration of division of duties related to oil and gas activities

Local Regulations

- Zoning Ordinances
  - Setbacks
  - Conditional Use
  - Variances or waivers
- Operational restrictions
- Subdivision and Land development applications
- Traffic access and impact studies



Exclusion Areas

- Crossover between land and environmental
  - Conservation easements
  - Agricultural Easements
  - Trail or Public Access Easements
  - Greenway or Open Space Easements
  - Prime Farmland Designations

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Wetlands and Waterways

Definitions, Identification, Jurisdiction, and Permitting

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Waters of the United States (WOTUS): Definition and Jurisdiction

Clean Water Act: Federal Jurisdiction applies to navigable waters, defined as water of the United States, including territorial seas

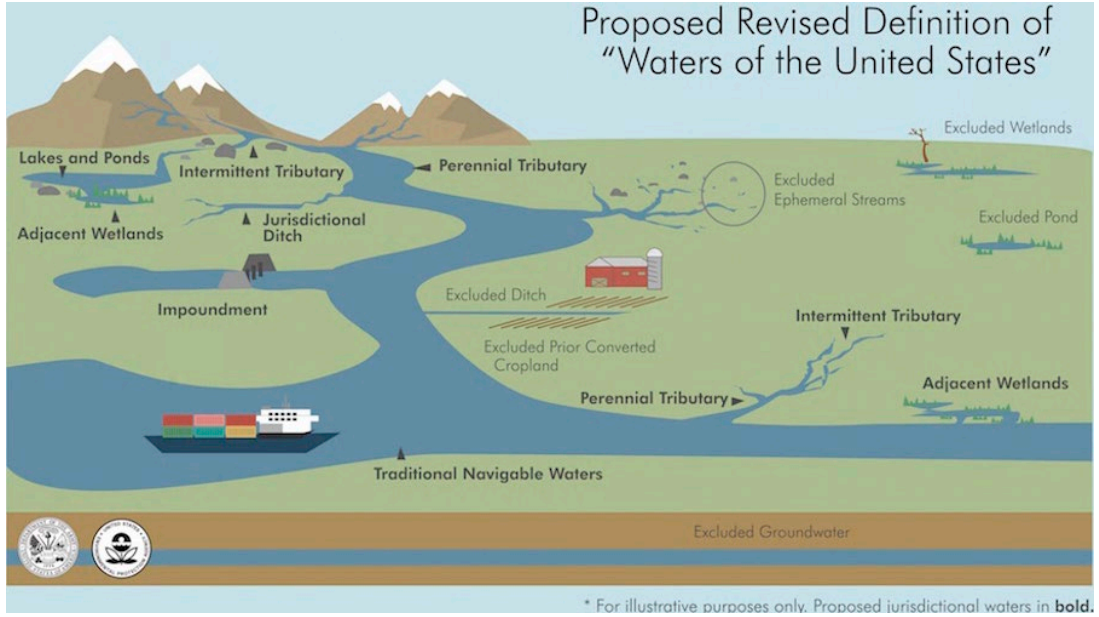
Federal Jurisdiction - USACE Regulatory Authority

- Regulates **discharge of dredged or fill material** into Waters of the U.S. (WOTUS) under **Section 404 of the Clean Water Act (CWA)**.
- Regulates **structures placed in or over navigable waters** under **Sections 9 & 10 of the Rivers and Harbors Act of 1899**.

How are navigable water defined? That's a tough one!

WOTUS: Key Regulatory & Legal Milestones

- **May 2023 Sackett v. EPA (major judicial reset)**
  - Rejected the significant nexus test; limited federal wetland jurisdiction to areas with a continuous surface connection to relatively permanent waters, driving immediate implementation changes.
- **2025–2026 implementation (guidance → proposed rule; uneven state impacts)**
  - March 2025 guidance emphasized physical adjacency and continuous surface connections; a November 2025 proposal aims to codify Sackett (comments closed January2026). Ongoing litigation yields state-by-state variation (revised 2023 rule vs. pre-2015 framework).



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Regulated Waters

- **Wetlands** – Transitional ecosystem where soil is periodically or permanently saturated with water
- **Watercourse** – any channel or conveyance of surface water having defined bed and banks, whether natural or artificial, with perennial or intermittent flow
- **Floodway** – area during the 100-year flood / portion of the floodplain that conveys most of the floodwaters
- **Body of Water** – a natural or artificial lake, pond, reservoir, swamp, marsh or wetland

Why are wetlands such a big deal?

- Wetlands:
  - Filter pollutants and improve water quality
  - Reduce flooding through water storage and slow release following rains
  - Provide habitat for endangered species

- Wetland delineation identifies wetland presence and boundaries using vegetation, soils, and hydrology.
  - Regional Supplements refine criteria for 10 wetland regions.

