

SUPERIOR COURT OF ARIZONA  
MARICOPA COUNTY

7/13/2017

CLERK OF THE COURT  
FORM V000

HONORABLE MARK H. BRAIN

L. Stogsdill  
Deputy

W-1, W-2, W-3, W-4 (Consolidated)

Contested Case No. W1-103

FILED: 7/13/2017

In Re: the General Adjudication  
of All Rights to Use Water in  
the Gila River System and Source

Findings of Fact and Conclusions of Law  
Regarding the Evidentiary Hearing held  
August 31 to September 3, 2015, in  
*In re the Revised Subflow Zone Delineation  
for the San Pedro River Watershed*

Order Entered re Pending Objections

**FINDINGS OF FACT AND CONCLUSIONS OF LAW**

**A. Procedural**

1. In 2009, the Arizona Department of Water Resources (“ADWR”) issued its Subflow Delineation Methodology Report for the San Pedro River Watershed that included maps of the subflow zone for the San Pedro River, the Babocomari River and Aravaipa Creek (“2009 Report”). It sent notice to all claimants in the San Pedro River Watershed and to persons listed on the Gila River Adjudication Court Approved mailing list informing them of the scope and availability of the 2009 Report. Interested parties submitted their objections to the 2009 report between July 31, 2009, and December 31, 2009. (Order, filed October 12, 2012, ¶2).
2. In its Order dated October 12, 2012 (“2012 Order”), the Court determined that ADWR had understated the extent of the saturated floodplain Holocene alluvium because it did not “appropriately take into account the fact that extensive alluvial fans cover much of the floodplain and adjacent basin fill.” 2012 Order, ¶9.

3. In April 2014, ADWR issued its “Revised Subflow Zone Delineation Report for the San Pedro River Watershed” (“2014 Report”) to delineate the full lateral extent of the floodplain Holocene alluvium for the San Pedro River, Babocomari River and Aravaipa Creek. The parties filed objections to the 2014 Report on October 1, 2014.
4. During a conference on November 6, 2014, the Court ordered ADWR to provide a supplemental subflow technical report by February 13, 2015. The parties filed comments and objections to ADWR’s February Supplement to the 2014 Report by April 2, 2015.
5. In May 2015, ADWR issued a revised Supplement to the 2014 Report (“the Supplement”).
6. Between August 31 and September 3, 2015, the Court held an evidentiary hearing to consider the objections to the 2014 Report and the Supplement. The Court heard testimony from Dr. Philip A. Pearthree, geologist employed by Arizona Geological Survey (“AZGS”), Jeff Inwood, a project analyst for ADWR, Dr. Peter Mock, a hydrologist and registered geologist retained by the Gila River Indian Community, Jon R. Ford, a registered geologist retained by Salt River Project Agricultural Improvement and Power District and Salt River Valley Water Users’ Association, Richard Burtell, hydrologist and registered geologist for Freeport Minerals Corporation, and William Victor, a hydrogeologist and registered geologist consulting for BHP Copper, Inc.
7. All parties have had a full and fair opportunity to submit objections to the 2014 Report and Supplement and its maps of the subflow zone in the San Pedro River Watershed.

#### **B. Standard for Defining Subflow**

1. Water known as subflow, as defined by the Court in *Maricopa County Mun. Water Conservation Dist. No. One v. Southwest Cotton Co.*, 39 Ariz. 65, 4 P.2d 369 (1931), is considered part of the surface stream and is therefore appropriable water under A.R.S. § 45-141. *In re the General Adjudication of All Rights to Use Water in the Gila River System and Source*, 198 Ariz. 330, 334, ¶5, 9 P.3d 1069, 1073 (2000) (“*Gila IV*”)
2. In the San Pedro River Watershed, the entire floodplain Holocene<sup>1</sup> alluvium (FHA) delineates the lateral borders of the subflow zone for the San Pedro River and its two major tributaries, the Babocomari River and Aravaipa Creek. *Id.* at 342, ¶35, 9 P.3d at 1081.

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<sup>1</sup> According to Dr. Pearthree, the most current definition of the Holocene is that it is that geological epoch spanning the most recent approximately 11,500 years. The Holocene is part of the Quaternary period, approximately 2.6 million years that is divided into the older Pleistocene epoch and the younger Holocene epoch. (August 31, 2015 transcript at pp. 81, 91)

3. The boundary of the subflow zone is adjusted in those areas where there is a hydrological connection between the underground flow associated with tributary and surface flows of the primary watercourse. In these cases, with certain exceptions, the subflow zone will be drawn more narrowly as the result of the setbacks. (2012 Order, ¶22).
4. The owner of a well located in the designated subflow zone may rebut the determination that the well is pumping subflow by showing that it is more probable than not, i.e., by a preponderance of the evidence, that the well is pumping groundwater. *Id.* at 343, ¶¶ 42-43, 9 P.3d at 1082.

