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5

6 IN THE SUPERIOR COURT OF THE STATE OF ARIZONA

7 IN AND FOR THE COUNTY OF MARICOPA

8 IN RE THE GENERAL ADJUDICATION  
9 OF ALL RIGHTS TO USE WATER IN THE  
GILA RIVER SYSTEM AND SOURCE

W-1 (Salt)  
W-2 (Verde)  
W-3 (Upper Gila)  
W-4 (San Pedro)  
(Consolidated)

11 CIVIL NO. W1-103

12 REPORT OF THE SPECIAL MASTER ON  
13 THE ARIZONA DEPARTMENT OF  
14 WATER RESOURCES' SUBFLOW  
15 TECHNICAL REPORT, SAN PEDRO  
RIVER WATERSHED; MOTION FOR  
APPROVAL OF REPORT; AND NOTICE  
OF SUBSEQUENT PROCEEDINGS

16  
17 CONTESTED CASE NAME: *In re Subflow Technical Report, San Pedro River Watershed.*

18 HSR INVOLVED: None.

19 DESCRIPTIVE SUMMARY: The Special Master submits a report to the Court under Arizona Rule  
20 of Civil Procedure 53 pursuant to an order of reference. The report contains recommendations  
regarding whether the *Subflow Technical Report, San Pedro River Watershed*, prepared by the  
Arizona Department of Water Resources, should be adopted in whole or in part or modified.  
21 Objections to the Special Master's report must be filed with the Superior Court on or before  
**Wednesday, September 1, 2004**. Responses to objections shall be filed on or before **Friday,**  
22 **October 1, 2004**, and replies shall be filed by **Friday, October 29, 2004**.

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1 **I. CHRONOLOGY OF PROCEEDINGS**

2 This report addresses the objections filed to the *Subflow Technical Report, San Pedro River*  
3 *Watershed* (2002) (“Subflow Report”) prepared by the Arizona Department of Water Resources  
4 (“ADWR”).<sup>1</sup> ADWR filed the Subflow Report pursuant to the trial court’s directive to supplement  
5 the department’s prior *Report Concerning Implementation of the Arizona Supreme Court’s Decision*  
6 *on Subflow* (2001). The reports recommend procedures to implement the subflow criteria and a cone  
7 of depression test in accordance with the Arizona Supreme Court’s *Gila II*<sup>2</sup> and *Gila IV*<sup>3</sup> decisions.  
8 Those decisions, arising from the same interlocutory review appeal, deal with subflow, an issue  
9 extensively litigated in this adjudication since 1987.

10 The Gila River Adjudication will determine or establish “the extent and priority of the rights  
11 of all persons to use water in [the Gila] river system and source.”<sup>4</sup> A “river system and source”  
12 includes “all water appropriable” under A.R.S. § 45-141.<sup>5</sup> The Arizona Supreme Court has held that  
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16 <sup>1</sup> The pleadings and orders filed in the proceedings before the Special Master are available at the office of the  
17 Clerk of the Maricopa County Superior Court, 601 West Jackson Street, Phoenix, Arizona 85003, under Civil  
18 No. W1-103 (contact Tina Barrett or Veronica Olivas at 602-506-1351). Electronic copies of the orders are  
19 posted at <http://www.supreme.state.az.us/wm/> on the page titled *Gila River Adjudication (In re Subflow*  
20 *Technical Report, San Pedro River Watershed)*.

21 <sup>2</sup> *In re the General Adjudication of All Rights to Use Water in the Gila River System and Source*, 175 Ariz.  
22 382, 857 P.2d 1236 (1993) (“*Gila II*”). The Supreme Court framed the interlocutory review issue as, “Did the  
23 trial court err in adopting its 50%/90 day test for determining whether underground water is ‘appropriable’  
24 under A.R.S § 45-141.” 175 Ariz. at 386, 857 P.2d at 1240.

<sup>3</sup> *In re the General Adjudication of All Rights to Use Water in the Gila River System and Source*, 198 Ariz.  
330, 9 P.3d 1069 (2000), *cert. denied sub nom. Phelps Dodge Corp. v. U.S.*, 533 U.S. 941 (2001) (“*Gila IV*”).  
In *Gila II*, the Arizona Supreme Court remanded to the trial court, which after further hearings issued a ruling  
whose appeal to the Supreme Court resulted in *Gila IV*. *Gila II* and *Gila IV* sought to resolve “the ambiguities  
and uncertainties left by” the Court’s decision in *Maricopa County Mun. Water Conservation Dist. No. 1 v.*  
*Southwest Cotton Co.*, 39 Ariz. 65, 4 P.2d 369 (1931), *modified and reh’g. denied*, 39 Ariz. 367, 7 P.2d 254  
(1932) (“*Southwest Cotton*”). 175 Ariz. at 389, 857 P.2d at 1243.

<sup>4</sup> A.R.S. § 45-251(2).

<sup>5</sup> A.R.S. § 45-251(7).

1 “[b]ecause subflow is considered part of the surface stream, it is appropriable as such under § 45-  
2 141(A).”<sup>6</sup> Therefore, a well pumping subflow is subject to the adjudication.

3 In *Gila IV*, the Supreme Court defined the subflow zone as the saturated floodplain Holocene  
4 alluvium and set forth three tests to determine if a well is subject to the adjudication because it  
5 pumps subflow:

- 6 1. All wells located within the lateral limits of the subflow zone are subject to this  
7 adjudication;
- 8 2. [A]ll wells located outside the subflow zone that are pumping water from a stream  
9 or its subflow, as determined by DWR’s analysis of the well’s cone of depression, are  
10 included in this adjudication; and
- 11 3. [W]ells that, though pumping subflow, have a *de minimis* effect on the river system  
12 may be excluded from the adjudication based on rational guidelines for such an  
13 exclusion, as proposed by DWR and adopted by the trial court.<sup>7</sup>

14 Whether ADWR’s proposed procedures to delineate the lateral limits of the subflow zone,  
15 implement a cone of depression test, and set rational guidelines for *de minimis* water uses comport  
16 with the Supreme Court’s decisions are the central issues addressed in this report.

17 Chapter I of this report describes the proceedings. Chapters II, III, IV, and V address the  
18 issues raised in Chapters 2, 3, 4, and 5, respectively, of the Subflow Report. Chapters VI, VII, and  
19 VIII relate to future proceedings before the trial court regarding this report. The Special Master has  
20 considered all the papers, declarations, testimony, thirty-eight admitted exhibits, and oral arguments.

#### 21 **A. The Technical Reports**

22 At the trial court’s hearing held on September 27, 2001, counsel inquired as to ADWR’s  
23 plans to propose criteria for determining the subflow zone. ADWR answered it had “internally been  
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<sup>6</sup> 198 Ariz. at 334, 9 P.3d at 1073.

<sup>7</sup> 198 Ariz. at 344, 9 P.3d at 1083.

1 discussing the issues related to developing subflow criteria.”<sup>8</sup> The court directed ADWR to file a  
2 report describing its “proposals for determining the subflow criteria for purposes of this  
3 adjudication.”<sup>9</sup> The court allowed parties to file responses to the report and set a hearing on January  
4 8, 2002, to consider the report and responses.

5 On December 18, 2001, ADWR filed a *Report Concerning Implementation of the Arizona*  
6 *Supreme Court’s Decision on Subflow*. The San Carlos Apache Tribe, Tonto Apache Tribe, and  
7 Yavapai-Apache Nation (collectively “Apache Tribes”); Arizona Public Service (“APS”); Phelps  
8 Dodge Corporation (“Phelps Dodge”); ASARCO Incorporated (“ASARCO”); BHP Copper, Inc.  
9 (“BHP”); Inscription Canyon Ranch; Baca Float Water Company; Cities of Chandler, Glendale,  
10 Mesa, and Scottsdale (collectively “Cities”); City of Phoenix (“Phoenix”); Gila River Indian  
11 Community (“GRIC”); Gila Valley and Franklin Irrigation Districts (collectively “Upper Valley  
12 Irrigation Districts”); Salt River Project (“SRP”); State of Arizona Agency Claimants (“State of  
13 Arizona”); United States; and The Nature Conservancy (“Nature Conservancy”) filed responses to  
14 the report or joinders to others’ comments.<sup>10</sup>

15 On January 8, 2002, during the hearing of ADWR’s report and the responses, the trial court  
16 directed “ADWR to prepare another more specific and detailed report pertaining to the San Pedro  
17 River watershed...”<sup>11</sup> The court’s order issued later stated:

18 To promote an efficient and accurate determination of the jurisdictional subflow  
19 zones, ADWR shall prepare a supplemental report specifically identifying and  
20 describing the procedures and processes it proposes to use to establish the limits of the  
subflow zone within the San Pedro River watershed. This report shall include the  
following:

21 1. A proposal for determining the subflow zone that includes more than just  
consideration of the saturated lateral extent of the Holocene alluvium. The Court has

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22 <sup>8</sup> Sept. 27, 2001 Minute Entry 4 (Oct. 25, 2001).

23 <sup>9</sup> *Id.*

24 <sup>10</sup> Several parties filed jointly, but each party will be listed separately in this report.

<sup>11</sup> Jan. 8, 2002 Minute Entry 2 (Jan. 22, 2002).

1 considered ADWR's position that the decision of the Arizona Supreme Court in "Gila  
2 IV" requires that the subflow zone be initially delineated by simply mapping the  
3 saturated lateral limits of the floodplain of this alluvium. Many claimants object to  
4 this procedure and assert that ADWR's current proposal is not legally sufficient. The  
5 Court notes that the guidelines set forth in Gila IV direct ADWR to use all criteria  
6 geologically and hydrologically appropriate for subflow determination in each  
7 watershed. Even if ADWR is correct about the tasks mandated by Gila IV to  
8 determine the subflow zone, the work required to address the other considerations  
9 mentioned in Gila IV will serve to confirm the accuracy of ADWR's determinations.  
10 Therefore, in determining the subflow zone in the San Pedro River watershed ADWR  
11 shall use a methodology that addresses the appropriate use, if any, of each of the  
12 criterion listed in Gila IV, as well as any other relevant factors that will be helpful  
13 in insuring that ADWR's subflow zone determination is completed using all reasonable  
14 means to arrive at results that are as accurate as possible;

15 2. A test for determining if a well's cone of depression is withdrawing water from the  
16 subflow zone;

17 3. A set of rational guidelines for determining whether a given well, though pumping  
18 subflow, has a de minimis effect on the river system;

19 4. A method for including both perennial and intermittent streams as part of the  
20 subflow analysis, including streams that historically contained perennial or  
21 intermittent flows, but which now are ephemeral due to development and other human  
22 initiated actions. The Court recognizes this direction makes ADWR's task more  
23 complicated and expects the department to formulate a proposal using readily  
24 available historical data that will permit determination of water levels and locations as  
of date(s) prior to widespread diversion and depletion of Arizona's stream flows.  
Effluent-fed streams are also to be included as part of ADWR's analysis; and

5. A timeline for completion of the tasks outlined in the report. A similar timeline for  
the Upper Gila River and Verde River watersheds is also to be submitted.

ADWR's supplemental report shall be filed on or before March 29, 2002 and shall  
contain a certification by the ADWR Director that he has read and is familiar with the  
proposal set forth in the report.

After the report is filed, claimants and parties shall have until May 13, 2002 [*note: on  
May 7, 2002, upon motion, the Court granted additional time to respond until June  
17, 2002*] to file objections or requested revisions to the report. These comments may  
be presented by legal memorandum, exhibits and/or sworn declarations of experts.

After receipt of all timely filed objections, the Court will review ADWR's proposal  
and party comments. It is likely the Court will enter an order after this review  
directing ADWR as to how it is to proceed. Should the Court determine that further  
information or explanation is needed, the matter will be referred [to] the Special

1 Master for hearing. The declarations submitted by the parties will serve as the direct  
2 testimony at any hearing scheduled by the Special Master. The only testimony to be  
3 received at any scheduled hearing will be by way of cross-examination (and, perhaps,  
4 some limited redirect examination).<sup>12</sup>

5 On March 29, 2002, ADWR filed the Subflow Report. The report sets forth ADWR's  
6 proposed procedures to delineate the lateral extent of the subflow zone, implement a cone of  
7 depression test, establish guidelines for *de minimis* water uses, and schedules to implement the  
8 methodologies in the Gila River Adjudication.<sup>13</sup>

9 On June 17, 2002, comments, objections, and joinders were filed by the Apache Tribes;  
10 Arizona Geological Survey; APS; Phelps Dodge; ASARCO; Arizona Water Company; Bella Vista  
11 Water Company ("Bella Vista"); BHP; Cities; City of Flagstaff; City of Safford ("Safford"); DYM,  
12 Inc.; Painted Rock Ranches; Paloma Ranch Investments, Inc. ("Paloma Ranch"); Rio Rico  
13 Properties, Inc. ("Rio Rico"); Tonopah Irrigation District ("Tonopah"); GRIC; Upper Valley  
14 Irrigation Districts; City of Goodyear; George E. Price on behalf of the Long Meadow Ranch  
15 Property Owners Association; City of Benson; Valory Strausser individually and on behalf of Lower  
16 San Pedro River Landowners; Phoenix; SRP; State of Arizona; United States; City of Sierra Vista  
17 ("Sierra Vista"); City of Tucson ("Tucson"); City of Sedona, Town of Jerome, Town of Clarkdale,  
18 City of Cottonwood, and Town of Camp Verde (collectively "Verde Valley Communities"); Verde  
19 Valley Water Users Association, Inc. by officers and directors Ray Wrobley, Mary Margaret  
20 Kovacovich, and John Kovacovich; and the County of Yavapai.

21 The following expert witnesses filed sworn declarations on June 17, 2002:

22 1. Kirk C. Anderson, Ph.D. (Upper Valley Irrigation Districts).

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23 <sup>12</sup> Minute Entry (Jan. 22, 2002) ("Ballinger Order").

24 <sup>13</sup> The report has six chapters: Chapter 1 Introduction; Chapter 2 Subflow Zone; Chapter 3 Cone of  
Depression; Chapter 4 *De Minimis* Uses; Chapter 5 Summary and Implementation; and Chapter 6 References  
Cited. The attachments include one table, five figures, six plates, and nine appendices. An electronic copy of  
the report is posted at <http://www.water.az.gov> under *Publications* and *Adjudications*.

- 1 2. Philip C. Briggs, P.E. (Verde Valley Water Users Association, Inc. by officers and  
2 directors Ray Wrobley, Mary Margaret Kovacovich, and John Kovacovich).
- 3 3. Jon R. Ford (SRP).
- 4 4. T. Allen J. Gookin, P.E., R.L.S., P.H. (GRIC).
- 5 5. Eric J. Harmon, P.E. and Mark R. Palumbo (APS and Phelps Dodge).
- 6 6. W. Gerald Matlock, P.E., Ph.D. (Upper Valley Irrigation Districts).
- 7 7. Peter A. Mock, Ph.D., R.G. (GRIC).
- 8 8. Errol L. Montgomery, Ph.D., P.G. and Thomas W. Anderson, P.H. (BHP).
- 9 9. Oliver S. Page, R.G., Peter M. Pyle, R.G., C.Hg., and Jean M. Moran, R.G., C.Hg. (United  
10 States).
- 11 10. Doug Toy, P.E. (Cities).

#### 11 **B. Order of Reference to the Special Master**

12 Following a hearing held on January 22, 2003, the trial court referred ‘the consideration of  
13 the responses and objections filed to the Subflow Report to the Special Master,’ who “[a]fter  
14 reviewing the matter and holding such hearings as he deems necessary...shall prepare a report to the  
15 Court setting forth his recommendations as to whether the Subflow Report should be adopted in  
16 whole or in part or modified.’<sup>14</sup> The order of reference did not direct the Special Master to make  
17 findings of fact and conclusions of law.<sup>15</sup>

#### 18 **C. Issues Set for Briefing and Hearing**

19 On April 10, 2003, the Special Master held a conference to discuss the scope of the Special  
20 Master’s report and establish procedures to comply with the order of reference. SRP, Upper Valley  
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22 <sup>14</sup> Order 1 (Feb. 21, 2003).

23 <sup>15</sup> Ariz. R. Civ. P. 53(h) states, “The master shall prepare a report upon the matters submitted to the master by  
24 the order of reference and, if required to make findings of fact and conclusions of law, the master shall set  
them forth in the report.” This matter does not involve the determination of any individual water uses.

1 Irrigation Districts, and the Verde Valley Communities submitted proposed issues for resolution.  
2 APS and Phelps Dodge filed comments to the proposed issues.

3 The Special Master considered all the comments and proposed issues, and on April 25, 2003,  
4 issued an order:

5 1. Setting the following issues for briefing prior to the cross-examination of witnesses:

6 a. Should ADWR's subflow analysis consider predevelopment or current  
7 stream flow conditions?

8 b. Should ADWR consider the criteria specified in *Gila IV* to identify the  
9 subflow zone or have the criteria already been taken into account in the Arizona  
10 Supreme Court's holding that the saturated floodplain Holocene alluvium is the  
11 subflow zone?

12 c. In addition to analyzing a well's drawdown at the subflow zone, should  
13 ADWR report the cumulative effect of wells or of groups of wells?

14 d. Should ADWR's findings be reported in supplemental contested case  
15 hydrographic survey reports (HSRs) ("case-by-case") or in a supplemental San Pedro  
16 River Watershed HSR ("the entire watershed"), which identifies the subflow zone,  
17 wells reaching and depleting a stream, and *de minimis* water rights?

18 2. Allowing parties to file sworn rebuttal declarations on or before June 27, 2003,  
19 limited to rebutting the opinions or information contained in the initial sworn  
20 declarations and not presenting any new matters not contained in those declarations.

21 3. Setting a hearing for the cross-examination of witnesses on October 21 and 22,  
22 2003.

23 4. Directing that the cross-examination of witnesses would address, but would not be  
24 limited to, the following matters:

*Location of Subflow Zone*

a. Are ADWR's recommendations for locating perennial, intermittent, and  
effluent-fed streams valid?

b. Does ADWR's recommendation that the entire lateral extent of the  
floodplain Holocene alluvium be assumed to be saturated comport with *Gila IV*?

1 c. Is ADWR's recommended assumption for effluent-fed streams "that the  
2 sediments immediately beneath these reaches are unsaturated due to clogging layers"  
valid?

3 d. Are ADWR's recommendations sufficient to identify and exclude tributary  
4 aquifers and basin fill saturated zones?

5 *Cone of Depression Test*

6 a. Does ADWR's recommended drawdown of greater than or equal to 0.1 foot,  
7 where the cone of depression has reached the edge of the subflow zone, comport with  
8 *Gila IV*?

9 b. Does ADWR's recommended condition that the water level in a well be  
10 below the water level in the subflow zone during pumping comport with *Gila IV*?

11 c. What is the accuracy and reliability of analytical (THWELLS) and  
12 numerical (MODFLOW) models for the cone of depression test?

13 d. Is ADWR's recommendation that the impact of a well be measured "*at the*  
14 *time of the modeling*" scientifically valid?

15 e. Should ADWR recommend a methodology to evaluate the impact of wells  
16 perforated below an impervious formation within the limits of the subflow zone?<sup>16</sup>

17 The Special Master indicated the four issues set for briefing would be ruled upon prior to the  
18 cross-examination of the expert witnesses. Memoranda, responses, and replies were filed between  
19 June 6, 2003, and August 11, 2003. Oral argument was not set.

20 **D. Discovery**

21 A discovery issue arose prior to the submission of briefs. The United States requested  
22 clarification of permissible discovery after being served with a request for documents by the Upper  
23 Valley Irrigation Districts. The request sought copies of forty documents listed by the United States'  
24 expert witnesses in their credentials.

On August 7, 2003, the Special Master issued an order stating that formal discovery of other  
than the disclosure of the sworn declarations, by means of depositions, interrogatories, production of

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<sup>16</sup> Special Master's Order Setting Briefing Schedule and Hearing 3-4 (Apr. 25, 2003).

1 documents or things, inspections, examinations, and requests for admissions was not contemplated in  
2 this proceeding, but informal discovery of not more than eight reports described or listed in the  
3 declarations would be allowed. Informal discovery was to be completed by October 7, 2003.

4 **E. Rebuttal Declarations**

5 On June 27, 2003, the following expert witnesses filed rebuttal declarations:

- 6 1. Mr. Briggs (Verde Valley Water Users Association, Inc. by officers and directors Ray  
7 Wrobley, Mary Margaret Kovacovich, and John Kovacovich).
- 8 2. Mr. Ford (SRP).
- 9 3. Mr. Gookin (GRIC).
- 10 4. Messrs. Harmon and Palumbo (APS and Phelps Dodge).
- 11 5. Mr. Michael J. Lacey (Bella Vista and Pueblo Del Sol Water Company (“Pueblo Del  
12 Sol”)).
- 13 6. Mr. Ralph P. Marra, Jr. (Tucson).
- 14 7. Dr. Mock (GRIC).
- 15 8. Dr. Matlock (Upper Valley Irrigation Districts, Verde Valley Communities, and the  
16 Maricopa-Stanfield and Central Arizona Irrigation and Drainage Districts).
- 17 9. Dr. Montgomery and Mr. Anderson (BHP).
- 18 10. Messrs. Page and Pyle (United States).
- 19 11. Mr. Toy (Cities).

20 **F. Special Master’s Proposed Rulings**

21 On September 8, 2003, the Special Master issued proposed rulings for the four issues briefed  
22 prior to the hearing. The order stated the rulings “may be modified in accordance with relevant  
23  
24

1 testimony, credible evidence, or persuasive argument presented during the examination of witnesses  
2 on October 21 and 22, 2003.”<sup>17</sup>

3 The issues and a summary of the rulings are as follows:

4 Issue 1: Should ADWR’s subflow analysis consider predevelopment or current stream  
5 flow conditions?

- 6 1. ADWR’s subflow analysis shall consider predevelopment stream flow conditions.
- 7 2. The date of predevelopment shall be a chronological year or a range of years  
8 immediately prior to widespread diversion and depletion of the stream’s flows as a  
9 result of any human activity.

10 Issue 2: Should ADWR consider the criteria specified in *Gila IV* to identify the  
11 subflow zone or have the criteria already been taken into account in the Arizona  
12 Supreme Court’s holding that the saturated floodplain Holocene alluvium is the  
13 subflow zone?

- 14 1. The criteria specified in *Gila IV* to identify or delineate the subflow zone have  
15 already been taken into account in the Arizona Supreme Court’s holding that the  
16 saturated floodplain Holocene alluvium is the subflow zone.
- 17 2. If ADWR is unable by using the means it proposes to identify or delineate the  
18 subflow zone in a stream segment, ADWR is directed to use the criteria specified in  
19 *Gila IV* and any other relevant factors that are appropriate for the particular location to  
20 delineate the subflow zone.

21 Issue 3: In addition to analyzing a well’s drawdown at the subflow zone, should  
22 ADWR report the cumulative effect of wells or of groups of wells?

- 23 1. A well’s drawdown at the subflow zone shall be analyzed individually for each  
24 well.
2. The Special Master will not decide in this order whether ADWR should report the  
cumulative effect of wells or of groups of wells. A ruling will be made after  
considering the evidence presented at the October hearing.

Issue 4: Should ADWR’s findings be reported in supplemental contested case  
hydrographic survey reports (HSRs) (“case-by-case”) or in a supplemental San Pedro  
River Watershed HSR (“the entire watershed”), which identifies the subflow zone,  
wells reaching and depleting a stream, and *de minimis* water rights?

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<sup>17</sup> Special Master’s Order Determining Issues 1 Through 4, 11 (Sept. 8, 2003).

1 1. The Special Master recommends the following schedule for the San Pedro River  
2 Watershed:

3 A. After the Superior Court adopts or modifies the Special Master's report  
4 recommending the procedures and processes to delineate the subflow zone within the  
5 San Pedro River Watershed and a cone of depression test, ADWR is directed to  
6 prepare a map delineating the subflow zone for the entire San Pedro River Watershed.  
7 ADWR shall submit this map and related information in a technical report and not in  
8 any form of HSR. The scope of the technical report shall be limited to delineating the  
9 subflow zone.

10 B. Upon filing its technical report with the Superior Court, ADWR shall send a notice  
11 to all claimants in the San Pedro River Watershed and the parties listed in the Gila  
12 River Adjudication Court-Approved Mailing List informing them of the scope and  
13 availability of the report and of a claimant's right to file written objections to the  
14 report and of the deadline for filing objections.

15 C. Any claimant in the San Pedro River Watershed may file a written objection to  
16 ADWR's technical report within 120 days of the date on which the report was filed.  
17 Objections shall be limited to ADWR's findings regarding the subflow zone.

18 D. After considering the objections, the Superior Court will approve the map that  
19 delineates and establishes the subflow zone for the San Pedro River Watershed.

20 E. Using the cone of depression test adopted by the Superior Court, ADWR will  
21 analyze wells located outside the lateral limits of the subflow zone to determine if the  
22 well's cone of depression reaches an adjacent subflow zone, and if continuing  
23 pumping will cause a loss of such subflow as to affect the quantity of the stream.  
24 ADWR will examine the other water right claims to determine *de minimis* water rights  
in the San Pedro River Watershed in accordance with the Superior Court's September  
26, 2002, order. ADWR will investigate and supplement, as needed, its findings  
reported in the 1991 Final San Pedro River Watershed HSR.