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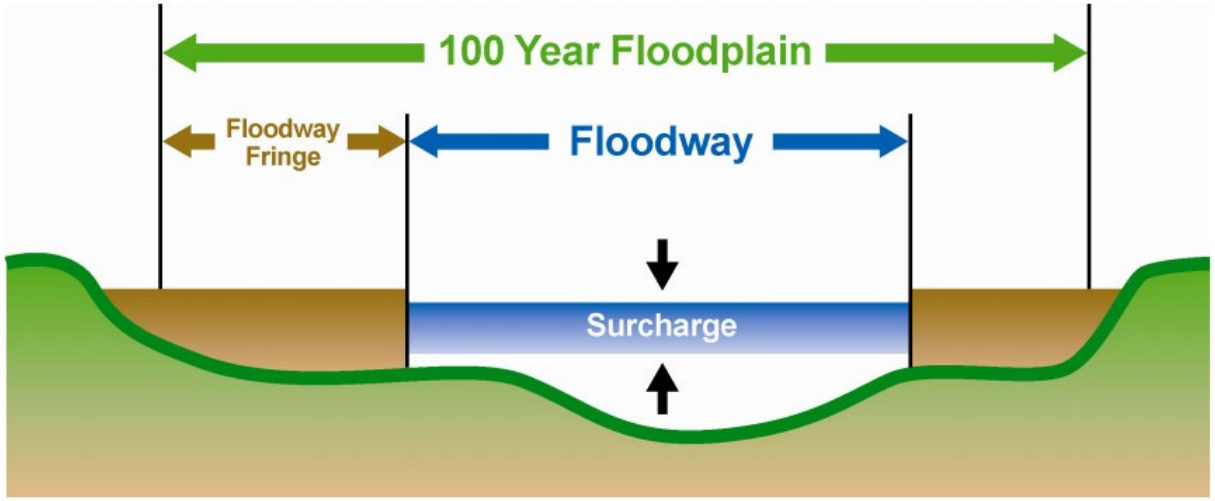
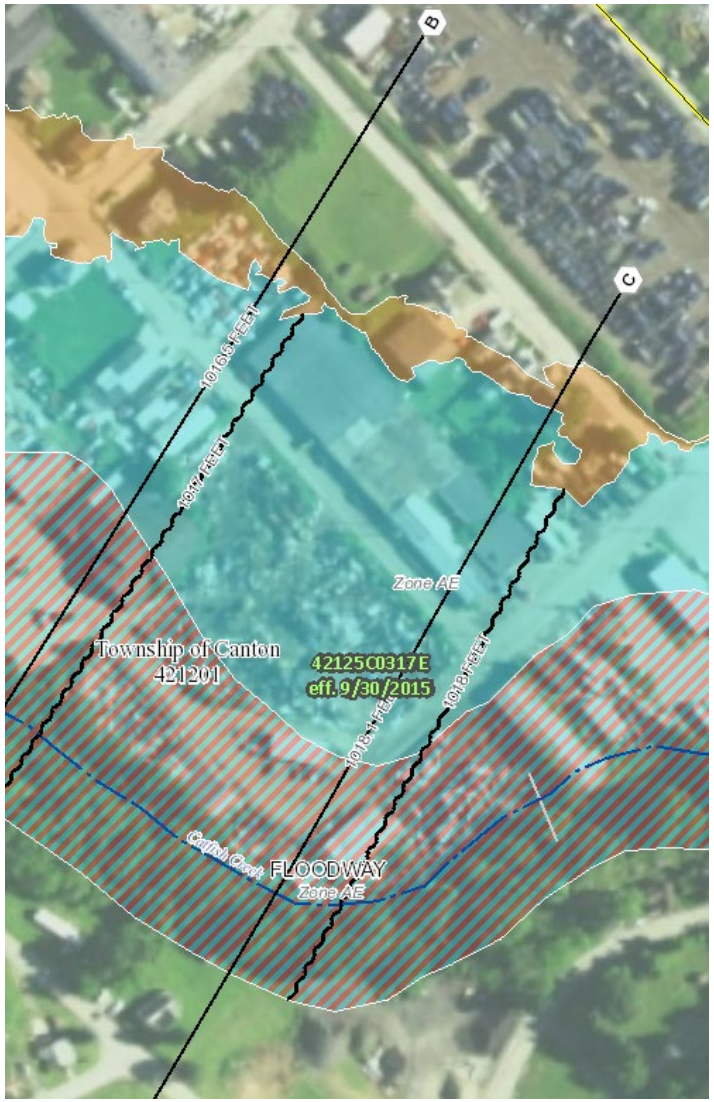
Floodways – Regulated in PA

- Regulated 100 Year Floodways
  - 50 foot assumed from top of bank to top of bank
  - FEMA Delineated Zone AE
  - Floodway Determination Study
- In areas where there is no studied FEMA Zone AE floodway, it is assumed the floodway extends 50-ft from top of bank to top of bank



FEMA Floodzones

Zone A Floodzone



Zone AE Studied Floodzone

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Permitting Impacts to Waters in the Tri-State

	Pennsylvania	West Virginia	Ohio
Primary Agency	Pennsylvania DEP, Bureau of Waterways Engineering & Wetlands	West Virginia Department of Environmental Protection (WVDEP)	Ohio EPA Division of Surface Water
Jurisdictional Notes	PADEP Claims Jurisdiction Over all Wetlands and Waterways	Follows the Federal Definition	Follows the Federal Definition, Water of the **State** controlled by the OEPA
Permitting – State and Federal	Pennsylvania State Programmatic General Permit **PASPGP-6** for minimal impacts; NWPs as Joint Permits also available	No standalone isolated wetland permit; WV regulates under water + floodplain laws; local rules may apply	USACE NWP for Federal Jurisdiction Water, **Isolated Wetland Permit** required for impacts to isolated wetlands (state program)

Landslides & Geologic Hazards

Definitions, Identification, and Impacts

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Landslide Hazards

- Deep slope failures
- Shallow debris flows
- Rockfalls
- Avalanches

Triggers

- Steep slopes
- Construction activity / Earth disturbance
- Climate
- Geology
- Groundwater movement
- Age and duration of erosion

Geologic Hazards

Geologic hazards are geologic conditions that present a risk to life, of substantial loss or damage to property, or damage to the environment

