ENVIRONMENTAL PROJECTS

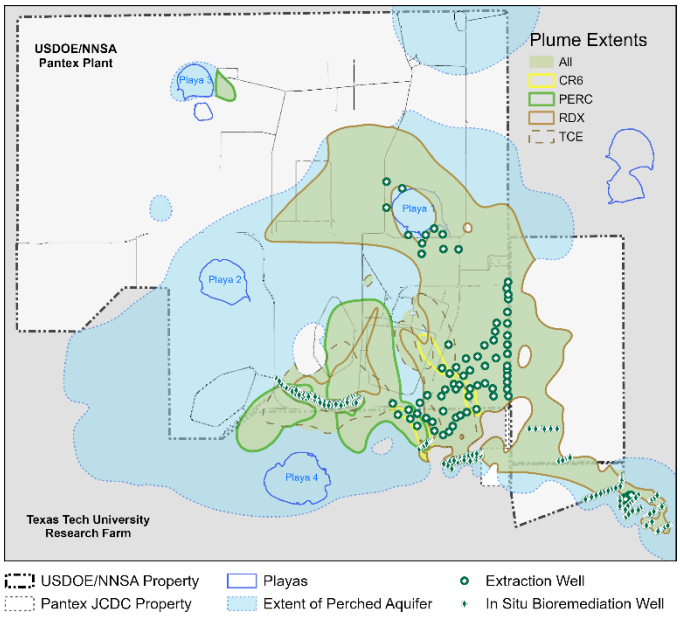
PANTEX ENVIRONMENTAL RESTORATION



In Situ Groundwater Bioremediation Systems

The Pantex Groundwater Resource Conservation and Recovery Act Facility Investigation Report identified impacts to perched groundwater that require corrective action. The Pantex Site Wide Human Health Risk Assessment found that perched groundwater underneath the Pantex Plant contains high explosives (HEs) and other constituents that could migrate over time to the High Plains Aquifer, the main drinking water source for the area. A Record of Decision was issued in 2008 with concurrence of the Environmental Protection Agency and Texas Commission on Environmental Quality to address cleanup of the legacy contamination at the Pantex Plant. The selected remedy for perched groundwater is a combination of extraction and treatment in areas with greater than 15 feet of saturation and in situ bioremediation (ISB) treatment in the thinner areas. Pantex currently operates six ISB systems to clean up groundwater plumes, with the sixth one having started operations in 2026. A seventh system is planned for operation in the future.

The area of primary concern for in situ treatment is in the area southeast of the main Plant. The fine-grained zone prevents vertical migration in most areas, but becomes thinner and more permeable in the southeast, so migration to the High Plains Aquifer is more of a risk there. The area to the southeast also has thin saturation so pump and treat technology is not a viable option in that area. An area further southeast was noted after the first Five-Year Review (2008) as not being under control of the pump and treat system, so the HE plume continued to migrate offsite to the southeast. Another area identified for cleanup is located south of Zone 11 on Pantex property, which presents a concern for migration offsite to the Texas Tech University property. HE are the main contaminants treated by the ISB systems at Pantex, but chlorinated solvents, perchlorate, and hexavalent chromium are also remediated by this technology.

