Water Resources

**CAP Disclosed**

*Leo Lin and Brandon M. Azvedo*

The CAP (Central Arizona Project) is the manager of Arizona’s single largest renewable water supply. Officially named the Central Arizona Water Conservation District (CAWCD), CAP is an organization aimed at securing the water supplies for Arizona in many aspects. Delivering its full allocation of Colorado River water to central Arizona efficiently is one of the main missions that CAP strives to accomplish.

Furthermore, conserving Arizona’s groundwater supplies by the importation of surface water and a series of recharge and other peripheral projects mark the goals of this organization. Among these “peripheral projects” are flood control, education, recreation, and fish and wildlife benefits.

CAP is generally able to deliver in the vicinity of 1.5 to 1.8 million acre-feet of Colorado River water per year to Maricopa, Pima, and Pinal counties in Arizona. CAP’s infrastructures include a 335-mile long system of aqueducts, tunnels, pumping plants, and pipelines. Along with the awesome system of water-transportation is an intricate link of communications that connects all of the major stations and components of the project. Some of the water goes to agriculture, some to cities and some for recharge.

What's this deal with the recharge? Well, it is as simple as a rudimentary math problem: Ground water is being extracted at a higher rate than it is being replenished. Like any other renewable resource, it would not be considered "renewable" if the “tragedy of the commons” were manifested. At the current rate of exploitation, the groundwater in the Tucson Basin is decreasing in volume, thereby making Tucson and other surrounding areas “sink” as a result.

Furthermore, concerns of the future water supplies in Arizona are immediate, corresponding with the conflicts of the “hydro-politics” with California and Nevada, the State and the Country, and even the State and its citizens.

The site chosen for the visit and evaluation was the Twin Peaks Pumping Plant in Marana, Arizona; this is one of the many pumping plants along the aqueduct of the CAP. The aqueduct system works (flows) by taking advantage of gravity, utilizing the principle of potential
energy. The pumping stations lift or pump the water to higher ground and let it flow downstream to the next pumping station.

The Twin Peaks Pumping Plant contains 6 vertical turbines that lift the water about 82 ft; three of which are electrically driven, 54", 2000 Hp turbines that are each paired with their individual sums. The other three are 36", 750 Hp turbines that share a single sum. Generally, only one or two pumps would be running at any given time due to the ability of each to handle large quantities of water; also, there is not currently a big demand for the CAP water downstream to the pumping station in the Tucson area.

At the onset of the visit, Bob Bradford, engineer and supervisor at the plant, introduced himself. Although most of his presentation was of the technical/engineering nature, there was still room to get a feel for what was going on. Many points were discussed; among them were the physical dimensions and features of the plant, their functions, maintenance, means of keeping the plant running, and objectives.

The equipment sure were impressive. However, some important issues were neglected. For example, why are there so many “misunderstandings” with the public about CAP? Are these simply communication problems, or are there things CAP is trying to hide? What is being done to address the problems that CAP is having? And what is the big picture? From these questions arises both sympathy and doubts. Who hasn’t screwed up due to the lack of skilled communication or bad management? But at the same time, simply the absence of communication suggests problems internal and external.

Rich Wiersma, Executive Vice-President of the Citizens Alliance for Water Security (The CAWS) was kind enough to give valuable input to the whole issue. The CAWS is a Tucson based ratepayer’s advocacy group. CAWS is currently focussing on helping solve the water problems in the Tucson Area. Although the organization is a proponent of the CAP, they too, are often viewed otherwise. “We believe, while CAP water is available, that we should use every available drop. However, with award winning groundwater in our aquifer, we do not believe that people should have to drink chemically treated ditch water while cotton plants, pecan trees, golf courses, and mines suck up the precious ground water,” says Wiersma. Moreover, he addresses the issue with the Water Consumer Protection Act (WCPA), which the CAWS helped pass in 1995:

“Our WCPA set a water quality standard to insure that the public gets the best water. The WCPA assures that people are not, once again, going to get stuck with an expensive, third class water supply that undermines their health and corrodes their household plumbing and water related appliances. We have been able to find no other community in the U.S. which has opted off good quality groundwater for chemically treated surface water. We don’t believe that Tucson should, either. In short, our group’s goal is to keep chemicals out of our water supply and provide a secure domestic supply at the lowest possible price.”

In other words, while supporters of the CAP, they want what’s best for Tucson and Arizona as a whole: a safe and balanced system of water utilization. It is also clear that the CAWS have strict limitations and standards that seemingly oppose the CAP.

