

Costs rise as aquifers shrink

South suburbs seek reliable water sources

By [Karen Rouse](#)
Denver Post Staff Writer

Sunday, June 24, 2001 - Beneath Denver and its south suburbs, water levels are dropping by as much as 30 feet a year. There's enough water to last several centuries.

But getting it from the aquifers to thousands of people in the south metro area could become much more expensive if water providers don't find a replenishable source of water - a solution that is far from certain - for the expanding population.

And even if the population holds steady, more water is being pumped today than is being replenished, leading to steadily dropping water levels.

Already, some cities are paying thousands of dollars more to replace wells and pumping equipment than when water levels in the aquifers were higher. Those costs, as much as \$1 million for a new well, eventually trickle down to groundwater users who pay service fees.

"The harder it is to get the supply, the cost will continue to go up, and that cost will be transferred over to the users," said Stan Brown, public works director for Castle Rock, which provides water to 8,000 households.

Homeowners with wells also could be faced with paying hundreds of dollars to sink new wells or drop pumps deeper into existing wells.

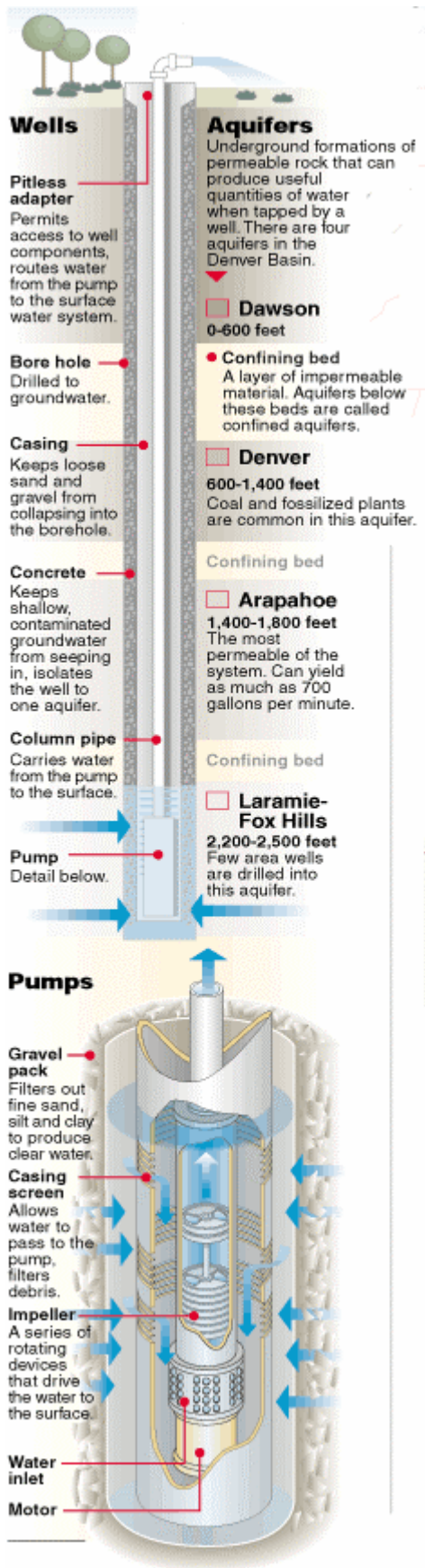
At \$10 per foot, a homeowner in Douglas County for example, could spend as much as \$6,000 to drill a 600-foot well. Add to that higher energy bills and the \$1,000 to \$2,000 cost of a pressure tank, pump and other equipment required to lift water, said Courtney Hemenway, a groundwater hydrologist and owner of Hemenway Groundwater Engineering Inc. in Parker.

Foxfield resident Arnie Wills spent \$1,500 to increase the horsepower of his water pump, then lower it to the bottom of his 230-foot well five years ago.

"The pump was sitting at 200 feet, and we ran out of water," said Wills.