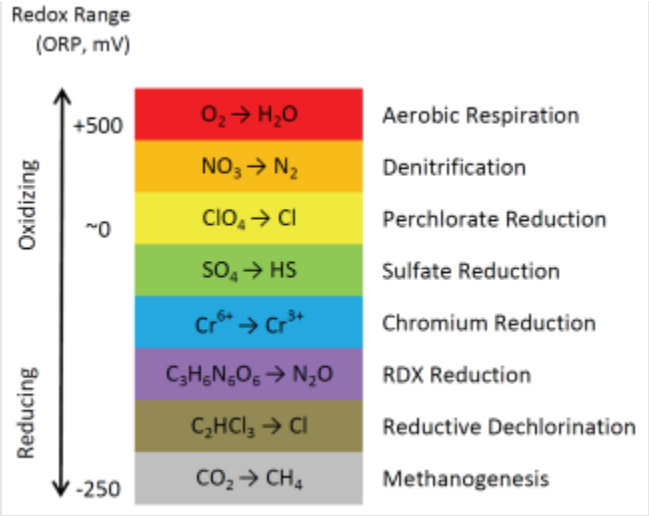


Plume Boundary and Groundwater Remedies, 2025

Pantex operates six ISB systems consisting of 247 active ISB injection wells, 44 ISB extraction wells (named REC wells in figures), 22 treatment zone monitoring wells, and 17 in situ performance monitoring wells. The Southeast ISB was installed in the southeast area of the plume on Texas Tech property where the fine-grained zone is more permeable. The Southeast ISB Extension was installed at the southeast property boundary east of FM 2373 to prevent further offsite movement of the perched groundwater plumes. The Offsite ISB has been installed in stages to cleanup plumes that have moved offsite. The Zone 11 ISB was installed to intercept multiple contaminants moving towards Texas Tech University property to the south.

Pantex drilled wells for two new ISB Systems in 2024, the Perchlorate/Chromium (PCR) ISB and the County Road 8 (CR8) ISB. The PCR ISB is intended to treat elevated levels of perchlorate and hexavalent chromium (Cr(VI)), and the CR8 system is designed to lower concentrations of HEs moving toward the southeast property boundary ensuring complete treatment of HEs before moving offsite.

The objective of the ISB systems is to establish an anaerobic biodegradation treatment zone capable of reducing contaminants to levels below the groundwater protective standard (GWPS). This is accomplished by injecting the necessary amendments or nutrients into the treatment zone wells to stimulate resident bacteria. As the naturally occurring bacteria feed and multiply, oxygen is removed from the injected area and deep reducing conditions are established for treatment of the contaminants. The ISB must establish reducing conditions to treat targeted contaminants including perchlorate, Cr(VI), and HEs, and achieve reductive dechlorination of solvents like trichloroethene (TCE). The figure below shows the conditions required to break down various contaminants.



Pantex monitors the treatment zone to evaluate the health of the bacteria so injection frequencies and volume of food source can be adjusted. Downgradient wells are also monitored to evaluate the effectiveness of treatment. As long as optimal subsurface reducing conditions and a food source are available, a diverse bacterial community can be sustained which leads to in situ treatment of contaminants.

ISB Systems Purpose and Operation:

The Southeast ISB system was installed in 2007 on the Texas Tech University property as an early action to treat HEs and Cr(VI). The injection wells were drilled in a line perpendicular to the hydraulic gradient so the water flowing through the treatment zone will be treated before reaching the area where the fine-grained zone layer becomes thinner and more permeable.



Amendment Tanks and Control Trailer at the ISBs

This system has been significantly impacted by the dewatering operations of the pump and treat systems; however, Pantex was able to inject this system in 2025. Pantex will continue to monitor to determine whether further injections are possible and necessary.

The Southeast ISB Extension was installed in 2017 after discovery of the HE plume expansion to an offsite property. The system was designed to prevent further movement of the groundwater plume offsite in areas that are not captured by the pump and treat system, and water saturation is too thin to pump. Based on the rate of perched groundwater flow and estimated longevity of molasses, injections are necessary every 12 months.

The PCR ISB was drilled in 2024 between the Southeast ISB and Zone 11 ISB to treat perchlorate and Cr(VI) plumes as they move towards the southeast. The PCR

ISB was injected for the first time in fall 2024 and again in 2025. This system will be injected every three years.

The Offsite ISB installation began in 2020 and is mostly complete with small additions still to be constructed if plume spread occurs. This system was designed to treat HE contaminants that have moved offsite in thinner areas of perched saturation. This system was injected with molasses twice annually. This system uses water pumped out of the perched aquifer from REC wells before being reinjected with amendment into ISB wells, creating a circulation system that more efficiently distributes the amendment throughout the entire system. This allows for the entire offsite plume to be treated in a shorter timeframe, while other systems treat water as it moves through the system.

The Zone 11 ISB system was installed in 2009 as part of the original final remedy with multiple expansions occurring as the plumes have changed direction due to the removal of water by the pump and treat systems. The latest phase of installation occurred in 2021. The injection wells were installed so water flowing through this zone will be treated before it reaches the area to the south on Texas Tech property near Playa 4. Based on the rate of perched groundwater flow and longevity of molasses, injections are necessary every 12 months.

Pantex completed the installation of the CR8 ISB in 2025 to address the heart of the HE plume that is moving offsite. Six extraction wells located east of FM 2373 were converted to ISB injection wells in 2025 and have been tied into the CR8 ISB. This system was injected in October 2026 and is planned for injection every three years.

