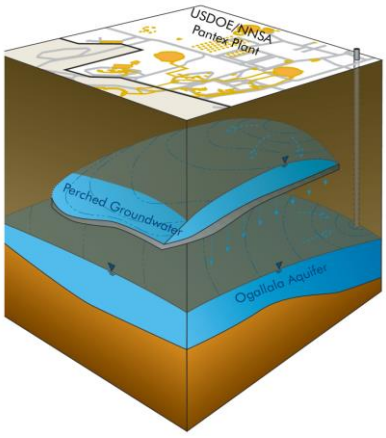
PANTEX ENVIRONMENTAL RESTORATION

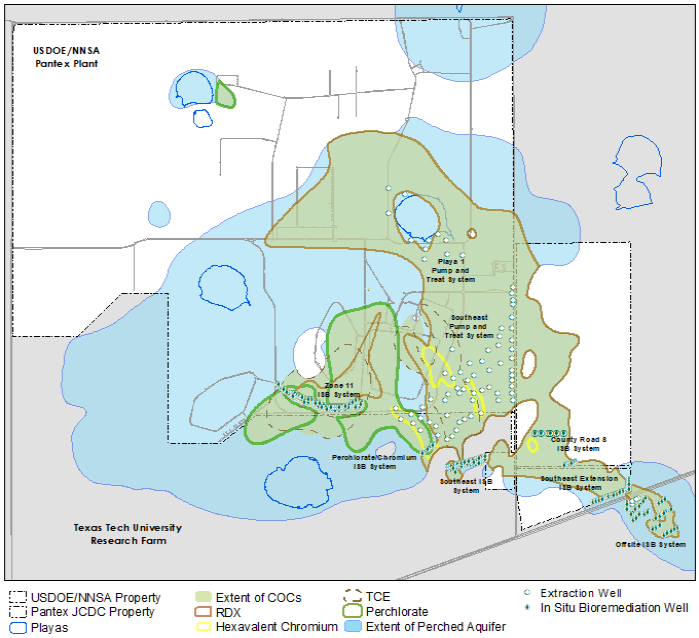
Groundwater Monitoring

The Pantex Remedial Action established in the Record of Decision (ROD) and the Compliance Plan in the Hazardous Waste Permit (HW-50284) includes two pump and treat systems and two *in situ* bioremediation systems for the cleanup of perched groundwater. Five additional *in situ* bioremediation systems are planned or have been installed to ensure cleanup of the whole perched aquifer in accordance with the Explanation of Significant Difference to the ROD completed in 2022. Groundwater monitoring is conducted as part of the Remedial Action to evaluate the effectiveness and protectiveness of the actions and for early detection of potential breakthrough to the underlying drinking water aquifer (commonly referred to as the Ogallala Aquifer).

Groundwater beneath the Pantex Plant and vicinity occurs in the Ogallala and Dockum Formations at two intervals. The first water-bearing unit below the Pantex Plant in the Ogallala Formation is a localized zone of perched groundwater located at approximately 200 to 300 feet below ground surface and 100 to 200 feet above the drinking water aquifer. A zone of fine-grained sediment (rich in silt and clay) supports or "perches" the perched groundwater and separates it from the underlying drinking water aquifer. The fine-grained zone acts as a significant barrier to downward migration of contaminated water. The perched groundwater ranges in saturated thickness from less than a foot at the margins to more than 50 feet beneath Playa 1. Perched groundwater is formed by surface water that collects in the playas and then infiltrates down to the fine-grained zone. The groundwater then flows outward in a radial manner away from the playa lakes and downslope along the surface of the fine-grained zone. The largest area of perched groundwater beneath Pantex is associated with natural recharge from Playas 1, 2, and 4, treated wastewater discharge to Playa 1, historical releases to the ditches draining Zones 11 and 12, and storm water runoff that drains to the unlined ditches and playas.



Groundwater Beneath Pantex



Extent of Perched Groundwater and Plumes (2024)

Pantex has developed goals which include reduction of perched water levels and cleanup of perched groundwater to protection standards to protect the underlying Ogallala Aquifer.

