

1 James A. Worth, State Bar No. 147207
2 McMURTREY, HARTSOCK, WORTH & ST LAWRENCE
3 2001 22nd Street, Suite 100
4 Bakersfield, California 93301
5 Phone No.: (661) 322-4417
6 Fax No.: (661) 322-8123
7 Email: jim@mhwslegal.com

Exempt From Fees Per
Govt. Code § 6103

6 Douglas J. Evertz, State Bar No. 123066
7 Emily L. Madueno, State Bar No. 251721
8 MURPHY & EVERTZ LLP
9 650 Town Center Drive, Suite 550
10 Costa Mesa, California 92626
11 Phone No.: (714) 277-1700
12 Fax No.: (714) 277-1777
13 Email: devertz@murphyevertz.com
14 emadueno@murphyevertz.com

11 Attorneys for Defendant, Cross-Complainant, & Cross-Defendant
12 INDIAN WELLS VALLEY WATER DISTRICT

13
14
15 **SUPERIOR COURT OF THE STATE OF CALIFORNIA**
16 **COUNTY OF ORANGE, CIVIL COMPLEX CENTER**
17

18 MOJAVE PISTACHIOS, LLC; et al.,
19 Plaintiffs,

20 v.

21 INDIAN WELLS VALLEY WATER
22 DISTRICT; et al.,
23 Defendants.

Case No. 30-2021-01187275-CU-OR-CJC

Assigned For All Purposes To:
Hon. William Claster, Dept. CX101

**TECHNICAL WORKING GROUP PHASE 2
JOINT TRIAL BRIEF**

RELATED TO ROA 1959

Date: June 8, 2026

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Dept: CX101

Action Filed: November 19, 2019

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Phase 2 Trial Date: June 8, 2026

1 INDIAN WELLS VALLEY WATER
2 DISTRICT,

3 Cross-Complainant,

4 v.

5 ALL PERSONS WHO CLAIM A RIGHT
6 TO EXTRACT GROUNDWATER IN THE
7 INDIAN WELLS VALLEY
8 GROUNDWATER BASIN NO. 6-54
9 WHETHER BASED ON
10 APPROPRIATION, OVERLYING RIGHT,
11 OR OTHER BASIS OF RIGHT, AND/OR
12 WHO CLAIM A RIGHT TO USE OF
13 STORAGE SPACE IN THE BASIN, et al.,

14 Cross-Defendants.

15 SEARLES VALLEY MINERALS INC.,

16 Cross-Complainant,

17 v.

18 ALL PERSONS WHO CLAIM A RIGHT
19 TO EXTRACT GROUNDWATER IN THE
20 INDIAN WELLS VALLEY
21 GROUNDWATER BASIN NO. 6-54
22 WHETHER BASED ON
23 APPROPRIATION, OVERLYING RIGHT,
24 OR OTHER BASIS OF RIGHT, AND/OR
25 WHO CLAIM A RIGHT TO USE OF
26 STORAGE SPACE IN THE BASIN, et al.,

27 Cross-Defendants.
28

1 Derek Hoffman, Bar No. 285784
2 Darien K. Key, Bar No. 324353
3 **FENNEMORE LLP**
4 8080 North Palm Avenue, Third Floor
5 Fresno, California 93711
6 Phone No.: (559) 432-4500
7 Fax No.: (559) 432-4590
8 dhoffman@fennemorelaw.com
9 dkey@fennemorelaw.com

10 Sean Hood, Arizona Bar No. 022789 (*pro hac vice*)
11 **FENNEMORE CRAIG, P.C.**
12 2394 E. Camelback Road, Suite 600
13 Phoenix, Arizona 85016-3429
14 Phone No.: (602) 916-5000
15 Fax No.: (602) 916-5999
16 shood@fennemorelaw.com

17 Attorneys for Defendants and Cross-Defendants
18 MEADOWBROOK DAIRY REAL ESTATE, LLC;
19 BIG HORN FIELDS, LLC; BROWN ROAD
20 FIELDS, LLC; HIGHWAY 395 FIELDS, LLC; and,
21 THE MEADOWBROOK MUTUAL WATER
22 COMPANY

23 ERIC GARNER, Bar No. 130665
24 eric.garner@bbklaw.com

25 JEFFREY V. DUNN, Bar No. 131926
26 jeffrey.dunn@bbklaw.com

27 WENDY Y. WANG, Bar No. 228923
28 wendy.wang@bbklaw.com

ALISON K. TOIVOLA, Bar No. 350252
alison.toivola@bbklaw.com

BEST BEST & KRIEGER LLP
300 South Grand Avenue, 25th Floor
Los Angeles, California 90071
Phone No.: (213) 617-8100
Fax No.: (213) 617-7480

Attorneys for Defendant, Cross-Defendant, and Cross-Complainant
SEARLES VALLEY MINERALS INC.

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1 The Indian Wells Valley Water District (“District”), the Meadowbrook Dairy entities¹
2 (“Meadowbrook”), and Searles Valley Minerals, Inc. (“Searles”) (collectively, the “TWG Parties”)
3 jointly submit this Phase 2 Trial Brief.²

4 **I. INTRODUCTION**

5 This Phase 2 Trial requires the Court to determine the safe yield of the Indian Wells Valley
6 Groundwater Basin (“Basin”) under settled California law. Safe yield is “the maximum quantity of
7 water which can be withdrawn annually from a ground water supply under a given set of
8 conditions without causing an undesirable result,” where the “undesirable result” is “a gradual
9 lowering of the ground water levels resulting eventually in depletion of the supply.” (*City of Los*
10 *Angeles v. City of San Fernando* (1975) 14 Cal.3d 199, 278–279 [“*San Fernando*”].)

11 Accordingly, the Court’s task is not to adopt a policy preference, ratify a groundwater
12 sustainability plan (“GSP”), or defer to agency determinations. The Court determines safe yield
13 based on admissible evidence, reliable methodologies, sound hydrogeologic principles, and the
14 Basin’s actual physical behavior under current conditions. Although expert testimony may assist
15 the Court, California law requires that such opinions rest on a foundation that can be examined
16 and evaluated. Where the underlying methodology cannot be tested or independently assessed, the
17 resulting opinion lacks the reliability required for admissibility.

18 Before the Court hears from expert witnesses, a threshold evidentiary issue bears directly
19 on the safe yield opinions offered by the Indian Wells Valley Groundwater Authority (“IWVGA”)
20 and the United States (“U.S.”). The IWVGA and U.S. rely on a safe yield figure of 7,650 acre-feet

21
22 ¹ Defendants and Cross-Defendants Meadowbrook Dairy Real Estate, LLC, a California Limited
23 Liability Company; Big Horn Fields, LLC, a California Limited Liability Company; Brown Road
24 Fields LLC, a California Limited Liability Company; Highway 395 Fields, LLC, a California
25 Limited Liability Company; and The Meadowbrook Mutual Water Company, a California
26 corporation.

27 ² The TWG Parties submit this brief jointly rather than through three separate briefs. Though
28 longer than any individual party’s brief would have been, separate briefs would necessarily have
required extensive duplication of factual background, expert testimony summaries, and legal
argument. This Court has long-favored mechanisms that promote judicial economy, avoid
unnecessary duplication, and streamline the presentation of common issues. Consistent with those
principles, the TWG Parties have endeavored to present the relevant evidence and legal authorities
in a single, organized brief that will assist the Court in evaluating the issues to be tried.

1 per year (“AFY”) derived from a two-dimensional groundwater model (the “DRI 2-D Model”),
2 which has not been produced. As a result, its assumptions, governing equations, calibration, and
3 sensitivity analyses cannot be evaluated and the basis for the 7,650 AFY value cannot be
4 independently assessed to determine whether it reflects a reproducible scientific result or an
5 embedded modeling assumption.

6 The record concerning the missing DRI 2-D Model is particularly troubling. “DRI” is the
7 Desert Research Institute. The U.S. Navy commissioned DRI to prepare McGraw et al. (2016)
8 (Ex. 21), a groundwater modeling report concerning the Basin. As part of that work, the DRI 2-D
9 Model estimated that pre-1920 recharge to the Basin was 7,650 AFY. (Ex. 21 at p. 21-21.) DRI’s
10 modeling work for the Navy “became the basis for the [IWVGA’s] efforts to develop [the GSP]”
11 (see Ex. 55 at p. 55-1), and was transferred to the IWVGA and its GSP contractor, Stetson
12 Engineers (“Stetson”), for that purpose. The 7,650 AFY recharge value calculated using the DRI
13 2-D Model was embedded in the GSP groundwater model (“2020 DRI Model”), and 7,650 AFY
14 was again held constant in the 2025 update to that model (“2025 DRI Model”).

15 For years, Searles and other Technical Working Group (“TWG”) parties repeatedly sought
16 production of the 2020 DRI Model through Public Records Act requests, related litigation,
17 discovery, depositions, and court proceedings. The requests specifically sought the model itself, all
18 files necessary to run the model, and all modeling information, and DRI and Stetson work product.
19 IWVGA was obligated to identify any responsive materials that were missing, destroyed, or no
20 longer in existence.

21 At no point did IWVGA disclose that the foundation of the model—the DRI 2-D Model—
22 allegedly does not exist despite having a duty on multiple occasions to disclose that it was
23 missing. Instead, IWVGA repeatedly represented that responsive records existed and asserted
24 privileges and vague federal restrictions, implying the model existed but was being withheld.
25 IWVGA even represented to this Court that the model was being updated. IWVGA’s conduct
26 conveyed a consistent message that the model existed and would ultimately be produced. Only
27 years later—during recent expert discovery—did the TWG parties learn for the first time that the
28 model that calculated 7,650 AFY—the DRI 2-D Model—has allegedly vanished. The DRI 2-D

1 Model was not produced. The present record does not include the model or the materials necessary
2 to evaluate or reproduce it.

3 Here, the existence—or nonexistence—of the groundwater model is material because it
4 provides the analytical basis for the 7,650 AFY recharge value relied upon by the IWVGA and
5 U.S. The consequence of the failure to produce the model is straightforward: California law does
6 not permit expert testimony to rest on such an unexamined foundation. Under Evidence Code
7 sections 801 through 803 and *Sargon Enterprises, Inc. v. University of Southern California* (2012)
8 55 Cal.4th 747 [*“Sargon”*], trial courts must exclude expert testimony where there is too great an
9 analytical gap between the data and the opinions offered, or where the underlying methodology
10 cannot be scrutinized at all. That is precisely the problem here: the Court is being asked to accept a
11 numerical conclusion without a reviewable analytical process. This is not a dispute over
12 competing interpretations of evidence; it is the absence of admissible evidence altogether.

13 The reliability concerns are compounded by the fact that the missing model does not
14 appear to have ever been accepted by a California court as an acceptable model to estimate a
15 groundwater basin’s safe yield. Nor does the missing model appear on the California Department
16 of Water Resources’ (“DWR”) list of suggested groundwater models. While DWR guidance is not
17 dispositive, it reflects accepted professional groundwater modeling practices within California’s
18 hydrogeologic community. In any event, the Court cannot determine whether the missing model
19 satisfies accepted professional standards.

20 The problems with the IWVGA’s and U.S.’s safe yield opinions do not end there. Their
21 safe yield estimates are unsupported because they:

- 22 • rely on a hypothetical steady-state Basin condition that no longer exists;
- 23 • disregard current land use and anthropogenic recharge;
- 24 • fail to account for the Basin’s actual observed behavior;
- 25 • do not include all sources of groundwater recharge; and
- 26 • substitute speculative historical recharge estimates for measured groundwater
27 response under current conditions.

28 This disconnect from observed Basin conditions is reflected in actual well levels. If the Basin were

1 as constrained as the IWVGA and U.S. claim, widespread groundwater level declines and
2 corresponding shallow-well impacts would be evident throughout the Basin; they are not.

3 Their opinions are also legally flawed because they do not use California’s governing
4 definition of safe yield under *San Fernando*. Instead, they improperly redefine safe yield as
5 groundwater recharge only tied to speculative, no longer existing “pre-development” conditions
6 from more than a century ago.

7 Finally, the 7,650 AFY figure is not the product of independent scientific analysis, but
8 rather a fixed assumption that has been carried forward unchanged across multiple model
9 iterations despite substantial revisions to model geometry, storage parameters, and hydrogeologic
10 inputs. The persistence of that figure demonstrates that it functions as a predetermined constraint
11 rather than a scientifically derived result.

12 By contrast, the TWG parties will present coordinated expert testimony grounded in *San*
13 *Fernando*’s definition of safe yield, measured groundwater levels, verified pumping data, Basin-
14 specific hydrogeologic information, accepted groundwater science, inclusion of all sources of
15 recharge, and current Basin conditions. Unlike the IWVGA’s and U.S.’s incomplete and limited
16 recharge approach, the TWG evaluates the Basin’s actual response to pumping through measured
17 changes in groundwater storage over a representative hydrologic period. Using multiple
18 independent analytical methods, those analyses consistently converge on the same conclusion: the
19 Basin’s safe yield is substantially greater than 7,650 AFY—conservatively no less than **14,300**
20 **AFY and approximately 15,400 AFY.**

21 The TWG’s conclusion is supported by a coordinated team of highly qualified and
22 experienced experts applying data-driven methods and the best available science. Central to the
23 TWG’s work is the “Change in Storage Approach,” which relies on *measurable data*—including
24 groundwater levels, verified groundwater pumping, and hydrogeologic conditions—over a
25 representative base period reflecting recent cultural conditions. Accordingly, the TWG’s approach
26 aligns with *San Fernando*’s standard for determining safe yield in a groundwater basin
27 adjudication. The District developed an independent groundwater model, which independently
28 evaluates safe yield and corroborates the TWG’s analyses.

1 Ultimately, this case is not a “battle of experts” in the conventional sense. The threshold
2 issue is whether the IWVGA’s and U.S.’s opinions rest on a reliable and legally admissible
3 foundation at all. They do not. When the Court applies the governing legal standard under *San*
4 *Fernando* and excludes methodologies that are untestable, unsupported, and legally flawed, the
5 evidence demonstrates that the Basin’s safe yield is substantially greater than 7,650 AFY and falls
6 within the range established by the TWG’s multiple independent analyses.

7 **II. THE IWVGA’S AND U.S.’S SAFE YIELD OPINIONS COLLAPSE BECAUSE**
8 **THEY ARE BASED ON A NON-PRODUCED AND UNAVAILABLE MODEL.**

9 This is not merely a discovery dispute. Nor is it a disagreement among competing experts
10 concerning assumptions or methodologies. The problem is more fundamental: the IWVGA and
11 U.S. ask this Court to adopt a safe yield figure derived from a scientific model that no party has
12 been permitted to examine and no expert in this case has independently evaluated—not even the
13 experts for the IWVGA (Dr. Todd Kincaid) and the U.S. (Dr. Sean McKenna). The absence of the
14 DRI 2-D Model deprives the Court of any meaningful ability to determine whether the 7,650 AFY
15 figure rests on reliable hydrogeologic analysis or merely reflects assumptions embedded within an
16 inaccessible and untestable modeling framework.

17 Because the missing model is the foundation of the IWVGA’s and U.S.’s safe yield
18 opinions, the resulting expert testimony lacks the transparency, reliability, and foundational
19 support required under California law.

20 **A. The Missing Groundwater Model Is the Foundation of the IWVGA’s and**
21 **U.S.’s Safe Yield Opinions.**

22 The expert depositions establish that the IWVGA’s and U.S.’s 7,650 AFY safe yield figure
23 originates from the DRI 2-D Model. The IWVGA’s and U.S.’s experts acknowledge:

- 24 • **their 7,650 AFY recharge estimate originated from that model;**
- 25 • **that same recharge figure has remained fixed across subsequent IWVGA**
26 **modeling efforts; and**
- 27 • **the underlying DRI 2-D Model itself cannot now be produced.**

28 (Ex. 60 at p. 60-24; see also Ex. 125 at pp. 125-12–125-13.)

1 Indeed, Dr. McKenna admitted at deposition:

- 2 • he never had access to the DRI 2-D Model;
- 3 • he never ran the DRI 2-D Model; and
- 4 • he could not evaluate the calculations that produced the 7,650 AFY figure—the
- 5 same safe yield figure that IWVGA and U.S. ask this Court to adopt.

6 (McKenna Depo., 32:10–19, 46:18–23, 90:25–91:8.) He further testified that he accepted the
7 underlying recharge values “at face value” and did not evaluate or verify the calculations that
8 produced them. (McKenna Depo., 91:9–16, 92:4–7.)

9 Without the DRI 2-D Model, neither the Court nor the parties can determine:

- 10 • the governing equations used;
- 11 • the calibration methodology;
- 12 • the sensitivity analyses performed;
- 13 • the assumptions embedded within the recharge calculations;
- 14 • whether the DRI 2-D Model reasonably reflects Basin conditions;
- 15 • whether the DRI 2-D Model responds appropriately to wet-year recharge events; or
- 16 • whether the resulting recharge estimate is scientifically reliable.

17 The inability to evaluate the model is not hypothetical—Dr. McKenna admitted he made no
18 independent effort to analyze or recalculate the inflow values and could not test the assumptions
19 embedded in the DRI 2-D Model. (McKenna Depo., 47:6–17, 91:9–16, 92:4–11.)

20 The missing DRI 2-D Model is therefore not a peripheral evidentiary issue. It is the central
21 analytical foundation of the IWVGA’s and U.S.’s safe yield case.