Additionally, three previously installed wells that were originally for use with a mobile pump and treat system have been converted and will now be used for injection. These wells will comprise the Northeast ISB. This system will target high concentrations of RDX that continue to move to the southeast and offsite. New infrastructure is required at the Northeast ISB, and Pantex plans to install this infrastructure and begin injections at the Northeast ISB as funding becomes available.

ISB Cleanup Effectiveness:

The Southeast ISB primarily treats the HE RDX and Cr(VI). This system has successfully treated HEs and Cr(VI) below safe levels at most downgradient wells. One downgradient well on the southwest end of the system demonstrates partial treatment. Pantex converted this well into an injection well in 2025 to target the persistent contamination at this location. This well was injected in 2025 and will be monitored as treatment establishes. Due to the decrease in water levels from the operation of the pump and treat system, this system is near the end of injections. An injection event was completed in 2025, and future injections will only be performed as indicated by monitoring data.

The Southeast ISB Extension primarily treats the HE RDX and 4-amino-2,6-DNT (a breakdown product of the HE TNT). The system was injected once in 2025. Injections for the system are necessary every 12 months. Treatment effects are beginning to be observed in downgradient wells. Treatment effects inside the ISB have already been established.

The Zone 11 ISB primarily treats the organic solvent TCE and perchlorate. This system has successfully treated perchlorate to safe levels and TCE has been greatly reduced and is meeting safe levels through most of the ISB. Other areas are expected to meet safe levels in the near future.



Injection Trailers at Zone 11 ISB

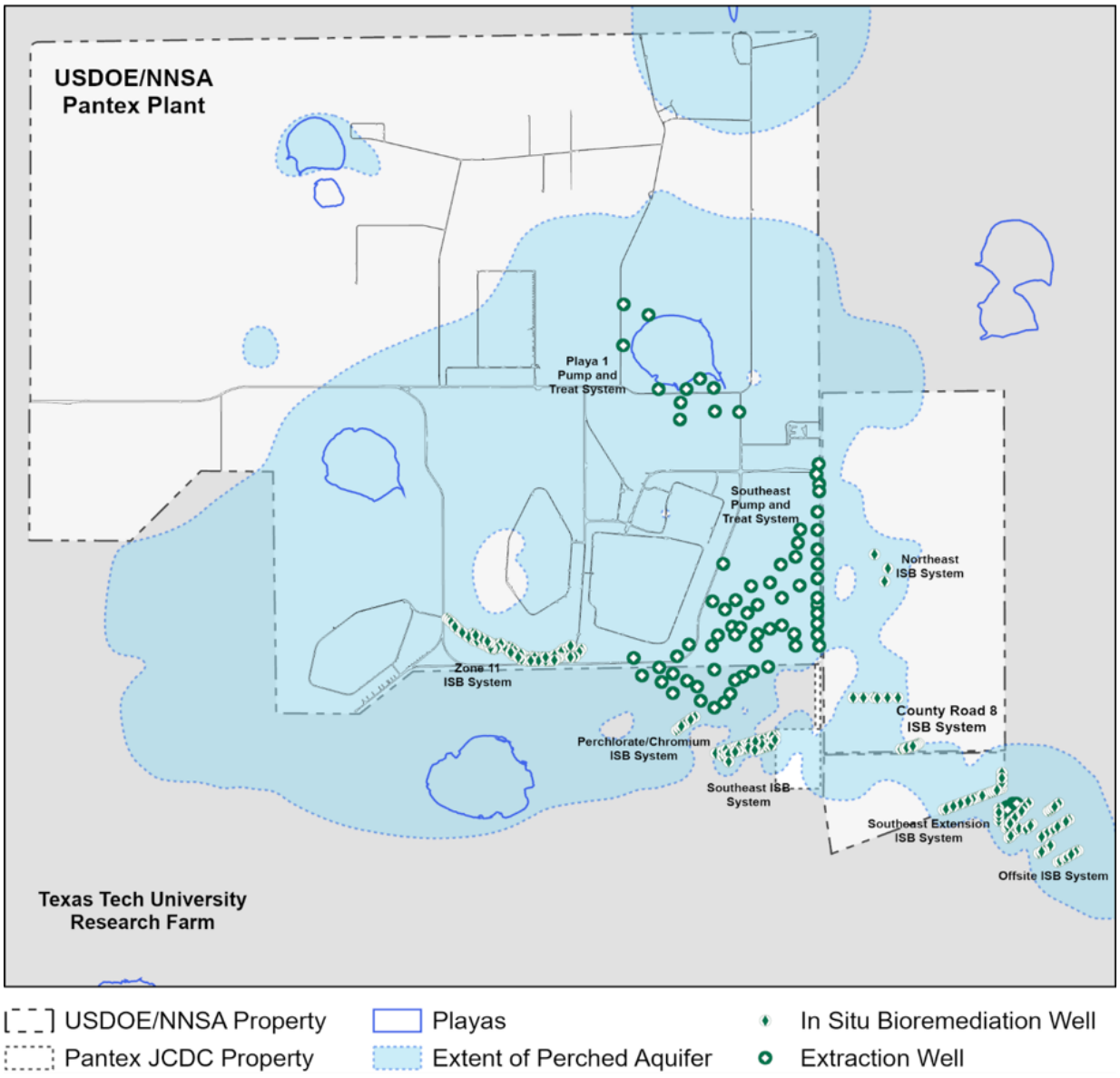
Breakdown products of TCE are also declining, with most wells meeting safe levels. The amendment strategy was changed in 2018 from emulsified soybean oil to a more soluble carbon source (molasses) to provide better distribution of the amendment throughout the zone. It is expected that the change in

