Green Remediation Focus

Minimizing the environmental footprint of site cleanup

A Profile in Using Green Remediation Strategies

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Phoenix-Goodyear Airport Superfund Site
Phoenix, Arizona

Superfund

Cleanup Objectives: Remediate groundwater contaminated by volatile organic compounds (VOCs), such as trichloroethylene, as well as perchlorate and chromium remaining from past use of the site to manufacture defense and aerospace equipment and operate a U.S. Navy facility. Since 1990, seven groundwater treatment systems (GTSs) have been installed in the non-contiguous "south" and "north" areas and continue to address groundwater extracted at different portions of this 905-acre site, much of which now serves as the Phoenix-Goodyear Airport.

Green Remediation Strategy: The strategy focuses on using best management practices associated with beneficially reusing the treated groundwater within the City of Phoenix and enhancing surface water management in a target area of the West Salt River Basin. Beneficial reuse of the water is critical to the community due its location in the Sonoran Desert, which receives 7-10 inches of rainfall annually and has an average summer temperature of 105°F. Groundwater is the primary source of drinking water in the area.

From 1990 through 2010, all treated groundwater was re-injected into the aquifer to contain the contaminant plume. Significant reductions in the plume size over time have enabled increasing portions of the treated water to be beneficially used. The site's record of decision allows for conveyance of the treated water from one or more of the seven GTSs for the following purposes:

- Agriculture, as irrigation water for crop production.
- Industrial uses.
- Municipal use, to supplement water supplies (subject to certain water rights).
- Recreation, such as creating lakes or irrigating public parks or golf courses.
- Surface discharge to nearby rivers, for diversion and downstream municipal use.

Results:

- Reusing an estimated 81.5 million gallons of water treated by the single GTS in the site's south area to irrigate the 105-acre Goodyear Recreation Complex each year, which annually saves approximately $250,000 in purchases from the water supplier and avoids approximately $75,000 in Arizona groundwater replenishing fees. The south area's potentially responsible party (Goodyear Tire and Rubber Co.) constructed the 1.5-mile, $1.3 million underground pipeline used to convey the water and now delivers up to 720,000 gallons of water through the pipeline per day to the City of Goodyear free of charge.
- Discharging additional water, as available, from the south GTS to the Buckeye Irrigation System for use by local agricultural producers at no charge.
- Reusing approximately 21 million gallons of water treated by the north area's EA-06 GTS to irrigate the Goodyear Community Park each year since 2013, resulting in an annual $75,000 savings in municipal park maintenance costs. Up to 100,000 gallons per day, or up to 200,000 gallons per day in peak periods, of the treated groundwater is delivered by the Crane Co. (the north area's potentially responsible party) to the City of Goodyear free of charge; the majority of this allotment is used for Goodyear Community Park irrigation.

- Reusing approximately 197 million gallons of water treated by the same (EA-06) GTS each year to operate a heat exchanger at the Saint Thomas Aquinas Grade School since 2013. The closed-loop heat exchanger conditions cooling water and reduces the building heating and cooling costs by an estimated 40 percent. Costs to construct the approximate 2-mile pipeline for conveying the treated water were covered by Crane Co. Process water discharged from the heat exchanger and the remaining EA-06 GTS effluent is injected into the aquifer for plume containment through five injection wells.
- Reusing approximately 140 million gallons of the water treated by the north area's 33A GTS each year to irrigate the Palm Valley Golf Course since 2013, resulting in an annual $250,000 savings in the golf course operating costs. The water is delivered to the golf course free of charge through a 1.5-mile pipeline.
- Discharging a separate portion of the 33A GTS treated water to the nearby Roosevelt Irrigation District canal that sends the water to downstream users for agricultural irrigation.
- Reusing approximately 52 million gallons of water addressed by the north area's separate "main" treatment system to irrigate onsite agricultural plots each year since 2013 at an annual savings ranging from approximately $94,000 to $250,000, depending on the crop type and alternate water source if the treated water was not available. Crane Co. continues to collaborate with a local farmer in developing additional plots of dryland crops such as rye grasses on a trial basis to minimize wind-driven erosion, control onsite dust and improve visual aesthetics of the site while gaining the crops' carbon sequestration and economic benefits.
- Returning water specifically to the vadose zone through use of two infiltration galleries constructed in 2015 along the agricultural plots, to optimize flexibility of managing groundwater treated by the main treatment system. The remaining main treatment system effluent is injected back into the aquifer through seven injection wells.
- Providing a portion of water treated by the north area's EA-05 GTS to the Maricopa County Flood Control for use in controlling dust on county roads and public properties as needed; fugitive dust from unstable or disturbed ground surfaces is a significant contributor to the County's non-attainment status for airborne particulate matter less than 10 micrometers in diameter (PM10). The remaining EA-05 GTS effluent is injected into the aquifer through a single well.
- Injecting back into the aquifer a total of approximately 967 million gallons of treated water to control the target groundwater plumes each year since 2010 through five of the seven GTSs (the main treatment system, EA-04, EA-05, EA-06 and EA-08).
- Eliminating groundwater well purging in the site's south areas through use of Hydrasleeve technology for periodic sampling of groundwater. This sampling technique avoids energy consumed for the sole purpose of well purging, saves vehicle gasoline due to reduced travel by sampling personnel, avoids electricity consumption associated with treating purge water, and generally reduces project labor hours.
- Continuing a partnership among the Arizona Department of Water Resources, Arizona Department of Environmental Quality, U.S. Environmental Protection Agency and City of Goodyear as well as local businesses to beneficially use more of the treated water as site remediation progresses.