22 **B. The Record Establishes a Consistent Pattern of Nondisclosure Concerning the**
23 **Model.**

24 For years, Searles and other TWG parties repeatedly sought production of DRI’s
25 groundwater modeling and associated documents, requests that clearly encompassed the DRI 2-D
26 Model. (See Exs. 295, 297, 299, 300, 302.) At no point did IWVGA disclose that the model
27 allegedly does not exist. This chronology demonstrates far more than an ordinary discovery
28

1 failure; it establishes a prolonged failure to disclose the non-existence of the very model upon
2 which the IWVGA's and U.S.'s 7,650 AFY safe yield opinions depend:

- 3 • In 2022, IWVGA acknowledged that Searles' Public Records Act request sought
4 public records and stated it would produce responsive materials, without disclosing
5 that the model was unavailable. (Exs. 295, 296.)
- 6 • In 2024, IWVGA again received requests for the model and related materials and
7 did not disclose that the model did not exist. (Exs. 297, 298.)
- 8 • In its response to formal discovery seeking the model, IWVGA failed to identify
9 the model as "missing," "destroyed," or "no longer in existence," despite being
10 expressly required to do so. Instead, IWVGA asserted objections and limitations
11 that necessarily implied the model existed but was being withheld. (See Exs. 300,
12 301.)
- 13 • At no time during Searles' lawsuit to enforce its Public Records Act requests did
14 the IWVGA disclose that the model underlying the 7,650 AFY recharge calculation
15 was missing. (Exs. 302, 303.)
- 16 • Most significantly, during court proceedings in this case, the IWVGA represented
17 that the 2020 DRI Model was being updated but never mentioned that the DRI 2-D
18 Model was missing. (Ex. 299.)

19 This sequence is critical. It demonstrates that the IWVGA did not merely fail to produce
20 the model—it repeatedly failed to disclose its alleged nonexistence while making representations
21 that reasonably led to the belief that the model existed and would be produced.³

22
23
24
25
26 _____
27 ³ Civil Code section 1710 defines deceit to include "[t]he suppression of a fact, by one who is
28 bound to disclose it," or providing "information of other facts which are likely to mislead for want
of communication of that fact." The existence—or nonexistence—of the DRI 2-D Model is a
material fact. It is the foundation of IWVGA's and U.S.'s safe yield analysis and expert opinions.

1 **C. The Missing Model Cannot Satisfy California’s Requirements for Reliable**
2 **Expert Testimony.**

3 Under Evidence Code sections 801 through 803 and *Sargon*, trial courts have a
4 gatekeeping obligation to exclude expert testimony that lacks reliable foundation or rests upon
5 unsupported methodology.

6 Here, the Court cannot assess the IWVGA’s and U.S.’s methodology because the
7 underlying model is unavailable. As a result, neither the experts nor the Court can determine
8 whether the model was properly calibrated, based on reasonable assumptions, or reflective of
9 actual Basin conditions—including its treatment of recharge and variability.

10 This inability to evaluate the methodology creates the type of “analytical gap” *Sargon*
11 prohibits. (*Sargon, supra*, 55 Cal.4th at p. 771.)

12 **D. The Missing Model Is Not on DWR’s List of Recommended Models.**

13 The reliability concerns surrounding the missing model are further amplified by the fact
14 that the model does not appear to conform to groundwater modeling approaches recommended by
15 DWR for Sustainable Groundwater Management Act (“SGMA”) implementation. (Cal. Code
16 Regs., tit. 23, § 352.4 [groundwater models used to estimate sustainable yield under SGMA must
17 comply with the regulations].)

18 DWR has issued Best Management Practices and groundwater modeling guidance
19 identifying accepted and recommended approaches for evaluating recharge, groundwater storage,
20 and sustainable groundwater management in California basins. ([https://water.ca.gov/-
21 /media/DWR-Website/Web-Pages/Programs/Groundwater-Management/Sustainable-
22 Groundwater-Management/Best-Management-Practices-and-Guidance-Documents/Files/BMP-5-
23 Modeling_ay_19.pdf](https://water.ca.gov/-/media/DWR-Website/Web-Pages/Programs/Groundwater-Management/Sustainable-Groundwater-Management/Best-Management-Practices-and-Guidance-Documents/Files/BMP-5-Modeling_ay_19.pdf).) Those recommendations reflect accepted professional groundwater
24 modeling practices within California’s hydrogeologic community.

25 The fact that the missing DRI 2-D Model underlying the IWVGA’s and U.S.’s 7,650 AFY
26 estimate is not among the modeling approaches recommended by DWR demonstrates that the
27 methodology employed by the IWVGA and U.S. falls outside the groundwater modeling
28 approaches recognized by California’s primary groundwater regulatory agency.

1 **E. The Missing Model Has Not Been Accepted by Any California Court for**
2 **Estimating Safe Yield.**

3 The IWVGA’s and U.S.’s safe yield opinions suffer from an additional and independent
4 defect: the Court cannot determine whether the underlying groundwater model satisfies accepted
5 standards of reliability for expert testimony under California law.

6 The model has never been subjected to judicial scrutiny in any California groundwater
7 adjudication or other California court proceeding. No California court has evaluated or accepted
8 this modeling framework as sufficiently reliable to support expert testimony concerning basin safe
9 yield. That is the analytical gap that *Sargon* prohibits.

10 **F. The Failure to Produce the Model is a Trial Admissibility Issue—Not Merely a**
11 **Discovery Issue.**

12 The IWVGA and U.S. attempt to treat the missing model as a discovery dispute
13 concerning document production. It is not. This issue has now become a threshold trial
14 admissibility issue. The IWVGA and U.S. ask the Court to rely on expert opinions derived from a
15 model that cannot be examined, cannot be tested, cannot be reproduced, and cannot be
16 independently evaluated. This defect of the DRI 2-D Model directly implicates Evidence Code
17 sections 801 through 803, *Sargon*, and the Court’s gatekeeping responsibility concerning
18 reliability and foundation.

19 Moreover, this defect cannot be cured through cross-examination alone. Cross-examination
20 presupposes access to the underlying methodology and assumptions. Nor does this issue merely go
21 to “weight.” Questions of weight arise where assumptions can be challenged, inputs can be
22 evaluated, and methodology can be examined. The missing DRI 2-D Model presents a threshold
23 admissibility problem, not merely a dispute concerning credibility.

24 **G. The IWVGA’s and U.S.’s Expert Testimony Should be Excluded or Afforded**
25 **No Weight.**

26 The IWVGA’s and U.S.’s safe yield opinions:

- 27 • rely on a model that has never been produced;
- 28 • cannot be independently evaluated;

- rest upon an untestable analytical framework; and
- were developed through a process marked by prolonged and repeated nondisclosure concerning the model’s existence.

The Court cannot reliably determine safe yield based upon a scientific model that no one has seen, no one can test, and no one can evaluate. Accordingly, the Court should exclude the IWVGA’s and U.S.’s expert testimony concerning safe yield; or, at minimum, afford those opinions no weight.

H. IWVGA Did Not Want the Court or TWG Parties to Examine the Model But Asks the Court to Adopt the Model’s Sustainability Estimate.

IWVGA persists in its efforts to avoid the consequences of its inability to produce the model by asking the Court to simply adopt the GSP’s “sustainable yield” figure of 7,650 AFY as the Basin’s safe yield.⁴

The Court has stated that “not automatically deferring to the [IWVGA’s] sustainable yield determination is particularly warranted in this case. Both the [IWVGA] and the DWR acknowledge data gaps underlying that determination. If the Court ultimately imposes a physical solution, it should do so based on the most complete, accurate and up to date information.” (Minute Order, August 5, 2024 [ROA 1465, 1469], at p. 11.)

The Court further stated that, “to the extent that the GSP relied on studies and technical information in determining sustainable yield, the Court presumes most, if not all, of this information will be admissible in the phase 2 trial....” The TWG Parties presumed this as well. However, that is not the case because both the IWVGA and the U.S. claim that they can no longer locate the DRI 2-D Model. Indeed, their experts could not even explain what happened to it, which is particularly notable when *one of the experts (Dr. McKenna) is a DRI employee.*

Because the model was not produced, its calibration targets, assumptions, and any sensitivity testing are unavailable for review. In the absence of that information, the Court cannot meaningfully evaluate whether the model reasonably represents average, dry, or wet conditions, assess whether its recharge assumptions are physically reasonable, or determine the reliability of

⁴ The IWVGA unsuccessfully promoted legislation to remove this Court’s authority to make a safe yield determination. (Assem. Bill No. 1413 (2025–2026 Reg. Sess.) as amended Jul. 17, 2025.)

1 the recharge estimate derived from it. A scientific opinion dependent on an unproduced model fails
2 fundamental reliability requirements. (*Sargon, supra*, 55 Cal.4th at p. 770 [“An expert opinion has
3 no value if its basis is unsound” [quoting *Lockheed Litigation Cases* (2004) 115 Cal.App.4th 558,
4 564].)

5 But there is an additional flaw in the IWVGA’s and U.S.’s 7,650 AFY safe yield estimates:
6 their groundwater recharge estimate of 7,650 AFY is derived from legally erroneous definitions of
7 safe yield.

8 **III. SAFE YIELD IS A LEGAL STANDARD ESTABLISHED BY *SAN FERNANDO*.**

9 **A. Case Law Establishes a Single, Settled Legal Standard that California Courts**
10 **Uniformly Apply: The *San Fernando* Court’s Definition of Safe Yield.**

11 In *San Fernando*, the California Supreme Court defined safe yield as “the maximum
12 quantity of water which can be withdrawn annually from a ground water supply under a given set of
13 conditions without causing an undesirable result,” where the “undesirable result” is “a gradual
14 lowering of the ground water levels resulting eventually in depletion of the supply.” (*San Fernando*,
15 *supra*, 14 Cal.3d at p. 278.) The court also described the equivalent formulation that safe yield is “in
16 essence, the maximum amount of water that could be extracted annually, year after year, without
17 eventually depleting the underground basin.” (*Id.* at p. 214.)

18 Since *San Fernando* was decided over five decades ago, California courts have not adopted
19 competing definitions of safe yield; rather, they have repeatedly and consistently cited, quoted,
20 restated, and applied the California Supreme Court’s definition of safe yield in *San Fernando*.

21 In *Wright v. Goleta Water District* (1985) 174 Cal.App.3d 74 [“*Wright*”], the court quoted
22 *San Fernando*’s definition verbatim, confirming that safe yield is “the maximum quantity of water
23 which can be withdrawn annually from a ground water supply under a given set of conditions
24 without causing an undesirable result,” and where the “undesirable result” is the gradual lowering
25 of groundwater levels leading to depletion. (*Id.* at p. 81, fn. 2.)

26 In *Phelan Piñon Hills Community Services District v. California Water Service Co.* (2020)
27 59 Cal.App.5th 241 [“*Phelan*”], the court again quoted *San Fernando*, defining safe yield as the
28 maximum annual withdrawal that does not cause “an undesirable result,” meaning groundwater

1 decline leading to depletion. (*Id.* at p. 251, fn. 1.) The *San Fernando* safe yield definition was
2 recognized in subsequent published decisions also arising from the Antelope Valley adjudication.
3 (See, e.g., *Los Angeles County Waterworks Dist. No. 40 v. Tapia* (2021) 63 Cal.App.5th 17, 40;
4 *Willis v. Los Angeles County Waterworks Dist. No. 40* (2021) 62 Cal.App.5th 992, 1024 [“*Willis*”].)

5 Other published decisions use the equivalent *San Fernando* formulation that safe yield is the
6 amount that may be extracted annually, year after year, without eventually depleting the basin.
7 (E.g., *City of Santa Maria v. Adam* (2012) 211 Cal.App.4th 266, 279 [“*Santa Maria*”]; *Las Posas*
8 *Valley Wat. Rights Coalition v. Ventura County Waterworks Dist. No. 1* (2026) 118 Cal.App.5th
9 1170, 1198.)

10 These cases confirm that California courts have treated *San Fernando*’s safe yield definition
11 as settled, controlling law. No published California decision has adopted a competing or alternative
12 definition. The uniformity of this precedent confirms that “safe yield” is not an open-ended
13 scientific concept subject to expert-specific interpretation. Instead, it is a settled legal standard to be
14 applied consistently in groundwater adjudications. Accordingly, this Court should apply the *San*
15 *Fernando* definition and require that all expert testimony conform to that legal standard.

16 **B. The IWVGA and U.S. Experts’ Failure to Base Their Safe Yield Opinions on**
17 ***San Fernando* Is a Methodological Error, Not Merely a Difference of Opinion.**

18 The expert testimony of Dr. McKenna and Dr. Kincaid regarding the “safe yield” of the
19 Basin should be excluded. Dr. McKenna and Dr. Kincaid replace the California Supreme Court’s
20 governing legal standard of safe yield with a recharge amount, rendering their opinions irrelevant to
21 the issue before this Court.

22 Dr. McKenna initially acknowledges his safe yield definition as “the maximum
23 quantity...without causing an undesirable result...[the] gradual lowering of the groundwater
24 level...” (Ex. 60 at p. 60-21.) However, he then abandons that definition and substitutes a recharge
25 limitation: “the safe yield cannot be more than the recharge...[and] must be less than recharge...”
26 (Ex. 60 at p. 60-6.)

1 Dr. Kincaid adopts the same approach, defining safe yield as: groundwater extraction “equal
2 to, or less than...groundwater recharge.” (Ex. 80 at p. 80-7.) He further states: safe yield “will
3 necessarily be less than the total natural recharge.” (*Id.* at pp. 80-3, 80-7.)

4 Although both experts present themselves as applying accepted hydrogeological principles,
5 their opinions are not the product of reliable methodology. Instead, they:

- 6 • Use an incorrect definition of “safe yield” that conflicts with California law;
- 7 • Adopt a recharge-limited framework that is not generally accepted in
8 hydrogeology;
- 9 • Disregard observed empirical data in favor of speculative reconstructions; and
- 10 • Fail to reliably apply the governing hydrologic equation by omitting groundwater
11 storage.

12 Although sometimes “weaknesses in assumptions go to weight, not admissibility,” this is
13 not a debatable scientific assumption—it is the wrong legal question, which makes the IWVGA
14 and U.S. expert opinions irrelevant, misleading, and improper legal opinions, and therefore
15 excludable. Under *Sargon*, the Court acts as a gatekeeper to exclude expert opinions that are
16 speculative, unsupported by proper methodology, or based on reasoning that leaps from data to
17 conclusion without a reliable analytical bridge. The opinions at issue fail that standard.

18 **C. The IWVGA’s and U.S.’s Expert Testimony Should Have Been Based on the**
19 **Proper Definition of “Safe Yield” and Should Be Excluded as an Improper**
20 **Legal Opinion.**

21 Even though experts may opine on “ultimate issues,” they may not instruct the court or jury
22 on the law, and they certainly cannot give opinions that amount to “how the case should be
23 decided.” (*Summers v. A.L. Gilbert Co.* (1999) 69 Cal.App.4th 1155, 1182–1183.) *Summers* holds
24 that expert testimony on issues of law is inadmissible because it usurps the trial court’s role to
25 instruct on the law. Although Evidence Code section 805 says an expert opinion is not objectionable
26 merely because it “embraces the ultimate issue,” *Summers* clarifies that section 805 is not carte
27 blanche authority for experts to give legal opinions.

1 A testifying expert’s definition of “safe yield” must be based on a legal standard drawn
2 from applicable case law. If the expert offers a definition that conflicts with California decisions
3 (e.g., treating “safe yield” as a “predevelopment” construct), they are testifying to the law and
4 instructing the trier of fact on the governing standard—squarely within the prohibition of
5 *Summers*. For this reason alone, the Court should not accept the safe yield estimates of either Dr.
6 Kincaid or Dr. McKenna. The IWVGA’s and U.S.’s safe yield opinions should be excluded.

7 **IV. SAFE YIELD MUST BE DETERMINED UNDER CURRENT CONDITIONS.**

8 California courts treat safe yield as a function of actual basin conditions including existing
9 land uses and cultural conditions, return flows, pumping methods and effects, and the basin’s real
10 hydrogeologic behavior over time. (E.g., *San Fernando, supra*, 14 Cal.3d at pp. 260–261, 280–
11 281 [safe yield considers return flows including those from water imported from outside the basin,
12 use conditions, and actual basin storage and behavior]; *Allen v. California Water & Telephone Co.*
13 (1946) 29 Cal.2d 466, 473–475 [describes trial court record supporting safe yield finding based on
14 actual hydrogeologic conditions, not an abstract formula].)

15 California cases show that “safe yield” is not a pre-development abstraction—it is
16 explicitly tied to a given set of current conditions, and those conditions include current land use,
17 often referred to as “cultural” characteristics (e.g., irrigation and urban return flows, urbanization
18 effects, etc.). As a matter of law, it is erroneous to define or estimate “safe yield” using nonexistent
19 cultural conditions from 100 years ago when the basin’s current recharge, return-flow dynamics,
20 and beneficial uses are materially different today.

21 In *San Fernando*, the California Supreme Court safe-yield analysis depends on current
22 conditions. In particular, *San Fernando* recognizes that urbanization can change the safe yield
23 estimate:

- 24 • The definition of safe yield is the maximum quantity that can be withdrawn
25 annually “under a given set of conditions” without an undesirable result. (*San*
26 *Fernando, supra*, 14 Cal.3d at pp. 278–279.)
- 27 • The court describes the referee’s safe-yield work as relying on assumptions about
28 return flow from water deliveries to various users in service areas with particular

1 “natural and cultural characteristics.” (*Id.* at p. 260.)