25 F. ADWR publishes a Supplemental Final San Pedro River Watershed HSR reporting  
26 its findings on a claim by claim basis, in accordance with A.R.S. § 45-256(B),  
27 including wells withdrawing subflow, cone of depression analyses, *de minimis* water  
28 rights, and all other updated information.

29 G. ADWR shall send a notice of the filing of the Supplemental Final San Pedro River  
30 Watershed HSR to all claimants in the Gila River Adjudication, who may file  
31 objections within 180 days of the date on which the report was filed.

32 2. The Special Master will direct ADWR to file the supplemental contested case HSR  
33 for *In re Fort Huachuca* after the Superior Court has approved the map delineating the  
34 subflow zone for the San Pedro River Watershed.

1 3. The Special Master recommends that this schedule be adopted for all the  
2 watersheds in the Gila River Adjudication subject to modifications that may be proper  
as a result of experience with this process.<sup>18</sup>

3 **G. ADWR’s Proposed Use of Soil Surveys and Expert Declarations**

4 On September 25, 2003, ADWR filed a notice stating it had recently become aware of soil  
5 survey maps published for a portion of Cochise County that ADWR believes should be used to  
6 determine the lateral limits of the subflow zone. ADWR proposes to use the soil survey maps,  
7 prepared under the auspices of the Natural Resources Conservation Service (“NRCS”) (part of the  
8 United States Department of Agriculture) working with other federal, state, and local agencies, to  
9 delineate the lateral extent of the subflow zone. The soil survey maps would be used instead of the  
10 surficial geology maps described in section 2.4 of the Subflow Report. ADWR indicated that soil  
11 survey maps will in the future be available for the entire San Pedro River Watershed and for other  
12 areas of the Gila River Adjudication.

13 The *Soil Survey of Cochise County, Arizona, Douglas-Tombstone Part* (2002) was based on  
14 major field work, cropland mapping, and rangeland mapping completed in 2000.<sup>19</sup> The “soil survey  
15 is an inventory and evaluation of the soils in the survey area” that “can be used to identify the  
16 potentials and limitations of each soil for specific land uses and to help prevent construction failures  
17 caused by unfavorable soil properties.”<sup>20</sup> The 734-page report describes 152 soil map units within the  
18 survey area. One unit was not mapped because the landowner denied access. The report contains  
19 maps of the soil units with the classification of the soil series and their morphology found within  
20 each unit. Appendix A of ADWR’s notice contains copies of several pages of the report that describe  
21 how the survey was completed.

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22 <sup>18</sup> *Id.*

23 <sup>19</sup> An electronic copy of the report is posted at <http://www.water.az.gov> under *Publications and Adjudications*.

24 <sup>20</sup> ADWR Notice of Recently Published Soil Survey Maps for Cochise Co. app. A (NRCS Soil Survey Report 187) (Sept. 25, 2003) (“ADWR Notice of Recently Published Soil Survey Maps”).

1 ADWR proposes to use NRCS survey AZ671 to delineate the lateral extent of the floodplain  
2 Holocene alluvium along the San Pedro River between the International Border and St. David,  
3 Arizona. ADWR submitted soil survey maps covering the Hereford, Fairbank, and Land 7.5-minute  
4 Quadrangles for this river segment (Appendices C, D, and E, respectively). The State Soil Scientist  
5 provided the approximate geologic age of each soil unit shown on the three maps (Appendix F).

6 On October 8, 2003, APS and Phelps Dodge requested additional time to analyze and submit  
7 expert testimony on ADWR's proposed use of the soil surveys. BHP, Casa Grande, and the Verde  
8 Valley Communities filed joinders to the motion. SRP and the United States opposed the motion.  
9 During the conference held on October 10, 2003, the Special Master stated he would take up the  
10 request after the hearing.

11 At the conclusion of the hearing on October 22, 2003, the Special Master granted the request  
12 for additional time. The ruling was memorialized in an order issued on October 28, 2003. The order  
13 allowed parties to file sworn declarations that would "serve as the direct testimony of the expert  
14 witness if a hearing is held," and to file sworn rebuttal declarations "limited to rebutting the opinions  
15 or information contained in the sworn declarations filed on or before December 8, 2003, and shall not  
16 present any new matters not contained in those declarations."<sup>21</sup> A hearing to cross-examine the  
17 expert declarants was not set or held.

18 The following experts filed sworn declarations on December 8, 2003:

- 19 1. Marshall P. Brown, P.E. (Cities).
- 20 2. Mr. Ford (SRP).
- 21 3. Mr. Gookin (GRIC).
- 22 4. Mr. Harmon (APS and Phelps Dodge).

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23 <sup>21</sup> Special Master's Order Allowing Filing of Sworn Declarations Regarding the Proposed Use of Soil Surveys  
24 2 (Oct. 28, 2003).

1 5. Dr. Mock (GRIC).

2 6. Dr. Montgomery (BHP).

3 7. Mr. Page (United States).

4 The Upper Valley Irrigation Districts, Casa Grande, and the Verde Valley Communities filed  
5 joinders to Mr. Harmon's declaration.

6 On January 12, 2004, Mr. Ford (SRP), Mr. Gookin (GRIC), Dr. Mock (GRIC), and Mr. Page  
7 (United States) filed sworn rebuttal declarations. At the October 21, 2003, hearing, ADWR presented  
8 the direct testimony of Richard T. Burtell, P.G. regarding the proposed use of the soil surveys.

9 **H. Prehearing Proceedings**

10 On October 8, 2003, the Special Master held a telephonic conference "to consider any matters  
11 that will facilitate the orderly and efficient conduct of cross-examination at the hearing set on  
12 October 21 and 22, 2003."<sup>22</sup> Procedural matters and two prehearing motions were taken up during  
13 the conference. A deadline was set to file responses to (1) the request of APS and Phelps Dodge for  
14 additional time to analyze and submit expert testimony on ADWR's proposed use of the soil surveys,  
15 and (2) a motion in limine filed a week earlier. A request to reschedule the cross-examination of  
16 witnesses was denied. Parties were directed to premark exhibits, exchange copies of exhibits, and  
17 reintroduce as a new exhibit any exhibit that had been introduced during a prior hearing in this  
18 adjudication. ADWR was requested to present additional information in the form of direct testimony  
19 regarding the proposed use of the soil surveys.

20 On October 3, 2003, the Upper Valley Irrigation Districts, Casa Grande, Central Arizona  
21 Irrigation and Drainage District, and the Verde Valley Communities filed a Motion in Limine to  
22 Exclude All Expert Testimony Re Legal Issues and To Exclude T. Allen J. Gookin's Rebuttal

23 \_\_\_\_\_  
24 <sup>22</sup> Special Master's Order Setting Prehearing Telephonic Conference 2 (Sept. 29, 2003).

1 Reports and Testimony. ASARCO filed a joinder. APS, Phelps Dodge, and the State of Arizona  
2 supported the motion, which the Apache Tribes, GRIC, SRP, and the United States opposed. The  
3 movants argued that Messrs. Ford, Gookin, and Page, and Dr. Mock had in their declarations stated  
4 opinions on legal issues, or outside their areas of expertise, or beyond the scope allowed by the  
5 Special Master.

6 At the start of the hearing on October 21, 2003, the Special Master granted the motion in part  
7 and denied it in part. The ruling announced in open court was as follows:

8 1. None of the sworn declarations, reports, and affidavits will be excluded in its  
9 entirety on the grounds of inadmissibility of expert opinions on questions of law,  
10 opinions outside the scope of the expert's competency, and relevance.

11 2. The Special Master will determine the weight and credibility to give to a sworn  
12 declaration, report, affidavit, or testimony that states an expert's understanding or  
13 views of a legal opinion or holding.

14 3. Any sworn declaration or testimony that in the opinion of the Special Master rises  
15 to the level of being a conclusion of law will be disregarded.

16 4. Any testimony that is based on pure speculation or conjecture will be disregarded.

17 5. Little, if any, weight would be given to any testimony about perceived inequities in  
18 Arizona's or other states' water laws, the future of Arizona's water laws or water  
19 resources management, the unstated intent and goals of court decisions, judges, and  
20 statutes, and how the Arizona Supreme Court should have or could have defined the  
21 subflow zone differently than it did in *Gila IV*.<sup>23</sup>

22 On October 14, 2003, reiterating an oral request made during the telephonic conference,  
23 GRIC filed a Motion for Reciprocal Treatment of All Expert Witness Reports, Declarations, Rebuttal  
24 Declarations, Affidavits, and/or Testimony with Regard to the October 3, 2003, Motion In Limine.  
The Upper Valley Irrigation Districts and the Verde Valley Communities opposed the motion. At the  
hearing on October 21, 2003, the Special Master adopted the ruling on the motion in limine as the

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<sup>23</sup> Hrg. Tr. 11:17-12:11 (Oct. 21, 2003).

1 ruling on this motion and granted GRIC's motion to the extent that the relief requested was granted  
2 in the ruling on the motion in limine.

3 **I. Participation of the Verde Valley Water Users, Inc.**

4 Mr. Ray Wrobley, Ms. Mary Margaret Kovacovich, and Mr. John Kovacovich, "as officers  
5 and directors of Verde Valley Water Users, Incorporated, an Arizona non-profit corporation," filed a  
6 response to the Subflow Report which included Mr. Briggs' sworn declaration.<sup>24</sup> During the October  
7 10, 2003, telephonic conference, Phoenix objected that because the corporation is neither a claimant  
8 nor a party in the Gila River Adjudication it should not be allowed to participate in this proceeding.

9 The Verde Valley Water Users, Inc. has not filed a statement of claimant in this adjudication.  
10 Mr. Wrobley, Ms. Kovacovich, and Mr. Kovacovich have, however, filed statements of claimant for  
11 their individual water uses.<sup>25</sup> After further discussion, counsel for the Verde Valley Water Users, Inc.  
12 stated that "he did not object to Mr. Briggs' testimony being offered on behalf of the persons who  
13 filed the statements of claimant listed in the filings of Mr. Briggs' declarations."<sup>26</sup>

14 The issue was again taken up at the end of the first day of hearing. No evidence was  
15 presented showing that the Verde Valley Water Users, Inc. has been served with a summons or has  
16 filed a statement of claimant in this adjudication. The adjudication statutes provide that only a  
17 "claimant" "may file written objections" to ADWR's reports, "have a fair and reasonable opportunity  
18 to present evidence in support of or in opposition to [ADWR's] recommendations," and "may enter  
19 into agreements regarding the attributes, satisfaction or enforcement" of water rights in relation to  
20

21  
22 

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<sup>24</sup> Verde Valley Water Users, Inc.'s Response 1 (June 17, 2002).

23 <sup>25</sup> At the conference, it was unclear who had filed the statements of claimant listed in the response. At the  
24 hearing, it was clarified that these individuals have filed claims, and the correct numbers are for Mr. Wrobley  
39-05-55886, and for Ms. Kovacovich and Mr. Kovacovich 39-05-50030 through 39-05-50034, inclusive.

<sup>26</sup> Special Master's Corrected Minute Entry 2 (Oct. 16, 2003).

1 other claimants.<sup>27</sup> Under the pretrial orders in this adjudication a claimant is a person who has filed a  
2 statement of claimant.<sup>28</sup> A corporation which has not been served a summons or has not filed a  
3 statement of claimant may not participate as a party in the adjudication. The Special Master ruled  
4 that Mr. Briggs would be allowed to testify on behalf of Mr. Wrobley, Ms. Kovacovich, and Mr.  
5 Kovacovich as individual claimants but not on behalf of the corporation.<sup>29</sup>

## 6 **J. Hearing**

7 The Apache Tribes, APS, Phelps Dodge, Bella Vista, Pueblo Del Sol, BHP, Cities, GRIC,  
8 Upper Valley Irrigation Districts, Verde Valley Communities, Mr. Wayne D. Klump, Mr. Ray  
9 Wrobley, Ms. Mary Margaret Kovacovich, Mr. John Kovacovich, Safford, Paloma Ranch, Rio Rico,  
10 Tonopah, SRP, Tucson, and the United States participated in the cross-examination of the expert  
11 witnesses. Thirty-eight exhibits were admitted. The order of appearance of the expert witnesses was  
12 as follows:

13 On October 21, 2003: 1. Richard T. Burtell, P.G. (ADWR).

14 2. Dale A. Mason (ADWR).

15 3. Dr. Montgomery (BHP).

16 4. Mr. Page (United States).

17 5. Dr. Matlock (Upper Valley Irrigation Districts).

18 On October 22, 2003: 6. Mr. Ford (SRP).

19 7. Mr. Briggs (Mr. Wrobley, Ms. Kovacovich, and Mr. Kovacovich).

20 8. Mr. Gookin (GRIC).

21 9. Mr. Harmon (Phelps Dodge).

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22 <sup>27</sup> A.R.S. §§ 45-256(B) and 45-257(C).

23 <sup>28</sup> See Gila River Adjudication Pretrial Orders No. 4 (Jan. 24, 2000) and 5 (Mar. 29, 2000); see also Rules for  
Proceedings Before the Special Master §§ 1.04 (definition of “claimant”) and 1.16 (definition of “parties”).

24 <sup>29</sup> Hrg. Tr. 240:15-19 (Oct. 22, 2003).

1 10. Mr. Toy (Cities).

2 11. Dr. Mock (GRIC).

3 12. Mr. Lacey (Bella Vista and Pueblo Del Sol).

4 13. Mr. Marra (Tucson).

5 **K. Posthearing Proceedings**

6 On December 8, 2003, the Upper Valley Irrigation Districts, Verde Valley Communities, and  
7 Casa Grande requested to cross-examine Mr. Burtell of ADWR regarding the proposed use of the  
8 soil surveys and to allow the parties to present legal arguments and their positions.

9 On January 28, 2004, the Special Master denied the request to cross-examine Mr. Burtell for  
10 the reasons that claimants had prior opportunities to file expert declarations and rebuttal declarations  
11 regarding ADWR's proposed use of the soil surveys, and the expert witnesses who had submitted  
12 declarations had available to them ADWR's proposal, Mr. Burtell's testimony, and the extensive  
13 testimony and evidence presented in this matter. The Special Master ruled that sufficient evidence  
14 had been presented regarding the appropriateness of using the soil surveys as proposed by ADWR.

15 The request for parties to present legal arguments and their positions on all the proposed  
16 procedures was granted. Parties were allowed to file memoranda, responses, and replies on any issue  
17 arising from ADWR's recommended procedures and on any of the proposed rulings issued on  
18 September 8, 2003. Oral argument was set on May 20, 2004.

19 The following parties filed a brief or a joinder: Apache Tribes, State of Arizona, APS, Phelps  
20 Dodge, ASARCO, Arizona Water Company, Tucson Electric Power Company, Bella Vista, Pueblo  
21 Del Sol, Sierra Vista, Cities, GRIC, Safford, Paloma Irrigation and Drainage District, Rio Rico,  
22 Roosevelt Water Conservation District ("Roosevelt"), SRP, Upper Valley Irrigation Districts, Verde  
23  
24

1 Valley Communities, Maricopa-Stanfield Irrigation and Drainage District, Central Arizona Irrigation  
2 and Drainage District, Casa Grande, and the United States.

3 Prior to the last day to file responses, SRP filed objections and a motion for expedited  
4 consideration of its request to exclude eleven exhibits attached to the Cities' opening brief. The  
5 Special Master took up the request on an expedited basis, and on April 7, 2004, granted in part and  
6 overruled in part SRP's objections to the exhibits. The objections to five exhibits and a portion of one  
7 exhibit were overruled on the grounds the Special Master had already considered the exhibits as the  
8 documents were first filed on June 17, 2002. The objections to three exhibits were overruled, but the  
9 consideration the Special Master would give to these exhibits was limited to a specific issue on  
10 which the Cities offered argument. The objections to two exhibits were granted on the grounds they  
11 were cumulative evidence.

12 On May 20, 2004, oral argument lasting almost two and one-half hours was heard, after  
13 which the matter was deemed submitted.

14 **II. SUBFLOW ZONE (Chapter 2 of the Subflow Report)**

15 **A. Are ADWR's recommendations for locating perennial, intermittent, and**  
16 **effluent-fed streams valid?**

17 The trial court directed ADWR to propose:

18 A method for including both perennial and intermittent streams as part of the  
19 subflow analysis, including streams that historically contained perennial or  
20 intermittent flows, but which now are ephemeral due to development and other human  
21 initiated actions. The Court recognizes this direction makes ADWR's task more  
22 complicated and expects the department to formulate a proposal using readily  
23 available historical data that will permit determination of water levels and locations as  
24 of date(s) prior to widespread diversion and depletion of Arizona's stream flows.  
Effluent fed streams are also to be included as part of ADWR's analysis.<sup>30</sup>

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30 Ballinger Order 2.

1 ADWR proposes to identify perennial, intermittent, and effluent-fed streams in the Gila River  
2 Adjudication area by using information contained in eleven streamflow maps and several technical  
3 reports. The published maps and reports identify predevelopment perennial streams and recent  
4 perennial and intermittent streams. ADWR was unable to find a published map that shows  
5 predevelopment intermittent streams.

6 The predevelopment perennial streams are shown in the Hydrologic Investigations Atlas  
7 (“Atlas,” 1986) compiled by the United States Geological Survey (“USGS”). The recent perennial  
8 and intermittent streams are depicted on maps prepared by the Arizona Game and Fish Department  
9 (“AGFD”) dated 1981, 1993, and 1997. ADWR plans to combine information contained in these  
10 sources to create a composite map of predevelopment and recent perennial and intermittent streams.

11 Using the surface water quality rules of the Arizona Department of Environmental Quality  
12 (“ADEQ”), ADWR identified three major and 21 minor “effluent dependent waters” within the Gila  
13 River system, including two reaches in the San Pedro River Watershed.<sup>31</sup>

14 In its June 30, 1994, order regarding subflow, the trial court adopted from ADWR’s  
15 Technical Assessment<sup>32</sup> these definitions of “perennial,” “intermittent,” and “ephemeral” streams:

16 Perennial streams discharge water continuously through the year. Their source  
17 of supply is normally comprised of both direct runoff from precipitation events or  
snow melt, and baseflow derived from the discharge of groundwater into the stream.

18 Intermittent streams discharge water for long periods of time, but seasonally.  
19 For example, an intermittent stream may flow all winter, every winter, but never flow  
20 continuously during the summer. During seasons when baseflow is maintained,  
21 groundwater is contributing to the stream. During seasons of discontinuous  
streamflow, natural and cultural losses may be greater than the contribution from  
groundwater, resulting in a losing stream. Or, the amount of groundwater discharge  
itself may have decreased due to natural or cultural uses.

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23 <sup>31</sup> Subflow Report, app. D; *see* Ariz. Admin. Code R18-11-113 (Effluent Dependent Waters).

24 <sup>32</sup> *Technical Assessment of the Arizona Supreme Court Interlocutory Appeal Issue No. 2 Opinion* (Dec. 15, 1993, ADWR) (“Technical Assessment”).

1 Ephemeral streams discharge water only in response to precipitation events or  
2 snowmelt, and do not have a baseflow component at any time of the year; they flow  
3 out sporadically. The groundwater system and surface water system do not establish a  
4 hydraulic connection in these systems.<sup>33</sup>

5 *Gila IV* affirmed the trial court's order "in its entirety" and "in all respects."<sup>34</sup>

6 Dr. Mock recommended that the definitions of perennial and intermittent streams be refined  
7 by limiting intermittent streams to those which are "groundwater-fed," and by "arbitrarily" defining a  
8 perennial stream as one that flows "at least 11 months out of each year," and an intermittent stream  
9 as one flowing "at least one month per year and less than 11 months per year of flow."<sup>35</sup> He posited  
10 that "[f]or this adjudication, we are only interested in groundwater-fed intermittent streams," and  
11 "arbitrary but useful thresholds of time [will] allow ADWR to make expedient progress in their  
12 analysis."<sup>36</sup>

13 There has not been a judicial determination that the Gila River Adjudication is, or should be,  
14 only interested in groundwater-fed intermittent streams. An intermittent stream may be spring-fed or  
15 in high altitude areas carry flows from melting snow. Second, adoption of time frames to classify  
16 streams could render determinations indefensible due to arbitrariness. Furthermore, the fact these  
17 definitions were provided to the trial court in a technical report addressing subflow warrants  
18 recognition that ADWR considered generally accepted hydrology principles when it submitted these  
19 definitions.

20 There is general agreement that the maps ADWR selected to identify perennial, intermittent,  
21 and effluent-fed streams are a good start, but the maps have limitations that require ADWR to

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22 <sup>33</sup> Order 23-24 (June 30, 1994) ("Goodfarb Order") quoting the Technical Assessment 6, 9.

23 <sup>34</sup> 198 Ariz. at 334, 344, 9 P.3d at 1073, 1083.

24 <sup>35</sup> Peter A. Mock Decl. 17 (June 17, 2002).

<sup>36</sup> *Id.*

1 undertake additional verification. Limitations include the quality of the sources of information and  
2 inconsistencies, inaccuracies, and omissions in the maps.

3 Regarding the USGS Atlas, Dr. Montgomery and Mr. Anderson declared that:

4 [S]everal of these maps were based chiefly on observations recorded in journals of  
5 pioneers traveling through the area, early government survey field notes, and initial  
6 hydrologic investigations for selected basins. Some of the reports are from casual  
7 observations recorded by nonprofessionals whose reliability for technical observations  
8 has not been established; others represent only a single point in time and possibly only  
9 a limited reach of a stream.<sup>37</sup>

10 Regarding the AGFD maps, Mr. Page declared that:

11 1. There are inconsistencies in the 1993 and 1997 AGFD maps, and “[v]erification is needed  
12 where reaches are not classified and where definitions in the AGFD classification vary somewhat  
13 from that of the Trial Court;”

14 2. “A more precise definition of the dates of data collection would be helpful” to understand  
15 the 1993 and 1997 AGFD maps because overlaps of perennial and intermittent streams appear in two  
16 areas in the San Pedro River Watershed, and the dates “may represent the report or map publication  
17 date, rather than the date the data actually represents;” and

18 3. A 1997 AGFD report relied on by ADWR indicates some stream segments are “in  
19 dispute,” but these “are not shown or discussed in the ADWR report and need to be clarified.”

20 4. A 1998 AGFD map of perennial and intermittent reaches “differ[s] significantly from the  
21 1993 and 1997 AGFD stream classifications for the San Pedro River, suggesting that the  
22 classifications are subject to change due to seasonal variation, short term climatic cycles, effects of  
23 development or other factors. Some discussion of the cause of variations affecting the length and  
24 permanence of each reach is needed to define the uncertainty associated with the classifications.”<sup>38</sup>

Dr. Montgomery and Mr. Anderson declared that ADWR should carefully review certain  
reaches along the Santa Cruz River near Tucson because these reaches “are indicated to contain  
perennial or intermittent flow when, in fact, they previously were reported to be ephemeral flow  
reaches.”<sup>39</sup>

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<sup>37</sup> Errol L. Montgomery and Thomas W. Anderson Decl. 11 (June 17, 2002).

<sup>38</sup> Oliver S. Page, Peter M. Pyle, and Jean M. Moran Decl. 6-7 (June 17, 2002).

<sup>39</sup> Errol L. Montgomery and Thomas W. Anderson Decl. 12 (June 17, 2002).

1 Mr. Gookin identified twelve rivers and creeks and one wash that “historic documentation  
2 indicates...were, in fact, live rivers,” but under ADWR’s methodology they would not be classified  
3 “as perennial and/or intermittent.”<sup>40</sup> He declared that ADWR needs to obtain additional historical  
4 evidence to classify these streams. Dr. Mock expressed the same view.<sup>41</sup>

5 ADWR is aware the maps it has identified do not show some current perennial stream  
6 reaches, that intermittent reaches currently exist that were not previously identified as perennial, and  
7 that some intermittent reaches depicted on the 1997 AGFD map are “questionable” and are believed  
8 to be ephemeral based on recent stream gage data. The maps and reports ADWR has identified are a  
9 very good start, but additional work must be done to locate perennial, intermittent, and effluent-fed  
10 streams with more accuracy and reliability. The work could be as narrow as verifying stream  
11 segments. The tasks could include searching the literature for additional historical and current maps  
12 and reports; examining notices of appropriation recorded in county recorders’ offices; reviewing  
13 court records of prior decrees; reviewing geological reports; field investigations; and interpreting  
14 aerial photography.

15 In this work, ADWR must be guided by *Gila IV*’s holding that “it is critical that any test used  
16 for determining the boundaries of a subflow zone be as accurate and reliable as possible.”<sup>42</sup> The trial  
17 court likewise directed ADWR to “arrive at results that are as accurate as possible.”<sup>43</sup>

18 **Recommendation 1:** The Court should direct ADWR to use the definitions of perennial,  
19 intermittent, and ephemeral streams set forth in the trial court’s June 30, 1994, order.

