

The Sustainable Water Initiative for Tomorrow (SWIFT)

A forward-looking solution to tackle today's problems



SWIFT is an innovative water treatment initiative in eastern Virginia designed to ensure a sustainable source of groundwater while addressing environmental challenges such as Chesapeake Bay restoration, sea level rise and saltwater intrusion. The multi-year initiative will take already highly treated wastewater (that would otherwise be discharged into the Elizabeth, James or York rivers) through additional advanced water treatment to produce drinking-quality water. This SWIFT Water will then be treated to match the existing groundwater chemistry and added to the Potomac Aquifer, the primary source of groundwater throughout eastern Virginia.

Benefits

SWIFT is designed to:

- **Help the Bay** by significantly reducing the amount of nutrients such as nitrogen and phosphorus that HRSD discharges to the James, Elizabeth and York rivers;
- **Replenish our dwindling groundwater supply**, allowing this natural resource to remain productive for generations to come;
- **Fight sea level rise** by reducing the rate at which land is sinking in Hampton Roads;
- **Protect groundwater from saltwater intrusion** due to a shrinking aquifer; and

- **Support Virginia's economy** by providing businesses with the water they need to operate.

The Pilot Project

Scientists and engineers tested two proven drinking water treatment technologies in the SWIFT pilot project at HRSD's York River Treatment Plant. Membrane-Based and Carbon-Based Advanced Water Treatment Processes were compared side-by-side to determine which technologies worked most efficiently with HRSD's existing wastewater treatment process. The multi-step advanced water treatment processes create multiple barriers to remove potential contaminants and pathogens and were stringently monitored throughout each stage to ensure the final product was safe and reliable.

The Next Step

The results of the Pilot project were used to select the appropriate technology to incorporate in the SWIFT Research Center, currently under construction at HRSD's Nansemond Treatment Plant in Suffolk, Va. This facility will produce up to one million gallons of SWIFT Water per day using Carbon-Based Advanced Water Treatment and then treat it to match the existing groundwater. HRSD will then test its ability to add this water into the aquifer. The results of groundwater replenishment at this site will be

"SWIFT is vital to proactively addressing our water, environmental and economic needs not only for today, but for generations to come."

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extensively monitored for one year and the findings used to support requests for the necessary state and federal approvals.

Background

The residents of Hampton Roads send approximately 150 million gallons of water to HRSD each day. HRSD cleans this water to exacting standards and returns it safely to area waterways. The cost to clean water is rising as new regulatory requirements, like nutrient removal, are implemented to address environmental issues that continue to be further refined.

Groundwater in Eastern Virginia

The HRSD service area is entirely within the Eastern Virginia Groundwater Management Area, an area of Virginia extending eastward from the Fall Zone (approximately along the I-95 corridor) to the Chesapeake Bay. Groundwater in this region is primarily contained in aquifers (porous layers of sands, shells and gravels) that are confined by layers of impermeable soils (clays and silts). The layers of impermeable soils prevent rain water from seeping into the ground to replenish these deeper aquifers.

The largest of the aquifers in this area is the Potomac aquifer, located along the Virginia coast, which is several thousand feet thick and contains hundreds of trillions of gallons of pressurized water. With insufficient ability to recharge naturally, the water within the Potomac aquifer is a limited natural resource. As water is withdrawn, the pressure in the aquifer decreases. For more than 100 years Virginians have been withdrawing water from this confined aquifer, significantly lowering the pressure. The reduced pressure has caused the aquifer to compact, resulting in land subsidence, and has

increased the potential for salt water contamination.

A Sustainable Solution

HRSD modeled the effect of adding 120 million gallons of purified water daily into the Potomac aquifer at several HRSD plant locations in southeastern Virginia. The results show a positive impact on nearly the entire Potomac aquifer, increasing pressures west to the Fall Zone, as far north as Maryland and south beyond the North Carolina border. The increased pressure along the coast would also inhibit salt water contamination. With the addition of 120 million gallons of clean water each day, the model predicts that the aquifer can support all existing permits for groundwater use, with capacity to allow future withdrawals practically anywhere within the Eastern Virginia Groundwater Management Area.

Advanced Water Treatment

The Carbon-Based Advanced Water Treatment Process to be used by HRSD will produce water that both protects human health and closely matches the chemistry of the water already in the aquifer. Treating water to match the chemistry of that in an aquifer (which prevents damage to the structure of the aquifer and the release of contaminants within the soils in the aquifer) has been done successfully for decades throughout the world, and since the late 1980s at Southeast Virginia's Chesapeake Aquifer Storage and Recovery facility.

Slowing the Rate of Land Subsidence

In addition to stabilizing and restoring the water supply in the aquifer, SWIFT is expected to slow the rate of land subsidence in eastern Virginia. The United States Geological Service (USGS) has estimated that groundwater withdrawals are responsible for

more than half of the land subsidence in eastern Virginia, and land subsidence is estimated to contribute to more than half of the net effect of sea level rise in Hampton Roads. A reduction or complete halt of subsidence would provide years of added use of highly valuable developed land impacted by sea level rise, as well as protect thousands of acres of environmentally valuable wetlands from complete inundation.

Eliminating Surface Water Discharge

A key benefit of this effort is that it will practically eliminate HRSD's discharge into the James, Elizabeth and York rivers. HRSD will only need to discharge clean water through existing permitted outfalls into these rivers during periods of extremely high flows that occur occasionally during significant storms.

Schedule

HRSD is working toward obtaining all necessary approvals for construction of the first full-scale SWIFT facility in 2020. HRSD estimates a 10-year construction schedule to fully build all facilities required to reach full scale operations by 2030.