- 2 • The opinion notes safe-yield computations can change safe yield as land use
3 conditions change. The opinion specifically includes “return flow[s] from imported
4 water” which reflects the present-day conditions. (*Id.* at p. 278.)
- 5 • The safe yield determined by the court was during the 1964–1965 time period
6 which reflected the then-present-day conditions. (*Id.* at p. 288.)

7 There can be no reasonable dispute that safe yield is defined and estimated “under a given
8 set of conditions,” and that the *San Fernando* court-recognized analysis uses current cultural
9 characteristics and return flows. The IWVGA and U.S. cannot present expert opinion testimony
10 pretending the Basin is still in a non-existent, pre-groundwater pumping or pre-agricultural
11 condition.

12 In applying *San Fernando*’s safe yield definition, the *Wright* court also determined the safe
13 yield definition’s component terms include “under a given set of conditions.” The terms are integral
14 to the applicable safe yield definition: “Safe yield” is “the maximum quantity of water which can be
15 withdrawn annually from a ground water supply under a given set of conditions without causing an
16 undesirable result.” *Wright* confirms that the judicial safe yield definition is explicitly condition-
17 dependent and not “natural yield” untouched by human land use in a pre-development time period.
18 Further, *Wright* relied on *San Fernando* in concluding that the trial court has the power to
19 redetermine safe yield based on changed hydrologic conditions. (*Wright, supra*, 174 Cal.App.3d at
20 p. 90 [citing *San Fernando, supra*, 14 Cal.3d at p. 287].)

21 Additionally, *City of Barstow v. Mojave Water Agency* (2000) 23 Cal.4th 1224 frames “safe
22 yield” under Article X, section 2 of the California Constitution, including protection of established
23 uses and return flows. (*Id.* at pp. 1241–1242, 1245–1248.) The *Mojave* court applies *San*
24 *Fernando*’s discussion of apportionment factors including return flows and the extent of established
25 uses—not a fictional or long-ago landscape. (*Id.* at pp. 1245–1246.) *Mojave* and *San Fernando*
26 recognize established uses and return-flow conditions that are inherently tied to existing land use
27 and present cultural conditions, not conditions before pumping existed.

1 Safe yield is determined by reference to a representative hydrologic base period. As
2 discussed more fully below, the TWG carefully selected a 2014 to 2023, inclusive, base period
3 because it satisfies accepted hydrologic criteria: approximates long-term average precipitation,
4 includes both wet and dry years; reflects current “cultural conditions;” spans at least ten years,⁵
5 and—most importantly—relies on more recent and accurate and complete pumping and water-level
6 data than earlier periods.

7 The approach of the U.S. is no less flawed. Like the IWVGA, the U.S. proposes its own
8 “safe yield” definition that is driven by “pre-development” estimates of basin recharge based on
9 the missing model’s 7,650 AFY safe yield estimate. Like the IWVGA, the U.S. expert ignores
10 current basin conditions which is directly contrary to *San Fernando*.

11 **V. THIS IS NOT A TRIAL TO REVIEW A GSP; THE TRIAL IS TO DETERMINE**
12 **SAFE YIELD.**

13 **A. SGMA and Sustainable Yield Are Groundwater Management.**

14 SGMA provides that with minimal, specific exceptions, it does not alter or supersede
15 California common law. (Wat. Code, § 10720.5; see also Code Civ. Proc., § 830(b)(7).) Neither a
16 GSA nor a GSP may determine or alter water rights. (Code Civ. Proc., § 834(a); Wat. Code,
17 §§ 10720.5, 10737; *Hillside Mem. Park & Mortuary v. Golden State Wat. Co.* (2011) 205
18 Cal.App.4th 534, 549 [*“Hillside”*].) Rather, GSAs and GSPs are for groundwater management.
19 GSAs are required to estimate a basin’s *sustainable yield* for purposes of groundwater
20 management. Courts determine *safe yield* as a predicate to adjudicating water rights and
21 developing a physical solution.

22 **B. “Undesirable Results” and “Minimum Thresholds”**

23 In compliance with Article X, Section 2 of the California Constitution requiring water be
24 placed to maximum beneficial use, courts have identified that the primary undesirable result to be
25 avoided in determining safe yield is “a gradual lowering of the ground water levels resulting
26 eventually in depletion of the supply.” (*San Fernando, supra*, 14 Cal.3d at p. 278.)

27
28 ⁵ Ex. 643 at p. 643-18.

1 SGMA defines “sustainable yield” as the maximum quantity of water, calculated over a
2 base period representative of long-term conditions in the basin and including any temporary
3 surplus, that can be withdrawn annually from a groundwater supply without causing an
4 undesirable result. (Wat. Code, § 10721(w).) Examples of undesirable results to be avoided in
5 determining sustainable yield include a “[c]hronic lowering of groundwater levels indicating a
6 significant and unreasonable depletion of supply if continued over the planning and
7 implementation horizon” or a “[s]ignificant and unreasonable reduction of groundwater storage.”
8 (Wat. Code, § 10721(x).) The qualifying phrases in SGMA’s examples reflect that GSAs make
9 *policy* determinations as to what may qualify as “significant” and “unreasonable.”

10 Pursuant to DWR regulations, GSAs must numerically identify and quantify “minimum
11 thresholds” as the point at which sustainability indicators (such as water levels) are “significant
12 and unreasonable” and will thereby cause undesirable results. (Cal. Code Regs., tit. 23, § 351(t)
13 [defining “minimum threshold” as “a numeric value for each sustainability indicator used to define
14 undesirable results].) As described further below, the IWVGA GSP’s minimum thresholds were
15 based primarily on basin *management* modeling scenarios that included restricting pumping
16 allocations and founded upon the faulty premise that the Navy’s Federal Reserved Water Right
17 was nearly 7,000 AFY. (Ex. 32.)

18 C. **GSAs Determine Undesirable Results by Vote, Whereas the Court Considers**
19 **Evidence and Assures Due Process.**

20 GSAs are political bodies. (See Wat. Code, § 10723.) They make policy decisions on
21 sustainable groundwater management with some DWR oversight. Sustainable yield results from
22 an administrative process conducted by the political body. There are no evidentiary or procedural
23 safeguards, such as the ability to cross-examine witnesses and present information before a neutral
24 factfinder—i.e., due process. (See Wat. Code, §§ 10720.1(d), 10720.5(b), 10721(r), 10726.8(b),
25 10738.) In the case of the IWVGA, a joint powers authority, its Board of Directors has even
26 included *non-elected* local agency staff for two of its member agencies (Inyo County, San
27 Bernardino County) to hold Board member positions and to vote on the GSP and its
28 implementation.

1 By contrast, safe yield is determined by the court, an impartial fact finder. It is tasked with
2 adjudicating groundwater rights and adopting a physical solution that promotes sustainable
3 groundwater management consistent with its determination of groundwater rights and California
4 common law. The court determines a basin’s safe yield through a judicial process after taking
5 evidence and hearing testimony including expert witness testimony. (See Code Civ. Proc., § 843.)
6 There is due process. (See Code Civ. Proc., §§ 830(b)(2), 834(b), 849(a); Wat. Code, § 10720.5(c);
7 *San Fernando, supra*, 14 Cal.3d at pp. 278–279; *Rancho Santa Margarita v. Vail* (1938) 11 Cal.2d
8 501, 558–559; *City of Lodi v. East Bay Municipal Utility District* (1936) 7 Cal.2d 316, 341;
9 *Hillside, supra*, 205 Cal.App.4th at pp. 538–539, 549.)

10 **D. Safe Yield Can Be Re-Assessed in the Future if Hydrologic Conditions Change.**

11 Given that safe yield is tied to existing conditions, safe yield can—and should—be re-
12 assessed in the future in the event that hydrological conditions change. (See *Willis, supra*, 62
13 Cal.App.5th at pp. 999–1000, fn. 1 [safe yield is “the maximum quantity of water which can be
14 withdrawn annually from a ground water supply **under a given set of conditions** without causing
15 an undesirable result” (quoting *San Fernando, supra*, 14 Cal.3d at p. 278 (emphasis added))]; see
16 also Code Civ. Proc., § 852 [reserving the Court’s continuing jurisdiction to modify or amend a
17 final judgment in a comprehensive adjudication in response to new information, changed
18 circumstances, the interests of justice, or to ensure that the criteria of Code Civ. Proc., § 850(a) are
19 met].) If safe yield is to be adjusted to meet future hydrologic conditions it necessarily follows that
20 safe yield cannot be based on historical and no longer existing conditions as was done by the
21 IWVGA and U.S. for this trial.

22 **VI. GROUNDWATER LEVELS REFLECT CHANGES IN THE AMOUNT OF**
23 **GROUNDWATER IN STORAGE, WHICH IS CONSIDERED BY COURTS IN A**
24 **SAFE YIELD ANALYSIS AND PHYSICAL SOLUTION.**

25 Safe yield is the factual foundation for a subsequent water rights allocation and physical
26 solution. (See, e.g., *Willis, supra*, 62 Cal.App.5th at pp. 1000–1002 [court determined safe yield
27 before considering a physical solution and before deciding contested groundwater rights]; *Phelan*,

1 *supra*, 59 Cal.App.5th at p. 248; *Santa Maria, supra*, 211 Cal.App.4th at pp. 278–279; *Cal. Water*
2 *Service Co. v. Edward Sidebotham & Son* (1964) 224 Cal.App.2d 715, 725–726.)

3 For example:

- 4 • A court cannot determine whether a basin is in a state of overdraft—i.e., when
5 extractions from a basin exceed a basin’s safe yield plus any temporary surplus
6 (*San Fernando, supra*, 14 Cal.3d at p. 280)—without first determining the safe
7 yield and the amount of groundwater in storage. (See also *Santa Maria, supra*, 211
8 Cal.App.4th at p. 292, fn. 16 [citing *San Fernando, supra*, 14 Cal.3d at p. 280];
9 *Center for Biological Diversity v. County of San Bernardino* (2016) 247
10 Cal.App.4th 326, 333–335.)
- 11 • Some types of water rights (e.g., prescriptive, appropriative) cannot be determined
12 without knowing if there is a groundwater surplus or overdraft, both of which are
13 based in part on safe yield including the amount of groundwater in storage.
- 14 • The amount of available groundwater in storage and a basin’s storage capacity bear
15 on the amount of water that is potentially available, the safe yield, and the parties’
16 water rights. (See *Willis, supra*, 62 Cal.App.5th at p. 1031 [“the availability of
17 storage water” is one of the “relevant factors” in determining water rights (quoting
18 *San Fernando, supra*, 14 Cal.3d at pp. 265–266)].)
- 19 • A trial court “may determine . . . use of storage space in the basin” (Code Civ.
20 Proc., § 834(a)) and its “final judgment in a comprehensive adjudication . . . may
21 declare . . . use of storage space in the basin” (Code Civ. Proc., § 834(b)). To do so,
22 a court must evaluate the amount of groundwater in storage and the basin’s storage
23 capacity.

24 The size of the aquifer and the quantity of water in storage is a material metric when
25 considering “undesirable results.” (Wat. Code, § 10721(x)(1)–(2) [referencing “reductions in
26 groundwater levels or storage” and “Significant and unreasonable reduction of groundwater
27 storage”]; *San Fernando, supra*, 14 Cal.3d at p. 280 [“[O]verdraft occurs only if extractions from
28

1 the basin exceed its safe yield plus any such temporary surplus” derived from groundwater in
2 storage.].) Determining if there will be undesirable results is required in determining safe yield.

3 The amount of groundwater in storage within a basin also informs the strategies for
4 managing a basin. For example, a large basin with millions of AF of water in storage is ordinarily
5 not subject to the same risks of undesirable results from pumping in excess of recharge as a
6 smaller basin with less than 100,000 AF. The amount of available groundwater in storage can also
7 impact the duration of a ramp down period in an overdrafted basin. (See, e.g., *Willis, supra*, 62
8 Cal.App.5th at pp. 1014, 1056 [discussing the “ramp down period” included in the physical
9 solution adopted by the court].)

10 *San Fernando* defines safe yield as the *maximum* quantity of water which can be
11 *withdrawn* (i.e., pumped or “produced”) annually from a groundwater supply under a given set of
12 conditions without causing an undesirable result. The California Supreme Court’s definition of
13 safe yield inherently reflects the constitutional mandate “that the water resources of the State be
14 put to beneficial use to the fullest extent of which they are capable.” (Cal. Const., art. X, § 2.)
15 Thus, the amount of groundwater in storage must be considered in establishing the safe yield,
16 which may be further conditioned (temporal, physical, or geographical) by court orders in the next
17 phases of trial.

18 **VII. MULTIPLE INDEPENDENT TWG ANALYSES RELIABLY DEMONSTRATE**
19 **THAT THE BASIN’S SAFE YIELD IS AT LEAST 14,300 AFY AND**
20 **APPROXIMATELY 15,400 AFY.**

21 The TWG parties present a coordinated body of evidence derived from multiple
22 independent methodologies, all grounded in a review of existing Basin studies, measured data, and
23 observed Basin behavior to estimate safe yield. The independent methodologies include:

- 24 • two analyses based upon a “Change in Storage Approach” that uses measurable
25 data including water levels, verified groundwater pumping, and hydrogeologic data
26 over a representative base period reflecting recent cultural conditions (see, *infra*,
27 §§ VII.B, VII.E.4, VII.G.5(b));

- a refined change in storage analysis that also uses measurable data including water levels, verified groundwater pumping, and hydrogeologic data over a representative base period reflecting recent cultural conditions (see, *infra*, § VII.E.5);
- an independent groundwater model developed by the District to evaluate safe yield (see, *infra*, §§ VII.G.6, VII.H.2, VII.I.5); and
- an analysis combining land surface process modeling conducted using the USGS’s statewide BCM with other science-based calculations and analyses of historical hydrologic data to estimate recharge rates on an annual average basis over a multi-decadal period (1980–2023) and then, with those recharge inputs, using the 2025 Ramboll Model to corroborate estimates of recharge and to estimate safe yield (see, *infra*, § VII.I.2).

The TWG parties’ analyses follow the legal standards of *San Fernando* that are necessary in determining safe yield in a groundwater basin adjudication.

These analyses—conducted by separate experts using different approaches, datasets, and assumptions—converge on the same result: **The safe yield of the Basin is no less than 14,300 AFY and is conservatively approximately 15,400 AFY.** This convergence is not coincidental. It is the hallmark of a reliable determination.

A. The TWG’s Organization and Approach

In 2022, the TWG Parties, together with the Mojave Pistachios parties,⁶ formed a technical working group (“TWG”). The TWG was formed to assist the Court in resolving the Phase 2 safe yield issue by applying accepted hydrogeologic principles and multiple independent analytical methods. The TWG was organized and operated to carry out those objectives in a manner consistent with standard groundwater adjudication practice.

The TWG was deliberately structured to promote methodological rigor, transparency, and technical coherence. Rather than producing a single, consolidated opinion, the TWG coordinated

⁶ Mojave Pistachios includes Mojave Pistachios, LLC, John Thomas Conaway, John Thomas Conaway Trust, John Thomas Conaway Living Trust u/d/t August 7, 2008, Nugent Family Trust, and Sierra Shadows Ranch LP.

1 multiple independent analyses addressing safe yield—using different analytical tools, datasets,
2 assumptions. Each participant was responsible for developing and defending his or her own
3 analyses while participating in iterative peer review and coordinated evaluation with other TWG
4 members. That structure was intended to bound uncertainty, test internal consistency, and ensure
5 that conclusions were grounded in basin-wide physical behavior rather than in any single model or
6 method.

7 To achieve this, the original TWG Parties assembled a team of experienced groundwater
8 professionals with complementary areas of expertise, including basin characterization, numerical
9 groundwater modeling, water balance analysis, and geophysics:

- 10 • Ramboll Americas Engineering Solutions (“Ramboll”) and Parker Groundwater
11 (Timothy K. Parker, PG, CEG, CHG) for the District;
- 12 • Krieger & Stewart Engineering Consultants (Charles Krieger, PE, and Travis
13 Romeyn, PE) for the District;
- 14 • Luhdorff & Scalmanini Consulting Engineers (“LSCE”) (Eddy Teasdale, PG, CHG,
15 and Will Halligan, PG) for Meadowbrook;
- 16 • Geoscience Support Services (“Geoscience”) (Johnson Yeh, Ph.D., PG, CHG, and
17 Lauren Wicks, PG) for Searles; and
- 18 • Aquilogic, Inc. (Anthony Brown and Wade Major, MBA, PE) for Mojave
19 Pistachios.

20 In early 2025, the District retained S.S. Papadopoulos & Associates (“SSP&A”) (Matthew
21 Tonkin, Ph.D., and Vivek Bedekar, Ph.D., PE) as independent consultants to review the TWG’s
22 work, apply their own methodologies, and provide their own independent opinions.

23 Over more than four years, the TWG met regularly to review available data, conduct
24 additional analyses, reconcile methodological differences, and refine conclusions through further
25 testing rather than deferral. Unlike regulatory planning processes conducted under SGMA, the
26 TWG’s work is not directed toward adoption of policy-based management targets or pre-
27 determined results. Rather, the TWG focuses on evaluating the Basin’s physical behavior and
28 constraints using methods appropriate in a comprehensive groundwater adjudication.

1 The TWG’s work is relevant to Phase 2 because it:

- 2 • examines groundwater storage behavior and basin response over time, rather than
- 3 relying on assumed steady-state pre-1920 conditions;
- 4 • frames groundwater in storage changes as a physical characteristic of the Basin that
- 5 informs safe yield, which is a legal determination grounded in hydrogeologic
- 6 behavior, basin-wide water balance, and observed groundwater response;
- 7 • applies multiple, independent scientific approaches to evaluate groundwater in
- 8 storage and safe yield and to bound uncertainty; and
- 9 • provides coordinated expert testimony designed to assist the Court, while leaving
- 10 ultimate findings to the Court.