The smart thing to do now is to give Tucson time to awaken and recover from its nightmare, and not rush into things, again. Moreover, it wouldn’t be wise to start serving CAP water to the households. Currently, CAP water is mainly used for agriculture and artificial recharge, and there’s no sense in changing that.

When Tucson Water, CAP, and the rest of Tucson are ready to take it one (planned) step at a time, we’ll know it’s time to move on to bigger and better things. When that time comes, it’s equally important to be careful. For example, set up pilot neighborhoods and monitor with extreme caution. Hey, if California is using every drop of
Colorado River water they can get, why shouldn't we?

Furthermore, it’s all too clear that good water treatment, along with proper planning and intercommunication with the public, would make surface water more than drinkable.

Even from a laymen’s viewpoint, the chain of events that occurred just a few years ago and opposing propaganda, it’s no surprise that the majority of Tucson’s citizens are appalled at the first mention of “CAP.” There’s no doubt that CAP and associated organizations’ operations aren’t perfect or perfectly planned.

What’s more important, though, is not to sit and dwell on the failures of the past, but rather work together to reach a collective goal. As it is evident, CAP has a bright vision, and an equally bright future, now it’s up to the rest of the community to work with them to obtain our shared dream: H₂O.

**METROpolitan**

*Leo Lin and Brittany D. Finney*

Within a steadily growing city, there is a desperate need. The need is a peace. The peace is from the manifestation of a vision. The vision is a solution. The (optimistic) solution is that, one-day, in this infant metropolis, water would be balanced between supply, demand, politics, and nature. Does this sound familiar, by any chance? Yes, Tucson is in such a situation, and one hero has come to the rescue: Metro.

The Metropolitan Domestic Water Improvement District, or Metro for short, is a Tucson based, water distributing, service organization. Established in 1992, it now provides water to roughly 14,000 customers representing 40,000 (10−15%) people in the northwest region of metropolitan Tucson, Arizona.

The Avra Valley Recharge Project is the means by which Metro is helping reach the vision. This is a replenishment program that recharges untreated Central Arizona Project, CAP, water into the Lower Santa Cruz River and eventually into the Cañada Del Oro Basin.

Now past its pilot phase, the Avra Valley Recharge Project, located near the Avra Valley Airport, serves as a demonstration and example of a successful recharge project. It is now also “going on-line as the first operational, full-scale recharge project in Pima County.”

With this project, Metro is able to recharge about 11,000 acre feet of CAP water each year. Remarkably, the water that it recharged in 1996 and 1997 equaled approximately half the groundwater that it pumped out in its service area, about 18 miles to the east, during that time. Several projects have followed the success of this one, and many more are in store for the future.

One of the Metro representatives, Mike Block, explained the goals and ideals of the organization. He discussed largely, the physical aspects of the project, and its endowments. Furthermore, detailed data of the history of Tucson’s water use, Metro’s history and performance, and other statistical data were provided as reference. The concepts and drawbacks of the Active Management Area, AMA-wide accounting system of pumping credits were also mentioned.

Other organizations involved include Central Arizona Water Conservation District (CAWCP, aka CAP) and BKW farms. The project itself sits and operates on BKW’s land, and the BKW farms helped build, and now maintains much of the infrastructure. BKW farms is also implementing a part of an indirect recharge project with the City of Tucson, or Tucson Water; the water pumping credits earned by that project by BKW farms go towards the City of Tucson.

Direct or indirect, there are major flaws with the system of pumping credits for the Tucson Active Management Area (TAMA). Blamelessly, the current recharge sites are located in areas of little or no water pumping. As if past and current pumping of Tucson’s Central Well-field and Metro’s well-field areas aren’t enough, there are no laws prohibiting the extraction of water from those central, subsidence-prone areas. This is
not logical, because one of the major concerns is this exact issue.

Looking strictly at the basin-wide figures, there is definite progress; but in the big picture, it’s clear that a disservice is being done. Areas of little problem are being filled with water, while the areas of real concern, where aquifers are being over-pumped, are jeopardized because they are now potentially subject to more pumping with earned credits.