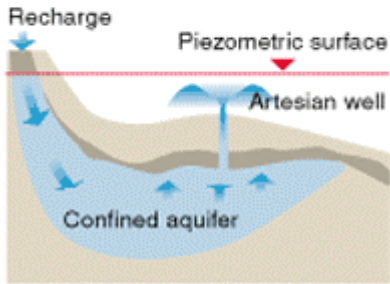
The drop has been roughly 50 feet over seven years, he said.

"The problem is not going to go away because you've got such an increased demand on the aquifer," he said.



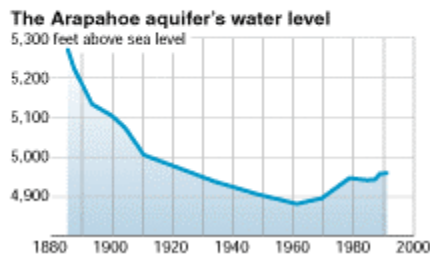
Artesian pressure

Confined aquifers are sometimes referred to as artesian, and a well in such an aquifer is called an artesian well. Water levels in the Denver Basin aquifers were once so high that artesian pressure was used to power elevators in downtown Denver.



Water levels

In 1884, when wells were first drilled in the area, water levels were very high in the Arapahoe aquifer. The level declined until 1960 when it began to rise due to decreasing local withdrawal. Recently, withdrawal is increasing and indications are that the level is again falling.



Tapping the waters of the Denver Basin

The groundwater of the Denver Basin is an essential and vital resource for the metro area, particularly those living in southeast regions of the basin. It is the sole source of water for those communities and the fear of running out is of great concern. Here's a snapshot of the Denver Basin.



increased demand on the aquifer," he said.

The problem is this: The lower water levels drop, the harder it is to pull water out of the aquifers as quickly without drilling additional wells or dropping water pumps deeper - all of which costs money.

Dropping levels also cause a reduction of the natural underground pressure that helps boost water up through those wells.

South metro area depends on basin of 4 aquifers

The problem potentially affects any of the estimated 170,000 people in the south metro area who wash their hands, dishes and dogs with water drawn from wells, according to Peter Binney, an engineer with the Denver consulting engineering company Montgomery Watson.

The source of their water is the Denver Basin, a massive underground storage reservoir. It covers 6,700 square miles and reaches from Greeley south to Colorado Springs and from Limon west to the Dakota Hogback in Jefferson County.

The basin is made up of four aquifers - or water-bearing layers of permeable rock, sand or gravel - known as the Dawson, Denver, Arapahoe and Laramie-Fox Hills.

They are arranged like a stack of bowls, with the Dawson being the most shallow aquifer and the Laramie-Fox Hills the deepest.

About 2 million people live above the area covered by the Denver Basin, but the households that rely on it most are in Arapahoe and Douglas counties, Binney said.

About 70 percent of the estimated 220,000 residents in the south metro area get their water from a private residential well, a municipal water provider like Castle Rock or a water and sanitation district, he said.

Just about all the rest of the metro area, including Denver and

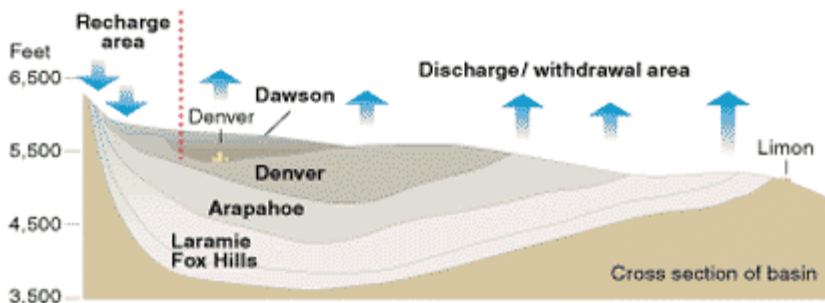
Tapping the waters of the Denver Basin

The groundwater of the Denver Basin is an essential and vital resource for the metro area, particularly those living in southeast regions of the basin. It is the sole source of water for those communities and the fear of running out is of great concern. Here's a snapshot of the Denver Basin.