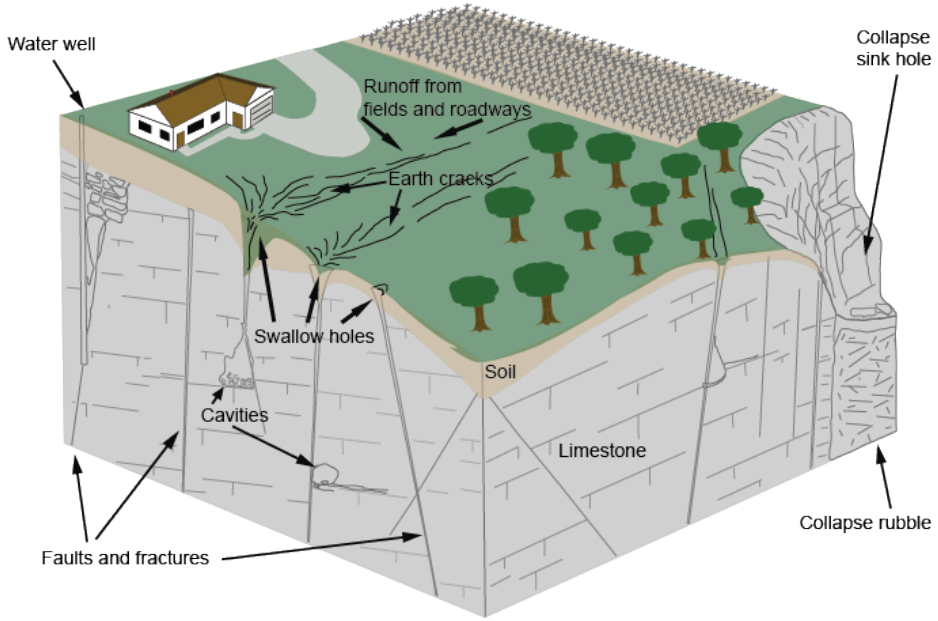
A few geologic conditions in the tri-state area include:

- Karst and Sinkholes
- Abandoned mine lands
- Subsidence
- Coal outcrops
- Radioactive or arsenic bearing formations

Karst and Sinkholes

Karst landscapes are formed when dissolving of the bedrock by water passing through fractures or cracks leaving voids below the surface and thus creating sinkholes, caves, springs, and other features

Many karst features store water as an aquifer that provides drinking water to plants, animals and people



Source: Michigan Karst Conservancy

Source: Ohio Department of Natural Resources

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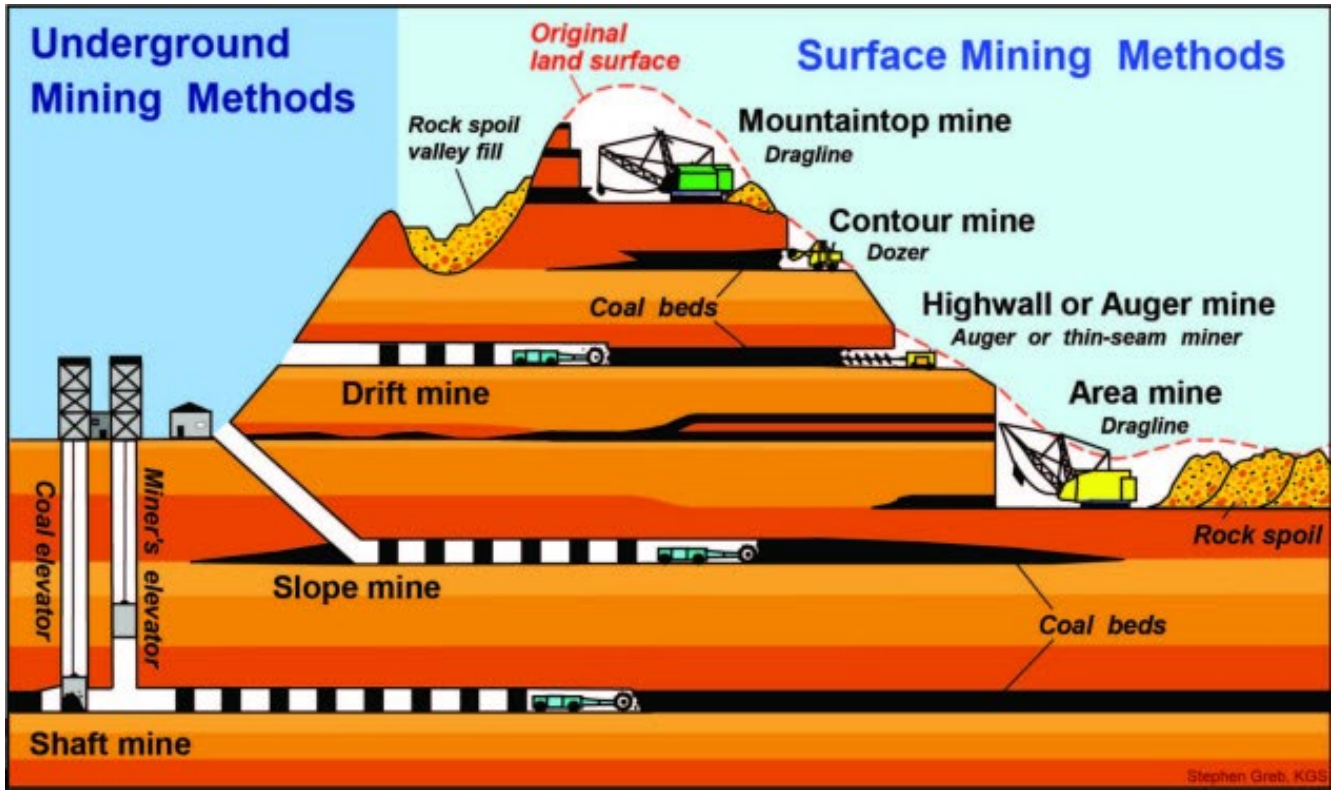
Mining History

- Surface / Strip Mining
  - Remove layers of overburden to expose mineral (typically coal) seams
  - Historically, strip mining degraded the land through vast clearing resulting in flooding and erosion
  - Exposed rock can result in acid mine drainage that contaminates waterways
- Deep Mining
  - Underground mining typically starts at 50 feet below ground
  - Utilizes shafts or tunnels to access and transport minerals
  - Many deep mines were abandoned resulting in subsidence from the collapse of shafts and tunnels
  - These tunnels from the deep mines can cause disappearing streams, dry groundwater wells, or drained aquifers

Mining History



Source: US EPA

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Coal Seams

Identification

- Structure contours indicate coal seam elevations
- Coal seam type is inducive of thickness