amendment distribution will completely treat TCE and its breakdown products to safe drinking levels. Pantex added new wells in 2021 with closer spacing to allow for injection with emulsified vegetable oil, a longer lasting amendment. Those wells will only require reinjection every 3 to 5 years.

To address HE contamination that moved onto a neighboring property, Pantex began installing an Offsite ISB system in 2020. This ISB is located to the southeast of Pantex-owned property, south of Highway 60. The main installation phase of this system was completed in 2023, and two injection events occurred in 2025.

Based on the use of molasses, injections are planned every six months at differing parts of the system. Injection plans will follow the schedule that was designed using fate and transport modeling and optimization modeling.

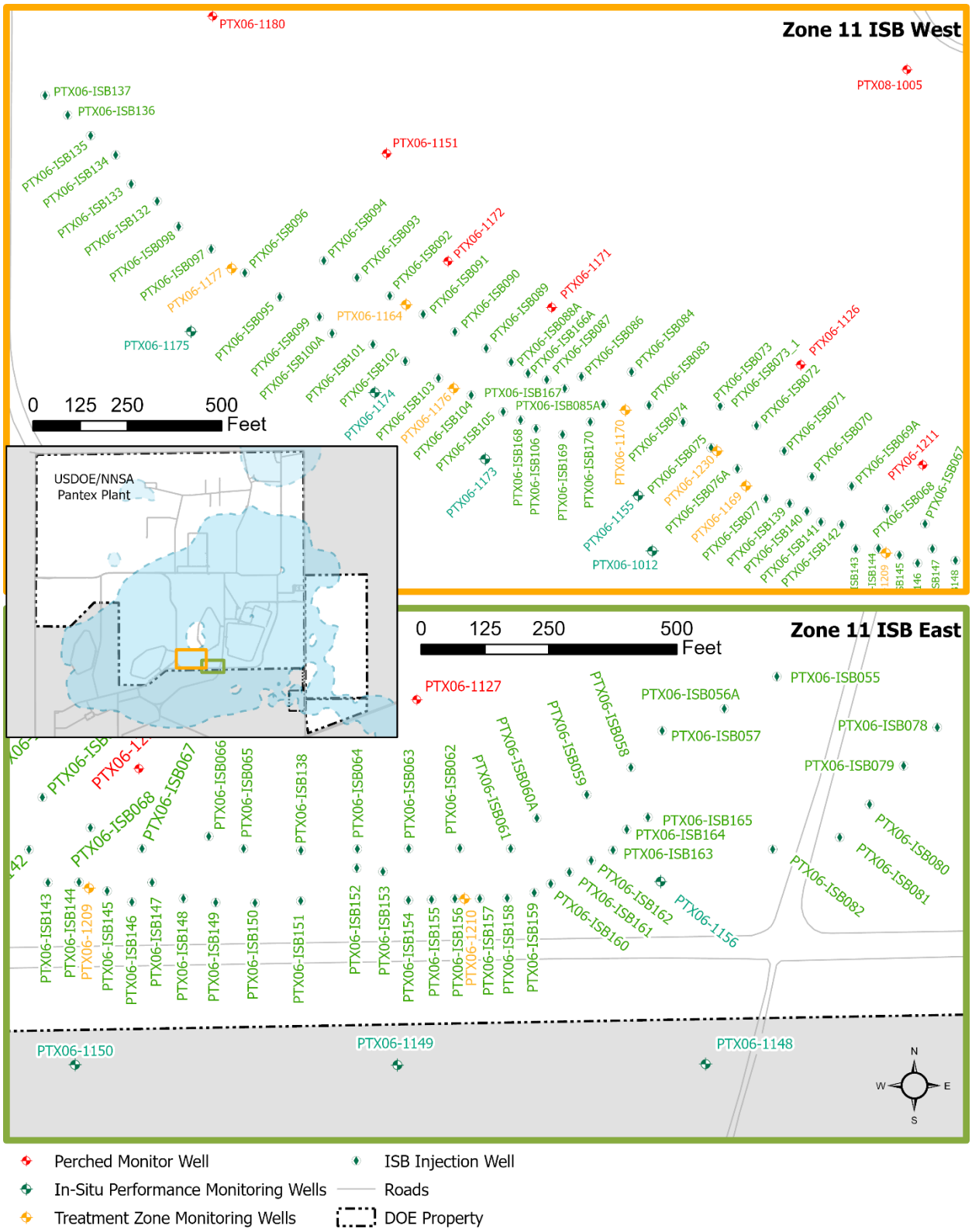
It is expected to take several years of treatment to allow the contaminant plumes to move through the ISB treatment zones. Pantex will continue to operate this action and provide results in progress reports that can be found at pantex.energy.gov. This action is one of several positive steps Pantex is taking to protect the High Plains Aquifer.