20 **Recommendation 2:** The Court should direct ADWR to investigate additional sources,  
21 including historical and current documents, scientific reports, mapping projects, aerial photography,

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22 <sup>40</sup> T. Allen J. Gookin Decl. sec. 1 at 3, 2 (June 17, 2002).

23 <sup>41</sup> Peter A. Mock Decl. 13-14 (June 17, 2002).

24 <sup>42</sup> 198 Ariz. at 335, 9 P.3d at 1074; *see* 175 Ariz. at 388-9, 857 P.2d at 1242-3.

<sup>43</sup> Ballinger Order 2.

1 and field investigations to locate perennial, intermittent, and effluent-fed streams with as much  
2 accuracy and reliability as possible.

3 **B. Is ADWR’s recommended assumption for effluent-fed streams that were not**  
4 **previously perennial, or recently perennial or intermittent, “that the sediments immediately**  
5 **beneath these reaches are unsaturated due to clogging layers”<sup>44</sup> valid?**

6 In its directions to ADWR, the trial court directed that “[e]ffluent fed streams are also to be  
7 included as part of ADWR’s analysis.”<sup>45</sup> In the Subflow Report, ADWR lists three major and 21  
8 minor “effluent dependent waters” within the Gila River system, including two reaches in the San  
9 Pedro River Watershed.

10 ADWR proposes that for effluent-fed streams that were not previously perennial, or recently  
11 perennial or intermittent, “it be assumed that the sediments immediately beneath these reaches are  
12 unsaturated due to clogging layers.”<sup>46</sup> Therefore, these streams would not undergo subflow analysis.  
13 According to ADWR, “it is common for low permeability” clogging layers to be formed by the  
14 “elevated nutrient and/or organic content of most effluent,” and as layers form along the bed of  
15 effluent-fed streams, the layers “can restrict the seepage of streamflow and, as a result, can cause the  
16 sediments beneath the stream to be unsaturated.”<sup>47</sup> Bower’s textbook is cited for the observation  
17 that clogging “is primarily a surface phenomenon that rarely extends more than 10 cm [*note:*  
18 *approximately 4 inches*] into the soil and often is restricted to the top centimeter or less [*note: less*  
19 *than ½ inch*].”<sup>48</sup> The “area adjacent to and beneath such streams would not, by definition, be  
20  
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22 <sup>44</sup> Subflow Report 9.

23 <sup>45</sup> Ballinger Order 2.

24 <sup>46</sup> Subflow Report 9.

<sup>47</sup> *Id.* at 8.

<sup>48</sup> *Id.* at 9 quoting H. BOUWER, GROUNDWATER HYDROLOGY (McGraw-Hill 1978).

1 characteristic of a jurisdictional subflow zone due to the lack of a hydraulic connection between the  
2 subflow and the stream.”<sup>49</sup>

3 ADWR further states, “[d]etailed geologic and hydrologic data are needed to confirm the  
4 presence or absence of clogging layers along effluent fed streams, and the occurrence of unsaturated  
5 flow beneath these streams. The Department believes these data are generally unavailable at this time  
6 and would require considerable time and resources to collect in the future.”<sup>50</sup>

7 The basis of the assumption is “the lack of a hydraulic connection” between an effluent-fed  
8 stream and the subflow. Mr. Gookin declared that “[s]tudies have suggested that effluent does tend to  
9 lead to plugging, which restricts, but does not eliminate the recharge to the groundwater.”<sup>51</sup> In his  
10 opinion, a clogging layer acts as a restriction only during one of four conditions, namely, periods of  
11 low flow and when the water table is below the stream. As for the other three conditions:

12 If the water table is up to the river, then water flows from the groundwater into the  
13 river, and the muck at the bottom of the river does not form an appreciable  
14 restriction... The third and fourth conditions are periods of high flow with and  
15 without a high water table. During periods of greater than normal flow, due to storm  
16 run off or some other event, this layer of muck is rapidly scoured away and recharge  
17 immediately begins in large amounts, if the aquifer has room to accept the water.  
18 These recharge amounts can be huge. Further, once the flood has passed, it takes time  
19 for this effluent plugging to occur again. During that time, the low flow will continue  
20 to recharge. I am unaware of any situation where effluent has caused recharge to cease  
in a natural environment. It slows it down. It does not stop it.<sup>52</sup> (Emphasis added.)

21 According to Mr. Gookin, there is a hydraulic connection between an effluent-fed stream and  
22 the subflow, which can be greater than normal during periods of high flow and varies under other  
23 conditions. This opinion accords with ADWR’s description that clogging layers have “low  
24 permeability” (rather than being impermeable).

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<sup>49</sup> Subflow Report 9.

<sup>50</sup> *Id.*

<sup>51</sup> T. Allen J. Gookin Rebuttal Decl. ch. IX, 2 (June 27, 2003).

<sup>52</sup> *Id.*

1 In *Gila II*, the Supreme Court approved the trial court’s adoption of “reasonable simplifying  
2 assumptions” which would facilitate the conclusion of the adjudications.<sup>53</sup> The assumption proposed  
3 for effluent-fed streams due to clogging layers is not reasonable because it cannot be concluded that  
4 there is a lack or absence of hydraulic connection in effluent-fed reaches between the stream and the  
5 subflow. The evidence that there is no hydraulic connection due to clogging layers is not conclusive.

6 **Recommendation 3:** The Court should not adopt ADWR’s assumption for effluent-fed  
7 streams that were not previously perennial, or recently perennial or intermittent, that the sediments  
8 immediately beneath these reaches are unsaturated due to clogging layers.

9 **C. Should ADWR use the soil survey maps prepared by the Natural Resources  
10 Conservation Service to delineate the lateral limits of the subflow zone?**

11 ADWR’s proposed use of the NRCS soil survey maps to delineate the subflow zone modifies  
12 Section 2.4 of the Subflow Report. In that section, ADWR proposed using the best available  
13 Holocene maps to delineate the lateral extent of the floodplain Holocene alluvium. ADWR believes  
14 that the NRCS soil survey maps are a better tool. The proposal raised four principal objections:

- 15 1. The maps include soil types “that are of mixed alluvial fan, floodplain, or stream terrace  
16 origin, not definitively of floodplain origin.”<sup>54</sup>
- 17 2. The maps include soil types which are not associated with Holocene alluvium.
- 18 3. The maps include ephemeral streams.
- 19 4. The maps contain little site-specific information regarding depth, saturation, or aquifer  
20 characteristics because soil profiles are described down to 60 inches.

21 The first two objections are evident in two of the 7.5-minute quadrangle maps ADWR  
22 prepared to show the soil survey units. Mr. Burtell testified that the Hereford Quadrangle shows

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23 <sup>53</sup> 175 Ariz. at 394, 857 P.2d at 1248.

24 <sup>54</sup> Eric J. Harmon Soil Surveys Decl. 3 (Dec. 8, 2003).

1 areas of (1) floodplain alluvium of Holocene age and (2) “mixed floodplain and alluvial fan materials  
2 of Holocene age,” and both areas “would be considered for at least determining where the subflow  
3 zone is.”<sup>55</sup> In the Land Quadrangle,<sup>56</sup> Mr. Burtell identified “relic fan deposits” that have been  
4 preserved within the channel of the San Pedro River, and described an “island” of material that is  
5 “either not of Holocene age or if it is, it’s not related to floodplain deposits.”<sup>57</sup> The soil survey map  
6 shows that the “island” Mr. Burtell described in the Land Quadrangle (in Soil Unit 2) consists of  
7 “Pre-Pleistocene to Holocene Non-Floodplain Deposits,” and another island on the same map (in Soil  
8 Unit 35) is identified as “Pleistocene Stream Deposits and Non-Floodplain Deposits of Various  
9 Ages.”<sup>58</sup>

10 Mr. Harmon declared that of the eleven soil map units ADWR had identified “as being  
11 definitive of the floodplain Holocene alluvium,” seven are associated with alluvial fans in addition to  
12 floodplains, and two units are associated with stream terraces.<sup>59</sup> “Alluvial fans are distinctly different  
13 from floodplain alluvium.”<sup>60</sup> The soil survey maps, in short, (1) show the presence of Pre-  
14 Pleistocene, Pleistocene, Holocene non-floodplain, and non-floodplain deposits of various ages  
15 within the areas ADWR will investigate to determine the lateral extent of the subflow zone, and (2)  
16 in some areas do not distinguish between floodplain and alluvial fan deposits.

17 A group of parties argues that the subflow zone includes all of the floodplain alluvium  
18 deposited by a river or stream and not just the portion that is of Holocene age. Accordingly, the  
19 floodplain alluvium may contain Pleistocene deposits and not just Holocene alluvium. Other parties

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21 <sup>55</sup> Hrg. Tr. 25:18-26:1 (Oct. 21, 2003); ADWR Notice of Recently Published Soil Survey Maps, app. C.

22 <sup>56</sup> ADWR Notice of Recently Published Soil Survey Maps, app. E.

23 <sup>57</sup> Hrg. Tr. 27:17-20 (Oct. 21, 2003).

24 <sup>58</sup> ADWR Notice of Recently Published Soil Survey Maps, app. E.

<sup>59</sup> Eric J. Harmon Soil Surveys Decl. 6 (Table 1), 7 (Dec. 8, 2003); *see also* Marshall P. Brown Soil Surveys  
Decl. ¶¶ 10-12 (Dec. 8, 2003).

<sup>60</sup> Marshall P. Brown Soil Surveys Decl. ¶ 10 (Dec. 8, 2003).

1 argue that *Gila IV* explicitly affirmed the trial court’s ruling that the subflow zone is the saturated  
2 floodplain Holocene alluvium, and therefore, the subflow zone cannot include Pleistocene deposits.

3 After considering the opinions of the parties and their experts, the trial court ruled:

4 Throughout the hearings, field trip and later briefing, the parties have used the  
5 terms Holocene, younger alluvium, and floodplain alluvium interchangeably. This  
6 Court believes the proper terminology for the geologic unit which defines “subflow”  
7 is the “saturated floodplain Holocene alluvium.” That term is used deliberately.<sup>61</sup>

8 The court noted the potential difficulty of discerning different materials:

9 While the depositional processes were somewhat different, where [the Holocene or  
10 younger alluvium and the basin fill] meet it is sometimes difficult to discern the  
11 differences between one type of eroded, depositional debris from another, particularly  
12 when they may both be saturated and water bearing.... However, only the younger  
13 Holocene alluvium can pass the test of “subflow” as it is the only stable geologic unit  
14 which is beneath and adjacent to most rivers and streams, except those in the  
15 mountains where bedrock surrounds the flow.<sup>62</sup>

16 The trial court clearly stated subflow is found within the floodplain Holocene alluvium. The  
17 classification “Holocene” is uniformly used throughout its order to describe the floodplain alluvium  
18 associated with subflow. *Gila IV* affirmed the trial court’s rulings in their entirety. The Supreme  
19 Court defined the term “Holocene” to refer “to the Holocene epoch, which is that part of the  
20 Quaternary period that covers approximately the most recent 10,000 years. During that time frame,  
21 floods caused rivers to carry and deposit certain materials that originated from erosion of bedrock  
22 and basin fill deposits....”<sup>63</sup> The trial court’s rulings and *Gila IV* cannot be interpreted to mean  
23 anything other than the floodplain Holocene alluvium is where ADWR must start to delineate the  
24 lateral limits of the subflow zone.<sup>64</sup>

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22 <sup>61</sup> Goodfarb Order 56.

23 <sup>62</sup> *Id.*

24 <sup>63</sup> 198 Ariz. at 334 n.2, 9 P.3d at 1073 n.2.

<sup>64</sup> “The entire saturated floodplain Holocene alluvium, as found by DWR, will define the subflow zone in any given area.” 198 Ariz. at 342, 9 P.3d at 1081.

1 ADWR may find areas where it will be “difficult to discern the differences” between  
2 materials, and in those, it must exercise its best technical analysis and evaluation to delineate the  
3 lateral extent of the floodplain Holocene alluvium. If other materials such as Pleistocene or relic fan  
4 deposits are found, ADWR should report their presence and extent.

5 The third main objection is that the soil survey maps include ephemeral streams. Mr. Harmon  
6 declared that Soil Unit 123 in the Fairbank Quadrangle is “associated with streams that are partly  
7 ephemeral and partly perennial.”<sup>65</sup> Mr. Brown listed seven ephemeral washes whose alluvium “has  
8 been inappropriately delineated as saturated floodplain Holocene alluvium associated with the San  
9 Pedro River.”<sup>66</sup> Mr. Ford identified fourteen ephemeral tributaries whose inclusion in the subflow  
10 zone is questionable.<sup>67</sup> The parties and other experts who filed declarations agree that under *Gila IV*  
11 the ephemeral streams shown on the soil survey maps must be excluded from the subflow analysis.<sup>68</sup>

12 The fourth main objection is that the NRCS used soil borings to define and map the soil  
13 types, but the boreholes generally did not exceed three to four feet and only in exceptional situations  
14 went down six or seven feet. The soil maps, therefore, contain little site-specific information about  
15 depth, saturation, or aquifer characteristics in the floodplain Holocene alluvium.

16 This objection evinces a concern that the soil survey maps will be used as the exclusive  
17 means to delineate the lateral limits of the subflow zone. The Special Master has previously stated,  
18 “[i]t is clear from the evidence heard that there is no single or exclusive available indicator that  
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22 <sup>65</sup> Eric J. Harmon Soil Surveys Decl. 8 (Dec. 8, 2003) (quoting the NRCS Soil Survey Report 156).

23 <sup>66</sup> Marshall P. Brown Soil Surveys Decl. ¶ 14 (Dec. 8, 2003).

24 <sup>67</sup> Jon R. Ford Soil Surveys Decl. ¶ 8 (Dec. 8, 2003).

<sup>68</sup> The exclusion of ephemeral streams is discussed in chapter 2, section G, and an exception is described in chapter 2, section E, of this report.

1 delineates the subflow zone as defined in *Gila IV*. Delineating the entire subflow zone in a watershed  
2 will require using more than one indicator.”<sup>69</sup>

3 The Special Master adheres to this view, and the experts stated similar opinions. Mr. Brown  
4 declared, “[i]t may be appropriate to use soil survey results as a supplemental resource to assist in  
5 delineation of the saturated floodplain Holocene alluvium,” but they “should not be used as the  
6 primary basis....”<sup>70</sup> Mr. Ford “agree[s] with the use of NRCS soil data as an additional source of data  
7 to be used to delineate the Subflow Zone, but [does] not support the use of NRCS soil data as the  
8 exclusive delineation method.”<sup>71</sup> Dr. Mock declared the maps “would serve as but a supplemental  
9 source of data for some interpretations.”<sup>72</sup> Dr. Montgomery opined the maps “should be used in  
10 conjunction with other maps and resources previously identified by” ADWR.<sup>73</sup> Mr. Page declared  
11 that “the soil information can and should be used as one of many tools.”<sup>74</sup>

12 Although the NRCS surveys evaluate soils for purposes of land use planning and  
13 management, the surveys can provide useful information to delineate the subflow zone. The surveys  
14 “collect data on erosion, droughtiness, flooding, and other factors that affect soil uses and  
15 management.” The surveys may not qualify as the exclusive indicator to delineate the lateral limits of  
16 the floodplain Holocene alluvium in accordance with *Gila IV*, but they should be used as they  
17 contain relevant and useful information.

18 ADWR specifically recommends that certified NRCS survey AZ671, released in 2003, be  
19 used to determine the lateral extent of the floodplain Holocene alluvium along the San Pedro River  
20 between the International Border and St. David, Arizona. The Hereford, Fairbank, and Land

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22 <sup>69</sup> Special Master’s Order 2 (Jan. 28, 2004).

<sup>70</sup> Marshall P. Brown Soil Surveys Decl. ¶ 20 (Dec. 8, 2003).

<sup>71</sup> Jon R. Ford Soil Surveys Decl. ¶ 13 (Dec. 8, 2003).

<sup>72</sup> Peter A. Mock Soil Surveys Decl. 3 (Dec. 8, 2003).

<sup>73</sup> Errol L. Montgomery Soil Surveys Decl. 4 (Dec. 8, 2003).

<sup>74</sup> Oliver S. Page Soil Surveys Decl. 9 (Dec. 8, 2003).

1 Quadrangles are part of survey AZ671. The survey includes soil maps for most of the Babocomari  
2 River and stream reaches within Ramsey, Garden, and Miller Canyons.

### 3 *Mapping*

4 Before ADWR presented its proposal to use the NRCS soil survey maps, some experts  
5 pointed out limitations of the surficial geology maps ADWR proposed to use to delineate the lateral  
6 extent of the subflow zone. Because ADWR may consult some or all of these maps as additional  
7 sources of information, those concerns are addressed.

8 First, ADWR proposes to utilize four criteria to evaluate the adequacy of the surficial maps,  
9 for the areas with perennial and intermittent streams, which delineate floodplain Holocene alluvium:  
10 field work, map coverage, dating methods, and map scale. Mr. Page recommended that mapping  
11 methods be added to the selection criteria. Mapping methods include aerial photography analysis,  
12 geomorphic (topographic map) interpretation, phreatophyte mapping, and infrared image  
13 interpretation. The recommendation is appropriate.

14 Second, Messrs. Harmon, Palumbo, Anderson, and Page commented on map scale. They  
15 favor using larger scale maps than ADWR proposes and agree that a scale of 1:24,000 is the  
16 preferred scale. Concerning ADWR's proposed use of the Pool and Coes map<sup>75</sup> to delineate the  
17 floodplain Holocene alluvium within the Sierra Vista Subwatershed, Messrs. Harmon and Palumbo  
18 declared:

19 The Pool and Coes map is published at a scale of 1:135,000.... In our experience,  
20 using a map at this scale does not provide sufficient detail to allow accurate  
21 determination of a geologic contact on the ground. If ADWR's proposal to use the  
22 Pool and Coes map is adopted, we believe this will lead to inaccurate conclusions  
23 regarding the location of the edge of the jurisdictional subflow zone.... [A] better  
24 choice of map for use in defining the subflow zone would be the published USGS

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24 <sup>75</sup> D. R. Pool and A. L. Coes (USGS, 1999).

1 1:24,000 topographic map series. These maps provide a significantly more detailed  
2 scale, with one mile being depicted as 2.64 inches.<sup>76</sup>

3 Mr. Anderson declared, “[i]f I were given the task of accurately and reliably identifying the  
4 Holocene alluvium, I would attempt to locate a map focused on the Holocene alluvium with a scale  
5 of 1:24,000 (or larger, even 1:12,000) because the level of detail provided by such maps is probably  
6 necessary to identify the different surficial deposits.”<sup>77</sup> Mr. Ford recommended “DWR should obtain  
7 large-scale draft mapping (typically at a scale of 1 inch = 2,000 feet)... Once a particular map is  
8 selected, DWR should obtain the largest scale version of that map that is available.”<sup>78</sup>

9 The recommendation that ADWR should obtain the largest scale version of a map whenever  
10 possible is appropriate. When area is the same, a large scale map will show items in greater detail  
11 than a small scale map. The Special Master will not recommend a minimum or maximum map scale,  
12 as the decision is within ADWR’s professional judgment.

13 Third, Mr. Ford recommended that ADWR “should take special care in ensuring that the edge  
14 of the Holocene alluvium is properly transferred from the authors’ published or draft mapping, so  
15 that it is accurately re-projected to the current datum used on the DWR base maps.”<sup>79</sup> Any substantial  
16 error in transferring or re-projecting a depiction from a surficial map to ADWR’s base map will  
17 negate the department’s efforts to select the proper map. The NRCS report contains a similar caution,  
18 if large copies of the soil survey maps are made: “Enlargement of these maps, however, could cause  
19 misunderstanding of the detail of mapping. If the maps are enlarged, distortion will occur. Enlarged  
20  
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22 <sup>76</sup> Eric J. Harmon and Mark R. Palumbo Decl. 10-11 (June 17, 2002).

23 <sup>77</sup> Kirk C. Anderson Decl. ¶ 6 (June 17, 2002).

24 <sup>78</sup> Jon R. Ford Decl. ¶ 11a (June 17, 2002).

<sup>79</sup> *Id.* at ¶ 11b.

1 maps do not show the small areas of contrasting soils that could have been shown at a larger scale.”<sup>80</sup>

2 The recommendation regarding technical mapping is appropriate.

3 The experts who submitted declarations concerning the soil surveys provided technical  
4 information, and some addressed characteristics in specific soil units. *Gila IV*'s invitation is pertinent  
5 and should be accepted: “DWR may use such data accumulated during these proceedings to aid in its  
6 task.”<sup>81</sup>

7 **Recommendation 4:** The Court should adopt ADWR's proposal to use the NRCS soil survey  
8 maps to delineate the lateral extent of the floodplain Holocene alluvium but should direct ADWR to  
9 use the maps as one source or indicator - but not the exclusive means - to delineate the lateral limits  
10 of the subflow zone.

11 **Recommendation 5:** The Court should direct ADWR to limit its subflow analysis to the  
12 floodplain Holocene alluvium. If other deposits or materials (such as Pleistocene) are found within  
13 the floodplain alluvium of a stream, the presence and extent of those deposits shall be reported, but  
14 the criterion is the floodplain Holocene alluvium.

15 **Recommendation 6:** The Court should direct ADWR to exclude from the subflow analysis  
16 the ephemeral streams shown on the NRCS soil survey maps.

17 **Recommendation 7:** The Court should adopt ADWR's proposal to use NRCS survey AZ671  
18 as a source of information to determine the lateral extent of the floodplain Holocene alluvium in the  
19 San Pedro River and its reaches between the International Border and St. David, Arizona.

20 **Recommendation 8:** The Court should direct ADWR to consider mapping methods as a  
21 criterion to evaluate the adequacy of a surficial map which depicts floodplain Holocene alluvium.

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23 <sup>80</sup> ADWR Notice of Recently Published Soil Survey Maps, app. A (NRCS Soil Survey Report 2).

24 <sup>81</sup> 198 Ariz. at 342, 9 P.3d at 1081. Such information would include the comments submitted by the Arizona  
Geological Survey to ADWR, which ADWR filed with the Court on June 17, 2002.

1           **Recommendation 9:** The Court should direct ADWR to obtain the largest scale version of a  
2 map whenever possible.

3           **Recommendation 10:** The Court should direct ADWR to take special care in transferring or  
4 re-projecting any depiction on a surficial map to a base map.

5           **D.     Should ADWR consider the criteria specified in *Gila IV* to identify the subflow  
6 zone or have the criteria already been taken into account in the Arizona Supreme Court’s  
7 holding that the saturated floodplain Holocene alluvium is the subflow zone?**

8           This question was briefed prior to the hearing. On September 8, 2003, a ruling was issued  
9 subject to modification after considering the evidence presented during the hearing. The proposed  
10 ruling is adopted as the evidence is not sufficient to modify it.

11           In *Gila II*, the Supreme Court held that in order to determine “[w]hether a well is pumping  
12 subflow...comparison of such characteristics as elevation, gradient, and perhaps chemical makeup  
13 can be made. Flow direction can be an indicator.”<sup>82</sup> After remand, the trial court found that if  
14 elevation, gradient, chemical composition, and flow direction are added to the concept that the  
15 subflow zone can be differentiated from adjacent tributary aquifers and the basin fill aquifer that  
16 contribute or receive discharge from the subflow zone, “a set of principles can be developed to define  
17 ‘subflow.’”<sup>83</sup> The trial court found that combining the four factors with this concept was “[t]he only  
18 logical and rational way” to make *Southwest Cotton* and *Gila II* “consistent with the scientific  
19 principles” presented by the expert witnesses.<sup>84</sup>

20           Before discussing the “different sides or proposals” presented to the trial court, Judge  
21 Goodfarb found that *Gila II* and the uncontested evidence he had heard required that the subflow  
22 zone “be defined by at least the following principles:”

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23 <sup>82</sup> 175 Ariz. at 392, 857 P.2d at 1246.

24 <sup>83</sup> Goodfarb Order 34.

<sup>84</sup> *Id.*

1 1. The “subflow” zone must be adjacent and beneath a perennial or intermittent  
2 stream.

3 2. It may not be adjacent or beneath an ephemeral stream. However, it may be  
4 adjacent or beneath an ephemeral section of a perennial or intermittent stream, if the  
5 ephemeral section is caused by adjacent surface water diversion or groundwater  
6 pumping. There must, however, be a saturated zone beneath connected to similar  
7 zones beneath the upper and lower perennial or intermittent stream sections.

8 3. Except as set forth in paragraph 2 above, there must be a hydraulic connection  
9 between the surface stream and the “subflow” zone.

10 4. The “subflow” zone must be distinguished from adjacent tributary aquifers or  
11 connecting basin fill.