Recharge, discharge, withdrawal

Recharge is the process that replenishes groundwater. A recharge area is where water from precipitation is transmitted to an aquifer. In the Denver Basin nearly all recharge occurs in the foothills. Discharge areas are the opposite of recharge areas. They are the locations where groundwater leaves the aquifer, rivers, streams, springs, etc. Withdrawal from wells also contribute to discharge. In the Denver Basin withdrawal greatly exceeds the recharge.



At the bottom

The metro area has a long history of water-level decline in wells. Some well owners have recently reported as much as a 30-foot per year decline in artesian water levels. That's likely true, but state hydrologists say that at current withdrawal rates there are still thousands of years worth of water in the Denver Basin.

Sources: Washington State Department of Ecology, Environment Canada, Popular Mechanics, USGS
The Denver Post/Peter Pauley

Boulder counties, uses surface water - streams and mountain snowmelt - which is regularly replenished.

About 53 million gallons of water are pumped from the Denver Basin every day. That's enough to cover Invesco Field at Mile High under 161 feet of water.

But only a fraction of that amount is replenished through rain and snow, which means the aquifers are being drained faster than they are being filled.

That pace will continue as the south metro population leaps closer to projections of 450,000 people by 2025 unless a renewable source of water is found, said Binney, who is investigating alternative surface-water sources for the region.

A drop in water levels is also causing the loss of artesian pressure - the natural pressure that helps boost water higher in wells, according to water engineers.

Pressure is created in an aquifer when the water level at the edges of each bowl-shaped formation sits higher than the water level at the center, said George VanSlyke, chief of geotechnical services at the state Division of Water Resources.

When a well penetrates an aquifer, pressure is relieved and water is forced up the well, making it easier to pump, he said. Artesian pressure is maintained as long as the water level at the edge of the basin is higher than the center, geologists say.

But as more wells are drilled to meet the demands of growth, that level will drop and artesian pressure eventually will be lost for good, water engineers say.

"Within the next 20 years, the artesian pressure is going to be gone over a large part of the basin, that whole I-25 corridor," said VanSlyke.

"Once you lose the artesian pressure completely, that's when your production rate would start to decline, not just the water level, but the actual rate in gpm (gallons per minute) starts to decline," VanSlyke said.

The number of wells and amount of energy needed to retrieve water from lower depths will increase, while the amount of water produced per minute will diminish, he said.

"The higher you have to lift it, the more electricity you have to use to get it out," said VanSlyke. "How many of these things can you drill and still be able to provide water at a cost people can afford?"

In Castle Rock, where more than 30 wells pump water from the Dawson, Denver and Arapahoe aquifers to households, town engineer Will Koger is seeing levels drop 15 to 30 feet per year.

As a result, Koger said, the water production rate has dropped 5 percent each year and the town is spending \$720,000 a year to make up for it by purchasing larger pumps and replacement wells and paying more for the electricity.

"After a while, you're pouring more and more money into well fields" to recover productivity, he said. "You could just continue ... but the cost would just skyrocket."

At full capacity, the town's well system can pump 12.1 million gallons per day. That rate has diminished by 605,000 gallons, he said.

Castle Rock officials want to get 50 percent of its water from surface water by 2020, Koger said. So far, that's just a wish.

"It's not really clear right now what we're going to do."

That's typical. Few of the water providers in the south metro area have a clear plan for obtaining renewable water over the next several decades. And they say they don't have enough water rights to the South Platte River or other streams to support the population on surface water alone.

The Parker Water and Sanitation District plans to build the 135-foot-high, 5,300-foot-long Rueter-Hess dam by 2005 to store water from Cherry Creek. And in Highlands Ranch, the Centennial Water and Sanitation District is already getting 85 to 90 percent of its water from surface streams and 10 percent from wells.

Most other providers, however, are relying on a proposal to link the south metro area to Denver Water's mountain supply.