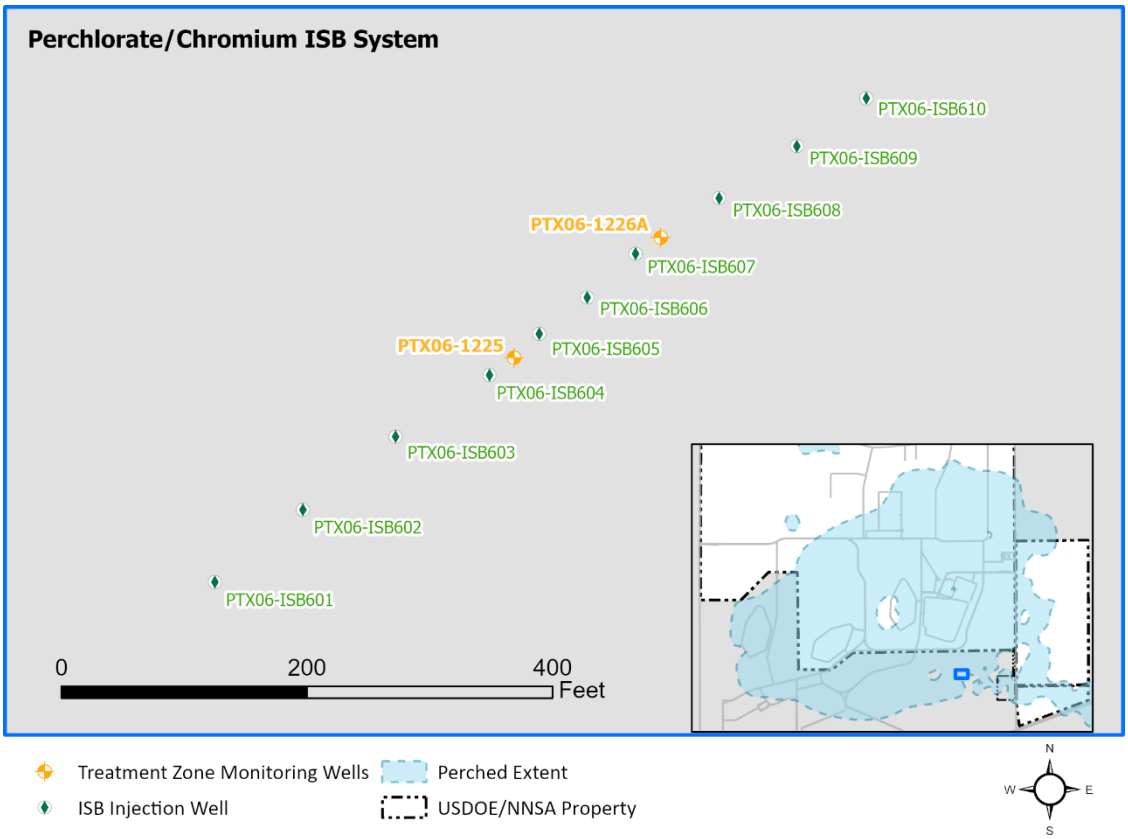
Pantex Remedial Action Systems with Planned Expansions