12 5. The parameters of the “subflow” zone, if it is to be defined by reference to the  
13 saturated floodplain alluvium, Holocene alluvium, or younger alluvium, must be  
14 outside of and not include those tributary alluvial deposits known as “inliers” as  
15 indicated in [a figure in an expert’s report]. (Numbers 6 and 7 are omitted because  
16 they are not germane to this discussion).<sup>85</sup>

17 The trial court then took up the different proposals for defining the subflow zone and  
18 concluded:

19 After consideration of flow direction, water level elevation, the gradation of water  
20 levels over a stream reach, the chemical composition if available, and lack of  
21 hydraulic pressure from tributary aquifer and basin fill recharge which is  
22 perpendicular to stream and “subflow” direction, the Court finds the most accurate of  
23 all the markers is the edge of the saturated floodplain Holocene alluvium.<sup>86</sup>

24 The court gave the reasons for this determination. First, the floodplain Holocene alluvium “is  
the only stable geologic unit which is beneath and adjacent to most rivers and streams....”<sup>87</sup> Second,  
when the floodplain Holocene alluvium is saturated, “that part of the unit qualifies as the ‘subflow’  
zone, where the water which makes up the saturation flows substantially in the same direction as the  
stream, and the effect of any side discharge from tributary aquifers and basin fill is overcome or is

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<sup>85</sup> *Id.* at 35-36.

<sup>86</sup> *Id.* at 56; *see also* 198 Ariz. at 337, 9 P.3d at 1076.

<sup>87</sup> Goodfarb Order 56.

1 negligible.”<sup>88</sup> The subflow zone must be saturated because there must be a hydraulic connection  
2 between the stream and the subflow.

3 In further support of the determination that the subflow zone is the saturated floodplain  
4 Holocene alluvium, the trial court stated:

5 If we add the following additional criteria, then even more certainty and  
6 reliability is provided. First, the water level elevation of the “subflow” zone must be  
7 relatively the same as the stream flow’s elevation. Second, the gradient of these  
8 elevations for any reach must be comparable with that of the levels of the stream flow.  
9 Third, there must be no significant difference in chemical composition that cannot be  
10 explained by some local pollution source which has a limited effect. Fourth, where  
11 there are connecting tributary aquifers or floodplain alluvium of ephemeral streams,  
12 the boundary of the “subflow” zone must be at least 200 feet inside of that connecting  
13 zone so that the hydrostatic pressure effect of the side recharge of this tributary  
14 aquifer is negligible and the dominant direction of flow is the stream direction. Fifth,  
15 where there is a basin-fill connection between saturated zones of the floodplain  
16 Holocene alluvium and a saturated zone of basin fill, the boundary of the “subflow”  
17 zone must be 100 feet inside of the connecting zone so that the hydrostatic pressure  
18 effect of the basin-fill’s side discharge is overcome and the predominant direction of  
19 flow of all of the “subflow” zone is the same as the stream’s directional flow.<sup>89</sup>  
20 (Underlining in original.)

21 The Supreme Court held that “the [trial] court based its ruling on evaluation of the pertinent  
22 factors set forth in *Gila River II* for delineating the subflow zone.”<sup>90</sup> The Court, foreshadowing  
23 similar arguments made in this proceeding, held:

24 At oral argument, the groundwater users questioned...what role, if any, the  
criteria that we set forth in *Gila River II* and that the trial court used will play in  
determining subflow in different locations. The criteria that the trial court articulated  
were elaborations of, but consistent with, the more general criteria set forth in *Gila  
River II*. The trial court properly applied these criteria to the San Pedro River basin in  
order to determine the most appropriate subflow zone, and the weight of the evidence  
supports the trial court’s identification of that zone as the “saturated” floodplain  
Holocene alluvium.<sup>91</sup>

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<sup>88</sup> *Id.* at 57.

<sup>89</sup> *Id.* at 57-58; *see* 198 Ariz. at 337-8, 9 P.3d at 1076-7.

<sup>90</sup> 198 Ariz. at 337, 9 P.3d at 1076.

<sup>91</sup> 198 Ariz. at 341-2, 9 P.3d at 1080-1.

1 The trial court considered each of the criteria specified in *Gila II*, and determined they are  
2 met within the saturated floodplain Holocene alluvium. The trial court did not simply identify or  
3 formulate a set of more specific criteria or parameters to delineate the subflow zone. The Supreme  
4 Court affirmed this order in all respects.

5 The Special Master finds that the criteria specified in *Gila IV* to delineate the subflow zone  
6 have already been taken into account in the Supreme Court’s holding that the saturated floodplain  
7 Holocene alluvium is the subflow zone.

8 This determination means that ADWR is required to apply the same criteria when it cannot  
9 delineate the subflow zone utilizing the procedures approved by the trial court. ADWR may find  
10 stream segments where the procedures approved by the trial court are insufficient to delineate the  
11 subflow zone with the requisite accuracy and reliability. In those situations, *Gila IV* directs that  
12 ADWR must consider “insofar as they apply and are measurable,” the “detailed criteria set forth in  
13 the trial court’s order,” and may consider “other criteria that are geologically and hydrologically  
14 appropriate for the particular location.”<sup>92</sup> ADWR should report the reasons for selecting any other  
15 criteria it found appropriate for the location.

16 **Recommendation 11:** The Court should adopt the finding that the criteria specified in *Gila*  
17 *IV* to delineate the subflow zone have been taken into account in the Supreme Court’s holding that  
18 the saturated floodplain Holocene alluvium is the subflow zone.

19 **Recommendation 12:** The Court should direct ADWR to use the criteria specified in *Gila IV*  
20 and any other criteria that are geologically and hydrologically appropriate for the particular location  
21 to delineate the subflow zone, if ADWR is unable to do so with the requisite accuracy and reliability  
22

23 \_\_\_\_\_  
24 <sup>92</sup> 198 Ariz. at 342, 9 P.3d at 1081.

1 utilizing the procedures approved by the Court. ADWR should report the reasons for selecting any  
2 other criteria it found appropriate for the location.

3 **E. Should ADWR’s subflow analysis consider predevelopment or current stream**  
4 **flow conditions?**

5 This question was briefed prior to the hearing. On September 8, 2003, a proposed ruling was  
6 issued subject to modification after considering the evidence presented at the hearing. The ruling is  
7 modified based on subsequent evidence and arguments.

8 Parties argue that Judge Goodfarb, the Arizona Supreme Court, and Judge Ballinger have  
9 decided this issue. One party argues Judge Ballinger decided the issue in his January 22, 2002, order  
10 directing ADWR to prepare a report that:

11 shall include...a method for including both perennial and intermittent streams as part  
12 of the subflow analysis, including streams that historically contained perennial or  
13 intermittent flows, but which now are ephemeral due to development and other human  
14 initiated actions. The Court...expects the department to formulate a proposal using  
readily available historical data that will permit determination of water levels and  
locations as of date(s) prior to widespread diversion and depletion of Arizona’s stream  
flows.<sup>93</sup>

15 Judge Ballinger’s directions to ADWR to present a “method” and “formulate a proposal” to  
16 delineate the lateral limits of the subflow zone in the San Pedro River Watershed do not constitute a  
17 ruling on this issue. Even considered in its entirety, the January 22, 2002, order cannot be interpreted  
18 to say that the trial court ruled predevelopment conditions should be used for the subflow analysis.  
19 The trial court gave directions to ADWR as to what the department was to present in its  
20 recommendations. The trial court did not decide this issue in that order.

21 In the proposed ruling, the Special Master stated that a close reading of the trial court’s  
22 orders, *Gila II*, and *Gila IV* does not show this issue was presented to the trial court or to the Arizona  
23 Supreme Court or “that it was decided by either court with definiteness and clarity, that it can be said

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24 <sup>93</sup> Ballinger Order 1-2.

1 the law of the case was set.”<sup>94</sup> The parties arguing that the issue of predevelopment vs. current  
2 conditions was presented to the trial court and to the Supreme Court, and both courts decided the  
3 issue, point to what has been called the “ephemeral stream exclusion” or “exception” and to the trial  
4 court’s definition of an intermittent stream. The Special Master believes exception fits better than  
5 exclusion.

#### 6 *The Ephemeral Stream Exception*

7 The exception is set forth in the second principle Judge Goodfarb found was necessary to  
8 define the subflow zone:

9 [The subflow zone] may not be adjacent or beneath an ephemeral stream.  
10 However, it may be adjacent or beneath an ephemeral section of a perennial or  
11 intermittent stream, if the ephemeral section is caused by adjacent surface water  
12 diversion or groundwater pumping. There must, however, be a saturated zone beneath  
13 connected to similar zones beneath the upper and lower perennial or intermittent  
14 stream sections.<sup>95</sup>

15 The Cities argue that ADWR and they presented expert reports and testimony to the trial  
16 court, during the 1987 and 1994 hearings, indicating that in some river segments the  
17 groundwater/surface water connection had ceased to exist or had been severed due to development of  
18 water resources, and therefore, wells within these ephemeral reaches should be excluded from the  
19 adjudication. Furthermore, it is implicit in the ephemeral stream exception that current conditions  
20 must be used for the subflow analysis because the exception applies “if the ephemeral section is  
21 caused by adjacent surface water diversion or groundwater pumping,” and these activities did not  
22 occur in predevelopment times. According to the Cities, the exception requires, at a minimum,  
23 determination of its applicability, and at a maximum, delineation of the subflow zone using current,  
24 not predevelopment, stream flow conditions. Because the Supreme Court affirmed the trial court’s

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<sup>94</sup> Special Master’s Order Determining Issues 1 Through 4, 3.

<sup>95</sup> Goodfarb Order 35.

1 order in its entirety including the principles, it is argued the law of the case was set, and the point of  
2 law is binding on the trial court under the doctrine of *stare decisis*.<sup>96</sup>

3 In his 66-page ruling with 36 pages of exhibits, Judge Goodfarb did not amplify or explain  
4 the exception, and he did not repeat it in the summary of his findings. The order does not shed light  
5 on the reasons for the exception.

6 The Cities presented copies of pages of some of the briefs they and the Nature Conservancy  
7 filed in the Arizona Supreme Court related to the *Gila II* and *Gila IV* appeals.<sup>97</sup> The Nature  
8 Conservancy's *Gila II* opening brief (May 15, 1992) stated in pertinent part:

9 It would be a difficult task at best for the trial court to attempt now to reconstruct what  
10 happened to surface water appropriations as a result of subflow withdrawals  
11 throughout the Gila River System. Put another way, practicalities make it difficult to  
12 apply the proper test for "subflow" back to the point of restoring streams long ago  
13 depleted without formal objection registered (or litigation brought) by those who had  
14 prior appropriations in those streams. Instead, the most practical approach may simply  
15 be to exclude from the adjudication those wells in areas where the surface streams  
16 have already been completely, essentially permanently, depleted. Such areas would  
17 include, for example, the Santa Cruz River near Tucson, the lower Salt, and the lower  
18 Gila Rivers.<sup>98</sup>

19 The Cities' briefs filed in the Arizona Supreme Court in *Gila II* (May 15, 1992) and *Gila IV*  
20 (May 15, 1995) discussed the lack of hydraulic connection in ephemeral streams as a result of  
21 surface water diversions and groundwater pumping. The pages of the *Gila II* opening brief described  
22 the severing of hydraulic connection in the Lower Salt River due to the construction of dams,  
23 urbanization, and groundwater pumping. The pages from the *Gila IV* brief described how ephemeral  
24 streams can be caused by the severing of hydraulic connection as a result of human activity, and

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21 <sup>96</sup> The doctrine embodies the "principle that a decision made in one case will be followed in the next." A.  
22 SCALIA, A MATTER OF INTERPRETATION: FEDERAL COURTS AND THE LAW 7 (1997).

23 <sup>97</sup> Cities' Subflow Post-Hearing Opening Brief, exs. 9, 10, 11 (Mar. 3, 2004). SRP's objections to these  
24 exhibits were denied, but consideration of exhibits 10 (May 15, 1992, brief) and 11 (May 15, 1995, brief) was  
limited to the Cities' assertion that the issue of applying current, not predevelopment, stream conditions to the  
ephemeral stream exception was presented to the Arizona Supreme Court.

<sup>98</sup> *Id.* ex. 9 at 57-58.

1 argued that because there is no hydraulic connection between the stream and a groundwater aquifer,  
2 wells pumping within these ephemeral reaches do not impact subflow or stream flow.

3 The Supreme Court did not discuss the ephemeral stream exception in *Gila IV*. The word  
4 “predevelopment” appears only once in that opinion, in footnote 4 referring to the Nature  
5 Conservancy’s proposal to define the subflow zone by the geographic area phreatophytes had  
6 occupied in predevelopment times. “Current” also appears once in footnote 5 used as a noun.

7 Next the Cities claim that the trial court’s definition of an intermittent stream (adopted from  
8 ADWR’s Technical Assessment as stated on page 25 of this report) shows the court ruled subflow  
9 analysis must use current conditions. The pertinent portion of the definition states that intermittent  
10 streams may have periods of reduced groundwater discharge as a result of “natural and cultural  
11 losses” or “uses.”<sup>99</sup> The Special Master finds that the trial court adopted a commonly accepted  
12 definition of an intermittent stream.

13 The Special Master has carefully reviewed the papers, reports, and exhibits and has spent  
14 much time on this issue. The conclusion is that the Cities, the Nature Conservancy, and ADWR  
15 discussed before the trial court and, except ADWR, before the Arizona Supreme Court the  
16 requirement of hydraulic connection between the surface stream and the groundwater aquifer to  
17 define the subflow zone and the lack of hydraulic connection in certain streams, for example, the  
18 Lower Salt River and the Santa Cruz River near Tucson, as a result of surface water diversions and  
19 groundwater pumping. The Cities asserted their position that hydraulic connection between the  
20 surface water and the groundwater aquifer in the Lower Salt River has been altered as a result of

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24 <sup>99</sup> Goodfarb Order 24.

1 human activities, and therefore, wells within the ephemeral reaches of the Lower Salt River are not  
2 withdrawing subflow.<sup>100</sup>

3 The Special Master concedes the Cities have argued, and well, this position not only before  
4 the trial court but also before the Supreme Court and the Special Master.<sup>101</sup> The Special Master  
5 cannot find, however, that the trial court ruled, and was affirmed by the Supreme Court, that subflow  
6 analysis must consider current and not predevelopment stream flow conditions, entitling the affirmed  
7 ruling to *stare decisis*. Judge Goodfarb’s order shows he was deliberate with words and analysis,  
8 respectful of the needs for explanations of “reviewing appellate courts,” and cognizant of the trial  
9 court’s “duty to provide as much detail as it can to explain the factual decisions made.”<sup>102</sup> The trial  
10 court did not explain the exception, and *Gila IV* provides no assistance with the search for an answer.  
11 The Special Master cannot conclude that the unexplained exception decided this issue as a principle,  
12 precedent, or point of law in this adjudication.<sup>103</sup> Neither the trial court nor *Gila IV* has decided  
13 whether ADWR’s subflow analysis should consider predevelopment or current conditions.

14 The Special Master believes that in order to give effect to the plain language of the exception,  
15 and incorporate it into the subflow analysis, the applicability of the exception must be determined  
16 using post-development conditions. Under this view, a well will not be subject to the adjudication, if  
17 it meets all of the following conditions:

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19 <sup>100</sup> The condition described in the Lower Salt River may not exist to the same degree in other watersheds. Mr.  
20 Briggs declared, “[i]n the Verde Valley this is not a significant issue as there are no major upstream dams, nor  
21 has there been major groundwater development and overdraft.” Philip C. Briggs Rebuttal Decl. ¶ 11a (June  
22 27, 2003).

21 <sup>101</sup> See Affidavit of Doug Toy, P.E. in Cities’ Response to ADWR’s Subflow Report ex. 2 (June 17, 2002).

22 <sup>102</sup> Goodfarb Order 64.

23 <sup>103</sup> *Francis v. Ariz. Dept. of Transp., Mot. Veh. Div.*, 192 Ariz. 269, 271, 963 P.2d 1092, 1094 (Ariz. App.  
24 1998); *City of Bisbee v. Cochise Co.*, 52 Ariz. 1, 6, 78 P.2d 982, 984 (1938); see *State ex rel. La Prade v. Cox*,  
43 Ariz. 174, 30 P.2d 825 (1934). An instructive decision on the law of the case doctrine is *State v. King*, 180  
Ariz. 268, 278-9, 883 P.2d 1024, 1034-5 (1994), *cert. denied*, 516 U.S. 880 (1995). Arizona recognizes the  
law of the case doctrine as a rule of procedure not substance.

1 1. The well is located within an ephemeral section of a perennial or intermittent  
2 stream,

3 2. The ephemeral section of the perennial or intermittent stream is or was caused by  
4 adjacent surface water diversion or groundwater pumping and not by climate or  
5 watershed changes,<sup>104</sup> and

6 3. There is no saturated zone beneath the ephemeral section that is connected to  
7 similar saturated zones beneath the upstream and downstream perennial or  
8 intermittent sections.

9 The Special Master recommends that ADWR investigate and tabulate all wells that are or  
10 may be subject to the ephemeral stream exception. In this manner, the exception is reconciled with  
11 using predevelopment conditions for the subflow analysis.

#### 12 *Predevelopment Conditions*

13 The parties who favor using current stream flow conditions argue that information of  
14 predevelopment conditions is unavailable, inconsistent, unverifiable, and unreliable making subflow  
15 determinations uninformed guesswork that does not satisfy the clear and convincing evidentiary  
16 standard; predevelopment conditions cannot be recreated after decades of surface water diversions  
17 and groundwater pumping; and using predevelopment conditions will result in an expanded subflow  
18 zone at odds with the “narrow concept” of subflow long adhered to by the Arizona Supreme Court.<sup>105</sup>

19 Those in favor of predevelopment conditions argue that additional evidence is available in  
20 other sources such as historical reports and maps; using current conditions would unfairly advantage  
21 claimants who have been pumping subflow without water rights, with unquantified water rights, or  
22 without regard for prior vested surface water rights; and if current conditions are used, claimants at  
23 the end of ADWR’s watershed investigations would gain an unfair position because their claims will  
24 be adjudicated years from now when the subflow zone may be depleted.

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23 <sup>104</sup> Mr. Michael J. Lacey discussed the exception in his rebuttal declaration and pointed out the distinction  
24 between human activity and natural changes. Michael J. Lacey Rebuttal Decl. 6 (June 27, 2003).

<sup>105</sup> 175 Ariz. at 391, 857 P.2d at 1245.

1 A standard that satisfies all of these objections is a chronological point of reference:

2 1. That can be applied consistently, although the specific time period may vary from  
3 watershed to watershed;

4 2. For which evidence is available to delineate the lateral extent of the subflow zone  
5 as accurately and reliably as possible; and

6 3. That overcomes unfair practicalities due to the slow progress of the adjudication.

7 Predevelopment conditions are a consistent chronological point of reference that meets these  
8 criteria. The discrete time period will not be the same for all watersheds, but predevelopment  
9 conditions are the most consistent and fairest reference point for sub flow analysis.

10 The experts expressed different opinions about the quality and quantity of available evidence  
11 to evaluate predevelopment stream flow conditions. An example are the views about the USGS Atlas  
12 (which ADWR proposes to use) that shows the location of predevelopment perennial streams and  
13 predevelopment water level contours. Dr. Montgomery and Mr. Anderson expressed concerns about  
14 the quality of the sources of information used to compile the Atlas.<sup>106</sup> On the other hand, Mr. Briggs  
15 used the Atlas as a source of predevelopment groundwater elevations data.<sup>107</sup> Mr. Gookin  
16 recommended that additional sources be studied and professional historians retained to assist with  
17 this part of the investigations. Mr. Briggs declared, “I disagree that a predevelopment subflow zone  
18 cannot be delineated. There is ample scientific and [anecdotal] evidence available to use to delineate  
19 a predevelopment subflow zone in the Salt River Valley.”<sup>108</sup> The Special Master concludes that more  
20 and better evidence of predevelopment conditions can be obtained, and the effort to obtain it must be  
21 made.

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23 <sup>106</sup> Errol L. Montgomery and Thomas W. Anderson Decl. 11 (June 17, 2002).

24 <sup>107</sup> Philip C. Briggs Decl. ¶ 7i (June 17, 2002).

<sup>108</sup> Philip C. Briggs Rebuttal Decl. ¶ 11a(2) (June 27, 2003).

1 ADWR has not had an opportunity to obtain and review additional maps, reports, and  
2 documents suggested by the experts who submitted declarations; conduct field investigations;  
3 analyze drilling records; and run models. After ADWR submitted the Subflow Report, it found the  
4 NRCS soil survey maps which Mr. Burtell testified “would be very useful for our work in the  
5 adjudications.”<sup>109</sup> ADWR should be directed and allowed to obtain more concrete and useful  
6 information. Moreover, if adopted by the trial court, many of this report’s recommendations will  
7 improve the investigations. It is premature to conclude that ADWR cannot obtain reliable evidence  
8 of predevelopment stream flow conditions.

9 Using predevelopment conditions precludes claimants whose water use claims will be  
10 adjudicated in the later phases of ADWR’s watershed investigations from gaining an unfair position.  
11 If current conditions are used, claimants at “the back of the line”<sup>110</sup> who are pumping subflow would  
12 benefit because they could continue to withdraw subflow, and years from now their wells could be  
13 found to be outside the subflow zone delineated under then current conditions. This concern is  
14 heightened when claimants who are pumping subflow or stream flows without an appropriative water  
15 right are considered. The slow progress of investigations and adjudication of water uses is a reality  
16 that must be weighed in this discussion.

17 The concern that using predevelopment conditions might result in more wells included in the  
18 adjudication than under current conditions is unmerited. The subflow zone will remain as narrow as  
19 the saturated floodplain Holocene alluvium.

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22 <sup>109</sup> Hrg. Tr. 15:25 (Oct. 21, 2003).

23 <sup>110</sup> SRP’s Opening Brief on Legal Issues 4 (June 6, 2003). While SRP argues claimants would “race to” the  
24 back of the investigations line, the fact is that at the pace this adjudication has been proceeding due to a  
variety of factors, there is not much immediacy for claimants outside of the San Pedro River Watershed “to  
race.”

1 The time period selected to define predevelopment conditions will influence the accuracy and  
2 reliability of subflow determinations. Parties have suggested various years or periods to define  
3 predevelopment conditions:

- 4 1. 1848, the year the United States and Mexico signed the Treaty of Guadalupe  
5 Hidalgo (on February 2, 1848).
- 6 2. Post-1865 (after the Civil War).
- 7 3. Prior to about 1900 for surface water in highly developed watersheds.
- 8 4. 1931, the year *Southwest Cotton* was decided.
- 9 5. Prior to about 1940 for groundwater in highly developed watersheds.
- 10 6. February 17, 1978, the date Phelps Dodge filed a petition with the Arizona State  
11 Land Department to adjudicate water rights in portions of the Lower Gila River  
Watershed and the Upper Gila River Watershed including the San Francisco River,  
Chase Creek, and Eagle Creek.<sup>111</sup>

12 Selection of a date or period must consider the feasibility of obtaining the requisite technical  
13 data and evidence; potential delay and expense of those efforts and of subsequent investigations;  
14 level of accuracy and reliability of the subflow analysis; confidence of meeting the clear and  
15 convincing evidentiary standard; and fairness.

16 In its January 22, 2002, order, the trial court provided an appropriate time frame for defining  
17 predevelopment conditions that satisfies these concerns, namely, “prior to widespread diversion and  
18 depletion of Arizona’s stream flows.”<sup>112</sup> The word “widespread” is defined as “widely  
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22 <sup>111</sup> On April 19, 1978, Phelps Dodge supplemented this petition to include additional lands in the Lower Gila  
23 River and Upper Gila River Watersheds. In 1979, the petitions were transferred to the Arizona Superior Court.  
1979 Ariz. Sess. Laws, ch. 139, § 39 (effective Apr. 17, 1979).

24 <sup>112</sup> Ballinger Order 2.

1 extended...occurring over a wide area or extent.”<sup>113</sup> The term indicates greater than minimal,  
2 localized, or sporadic diversion and depletion of stream flows as a result of human activity.

3 The evidence is not sufficient to select one of the dates or periods advocated by the parties.  
4 The Special Master believes the evidence together with the factors listed above favor selecting a date  
5 or period after 1865 and before 1940. The Special Master recommends that the discrete time period  
6 be an approximate chronological year or a range of years immediately prior to widespread diversion  
7 and depletion of a stream’s flows as a result of human activity. The chronological year or range of  
8 years will not be the same for all watersheds.

9 **Recommendation 13:** The Court should direct ADWR to use predevelopment stream flow  
10 conditions for subflow analysis.

11 **Recommendation 14:** The Court should direct ADWR to investigate and tabulate all wells  
12 subject to the ephemeral stream exception set forth in the trial court’s June 30, 1994, order.

13 **Recommendation 15:** The Court should define predevelopment stream flow conditions, for  
14 the purpose of subflow analysis, to mean a chronological year or a range of years immediately prior  
15 to widespread diversion and depletion of the stream’s flows as a result of human activity.

16 **F. Does ADWR’s recommendation that the entire lateral extent of the floodplain**  
17 **Holocene alluvium be assumed to be saturated comport with *Gila IV*?**

18 ADWR recommends “that the entire lateral extent of the floodplain Holocene alluvium be  
19 assumed to be saturated for the purpose of delineating the jurisdictional subflow zone.”<sup>114</sup> The  
20 recommendation is based on the limitations of available data, variability of saturation of the  
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22 <sup>113</sup> WEBSTER’S NEW WORLD DICTIONARY OF AMERICAN ENGLISH 1526 (3d ed. 1988); *cf.* A.R.S. § 1-213 relating to  
23 statutory construction (“Words and phrases shall be construed according to the common and approved use of  
the language.”).