Many coal seams were never mined, likely due to access, ownership, or cost feasibility

Exposing coal seams and disposing of the coal without a mining permit or license can cause setbacks depending on state or local regulations

Acid Producing Rock (APR)

Source: West Virginia University

Contains iron sulfide minerals, which after exposure to air, creates iron oxides and acidity when exposed to water

Pyrite-rich or coal-bearing formation are potential source of APR

Mining history and coal seam data can assist in determining if the potential for APR exists on a property

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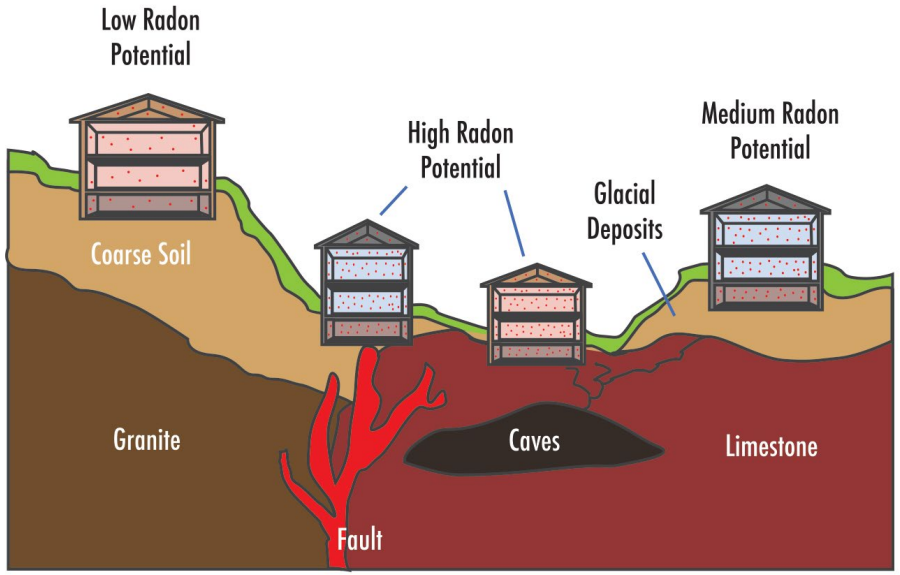
Radioactivity

Uranium-bearing minerals and oxides formed through the action of weathering in soils and rocks

Most common association is the occurrence of radon



Source: International Association of Certified Indoor Air Consultants

Desktop Due Diligence

Many of these geologic hazards can be identified early through desktop research by a professional

- USGS Landslides and Related Features Maps from ~1970s
- USDA National Resource Conservation Service Soils Report
- PA DCNR
  - Sinkholes and Distribution of Coals
- PA Mine Map Atlas
- Pennsylvania Geological Survey
- USGS Evaluation of Radon Occurrence in Groundwater in PA

Threatened and Endangered Species

Federal and State Listed in the Tri-State Region

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Potential Federal Bats in PA, OH, WV

- Bats (Five species, varied by state and location)
  - May require:
    - Time of year restrictions on clearing
    - Extensive mist-net or acoustic monitoring
  - Habitats can include forests, bridges, culverts, buildings

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Potential Federal Aquatic Species in PA, OH, WV

- Aquatic Species – Mussels, crayfish, fish, turtle
  - River or stream crossings
  - Can impact stream crossings of pipelines, electrical lines, access roads, docks
  - Specialized surveys and/or time of year restrictions on work can be necessary

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Potential Federal Plants in PA, OH, WV

- Plants
  - Specified time of year windows for surveys
  - Avoidance or relocation

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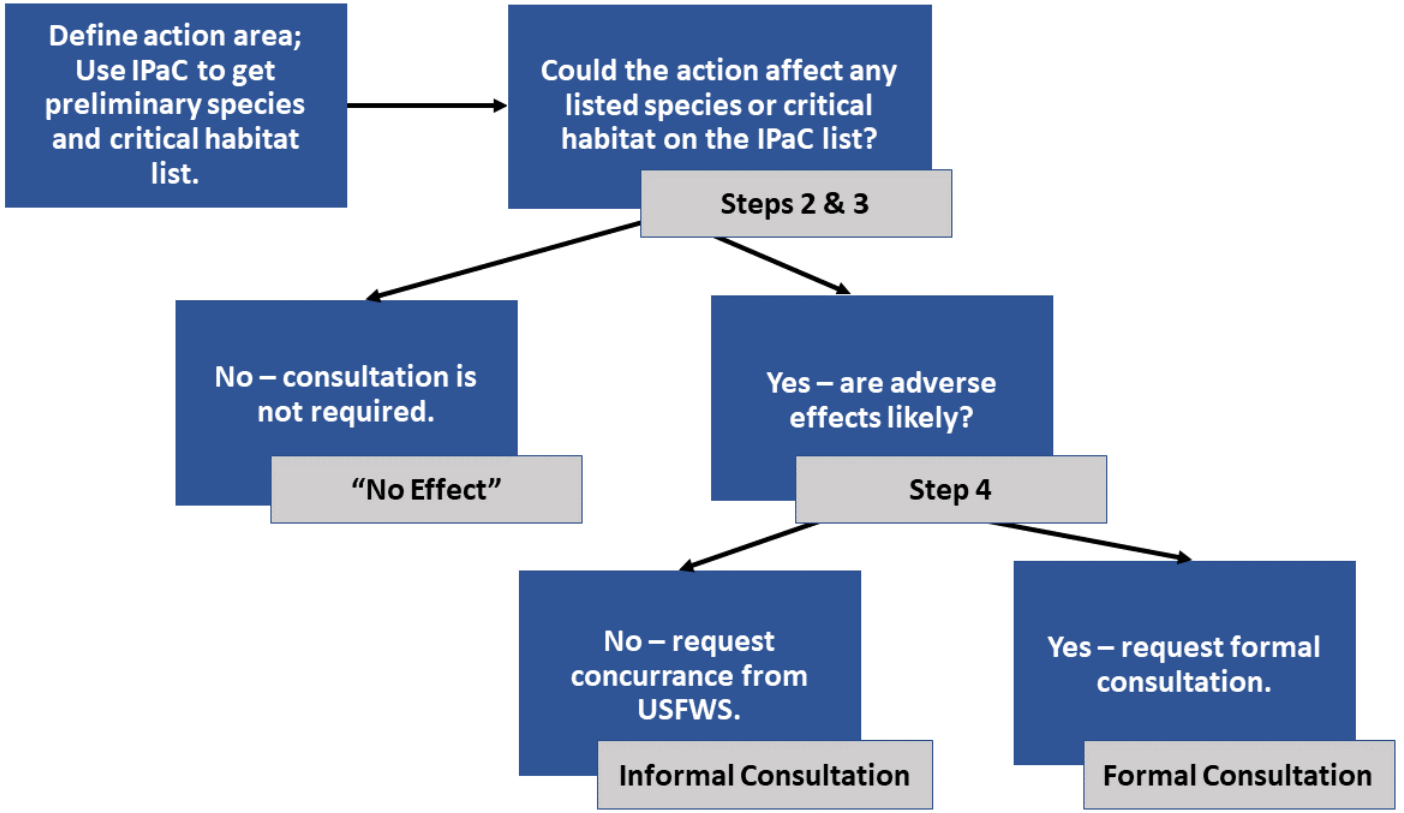
Rare, Threatened, and Endangered Species - Federal