11 The TWG’s emphasis on collaborative analysis and iterative peer review contrasts with the
12 IWVGA regulatory processes in which technical input was presented but not meaningfully
13 incorporated. As one highly experienced TWG participant testified at deposition, the TWG’s
14 process represented “the most robust and collaborative effort” he had experienced in developing a
15 safe yield analysis, reflecting an approach in which technical issues were evaluated, reconciled,
16 and addressed through additional analysis rather than deferred. (Brown Depo., 142:23–143:19.)

17 **B. 2024 TWG Safe Yield White Paper**

18 In September 2024, the TWG publicly released its “white paper” entitled, “Assessment of
19 Safe Yield for the Indian Wells Valley Groundwater Basin” (“2024 TWG Safe Yield Paper”;
20 Ex. 3).⁷

21 The TWG’s collaborative approach included a series of analyses, starting with reviewing
22 existing studies and published literature, conducting initial analyses with data currently used for
23 Basin management, and, finally, performing a more rigorous analysis with best available scientific

24 _____
25 ⁷ The Appendices to the TWG’s white paper are Exhibit 4 (Appendix A – TWG Evaluation of
26 Previous Estimates of Safe Yield and Similar Studies for the Indian Wells Valley Groundwater
27 Basin), Exhibit 8 (Appendix B – Ramboll Evaluation of Domestic Well Owners’ Pumping Rates in
28 the Indian Wells Valley Basin), Exhibit 9 (Appendix C – Groundwater Elevation Data Used for
Calculation of Safe Yield), and Exhibit 304 (Appendix D – Resumes and Qualifications of
Technical Working Group Members [as of Sept. 2024]). Current CVs for the TWG experts have
been produced separately as trial exhibits.

1 data to develop a range of safe yield values. The group used the most reliable methodology for
2 determining safe yield—the Change in Storage Method—which applies the following formula:
3 $\text{Safe Yield} = \text{Pumping} \pm \text{Change in Storage}$. This approach is not only consistent with *San*
4 *Fernando* but is considered technically superior to other estimation methodologies for an obvious
5 reason: it relies on measured data, such as water level measurements and recorded pumping; and it
6 represents a complete accounting of all groundwater inflows and outflows without the uncertainty
7 associated with estimating each element of the water budget (i.e., groundwater inflows and
8 outflows).

9 The TWG divided the Basin into multiple polygons using the Thiessen Polygon Method.
10 This method identifies a set of stationary monitoring points and defines a region around each point
11 to spatially apply data associated with the different point values. The TWG used two different
12 approaches with the Thiessen Polygon Method: one with 85 polygons and the other with 81
13 polygons. These two variations offered insights into the sensitivity of safe yield estimates to
14 different parameters and assumptions.

15 Ultimately, the TWG selected a hydrologic base period of January 2014 to December 2023
16 to calculate safe yield. The group selected this base period based on: (1) average precipitation
17 consistent with long-term (1945–2023) average precipitation at the China Lake NAF Station;
18 (2) inclusion of wet, dry, and average years of precipitation; (3) availability of groundwater
19 elevation data; (4) availability and reliability of pumping data; and (5) that it represents a ten-year
20 span, consistent with DWR recommendations.

21 A yield value was determined annually between January 2014 and December 2023 by
22 subtracting the annual pumping from the calculated change in storage (spring-to-spring storage
23 change was assumed, calculated based on water level change for each Thiessen polygon). The safe
24 yield was then calculated by averaging the annual yield values over the ten-year base period.

25 The average safe yield for the period from 2014 through 2023, calculated for the two
26 polygon approaches ranged from 14,300 AFY to 17,000 AFY. The TWG considered the average
27 and median safe yield values among the credible methods to provide a recommended estimate of
28 safe yield for the Basin in 2024 of **14,300 AFY**. (Ex. 3.)

1 **C. 2024 TWG Storage White Paper**

2 On February 23, 2024, the TWG issued its Assessment of Groundwater Storage for the
3 Indian Wells Valley Groundwater Basin (“2024 TWG Storage Paper”; Ex. 5), after collaboratively
4 developing a best estimate of the volume of groundwater in storage. To do so, the TWG evaluated
5 and applied three independent scientific approaches. Each approach applied different boundaries,
6 datasets, and assumptions to estimate groundwater in storage within the Basin. (Ex. 5 at p. 5-34,
7 table 14.)

8 The TWG presented its conclusions of the average groundwater storage volumes,
9 estimated from the three scientific methods it considered, as follows:

- 10 • The total volume of groundwater in storage—some of which is accessible but
11 would require additional infrastructure to develop—is approximately 66,890,000
12 AF (Ex. 5 at p. 5-35);
- 13 • The volume of fresh (total dissolved solids less than 1,000 mg/L) groundwater in
14 storage—some of which is accessible but would require additional infrastructure to
15 develop—is approximately 37,530,000 AF (Ex. 5 at p. 5-36); and
- 16 • The volume of fresh groundwater stored in the two shallowest aquifer zones (i.e.,
17 hydrogeologic zones (“HGZ”) 1 and 2)—which is readily accessible using existing
18 wells or new wells screened within those zones—is approximately 14,550,000 AF
19 (Ex. 5 at p. 5-35).

20 As discussed further below, the TWG conducted additional work that yielded consistent
21 estimates of groundwater in storage.

22 **D. Anthony Brown**

23 The District designated Anthony Brown of Aquilogic as a non-retained expert for Phase 2.
24 His testimony will address foundational groundwater concepts; his experience on the IWVGA
25 Technical Advisory Committee (“TAC”) compared to the TWG; Aquilogic’s analysis of
26 groundwater in storage; and Aquilogic’s shallow well analysis.

1 sorting, and degree of consolidation. The variability reflects real physical differences in pore
2 connectivity, drainage efficiency, and retained moisture, and underscores that effective basin-scale
3 specific yield must be evaluated using multiple lines of evidence including site-specific logic well
4 data, geophysical interpretations, published hydrogeologic literature, and observed aquifer
5 behavior. Specific yield values span a broad range, with coarse-grained alluvial deposits exhibiting
6 substantially higher drainage capacity than fine-grained or consolidated materials, and mixed
7 lithology yielding intermediate behavior. (Ex. 5 at §§ 2.2.1, 3.1, 5.0, 5.1, 6.3; Ex. 203.)

8 Specific yield directly governs how changes in groundwater levels translate into changes in
9 groundwater storage. Because changes in storage are a component of the basin water balance, the
10 specific yield selected directly affects calculated storage volumes and estimates of depletion
11 attributable to pumping.

12 3. Mr. Brown's Experience on the TAC Compared with the TWG

13 Mr. Brown will testify that his experience serving on the IWVGA's TAC—"one of the
14 most disappointing processes [he'd] ever been involved in" (Brown Depo., 142:23–143:19)—
15 differed materially from his subsequent experience participating in the TWG, particularly with
16 respect to how technical input was developed, vetted, and incorporated into substantive decision-
17 making.

18 Mr. Brown served on the TAC beginning in 2016 on behalf of Mojave Pistachios during
19 IWVGA's implementation of SGMA and development of its GSP. The TAC was intended to
20 provide technical input from groundwater professionals representing major Basin producers to
21 inform the IWVGA Board's evaluation of groundwater management options. Mr. Brown observed
22 that while technical issues were discussed, the process did not include a structured mechanism for
23 resolving technical disagreements or for incorporating competing analyses into the final GSP. As a
24 result, technical recommendations and concerns raised by TAC members—including issues
25 relating to recharge estimation, specific yield, and groundwater in storage—were not meaningfully
26 reflected in the sustainable yield determination ultimately adopted by IWVGA.

27 By contrast, Mr. Brown will testify that his experience on the TWG reflects a materially
28 different technical process. The TWG was expressly tasked with applying best available science to

1 evaluate safe yield, groundwater in storage, and potential impacts to wells. Mr. Brown will explain
2 that the TWG met regularly, shared data among participants, subjected analyses to iterative peer
3 review, and resolved technical disagreements through additional analysis rather than deferral. He
4 will further testify that the TWG's work was not outcome-driven in the technical sense:
5 conclusions were shaped by basin-specific hydrogeologic data, comparison of multiple
6 independent methodologies, and professional judgment informed by observed Basin behavior.

7 Within the TWG framework, Mr. Brown served as a lead contributor, including leading the
8 groundwater-in-storage assessment and evaluating shallow-well impacts.

9 **4. Volume of Groundwater in Storage within the Basin as Context for the**
10 **Court's Safe Yield Determination**

11 Mr. Brown will explain that the volume of groundwater in storage is a physical
12 characteristic of the Basin that provides important context for evaluating safe yield. As noted
13 above, not all basins are the same. California's Constitution and *San Fernando* require that the
14 determination of safe yield maximize the beneficial use of groundwater; not locking it up in cold
15 storage. Limitations on the extraction of water are drawn to avoid undesirable results, under the
16 given set of conditions before the Court, and specifically, the total volume of useable water in
17 storage.

18 Storage functions as a physical buffer, allowing demands to be met during dry periods by
19 drawing on water accumulated during wetter periods. This buffering capacity reflects the basin's
20 ability to absorb short-term imbalances between inflows and outflows without immediate or
21 irreversible impacts to groundwater availability. While groundwater in storage can provide
22 buffering capacity, it is not a renewable supply. Over time, where average withdrawals
23 consistently exceed average recharge, that buffer is depleted, manifested as declining groundwater
24 levels and a measurable loss of groundwater in storage. For this reason, safe yield is not evaluated
25 by reference to a single year of pumping or recharge, but by examining groundwater level trends
26 and changes in storage over a representative period that captures hydrologic variability and
27 delayed aquifer response.

1 The TWG’s estimates of the volume of groundwater in storage quantify the size and
2 distribution of that buffer and provide context for the Court’s Phase 2 determinations. Mr. Brown
3 will testify that the TWG estimated the volume groundwater in storage using three independent
4 scientific approaches. (Ex. 5 at §§ 3.0, 3.1, 4.0, 4.1, 5.0, 6.0, 6.1, tables 14, 15.) The estimates
5 converge on a consistent range and produce results that comport with observed groundwater
6 behavior in the Basin. (See, *supra*, § VII.C.) Mr. Brown will testify that in his professional
7 opinion, these estimates indicate the Basin contains at least 37.5 MAF of groundwater in storage
8 and given current projections of potential water use, there is no current threat of an appreciable
9 depletion over the next 20 years.

10 **5. The Lack of Shallow Well Impacts Verifies the Basin has Not**
11 **Approached Appreciable Depletion.**

12 Mr. Brown will testify regarding a basin-wide assessment of 857 domestic and public
13 supply wells using well construction data, groundwater elevation trends (2003–2023), and
14 projected groundwater conditions for 2040, 2045, 2047, and 2070. The evaluation applied DWR
15 criteria defining vulnerability at 80 percent of well depth, mitigation at 90 percent, and dry
16 conditions at 100 percent. Groundwater elevations were compared against these thresholds for
17 each well using GIS-based interpolation methods. (Ex. 204 at §§ 2.1, 2.3, 2.4, table 1, figs. 3–14.)

18 The assessment indicates no widespread shallow well impacts within the Basin. The
19 majority of shallow domestic wells remain above vulnerability thresholds under existing and
20 projected conditions. Results show no evidence of widespread shallow well failures or loss of
21 service, with only a small fraction of wells projected to become vulnerable or require mitigation
22 over time, and even fewer projected to go dry. These findings show that current pumping has not
23 caused significant impacts to shallow wells, a finding important to evaluating safe yield,
24 particularly undesirable results. (Ex. 204 at §§ 2.5, 3.6, 4.0, table 2, figs. 5–9.)

25 **E. Eddy Teasdale, PG, CHG**

26 Meadowbrook will call Eddy Teasdale of LSCE to testify as an expert witness for Phase 2.
27 Mr. Teasdale will opine that **the Basin’s Safe Yield is 15,400 AFY.**

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1. Qualifications

Mr. Teasdale is a Licensed Professional Geologist and California Certified Hydrogeologist. Mr. Teasdale has over 25 years of experience working on geological and hydrogeological investigations. Mr. Teasdale’s curriculum vitae is Exhibit 500.

2. Change in Storage Analysis

Mr. Teasdale’s expert work in this matter centered on assessing Safe Yield based on the “Change in Groundwater Storage” method. This approach employs the Equation of Hydrologic Equilibrium expressed as follows:

- $\text{Safe Yield} = \text{Pumping} \pm \text{Change in Groundwater Storage}$

As used in the above equation, Change in Groundwater Storage is calculated as follows:

- $\text{Change in Groundwater Storage} = \text{Change in Water Level} \times \text{Specific Yield} \times \text{Basin Area}$

Change in Groundwater Storage is calculated spatially using the “Thiessen Polygon Method,” whereby a basin is divided into discrete subareas (*i.e.*, polygons). Each polygon is delineated to correspond with the location of one or more monitoring wells selected based on (1) the completeness and consistency of their water level records and (2) their geographic distribution. This enables an assessment of Basin-wide Change in Groundwater Storage while accurately accounting for spatially variable pumping and groundwater level changes.

As Mr. Teasdale will describe at trial, the Thiessen Polygon Method is employed extensively in the context of groundwater management in basins throughout the State of California. Indeed, the Indian Wells Valley Groundwater Basin is among these numerous basins; **the IWVGA employs the Thiessen Polygon Method to assess Change in Groundwater Storage in connection with its annual reports submitted to DWR as required by SGMA.** Mr. Teasdale has extensive experience in this area, having used the Thiessen Polygon Method to calculate Change in Groundwater Storage in numerous basins and subbasins throughout California.

1 **3. Mr. Teasdale’s Participation on the TAC**

2 Mr. Teasdale also has substantial experience in the Indian Wells Valley Groundwater Basin.
3 Since 2016, Mr. Teasdale served on the TAC and the associated model ad hoc committee during
4 the process of developing the GSP for the Basin. In connection with that work, he reviewed
5 technical materials prepared in support of the GSP, participated in technical meetings and
6 discussions, and evaluated the adequacy of the data, assumptions, methodologies, and analyses
7 being used to support the plan. His involvement included review of technical matters relating to
8 groundwater conditions, groundwater budgets, recharge, pumping, sustainable management
9 criteria, and other issues central to Basin management. Mr. Teasdale further contributed to written
10 comments submitted to the IWVGA raising a number of technical concerns regarding the work
11 being advanced. In his view, those concerns were not adequately addressed. Participation in the
12 TAC and ad hoc committee ceased being productive, and Mr. Teasdale withdrew from those
13 groups in approximately 2021.

14 **4. Mr. Teasdale’s Role in the 2024 TWG Safe Yield Paper**

15 Mr. Teasdale’s work in the Basin continued. After leaving the TAC and ad hoc committee
16 in 2021, Mr. Teasdale served as Meadowbrook’s technical representative on the TWG. In that role,
17 he remained actively engaged in the review and evaluation of technical work products, including
18 reports, memoranda, modeling analyses, water budget evaluations, and other materials relating to
19 Basin management. He reviewed those materials in detail and provided technical input regarding
20 the underlying data, assumptions, methodologies, and conclusions being advanced by other parties
21 and consultants. His work included participating in technical discussions with Basin
22 representatives and consultants, reviewing hydrogeologic interpretations and water budget
23 analyses, and providing input on issues including groundwater storage, recharge, pumping
24 impacts, and safe yield. Through this work, Mr. Teasdale continued to assess whether the analyses
25 and conclusions being advanced by others were consistent with sound hydrogeologic principles
26 and supported by the available record.

27 In his role on the TWG, Mr. Teasdale contributed substantially to the development of the
28 2024 TWG Safe Yield Paper. Mr. Teasdale’s contributions included reviewing the hydrogeologic

1 framework for the Basin and calculating Safe Yield using the Change in Groundwater Storage /
2 Thiessen Polygon Method. The 2024 TWG Safe Yield Paper is Exhibit 3, and its appendices are
3 Exhibits 4, 8, and 9.

4 **5. Mr. Teasdale’s Refined Safe Yield Analysis and Opinions**

5 Mr. Teasdale’s expert work in Phase 2 is an extension and refinement of his work on the
6 TWG’s Safe Yield Paper calculating Safe Yield using the Change in Groundwater Storage /
7 Thiessen Polygon Method. He conducted his assessment using two Thiessen Polygon
8 configurations: “Approach #1” utilized an extended 85-polygon configuration derived from the
9 GSP Thiessen Polygon and further enhanced to provide full Basin coverage; “Approach #2”
10 employed a redesigned 81-polygon framework focused on the Basin’s alluvium, developed
11 through an independent assessment of updated groundwater level data. Mr. Teasdale’s initial
12 expert report (Aug. 2025) is Exhibit 85, and his rebuttal report (Dec. 2025) is Exhibit 91.

13 Mr. Teasdale will describe that his assessment that the Basin’s Safe Yield is 15,400 AFY is
14 based on industry-standard techniques using empirical, measured data. Mr. Teasdale selected a
15 base period of 2014-2023 for a number of reasons which include the availability of reliable
16 empirical data. The Change in Groundwater Storage approach utilizes (1) **measured** pumping
17 data, (2) **measured** changes in groundwater levels, and (3) specific yield values reflecting the
18 lithology of the Basin’s water-bearing aquifer materials.