24 <sup>114</sup> Subflow Report 13.

1 floodplain Holocene alluvium, and the trial court’s request to consider predevelopment stream flow  
2 conditions. ADWR explains:

3 Determination of the saturated portion of the floodplain Holocene alluvium requires  
4 data on two subsurface conditions:

- 5 • The thickness of the floodplain Holocene alluvium; and
- 6 • The depth to the water table beneath the floodplain.

7 ...

8 However, the two conditions indicated above cannot be determined with  
9 reasonable means in the San Pedro River watershed or elsewhere in the Gila River  
10 adjudication area. The thickness of the floodplain Holocene alluvium and the depth to  
11 the water table beneath the floodplain are highly variable, both spatially and  
12 temporally, and this makes the determination of saturation difficult. In many areas of  
13 the Gila River adjudication, detailed subsurface data for the floodplain simply do not  
14 exist or are limited, and additional data would have to be collected and analyzed at  
15 considerable cost and time. In the few areas where extensive subsurface data have  
16 been collected, it is often still difficult to define variations in the thickness of the  
17 Holocene alluvium across the floodplain and changes in the elevation of the water  
18 table over time.<sup>115</sup>

19 Concerning the thickness of the floodplain Holocene alluvium, ADWR gives an example of a  
20 “very costly” USGS hydrogeologic project in the Sierra Vista Subwatershed. Although the USGS  
21 used “very sophisticated and expensive geophysical and lithological data, the actual thickness of the  
22 Holocene alluvium could not be determined with any degree of certainty.”<sup>116</sup> In “the remainder of the  
23 San Pedro River watershed and most of the Gila River adjudication area, well driller’s logs will  
24 likely be the only source, if any, of subsurface geologic data for the floodplain,” and “[t]he accuracy  
of this data is questionable.”<sup>117</sup> “This lack of reliable data prevents the thickness of the floodplain  
Holocene alluvium from being determined with any certainty.”<sup>118</sup>

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25 <sup>115</sup> *Id.*

26 <sup>116</sup> *Id.* at 14.

27 <sup>117</sup> *Id.*

28 <sup>118</sup> *Id.* at 15.

1           Regarding the water table beneath the floodplain, ADWR states there “is a lack of reliable  
2 data concerning the depth to the water table,” which “is further exacerbated by the dynamic nature of  
3 the floodplain aquifer system,” as “the water table sometimes chang[es] rapidly in response to storm  
4 runoff events and evapotranspiration by plants, and sometimes chang[es] slowly due to the effects of  
5 droughts and wet periods, seasonal differences, and pumping.”<sup>119</sup> These “variations are not unique to  
6 recent times, but apparently also occurred during predevelopment conditions.”<sup>120</sup>

7           Saturation or how much water is stored in the floodplain Holocene alluvium can vary. Dr.  
8 Matlock defined the terms as follows:

9           “Saturated alluvium would be alluvium of which the pores are completely filled with  
10 water. Unsaturated would be a condition in which they’re not completely filled with  
water.”<sup>121</sup>

11 Mr. Burtell testified, “[t]here are times when it will be saturated and there are times when it’s  
12 possible that it will not be saturated.”<sup>122</sup> Mr. Harmon testified that the saturated extent of the  
13 floodplain Holocene alluvium “can change from year to year. It can change within a season with all  
14 types of recharge, inputs, discharge, different inflows and outflows....can change maybe from day to  
15 day....perhaps [from hour to hour] if you have a lot of wells turning on and off.”<sup>123</sup> Saturation is  
16 dynamic.

17           ADWR believes its proposal is consistent with using predevelopment stream flow conditions  
18 for subflow analysis because “[b]y definition, floodplain Holocene alluvium was saturated at some  
19 point in predevelopment time.”<sup>124</sup> The floodplain Holocene alluvium consists of sediments deposited  
20 under flood flow conditions. It, therefore, was saturated at the time floods deposited the sediments,

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21 <sup>119</sup> *Id.*

22 <sup>120</sup> *Id.*

23 <sup>121</sup> Hrg. Tr. 211:6-8 (Oct. 21, 2003).

24 <sup>122</sup> *Id.* at 43:9-11.

<sup>123</sup> *Id.* at 359:18-25 (Oct. 22, 2003).

<sup>124</sup> Subflow Report 17.

1 but for how long thereafter and to what extent the saturation lasted is debated. Mr. Ford declared that  
2 “the only processes that reduce the lateral extent of saturation from the historic maximum limit are  
3 human activity and climate cycles.”<sup>125</sup> On the other side, Mr. Lacey testified, “[i]t would not have  
4 been saturated once the flood flows had receded.”<sup>126</sup>

5 Mr. Page declared that ADWR’s recommendation “is reasonable based on available water  
6 level data that suggests the depth to water in the floodplain Holocene alluvium is very shallow,  
7 indicating only a thin margin along the edges of this unit may be unsaturated.... [O]nly a thin upper  
8 portion of the floodplain Holocene alluvium is unsaturated....”<sup>127</sup>

9 Resolving this issue is not easy. It would be wasteful to direct ADWR to do something that is  
10 not feasible, but it would be foolish to sidestep the law in a rush to expediency. The issue is whether  
11 the recommendation comports with *Gila IV*. The Special Master finds it does not.

#### 12 *The Clear and Convincing Evidentiary Standard*

13 After reviewing the trial court’s order which had sought “to determine the most appropriate  
14 subflow zone,” the Supreme Court affirmed the order holding that “the weight of the evidence  
15 supports the trial court’s identification of that zone as the ‘saturated’ floodplain Holocene  
16 alluvium.”<sup>128</sup> *Gila II* and *Gila IV* emphasize that the test to delineate the lateral extent of the subflow  
17 zone must not be “defective” or “flawed.” *Gila II* admonishes that using a defective test “would  
18 adversely affect the adjudication” because “errors in every HSR” would have to be litigated,  
19 exacerbating “an already lengthy and costly process,” and a flawed test “could cause significant  
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22 <sup>125</sup> Jon R. Ford Decl. ¶ 14c (June 17, 2002).

23 <sup>126</sup> Hrg. Tr. 417:7-8 (Oct. 22, 2003).

24 <sup>127</sup> Oliver S. Page, Peter M. Pyle, and Jean M. Moran Decl. 16 (June 17, 2002).

<sup>128</sup> 198 Ariz. at 342, 9 P.3d at 1081.

1 injustice.”<sup>129</sup> *Gila IV* is more direct - “it is critical that any test used for determining the boundaries  
2 of a subflow zone be as accurate and reliable as possible.”<sup>130</sup>

3 The test must be so robust because one “who asserts that underground water is a part of a  
4 stream’s subflow must prove that fact by clear and convincing evidence.”<sup>131</sup> Only clear and  
5 convincing evidence will rebut the presumption that underground waters are percolating, and are  
6 therefore, not appropriable as subflow. If ADWR uses the proper test to delineate the lateral extent of  
7 the subflow zone, “its determination that a well is pumping appropriable subflow constitutes clear  
8 and convincing evidence.”<sup>132</sup>

9 Parties have argued throughout this proceeding that ADWR’s proposed procedures, in whole  
10 or in part, do not satisfy the clear and convincing evidentiary standard associated with the  
11 presumption that underground waters are percolating and are not appropriable as subflow. Of all the  
12 issues litigated, this is the only one that, in the Special Master’s opinion, requires that its resolution  
13 closely review the clear and convincing standard.

14 In Arizona, a party who has a burden of proof by clear and convincing evidence must show  
15 that the claim is “highly probable.”<sup>133</sup> In the adjudication, when ADWR reports a well is pumping  
16 appropriable subflow, the report is considered to be a determination that it is highly probable the well  
17 is pumping appropriable subflow from the saturated floodplain Holocene alluvium. The standard “is  
18 more exacting than the standard of more probably true than not true but is less exacting than the  
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21 <sup>129</sup> 175 Ariz. at 388, 857 P.2d at 1242.

<sup>130</sup> 198 Ariz. at 335, 9 P.3d at 1074.

<sup>131</sup> *Id.*; see also 39 Ariz. at 85, 4 P.2d at 376 (*Southwest Cotton*).

<sup>132</sup> 175 Ariz. at 392, 857 P.2d at 1246.

<sup>133</sup> *State v. Renforth*, 155 Ariz. 385, 388, 746 P.2d 1315, 1318 (Ariz. App. 1987); *State v. King*, 158 Ariz. 419,  
23 763 P.2d 239 (1988); Recommended Arizona Jury Instructions (Civil) 3d Standard 10 (“A party who has the  
24 burden of proof by clear and convincing evidence must persuade you by the evidence that the claim is highly  
probable....”) (“RAJI Civil Standard 10”).

1 standard of proof beyond a reasonable doubt.”<sup>134</sup> Under *Renforth* and *King*, the highly probable  
2 standard does not require that ADWR’s determination be either certain or unambiguous.

3 The Special Master finds that the recommended assumption will not satisfy the clear and  
4 convincing standard. The assumption is expedient and likely less costly to implement than  
5 alternatives. The evidence, however, shows saturation fluctuates even in predevelopment conditions,  
6 and a thin upper portion of the floodplain Holocene alluvium is unsaturated.

7 To include a well in the adjudication, it is not enough to determine it is highly probable the  
8 entire lateral extent of the floodplain Holocene alluvium was saturated at some point. It must be  
9 shown it is highly probable the well is pumping subflow from the saturated floodplain Holocene  
10 alluvium. If the well owner disputes this assessment, the owner has the burden of proving by a  
11 preponderance of the evidence that the well is outside the subflow zone or is not withdrawing  
12 subflow.

13 Valid technical efforts must be undertaken to determine the saturated portion of the  
14 floodplain Holocene alluvium. The department avows it “has very limited resources available” to  
15 fund ongoing hydrogeologic projects or to obtain data.<sup>135</sup> Mr. Burtell described projects ADWR is  
16 undertaking or funding to collect more data in the San Pedro River Watershed and testified, “there is  
17 a tremendous amount of information that continues to be collected for that area.”<sup>136</sup> Mr. Briggs  
18 declared “ADWR’s proposed approach to delineation of the subflow zone to be far too conservative,  
19 pleading lack of data. While these data may not currently exist for every mile of Holocene alluvium,  
20 the data exist where there are wells (and hence a need to know). Where these data exist, they should

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22 <sup>134</sup> RAJI Civil Standard 10.

23 <sup>135</sup> Subflow Report 14.

24 <sup>136</sup> Hrg. Tr. 54:23-25 (Oct. 21, 2003). “The Sierra Vista subwatershed has been, and continues to be, one of the most studied areas in Arizona by geologists and hydrologists.” Subflow Report 13.

1 be used.”<sup>137</sup> ADWR may not have at this point sufficient information with the desirable level of  
2 detail, but it is striving to remedy this situation. This campaign must continue, and if necessary  
3 intensified. The task will not be simple, but the Special Master believes, after considering all the  
4 evidence, that the saturated portion of the floodplain Holocene alluvium can be established by clear  
5 and convincing evidence.

6 **Recommendation 16:** The Court should not adopt the recommendation that the entire lateral  
7 extent of the floodplain Holocene alluvium be assumed to be saturated for the purpose of delineating  
8 the subflow zone.

9 **Recommendation 17:** The Court should direct ADWR to determine the saturated portion of  
10 the floodplain Holocene alluvium as accurately and reliably as possible.

11 **G. Are ADWR’s recommendations sufficient to identify and exclude tributary**  
12 **aquifers, basin fill saturated zones, and ephemeral streams?**

13 The subflow zone must “be differentiated from adjacent geologic units such as tributary  
14 aquifers and the basin-fill aquifer which discharge into it or receive discharge from it...”<sup>138</sup> The trial  
15 court found this concept is necessary to define subflow consistent with *Southwest Cotton, Gila II*,  
16 and the scientific evidence the court had heard.

17 Subflow must be part of the surrounding floodplain of a stream but cannot be part of the  
18 alluvial plains of either a tributary aquifer (even if there is an alluvial connection between the  
19 tributary aquifer and the floodplain Holocene alluvium of the stream) or of an ephemeral stream. The  
20 trial court ruled:

21 Those parts of the alluvial plain which [subflow] may be a part of or which it is  
22 connected to must be the alluvial plain of a perennial or intermittent stream and not an  
ephemeral stream or a part of the alluvial plain of a tributary aquifer even if there is an  
alluvial connection. Where the alluvial plain of tributary aquifers or ephemeral

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23 <sup>137</sup> Philip C. Briggs Decl. ¶ 7g (June 17, 2002).

24 <sup>138</sup> Goodfarb Order 34.

1 streams connects to the floodplain Holocene alluvium of the stream itself and provides  
2 tributary or basin fill recharge, that tributary aquifer must also be excluded because its  
3 flow direction is different and often perpendicular to the stream-flow direction.<sup>139</sup>  
(Emphasis in order.)

4 The trial court added these two criteria so that “more certainty and reliability” would be  
5 provided to the definition of subflow:

6 Fourth, where there are connecting tributary aquifers or floodplain alluvium of  
7 ephemeral streams, the boundary of the “subflow” zone must be at least 200 feet  
8 inside of that connecting zone so that the hydrostatic pressure effect of the side  
9 recharge of this tributary aquifer is negligible and the dominant direction of flow is  
10 the stream direction. Fifth, where there is a basin-fill connection between saturated  
zones of the floodplain Holocene alluvium and a saturated zone of basin fill, the  
boundary of the “subflow” zone must be 100 feet inside of the connecting zone so that  
the hydrostatic pressure effect of the basin-fill’s side discharge is overcome and the  
predominant direction of flow of all of the “subflow” zone is the same as the stream’s  
directional flow.<sup>140</sup> (Underlining in order.)

11 Flow direction in the subflow zone must not be significantly affected by the pressure of side  
12 discharge from adjacent tributary aquifers or the basin fill aquifer. The water in the subflow zone  
13 must flow “substantially in the same direction as the stream, and the effect of any side discharge  
14 from tributary aquifers and basin fill is overcome or is negligible.”<sup>141</sup> The 100-foot and 200-foot  
15 setbacks overcome or substantially reduce the effects of side discharge. *Gila N* affirmed these  
16 rulings.

17 ADWR does not explicitly recommend procedures to exclude tributary aquifers, areas of  
18 basin fill recharge, and the alluvial plains of ephemeral streams. A group of parties argues that  
19 ADWR should be directed to propose procedures that take into account these exclusions from the  
20 subflow analysis.

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23 <sup>139</sup> *Id.* at 57.

24 <sup>140</sup> *Id.* at 57-58.

<sup>141</sup> *Id.* at 57.

1 The Subflow Report sets forth ADWR's proposed procedures to identify perennial,  
2 intermittent, and effluent-fed streams and delineate the lateral extent and saturated portion of the  
3 floodplain Holocene alluvium.<sup>142</sup> Because methodologies to locate tributary aquifers, areas of basin  
4 fill recharge, and ephemeral streams are not proposed, and ADWR's recommendations relate to the  
5 floodplain Holocene alluvium of a stream and its saturated portion, it can reasonably be concluded  
6 that ADWR will exclude tributary aquifers, areas of basin fill recharge, and ephemeral streams from  
7 the subflow analysis. The Special Master believes ADWR understands the exclusions described in  
8 the trial court's order and affirmed in *Gila IV*, but for certainty recommends that ADWR exclude  
9 from the subflow zone connecting tributary aquifers, areas of basin fill recharge, and the alluvial  
10 plains of ephemeral streams.

11 **Recommendation 18:** The Court should direct ADWR to exclude tributary aquifers, areas of  
12 basin fill recharge, and the alluvial plains of ephemeral streams from the subflow zone.

13 **Recommendation 19:** The Court should adopt Chapter 2 of the Subflow Report to the extent  
14 it does not conflict with any other recommendation made in this report.

### 15 **III. CONE OF DEPRESSION (Chapter 3 of the Subflow Report)**

#### 16 **A. Does ADWR's recommended drawdown of greater than or equal to 0.1 foot, 17 where the cone of depression has reached the edge of the subflow zone, comport with *Gila IV*?**

18 ADWR proposes to include a well in the adjudication if, at the time of the modeling, two  
19 conditions are met. The "first condition is that the simulated cone of depression has reached the edge  
20 of the jurisdictional subflow zone and drawdown at that point is greater than or equal to 0.1 foot, an  
21 amount that can be accurately measured in the field using standard water level measuring  
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23  
24 <sup>142</sup> Subflow Report 5.

1 equipment.”<sup>143</sup> The second condition is discussed in the next section. The distance of 0.1 foot is 1  
2 and 1/5 (or 1.2) inch.

3 *Gila IV* affirmed the trial court’s order that wells located outside the lateral extent of the  
4 subflow zone “may be included in the adjudication if ‘it is proven that their ‘cones of depression’  
5 [footnote omitted] reach the ‘subflow’ zone and the drawdown from the well affects the volume of  
6 surface and ‘subflow’ in such an appreciable amount that it is capable of measurement.”<sup>144</sup>  
7 ADWR’s recommendation addresses how to measure an appreciable amount.

8 Because it lacked pertinent evidence, the trial court did not establish a test for determining a  
9 well’s cone of depression but ruled that “whatever test ADWR finds is realistically adaptable to the  
10 field and whatever method is the least expensive and delay-causing, yet provides a high degree of  
11 reliability, should be acceptable.”<sup>145</sup> As *Gila IV* affirmed the trial court’s order in its entirety,  
12 ADWR’s recommendation will comport with *Gila IV* if it satisfies these criteria.

13 Computer modeling is generally accepted in the scientific community to measure water  
14 impacts.<sup>146</sup> Messrs. Briggs, Ford, Harmon, Lacey, Page, Marra, Dr. Mock, Dr. Montgomery, and  
15 ADWR have, and use, computer modeling in their professional work. These experts and ADWR  
16 have used analytical and numerical models for a variety of projects, and different models are used for  
17 different purposes, but the point is that professionals, including most of the experts who testified in  
18 this proceeding, use modeling as a tool to measure hydrologic impacts.

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22 <sup>143</sup> Subflow Report 31. “The cone of depression is the funnel-shaped area around a well where the withdrawal  
of groundwater through the well has lowered the water table.” 198 Ariz. at 342-3 n.9, 9 P.3d at 1081-2 n.9; see  
*also* 175 Ariz. at 391 n.10, 857 P.2d at 1245 n.10.

23 <sup>144</sup> 198 Ariz. at 342-3, 9 P.3d at 1081-2.

24 <sup>145</sup> *Id.* at 343, 1082 (quoting Goodfarb Order 62).

<sup>146</sup> Hrg. Tr. 79:18-25 - 80:1:5 (Oct. 21, 2003); 315:8-11 (Oct. 22, 2003).

1 ADWR recommends using computer modeling to measure the impact of a well's cone of  
2 depression on the subflow zone. ADWR does not give reasons for selecting a 0.1 foot drawdown  
3 level, but Mr. Ford posited that:

4 ADWR is proposing it because the Theis equation extends the cone of depression an  
5 infinite distance with an infinitesimally small drawdown. Thus, some practical  
6 drawdown cutoff is required. Using professional judgment, ADWR decided that the  
radius at 0.1 foot of drawdown represents the practical limit of the cone of  
depression.<sup>147</sup>

7 According to Mr. Ford, a well's cone of depression extends beyond the point where an impact of 0.1  
8 foot is measured. ADWR has simply selected 0.1 foot to represent the limit of the cone of depression.

#### 9 *Reliability of Modeling a 0.1 Foot Drawdown*

10 The principal objections against ADWR's proposal go to the reliability of modeling a 0.1 foot  
11 drawdown at the edge of the subflow zone. First, although a computer program, like the THWELLS  
12 model ADWR proposes to use, will simulate a 0.1 foot drawdown, this predicted or simulated  
13 drawdown will not match the actual drawdown measured in the field. Second, it is not possible to  
14 determine that a drawdown of 0.1 foot is due to a specific well's pumping because recharge,  
15 phreatophytes, pumping from other wells, surface water diversions, changes in river stage, and  
16 diurnal flow variations can cause aquifer drawdowns that cannot be isolated from the impact of a  
17 particular well. The objectors argue that this lack of reliability will not satisfy the clear and  
18 convincing evidentiary standard ADWR must meet to determine that a well's cone of depression has  
19 reached the subflow zone.

20 ADWR cautions that:

21 It is important to remember that the accuracy of model simulations will in most, if not  
22 all, cases be far less accurate than the ability to measure drawdown in the field.

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23 <sup>147</sup> Jon R. Ford Rebuttal Decl. ¶ 21 (June 27, 2003). ADWR proposes to use the THWELLS model, an  
24 analytical model described in chapter 3, section C, of this report, which is based on the Theis equation. The  
other model is a numerical model named MODFLOW also described in the same section.

1 Simulated water levels from even the most carefully calibrated MODFLOW models  
2 are typically no closer than  $\pm 5$  to 10 feet from the actual water levels measured in the  
3 field. And, unless water level data are available at the pumping well and at the edge of  
4 the jurisdictional subflow zone, it will be difficult to determine if the model  
5 simulations are overestimating or underestimating the true drawdown at these  
6 points.<sup>148</sup> (Emphasis added.)

7 The objectors focus on the underlined sentence to show the disparity between simulated and  
8 measured drawdowns even when using the most carefully calibrated MODFLOW model. It is not  
9 argued that field technicians cannot measure a drawdown of 0.1 foot in the field with standard  
10 hydrologic instruments. Although the trial court stated in 1994 that it “believes such close  
11 measurements [as a 0.1 foot drawdown] are difficult, at best, in the field,”<sup>149</sup> the testimony did not  
12 substantiate this belief. Mr. Mason testified that ADWR’s technicians can measure in the field a  
13 well’s drawdown to 0.1 foot, and in some cases, even down to 0.01 or .05 of a foot.<sup>150</sup> The objection  
14 is that a computer model’s simulated drawdown will not match the field measured true drawdown.

15 The MODFLOW model divides an aquifer into rectangular blocks which are then organized  
16 by rows, columns, and layers. Each block is called a cell. MODFLOW can consider numerous cells.  
17 Mr. Ford declared that:

18 [E]ach cell can have only a single value for each required parameter. The model  
19 assumes the water level in a given cell is everywhere the same. Therefore, if the cell  
20 size is such that the actual water level varies five to ten feet across the cell, the model  
21 cell value would vary from field values by the five to ten feet cited.<sup>151</sup>

22 A difference between a value representing a cell and a field measurement “does not imply error” but  
23 “means that the average value for the area represented by the cell size is different than at a point  
24

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22 <sup>148</sup> Subflow Report 31-32.

23 <sup>149</sup> Goodfarb Order 62.

24 <sup>150</sup> Hrg. Tr. 68:9-14 (Oct. 21, 2003). Dr. Montgomery testified, “[i]t’s easy to measure a change in water level  
of a tenth of a foot if that change occurs over a short period.” *Id.* at 120:6-7.

<sup>151</sup> Jon R. Ford Rebuttal Decl. ¶ 66 (June 27, 2003).

1 within the model cell.”<sup>152</sup> Dr. Mock likewise opined, “I doubt that the 5-10 foot number is from the  
2 comparison of simulated to measured drawdowns, as opposed to the comparison of simulated to  
3 measured water-level elevations for a specific location.”<sup>153</sup> A difference of five to ten feet in  
4 drawdown may not necessarily be found at every location within the cell or test area.

5 Mr. Ford expressed his opinion about the reliability of the MODFLOW model as follows:

6 If MODFLOW could not be more accurate than plus or minus 10 feet in its  
7 ability to predict the head distribution or drawdown in an aquifer, it would be of little  
8 use. However, MODFLOW is widely used in both the environmental engineering and  
9 ground water supply communities to analyze extremely complex situations. Federal  
agencies...rely upon the ability and accuracy of MODFLOW. So do many state  
agencies that are concerned about ground water contamination and water rights  
administration.<sup>154</sup>

10 Dr. Montgomery and Mr. Anderson declared:

11 While model projections have a high level of precision, they are not necessarily  
12 accurate. Model projections can only be as accurate as the hydraulic parameter values  
used for model input. Relatively small changes in input parameters may result in  
substantial changes in model projections for drawdown.<sup>155</sup>

13 Dr. Mock similarly declared about the importance of reliable parameter values:

14 Theis and MODFLOW...models can accurately calculate drawdowns to the  
15 hundredth of a foot or better, given acceptable parameter inputs. The real concern  
should be for the parameters used in these models.<sup>156</sup>

16 According to Mr. Mason, a computer model’s uncertainty arises from the many parameters  
17 the modeler is adjusting such as hydraulic conductivity, saturated thickness, and storage coefficient,  
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19  
20

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21 <sup>152</sup> *Id.* at ¶ 51.

<sup>153</sup> Peter A. Mock Rebuttal Decl. 7 (June 27, 2003).

<sup>154</sup> Jon R. Ford Rebuttal Decl. ¶ 52 (June 27, 2003).

<sup>155</sup> Errol L. Montgomery and Thomas W. Anderson Rebuttal Decl. 17 (June 27, 2003).