- United States Fish and Wildlife Service (USFWS)
  - Primary authority over terrestrial and freshwater species
  - “Any species which is in danger of extinction throughout all or a significant portion of its range”

  - Image Source: USFWS



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Rare, Threatened, and Endangered Species - **State**

State	Agency	Taxa Covered
PA (PNDI)	PFBC	Fish, reptiles, amphibians, aquatic invertebrates
	PGC	Mammals, birds
	DCNR	Native plants
WV (WVDNR ER)	WVDNR	Full list of state rare, threatened, and endangered species
OH (ODNR DOW ER)	ODNR Division of Wildlife	State-listed wildlife (mammals, birds, fish, reptiles, amphibians, invertebrates)

Hazardous Substances and Releases

Phase I and II Environmental Site Assessments (ESA)

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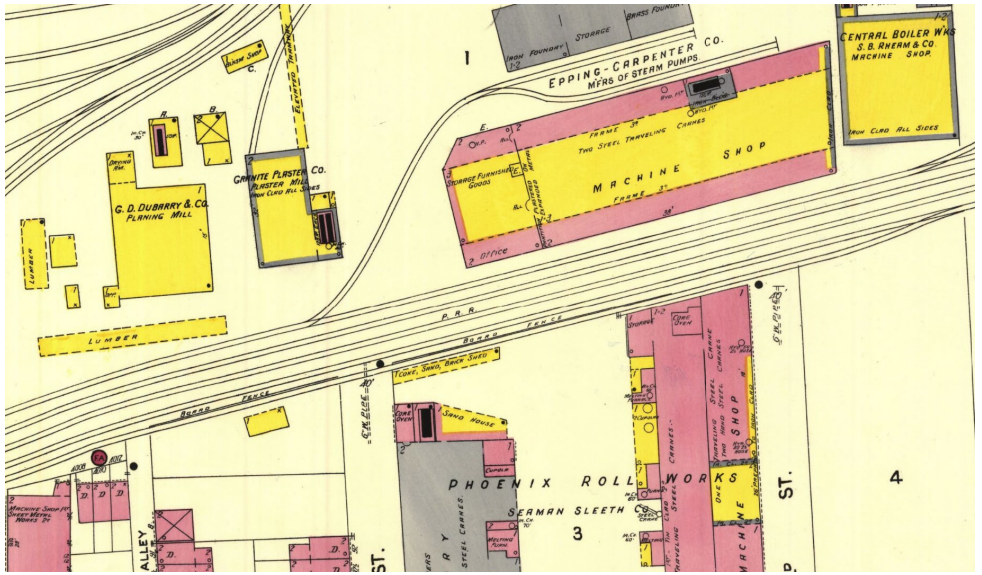
Phase I ESA

- Due diligence report to identify soil or groundwater contamination (i.e. recognized environmental conditions (RECs)) → **releases to the environment**
- Goal is to mitigate risk and liability during property transactions
- Key Components
  - Federal, state, and local records for past use, spills, or disposal
  - Historical aerial photos and topographic maps
  - Interviews
  - Site reconnaissance

Examples of RECs

REC Example 1



REC Example 2

REC Example 3

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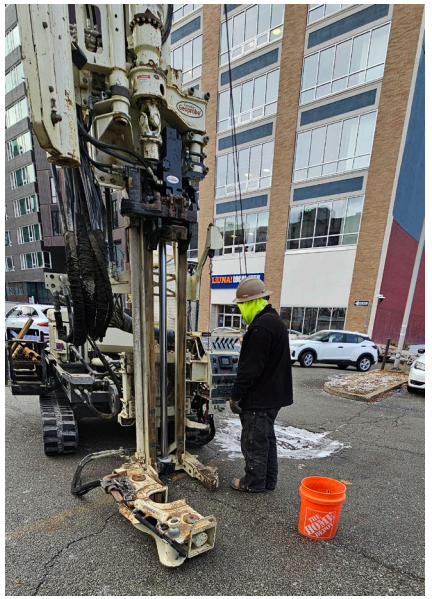
Phase II ESA

- Aims to confirm or dismiss the presence of contamination on a property by investigating the RECs
- Understand if there is a danger to human health or the environment on the property
  - Federal, state or local regulatory levels for constituents
- Key Components
  - Subsurface sampling
  - Laboratory analysis
  - Reporting



Environmental Justice

Pennsylvania Only Currently

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DEP Environmental Justice Policy