**C. Methodology for the Identification of the Lateral Boundaries of the Floodplain Holocene Alluvium**

1. All of the FHA is located within the topographically lowest part of the San Pedro Valley (the “inner valley”) which contains the modern river channel. (Revised Subflow Zone Delineation Report, April 2014, Appendix B, *Geology and Geomorphology of the San Pedro River* p. 6)
2. The FHA in the San Pedro River Watershed can be found on the surface in some locations, but materials such as tributary Holocene alluvium (“THA”) cover the FHA in other locations. Recognizing that the geology varies from location to location in the San Pedro River Watershed, ADWR classified the approximately 394 miles along the San Pedro River, the Babocomari River and the Aravaipa Creek into locations labelled as “Step 1,” Step 2,” and “Step 3.” (May 2015 Supplement, p. 3-1 )
3. Step 1 includes the locations where surface exposures of FHA are deposited directly against pre-Holocene bounding topography and no THA is present. (May 2015 Supplement, p. 2-4). Mr. Inwood testified that ADWR identified the Step 1 locations based on the surficial mapping provided by the AZGS and aerial photographs of the historic composite active floodplain. (August 31, 2015 Transcript at pp. 133-134)
4. Jon Ford, Richard Burtell and William Victor specifically concurred as to the validity of the lateral boundaries of the FHA at the Step 1 locations. *See* September 2, 2015 transcript at p. 28, September 3, 2015 transcript at p. 5-6, and September 3, 2015 transcript at p. 87, respectively. Although Dr. Mock was not asked his position about Step 1, it is consistent with his position that the FHA extends to the base of exposed bluffs of pre-Holocene sediments.
5. All testifying experts agree that lateral boundaries of the subsurface FHA do exist beyond the boundaries of the FHA observed on the surface in certain locations. The experts do not agree on the boundaries of the subsurface FHA, i.e., the Step 2 and

Step 3 locations, although as noted below, the disagreements regarding Step 2 were modest. See September 2, 2015 transcript at pp. 34-35 (Ford), September 2, 2015 transcript at 132 and 139 (Burtell); Transcript dated September 3, 2015 at p. 88 and 122 (Victor) and Exhibit 56, p. 28 (Mock).

6. In 2013, ADWR contracted with the AZGS to evaluate the geomorphic development and evolution of the San Pedro River valley and to conduct investigations of sedimentary relationships at selected sites along the San Pedro River for the purpose of determining the location of the subsurface FHA. See August 31, 2015 transcript at pp. 8-9; May 2015 Supplement, p. 1-3; 2014 Revised Subflow Zone Delineation Report, April 2014, Appendix B, *Geology and Geomorphology of the San Pedro River* p.1.
7. A relationship exists between the known and inferred distribution of the FHA, the width of the inner San Pedro River valley, the erodibility of the bounding geologic units, and the linearity of the bounding topography. See Revised Subflow Zone Delineation Report, April 2014, Appendix B, *Geology and Geomorphology of the San Pedro River* p. 13.
8. Where the inner valley is relatively narrow, bounding slopes are relatively steep and the topographic slope breaks that form the margins of the inner valley are linear to curvilinear, it is likely that all deposited river alluvium in the inner valley is FHA. Revised Subflow Zone Delineation Report, April 2014, Appendix B, *Geology and Geomorphology of the San Pedro River* p. 14; Exhibit. 47, Affidavit of Jon Ford, p. 12, ¶24, p. 16, ¶35; September 2, 2015 transcript at p. 16.
9. The Step 2 locations occur where the inner valley is narrow and well-defined and generally aligned parallel to the river with steep topographic slope breaks, fringes of THA deposits and visible alluvial fans along the margins of the inner valleys. Supplement, p. 2-5. The lateral boundaries for the subflow zone at Step 2 locations are the contact points between the tributary deposits and the pre-Holocene deposits. August 31, 2015 transcript at p. 141; Supplement, p. 2-6. According to ADWR, the boundary lines are accurate to  $\pm 25$  feet.
10. Dr. Pearthree testified that he and staff at the AZGS identified and examined 22 sites along the San Pedro River that were sufficiently incised to allow identification of the sedimentary layers. Twelve sites demonstrated that the boundaries of the subsurface FHA extended farther away from the modern river channel than shown on the surficial geologic maps August 31, 2015 transcript at pp 34-35, 77; April 2014 ADWR Report, Appendix B, *Site Investigation of Tributary Drainages to the San Pedro River*, p. 2. At one site, alluvium that was probably FHA was located 2,600 feet outside the mapped surficial boundary. April 2014 ADWR Report, Appendix B-3, *Site Investigation of Tributary Drainages to the San Pedro River*, p. 50.

