Prescott AMA Fourth Management Plan Review Comments

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Chapter 1, 1.1 Introduction (Safe Yield)

"Achievement of safe-yield requires that the amount of groundwater pumped from the AMA annually is balanced by an equal or greater amount of water naturally or artificially recharged. Groundwater withdrawals in excess of natural and artificial recharge lead to an overdraft of the groundwater basins in the AMA."

The term safe-yield is referenced not only in the above sentence but throughout the report. This definition of safe-yield appears to exclude natural discharges which the management plan in Chapter 2 describes as being a part of net recharge. Were safe-yield and net recharge intended to have the same conceptual meaning or are they two different concepts? With natural discharges included in the aquifer water balance, overdraft could be occurring with groundwater withdrawals (pumping) less than the natural and artificial recharge but the aquifer would be technically in safe yield. If safe yield and net recharge are two different concepts then it would be beneficial to specifically state so in this management plan.

The issue of what safe yield actually means was debated after the Director of ADWR declared the PrAMA not in safe yield in 1998/99.

Chapter 2, 2.5.2 Net Recharge

"Groundwater recharge is an important component of the water budget of the PRAMA. When groundwater recharge exceeds groundwater pumping in an area, water levels will rise. For the purposes of this discussion, recharge is comprised of the following natural and incidental components: (1) mountain front recharge, (2) stream channel recharge, (3) groundwater underflow (outflow), (4) groundwater discharge, (5) riparian evapotranspiration (ET), (6) canal recharge and (7) agricultural return flow (agricultural recharge)."

See comments above under Chapter 1, 1.1 Introduction (Safe Yield).

Chapter 2, Table 2-2 Components of Net Recharge PRAMA 1985-2010, Footnote

"7 Net Recharge = All Recharge Components - All Discharge Components"

See comment above under Chapter 1, 1.1 Introduction (Safe Yield).

Chapter 11, 11.3 Projected Natural Supply

"Net natural recharge is the sum of stream channel recharge, mountain front recharge and groundwater inflows minus groundwater outflow."

See comment above under Chapter 1, 1.1 Introduction (Safe Yield).

Chapter 11, 11.4.1 Determining Factors

"In addition to the concept of importing groundwater from the Big Chino basin, some have supported the idea of macro water harvesting as a method of augmenting the water supply in the PRAMA. The idea is based on harvesting stormwater at large-scale facilities to be used for AWS purposes. In addition to impervious surfaces, water could be captured from saturated soil via subsurface drainage systems. There may be possible legal obstacles to water harvesting. ADWR currently recognizes three types of water that qualify for either long term or short term recharge credits. They are reclaimed water, Central Arizona Project (CAP) water from the Colorado River, and appropriated surface water. Based on discussions with ADWR staff, there is no current mechanism in statute that describes methods for obtaining recharge credits for unappropriated surface waters. More information is needed to evaluate the water management and hydrologic impacts of macro water harvesting."

I appreciate that macro-rainwater harvesting was referenced in this MP. However, the thinking should not always be about recharge credits for just future water demands but rather also giving a "cut to the aquifer". What this really means is replacing the groundwater mined by existing water users with harvested water that otherwise would have been lost to evaporation. This would create a real physical water mass balance in the aquifer to prevent future problems associated with groundwater depletion.

Chapter 11, 11.5 Conclusions

"Based on the projections included in this chapter, the PRAMA can achieve safe-yield by 2025, but the period of time for which the AMA can maintain safe-yield will depend on choices related to conservation, importation, infrastructure construction and water management strategies."

Safe-yield is referenced in this conclusion (also in Chapter 12 conclusion) but there is no mention of creating a net recharge of zero. If these concepts are the same then referencing net recharge is not necessary. If they are different, then we are setting a goal of potentially still depleting the aquifers until the natural discharge is eliminated by groundwater level and pressure head reductions.

Chapter 12, 2.2.5 Limits on Use of Surface Water Supplies

"Prescott has been recharging water from the lakes; however, this is complicated and restricted by a court ordered stipulation between CVID and SRP that precludes recharge from the lakes prior to April 1 or after November 30, leaving only a 90 day window for recharge."

With the dates given it appears the open window for recharge from the lakes would be 8 months while the closed window would be 4 months.

Chapter 12, 12.3 Possible Solutions & 12.5 Conclusion (Importation of Groundwater From the Big Chino)

"ADWR will work with the regulated community as well as others within the PRAMA, to identify issues and develop and implement solutions to water management problems as well as craft a cohesive water management strategy for the entire AMA. Such a strategy would likely include the following components: .....Importation of groundwater from the Big Chino Subbasin"

"It is possible for PRAMA to achieve safe-yield by 2025, and safe yield can be maintained in PRAMA as far into the future as about 2070 (at projected growth rates), but it will require importation and use of Big Chino groundwater, or some other supply..."

No matter what aquifer in the world is being analyzed, the laws of physics of conservation of mass and energy apply. In the case of the Big Chino, the unknowns are the physical boundaries of the various aquifer formations and the characteristics of these formations that affect water storage and conductivity. Groundwater pumped from any aquifer can only originate from either storage and/or from a change in the mass balance between recharge and natural discharge. The unknown physical boundaries and formation characteristics will determine how much of the pumped groundwater comes from storage and how much comes from a reduction in natural discharge relative to the time since start of pumping.

The current data collection being conducted for the Big Chino importation project is good because more will be learned about the Big Chino basin hydrology and hydrogeology. Various hypotheses of hydrogeologic conditions could be formulated and evaluated for applicability as this data is being collected. Various mitigation alternatives could also be explored with each hypothesis. If pumped Big Chino groundwater will primarily come from storage then minimal mitigation may be necessary. If pumped Big Chino groundwater will originate from reduction of natural discharges then it is not a question of if mitigation will be needed but when, where and how.

Can possible mitigation alternatives, such as enhanced recharge, be explored for various hydrogelogic hypotheses in the management plan?

<u>Appendix 12-1, Municipal Growth and Safe-Yield PRAMA (Sustainable Alternatives)</u>

"Water harvesting is complicated by surface water law and the adjudication process and may be administratively burdensome to manage."

In the Prescott area and much of the southwest the primary mass flux components of the hydrologic cycle are precipitation and evapotranspiration. Groundwater recharge and surface flow are relatively minimal in many areas. The concept behind macro-rainwater harvesting is to harvest runoff on a large scale that otherwise would have been lost to evaporation.

The Prescott AMA has approximately 20 square miles of impervious surfaces creating runoff that did not occur naturally before development. These impervious surfaces create relatively high runoff flows sometimes with excessive eroding velocities and contaminate loadings. Before the Willow and Watson reservoir dams were constructed, runoff from the Granite Creek and Willow Creek watersheds would flow out to the Little Chino basin where natural linear recharge would occur in the permeable reach of Granite Creek north of the Granite Dells. However, even with increased runoff from impervious surfaces, linear recharge in Granite Creek has become a rare event that only occurs during flood years because of the dams and legal constraints on surface water releases.

With macro-rainwater harvesting, runoff from impervious surfaces could be harvested and transported to areas such as Granite Creek to increase recharge. The preferred method of recharge would be linear

in-stream recharge that would create a geographically effective, longitudinal hydraulic ridge through the Little Chino basin This is opposed to the off-stream basin recharge used currently to acquire maximum recharge credits. However, this method has the adverse result of potentially limiting the geographical effectiveness of recharge due to restrictive hydraulic mounding. Increased recharge using water that otherwise would have been lost to evaporation could result in increased groundwater levels and aquifer discharges thus contributing to downstream surface flows.