Yes, the actual process of water infiltration into the aquifer is effective, but what about the negative impacts (chemicals, etc.) and neglected components (basin balance)? Are they simply taken out of the picture? They must be addressed to give the public some answers. An Environmental Scientist at the University of Arizona proposed several intrinsic questions and insights challenging the organization, the projects, and their ideals:

"Why would a water provider recharge water in an area of known contamination? Why would a water provider recharge water in an area that has a number of landfills? Why is a water provider putting water of less quality in the ground when they are taking relatively good potable water out of the ground in another basin to water golf courses and landscaping areas? If there is truly an impending "water shortage", then why would a water provider continue to lay water lines to new or potential housing developments? Are water providers "crying wolf" unnecessarily and are they just "wolves in sheep's clothing"? If the public expresses through the political process that they do not want to drink CAP water in its current chemical state then why would a water provider continue to spend a lot of money recharging water that the public does not want to drink? Recharge is a very "fashionable" alternative option right now, however, is it truly what is needed? Wouldn't the money be better spent treating CAP water to make it more palatable and acceptable to the public? Recharging CAP water will not change the overall chemical nature of the water, so will it be "garbage in and garbage out"? If there is truly an impending water crisis, where will they get ground water that will be of suitable quality to blend with the recharged CAP? At some point will water providers have to treat CAP water anyway? So, why the costly middle step? Is the recharge project a nefarious subterfuge to dupe the public in order to pander to the economic interests of a select few?"

These inquiries are at the core of major arguments. It is therefore important to identify and attempt to search for explanations, if not resolutions. The “Hero,” along with other organizations, is one searching for the answers; but as with any plan, there are pros and cons. New knowledge of water recharge and water management is acquired each day, and robust teamwork is being built. But while the vision is clear, politics and physical bounds are hindering it. It is also apparent that progress is being made, but just as clearly, trouble is being created. Would it require more effort to deal with these new problems somewhere down the line?

Nevertheless, only time will reveal the overall effectiveness, shortcomings, and delinquencies (if any) of the organizations and projects supposedly helping out with our crises. It would be preferable, however, to halt any potential disasters before it’s too late, and they strike. In the meantime, Metro is doing its best to be a part of the solution and not the problem of bringing a balance to water in the Tucson Basin.

Our water supply is near empty!
AWBA: Always Wanting To Better Arizona

Carine M. Mininni and Brandon M. Azevedo

Arizona has had many advances within the past decades regarding solutions for our potentially very serious water problems. Arizona has begun to use Central Arizona Project (CAP) water for which the State has a yearly allotment of water from the Colorado River. Other states also receive water from the Colorado River such as California and Nevada.

Due to chemical problems a few years back, Tucson no longer receives CAP water in homes or businesses. But, what lies ahead for Tucson in the future if we continue to expand and do not use our allotment of CAP water and we continue to deplete our groundwater? Empty water basins. Thankfully the Arizona Water Banking Authority, AWBA, was established in 1996 to help solve our state's water problem by finding ways to use, save and store our CAP portion.

Until the AWBA was created, we would not have used our full allocation of water for thirty years, and our unused water would go to California. However, this organization is solving this problem, primarily by storing CAP water in underground aquifers (direct recharge) or delivering it to irrigation districts (indirect recharge). These irrigation districts, if not for the banking authority, would pump groundwater in large amounts too precious to be lost.

Water banking has several major benefits: drought protection, Indian water rights settlements, statewide benefits, and interstate water transfers. The AWBA protects us from droughts not only in our aquifers, but also if a drought were to occur in the Colorado River in the future. The Banking Authority may try to solve Indian water issues by supplying them with recharge credits in which they can redeem for water.

Cities that are in Arizona along the Colorado River, yet not receiving CAP water, can benefit by storing water for the AWBA and redeeming the water credits. While Arizona stores water for the other states not using all their Colorado River allotments, we can replenish our underground aquifers.

Water is not a common thing in the desert, the place of many of our homes, so we cannot take it for granted. We must think of it as a valuable commodity, without which we would not live, instead of a renewable resource. As the levels in the aquifers fall, it becomes more and more difficult to bring them back to their original levels.

Although one day in the very far future, the desert may not have any water, the AWBA is doing everything it can now to ensure our city and state a supply of water for many years to come.

Tucson's Water Supply Saga Continues with CAVSARP

Jeff P. Cady

A city of 800,000 people is still relying on groundwater. A rapidly growing population depends on 12 inches of rain per year to replenish their aquifer system. Welcome to Tucson, Arizona. Yes, it's a desert.

The problem of the shortage of water, although never solved, has been recognized by Tucsonans for hundreds of years. Hohokam Indians diverted surface water from the Santa Cruz River for irrigation as early as 1150. Groundwater use was first practiced from settlers in the 1880s. Recently, an effort to slow the overdraft of Tucson's most valuable resource was made when Colorado River water
arrived via the Central Arizona Project (CAP) aqueduct system in 1991. The project, which cost approximately $3.44 billion dollars, channels the water 335 miles to Tucson.