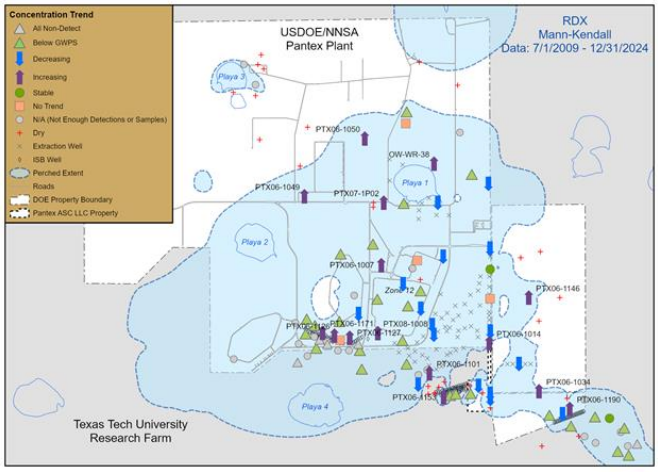
December 2025

Pantex monitors the perched groundwater and the Ogallala Aquifer to evaluate the following objectives:

- **Plume stability –** Pantex investigates whether the plumes are stabilizing or continuing to spread.
- **Corrective Action effectiveness –** Pantex evaluates the concentrations in and downgradient of the treatment systems to determine if the systems are effectively treating or removing contaminants as expected. Pantex also evaluates whether water levels are declining as expected. Reduction in saturated thickness will significantly reduce migration of contamination, both vertically and horizontally, to the Ogallala Aquifer.
- **Uncertainty management at the source areas** Pantex evaluates data to determine if the source areas are depleting as expected and verify that no new contamination has moved into the perched groundwater or the Ogallala Aquifer.
- **Early detection in the Ogallala Aquifer –** Pantex evaluates Ogallala wells at points where break through from impacted perched groundwater could occur and upgradient of water sources.
- **Natural attenuation of contaminants –** This process is monitored at Pantex to help determine where natural attenuation is occurring, under what conditions it is occurring, and to try to determine a rate of attenuation. Natural attenuation is evaluated to determine if it is a viable remedial option in areas that are difficult to treat.

The long-term monitoring system was designed in conjunction with the Texas Commission on Environmental Quality and the US Environmental Protection Agency. The design is documented in the *Long-Term Monitoring Design* and the detailed sampling and analysis requirements are provided in the *Sampling and Analysis Plan (SAP)*. The SAP is incorporated into the Pantex Hazardous Waste Permit and is submitted to regulatory agencies for approval.

As of 2024, Pantex monitors 131 perched groundwater wells for contaminants or continued dry conditions. Pantex also evaluates an additional 47 wells for water levels. Pump and treat extraction wells are monitored to gather additional data about the contaminant plumes. Pantex also monitors wells inside the *in situ* bioremediation systems to evaluate reducing conditions and determine when injections are necessary to continue treatment conditions. In an average year, Pantex analyzes for over 9,000 constituents in perched groundwater.