<sup>156</sup> Peter A. Mock Rebuttal Decl. 7 (June 27, 2003). Messrs. Harmon and Palumbo declared, “Briggs recommends that well information [in ADWR’s records] such as well depth, water levels, water quality, should be used in helping to determine whether any individual well should be subject to the Adjudication. We agree with this statement.” Eric J. Harmon and Mark R. Palumbo Rebuttal Decl. 32 (June 27, 2003).

1 but once these are defined by calibration, Mr. Mason agreed that “drawdown can be fairly accurately  
2 predicted.”<sup>157</sup>

3 *Gila IV* requires that the cone of depression test must yield results with a high degree of  
4 reliability. Under the clear and convincing evidentiary standard, ADWR’s determination that a well’s  
5 cone of depression impacts the subflow zone means it is highly probable the cone of depression has  
6 reached the edge of the subflow zone. The Special Master finds that a computer model’s simulation  
7 of a greater than or equal to 0.1 foot drawdown can satisfy the degree of reliability required by *Gila*  
8 *IV* and the highly probable standard of clear and convincing evidence. The requisite reliability will  
9 depend, as Dr. Mock and Dr. Montgomery stated, on the quality and quantity of parameter inputs. A  
10 focused and reasonable effort to collect and use reliable data and information must be made if a high  
11 degree of reliability is to be attained.

#### 12 *Alternatives to a 0.1 Foot Drawdown*

13 Dr. Montgomery and Messrs. Harmon, Palumbo, and Anderson suggested a drawdown of ten  
14 feet. This level is based on ADWR’s well spacing and impact standards, for wells in active  
15 management areas, of ten feet of drawdown over the first five years of operations, to determine well-  
16 to-well impacts.<sup>158</sup> Dr. Montgomery also suggested five to ten feet based on the drawdown that can  
17 be reliably simulated with MODFLOW according to ADWR’s statements in the Subflow Report.

18 Mr. Ford declared that:

19 In the case of well-to-well interference, the usual issue is whether a new well would  
20 significantly reduce the yield of a nearby existing well. In that case, well yield is not  
21 particularly sensitive to (affected by) drawdown, so a 10-foot criterion may be  
22 appropriate. In the case of determining the radius of the cone of depression, a 10-foot  
23 criterion is not appropriate because...the radius of the cone of depression is very  
24 different if the drawdown criterion is different by only a small amount.<sup>159</sup>

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23 <sup>157</sup> Hrg. Tr. 72:18-21 (Oct. 21, 2003).

24 <sup>158</sup> Temporary Rule R12-15-830 (Well Spacing and Well Impact) (Mar. 11, 1983); see A.R.S. § 45-598(A).

<sup>159</sup> Jon R. Ford Rebuttal Decl. ¶ 69 (June 27, 2003).

1 According to Mr. Ford, ADWR's well spacing standards are not intended to determine if a  
2 well's cone of depression impacts the subflow zone, but to determine if a well will interfere with  
3 another well. The standards relate to a well's pumping lift. Measuring a well's potential interference  
4 with a nearby well is, however, not the same as measuring the impact of a cone of depression on the  
5 subflow zone in accordance with *Gila IV*.

6 Mr. Gookin testified that if a ten-foot drawdown standard were adopted, "[b]y the time this  
7 adjudication is done, it would destroy the stream."<sup>160</sup> Mr. Page declared that "if all wells were  
8 subject to this standard the San Pedro River would become an ephemeral stream."<sup>161</sup> This  
9 consequence is due to the fact that a well's cone of depression extends farther out than the point  
10 where a ten-foot drawdown is measured. A well will withdraw water from the subflow zone long  
11 before a ten-foot drawdown level is reached.

12 Mr. Gookin suggested a maximum drawdown of 0.25 foot, but only if 0.1 foot is found "to be  
13 too tight a measurement."<sup>162</sup> Because the Special Master does not find that 0.1 foot is too tight a  
14 measurement for a cone of depression test, a 0.25 foot drawdown is not considered.

15 Mr. Briggs recommended implementing a concept often used to investigate the feasibility of  
16 recovering contaminated groundwater called "capture zone." The capture zone is the area where  
17 pumping the well depresses water levels. "All groundwater within the capture zone ultimately  
18 reaches the pumped well," but "[a]ll groundwater outside the capture zone, even if within the 'cone  
19 of depression,' escapes the effect of the well and continues down gradient."<sup>163</sup> Mr. Briggs posited  
20 that "drawdown" is not the issue, but "capture" of water by a well is the trial court's concern.

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22 <sup>160</sup> Hrg. Tr. 315:23-24 (Oct. 22, 2003).

23 <sup>161</sup> Oliver S. Page Rebuttal Decl. 10 (June 27, 2003).

24 <sup>162</sup> T. Allen J. Gookin Rebuttal Decl. ch. XI, 2 (June 27, 2003); *see also* Peter A. Mock Rebuttal Decl. 8 (June 27, 2003).

<sup>163</sup> Philip C. Briggs Decl. ¶ 8a (June 17, 2002).

1 Messrs. Harmon and Palumbo found the concept “confusing in the context of this  
2 Adjudication,” although it “does appear to be valid.”<sup>164</sup> Mr. Ford declared that:

3 Although capture analysis would demonstrate that a well is depleting the  
4 Subflow Zone, capture analysis is not by itself sufficient, because places likely exist  
5 where a pumping well located outside the Subflow Zone induces water to leave the  
6 Subflow Zone that is not captured by the well even though the Subflow Zone is still  
7 depleted. Furthermore, Mr. Briggs does not provide a method for performing the  
8 capture zone analysis. In my experience, some sort of drawdown analysis is first  
9 required in performing a capture zone analysis. Thus, Mr. Briggs’ suggestion that  
10 ADWR perform capture zone analysis would require more effort, not less.<sup>165</sup>

11 Dr. Montgomery and Mr. Anderson opined that capture zone analysis considers the “presence or  
12 absence of a groundwater divide” rather than “drawdown at the edge of the subflow zone.”<sup>166</sup> The  
13 issue of a groundwater divide in the cone of depression analysis is discussed in the next section. The  
14 Special Master finds that although capture zone analysis may be a method to measure the impact of a  
15 well on the subflow zone, there is insufficient evidence in the record to conclude that ADWR’s  
16 recommended procedures should be rejected in favor of capture zone analysis.

#### 17 *Economy and Expediency*

18 ADWR’s proposed cone of depression test must also be evaluated alongside the alternatives  
19 in order to determine which is the least expensive and delay-causing method. Alternatives presented  
20 consisted of using monitoring wells rather than modeling, and second, adopting higher drawdown  
21 levels that allegedly can be simulated more accurately than 0.1 foot.

22 Dr. Montgomery and Mr. Anderson recommended that “monitor wells should be used to  
23 determine if, and or when, the hydraulic gradient is inclined downward from the subflow zone  
24 toward a pumping well.”<sup>167</sup> To determine if the hydraulic gradient is continuously inclined

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25 <sup>164</sup> Eric J. Harmon and Mark R. Palumbo Rebuttal Decl. 33 (June 27, 2002).

26 <sup>165</sup> Jon R. Ford Rebuttal Decl. ¶ 27 (June 27, 2003).

27 <sup>166</sup> Errol L. Montgomery and Thomas W. Anderson Rebuttal Decl. 16 (June 27, 2003).

28 <sup>167</sup> *Id.* at 18.

1 downward from the subflow zone to a well, according to Dr. Montgomery, ADWR should drill  
2 monitor wells near the subflow zone and measure water levels in these and other wells. He estimated  
3 two monitor wells for each existing well would be appropriate to determine if the hydraulic gradient  
4 has reversed.<sup>168</sup> Dr. Montgomery could not estimate the number of wells that would have to be  
5 drilled and at what cost. As there are nearly 6,500 wells in the San Pedro River Watershed,<sup>169</sup> at least  
6 more than 6,500 monitor wells would have to be drilled. Mr. Marra testified that determining the cost  
7 of drilling and setting up a monitor well is “a difficult question to answer because monitor wells can  
8 be designed for different reasons and they can be designed at different depths and all of these factors  
9 will be involved in making an estimate of the cost,” but he estimated the cost of drilling two wells to  
10 monitor a one thousand gallons per minute well with a depth to water of 300 feet “could range from  
11 \$25,000 to \$30,000.”<sup>170</sup> A consideration for such a project is that landowners might deny access for  
12 drilling wells.

13 ADWR has stated it “does not currently have the resources to conduct cone of depression  
14 tests across wide areas of the Gila River adjudication” even using modeling.<sup>171</sup> During the past three  
15 years, ADWR has made the trial court, Special Master, and parties well aware of its weak budget  
16 situation. The Special Master finds that for reasons of cost, implementation, and delay such a well  
17 monitoring project is neither feasible nor practical and would not satisfy *Gila IV*'s criteria of  
18 economy and expediency.

19 After considering the extensive evidence presented on this issue, the Special Master finds that  
20 computer modeling is an appropriate, workable, and reliable method to conduct cone of depression

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22 <sup>168</sup> Hrg. Tr. at 133:24 - 136:13; 154:20 - 155:2 (Oct. 21, 2003).

23 <sup>169</sup> Oliver S. Page, Peter M. Pyle, and Jean M. Moran Decl. 30, 32 (June 17, 2002). Dr. Mock characterized  
24 this alternative as “the largest hydrogeologic field investigation program in human history...” Peter A. Mock  
Rebuttal Decl. 36 (June 27, 2003).

<sup>170</sup> Hrg. Tr. 443:3-12 (Oct. 22, 2003); cf. W. Gerald Matlock Rebuttal Decl. ¶ 11(m) (June 27, 2003).

<sup>171</sup> Subflow Report 22.

1 tests, and second, ADWR’s recommended drawdown of greater than or equal to 0.1 foot drawdown  
2 comports with *Gila IV*. The modeling of a simulated drawdown of greater than or equal to 0.1 foot is  
3 realistically adaptable to the field, is the least expensive and delay-causing method, and provides a  
4 high degree of reliability. This finding is valid as long as ADWR strives to obtain reliable data and  
5 information to safeguard the requisite reliability of the cone of depression test. The cone of  
6 depression tests must not be allowed to become unreasonably theoretical exercises. There must be an  
7 ongoing reasonable effort to obtain and use reliable data for the model’s parameters.

8 **Recommendation 20:** The Court should adopt ADWR’s recommended drawdown of greater  
9 than or equal to 0.1 foot where a well’s cone of depression has reached the edge of the subflow zone.

10 **Recommendation 21:** The Court should direct ADWR to obtain and use reliable data and  
11 information on an ongoing basis to safeguard the reliability of the cone of depression test.

12 **B. Does ADWR’s recommended condition that the water level in a well be below the**  
13 **water level in the subflow zone during pumping comport with *Gila IV*?**

14 ADWR recommends that a well be included in the adjudication if at the time of modeling,  
15 “the water level in the well is *below* the water level in the jurisdictional subflow zone during  
16 pumping. If the water level in the well is *above* the water level in the jurisdictional subflow zone  
17 during pumping, the well cannot be pumping subflow.”<sup>172</sup> (Italics in report.)

18 Messrs. Harmon and Palumbo declared that, “[i]n order for a well to withdraw appropriate  
19 subflow, the groundwater gradient must flow from the subflow zone to the well over the entire  
20 distance between the subflow zone and the well.”<sup>173</sup> Dr. Montgomery and Mr. Anderson declared  
21 that ADWR “has incorrectly indicated that if the cone of depression reaches a stream, and if [the]  
22 pumping groundwater level at the well is lower than the stream, then the well is drawing

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23 <sup>172</sup> Subflow Report 31.

24 <sup>173</sup> Eric J. Harmon and Mark R. Palumbo Decl. 36, Figs. 1-3 (June 17, 2002).

1 groundwater from the stream” because “[e]ven if the cone of depression reaches the stream, water is  
2 not drawn from the stream and/or subflow, unless an inclination of hydraulic gradient is  
3 demonstrated to occur continuously across the distance from the stream to the pumping well.”<sup>174</sup>  
4 (Underlining in declaration.) These experts submitted conceptual diagrams showing situations where  
5 the water level in a well is below the water level in the subflow zone, or a well’s cone of depression  
6 has reached the subflow zone, but the well is not withdrawing subflow.

7 Messrs. Harmon, Palumbo, Anderson, and Dr. Montgomery believe ADWR must show that  
8 the hydraulic gradient between the well and the subflow zone has reversed. In other words, the  
9 gradient flows downward continuously from the subflow zone to the well rather than flowing from  
10 the well down to the stream. Another way of expressing this point is to say that the groundwater  
11 divide, “the point at which groundwater either goes to the well or to the river, has reached the  
12 subflow zone.”<sup>175</sup> In short, whether a well’s cone of depression depletes subflow or stream flow  
13 depends on the direction and magnitude of the hydraulic gradient between the stream and the well.

14 To determine if the hydraulic gradient is continuously inclined downward from the subflow  
15 zone to a well, according to Dr. Montgomery, ADWR should drill monitor wells near the subflow  
16 zone and measure water levels in these and other wells. Dr. Montgomery estimated two monitor  
17 wells for each existing well would be appropriate to determine if the hydraulic gradient has  
18 reversed.<sup>176</sup> Dr. Montgomery could not estimate the number of wells that would have to be drilled  
19 and at what cost. As there are nearly 6,500 wells in the San Pedro River Watershed,<sup>177</sup> at least more  
20 than 6,500 monitor wells would have to be drilled. This well monitoring project has been previously  
21 described, and the Special Master has found that for reasons of cost, implementation, and delay, such

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22 <sup>174</sup> Errol L. Montgomery and Thomas W. Anderson Decl. 20, Figs. 1-8 (June 17, 2002).

23 <sup>175</sup> Hrg. Tr. 116:14-16 (Oct. 21, 2003).

24 <sup>176</sup> *Id.* at 133:24 - 136:13; 154:20 - 155:2 (Oct. 21, 2003).

<sup>177</sup> Oliver S. Page, Peter M. Pyle, and Jean M. Moran Decl. 30, 32 (June 17, 2002).

1 a project is neither feasible nor practical and would not satisfy *Gila IV's* criteria of economy and  
2 expediency.

3 Mr. Ford disagrees with ADWR's second condition because pumping from a well whose  
4 cone of depression reaches the subflow zone, even if the hydraulic gradient has not been reversed,  
5 "will induce some amount of water to exit the subflow zone."<sup>178</sup> That amount of water will not enter  
6 a well whose water level is above that of the subflow zone, but will travel downstream generally  
7 parallel to the subflow zone. According to this view, because some appropriable water has been  
8 induced out of the subflow zone, even when the water does not flow toward the well whose cone of  
9 depression has entered the subflow zone, the well should be included in the adjudication. Dr.  
10 Montgomery and Mr. Anderson disagreed with Mr. Page's declaration that subflow leaves the  
11 subflow zone as soon as a well's cone of depression expands to the subflow zone.

12 Mr. Ford declared that adoption of ADWR's condition "would require DWR to measure the  
13 water levels in each individual well, which is problematic" because "[p]umping levels are somewhat  
14 difficult to measure, and they often vary seasonally and with irrigation return flows or other  
15 recharge," and "the construction of many wells makes it virtually impossible to measure their  
16 pumping levels."<sup>179</sup>

17 Mr. Mason, manager of ADWR's Groundwater Modeling Section, testified regarding  
18 ADWR's proposed cone of depression test. He testified that ADWR proposes "three criteria," the  
19 first two being the two previously stated conditions, and the third is that the groundwater divide has  
20 reached the subflow zone.<sup>180</sup>

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23 <sup>178</sup> Jon R. Ford Decl. ¶ 19b (June 17, 2002).

24 <sup>179</sup> *Id.* at ¶ 19c.

<sup>180</sup> Hrg. Tr. 116:10-16; 77:5-10 (Oct. 21, 2003).

1 Dr. Mock and Mr. Gookin did not find ADWR's second condition useful and suggested a  
2 way to make it less confusing. Dr. Mock declared that the condition "is acceptable" only "[a]s long  
3 as the level of the jurisdictional subflow zone up to its entrance into the basin of interest is  
4 considered."<sup>181</sup> It "is difficult to conceive of a well that won't meet this 'second condition'" because  
5 "all wells in a basin containing a subflow zone will have water levels below the stage of the river at  
6 the point where it enters the basin."<sup>182</sup> Mr. Toy declared that this concept ignores the existence of  
7 natural hydraulic boundaries "such as bedrock boundaries" that "can limit or prevent subflow from  
8 the head of a basin ever reaching certain basin areas," and secondly, natural, incidental, and artificial  
9 recharge (such as Central Arizona Project water and effluent).<sup>183</sup> Dr. Matlock declared the "concept  
10 ignores the fact that wells draw water from several other sources."<sup>184</sup>

11 The trial court found seven principles necessary to define the subflow zone (the first five are  
12 discussed in chapter 2, section D). The seventh principle, which covers this issue, is: "Wells located  
13 outside the lateral parameters of the defined 'subflow' zone are not included unless it is proven that  
14 their 'cones of depression' reach the 'subflow' zone and the drawdown from the well affects the  
15 volume of surface and 'subflow' in such an appreciable amount that it is capable of measurement."<sup>185</sup>  
16 This principle has two elements, first, the well's cone of depression has reached the subflow zone,  
17 and second, the well's drawdown affects subflow and stream flow in a measurable amount.

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19 <sup>181</sup> Peter A. Mock Decl. 26 (June 17, 2002).

20 <sup>182</sup> *Id.* at 27. Mr. Gookin shares this view declaring that "[a]ny well outside the subflow zone should be  
21 deemed to be taking subflow once the piezometric (water table) surface of that well drops below the water  
elevation of the river entering the individual valley in consideration." T. Allen J. Gookin Decl. sec. 3, 3 (June  
17, 2002).

22 <sup>183</sup> Doug Toy Rebuttal Decl. 2, 3 (June 27, 2003).

23 <sup>184</sup> W. Gerald Matlock Rebuttal Decl. ¶ 15(1) (June 27, 2003).

24 <sup>185</sup> Goodfarb Order 36. In the summary of its findings, the trial court stated that in order to include in the  
adjudication a well located outside the subflow zone, there must be a finding that the well's cone of depression  
"has now extended to a point where it reaches an adjacent 'subflow' zone, and by continual pumping will  
cause a loss of such 'subflow' as to affect the quantity of the stream." *Id.* at 66.

1 The trial court described the testimony of Dr. Montgomery and Messrs. Ford and Page  
2 regarding reversal of hydraulic gradient:

3 As Montgomery admitted, stream depletion occurs as soon as the “cone of  
4 depression” reaches the stream, even though it may be some time before the hydraulic  
5 gradient at the river is reversed, and may be many years before a particle travels from  
6 the stream to the well. (citation to transcript omitted). Ford and Page contend that  
7 streamflow depletion first takes place when the cone intersects the stream, not when  
8 the hydraulic gradient is reversed or the molecule of streamflow is ejected by the well.  
9 (citations to transcript omitted). It is beyond dispute that even before the gradient is  
reversed, a measurable drawdown at the stream’s “subflow” zone necessarily results  
in water leaving the zone in order to fill the void which has been created by the well.  
Ford’s Report, (citation omitted) [when the cone intersects the “subflow” zone, it  
“induce[s] subflow to leave (deplete the Subflow Zone and the stream”)]. This is true  
even where the gradient has not been reversed everywhere between the well and the  
stream.<sup>186</sup> (Emphasis added.)

10 *Gila IV* affirmed the trial court’s order in all respects and held that a well located outside the  
11 subflow zone will be included in the adjudication if “the well’s cone of depression extends into the  
12 subflow zone and is depleting the stream.”<sup>187</sup>

13 The Special Master interprets the trial court’s ruling and its affirmance in *Gila IV* to hold that  
14 hydraulic gradient reversal, or that the gradient is continuously inclined from the subflow zone to the  
15 well, is not required to determine if a well’s cone of depression is withdrawing appropriable subflow.  
16 A cone of depression test, however, must yield results with a high degree of reliability, and although  
17 gradient reversal is not required under *Gila IV* to include a well in the adjudication, its consideration  
18 will increase the reliability of a questionable cone of depression test. ADWR should proceed with its  
19 proposal to investigate water levels in wells and in the subflow zone during pumping and the extent  
20 of hydraulic gradient reversal, but the trial court should not adopt ADWR’s second condition as a  
21 requisite for including a well in the adjudication.

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23 <sup>186</sup> *Id.* at 61.

24 <sup>187</sup> 198 Ariz. at 343, 9 P.3d at 1082.

1           **Recommendation 22:** The Court should not adopt as a condition to include a well in the  
2 adjudication that the water level in the well is below the water level in the subflow zone during  
3 pumping.

4           **Recommendation 23:** The Court should not adopt as a condition to include a well in the  
5 adjudication that the hydraulic gradient is continuously inclined from the subflow zone to the well.

6           **C. What is the accuracy and reliability of analytical (THWELLS) and numerical  
7 (MODFLOW) models for the cone of depression test?**

8           ADWR proposes to use both analytical and numerical models for the cone of depression tests.  
9 Models are sets of mathematical flow equations whose solutions yield simulations of the behavior of  
10 aquifers in response to stresses. ADWR recommends using an analytical computer-based program  
11 called THWELLS (van der Heijde, version 4.01, 1996) to evaluate a well’s cone of depression where  
12 “the aquifer system is less complex and the flow equations can be solved directly using calculus.”<sup>188</sup>  
13 ADWR recommends that a numerical model called MODFLOW (McDonald and Harbaugh, 1988;  
14 Harbaugh and McDonald, 1996) “only be used to evaluate the cone of depression of a well in special  
15 circumstances where, based on the conceptual model, the aquifer system is exceedingly complex and  
16 the flow equations can only be solved by recasting them in algebraic form.”<sup>189</sup> ADWR does not  
17 indicate what percentage of the cone of depression tests will be done using each model.

18           ADWR has considered economy and expediency to select a computer-based model it believes  
19 will yield simulations with a high degree of reliability in different aquifer systems. In support of its  
20 recommendations, the department explains that:

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23 <sup>188</sup> Subflow Report 28; app. G of the report contains a description of the THWELLS program.

24 <sup>189</sup> *Id.* at 29; app. H of the report contains a description of the MODFLOW program. “Currently, MODFLOW is the most widely used program in the world for simulating ground-water flow.” *Id.* app G, Fact Sheet, 1.

1           1. Analytical models “can be constructed relatively quickly” using commercially available  
2 computer software such as THWELLS.<sup>190</sup>

3           2. “[D]evelopment of numerical models is still a very time consuming process that requires  
4 substantial field data to justify its use and to properly calibrate.”<sup>191</sup>

5           3. Both models will give approximate solutions to the mathematical flow equations used in  
6 each program.

7           The testimony elicited the following regarding THWELLS and MODFLOW:

8           1. Mr. Mason, manager of ADWR’s Groundwater Modeling Unit, testified that an analytical  
9 model assumes an isotropic homogeneous aquifer (as opposed to heterogeneous).<sup>192</sup> There are  
10 aquifers in the San Pedro River Watershed that are not homogeneous. In aquifers where the “geology  
11 or the hydrology [is] complicated,” ADWR would use a numerical model.<sup>193</sup>

12           2. Mr. Mason testified that an analytical model assumes an aquifer has an infinite areal  
13 extent.<sup>194</sup> On the other hand, a numerical model divides an aquifer into rectangular blocks which are  
14 then organized by rows, columns, and layers. Each block is called a cell. THWELLS assumes a  
15 single model cell or block in infinite dimensions, while MODFLOW can consider numerous cells.  
16 Dr. Montgomery and Mr. Anderson declared that “both tributary aquifers and Holocene alluvial  
17 aquifers in Arizona stream valleys are of limited rather than infinite extent.”<sup>195</sup>

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20 <sup>190</sup> *Id.* at 29.

21 <sup>191</sup> *Id.*

22 <sup>192</sup> Hrg. Tr. 98:16-18 (Oct. 21, 2003).

23 <sup>193</sup> *Id.* at 93:16-18; 116:3-5. Mr. Burtell, for example, testified that in a preliminary appraisal of the water  
development potential of a mine in Tombstone, located in the San Pedro River Watershed, he had  
recommended using a numerical model due to the mine’s bedrock aquifer system. *Id.* at 45:19-46:5.

24 <sup>194</sup> *Id.* at 98:19-20.

<sup>195</sup> Errol L. Montgomery and Thomas W. Anderson Decl. 23 (June 17, 2002). They also declared that “[f]ew  
aquifers may approach homogeneous conditions.” *Id.*

1           3. A greater number of cells allows a numerical model to account better than an analytical  
2 model for geologic deposits (such as inliers, relic fan deposits, or bedrock) that come through but are  
3 not floodplain Holocene alluvium because these deposits can be anticipated with individual cells.<sup>196</sup>

4           4. In a numerical model, each well can be placed in its own cell and its cone of depression  
5 analyzed. Such a cell “could be very small.”<sup>197</sup>

6           5. The greater the number of cells used in a numerical model the higher is the likelihood of  
7 data entry errors and the difficulty of managing the information.<sup>198</sup>

8           6. In a numerical model, although it would be difficult to implement, cells can be included or  
9 excluded (“turned on and off”) from different test runs.<sup>199</sup>

10          7. Mr. Mason testified that “with THWELLS” the modeler uses “whatever data you have  
11 available,” and “you really can’t calibrate” THWELLS.<sup>200</sup> Calibration is a way to see if the model  
12 applied to a field situation is an acceptable representation.