19 **(a) Pumping Data**

20 Mr. Teasdale’s Change in Groundwater Storage / Thiessen Polygon Method calculations
21 utilized comprehensive pumping datasets collected over the past several years based on metering
22 and reporting prompted by SGMA implementation and disclosure requirements in this
23 Adjudication. Pumping data reflected in the IWVGA’s annual reports required by SGMA, other
24 IWVGA records, and the parties’ verified initial disclosures (sworn under penalty of perjury)
25 capture approximately 95 percent of the total groundwater production in the Basin. These datasets
26 therefore provide a comprehensive and reliable foundation for calculating Safe Yield using the
27 Change in Groundwater Storage / Thiessen Polygon Method.

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(b) Measured Groundwater Level Changes

The groundwater level changes Mr. Teasdale incorporated into his analyses are also data-driven and empirical. Among other data, Mr. Teasdale assessed groundwater level changes from a sizable network of more than 150 wells. Water level data for these wells were typically collected monthly or quarterly during the base period.

(c) Data-Based Sy Values

Specific yield (“Sy”) is used to calculate Change in Groundwater Storage. Sy is the amount of groundwater that a unit volume of aquifer will yield when drained by gravity. This is related to the pore space where water occurs between the grains of the various soil types within the saturated portions of an aquifer. Sy values vary throughout the Basin, depending on whether the materials are sand, gravel, silt, or clay, etc. Sand and gravel—which have more grain space and therefore higher water-bearing capacity—have higher Sy values than tighter-grained silts or clays.

Sy directly scales the magnitude of storage change, and, therefore, higher Sy values increase the magnitude of calculated storage gain or loss. Accordingly, if unreasonably high Sy values are used to calculate a negative Change in Groundwater Storage, it results in an erroneously low calculation of Safe Yield. When a higher Sy value is used in a calculation involving a fixed lowering of groundwater levels, a greater quantity of water is calculated to have been removed from the system. That’s because higher Sy means more water was contained in the now-drained pore space.

This erroneous Change in Groundwater Storage value, when used in the Safe Yield equation, will result in an erroneously low Safe Yield value, because it indicates (again, erroneously) that less recharge and other water inputs were available to offset pumping.⁹ Use of unreasonably low Sy values results in the inverse outcome, *i.e.*, an erroneously high Safe Yield. In sum—whether assessing Safe Yield using a groundwater model or employing the Change in Groundwater Storage / Thiessen Polygon Method—use of appropriate Sy values is important.

⁹ This is also true when Safe Yield is evaluated in a groundwater model. In either instance, when there is a lowering of groundwater levels, unreasonably high Sy values will skew Safe Yield erroneously low.

1 The Sy values Mr. Teasdale used are firmly rooted in data reflecting the aquifer's variable
2 lithology. Mr. Teasdale utilized Sy values from a hydrogeologic study conducted for the District in
3 2009 by Brown and Caldwell. (Ex. 67.) The Sy values used by Brown and Caldwell (2009) were
4 based on geologic logs, prior groundwater modeling studies in the model study area, and
5 interpretations made during model calibration considering the local geology and depositional
6 environment. Using the Brown and Caldwell (2009) dataset, Mr. Teasdale calculates the Basin's
7 Safe Yield to be between 14,200 and 14,900 AFY.

8 Mr. Teasdale also separately calculated Change in Groundwater Storage using a revised set
9 of Sy values prepared by Ramboll. Ramboll (2024) updated the Brown and Caldwell (2009)
10 values based on data collected in connection with an AEM survey conducted in 2017. AEM data
11 enabled Ramboll to further refine the hydrogeologic conceptual model of the Basin with respect to
12 spatial variability of subsurface soil types.¹⁰ Ramboll (2025) utilized Ramboll (2024) as a starting
13 point and calibrated aquifer properties including Sy. Using the refined Ramboll (2025) dataset, Mr.
14 Teasdale calculates the Basin's Safe Yield to be between 15,100 and 15,700 AFY. Mr. Teasdale's
15 opinion that Safe Yield is 15,400 AFY reflects the average of the range calculated using the
16 Ramboll (2025) Sy dataset.

17 The range and distribution of Sy values across the polygons used respectively in Approach
18 #1 and Approach #2 are reflected in Figure 2-11 and Figure 2-12, reproduced below from Mr.
19 Teasdale's initial report (Ex. 85).¹¹

24 ¹⁰ Mr. Teasdale further refined the Sy values in the area of Meadowbrook's wells based on a paired
25 well test he performed in 2025. As would be expected, Meadowbrook's agricultural production
26 wells were completed in more productive zones in the aquifer where the aquifer materials bear
27 more water and therefore have higher Sy values. Mr. Teasdale conservatively adopted the higher
28 range of the Sy values for these polygons, which has a downward effect on Mr. Teasdale's Safe
29 Yield calculations.

¹¹The higher Sy values correspond to the higher water bearing zones as determined by Mr.
Teasdale's well test.

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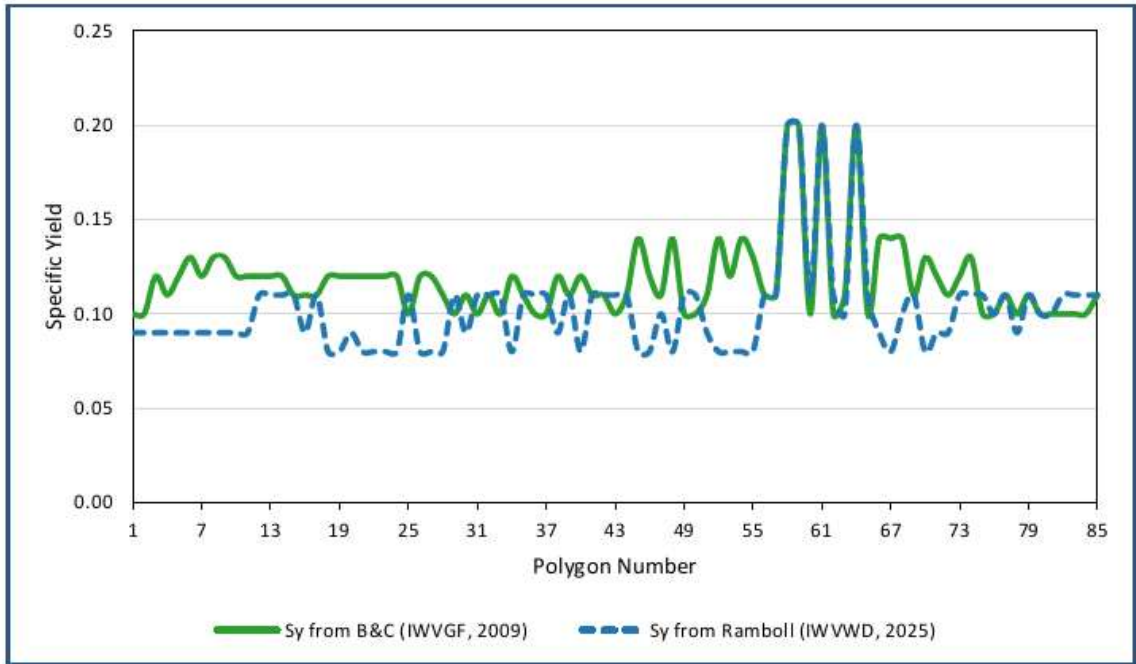


Figure 2-11. Specific Yield by Thiessen Polygon (Approach #1: Extended 85 Polygons)

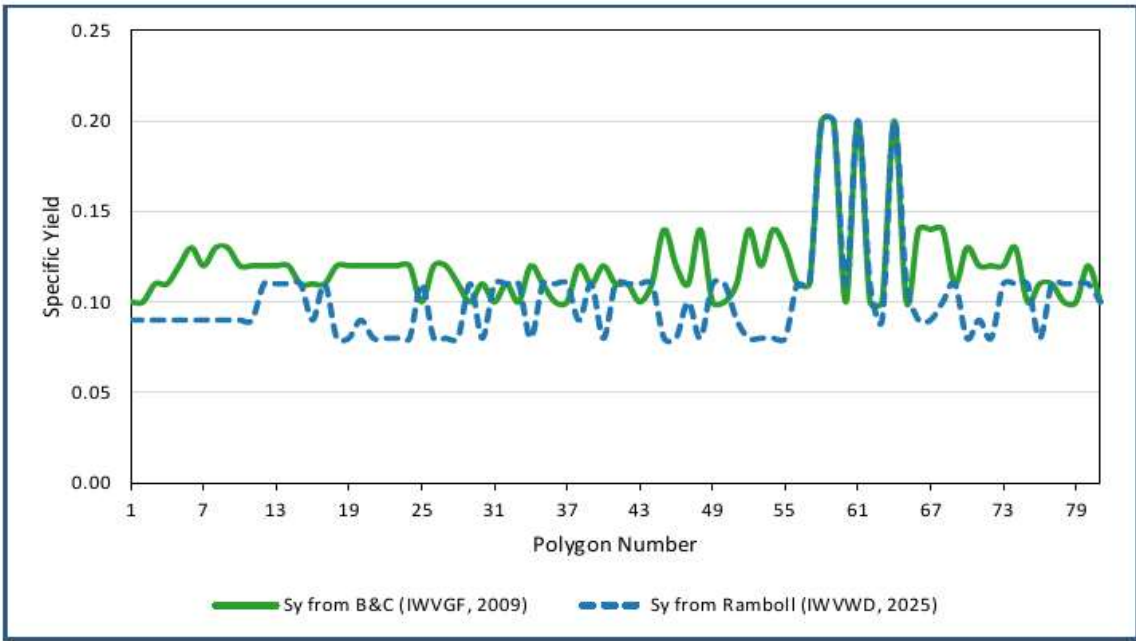


Figure 2-12. Specific Yield by Thiessen Polygon (Approach #2: Redesigned 81 Polygons)

(d) The 2025 DRI Model's Sy Values Are Not Data-Driven.

In stark contrast, Mr. Teasdale will explain that *the Sy values in the 2025 DRI Model are purely a function of the calibration process*. Mr. Teasdale will explain that the foundation of the 2025 DRI Model is an erroneously low recharge value of 7,650 AFY:

1 The 7,650 AFY safe-yield value presented by [opposing experts]
2 Kincaid and McKenna is inconsistent with observed basin behavior.
3 The recharge/ET-based methods used by McKenna and Kincaid
4 systematically undercount recharge because they rely on incomplete
5 tributary inflow components, restrictive precipitation thresholds,
6 uncertain historical ET estimates, and long-abandoned pre-
development conceptualizations. Their resulting inflow estimates do
not match the basin's actual measured response to pumping and
therefore cannot form a reliable basis for determining safe yield.

7 (Ex. 91 at p. 91-17.) The 7,650 AFY recharge value is **not** an output of the 2025 DRI Model. To
8 the contrary, 7,650 was predetermined modeling input that is hard-wired into the 2025 DRI Model.

9 Accordingly, getting the model to calibrate required the assignment of erroneously high Sy
10 values. This is described by Mr. Teasdale and the TWG as follows in Appendix A of the Safe Yield
11 Report (Ex. 4 at p. 4-31):

12 *During GSP model calibration, the predetermined recharge value of*
13 *7,650 AFY (5,250 AFY natural recharge and 2,400 AFY basin*
14 *interflow from Rose Valley) was held constant, relying on the*
15 *adjustment of Sy and other aquifer parameters to achieve adequate*
16 *calibration to observed groundwater elevations. As a result, the Sy*
17 *values used in the DRI model (McGraw et al., 2016) [Ex. 21] based*
18 *on the recharge estimate are too high and not considered*
representative of the aquifer sediments in the IWV Basin (see
additional discussion in main TWG paper). The use of more
representative values of Sy would dramatically increase the
estimate of recharge. (Emphasis added.)

19 The TWG provided an example of how the use of more representative Sy values would
20 result in dramatically higher estimates of annual recharge. Kunkel and Chase (1969) provides Sy
21 values ranging between .09 and .13, which corresponds to Safe Yield calculations ranging between
22 15,304 and 18,527 AFY. Kunkel and Chase (1969) is Exhibit 611.

23 The Ramboll (2024)'s Sy estimates are similar to the Kunkel and Chase (1969) values,
24 ranging from .06 to .17. They are also similar to the Brown and Caldwell (2009) values, as
25 visually depicted in Figure 6 from the Safe Yield Paper (Ex. 3 at p. 3-23), reproduced below.

26 More notably, Figure 6 illustrates the extreme divergence presented by DRI / IWVGA
27 calibrated Sy values.

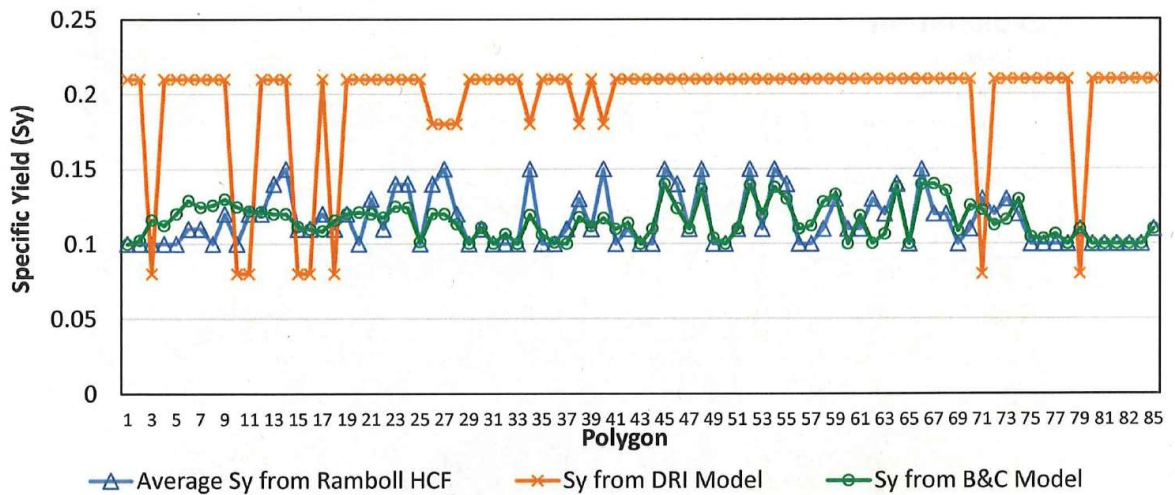


Figure 6. Specific Yield (Sy) by Thiessen Polygon (Extended 85 Polygons)

As Figure 6 reflects, calibrating the 2020 DRI Model to a predetermined annual recharge of 7,650 AFY required the use of much higher and much more heterogeneously distributed Sy values. Mr. Teasdale will testify that 7,650 AFY is an erroneously low estimate of annual recharge and that, when appropriate Sy values based on aquifer lithology are used, the result is a significant increase in calculated recharge and Safe Yield.

(e) The Advantages of the Change in Groundwater Storage / Thiessen Polygon Method Are Significant.

Mr. Teasdale will describe that there are significant advantages to his approach to calculating Safe Yield. As described in more detail, below, with respect to the testimony of Drs. McKenna and Kincaid, none of the mountain front recharge, inter-basin flows, anthropogenic sources of recharge, or other various inflow components of the water budget are susceptible to direct measurement. Instead, each element of an annual inflow must be estimated based on indirect evidence, introducing significant uncertainty to the calculations. As each flow component is estimated, the overall magnitude of the uncertainty is compounded.

By calculating Change in Groundwater Storage using Mr. Teasdale's approach, *inflows are accounted for automatically*. There's no need to separately estimate mountain front recharge, inflow from other basins, other forms of natural recharge, or the various anthropogenic water inputs to the system; *inflows are "baked in" to the Change in Groundwater Storage calculation*.

1 This means **the Change in Groundwater Storage approach involves significantly less**
2 **uncertainty and error than methods relying on highly uncertain recharge estimates.**

3 Additionally, the Groundwater Storage / Thiessen Polygon Method accounts for current
4 hydrologic and climatic conditions, which have been altered substantially by long-term pumping,
5 land-use change, vegetation shifts, and climate variability. Mr. Teasdale will opine that
6 “[e]valuating how the aquifer behaves under recent conditions, not how it may have behaved pre-
7 1920, provides a more accurate basis for determining safe yield.” (Ex.91 at p. 91-7.)

8 (f) ***Mr. Teasdale’s Assessment Agrees with Modeling Results from a***
9 ***Well-Calibrated Model that is not Based on a Predetermined***
10 ***Recharge Value.***

11 Mr. Teasdale will explain that the range of Safe Yield values estimated using the Ramboll
12 Model agrees very well with Mr. Teasdale’s assessment. He will confirm that “[t]his agreement
13 between a process-based numerical model and an observational mass-balance analysis *provides*
14 *powerful cross-validation*, indicating that the safe yield is the range calculated by LSCE and far
15 above the 7,650 AFY assumed by the Kincaid and McKenna analyses.” (Ex. 91 at p. 91-17.)

16 **F. Lauren Wicks, PG**

17 **1. Qualifications**

18 Lauren Wicks is a Senior Geohydrologist with Geoscience. She has more than a decade of
19 experience working on groundwater basin studies, water budgets, and hydrogeologic analysis.
20 (Ex. 51.) Ms. Wicks’ work in the Basin began in 2019, when her firm was retained to evaluate
21 technical information in the draft GSP. As a member of the TWG, she participated in regular
22 meetings, coordinated technical input among the TWG experts, and helped prepare the 2024 TWG
23 Safe Yield Paper (Ex. 3) and its supporting Appendix A (Ex. 4).