Property End Use: Commercial business, light industry and municipal airport infrastructure.

Point of Contact: Catherine Brown, U.S. Environmental Protection Agency Region 9

Recreation Complex Water Storage: Treated water transferred from the site's south area is stored in a reservoir at the Goodyear Recreation Complex for onsite distribution for irrigation.

Ball Park Irrigation: Treated water stored in the Goodyear Recreational Complex reservoir is primarily used to irrigate a ballpark used by the Cactus League's Cincinnati Reds and Cleveland Indians for spring training and exhibition games.

EA-06 GTS: The north area's EA-06 GTS consists of two liquid-phase granular activated carbon (LGAC) vessels for removing VOCs from groundwater that is extracted from two wells at a combined rate of approximately 625 gallons per minute.

Park Irrigation: Groundwater treated by the EA-06 GTS is conveyed to the Goodyear Community Park to irrigate open spaces mixed with other amenities such as walking trails, softball fields, tennis and volleyball courts, a skate park and a splash pad.

Offsite Heat Exchanger: Agreement to install the nearby school's heat exchanger developed during concurrent expansion of the EA-06 groundwater treatment system and the school buildings. The school owner (St. Thomas Aquinas Church) allowed the Crane Co. to install an interconnecting pipeline on the school property; in exchange, the Crane Co. worked with the school engineers to design a closed-loop system that uses the treated water for cooling/heating the incoming air flow handled by the heat exchanger.

33A GTS: Groundwater extracted from one well (33A) in the north area at a rate of 350-400 gallons per minute is conveyed to two LGAC treatment trains for VOC treatment. After carefully monitored use of the LGAC, the spent carbon is periodically replaced by fresh reactivated carbon and shipped offsite for reconstitution.

Golf Course Irrigation: Groundwater treated by the 33A GTS is conveyed through an underground pipeline to ponds at the Palm Valley Golf Club and used to irrigate the golf course.

Main Treatment System: Contaminated groundwater is extracted from nine wells in the north area at a rate of approximately 850 gallons per minute and conveyed to the main treatment system for removal of VOCs via air stripping or LGAC treatment and removal of perchlorate via ion-exchange technology.

Crop Irrigation: A portion of effluent from the main treatment system is discharged into a pipeline supplying irrigation water to the onsite agricultural plots.

Infiltration Gallery: Two onsite infiltration galleries were installed in positions parallel to opposing borders of the agricultural plot area.

EA-05 GTS: Groundwater is extracted through one north area well at a rate of 450-500 gallons per minute and conveyed to the EA-05 GTS for VOC removal via two LGAC vessels and associated influent and effluent bag filters.

Dust Abatement: The Maricopa County Flood Control District uses a portion of the EA-05 GTS effluent to control fugitive dust throughout the county. The remainder is injected back into the aquifer through a single injection well.

EA-08 GTS: Groundwater is extracted from another well (EA-08) in the north area at a rate of approximately 360 gallons per minute and conveyed to two LGAC vessels and associated bag filters. Following treatment, the water is injected back into the aquifer through two injection wells.

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United States Environmental Protection Agency
Office of Solid Waste and Emergency Response (5203P)

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