- **Effective date and purpose** **-** Effective January 3, 2026, the DEP EJ Policy sets a Commonwealth-wide framework to ensure equity and fairness in how environmental programs and decisions are carried out.
- **Definition of environmental justice** -EJ means just treatment and meaningful involvement of all people—regardless of income, race, national origin, residence, Tribal affiliation, disability, or other characteristics—in decisions affecting health and the environment.
- **Commitments and scope** **-** The policy recognizes historic and cumulative harms and integrates EJ into permitting, compliance, enforcement, grants, remediation, and climate work—centering transparency and community engagement, **including Tribes.**

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Trigger Projects & Opt-In Projects

Trigger Projects –

- Automatically receive Enhanced Public Participation if located in or affecting EJ Areas.
- Include major air sources, landfills, incinerators, mines, wastewater facilities, etc.
  - Does NOT include oil and gas

Opt-In Projects –

- Community or DEP may request inclusion.
- Applied when significant community concern or potential environmental burden exists.
- Unconventional Oil and Gas Development – Drill & Operate permits, changes in use, ESCGP may be included

Cultural Resources

Federal and State Requirements

NHPA Section 106 and 36 CFR Part 800 (federal regulations).

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What Triggers Section 106?

- A federal undertaking that may affect historic properties, including projects funded, permitted, licensed, or approved by a federal agency.
  - Federally jurisdictional wetland and water impacts
  - NEPA projects – federal grants, on federal land
- Tribal Consultation - Federal agencies must consult Tribes with ancestral ties to the APE; 574 federally recognized Tribes may require outreach. (USDA FSA guidance)
  - Provide surveys, research, NRHP evaluations, effect assessments, and support consultation documentation. (USDA FSA cultural resources guidance)

The Four Steps of the Section 106 Consultation Process

1. Initiate Consultation – Determine undertaking, identify consulting parties.
2. Identify Historic Properties – Define APE, survey, evaluate eligibility.
3. Assess Effects – Determine no effect, no adverse effect, or adverse effect.
4. Resolve Adverse Effects – Avoid, minimize, mitigate; develop MOA/PA.

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Examples of Cultural Resources

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Abandoned and Orphan Wells

Definitions, Identification, and Remediation

Federal and State Involvement

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Abandoned Wells

- Wells that are maintained by an entity but no are longer producing oil or gas
- Many of these wells are plugged by operators when they cease production

Source: PADEP

Source: PADEP

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Orphan Wells

- Exact definitions vary per state
- Orphan wells can be more than 150 years old
- Typically associated with a year being prior to that state's oil and gas regulations
- Owners of these wells likely went bankrupt or passed away; i.e. no responsible owner

Source: PADEP

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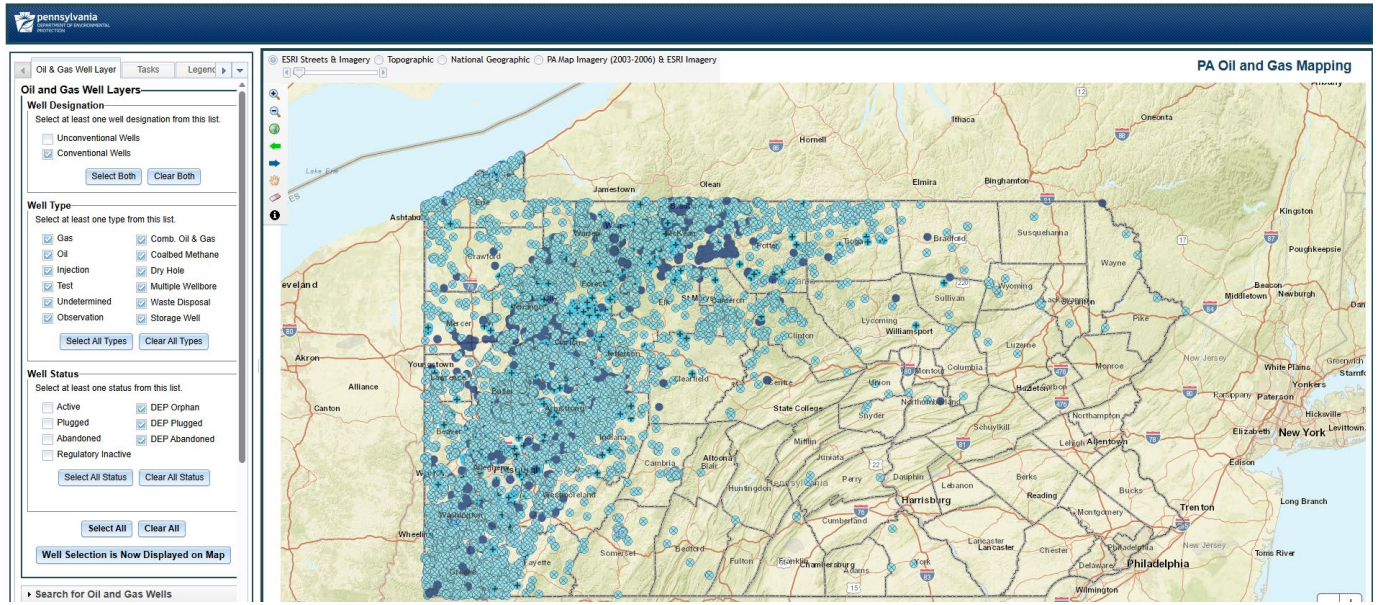
Information Sources

- Pennsylvania → PA Department of Environmental Protection (DEP)
  - Oil and Gas Well Layer → Filter by Abandoned, orphan or plugged wells
- West Virginia → WV DEP
- Ohio → Department of Natural Resources (DNR)