24 **2. Change In Storage Approach is the Superior Method to Evaluate Safe**
25 **Yield.**

26 Ms. Wicks will testify that the TWG undertook a comprehensive and collaborative
27 technical review of the Basin, including evaluation of at least two dozen prior studies and
28 competing methodologies for estimating safe yield. (Ex. 4.) She will testify that the change-in-

1 storage approach provides a more reliable and data-driven estimate of safe yield than recharge-
2 based methods, which require estimating individual inflow and outflow components that cannot be
3 directly measured and are subject to wide variability. Ms. Wicks' expert reports are Exhibit 6
4 (Aug. 2025) and Exhibit 7 (Nov. 2025).

5 **3. TWG Selection of the 2014–2023 Base Period**

6 Ms. Wicks will testify regarding the data supporting the TWG selection of the 2014–2023
7 base period, which is representative of long-term conditions, includes both wet and dry cycles,
8 reflects cultural conditions such as current groundwater use, and benefits from significantly
9 improved data quality compared to earlier decades. She will explain that modern data—
10 particularly post-2014 pumping and water-level measurements—are more reliable due to metering
11 requirements, expanded monitoring networks, and improved measurement technology.

12 She will testify that that the TWG utilized the most complete, current and reliable pumping
13 data to inform the selection of the base period, including: (a) verified initial disclosures that parties
14 have filed with the Court in this Adjudication that disclose pumping volumes for the years 2011–
15 2020; (b) metered pumping volumes reported by non-de minimis pumpers to the IWVGA for
16 years 2020–2023 as required by IWVGA measurement and reporting regulations; (c) reporting
17 volumes collected and reported by the IWVGA to the extent not addressed in the previously listed
18 datasets; and (d) the Ramboll assessment of domestic well pumping (Ex. 8).

19 **4. Limitations and Flaws of U.S. and IWVGA Approach**

20 Ms. Wicks will testify that the TWG's analysis also identified significant limitations in the
21 GSP's recharge-based approach, including reliance on a fixed 7,650 AFY recharge estimate that
22 U.S. and IWVGA experts cannot validate. She will explain the flaws in their attempts to assess
23 recharge by ratio comparisons to other basins. By contrast, she will explain that the TWG's
24 approach accounts for all inflows and outflows collectively—including recharge sources such as
25 irrigation return flows and other anthropogenic inputs—rather than excluding them based on
26 uncertain assumptions.

1 **G. Tim Parker, PG, CEG, CHG**

2 The District will call Timothy Parker of Ramboll and Parker Groundwater as an expert
3 during Phase 2. His testimony will address his experience in the Basin; the Basin Characterization
4 Model (“BCM”) developed by the U.S. Geological Survey (“USGS”); the Hydrogeologic
5 Conceptual Framework (“HCF”) developed by Ramboll; his participation in the TWG; and
6 development of the 2025 Ramboll Model.

7 **1. Qualifications**

8 Mr. Parker is a licensed professional geologist, certified engineering geologist, and
9 certified hydrogeologist in California, with nearly 40 years of hydrogeologic experience in
10 groundwater supply and groundwater resource management. (Ex. 351.)

11 **2. Mr. Parker has Worked in the Basin Since 2010.**

12 Mr. Parker has worked continuously in the Basin since 2010, including groundwater
13 supply planning, basin characterization, cooperative management efforts, SGMA implementation,
14 and technical analyses undertaken in this adjudication.

15 Following the formation of the IWVGA in 2016, he continued to serve as the District’s
16 consulting hydrogeologist on the TAC and model ad hoc committee. He will explain that the TAC
17 was established to provide technical expertise and recommendations to the IWVGA Board during
18 development and implementation of the GSP, while the ad hoc committee focused on technical
19 issues relating to groundwater modeling and incorporation of new data. In these roles, he
20 participated in technical discussions, reviewed work product (including the GSP), and provided
21 written comments identifying data gaps and technical concerns in the GSP. In his professional
22 judgment, those concerns were not substantively addressed in the final GSP. His experience
23 informed his later participation in the TWG, which applied a collaborative, science-driven
24 approach to evaluating Basin conditions. (Ex. 356.)

25 Mr. Parker will also explain that, although DWR approved the GSP, that approval is
26 limited. DWR evaluates whether a plan substantially complies with statutory requirements but
27 does not independently verify groundwater budgets, rerun models, or determine whether
28 assumptions represent the most accurate characterization of Basin conditions. Nor does DWR

1 approval determine groundwater allocations, pumping levels, or recharge estimates. DWR
2 approval does not resolve disputed technical issues relevant to this Court’s Phase 2 determinations.
3 (Ex. 359; see Wat. Code, § 10738 [“The approval of a groundwater sustainability plan by the
4 department shall not be construed to be a determination by or otherwise an opinion of the
5 department that the allocation of groundwater pumping rights in the plan are consistent with
6 groundwater rights law.”].)

7 **3. Recommended by DWR, the TWG Used the Statewide BCM.**

8 Mr. Parker initiated development of a locally calibrated BCM with USGS in 2015; USGS
9 issued its final report in March 2026. The locally calibrated BCM reflects Basin-specific climate,
10 watershed geometry, and recharge processes, providing an independent, physically based estimate
11 of recharge magnitude and variability.

12 Consistent with DWR best practices, the TWG used the statewide BCM as an informing
13 dataset within its broader water balance and modeling framework. The TWG chose to use the
14 statewide BCM rather than the locally calibrated BCM because the latter’s data covered 1980 to
15 2010, and the TWG wanted to bring the analysis through 2023.

16 The statewide BCM, developed by the USGS, is an established, state-of-the-art land
17 surface model specifically recommended by DWR for use in California. A land surface model
18 simulates how precipitation and snowmelt partition into ET, runoff, soil moisture, and deep
19 percolation (recharge), using climate inputs and watershed characteristics to estimate these
20 components over time. The BCM is physically based and was specifically developed to estimate
21 spatially distributed runoff and recharge in semi-arid environments, including mountain-bounded
22 basins in California, like the Basin. The USGS primarily developed the BCM in cooperation with
23 DWR for application in California.

24 **4. Ramboll’s HCF Provides the Most Accurate Basin Geometry.**

25 Ramboll developed a Basin-specific HCF to integrate the best available geologic and
26 hydrogeologic data into a 3-D representation of the Basin’s subsurface. The HCF is not a
27 groundwater flow model, but a framework depicting Basin geometry, hydrostratigraphy, and
28 aquifer materials that control storage, recharge, and pumping behavior. The HCF is based on

1 multiple independent datasets—including AEM survey data, seismic reflection data, lithology well
2 logs, and borehole information—allowing interpretations to be bested and validated rather than
3 inferred from a single source. (Ex. 364.)

4 This integrated analysis demonstrates that the Basin extends significantly deeper than
5 reflected in early conceptualizations and models. In particular, portions of the Basin for a deep
6 structural basin with water-bearing sediments at depths not previously incorporated into modeling
7 efforts. (Ex. 364; Ex. 98 at pp. 98-14–98-17.)

8 Accurate basin geometry is critical in an adjudication because it directly affects estimates
9 of groundwater in storage, aquifer thickness, and system response to pumping and recharge over
10 time. Earlier conceptualizations that underestimated Basin depth necessarily constrained storage
11 estimates and limited the ability of models to reproduce observed Basin behavior.

12 **5. Mr. Parker’s Role as TWG Coordinator**

13 At the District’s request, Mr. Parker served as a coordinator for the TWG. In that role, he
14 organized technical work, facilitated collaboration, and ensured appropriate sequencing, quality
15 assurance, and peer review.

16 The TWG’s work—including the 2024 TWG Storage Paper and 2024 TWG Safe Yield
17 Paper—reflects a collective, peer-reviewed effort based on multiple independent lines of evidence,
18 rather than the opinion of any single consultant. This coordinated, peer-reviewed approach was
19 intended to apply best available science to issues relevant to the Court’s Phase 2 determinations.

20 **(a) *Volume of Groundwater in Storage within the Basin***

21 Mr. Parker supervised Ramboll’s groundwater-in-storage analysis beginning in 2020,
22 which was later incorporated into the 2024 TWG Storage Paper as one of three independent
23 analytical approaches. The TWG determined that Ramboll’s approach was the most rigorous
24 because it relied on the 3-D HCF to define basin geometry and hydrostratigraphy, and integrated
25 multiple independent datasets rather than relying on simplified assumptions. (Ex. 5 at §§ 5.0–5.3;
26 Ex. 106 at §§ 2.2, 2.3, 2.5.)

27 Ramboll’s approach differs fundamentally from earlier estimates used in the GSP and
28 legacy studies, which relied on shallow depth assumptions (typically 100 to 300 feet), simplified

1 **H. Vivek Bedekar, Ph.D., PE**

2 The District will call Vivek Bedekar of SSP&A to testify as an expert for Phase 2. His
3 testimony will address his independent review of both the 2025 Ramboll Model and the 2025 DRI
4 Model, and he will offer rebuttal testimony.

5 **1. Qualifications**

6 Dr. Bedekar is a licensed professional civil and environmental engineer in Washington,
7 D.C. He has more than 25 years of experience in groundwater and surface-water modeling, flow
8 and transport modeling, numerical software development, and the development and application of
9 numerical groundwater models, including MODFLOW, MT3D, and IWFm. Dr. Bedekar is the
10 lead author and developer of MT3D-USGS, a USGS modeling code that expands upon MT3DMS
11 by incorporating enhanced transport capabilities, including transport in lakes and streams, kinetic
12 reaction modules, treatment-system simulation, and unsaturated-zone transport. He has also
13 contributed enhancements to the MODFLOW-USG (groundwater flow model) and IWFm
14 (integrated water flow model) modeling codes and developed the open-source Texture2Par utility
15 for estimating aquifer parameters from sediment texture data and integrating those parameters into
16 MODFLOW and IWFm models. (Ex. 41.)

17 **2. Dr. Bedekar’s Review of the 2025 Ramboll Model**

18 Dr. Bedekar will testify that he reviewed the 2025 Ramboll Model to evaluate whether,
19 notwithstanding inherent modeling limitations, it provides a reliable and scientifically sound basis
20 for estimating safe yield and the volume of groundwater in storage in an adjudication. His review
21 applies accepted groundwater modeling principles and focuses on the model’s overall structure,
22 inputs, calibration behavior, and responsiveness to hydrologic stresses, rather than on whether the
23 model reproduces every localized condition with precision.

24 **(a) *The 2025 Ramboll Model Incorporates the USGS BCM as an***
25 ***Informing Dataset.***

26 Dr. Bedekar will testify that recharge in basins similar to this Basin is commonly evaluated
27 using land-surface modeling—such as the statewide BCM—in combination with groundwater
28 flow modeling—such as the 2025 Ramboll Model. He will explain that the 2025 Ramboll Model

1 incorporates key outputs from the BCM as one line of evidence informing estimates of recharge
2 and boundary inflows. (Ex. 48.)

3 Dr. Bedekar will testify that recharge cannot be directly measured at the basin scale and
4 must therefore be evaluated using physically based methods capable of integrating climate,
5 topography, and watershed characteristics over time. He will explain that the BCM provides a
6 transparent, testable framework for estimating recharge that can be evaluated against observed
7 basin responses rather than relied upon as an unexamined point estimate.

8 Dr. Bedekar will further testify that the use of physically based time-varying recharge
9 inputs—such as those derived from the BCM—allows the model to represent episodic wet-year
10 inflows and corresponding groundwater level responses observed in Basin monitoring data. This is
11 significant because incorporation of wet-year recharge is necessary to reproduce the Basin’s actual
12 hydrologic behavior and to evaluate safe yield over a representative range of conditions.

13 BCM outputs, derived from precipitation, snowpack accumulation, ET, and runoff, were
14 used to inform estimates of mountain-front and mountain-block recharge and were evaluated
15 alongside independent datasets and observed Basin responses. Dr. Bedekar will testify that the
16 BCM was not treated as a standalone or controlling determination of recharge. Rather, its outputs
17 were integrated with other hydrologic inputs and calibration constraints within the 2025 Ramboll
18 Model and assessed for internal consistency and physical plausibility before being relied upon.
19 (Ex. 48.)

20 Here, the use of the BCM as an informing dataset within a broader, basin-scale modeling
21 framework is consistent with accepted adjudication practice, where recharge must be evaluated
22 using multiple independent lines of evidence at a scale relevant to safe yield.

23 Consistent with accepted modeling practice, the BCM was not used to impose a fixed
24 recharge constraint without evaluating its outputs for consistency with Basin-specific data,
25 observed groundwater responses, and other independent analyses to determine the BCM’s
26 reliability. Instead, its outputs served as a physically based line of evidence that was tested against
27 observed groundwater level responses and integrated with other data sources. Model calibration
28 using BCM inflows estimated aquifer properties that are within physically plausible parameters.

1 The use of physically based inflows makes the 2025 Ramboll Model useful in the safe yield
2 context and its potential use for estimating future conditions in the next phases of the adjudication.

3 This multi-line-of-evidence approach ensures that recharge estimates are evaluated based
4 on consistency with basin response rather than assumed a priori limits. Dr. Bedekar will testify
5 that the 2025 Ramboll Model reproduces the observed pattern of intermittent groundwater level
6 increases following wet-year events, demonstrating that model inflows are physically realistic and
7 that the model responds appropriately to hydrologic stresses.

8 **(b) “Flooded Cells” Do Not Undermine the Reliability of the 2025**
9 **Ramboll Model.**

10 The U.S. and IWVGA criticize the 2025 Ramboll Model for the presence of so-called
11 “flooded cells,” referring to model cells in which simulated groundwater levels exceed land-
12 surface elevation. Dr. Bedekar will explain that this condition reflects a numerical artifact
13 (artificial modeling feature) of MODFLOW’s treatment of storage, not a simulation of actual
14 surface flooding.

15 Specifically, when simulated groundwater levels exceed land surface, MODFLOW reports
16 a mathematical head value used to account for storage under confined conditions; it does not
17 represent a physically existing water body above the ground surface. Dr. Bedekar will testify that
18 the water budgets associated with these cells in the 2025 Ramboll Model are small relative to
19 basin-wide inflows and do not materially affect estimates of storage magnitude or safe yield.

20 Importantly, these numerical artifacts do not affect the model’s estimation of basin-wide
21 inflows, and, therefore, do not bear on the determination of safe yield. Dr. Bedekar will testify that
22 focusing on isolated numerical artifacts, rather than on whether the model reproduces basin-scale
23 hydrologic behavior, does not provide a reliable basis for evaluating model suitability for
24 adjudication purposes.

25 Dr. Bedekar therefore did not identify “flooded cells” as a basis to reject or materially
26 discount the 2025 Ramboll Model. While such numerical artifacts may be reduced through
27 alternative initialization choices or future refinements, their presence here does not undermine the
28

1 model's ability to represent basin-scale groundwater behavior or to support the Court's Phase 2
2 determination.

3 In sum, Dr. Bedekar's testimony establishes that the 2025 Ramboll Model, while
4 necessarily simplified and subject to uncertainty as all models are, is methodologically sound and
5 appropriately configured for evaluating basin-scale groundwater behavior. The model incorporates
6 physically based inflows, responds to observed hydrologic variability, and is calibrated in a
7 manner that validates—rather than dictates—its input assumptions.

8 His independent evaluation does not suggest that the model alone determines safe yield.
9 Rather, it confirms that the model provides a reliable, scientifically grounded framework within
10 which expert judgment can be applied to evaluate recharge, storage behavior, and Basin response
11 over time—issues central to the Court's Phase 2 determination. As such, the 2025 Ramboll Model
12 serves as a corroborative analytical tool that supports physically based conclusions regarding the
13 Basin's safe yield, rather than as a standalone calculator of that value.

14 **(c) *Specific Yield in the 2025 Ramboll Model***

15 Dr. Bedekar will testify that the specific yield values applied in the 2025 Ramboll Model—
16 generally ranging from approximately 0.08 to 0.11—are reasonable and consistent with the
17 hydrogeologic conditions of the Basin when evaluated using site-specific data. Outside limited
18 fine-grained playa areas, the Basin is predominantly composed of coarse-grained alluvial
19 sediments, as reflected in lithologic logs, aquifer-test results, and AEM data. For these materials,
20 specific yield values within this range are consistent with published literature and observed aquifer
21 behavior.

22 The calibrated values are not outliers but instead lie near the midpoint of a scientifically
23 plausible range for alluvial aquifers. This reflects accepted hydrogeologic practice, in which basin-
24 scale parameters are calibrated to represent average aquifer behavior rather than extremes. Their
25 reasonableness is corroborated by internal consistency with other aquifer properties, including
26 hydraulic conductivity. Consistent with accepted modeling practice, calibration was used to test
27 whether independently derived inflows produce groundwater level responses consistent with
28 observed conditions—not to adjust storage parameters to force agreement.

1 The U.S. and IWVGA contend that the specific yield values are too narrow or too low. The
2 relevant inquiry, however, is whether specific yield or, for that matter, any other aquifer properties
3 were pushed to extreme values to accommodate incorrect water budgets. The average
4 representation of specific yield and other aquifer properties by the 2025 Ramboll Model indicates
5 a reasonable calibration, increasing the confidence in the safe yield assessment validated using the
6 model. Generalized literature compilations cited by the U.S. and IWVGA aggregate values from
7 different locations, depths, and methods and are not intended to define basin-scale effective
8 storage. Such sources do not override observed aquifer behavior in this Basin.

9 Dr. Bedekar will further testify that unreasonably changing storage parameters to match
10 groundwater levels would mask deficiencies in model inflows rather than correct them. This
11 distinction is critical because safe yield is governed by the balance of inflows and outflows, not by
12 using implausible storage assumptions.

