Aquifer Storage: Economic Benefits and Costs

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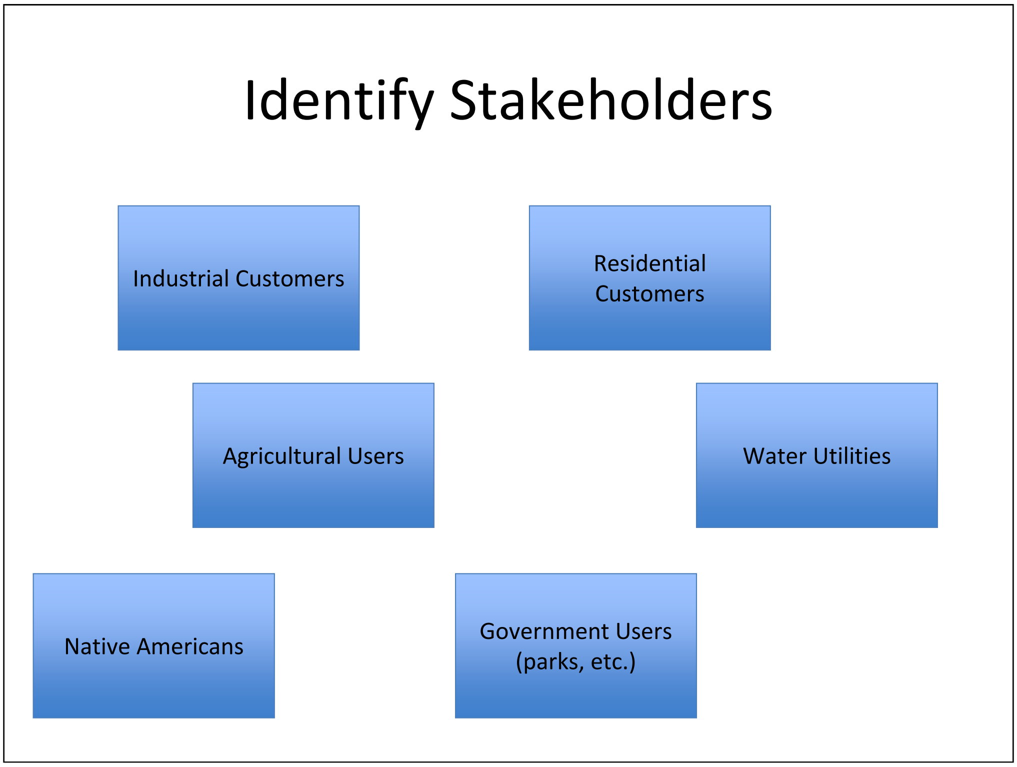
These represent some of the images I think of when considering water in the Albuquerque area.

Darn Economists Want to Monetize the Value of Water
Very difficult task to put monetary values on life
Since water is life, the task is equally daunting
If we can pull it off, assigning monetary values to the social benefits and costs of water management gives us a useful tool for weighing policy choices

Where are economists coming from?
Cost Benefit Analysis
-totaling up all of the costs and benefits of a particular project for a group or groups of **stakeholders**
-benefits from direct use and indirect use of a resource or public good (consumption of water, beauty of water in a stream or river)
-direct costs, indirect costs/opportunity costs
-all of these costs and benefits need to be put into a standard unit of measure—dollar values seem to do the trick



The first step, then, is identifying or categorizing the groups of people/or institutions that should be considered in our analysis of aquifer storage. Perhaps not a limited list, but industrial users, residential users, agricultural users, water utilities, native americans, and government users. We might alternatively break these down into geographical locations- north east heights, westside, rio rancho, north and south valley, etc. The issues facing residents of NE Albuquerque could be framed differently than users in the valley (due to levels of the aquifer, proximity to surface sources, use patterns…)

Another big part of the discussion naturally includes future generations.

Future Generations

Grandchildren's grandchildren

How we value those future generations can have a big impact on the result of our cost benefit analysis

Water Storage in the Aquifer

<u>Primary Benefits:</u>

-Access to water in times of high demand that we otherwise would not have

-Storing water that would otherwise evaporate from a reservoir (or escape as runoff)

-Easier access to water when it is nearer to the surface—reduces pumping costs

-More sustainable supply of water that is available for future generations

(this benefit level depends on what value we place on future generations)

Potential Indirect Benefits include aesthetics of water in arroyos & irrigation canals when it is on its way to be rechared.
Potential avoidance of subsidence (although not reported to be as big of an issue here as it is in other places)
Increased property values from a longer term availability of water

I am sure there are other benefits we could add to this list.