11. Step 2 locations also include an approximately two mile section from mile marker 89 to 91 of the river located where the pre-Holocene materials are less defined due to tributary erosion. August 31, 2015 transcript at p. 142. Due to tributary erosion, the slope breaks are not as steep and the pre-Holocene deposits have been eroded into isolated outcrops referred to as knobs, spines and ridges. The presence of subsurface FHA in this area was confirmed by two separate site examination. August 31, 2016 transcript at p. 143. The subflow zone boundary line for this Step 2 location is a smooth line drawn tangent to the inward-leading exposures of the eroded pre-Holocene topography. Supplement, p 2-7, August 31, 2015 transcript at p. 143.
12. Mr. Burtell testified that the subflow zone boundaries in the Step 2 locations were reasonable. Similarly, Mr. Victor agreed that the Step 2 boundary line was acceptable because based on the data he could map a Step 2 line with an “acceptable repeatability,” which he defined as “basically a line that is very close to [ADWR’s].” September 3, 2015 transcript at p. 107. Mr. Ford and Dr. Mock disagreed with portions of the Step 2 boundaries because in certain areas they did not believe that ADWR had mapped sufficiently close to the edges of the inner valley. Ex. 47, Affidavit of Jon Ford, p. 14, ¶ 31. Mr. Ford prepared modified subflow zone maps on which he drew his proposed corrections to ADWR’s Step 2 boundary. A review of those maps (Exhibit 55) demonstrates that no changes are proposed for many miles of Step 2 boundaries. Mr. Ford characterized the differences between his Step 2 boundaries and those proposed by ADWR as “pretty close.” September 2, 2015 transcript at p. 12.
13. The testimony of the experts who examined the maps and descriptions of the Step 2 locations and made no changes or suggested minor changes relative to the scope of the maps indicates that a reasonable, repeatable methodology was employed by ADWR in mapping the Step 2 locations of the subflow zone.
14. Step 3 locations occurred in two general areas. They occurred in minor gaps between Step 1 or Step 2 locations where the pre-Holocene units were eroded farther away from the river in a crenulated pattern. August 31, 2015 transcript at p 145-146. Based on the AZGS report, ADWR concluded that the river did not create the erosion pattern. Mr. Inwood testified that he studied aerial photography to identify land forms indicative of pre-Holocene geology. August 31, 2015 transcript at pp. 146-147.
15. Step 3 locations also occurred where the pre-Holocene bounding topography appears far from the river and there are extensive tributary deposits. May 2015 Supplement, p. 2-9. These locations occur at the reaches of the river near the towns of Benson and St. David. May 2015 Supplement, p. 2-9. The determination of the lateral boundary of the subflow zone for these Step 3 locations caused the most disagreement among the experts. September 2, 2015 transcript at pp. 31-32.