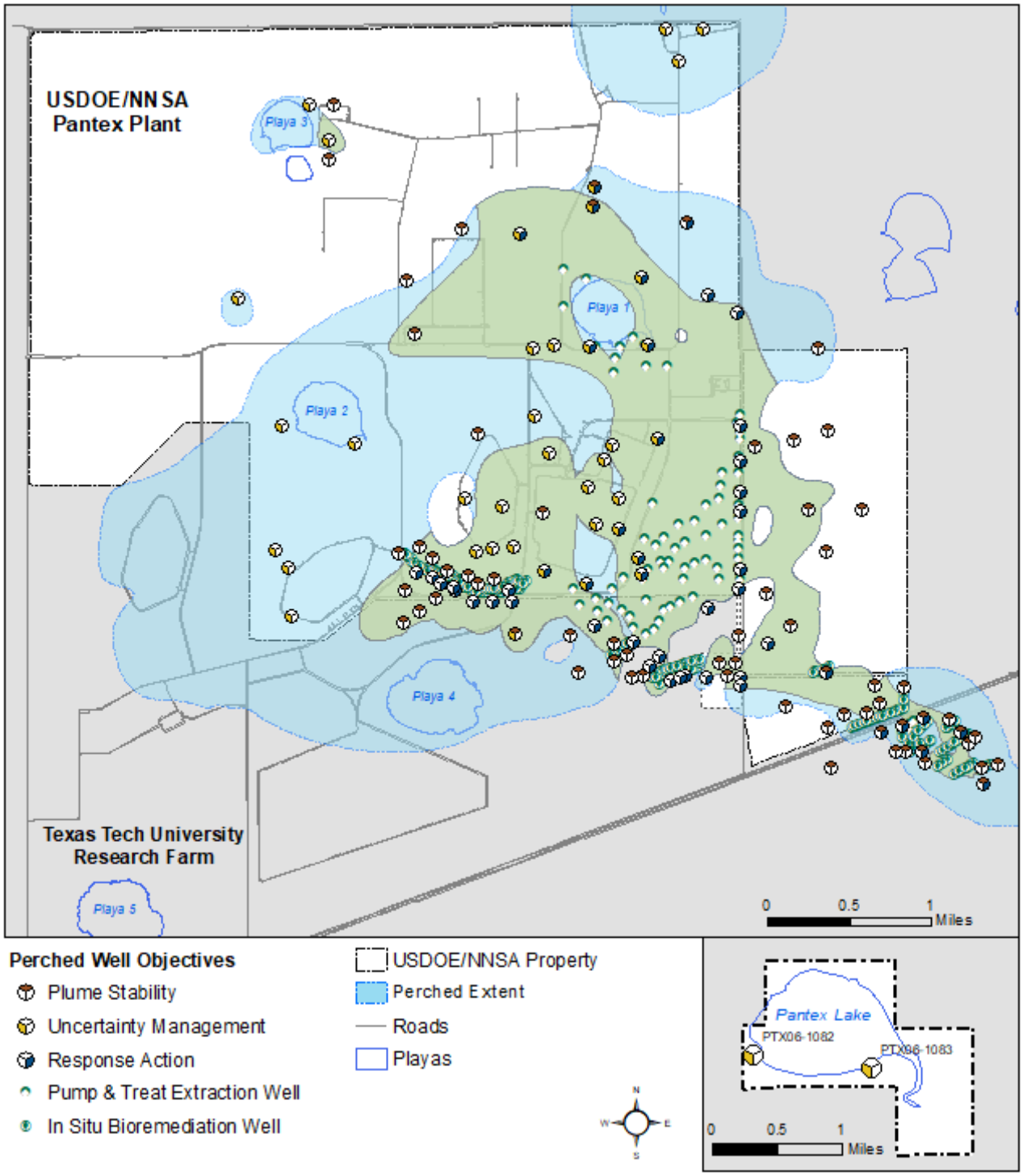


2024 Evaluation of RDX concentration trends based on monitoring data collected at perched groundwater wells

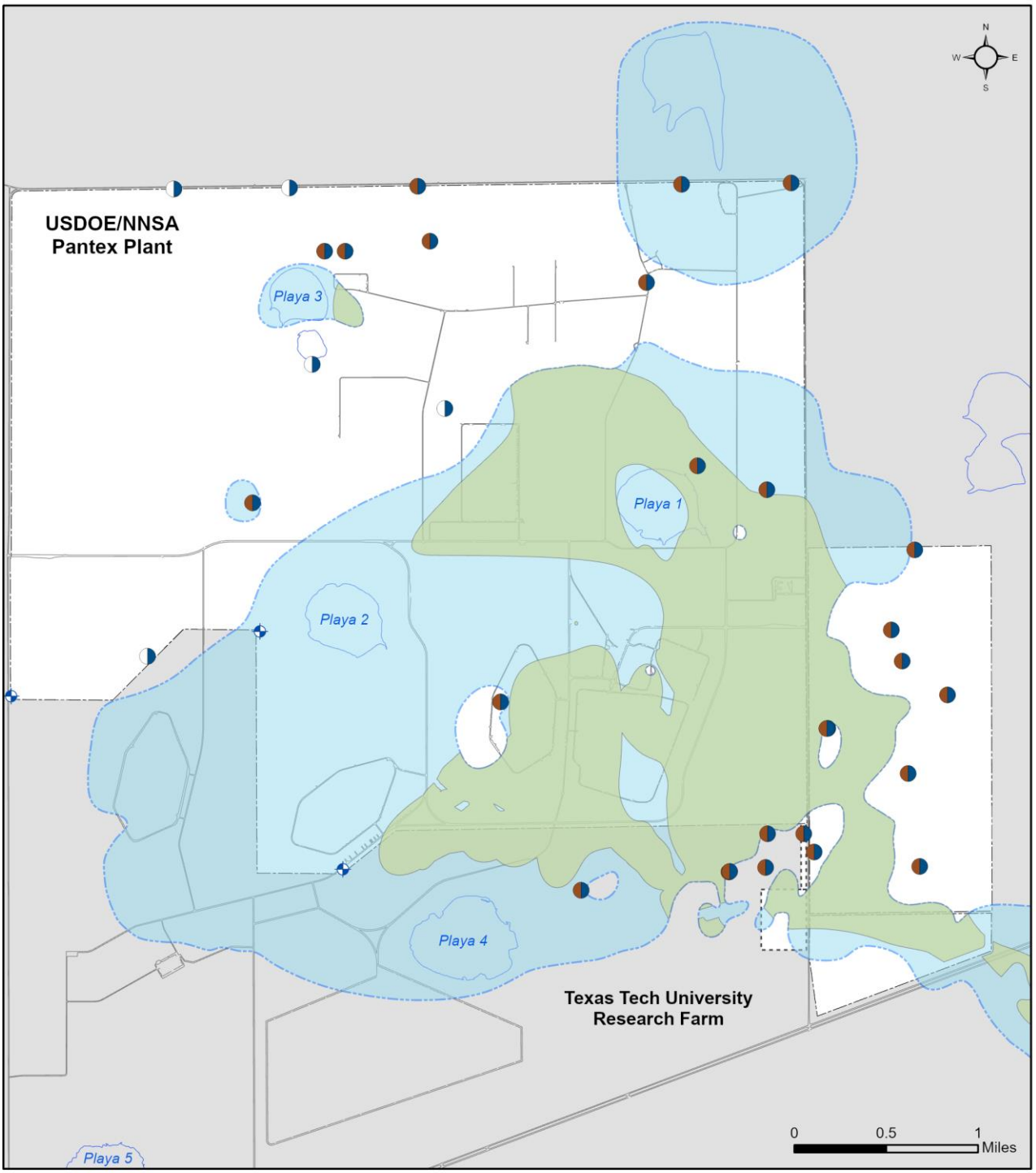
In 2024, Pantex monitored 29 wells in the Ogallala Aquifer for contaminants and water levels. Eight of the wells are sampled at multiple depths once every five years. In 2024, Pantex installed four new Ogallala wells to extend the monitoring network. In an average year, Pantex analyzes over 1,500 constituents in Ogallala groundwater.

Monitoring results are evaluated and presented to the public and the environmental agencies in semiannual and annual progress reports. Pantex also conducts five-year reviews to evaluate the protectiveness of the remedies and determine if changes to the remedy are required to meet the cleanup goals and provide short-term and long-term protectiveness of people and the environment. Pantex has developed a groundwater contingency plan, approved by regulatory agencies, to quickly and efficiently respond to unexpected results in perched groundwater and the Ogallala Aquifer. Many more years of treatment are required to remedy the plumes. Pantex will continue to monitor the Remedial Action and provide results in progress reports at pantex.energy.gov on the Environmental Cleanup Documents web page and in annual public meetings.

Fact sheets and progress reports can be found at pantex.energy.gov | Mission | Environment | Environmental Cleanup Documents web page.



Perched Monitoring Wells and Monitoring Objectives



Ogallala Monitoring Wells and Monitoring Objectives