The CAP water, however, is not delivered to the homes of Tucson's citizens. **Tucson Water**, the city's primary water supplier, made a severe error by delivering the water without testing or thinking the process through. When the water was delivered into the city's main water system, the iron pipes corroded. The result was smelly, brownish water. The people of Tucson were incredibly displeased and thus voted to pass Proposition 200 in 1995. The proposition banned the delivery of CAP water into Tucson homes.

Tucson Water was forced to return to the drawing boards. Their solution: the Central Arva Valley Storage and Recovery Project or CAVSARP. The 22,500 acres of land in the Avra Valley, according to Tucson Water Public Information Specialist Cate Bradley, was originally farm land bought in the 1970's for the water below it. After Proposition 200 passed, however, Tucson Water had a different plan.

CAVSARP was created in order to get around Prop 200. The idea is to recharge large amounts CAP water into the Arva Valley aquifer. Recovery wells will then pull the water back out of the aquifer. The water will then be mixed with groundwater at an approximate 50/50 ratio and delivered to Tucson homes.

CAVSARP is still in its trial stage. Each year, 15,000 acre ft. of water is being recharged into 3 basins. Studies are being conducted about the effectiveness of the recharge and the direction flow of the water once recharged (the water is estimated to move about 250 horizontal ft. per year). If all goes as planned, recovery wells will soon be drilled and the delivery of the mixed water will take place.

Bradley admits the process is complicated, "The way we're doing things now is make work" she stated. When asked why Tucson Water did not originally test the effects of delivering CAP water to Tucson homes, Bradley commented on how "we had all the answers, but when you overlay politics onto technology, reason doesn't always float to the top".

CAVSARP has already attracted strong opposition. The **Pure Water Coalition** and **The Citizens Water Advisory Committee**, two organizations that aided the developments of Prop 200, see recharge into the Central Well Field as a more logical choice. Mr. Rich Wiersma, a member of both organizations, feels that "streambed recharge in the Central Well Field would provide ratepayers with higher quality water without the threat of sucking the Arva Valley aquifer dry." Mr. Jerry Juliani, also of the Pure Water Coalition, states "CAVSARP cannot meet the standard of the WCPA (Water Consumer Protection act or Prop 200)".

The two recognize CAVSARP as the next political pawn of Tucson Water. They view Tucson Water as an organization, which is controlled by and suits the need of the speculator/developer sector and not the consumer.

Will CAVSARP meet Tucson's water needs? Only time will tell. Nonetheless, the Tucson water saga continues. Let us hope that the reasons of science and technology will soon prevail over that of politics, or we may eventually have willingly created America's largest ghost town.

**Could Tucson Soon be a Ghost Town?**

*Jennifer A. Shelledy*

Tucson is in some serious trouble. It is over-using its groundwater. If growth continues, the city will have no water unless the people can learn accept CAP water instead.

Many people in Tucson are against CAP water due to problems when it was first introduced in the early 1990's. Tucson Water says that those problems are fixed. The Central Avra Valley Storage and
Water Resources

Recovery Project (CAVSARP) is attempting to make CAP water quality higher by recharging it and then blending it with groundwater in hopes Tucson will accept this as a source of drinking water. Tucson must switch from only drinking groundwater and begin to use its CAP allocation or it will become a ghost town.

CAVSARP is currently putting forth quite an effort to ensure Tucson does not run out of water in the near future. Tucson Water has about 22,500 acres of land in which they plan to recharge precious $H_2O$. This plan, however, is not new. The Central Arizona Project canal was planned all the way back in 1920. It was known, even back then, that eventually there would be a water shortage in Tucson.

The CAP canal was planned through the Bureau of Reclamation’s. Monies were first allocated by the Federal Government in the 1940’s for this project. Starting construction in the 1970’s, this canal developed into a source of water for agriculture, however, it was a lot more expensive to use than normal groundwater. This made the new source unappealing to the farmers who could use it. Finally, in 1992, the canal to Tucson was finished and was located on the West Side of the Tucson Mountains.

CAVSARP is currently pumping CAP water from this canal and using recharge basins to put it into the ground so that it will mix with the groundwater in order to improve its water quality. Although it is an expensive and somewhat tedious process, water is recharged at a rate of about one foot per day.

Hopefully soon, there will be a way to raise the quality of the CAP water so it can be used and let the groundwater replenish itself naturally. Until then, Tucson citizens should thank CAVSRP for making their groundwater lasts longer than it normally would and keeping it from becoming a ghost town.