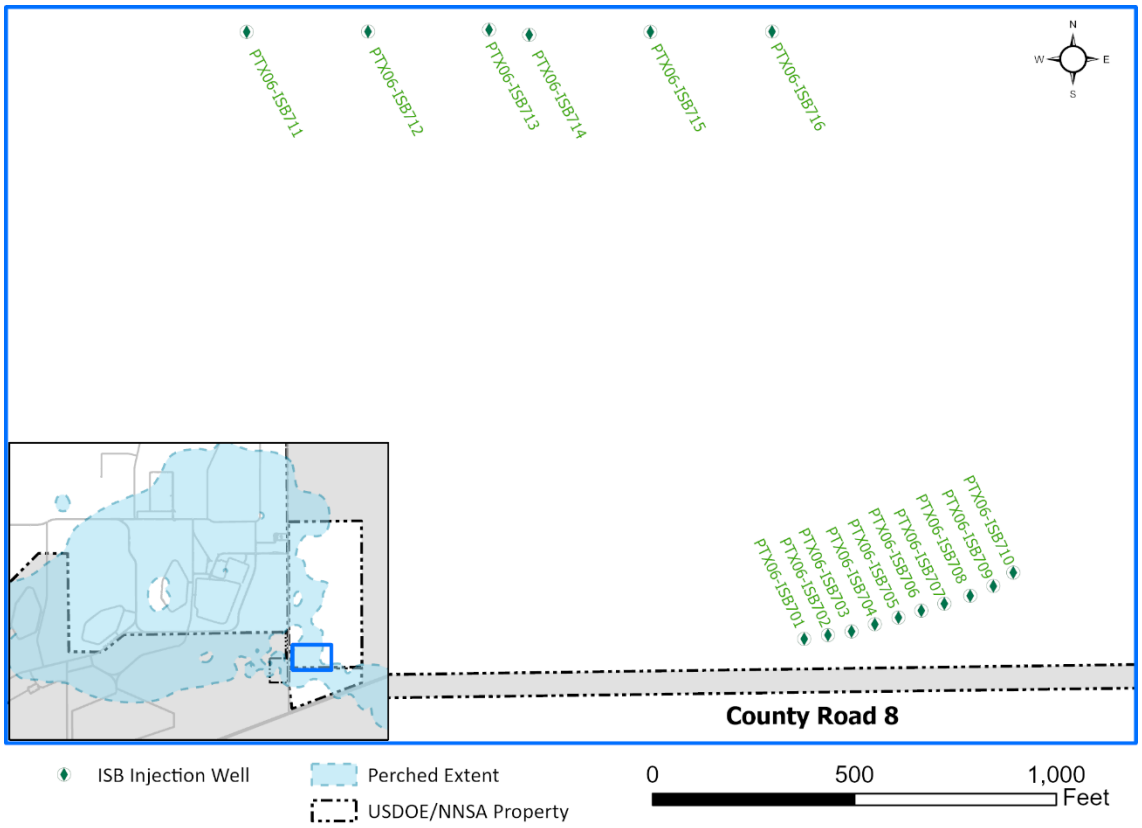
Southeast ISB and Southeast ISB Extension Systems, 2025