Water Production in Context of Artificial Recharge

- Recharge benefits us by keeping pumping costs lower
- Recharge benefits us from diminishing the costs of acquiring more water, particularly if we can reuse wastewater, and store water in the aquifer

Pumping water from the aquifer is one of the main drivers of the cost of production—recharge diminishes those costs, as the aquifer level is maintained or increased.

Purchasing more water rights (from agriculture or elsewhere)

Of course, this leads us to our explicit recharge costs

Explicit Recharge Costs

- Pumping to the recharge site
- Purifying water
- Managing the site
- Pumps used for injection
- Purchase of water rights
- Buying/leasing land that is suitable for recharge
- Conversion of surfaces that allow for seepage (many arroyos are made of concrete)

There are definite costs that need to be taken into consideration when choosing a recharge technique. These will add to the overall costs of production

Implicit Costs

- Lower river flows, when water is shifted to storage.
- Lower levels at state reservoirs
- Diminishing of agriculture in the area
- Conversion of agriculture practices to different crops, dry land agriculture

Additional costs that may need to be considered. When water is shifted to storage, there are lower river flows
State reservoirs are lowered, which may also impact our net benefits.
Diminishing of agriculture, as water rights are purchased
May be necessary to shift agricultural practices—these all require resources, and are not pain free

Recharge vs. Less pumping

Question: Why not just consume all surface water, instead of storing it?

1) Demand (winter) is lower than quantity of available surface water
2) Cost of moving surface water to some locations may cost more than recharging the water elsewhere in the Albuquerque.

Something that I have been asked in the past is, why not just consume all of the available surface water---completely eliminate pumping. That also would decrease depletion of the aquifer. Well, that may be true. But if what is available in surface water is higher than what is being pumped, it does make sense to store it. This probably will not last forever, as demand is growing.

Also, the cost of moving surface water to some locations may cost more than recharging the water elsewhere in the Albuquerque.
Those areas may be more suited for pumping only, leaving more water to be recharged elsewhere.

Seepage, percolation

- Less capital intensive
- Potentially fewer purification needs
- May be able to use existing infrastructure (agriculture ditches, arroyos)
- If aesthetics are taken into consideration, this may be a more viable option
- May require land purchases/leases

When looking at the different types of recharge available, we may see different issues. With the seepage method, it is likely to be less capital intensive. We might be able to let nature do some of the purification, but that could be a tough sell to the public. Existing infrastructure—agricultural ditches/arroyos. There may be a cost of leasing or buying land in areas where recharge could be most beneficial. Some of these methods may be aesthetically pleasing, and have spin-off benefits.

Storage through injection

- Water purification needs (no reliance on natural purification)
- Assist to gravity
- Adequate water rights, ensuring municipalities meet requirements for in stream flow.
- Direct injection of purified wastewater more cost effective as supplies decrease, and when future generations are given more value.

More direct storage will require greater purification needs, giving us higher costs. Requires pumping, since we are not just letting gravity do the work. Both methods require obtaining adequate water rights. I would suspect direct injection of purified wastewater will be more cost effective as supplies of water decrease in the future. Of course that requires much more purification. In those areas that are out of reach of the surface water flows, injection will probably become more cost effective sooner.

Finally, I have a few costs to share, to get an idea of what we are talking about cost wise.

Activity	Cost	Notes
Current cost of pumped water in Albuquerque	$1110 per ac.-ft. (avg. cost)	Includes wastewater treatment
Current costs of delivering SJC diversion water	$740 per ac.-ft. (avg. cost)	Including wastewater treatment
Recharge estimates, Utah Water Resources Division	$190-$570 per ac. ft.	Depends on whether direct injection or passive methods used
Recharge estimates in Australia	$68--$172 per ac. ft.	Passive methods
Las Vegas, NV	$250 per ac. ft	Injection through wells (info from 2002)

Do those costs outweigh the benefits? Some of the modeling I have done suggest it might indeed make sense, for certain locations.