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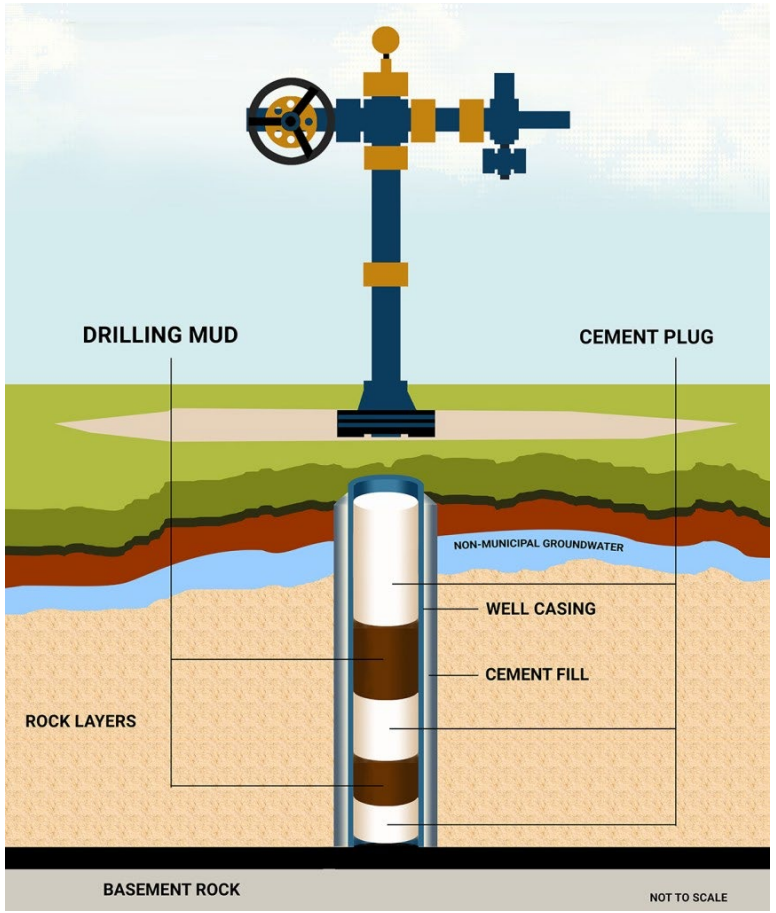
Remediation – Well Plugging

- Equipment Removal
- Cleaning the wellbore to the deepest safely accessible point (attainable bottom)
- Mechanical or cement plugs at specific intervals to stop the vertical flow of fluids or natural gas within the wellbore
  - Prevents migration of fluids or gas that could otherwise contaminate the ground, water supply or vent directly into the air
- Perforation and pressure testing
- Surface restoration

Source: PADEP



Source: California Department of Conservation

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Well Plugging Programs

- Pennsylvania
  - 2022 to 2025 significant boom in plugging
  - Growing Greener Fund and Federal assistance (IIJA)
- West Virginia
  - In 2020 created an Oil and Gas Abandoned Well Plugging fund
  - Total plugged through state funding is 169 wells
  - Recent IIJA funded projects have plugged approximately 200 wells
- Ohio DNR's Orphan Well Program
  - Recognized as one of the most well-funded and organized in the nation
  - State funded through Traditional Program costs and through "Landowner Pass-through Payment Program"
  - In 2023 and 2024, approximately 412 wells were plugged

PADEP Abandoned Well Inspections

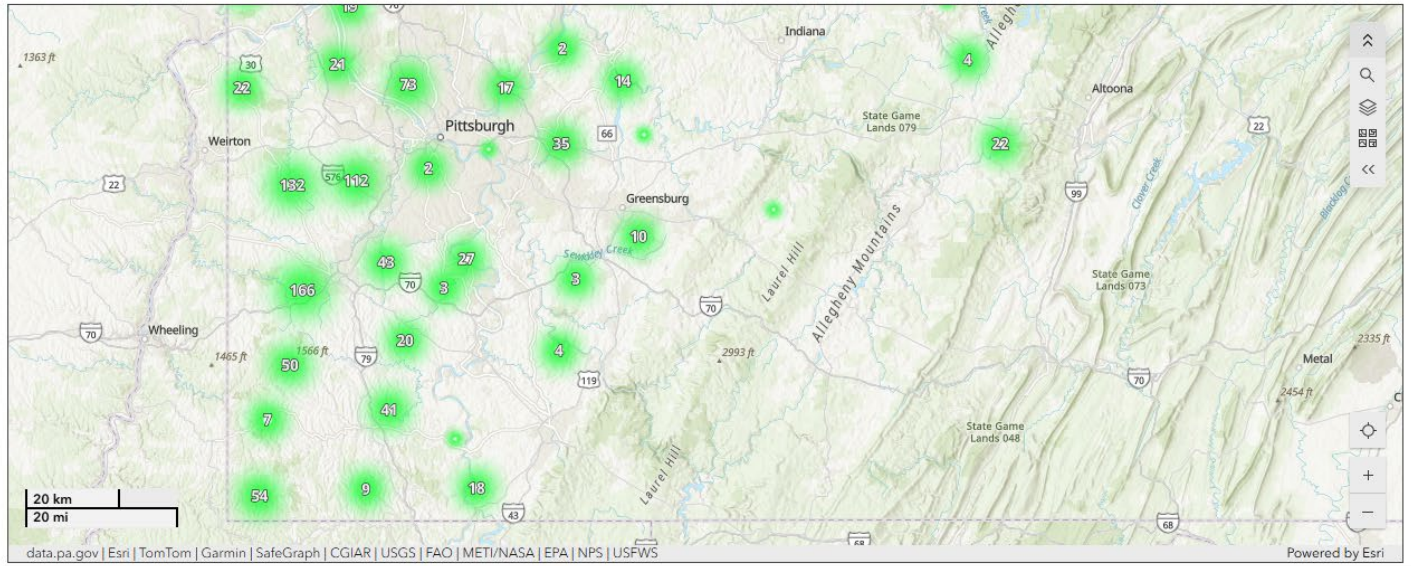
IIJA Inspection Data NOTE: This map represents real-time inspections. This data is not final, and may contain inaccuracies and is subject to change.