13          8. A numerical model such as MODFLOW is calibrated with hydrologic or well information  
14 obtained from field investigations or reliable sources, and is run until its results agree with the  
15 calibrating data (“until the model agrees with the real world”).<sup>201</sup>

16          9. Dr. Mock declared it is not true “that only numerical models should be calibrated,” and  
17 “[c]alibration should be required of both analytical and numerical models.”<sup>202</sup>

18          10. Both THWELLS and MODFLOW “require information for aquifer hydraulic parameters  
19 of hydraulic conductivity and storage coefficient, saturated thickness of the aquifer, pumping rate of  
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21 <sup>196</sup> Hrg. Tr. 165:14-23 (Oct. 21, 2003).

22 <sup>197</sup> *Id.* at 166:2-9; 88:7-11.

23 <sup>198</sup> *Id.* at 88:7-11; *see also* Jon R. Ford Rebuttal Decl. ¶¶ 12, 13 (June 27, 2003).

24 <sup>199</sup> Hrg. Tr. 88:17-23; 166:22-167-6 (Oct. 21, 2003).

<sup>200</sup> *Id.* at 81:20-21.

<sup>201</sup> *Id.* at 69:23-24; 81:23.

<sup>202</sup> Peter A. Mock Decl. 26 (June 17, 2002); Messrs. Harmon and Palumbo agreed with this opinion.

1 the well, duration of pumping, and distance from the well to the point where drawdown is to be  
2 estimated.”<sup>203</sup> The Subflow Report describes how the department plans to obtain and use these data.  
3 The information is not always available or reliable, and its interpretation may require considerable  
4 professional judgment and expertise.

5 11. Mr. Ford testified that THWELLS “doesn’t take into account very well the effects of  
6 phreatophytes” or of recharge from either precipitation or basin fill aquifers.<sup>204</sup> Recharge includes  
7 artificial recharge.

8 12. Dr. Mock testified it could cost “in the range of \$250,000 to \$500,000 to develop” a  
9 MODFLOW model for either the upper or lower portions of the San Pedro River Watershed.<sup>205</sup> This  
10 estimate is to develop the model and does not include some operational costs such as sensitivity  
11 analysis. His “rough approximation” for a similar THWELLS model is “[p]erhaps half the cost.”<sup>206</sup>

12 The parties split between those who favor using exclusively a numerical model for the cone  
13 of depression test, and those who believe ADWR has the expertise to select the appropriate model for  
14 an aquifer system and should be allowed to do so. ADWR uses both analytical and numerical models  
15 in its statutory activities. It has developed numerical models for the San Pedro River Watershed. In  
16 the Final San Pedro River Watershed HSR (1991), ADWR presented a MODFLOW analysis  
17 assessing the cumulative impact of eight municipal water companies on the aquifers near Fort  
18 Huachuca and the San Pedro Riparian National Conservation Area.

19 Mr. Harmon testified that:

20 There may be physical situations where the geology is fairly simple. The hydrology is  
21 not complex. There are not a lot of recharge inputs or discharge outputs; and in that  
22 case the analytic model might be just fine....

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23 <sup>203</sup> Errol L. Montgomery and Thomas W. Anderson Decl. 21 (June 17, 2002).

24 <sup>204</sup> Hrg. Tr. 260:7-18 (Oct. 22, 2003); 107:1-5 (Oct. 21, 2003).

<sup>205</sup> *Id.* at 405:17 (Oct. 22, 2003).

<sup>206</sup> *Id.* at 406:14-16.

1 In other instances and I think in my opinion many instances the geology is  
2 complex, heterogeneous. There are lots of inputs and outputs, gradients to the water  
3 table which may be in multiple directions and slopes. In that instance, it would  
4 probably take a well-calibrated MODFLOW model with good data to back it up....

5 QUESTION. So it will be different depending on the situation.

6 ANSWER. I believe it would.<sup>207</sup>

7 Responding to when THWELLS or MODFLOW should be used, Mr. Ford testified:

8 [I]t depends on the situation. There may be places where it makes very little  
9 difference whether you use THWELLS, MODFLOW. THWELLS in my view would  
10 be far less expensive to utilize. I think in those cases then THWELLS should be used.

11 I think DWR has the ability to make those professional decisions....<sup>208</sup>

12 Because ADWR recommends modeling for the cone of depression test, whether an analytical  
13 or a numerical model will be used is a critical component of the cone of depression test. The  
14 selection must be subjected to the criteria set forth in *Gila IV* for the cone of depression test, namely,  
15 the model should be (1) “realistically adaptable to the field,” (2) “is the least expensive,” (3) the least  
16 “delay-causing,” and (4) “provides a high degree of reliability.”<sup>209</sup>

17 The evidence does not support a finding that ADWR should use a numerical model or  
18 MODFLOW as the exclusive model for the cone of depression test. The evidence shows an  
19 analytical model is valid for a cone of depression test where the aquifer system is homogeneous,  
20 hydrologic conditions are simple, and the required information is reliable. For those aquifer systems,  
21 an analytical model like THWELLS would be the least expensive and delay-causing model,  
22 realistically adaptable to the field, that will provide highly reliable results.

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23 <sup>207</sup> *Id.* at 368:17-369:5.

24 <sup>208</sup> *Id.* at 266:17-20; Messrs. Harmon and Palumbo declared, “[t]he possible use of these two models in cone of  
depression analyses is not an issue. However, the proper selection of one model or the other in the analysis of  
a particular well is a significant issue.” Eric J. Harmon and Mark R. Palumbo Decl. 30 (June 17, 2002).

<sup>209</sup> 198 Ariz. at 343, 9 P.3d at 1082 (quoting Goodfarb Order 62).

1 The evidence, however, shows that a numerical model such as MODFLOW will provide a  
2 higher degree of reliability than an analytical model when the aquifer system is heterogeneous or  
3 when an analytical model cannot take into account very well certain conditions, for example,  
4 phreatophytes and artificial or natural recharge.

5 ADWR has the expertise and experience to conduct cone of depression tests. The department  
6 should be allowed to exercise its best professional judgments and technical analysis to utilize the  
7 most appropriate model that satisfies *Gila IV's* criteria for the cone of depression test. ADWR  
8 should, however, undertake an ongoing program to collect and obtain reliable information to use in  
9 the cone of depression tests. Regarding calibration, the Special Master finds that analytical and  
10 numerical models can be calibrated, calibration increases the reliability of results, and accordingly,  
11 ADWR should calibrate both models whenever feasible.

12 The majority of the experts expressed a preference for numerical models. The Special Master  
13 believes ADWR should use MODFLOW or a numerical model whenever there is professional doubt  
14 that THWELLS will not yield reliable results. Economy and expediency should not win over  
15 appropriate and prudent professional decisions, as what is gained today could be lost tomorrow in  
16 increased litigation over flawed assumptions or inadequate work. The decision to switch from an  
17 analytical to a numerical model in a particular situation should not be finessed.

18 **Recommendation 24:** The Court should adopt ADWR's proposal to use both analytical  
19 (THWELLS) and numerical (MODFLOW) models for the cone of depression tests.

20 **Recommendation 25:** The Court should direct ADWR to implement promptly any new  
21 versions of THWELLS or MODFLOW, if they will provide more reliable results.

22 **Recommendation 26:** The Court should direct ADWR to calibrate whenever feasible both  
23 the analytical and numerical models used for the cone of depression tests.

1           **Recommendation 27:** The Court should direct ADWR as part of its investigations to collect  
2 and obtain reliable information for the cone of depression tests.

3           **D.     Is ADWR’s recommendation that the impact of a well be measured “at the time**  
4 **of the modeling”<sup>210</sup> scientifically valid?**

5           ADWR recommends that the impact of a well on the subflow zone be measured at the time  
6 ADWR does the cone of depression test. ADWR proposes to run the cone of depression test for a  
7 well beginning on the date the well was constructed and ending on the date the modeling is done.<sup>211</sup>  
8 The test will not measure the future impact of a cone of depression. After the time of modeling, the  
9 well’s cone of depression could stabilize, expand into the subflow zone, or decrease if, for example,  
10 the well is capped. These effects occur gradually.<sup>212</sup> ADWR’s test is called transient state modeling.

11           The Subflow Report does not give ADWR’s reasons for the recommendation. Mr. Mason  
12 provided a reason when he testified that ADWR’s proposal does not include future impacts of a well  
13 “because we don’t know what’s going to happen in the future.”<sup>213</sup>

14           The parties favoring measuring future impacts argue that a well may not impact the subflow  
15 zone on the day ADWR does the cone of depression test, but the well may do so in the near future.  
16 Therefore, not measuring future impacts will result in many wells being excluded from the  
17 adjudication even though they will pump subflow at a future time. Although these wells could be  
18 retested later, these parties argue that ADWR may not have the resources to do ongoing cone of  
19 depression tests in the same watershed, and second, claimants should not be burdened with  
20 prosecuting enforcement actions to bring those wells into the adjudication.

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23 <sup>210</sup> Subflow Report 31.

24 <sup>211</sup> Hrg. Tr. 115:18-23 (Oct. 21, 2003).

<sup>212</sup> See Goodfarb Order 59-60; see also T. Allen J. Gookin Decl. sec. 3, 1-2 (June 17, 2002).

<sup>213</sup> Hrg. Tr. 90:1-5; 102:22-23 (Oct. 21, 2003).

1 The parties on the other side of this issue argue that, as Mr. Mason testified, the future is  
2 unknown, and pumping histories and water uses can vary over time; consideration of time of  
3 pumping is not necessary as long as data obtained from monitoring wells shows the groundwater  
4 gradient has reversed; and wells presently not pumping appropriable subflow would be improperly  
5 included in the adjudication on the ground they may impact the subflow zone at a future time.

6 Parties presented three alternatives for the length of simulations that will account for future  
7 impacts: (1) a fixed period such as five, ten, or twenty years,<sup>214</sup> (2) the timing of maximum  
8 drawdown at the subflow zone,<sup>215</sup> and (3) modeling to steady state conditions.<sup>216</sup>

9 The five-year period is related to ADWR's well spacing standard of ten feet of drawdown  
10 over five years to determine if a well will interfere with another well in an active management area.  
11 Measuring a well's potential interference with a nearby well is, however, not the same as measuring  
12 the impact of a cone of depression on the subflow zone in accordance with *Gila IV's* holdings, and  
13 moreover, a ten-foot drawdown would be measured long after a well's cone of depression has  
14 induced water out of the subflow zone.

15 Only Dr. Montgomery and Mr. Anderson declared in favor of using a period of ten or twenty  
16 years, and their evidence was limited to the statement that, "this period is sufficiently long to exclude  
17 wells that pump small amounts but is sufficiently long to assure that most large-scale pumping wells  
18 would be included in the adjudication if the cone of depression reaches the edge of subflow."<sup>217</sup> Dr.

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20 <sup>214</sup> Errol L. Montgomery and Thomas W. Anderson Decl. 8, 25 (five years) (June 17, 2002); Errol L.  
21 Montgomery and Thomas W. Anderson Rebuttal Decl. 25 (ten and twenty years) (June 27, 2003).

22 <sup>215</sup> Peter A. Mock Decl. 26 (June 17, 2002); *see* Errol L. Montgomery and Thomas W. Anderson Rebuttal  
Decl. 24 (June 27, 2003) for their opinion that Dr. Mock "believes...model projections should be run until at  
least the year 2100."

23 <sup>216</sup> Oliver S. Page, Peter M. Pyle, and Jean M. Moran Decl. 25 (June 17, 2002). Mr. Toy testified, "[i]f you  
wanted to see the ultimate effect a well had, you would pump it to steady state." Hrg. Tr. 397:4-5 (Oct. 22,  
2003).

24 <sup>217</sup> Errol L. Montgomery and Thomas W. Anderson Rebuttal Decl. 25 (June 27, 2003).

1 Mock recommended the timing of maximum drawdown with the declaration that it “would be a  
2 better measure of minimum time for simulation and should be, as the impact on flows will be,  
3 dependent on the local conditions.”<sup>218</sup> No further evidence was presented on these alternatives.

4 Mr. Page and Dr. Mock criticized ADWR’s time of the modeling and assigning a fixed period  
5 to all simulations because these periods are arbitrary. Underlying this argument is the position that  
6 cones of depression can expand over time, and expanding cones of depression can have substantial  
7 impacts on the subflow zone and aquifers. In its 1994 order, the trial court described some of the  
8 “destructive ability” of cones of depression in desert and semi-desert environments.<sup>219</sup> Under these  
9 experts’ view, a test that does not consider the future impact of a cone of depression is arbitrary and  
10 “unrealistic” because it “ignores the concept that, eventually, impacts will be felt.”<sup>220</sup>

11 More evidence was presented regarding the proposal that all simulations be run as steady  
12 state or long enough to approximate steady state conditions. Mr. Page explained the benefits of using  
13 a steady state model:

14 The term steady-state refers to an equilibrium hydrologic condition where...an  
15 equilibrium is established between the pumping well, and the amount of water they  
16 pump that is obtained from streams, recharge and underground water storage. In  
17 steady-state, these are constant and do not change over time. Usually long term  
18 average hydrology is used as input. Time is not an input to the model, eliminating the  
19 need to define a specific time period.

20 This approach...addresses the fact that the period of future use of wells (or  
21 their replacements) cannot be predicted, but is important to the cumulative impact of  
22 wells on subflow. This approach also simplifies the issue of how to assess the impact  
23 of future wells drilled due to growth...

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23 <sup>218</sup> Peter A. Mock Decl. 26 (June 17, 2002).

24 <sup>219</sup> Goodfarb Order 59-60.

<sup>220</sup> T. Allen J. Gookin Rebuttal Decl. ch. XIV 1, 2 (June 27, 2003).

1           The use of steady-state simulations as a means for evaluating wells will result  
2 in a greater number of wells that have cones of depression that intersect the subflow  
boundary.<sup>221</sup>

3           Mr. Page declared that steady state simulations are “available to all numerical and some  
4 analytical models.”<sup>222</sup> (Emphasis added.) It is not known if the steady state simulations are available  
5 for the THWELLS analytical model ADWR proposes to use.

6           Regarding a steady state model, Messrs. Harmon and Palumbo declared that:

7           1. The calibration of a steady state model “is, in general, not nearly so rigorous  
8 as the time-varying calibration done in transient modeling” because “time-varying  
inputs are simply averaged,” so “generally there is less reliability with the result;”

9           2. A steady state model “is not able to simulate [the] dynamic [hydrologic]  
10 system” in Southwestern deserts, where “streamflow, precipitation, long-term climate  
variation, and water level changes” are dynamic; and

11           3. A steady state model “ha[s] no provision for simulating the changes in  
12 ground water storage” resulting “from changes in ground water level and artesian  
head.”<sup>223</sup>

13           The resolution of this issue turns not only on the evidence but also on *Gila IV*'s holdings. In  
14 *Gila IV*, the Supreme Court affirmed the trial court's ruling that:

15           [A] well may be subject to the adjudication if its “‘cone of depression’ caused by its  
16 pumping has now extended to a point where it reaches an adjacent ‘subflow’ zone,  
and by continual pumping will cause a loss of such ‘subflow’ as to affect the quantity  
17 of the stream.”

18           DWR may seek to establish that a well located outside the limits of the saturated  
19 floodplain alluvium is in fact pumping subflow and is therefore subject to the  
adjudication, by showing that the well's cone of depression extends into the subflow  
zone and is depleting the stream.<sup>224</sup> (Emphasis added.)

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22 <sup>221</sup> Oliver S. Page, Peter M. Pyle, and Jean M. Moran Decl. 25-26 (June 17, 2002).

23 <sup>222</sup> *Id.* at 25.

24 <sup>223</sup> Eric J. Harmon and Mark R. Palumbo Rebuttal Decl. 22 (June 27, 2003).

<sup>224</sup> 198 Ariz. at 343, 9 P.3d at 1082 (quoting Goodfarb Order 66). The ruling is based on the trial court's seventh principle discussed in chapter 3, section B, of this report.

1           The Special Master interprets this holding and the pivotal underlined words to mean that a  
2 well will be subject to the adjudication if (1) ADWR determines the well’s cone of depression has  
3 already extended, and not that it may in the future extend, into the subflow zone, and (2) if the well,  
4 after its cone of depression has extended into the subflow zone, continues to be pumped, stream flow  
5 will be affected appreciably and directly. This holding does not support using a cone of depression  
6 test that projects the future impact of a cone of depression. The cone of depression test, under *Gila*  
7 *IV*, is to determine if a well’s cone of depression has “now” extended to the subflow zone and “is  
8 depleting the stream.”

9           Considering the evidence only, the Special Master finds that it is insufficient to conclude that  
10 cone of depression simulations using a fixed period of five, ten, or twenty years projected into the  
11 future will yield more reliable results than either ADWR’s time of the modeling or any other set  
12 period of years. The Special Master further finds that if the future impact of a cone of depression is  
13 excluded as a consideration, the evidence is insufficient to conclude that a steady state model will  
14 yield more reliable results than ADWR’s proposed time of the modeling cone of depression test. The  
15 Special Master finds that ADWR’s recommendation to measure the impact of a well at the time of  
16 the modeling is scientifically valid.

17           Although *Gila IV* and the evidence do not support rejecting ADWR’s recommendation, the  
18 impact of expanding cones of depression must be taken into account. The hydrologic reality that  
19 cones of depression can grow and substantially impact the subflow zone and aquifers cannot be  
20 overlooked.

21           The Special Master recommends that ADWR be directed to complete additional cone of  
22 depression tests in a watershed at a time to be determined by the trial court or the Special Master that  
23 is appropriate to identify old or new wells that impact the subflow zone at that time. Because cone of  
24

1 depression tests are labor intensive, the additional tests may exclude wells, even ones previously  
2 tested, under guidelines adopted by the trial court or the Special Master.

3 **Recommendation 28:** The Court should adopt ADWR’s recommendation that the impact of  
4 a well be measured at the time of the modeling.

5 **Recommendation 29:** The Court should direct ADWR to complete additional cone of  
6 depression tests in a watershed at a time to be determined by the trial court or the Special Master that  
7 is appropriate to identify old or new wells that impact the subflow zone at that time. The additional  
8 tests may exclude wells, even ones previously tested, pursuant to guidelines adopted by the trial court  
9 or the Special Master.

10 **E. Should ADWR recommend a methodology to evaluate the impact of wells  
11 perforated below an impervious formation within the limits of the subflow zone?**

12 The department does not recommend a methodology. The parties who briefed this issue do  
13 not believe ADWR needs to recommend a methodology, and no evidence was presented which could  
14 provide one. Mr. Page declared that a “method is needed,” and “[s]tudies by the USGS and others  
15 have shown that wells are likely to affect the flow of the river, but may not result in identifiable  
16 drawdown in the floodplain alluvium,” but hardly any evidence was presented on this issue.<sup>225</sup>

17 The genesis of this issue is *Gila IV*’s holding that:

18 All wells located in the lateral limits of the “subflow” zone are subject to the  
19 jurisdiction of this adjudication no matter how deep or where these perforations are  
20 located. However, if the well owners prove that perforations are below an impervious  
21 formation which preclude[s] “drawdown” from the floodplain alluvium, then that well  
22 will be treated as outside the “subflow” zone.<sup>226</sup>

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21 <sup>225</sup> Oliver S. Page, Peter M. Pyle, and Jean M. Moran Decl. 26 (June 17, 2002).

22 <sup>226</sup> 198 Ariz. at 338, 9 P.3d at 1077. This holding stemmed from the sixth of the seven principles the trial court  
23 deemed necessary to define the subflow zone. The principle was, “[w]ells which are located in but perforated  
24 below the saturated floodplain alluvium aquifer are to be included in the ‘subflow’ component unless these  
perforations are proven by their owners to be below a confining zone of impermeable material such as clay as  
the inevitable ‘draw-down’ of the well must affect the ‘subflow zone’ above the perforation.” Goodfarb Order  
36. The six principles are discussed in chapter 2, section D, and in chapter 3, section B, of this report.

1 Because *Gila IV* makes it clear that the well owner has the burden of proving that a well  
2 though punched in the subflow zone is not withdrawing water from the saturated floodplain  
3 Holocene alluvium but from an aquifer below an impervious formation, the well owner should  
4 formulate and present a methodology. The fact the well owner has this burden of proof does not  
5 mean that the trial court or the Special Master cannot ask ADWR to provide them technical  
6 assistance concerning the merits of a particular methodology.

7 **Recommendation 30:** The Court should not direct ADWR to recommend a methodology to  
8 evaluate the impact of wells perforated below an impervious formation within the subflow zone.

9 **F. In addition to analyzing a well’s drawdown at the subflow zone, should ADWR**  
10 **report the cumulative effect of wells or of groups of wells?**

11 This question was briefed prior to the hearing. A ruling was issued on September 8, 2003,  
12 subject to modification after considering the evidence presented during the hearing. The proposed  
13 ruling is adopted in part and modified in part.

14 The Special Master determined that a well’s drawdown at the subflow zone shall be analyzed  
15 individually for each well but deferred ruling on whether ADWR should report the cumulative effect  
16 of wells or of groups of wells until after considering the evidence presented at the hearing.

17 In *Gila IV*, the Supreme Court stated that the trial court “recognized that each well must be  
18 separately evaluated ‘to compute drawdown at the “subflow” zone’... We agree with the trial  
19 court.”<sup>227</sup> The trial court had considered the testimony of Mr. Ford and Dr. Montgomery, who had  
20 “agreed that individual analysis of wells is the most appropriate method to compute drawdown at the  
21 ‘subflow’ zone.”<sup>228</sup> Therefore, under *Gila IV* a well’s impact on the subflow zone must be  
22 individually evaluated for each well, and this portion of the proposed ruling is not modified.

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23 <sup>227</sup> 198 Ariz. at 343, 9 P.3d at 1082.

24 <sup>228</sup> Goodfarb Order 62.

1           The challenging inquiry is whether ADWR should go further after analyzing each well and  
2 report the cumulative effect of wells or of groups of wells. *Gila IV* is silent on this issue. Dr. Mock’s  
3 declaration highlights the concern some parties emphasize: “The potential exists for hundreds of  
4 wells to individually pass ADWR’s proposed cone of depression test at the current time and yet the  
5 group of wells could collectively have significant impacts on river flows at a later time.”<sup>229</sup> Mr. Page  
6 declared that “[w]hile individual wells may not have an instantaneous and measurable effect on  
7 stream flow, they can have a significant impact over time, particularly when combined with the  
8 effects of hundreds of other wells.”<sup>230</sup>

9           Implicit in an answer to the question are the expectations that ADWR will be able to obtain  
10 reliable information about cumulative effect, if any, and that it will be able to do so with a test that  
11 “is realistically adaptable to the field and...is the least expensive and delay-causing, yet provides a  
12 high degree of reliability...”<sup>231</sup> The realities of these expectations are not clearer today than they  
13 were prior to the hearing.

14           The Subflow Report does not contain scientific or technical information to form the basis of a  
15 methodology to evaluate cumulative effect, as the report does not directly address this issue, and the  
16 evidence is insufficient to formulate criteria to analyze cumulative effect. The desire of some parties  
17 that ADWR report cumulative effect is well-stated, but how ADWR should undertake the analysis  
18 that “provides a high degree of reliability” is not clear.

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20 <sup>229</sup> Peter A. Mock Decl 4 (June 17, 2002); *see also* T. Allen J. Gookin Decl sec. 3, 1-2 (June 17, 2002). After  
21 describing the testimony about wells located outside the subflow zone whose cones of depression “could  
22 severely affect the volume of stream flow and the ‘subflow’ which supported it,” the trial court noted that  
23 “[o]ften those wells had extensive and interconnecting ‘cones of depression.’” Goodfarb Order 60. Tucson  
commented that the “collective impact of many *de minimis* users” concentrated in areas with an unusually  
narrow and very shallow subflow zone “could have an appreciable effect on a subflow zone” and  
appropriate water right holders. Response to ADWR’s Subflow Report 5 (June 17, 2002).

24 <sup>230</sup> Oliver S. Page Rebuttal Decl. 11 (June 27, 2003).

<sup>231</sup> 198 Ariz. at 343, 9 P.3d at 1082 (quoting Goodfarb Order 62).

1 In this discussion, other important considerations must be weighed. The complexity of cone  
2 of depression analysis involving “numerous assumptions and considerable judgment,”<sup>232</sup> the number  
3 of wells that may require individual analysis,<sup>233</sup> and the time-sensitivity of cone of depression tests  
4 dictate that the task not be overly complicated. ADWR estimates that within the San Pedro River  
5 Watershed “several hundred cone of depression tests would have to be performed,” and “it takes one  
6 person working full time to make about 50 to 60 model runs using THWELLS in one year.”<sup>234</sup> The  
7 cone of depression tests should be completed within a practical period of time and must yield results  
8 with a high degree of reliability. Undertaking a comprehensive analysis of cumulative effect, in  
9 addition to individual effects, could impracticably expand the technical investigations and thwart  
10 their success.