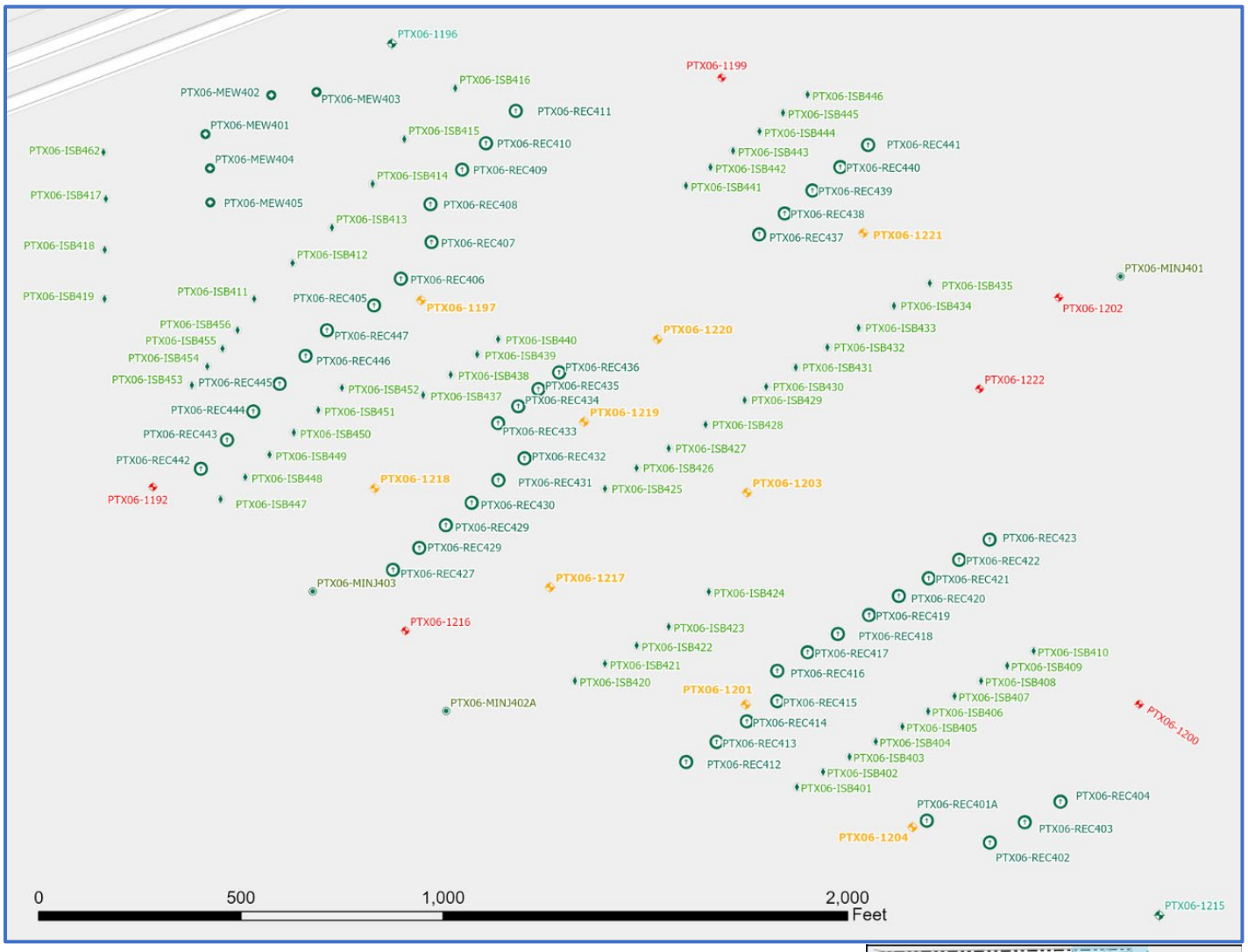
Zone 11 ISB System, 2025



Perchlorate/Chromium ISB System, 2025

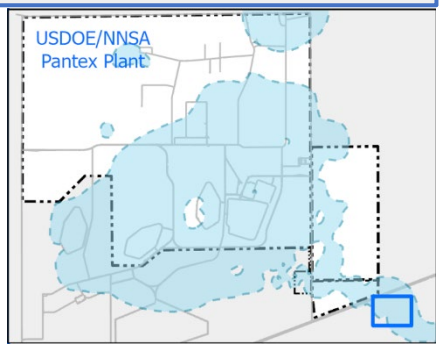


County Road 8 ISB, 2025



- Perched Monitor Well
- In-Situ Performance Monitoring Wells
- Treatment Zone Monitoring Wells
- ISB Injection Well
- ISB Extraction
- Pump & Treat Extraction
- Pump and Treat Injection Wells





Offsite ISB System, 2025