Filter Well Investigations by API #

Search...

- 083-13418
- 083-13419
- 083-57139
- 083-13647
- 083-12802
- 083-12803

Reset | Select all

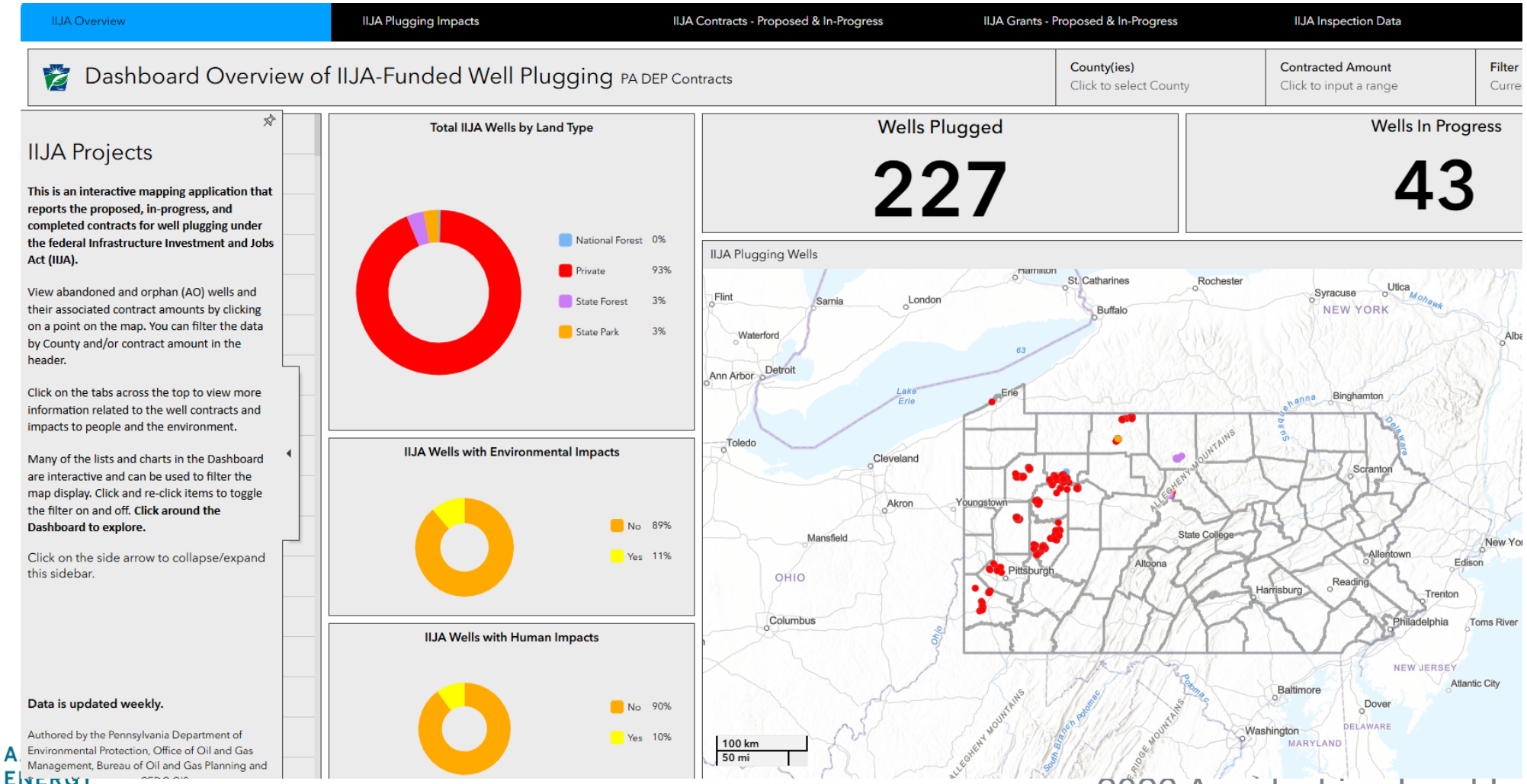


Total Well Investigation Reports

3,005

API No.	Inspection ID	Inspector	Date	Well Name	Well Type	Producing Formation	Well Status	State	County	Latitude	Longitude
083-13418		Mark Novak	12/12/23, 11:00 AM	Dep minard run 1	Oil		DEP Abandoned	PA	McKean	41.91	-78.64
083-13419	3659222	Hunter Danielson	12/12/23, 12:00 PM	DEP-Minard Run DEP2	Oil and Gas	Unknown	DEP Abandoned	PA	McKean	41.91	-78.64
083-57139	3651298	Hunter Danielson	12/12/23, 12:00 PM	Charlie's Cycle #1	Oil and Gas	Unknown	DEP Abandoned	PA	McKean	41.91	-78.65
083-13647	3660847	Hunter Danielson	12/18/23, 12:00 PM	Hostetter or Foster Farm DEP-1 OG Well	Conventional Oil and Gas	Unknown	DEP Abandoned	PA	McKean	41.91	-78.65
083-12802	3660904	Hunter Danielson	12/18/23, 12:00 PM	Hess 1 Well	Conventional Oil and Gas		Plugged	PA	McKean	41.91	-78.65
083-12803	3660965	Hunter Danielson	12/11/23, 12:00 PM	Hess 2	Conventional Oil and gas		Plugged and Vented	PA	McKean	41.91	-78.65

PADEP Well Plugging Program



Culmination – Critical Issue Analysis

- ❑Local, State, and Federal Regulations
- ❑Exclusion areas
- ❑Streams and Wetlands
- ❑Floodplains
- ❑Landslides and Geologic Hazards
- ❑Threatened and endangered species
- ❑Hazardous materials or releases – Phase I and II Environmental Site Assessments
- ❑Environmental Justice
- ❑Cultural Resources
- ❑Abandoned and Orphan Wells

Thank you!

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