11 In its closing brief, the United States indicated the USGS expects to finish in 2005 a study of  
12 the hydrology of the Sierra Vista Subwatershed that “once completed,” ADWR could use “to  
13 examine the effects of pumping from individual wells and the cumulative effects of pumping from  
14 groups of wells (footnote omitted).”<sup>235</sup> (Underlining in original.) The United States submits that the  
15 study “may provide the answer to the Special Master’s remaining question” about ADWR reporting  
16 cumulative effect.<sup>236</sup>

17 At the oral argument, the idea of ADWR doing certain analyses of cumulative effect and  
18 reporting its findings was discussed. The purpose would be to collect data regarding cumulative  
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20 <sup>232</sup> Subflow Report 21-22.

21 <sup>233</sup> According to Mr. Page, using 2001 data, there are 5,370 *de minimis* domestic wells (out of 5,413 wells) and  
22 1,066 *de minimis* stockwatering wells (out of 1,076 wells). In the Final San Pedro River Watershed HSR,  
23 ADWR, using 1990 data, reported 2,990 *de minimis* domestic wells and 72 *de minimis* other uses wells. The  
24 number of wells has increased significantly since 1990. Oliver S. Page, Peter M. Pyle, and Jean M. Moran  
Decl. 30, 32 (June 17, 2002).

<sup>234</sup> Subflow Report 22, 43.

<sup>235</sup> U.S. Memo. on Issues Related to ADWR’s Subflow Technical Report 5-6 (Mar. 3, 2004).

<sup>236</sup> *Id.* at 6.

1 effect so that the court's and the parties' understanding would be increased. Whether the findings  
2 will be, or should be, used to adjudicate any water uses is not addressed in this report. If ADWR is  
3 going to do cone of depression analyses, doing a cumulative effect analysis on selected groups of  
4 wells and obtaining observational and scientific information would be useful.

5 The Special Master recommends that ADWR select more than one group of wells, analyze  
6 their cumulative effect using the most accurate and reliable analytical or numerical models, and  
7 report the findings regarding cumulative effect, if any. The wells may be owned or used by one or  
8 several claimants, and the cone of depression analysis should provide information and data about  
9 cumulative effect. ADWR should research the scientific literature, review studies such as those the  
10 USGS expects to complete for the Sierra Vista Subwatershed, and build a body of knowledge.

11 **Recommendation 31:** The Court should direct ADWR to analyze a well's drawdown at the  
12 subflow zone individually for each well.

13 **Recommendation 32:** The Court should not direct ADWR to report the cumulative effect of  
14 wells or of groups of wells except as suggested in the next recommendation.

15 **Recommendation 33:** The Court should direct ADWR to select more than one group of  
16 wells, analyze their cumulative effect using the most accurate and reliable analytical or numerical  
17 models, and report the findings. The wells may be owned or used by one or several claimants, and  
18 the cone of depression analysis should provide information and data about cumulative effect. The  
19 purpose of these analyses is to build a body of knowledge about the cumulative effect of wells,  
20 including methodologies and findings. Whether the findings will be, or should be, used to adjudicate  
21 water uses is not determined in this report.

22 **Recommendation 34:** The Court should adopt Chapter 3 of the Subflow Report to the extent  
23 it does not conflict with any other recommendation made in this report.

1 **IV. DE MINIMIS USES (Chapter 4 of the Subflow Report)**

2 The trial court directed ADWR to submit a “set of rational guidelines for determining  
3 whether a given well, though pumping subflow, has a de minimis effect on the river system.”<sup>237</sup>  
4 Little posthearing briefing was submitted regarding guidelines for *de minimis* water uses in the San  
5 Pedro River Watershed, the reason most likely being that after ADWR filed the Subflow Report, the  
6 trial court ruled on this issue with respect to instream stockwatering, stockponds of a certain size and  
7 beneficial use, and household domestic water uses.

8 In the Subflow Report, ADWR summarizes the proceedings Special Master John E. Thorson  
9 held from 1993 to 1995 addressing *de minimis* stockwatering, stockponds, and domestic water uses  
10 within the San Pedro River Watershed.<sup>238</sup> Special Master Thorson determined that instream  
11 stockwatering and stockponds and domestic uses meeting certain criteria should be considered *de*  
12 *minimis* water uses. The Subflow Report focuses on the determinations regarding *de minimis*  
13 domestic water uses because Special Master Thorson found that 97% of domestic uses in the San  
14 Pedro River Watershed were supplied from wells.<sup>239</sup>

15 ADWR believes that the “special master’s proposed definition of *de minimis* domestic uses  
16 with a uniform quantification...is an acceptable definition,” but disagrees with “the special master’s  
17 determination that these *de minimis* uses should be summarily adjudicated with water rights  
18 characteristics.”<sup>240</sup> ADWR recommends that *de minimis* domestic water uses “should be excluded  
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21 <sup>237</sup> Ballinger Order 2.

22 <sup>238</sup> The contested case was *In re Sands Group of Cases (W1-11-19) and Other Related Cases (Consolidated)*.  
Special Master Thorson issued a Memorandum Decision, Findings of Fact, and Conclusions of Law for Group  
23 1 Cases Involving Stockwatering, Stockponds, and Domestic Uses (Nov. 14, 1994) (“Memorandum  
Decision”), and a Modifying Memorandum Decision (Feb. 23, 1995).

24 <sup>239</sup> Memo. Decision 19 (Finding of Fact No. 22).

<sup>240</sup> Subflow Report 38.

1 from the adjudication and catalogued in the decrees.”<sup>241</sup> Domestic wells determined to be *de minimis*  
2 would be listed in a catalog with basic descriptive information,<sup>242</sup> and “[a]s long as these catalogued  
3 domestic uses continued to satisfy the definition of a *de minimis* use adopted by the trial court, these  
4 uses would not be subject to post-decree administration or enforcement.”<sup>243</sup> *De minimis* “uses would  
5 not receive a decreed water right.”<sup>244</sup>

6 On September 26, 2002, nearly six months after ADWR filed the Subflow Report, the trial  
7 court adopted in part, rejected in part, and modified in part Special Master Thorson’s memorandum  
8 decisions on *de minimis* stockwatering, stockponds, and domestic water uses in the San Pedro River  
9 Watershed. The trial court adopted the special master’s definition of a *de minimis* domestic water use  
10 and the quantity to be adjudicated for the right. Special Master Thorson defined *de minimis* domestic  
11 water uses as “[i]ndividual domestic uses for single residences, when serving household purposes  
12 and associated outdoor activities on adjoining land not exceeding (=) 0.2 acres,” and determined that  
13 “[t]he quantity of ‘not to exceed 1 ac-ft/yr’ of water will be adjudicated for” those rights.<sup>245</sup>

14 The trial court also adopted Special Master Thorson’s definitions and quantifications for  
15 instream stockwatering and stockponds having a capacity of not more than 15 acre-feet used solely  
16 for stock or wildlife. The trial court directed ADWR to prepare future HSRs in accordance with the  
17 determinations adopted in the September 26, 2002, order.

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19 <sup>241</sup> *Id.* at 40.

20 <sup>242</sup> “The *de minimis* category would list the name of the present well owner, the well location to the nearest ¼  
21 ¼ section, the type of use (domestic *de minimis*), the place of use, and the quantity of use.” *Id.* The  
22 proposed catalog appears to be similar to Volume 8: *Catalogued Wells* of the Final San Pedro River  
23 Watershed HSR. Volume 8, however, reported for each listed well, if available, a “claimed date of first  
24 beneficial water use” and the “data source” of the reported information. Vol. 8, 6. Bella Vista agrees with  
ADWR but recommends that every well be catalogued using only the information required by A.R.S. § 45-  
596 to be set forth in a notice of intention to drill well. Comments on ADWR’s Subflow Report 9 (June 17,  
2002). The statute enumerates more information than ADWR recommends reporting in its proposed catalog.

<sup>243</sup> Subflow Report 40.

<sup>244</sup> *Id.* at 44.

<sup>245</sup> Memo. Decision 33 (Conclusions of Law No. 24 and No. 25).

1 ADWR recommends that *de minimis* water uses be catalogued and not be summarily  
2 adjudicated with water right attributes. It points to the holdings in *Gila II* that “the trial court may  
3 adopt a rationally based exclusion for wells having a de minimis effect on the river system,”<sup>246</sup> and in  
4 *Gila IV* that wells though pumping subflow which “have a de minimis effect on the river system may  
5 be excluded from the adjudication based on rational guidelines for such an exclusion....”<sup>247</sup> In *Gila*  
6 *II*, the Supreme Court held that “[a] properly crafted de minimis exclusion will not cause piecemeal  
7 adjudication of water rights or in any other way run afoul of the McCarran Amendment...it could  
8 simplify and accelerate the adjudication by reducing the work involved in preparing the hydrographic  
9 survey reports and by reducing the number of contested cases before the special master.”<sup>248</sup> ADWR  
10 submits that a catalog listing *de minimis* water rights is consistent with *Gila II* and *Gila IV* because  
11 exclusion does not include summary adjudication.

12 Special Master Thorson had the benefit of *Gila II* when he began (one month after *Gila II*  
13 was issued) the consolidated case that resulted in his memorandum decisions. In *Gila II*, the Supreme  
14 Court held that “a de minimis exclusion effectively allocates to those well owners whatever amount  
15 of water is determined to be de minimis. It is, in effect, a summary adjudication of their rights.”<sup>249</sup>  
16 (Emphasis added.) Special Master Thorson adopted procedures for the “summary adjudication” of *de*  
17 *minimis* uses. The procedures provided for the preparation of water right abstracts showing the  
18 characteristics or attributes of *de minimis* uses; incorporation of the abstracts into the special master’s  
19 catalog of proposed water rights for the watershed; allowing claimants to file objections to the  
20 abstracts but precluding resolution of objections concerning quantity of water; and incorporation of

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22 <sup>246</sup> 175 Ariz. at 394, 857 P.2d at 1248.

23 <sup>247</sup> 198 Ariz. at 344, 9 P.3d at 1083.

24 <sup>248</sup> 175 Ariz. at 394, 857 P.2d at 1248.

<sup>249</sup> *Id.*

1 all *de minimis* water rights in the final decree which would subject the rights to post-decree  
2 administration and enforcement against other water uses.<sup>250</sup>

3 Special Master Thorson concluded that these “summary procedures for *de minimis* uses  
4 accomplish the statutory purposes of the general stream adjudication to “[d]etermine the extent and  
5 priority date of and adjudicate any interest in or right to use the water of the river system and source  
6 .... ARIZ. REV. STAT. ANN. § 45-257(B)(1).”<sup>251</sup> He defined the term “summary adjudication” to  
7 mean “those procedures used by the court to adjudicate *de minimis* water uses in a simplified and  
8 expedited manner while safeguarding the statutory and due process rights of the litigants  
9 involved.”<sup>252</sup>

10 In its September 26, 2002, order the trial court specifically adopted Special Master Thorson’s  
11 definition of “summary adjudication” and ruled that “summary adjudication is appropriate to  
12 determine the attributes and characteristics of water uses that do not individually affect the water  
13 supply available to other claimants.”<sup>253</sup> The trial court has answered the issue ADWR’s  
14 recommendation raises. *De minimis* water uses within the San Pedro River Watershed will be  
15 summarily adjudicated with water right attributes and will receive a decreed water right.

16 A group of parties urges that ADWR be directed to propose guidelines for excluding  
17 agricultural, municipal, industrial, and other wells, not just domestic wells, which may have a *de*  
18 *minimis* effect on the river system.<sup>254</sup> This issue will best be considered at such time as ADWR and  
19 the parties have more new or updated data.

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22 <sup>250</sup> Memo. Decision 34-8 (What Summary Adjudication Procedures Are Appropriate?).

23 <sup>251</sup> *Id.* at 37; see A.R.S. § 45-252(A).

24 <sup>252</sup> *Id.* at 5.

<sup>253</sup> Order n.2, 2.

<sup>254</sup> Upper Valley Irrigation Districts’ Objection to ADWR’s Subflow Report 11 (June 17, 2002).

1 *Other Watersheds*

2 The argument has been made that the definitions of *de minimis* water uses “should be based  
3 on watershed specific tests to reflect the unique characteristics of each watershed....”<sup>255</sup> Special  
4 Master Thorson held a hearing to receive evidence specific to the San Pedro River Watershed  
5 regarding water availability in the watershed and to downstream users; the number of stockwatering,  
6 stockpond, and domestic uses; the number and impact of these uses; and the costs and benefits of  
7 adjudicating these water uses.<sup>256</sup> That matter integrated into the adjudication a practical concept of *de*  
8 *minimis* water uses and established procedures to define and adjudicate them. It is realistic to believe  
9 that a similar evidentiary hearing will be required in the other watersheds. The time to take up those  
10 issues is after the watershed HSR is filed. Some of the ground Special Master Thorson covered will  
11 not be revisited, but it is reasonable to believe that a watershed specific hearing will be necessary.

12 **Recommendation 35:** The Court should adopt Chapter 4 of the Subflow Report except the  
13 recommendation that *de minimis* uses not be summarily adjudicated with water right attributes, and  
14 to the extent Chapter 4 does not conflict with any other recommendation made in this report.

15 **V. IMPLEMENTATION OF PROCEDURES (Chapter 5 of the Subflow Report)**

16 **A. Should ADWR’s findings be reported in supplemental contested case**  
17 **hydrographic survey reports (HSRs) (“case-by-case”) or in a supplemental San Pedro River**  
18 **Watershed HSR (“the entire watershed”), which identifies the subflow zone, wells reaching and**  
19 **depleting a stream, and *de minimis* water rights?**

20 This was the fourth question briefed prior to the hearing, and a ruling was issued on  
21 September 8, 2003, subject to modification after considering the evidence presented during the  
22 hearing. The proposed ruling is adopted as the evidence is insufficient to modify it.

23 \_\_\_\_\_  
24 <sup>255</sup> Philip C. Briggs Decl. ¶ 9 (June 17, 2002). Claimants in the Verde River Watershed raised this issue.

<sup>256</sup> Order 3 (Sept. 26, 2002).

1           The trial court directed ADWR to include “[a] timeline for completion of the tasks outlined in  
2 the report” and to submit “[a] similar timeline for the Upper Gila River and Verde River  
3 watersheds....”<sup>257</sup> In the proposed ruling, the Special Master found that the term timeline connotes a  
4 reporting schedule and with the desire to move the adjudication forward, set a schedule for ADWR to  
5 file a technical report containing a map of the lateral extent of the subflow zone within the entire San  
6 Pedro River Watershed; investigate and supplement, as needed, the Final San Pedro River Watershed  
7 HSR; and publish a supplemental final HSR. Claimants would have one hundred and twenty days to  
8 file objections to ADWR’s report showing the map of the subflow zone, and one hundred and eighty  
9 days to file objections to the supplemental final HSR.

10           Some parties argue that under A.R.S. § 45-256(B) the technical assistance provided by  
11 ADWR must be set forth in a report filed with the trial court or the Special Master, and a claimant  
12 may file an objection to the report or any part of it within one hundred and eighty days of the date on  
13 which the report is filed. A.R.S. § 45-256(B) states in pertinent part:

14           The technical assistance rendered by the director shall be set forth in summary form  
15 on a claim by claim basis in a report prepared by the director and filed with the court  
16 or the master.... The report shall list all information that is obtained by the director  
17 and that reasonably relates to the water right claim or use investigated. The report  
18 shall also include the director's proposed water right attributes for each individual  
water right claim or use investigated.... If no water right is proposed in connection  
with an individual water right claim or use, the director's recommendations shall so  
indicate.... An objection shall specifically address the director's recommendations  
regarding the particular water right claim or use investigated. (Emphasis added.)

19           The Special Master interprets A.R.S. § 45-256(B) to mean that the 180-day objection period  
20 applies to a report that contains the information ADWR has compiled during its investigations and  
21 sets forth the department’s proposed attributes for each water right claim or use investigated. The  
22 180-day period applies to a watershed or a supplemental contested case HSR that reports on

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23  
24 <sup>257</sup> Ballinger Order 3.

1 individual water right claims. The technical report to which all claimants in the San Pedro River  
2 Watershed will have one hundred and twenty days to file objections will not contain ADWR's  
3 proposed water right attributes for any claim or use. The report will contain ADWR's map of the  
4 subflow zone and related analysis. A report that covers a discrete, albeit important, technical issue is  
5 not subject to the time periods prescribed by A.R.S. § 45-256(B).

6 One party does not disagree with the Special Master's proposed schedule, but requests that it  
7 be recommended that in other watersheds ADWR divide a stream into manageable segments and  
8 publish a supplemental HSR that contains the subflow analysis for each stream segment. The  
9 "segment-by-segment" approach, is suggested, would be fair, efficient, and speedy.

10 A great amount of experience will be gained from going through the process of delineating  
11 the subflow zone in the San Pedro River Watershed. The segment-by-segment approach may have  
12 merit in other watersheds, but a decision in that respect should await the experience gained by going  
13 through the process in the San Pedro River Watershed. Although a recommendation regarding this  
14 approach is not made in this report, the parties may make suggestions when ADWR begins, or is in a  
15 position that it can undertake concurrently, the subflow analysis in another watershed.

16 ADWR recommends that for each watershed the subflow zone be identified first, followed by  
17 the identification of *de minimis* water uses, and concluding with the cone of depression tests. The  
18 second and third phases "should only be implemented when the watershed is ready to be  
19 litigated...."<sup>258</sup> This implementation sequence is reasonable.

20 ADWR does not propose a sequential watershed schedule, but based on the trial court's  
21 February 21, 2003, order and Pre-Trial Order No. 1 Re: Conduct of Adjudication ¶ 12(B)(4) (May  
22 29, 1986), the Special Master recommends the following sequence for completing the subflow and

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24 <sup>258</sup> Subflow Report 45.

1 cone of depression analysis in each watershed: San Pedro River; Verde River; Upper Gila River;  
2 Upper Salt River; Upper Agua Fria River; Lower Gila River; and Upper Santa Cruz River.

3 **Recommendation 36:** The Court should implement the following schedule in the San Pedro  
4 River Watershed:

5 A. After the Court considers the Special Master's report recommending the procedures and  
6 processes to delineate the subflow zone within the San Pedro River Watershed and a cone of  
7 depression test, ADWR is directed to prepare a map delineating the subflow zone for the entire San  
8 Pedro River Watershed. ADWR shall submit this map and related information in a technical report  
9 whose scope shall be limited to delineating the subflow zone and shall not set forth ADWR's  
10 proposed water right attributes for any individual water right claim or use.

11 B. Upon filing the technical report with the Court, ADWR shall send a notice to all claimants  
12 in the San Pedro River Watershed and to the persons listed in the Gila River Adjudication Court-  
13 Approved Mailing List informing them of the scope and availability of the report and of a claimant's  
14 right to file written objections to the report and of the deadline for filing objections.

15 C. Any claimant in the San Pedro River Watershed may file objections to ADWR's technical  
16 report within one hundred and twenty days of the date on which the report is filed. Objections shall  
17 be limited to ADWR's findings regarding the lateral extent of the subflow zone.

18 D. After considering the objections, the Court will approve a map that delineates the subflow  
19 zone within the San Pedro River Watershed.

20 E. Using the cone of depression test adopted by the Court, ADWR will analyze all wells  
21 located outside the lateral limits of the subflow zone to determine if a well's cone of depression  
22 reaches an adjacent subflow zone, and if continuing pumping will cause a loss of such subflow as to  
23 affect the quantity of the stream. ADWR will examine all water right claims to determine *de minimis*  
24

1 water rights in the San Pedro River Watershed in accordance with the Court's September 26, 2002,  
2 order. ADWR will investigate and supplement, as needed, its findings reported in the Final San  
3 Pedro River Watershed HSR.

4 F. ADWR will publish a Supplemental Final San Pedro River Watershed HSR reporting its  
5 findings and proposed water right attributes on a claim by claim basis, in accordance with A.R.S. §  
6 45-256(B), including wells withdrawing subflow, cone of depression analyses, *de minimis* water  
7 rights, and all other new or updated information.

8 G. ADWR shall send a notice of the filing of the Supplemental Final San Pedro River  
9 Watershed HSR to all claimants in the Gila River Adjudication, who may file objections within one  
10 hundred and eighty days of the date on which the report was filed.

11 **Recommendation 37:** The Court should adopt the same schedule for completing the subflow  
12 and cone of depression analysis in all the other watersheds in the Gila River Adjudication subject to  
13 modifications that may be proper as a result of experience with this process.

14 **Recommendation 38:** The Court should adopt the following sequence for completing the  
15 subflow and cone of depression analysis in each watershed: San Pedro River; Verde River; Upper  
16 Gila River; Upper Salt River; Upper Agua Fria River; Lower Gila River; and Upper Santa Cruz  
17 River.

18 **Recommendation 39:** The Court should adopt Chapter 5 of the Subflow Report to the extent  
19 it does not conflict with any other recommendation made in this report.

## 20 **VI. AVAILABILITY OF REPORT**

21 This report will be filed with the Clerk of the Maricopa County Superior Court, and a copy  
22 will be mailed to all persons listed on the Gila River Adjudication Court-Approved Mailing List and  
23 on those additional persons appearing in the certificate of service. An electronic copy will be posted  
24

1 at <http://www.supreme.state.az.us/wm/> on the *Gila River Adjudication* page. A transcript of the  
2 October 21-22, 2003, hearing and of the evidence and the original exhibits are at the Clerk's office.  
3 A printed copy of this report can be purchased from the office of the Special Master for \$8.00  
4 payable by check or money order.

## 5 **VII. MOTION FOR ADOPTION OF SPECIAL MASTER'S REPORT**

6 The Special Master recommends adoption of the recommendations made in this report and  
7 moves the Court, under Arizona Rule of Civil Procedure 53(h), to adopt each recommendation. A  
8 proposed order of adoption will be lodged as the Court may order upon consideration of the report.

## 9 **VIII. NOTICE OF SUBSEQUENT PROCEEDINGS**

10 Any claimant in the Gila River Adjudication may file a written objection to this report on or  
11 before September 1, 2004.<sup>259</sup> Responses to objections must be filed on or before October 1, 2004.  
12 Replies must be filed on or before October 29, 2004. Each objection should identify the related  
13 recommendation. Objections, responses, and replies must be filed with the Clerk of the Maricopa  
14 County Superior Court, Attn: Water Case, 601 West Jackson Street, Phoenix, Arizona 85003. Copies  
15 of pleadings must be served personally or by mail on all persons appearing on the most recent Gila  
16 River Adjudication Court-Approved Mailing List and on those additional persons named in the  
17 certificate of service. The hearing on the Special Master's motion to approve the report and on any  
18 objections to the report will be taken up as ordered by the Court. The "court after hearing may adopt  
19

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20 <sup>259</sup> The periods for filing objections to the report, responses, and replies are calculated under Ariz. R. Civ. P.  
21 53(h). As this report does not contain determinations of the relative water rights of any claimant, the time  
22 periods prescribed by A.R.S. § 45-257(A)(2) do not apply. The period for filing objections includes the ten-  
23 day period provided by Rule 53(h), not including intermediate Saturdays, Sundays, and legal holidays as  
24 specified by Ariz. R. Civ. P. 6(a). The ten-day period for filing responses and the five-day period for filing  
replies are specified in Ariz. R. Civ. P. 7.1(a). An additional five-day period when service has been made by  
mail is specified in Ariz. R. Civ. P. Rule 6(e). In order to allow time for the distribution of the monthly docket  
sheet to subscribers and reasonable time for all filings, the Special Master has added thirty days for objections  
and fifteen days for responses and replies.

1 the report or modify it or may reject it in whole or in part or may receive further evidence or may  
2 recommit it with instructions.”<sup>260</sup>

3 Submitted this 16th day of July, 2004.

4  
5 /s/ George A. Schade, Jr.  
6 GEORGE A. SCHADE, JR.  
*Special Master*

7 The original report was filed with the Clerk of the  
8 Maricopa County Superior Court on July 16, 2004,  
9 and was delivered to the Distribution Center for  
10 mailing to the persons listed on the Gila River  
Adjudication Court-Approved Mailing List dated  
October 6, 2003 (Attachment A) and to the  
following persons:

11 City of Benson  
12 Jennele Morris O’Hair, P.C.  
13 P. O. Box 568  
Vail AZ 85641-0568

14 Long Meadow Ranch Property Owners Association  
15 George E. Price, President  
12110 N. Antelope Run  
Prescott AZ 86305

16 Valory Strausser  
17 Lee A. Storey and Steve Wene  
18 Moyes Storey, Ltd.  
1850 N. Central Ave., Suite 1100  
Phoenix AZ 85004

19 Yavapai County Attorney’s Office  
20 M. Randolph Schurr  
255 East Gurley St., 3rd Floor  
Prescott AZ 86301

21 /s/ KDolge  
22 Kathy Dolge

23 \_\_\_\_\_  
24 <sup>260</sup> Ariz. R. Civ. P. 53(h).