Proposition 200 is a Complex Piece of Tucson's Water Puzzle

Brittany D. Finney and Jeff P. Cady

The Ground Water Users Advisory Council (GUAC) is a group of citizens that works to solve the water shortage problem in the Tucson Basin. The organization was founded as a result of President Carter’s threats to cease funding to the CAP. The Arizona State Legislature responded to Carter by passing the Ground Water Management Act of 1980. The act pronounced there be an advisory council for all areas with excessive water overdrafts. The GUAC we visited is the advisory council to the Tucson Active Management Area (TAMA).

The goal of GUAC is to achieve a safe water yield or, in other words, to balance the water that is going into the ground with the water that is being drawn out. GUAC hopes to achieve this balance by the year 2025.

In their effort to reach a safe yield, GUAC has come across considerable legal problems; the biggest obstacle being Proposition 200. Prop 200 was passed after water users in Tucson were beginning to receive water from the Colorado River via the Central Arizona Project (CAP) aqueduct. The people were so disgusted with the quality of the water that they came together to pass Prop 200. The proposition stated that CAP water could not be directly pumped into peoples' houses.

The quality of CAP water, unfortunately, was not the problem. The pipes that the water was transported in corroded when the CAP water was introduced. CAP water had higher levels of residual chlorine and a different pH than groundwater. Therefore, the new type of water corroded the calcium and rust deposits off the pipes. The result was brown, smelly water.

Prop 200 created a huge problem to GUAC. The original plan of direct CAP delivery had failed. Thus, GUAC has had a tough time meeting the safe yield prospective because they had to think of new ways to distribute the water. After much thought, GUAC decided that recharging...
the CAP water was the only practical option. They also concluded that the recharging would be more effective in the Arva Valley Well Field (West of the Tucson Mountains) instead of the Central Well Field. The recharged CAP water would be mixed with groundwater to create a blend satisfactory to Prop 200.

The major problem with Arva Valley recharge is the multi-million dollar cost of transferring the water over the Tucson mountains and into the homes of Tucson citizens.

Proposition 200 has caused many problems to solving Tucson's water puzzle. The head of the Department of Water Resources states, "Conservation will not do it (balance Tucson's water deficit) alone." Next time Tucsonans vote, they must realize that CAP water is the solution to Tucson's water shortage.

Golf Courses and Pecan Fields Need More Water!

Jennifer A. Shelledy and Carine M. Mininni

Green Valley—a land of retirement filled with golf courses, pecan fields, mines, and of course, homes. What could be better, right? Well, as the groundwater shortage keeps growing in Southern Arizona, all this could disappear.

In order to make sure this doesn’t happen, the Upper Santa Cruz Water Users Group, USCWUG, decided to take action. In 1996, this group formed to work with State and Federal agencies and other water entities toward the goal of bringing surface water supplies to water providers and users south of the Central Arizona Project (CAP) canal terminus, which ends about six miles north of Green Valley. USCWUG did a study to find out the feasibility of pumping the CAP water south.

The first thing USCWUG did was to bring in an engineering consultant to conduct this study. Their primary investigation was to see who uses water, when, where, and why. Next, the engineering firm came up with a conceptual design to find out how much disturbance installing a pipeline would cause.

An optimal route was identified based on access, cost, flexibility, and compatibility. After they found the best route, they developed a primary design of how to deliver the water there. Next, the USCWUG did a financial feasibility analysis to figure out the total cost of delivering the water. The last task in this study was to write a study report based on their findings. In this report, many recommendations were made.

A recommended pipeline route was formed, bringing water down in three stages. The only problem with pumping and using CAP water is that it is expensive. It would cost users no less than $110 per acre-foot for CAP water compared to $50 per acre-foot for groundwater. The first of the above mentioned stages would cost $23 million. To add phase two would bump the total to $98 million and to bring CAP water to all three phases would cost $116 million. The people who can use and benefit from using CAP water can’t afford it.

Therefore, USCWUG has to do some things to try to make everything happen. First, they have to identify project sponsors. This is to get the money necessary for everything. They also need to take advantage of conveyance system capacity, refine system design, investigate artificial recharge, pursue required approvals for tie-in to CAP reach 6 pipeline, and track changing conditions. The most important aspect, however, is to get the needed financial backing to jump-start the program.

USCWUG is looking to the state to fund and/or provide incentives to sponsors to provide the water. If anyone is interested in sponsoring this program, please call Alan Forest at (520)625-8409. Your help will let them preserve the wonderful golf courses and pecan fields and save some of our precious groundwater.
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