13 The U.S. and IWVGA also argue that specific yield was not directly measured at most
14 locations. However, specific yield is not typically measured at basin scale, and localized tests
15 reflect short-term drainage over limited intervals. Such measurements cannot be reliably
16 extrapolated to characterize effective basin-wide storage and are properly treated as data points
17 rather than controlling values.

18 Instead, accepted practice constrains specific yield using multiple lines of evidence,
19 including lithologic data, AEM-derived texture, aquifer testing, and consistency with groundwater
20 level response. The values used in the 2025 Ramboll Model reflect effective storage behavior at
21 the scale of the Basin.

22 Although groundwater models are sensitive to storage parameters, that sensitivity does not
23 justify selecting values outside physically plausible ranges. Where parameters are independently
24 constrained and consistent with observed system response, sensitivity analyses confirm model
25 reliability. By contrast, adjusting storage parameters beyond plausible ranges may reproduce
26 historical levels but does not reflect realistic aquifer behavior.

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1 **3. Dr. Bedekar’s Review of the 2025 DRI Model**

2 Dr. Bedekar reviewed and evaluated the 2025 DRI Model in response to the U.S.’s and
3 IWVGA’s Phase 2 opinions, including their asserted safe yield figure of 7,650 AFY. He reviewed
4 the model files, assumptions, calibration behavior, and resulting groundwater responses and
5 compared them to observed basin conditions and accepted groundwater modeling principles. This
6 evaluation is directed at the issues before the Court in Phase 2, including whether the model
7 provides a reliable basis for determining safe yield by accurately representing basin-scale inflows,
8 storage behavior, and groundwater response over time.

9 **(a) *The 2025 DRI Model Inflows were Estimated for Dry Conditions,***
10 ***and Wet-Year Inflows are Missing.***

11 Dr. Bedekar will testify that the 2025 DRI Model relies on a 2016 assessment that was
12 based on 1920–1926 dry conditions. Groundwater levels during these dry conditions are expected
13 to be low and are further affected by groundwater pumping during that period. Back-calculating
14 inflows based on low groundwater levels resulted in an estimated 7,650 AFY of inflow. This
15 estimate at best represents dry conditions and does not account for wet-year inflows. It is known
16 that in the Basin intermittent precipitation pulses generate enhanced recharge and streamflow
17 infiltration. The DRI 2-D Model, which forms the basis of 7,650 AFY of inflow in the current
18 2025 DRI Model, was not available for review.

19 Dr. Bedekar will further testify that the estimate of 7,650 AFY of inflow is not based on
20 measured values such as precipitation, streamflow, runoff, or infiltration. The lack of a physical
21 basis in the 2025 DRI Model makes the inflow estimate, and hence any safe yield estimates drawn
22 from the model, questionable. No attempts were made by the IWVGA to incorporate recent data,
23 measurements, independent assessments of inflows such as the USGS’s BCM, or other evidence to
24 assess wet-year inflows in the model revisions in 2020 or 2025 by IWVGA. There have been two
25 large precipitation events in 2017 and 2023 and, yet, the current 2025 DRI Model inflow estimate
26 has not changed. Contrary to the data, wet-year inflow measurements in the latest modeling effort
27 were scaled to the older estimate of 7,650 AFY.

1 The underestimation of inflows in the 2025 DRI Model is reflected in the model
2 performance and calibrated aquifer storage properties of the model.

3 **(b) *Observed Basin Behavior is Not Reproduced in the 2025 DRI***
4 ***Model.***

5 Dr. Bedekar will testify that a fundamental limitation of the 2025 DRI Model is its failure
6 to reproduce observed increases in groundwater levels following wet-year recharge events.
7 Monitoring data from multiple wells show intermittent, and sometimes delayed, groundwater level
8 rises following major precipitation and snowpack years. In Dr. Bedekar’s opinion, a basin-scale
9 model intended to evaluate recharge, storage, and safe yield must be capable of reproducing this
10 basic hydrologic response. (Ex. 50.) This observed pattern of groundwater level recovery
11 following wet-year events provides a direct measure of Basin response to recharge and represents
12 a fundamental behavior that any basin-scale model must capture in order to reliably evaluate safe
13 yield.

14 Dr. Bedekar demonstrated that, unlike the 2025 Ramboll Model, the 2025 DRI Model is
15 largely unresponsive to such wet-year inflows. Groundwater levels in the 2025 DRI Model
16 continue to decline monotonically, even during periods when observed data show measurable
17 recovery. He concluded that this lack of responsiveness indicates that intermittent recharge—
18 particularly mountain-front and mountain-block recharge—is inadequately represented in the 2025
19 DRI Model. This apparent lack of sensitivity to precipitation is highly implausible for a basin that
20 is recognized as being highly dominated by mountain-front recharge processes. (Ex. 50 at pp. 50-
21 9–50-10.) Dr. Bedekar will further testify that this lack of responsiveness contrasts sharply with
22 the 2025 Ramboll Model, which reproduces intermittent groundwater level increases
23 corresponding to major precipitation events, demonstrating that physically based, time-varying
24 inflows are necessary to represent actual Basin behavior. This failure to reproduce observed
25 groundwater response demonstrates that the 2025 DRI Model does not reliably represent basin-
26 scale recharge processes and therefore cannot serve as a reliable basis for evaluating safe yield.

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(c) *Storage Parameters Mask Recharge Deficiencies.*

Dr. Bedekar will further testify that the 2025 DRI Model relies on aquifer storage parameters—particularly specific storage values—that are inconsistent with scientific literature and site-specific data from the Basin. Elevated specific storage values are applied broadly, including in areas characterized by coarse-grained alluvial sediments where such storage behavior is not physically plausible. In particular, the use of elevated storage parameters in coarse-grained zones is inconsistent with hydrogeologic literature and observed aquifer behavior and results in model dynamics that do not reflect actual basin conditions. (Ex. 50 at pp. 50-10–50-12.)

The elevated specific storage values in the 2025 DRI Model are a result of model calibration that relies on low estimates of inflows. This parameterization reflects a calibration approach in which recharge is effectively held fixed while storage parameters are adjusted to match groundwater levels. As a result, storage properties function as compensating variables for insufficient inflow rather than independent representations of aquifer behavior.

Sensitivity analyses performed by Dr. Bedekar demonstrate that these storage parameters compensate for insufficient recharge. When storage values are constrained to more physically reasonable ranges, the 2025 DRI Model can no longer reproduce historical groundwater levels without materially increasing recharge. This result indicates that the model’s calibration depends on exaggerated storage properties rather than a physically realistic depiction of basin inflows. Dr. Bedekar will further explain that this pattern is diagnostic of model misspecification: where recharge is underestimated, models commonly compensate by inflating storage properties, thereby allowing simulated groundwater levels to match observations without accurately representing basin inflows. (Ex. 50.)

This compensatory use of storage parameters demonstrates that the model’s calibration reflects adjustment of internal parameters rather than an accurate representation of basin inflows, undermining its reliability for safe yield determination.

1 compensate for insufficient inflows. When those assumptions are constrained within physically
2 reasonable bounds, the model is unable to reproduce observed groundwater conditions without
3 increasing recharge. Because safe yield depends on the long-term balance between basin inflows
4 and outflows, a model that understates recharge or fails to reproduce the Basin's response to
5 recharge cannot provide a reliable basis for determining safe yield.

6 Dr. Bedekar will further explain that experienced groundwater modelers understand that
7 numerical model outcomes are inherently sensitive to underlying assumptions and that changes to
8 recharge, storage, or boundary inputs can materially alter results. For that reason, modeling
9 practice focuses not on whether a model can be adjusted to produce a particular number, but on
10 whether the assumptions underlying that number are physically reasonable, internally consistent,
11 and consistent with observed basin behavior.

12 In Dr. Bedekar's opinion, the 2025 DRI Model does not meet the standard required
13 because it fails to represent recharge-driven variability and relies on storage parameters that mask
14 deficiencies in inflow. As a result, the model reflects its underlying assumptions rather than the
15 Basin's actual hydrologic behavior. By contrast, the 2025 Ramboll Model incorporates physically
16 based inflows, reproduces observed groundwater responses, and provides a scientifically grounded
17 framework for evaluating safe yield at the basin scale.

18 **I. Matthew J. Tonkin, Ph.D.**

19 The District will call Matthew J. Tonkin of SSP&A to testify as an expert witness for
20 Phase 2. His testimony will address the TWG's use of the BCM developed by the USGS; the 2025
21 Ramboll Model; the role of groundwater models as corroborating tools; areas of material
22 difference between his estimate of safe yield and those of the U.S. and IWVGA; and his review
23 and critique of the analyses and opinions of Dr. Kincaid and Dr. McKenna. Dr. Tonkin will opine
24 that the **Basin's safe yield is approximately 14,375 AFY.**

25 **1. Qualifications**

26 Dr. Tonkin is the President and a Principal Hydrogeologist at SSP&A, where he manages
27 and advises on projects involving data synthesis and modeling for groundwater, surface water,
28 soil, and contamination studies. He has more than 30 years of professional experience developing,

1 evaluating, and applying groundwater-flow and contaminant-transport models, with particular
2 emphasis on model calibration and uncertainty analysis. Dr. Tonkin has qualified and testified as
3 an expert witness in both state and federal courts. Together with the USGS and EPA, Dr. Tonkin
4 contributed to the development of the groundwater transport simulator MT3D-USGS. He has also
5 authored or co-authored USGS techniques and methods and open-file reports addressing
6 predictive analysis and data-worth evaluation using the groundwater simulator MODFLOW,
7 including MOD-PREDICT (which calculates predictions and their associated sensitivities) and
8 OPR-PRR (which identifies directly how new data improve the accuracy of model predictions).
9 (Ex. 401.)

10 **2. Dr. Tonkin’s Safe Yield Estimate Using Land Surface Modeling and**
11 **Science-Based Methods and Assumptions**

12 Dr. Tonkin used state-of-the-art methods to estimate the Basin’s safe yield under existing
13 physical conditions. First, he combined land surface process modeling conducted using the
14 USGS’s BCM with other science-based calculations and analyses of historical hydrologic data to
15 estimate recharge rates to the Basin on an annual average basis over a multi-decadal period (1980
16 to 2023). He then used the 2025 Ramboll Model, with recharge inputs derived following the
17 process above, to corroborate his estimates of Basin recharge and from there obtain his safe yield
18 estimate. He then compared his estimated safe yield with values obtained by members of the TWG
19 using different methods.

20 Based on this analysis, Dr. Tonkin estimated the total safe yield of the Basin to be
21 approximately 14,375 AFY when ET losses from the regional aquifer are excluded. He also
22 calculated a more conservative estimate of approximately 12,329 AFY that includes ET as a
23 discharge from the regional groundwater system. Both estimates were derived using the same
24 modeling framework and recharge inputs and differ only in their treatment of ET.

25 Dr. Tonkin will explain that he presented these two values to bracket uncertainty regarding
26 the sources of the water that is lost to ET in the Basin. While ET is known to occur in the Basin,
27 the extent to which ET draws from the regional aquifer—as opposed to shallow or hydraulically
28 restricted zones, or local precipitation—remains uncertain. Accordingly, the ET-exclusive estimate

1 reflects an upper-bound calculation, while the ET-inclusive estimate reflects a conservative lower-
2 bound calculation that assumes all ET calculated using the 2025 Ramboll Model represents a
3 demand on the regional groundwater system.

4 Importantly, even the ET-inclusive estimate reflects basin-scale recharge and discharge
5 averaged over a representative range of hydrologic conditions and is materially higher than the
6 safe yield estimates derived from drier calibration periods. Dr. Tonkin will also testify that his safe
7 yield estimates are consistent with independent evaluations performed by the TWG using
8 empirical “change-in-storage” methods and provide a science-based and physically grounded basis
9 for the Court’s Phase 2 determination.

10 **3. Groundwater Models as Corroborating Tools**

11 While Dr. Bedekar’s testimony will address whether the 2025 Ramboll Model satisfies
12 threshold requirements of scientific reliability for adjudicatory use, Dr. Tonkin’s testimony will
13 address a distinct but complementary issue: how a reliable groundwater model should properly be
14 used in determining safe yield. Taken together, their testimony reflects accepted practice in
15 comprehensive groundwater adjudications, where numerical groundwater models inform—and
16 corroborate—but do not replace professional hydrogeologic judgment.

17 Dr. Tonkin will testify that groundwater models are not typically dispositive calculators of
18 safe yield. Rather, groundwater models are best used as corroborative tools in adjudications and
19 safe yield calculations should be evaluated for consistency with observed basin behavior, long-
20 term recharge variability, and changes in groundwater storage over time. In his opinion, models
21 assist experts and courts in evaluating whether assumptions and calculations regarding recharge,
22 interbasin flow, storage changes, and pumping are consistent with observed basin behavior, but
23 they do not supplant other lines of evidence and professional judgment regarding what constitutes
24 a safe yield. Consistent with that understanding, even Dr. McKenna acknowledges that numerical
25 models can be calibrated to conform to the modeler’s assumptions, so that the resulting model
26 outputs reflect those assumptions rather than independently validating them. (See McKenna
27 Depo., 47:5–13, 97:25–98:4, 145:17–25.) In light of this “non-uniqueness,” Dr. Tonkin will testify
28 that in scientific studies of safe yield, greater credence should be given to estimates of recharge

1 and other quantities that are made using transparent methods possessed of clear provenance, and
2 he will contrast the provenance of his calculations with the calculations relied upon by the U.S.
3 and IWVGA.

4 Dr. Tonkin will also explain that experienced groundwater modelers recognize that model
5 outcomes are inherently sensitive to underlying assumptions. Changes in assumptions regarding
6 recharge, storage properties, boundary conditions, or other key inputs can materially alter model
7 outputs, including estimates of safe yield. For that reason, adjudication practice does not evaluate
8 models based on whether they can be adjusted to produce a particular numerical result, but on
9 whether the assumptions underlying that result are reasonable, internally consistent, and consistent
10 with observed basin responses.

11 Dr. Tonkin will further testify that criticisms focusing on numerical artifacts—such as dry
12 or flooded model cells—reflect a misunderstanding of the role of basin-scale models. As he will
13 explain, such artifacts do not invalidate a model’s overall representation of basin behavior or its
14 usefulness for evaluating basin-scale responses.

15 Consistent with this practice, Dr. Tonkin evaluates model results for their coherence with
16 observed groundwater trends and basin-wide water-balance constraints, rather than for
17 mathematical perfection or the ability to generate a preferred outcome.

18 **4. Areas of Material Difference between the District’s Estimates and the** 19 **U.S.’s and IWVGA’s Estimates**

20 The material differences between the parties’ safe yield opinions arise from two distinct
21 components of recharge that, together, account for more than 6,000 AFY—an amount that explains
22 the vast majority of divergence in safe yield estimates between the District and both the U.S. and
23 IWVGA. These two differences are summarized in the table that follows.

24 The first difference concerns mountain front recharge. Dr. Tonkin will testify that the
25 District’s estimate of average annual mountain front recharge is approximately 9,200 AFY, while
26 the U.S. and IWVGA both estimate approximately 5,731 AFY—nearly 3,500 AFY less.
27 Dr. Tonkin will testify that this difference reflects fundamentally different methodological choices
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1 regarding (a) the use of physically based land surface modeling, (b) the treatment of episodic wet-
 2 year recharge, and (c) the comparison of calculation outputs against observed system responses.

3 The second difference concerns incidental recharge. The District estimates approximately
 4 2,600 AFY of incidental recharge from irrigation return flows, conveyance losses, and water
 5 distribution system leakage. By contrast, the U.S. and IWVGA assume that no incidental recharge
 6 ever occurs. Dr. Tonkin will testify that the exclusion of incidental recharge is not a conservative
 7 assumption but a categorical omission that results in an incomplete water balance.

8 These two fundamental differences in methods and assumptions—reduced mountain front
 9 recharge and elimination of incidental recharge—together remove more than 6,000 AFY from the
 10 U.S.’s and IWVGA’s Basin inflow estimates. As Dr. Tonkin will explain, the methods and
 11 assumptions that the U.S. and IWVGA relied upon to materially suppress the safe yield value are
 12 unreliable, lack any provenance, and are therefore not credible.

| Expert | Party | Affirmative Opinion of Safe Yield | Recharge Components and Total | | | | Evapo- transpiration (ET) |
|------------------|-------|---|---------------------------------------|--------------------------|------------------------|-------------------------------------|---------------------------------|
| | | | Mountin Front Recharge (MFR) | Rose Valley Underflow | Incidental Recharge | Total Recharge | |
| Teasdale | MBD | 15,400 | n/a | n/a | n/a | n/a | 4,500–4,600 |
| Yeh and Wicks | SVM | | n/a | n/a | n/a | n/a | |
| Parker | IWVWD | 14,300 | n/a | n/a | n/a | n/a | n/a |
| Tonkin | IWVWD | 12,300–14,400 | 9,200 | 2,600 | 2,600 | 14,400 | 2,300--1,600 |
| Kincaid | IWVGA | 6,100–8,400 | 5,731 | 1,919 | 0 | 7,200–9,900 | n/a |
| McKenna | USA | 7,650 | 5,731 | 1,919 | 0 | 4,300–6,355 7,462–8,745 7,650 | 4,000 |

24 (Ex. 125 at p. 125-32, table 2-1.)