16. Dr. Mock's expert opinion is that FHA extends to the base of the exposed bluffs of Neogene sedimentary deposits (NSD) which are sediments from the time preceding the Pleistocene epoch. Exh. 56, Affidavit of Peter Mock, dated September 30, 2014 at pp. 11-12, 39.
17. Mr. Ford, who identified the Benson and St. David areas as the location where he most differs from the subflow zone boundary proposed by ADWR, stated that there are places where he did not agree with the Dr. Mock that the boundary should be extended laterally to the basin fill. September 2, 2015 Transcript at p. 51.
18. In the report he co-authored, Dr. Pearthree states that it is likely that tributary erosion, tributary deposits and hillside erosion resulted in the surface elimination of bounding topography that forms the inner valley. Revised Subflow Zone Delineation Report, April 2014, Appendix B, *Geology and Geomorphology of the San Pedro River* p.13. Accordingly, he concludes that "the extent of Holocene river alluvium in the subsurface cannot be determined from surficial geology alone." *Id.*
19. Mr. Burtell testified that no pre-Holocene deposits could not be found within a mile of the river in some areas surrounding Benson. Mr. Burtell considered this condition indicative of a "lot of lateral tributary erosion in this area." September 3, 2015 Transcript at pp. 63-64, 66.
20. After considering the conflicting expert opinions and the inferences, the weight of the evidence supports a finding that the subflow zone in the Step 3 locations cannot be determined by topography alone. The evidence supports the conclusion that the subflow zone does not extend to the existing bounding topography.
21. Mr. Victor testified that there is insufficient subsurface data to support the lateral boundaries at the Step 3 locations. September 3, 2015 transcript at pp. 90, 94, 115. He suggested that a series of boreholes should be drilled in the Step 3 locations to obtain additional data. September 3, 2015 transcript at p. 104.
22. Mr. Burtell also called for more data and opined that core samples obtained for the specific purpose of identifying FHA would be the best approach. He also testified that such new data set could not guarantee a clear answer because alternative conclusion may be drawn from the new data. September 2, 2015 transcript at pp. 142, 149. He testified that although he agrees that there is subsurface FHA in at least the Step 3 locations in the St. David area, the subflow zone in the Step 3 locations should be limited by the surficial mapping and historic composite active floodplain. September 3, 2015 transcript at pp. 5, 160, 163, 164, and 166.
23. The subflow zone must "accurately reflect the full extent of the FHA." 2012 Order, p.5 ¶2(e). Necessarily, therefore, the determination of the subflow zone boundaries should not be deliberately biased toward being too narrow or too wide. A

methodology that results in the knowing exclusion of subsurface FHA (except where setbacks have been applied) cannot be accepted. Such an error could result in a failure to properly protect appropriable surface water rights and could, depending on the facts and circumstances, unfairly deprive a well owner of the benefit of protections provided by the surface water legal regime that applies to the subflow zone.<sup>2</sup>

24. Mr. Ford testified that additional data was not necessary to determine the lateral boundaries of the subflow zone in the Step 3 locations. No methodology or test will result in a clear, unambiguous answer concerning the location of the subsurface FHA. Instead, Mr. Ford explained that the determination of the correct boundary requires a consideration of the data using professional judgment. September 2, 2015 transcript at p. 53)
25. Mr. Ford, stated that his proposed boundary line was based on site visits, aerial photographs, topographical map, drillers' logs, isopach maps, high capacity wells and the exercise of professional judgment. September 2, 2015 transcript at pp. 12, 35, 42, and 53.
26. Mr. Inwood testified that ADWR mapped the lateral boundary for the Step 3 locations based on its review of five site investigations where subsurface FHA was observed and identified, geology mapping, aerial photography, and applied additional geologic and hydrologic reasoning. August 31, 2015 transcript at pp. 152 and 158; Report, p. 2-18, 2-19; Supplement, pp. 2-7, 2-9, and 2-10.
27. Having considered the methodological soundness of the 2012 Report as supplemented, the data on which the 2012 Report as supplemented was based including the numerous site visits and the testimony concerning the exercise of professional judgment, the boundaries of the subflow zone delineated in the revised Subflow Zone Delineation Maps are accurate and reliable.

**IT IS ORDERED:**

1. The parties' objections to the Revised Subflow Zone Delineation Report for the San Pedro River Watershed issued in April 2014, as supplemented in February 2015 and reissued in May 2015, and the subflow zone boundary maps are overruled consistent with the findings of fact and conclusions of law set forth herein.

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<sup>2</sup> In the seminal case on subflow, *Maricopa County Mun. Water Conservation Dist. No. One v. Southwest Cotton Co.*, 39 Ariz. 65, 4 P.2d 369 (1931), Southwest Cotton attempted to use the legal protections available to surface water right holders to protect its pre-existing wells from a new upstream surface water use that threatened to prevent water from reaching its downstream wells. The application of the prior appropriation doctrine would have been to Southwest Cotton's advantage. John D. Leshy and James Belanger, *Arizona Law Where Ground and Surface Water Meet*, 20 Ariz. L. Rev. 657 (1988).

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July 13, 2017

2. The revised Subflow Zone Delineation Maps for the San Pedro River Watershed prepared by Arizona Department of Water Resources in April 2014 as supplemented in February 2015 and reissued in May 2015 are approved.

IT IS FURTHER ORDERED signing this minute entry as a formal written Order of the Court.

\s\ Hon. Mark Brain  
HON. MARK H. BRAIN  
JUDGE OF THE SUPERIOR COURT

A copy of this order is mailed to all parties on the court-approved mailing list for Contested Case No. W1-103 dated March 2, 2017.