Two years ago, Douglas County commissioners asked the Denver Water Board to participate in a study of whether it is possible and cost effective for Denver to sell the excess water that spills off its reservoirs to south metro customers.

A 40- to 50-mile pipeline would funnel excess snowmelt from Denver's mountain reservoirs to the Foothills Treatment Plant near Roxborough State Park and along C-470 and E-470.

The South Metropolitan Water Supply Board - made up of Douglas County, the Denver Water Board, 12 south metro water districts and municipal providers and the Colorado River Water Conservation District -

was formed in support of the two-year, \$1 million study that engineer Binney expects to finish next year.

It would be more cost effective for the south metro providers to work with Denver Water than to copy its system of reservoirs, treatment plants and tunnels, said Douglas County Commissioner James Sullivan, who also heads the Douglas County Water Authority.

But not everyone is eager to see that pipeline snaking through the south metro area. Denver Water and the Colorado River district, which represents Western Slope residents who use the Dillon Reservoir for recreation and domestic water, are concerned about how that plan would impact their lifestyle.

Alternatives to pipeline from Western Slope sought

"They want to make sure that reservoir won't be dry," said Eric Kuhn, manager of the Colorado River district.

Kuhn said he wants the south metro area to explore other alternatives, such as reusing groundwater or storing water from the South Platte River underground for use in dry years, before looking to the Western Slope.

"I don't know that this has to be done," Kuhn said of the pipeline proposal. But he agrees a renewable water source should be secured before it becomes a crisis.

"If we do nothing for 30 years and you continue to deplete the aquifer and you get a town like Parker or Castle Rock that might be triple the size, there's going to be fairly significant political pressure to solve that in a way that might cause problems for the Western Slope."

Sullivan said the plan will do no harm because south metro providers would only take unused spilloff water. "We want to pay them for this excess water. ... How can that harm them?"

David Little, manager of water resources for the Denver Water Board, said members are "real nervous" about the proposal.

Water rights, he noted, are among the legal issues to be addressed. "More people are standing in line to use that water than there is water," he said.

Water providers in the south metro area could apply for rights to mountain water, but even then, their access to the water would be secondary to those with senior rights, VanSlyke said. And just about "all the water in the South Platte is spoken for."

The pipeline proposal needs approval from the state, the Denver Water Board and Western Slope authorities to move forward. Should it clear those hurdles, it would take a minimum of six years to get to renewable water, Binney said.

Several districts are relying on it.

"If we don't get that water from this plan, we're going to have to drill additional wells to keep up with production, and that's definitely going to increase our cost," said Pat Mulhern, manager of the Inverness Water and Sanitation District.

He's seeing water levels drop 30 feet per year under his district, which serves 18,000 people south of the Denver Tech Center.

Groundwater is a "great resource," Mulhern said. "The bad thing is that eventually, we're going to deplete it and then what do we do?"

Frank Jaeger, manager for Parker Water and Sanitation, said that "it would be shortsighted for me to wait" on the outcome of a study to get started on finding surface water.

"I've got houses going up at a rate of 1,200 a year," he said.

Jaeger is focused on building the Rueter-Hess reservoir to supplement the town's groundwater.

But that project has been 20 years in the making and is far from governmental approval.

Of all the groundwater providers in Douglas County, Centennial Water and Sanitation District appears to be in the best position.

Centennial turned to surface water in 1979 because there wasn't enough groundwater to support Highlands Ranch, said manager John Hendrick.

Centennial acquired water rights to the South Platte River and purchased surplus water rights allowing it to collect spilloff from Englewood's McLellan Reservoir.

Centennial also operates about 30 wells. But it replaces the water it draws from the aquifers beneath Highlands Ranch by "injecting" treated surface water back into the wells.

"When there's a drought, we've got water in the aquifer that doesn't evaporate out and it's a good safe way to store water," he said.

"We can put it away for a nonrainy day."

All contents Copyright 2001 The Denver Post or other copyright holders. All rights reserved. This material may not be published, broadcast, rewritten or redistributed for any commercial purpose.