25 **5. The Technical and Regulatory Foundation for the District’s Recharge**
 26 **and Safe Yield Estimates**

27 The District’s recharge and safe yield estimates were developed to address the Court’s
 28 Phase 2 task: determining the Basin’s safe yield. Because the Basin functions as an essentially

1 terminal basin with minimal outflow relative to other water budget components, long-term average
2 recharge provides an upper constraint on safe yield. Accordingly, the reliable estimation of
3 recharge—rather than reliance on short-term or steady-state assumptions—is a significant issue for
4 Phase 2.

5 **(a) *Rates and Locations of Recharge were Quantified Using***
6 ***Integrated Land Surface Modeling and Corroborated via***
7 ***Groundwater Modeling.***

8 The District quantified mountain front recharge using a physically consistent, two-step
9 framework that integrates land-surface process modeling and basin-scale groundwater modeling.
10 Natural recharge resulting from mountain front processes was estimated using the BCM, and those
11 estimates were then evaluated and applied through the 2025 Ramboll Model to assess Basin
12 response under representative historical hydrologic conditions.

13 There is no dispute that recharge to the Basin is dominated by mountain front recharge
14 processes, which are associated with episodic runoff and underflow from the surrounding Sierra
15 Nevada and other basin-margin ranges. These processes are inherently climate-driven and non-
16 steady, occurring disproportionately during wetter years and major precipitation events rather than
17 as uniform annual quantities. The BCM was designed specifically to represent these processes in
18 semi-arid, mountain-bounded California basins by translating long-term climate data into spatially
19 and temporally distributed estimates of runoff, ET, and recharge.

20 Dr. Tonkin will testify that he independently reviewed and applied the BCM using PRISM
21 climate data as input to evaluate whether the outputs from the BCM reflect observed Basin
22 conditions. This step matters because recharge in this Basin occurs primarily along the
23 surrounding mountain fronts, where precipitation varies substantially with elevation and terrain.

24 PRISM climate data are relied upon nationwide as a method of combining data from
25 weather stations with topographic information—such as elevation and landscape features—to
26 estimate how much precipitation falls in different locations. This allows precipitation in higher-
27 elevation mountain areas, where most recharge to many California basins originates, to be
28 distinguished from conditions on the valley floor. Without accounting for these climate and terrain

1 data, recharge would be misunderstood and understated in mountain-bounded basins like the
2 Basin.

3 Dr. Tonkin will explain that the BCM was not used to substitute for basin-specific
4 hydrogeologic evidence. Rather, outputs from the BCM were corroborated via their use as inputs
5 to the 2025 Ramboll Model, providing an additional line of evidence to test whether assumed
6 recharge rates produce groundwater behavior consistent with the historical record. Specifically,
7 using the PRISM-based inputs, Dr. Tonkin confirmed that the BCM reproduces known patterns of
8 precipitation variability and measurement records of episodic runoff at the Basin margins. He also
9 verified that variations in recharge rates derived from the BCM correspond with observed
10 groundwater level responses following wet periods—responses that are also reproduced when the
11 BCM recharge estimates are incorporated into the 2025 Ramboll Model.

12 The U.S. and IWVGA criticize the BCM on the grounds that it does not generate formal
13 uncertainty bounds and that BCM-based estimates differ from values used in prior studies. Dr.
14 Tonkin will testify that uncertainty is inherent in all recharge estimation methods and is
15 appropriately evaluated by comparing modeled results to observed basin-scale behavior, and also
16 by assessing the provenance and credibility of the methods used, rather than by relying on simple
17 regression equations and confidence intervals that lump many sources of variation and obscure
18 physical behavior.

19 The combined use of the BCM and the 2025 Ramboll Model provides a physically
20 constrained framework in which climate-driven inflows are translated into groundwater system
21 response. The BCM provides a physically based and scientifically grounded method for
22 calculating recharge, while the 2025 Ramboll Model evaluates how the Basin stores and transmits
23 that recharge over time in the presence of pumping and natural discharge mechanisms. This
24 combined framework is consistent with state-of-the-practice groundwater analysis and with
25 guidance from DWR.

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1 budgets, which can systematically underestimate recharge and safe yield by omitting material
2 components such as incidental recharge or failing to represent recharge variability.

3 The convergence of groundwater modeling results with independent storage-based and
4 empirical analyses confirms that the District’s safe yield estimate reflects the Basin’s actual
5 physical capacity, rather than the assumptions or limitations of any single method. This
6 convergence provides a robust, technically defensible basis for the Court’s safe yield
7 determination.

8 **6. Lack of and Improper Technical Foundation for the Recharge and Safe**
9 **Yield Estimates of the U.S. and IWVGA**

10 The recharge and safe yield estimates offered by the U.S. and IWVGA do not result from a
11 physically grounded analysis of the Basin. Instead, as Dr. Tonkin will explain, their opinions are
12 based on a sequence of flawed methodological choices that collectively result in recharge
13 estimates that are systematically lower than warranted by the available Basin-specific evidence
14 and therefore result in correspondingly reduced safe yield values. Furthermore, Dr. Tonkin will
15 testify that despite these errors—some of which were identified by the U.S.’s own expert—and
16 multiple revisions to the DRI groundwater model, IWVGA’s recharge and “sustainable yield”
17 estimates have remained constant at 7,650 AFY since 2016 and were also adopted by the U.S.
18 without any revision.

19 As Dr. Tonkin will explain, the persistence of the 7,650 AFY yield value across materially
20 different model configurations indicates that it functions as a “preferred value” or retained
21 constraint rather than a result derived from basin-specific analysis. Dr. Tonkin will demonstrate
22 that this “preferred value” is applied by the IWVGA regardless of the historical period under
23 consideration and of the prevailing climate conditions over that period. This stands in stark
24 contrast to the approach used by the District.

1 (a) *The U.S. and IWVGA Rely on Inapplicable Methods and*
2 *Assumptions that Underestimate Recharge to, and the Safe Yield*
3 *of, the Basin.*

4 The U.S. and IWVGA rely primarily on recharge estimates derived from a combination of
5 empirical regression methods—including Anderson et al. (1992) and Epstein et al. (2010)—and
6 semi-empirical two-dimensional (2-D) modeling (i.e., the DRI 2-D Model), all of which was
7 originally performed and documented by McGraw et al. (2016).

8 As Dr. Tonkin will testify, the empirical methods were developed as regional screening
9 tools to provide initial order-of-magnitude estimates across many arid basins and should not be
10 used to obtain “best estimates” of basin-specific recharge rates for use in establishing safe yield in
11 an adjudication. Consistent with their regional, basin-agnostic design, these methods rely upon
12 information drawn from numerous basins with differing climate, physiography, and hydrologic
13 conditions. Both Anderson et al. (1992) and Epstein et al. (2010) use empirical regression methods
14 to obtain estimates of the range of recharge rates previously obtained by others using different
15 methods. Importantly, Epstein et al. (2010) explain that to develop their regressions they
16 purposefully excluded other empirical results from their analyses—relying instead on water
17 balance and modeling studies—so that their empirical results are best considered to be “meta-
18 summaries” of previous work by others for other basins. Thus, as Dr. Tonkin will testify, the
19 methods of Anderson et al. (1992) and Epstein et al. (2010) BBRM are helpful for preliminary or
20 reconnaissance-level studies, but do not provide reliable estimates for specific basins.

21 As Dr. Tonkin will explain, when the Anderson regression method is applied to this Basin,
22 the resulting uncertainty spans approximately 1,800 to 25,000 AFY, underscoring that such
23 methods do not meaningfully constrain recharge values at any *specific* basin. Rather than treating
24 this range as contextual information, the U.S. and IWVGA relied upon the single low value (7,650
25 AFY) selected by McGraw et al. (2016) and treat it as a hard limit on recharge and safe yield.
26 (Ex. 125 at p. 125-11.)

27 Similarly, the Bootstrap Brute-force Recharge Method (“BBRM”) described by Epstein et
28 al. (2010) is not reliable for developing best-estimates for specific basins. The BBRM was

1 developed primarily for basins in Nevada and, as a result, its empirical relationships are valid only
2 within the domain of its calibration and are not transferrable to other hydrologic settings outside
3 Nevada. The BBRM has not been used to estimate recharge in any other California basin, and
4 DWR’s Best Management Practices and Handbook for Water Budget Development do not list the
5 BBRM as one of the recommended tools for estimating recharge—unlike the BCM, which DWR
6 lists. (Ex. 2 at p. 2-44.)

7 **(b) *Through Reliance on DRI’s Calculations, the U.S. and IWVGA***
8 ***Embed and Amplify McGraw’s Misapplication of Both Anderson***
9 ***and Epstein.***

10 The safe yield estimates opined by the U.S. and IWVGA trace their recharge assumptions
11 to McGraw et al. (2016), which in turn relied on calculations using Anderson et al. (1992) and
12 Epstein et al. (2010) regression-based recharge methods. However, the theoretical shortcomings of
13 the regression-based methods were further compounded by errors in the calculations presented by
14 McGraw, together with a lack of reproducibility—critically undermining credibility—of the final
15 stage of calculations which further reduced the recharge estimates (erroneously) obtained using the
16 methods of Anderson and Epstein.

17 First, the recharge estimate obtained by McGraw et al. (2016) using the method of
18 Anderson et al. (1992) was incorrectly computed and reported, an error that was identified and
19 corrected by Dr. McKenna in his expert report. This correction results in an increase in the value
20 for recharge so obtained from approximately 4,100 AFY to approximately 7,500 AFY. (Ex. 60 at
21 p. 60-23.) This corrected value is much closer to the value for mountain front recharge obtained
22 using the BCM as determined by the District experts.

23 Second, the recharge value obtained by McGraw et al. (2016) in their initial application of
24 the Epstein et al. (2010) BBRM method was subject to two errors. The first error was identified
25 and corrected by Dr. McKenna in his expert report. This correction results in a change in the value
26 for recharge so obtained from approximately 9,300 AFY to approximately 8,800 AFY. (Ex. 60 at
27 p. 60-24.) The second and more material error—one of misunderstanding in the application of the
28 Epstein BBRM method—was not identified by experts for the U.S. or IWVGA. Epstein’s BBRM

1 framework uses regression to derive coefficients (multipliers) that, when applied to precipitation
2 rates, provide an estimate for the total recharge to a basin. To derive the necessary coefficients,
3 Epstein’s BBRM method explicitly incorporates all precipitation ranges—including low-
4 precipitation ranges—and assigns to each range a non-zero recharge value based on all coefficients
5 obtained across the full precipitation distribution; it does not impose a lower precipitation cutoff or
6 assign zero recharge to low-precipitation zones.

7 McGraw reports two recharge estimates using the Epstein BBRM method—one of which
8 correctly includes all precipitation ranges to the calculation, and the second of which removes the
9 lowest precipitation range from the calculation. In doing so, he does not correctly apply Epstein’s
10 method—he erroneously alters it. This alteration is mathematically flawed because each regression
11 coefficient is dependent upon the values of the other coefficients; they cannot be used
12 independently to estimate the total recharge. Furthermore, because regions of relatively low
13 precipitation occupy a disproportionately high area of the basin, excluding this region from the
14 calculations materially suppresses the estimated recharge. The magnitude of that suppression is
15 substantial. When the Epstein BBRM method is applied consistent with its design—including the
16 full precipitation distribution—the recharge value spans a broad range with a “best estimate” equal
17 to 15,266 AFY, rather than the value of 9,265 AFY reported by McGraw, or the value of 8,745
18 AFY reported by Dr. McKenna. This corrected value of 15,266 AFY is closer to but even larger
19 than the value for mountain front recharge obtained using the BCM as determined by District
20 experts.

21 This error in the application of Epstein’s BBRM method is then compounded and
22 amplified in the final calculation step completed by McGraw to obtain his recharge value upon
23 which the U.S. and IWVGA rely. In that final step, McGraw further reduces the already truncated
24 BBRM-based recharge estimate by applying yet another regression procedure using a wholly
25 different—and apparently unavailable—DRI 2-D Model.

1 First, the historical record shows that the Basin was already experiencing measurable
2 groundwater extraction from 1920 to 1926, with pumping on the order of greater than 1,000 AFY.
3 As a result, the 1920 to 1926 period does not represent pre-development conditions during which
4 natural recharge equaled natural discharge, and groundwater levels and recharge-discharge
5 relationships were unaltered by pumping.

6 Second, Dr. Tonkin will explain that the 1920 to 1926 period coincides with a historically
7 dry interval, as reflected in precipitation records later incorporated into basin-scale modeling
8 analyses. Deriving recharge using a model calibrated to a dry period embeds drought-biased
9 conditions into the model, causing recharge to be understated when extrapolated to longer-term or
10 representative basin conditions. (Ex. 24 at p. 24-67, fig. 5-2.)

11 The compounded effect of calibrating the missing DRI 2-D Model to data from a period
12 during which pumping occurred and which was also drier than average, the resulting recharge
13 value so obtained is biased low. In Dr. Tonkin's opinion, the methods, assumptions, and data
14 period relied upon to derive recharge using the missing DRI 2-D Model necessarily
15 underestimates recharge and leads therefore to an underestimate of safe yield, irrespective of
16 subsequent 3-D modeling efforts.

17 (e) ***Historical ET Estimates Used to Cap Recharge Rely on Limited***
18 ***and Uncertain Data.***

19 Dr. Tonkin will testify that the U.S. and IWVGA constrain recharge—and therefore safe
20 yield—by assuming a value for pre-development ET that is highly uncertain and derived from
21 limited historical information.

22 As Dr. Tonkin will explain, ET rates cannot be directly measured and are very difficult to
23 estimate even under present conditions using modern technology. Estimating basin-wide ET rates
24 from more than a century ago is even more challenging and prone to uncertainty due to the lack of
25 reliable, contemporaneous data regarding vegetation types and extent, groundwater elevations, and
26 the documented presence of springs and other discharge mechanisms. Dr. Tonkin will describe
27 how it is much more likely that natural rates of discharge exceeded the pre-development ET value
28 assumed by the U.S. and IWVGA. This result is consistent with the long-recognized

1 understanding that historical groundwater development reduced natural discharge by capturing
2 water that previously exited the Basin through ET, springs, and related processes. In Dr. Tonkin’s
3 opinion, treating a highly uncertain estimate of ET for a single historical period over one century
4 ago as a binding quantitative constraint on basin-wide long-term recharge entirely neglects the
5 important role of wet periods on recharge and artificially constrains the calculated safe yield
6 without adequate technical support. (Ex. 125 at pp. 125-11, 125-15–125-16.)

7 This line of inquiry by McGraw and thereafter the U.S. and IWVGA thus proceeds
8 backward: rather than asking how the Basin responds to recharge and to pumping, they assume an
9 inflow limit and derive their safe yield from that assumption. Under this approach, recharge is
10 effectively capped at a presumed historical ET value—which per chance coincides with other
11 artificially suppressed empirical recharge estimates—regardless of hydrologic variability or
12 observed Basin behavior. Treating this assumed inflow ceiling as an upper bound on safe yield
13 neglects the Basin’s response to historical wet, dry, and average conditions and, in particular,
14 whether wet periods support a greater safe yield value.

15 By contrast, state-of-the-practice recharge estimation methods—such as the BCM—use
16 local climate records, watershed geometry, soil and rock properties, and time-varying hydrologic
17 processes to estimate recharge in a manner that is physically based, basin specific, and can be
18 evaluated against observed Basin behavior. In Dr. Tonkin’s opinion, state-of-the-practice recharge
19 and safe yield analysis requires Basin-specific, physically based analyses of inflows and outflows
20 over time. Dr. Tonkin will show that when empirical regression-based “meta” methods, such as
21 that of Anderson et al. (1992) and Epstein et al. (2010), are used appropriately—as contextual
22 references rather than dispositive basin-specific limits—they confirm that physically based
23 recharge estimates for the Basin using the BCM fall neatly within expected ranges. But, by
24 substituting regional regression-based screening tools for rigorous Basin-specific analysis,
25 misapplying those same regression methods to obtain recharge estimates, and compounding those
26 faulty analyses through modeling steps that are not available for review or testing, the U.S. and
27 IWVGA arrive at recharge and safe yield values that are not supported by the weight of the
28 technical evidence that will be before the Court.

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(f) *Lack of Corroboration via 3-D Groundwater Model*

Dr. Tonkin will testify that for several reasons the recharge estimate derived from the Epstein BBRM, as adjusted downward using the missing steady-state DRI 2-D Model, is in no way supported or reinforced by the U.S.'s or IWVGA's transfer of that estimate into a separate 3-D groundwater flow model.

First, the 3-D model was constructed with materially different basin geometry and aquifer thickness and aquifer properties than the missing 2-D model. In the transition from 2-D to 3-D modeling, recharge was held fixed while hydraulic conductivity and, later, storativity were recalibrated, thereby altering the water-bearing and transmitting properties of the Basin that govern the relationship between inputs and outputs. Because the original 2-D model used transmissivity values derived through one process of calibration, whereas the 3-D model used materially different transmissivity values while holding recharge constant, the relationship between recharge and transmissivity that underpins the 7,650 AFY value reported by McGraw and relied upon by the U.S. and IWVGA is severed.

Second, the recharge value does not reflect a result obtained from a coherent modeling framework; instead, it is an artifact of enforcing assumptions across fundamentally different model structures. That the U.S. and IWVGA still deem their 3-D model to be well calibrated is not a support for their recharge value: as Dr. McKenna acknowledges, numerical models can be calibrated to conform to the modeler's assumptions, so that the resulting model outputs reflect those assumptions rather than independently validating them. (McKenna Depo., 47:5–13, 97:25–98:4, 145:17–25.) However, under accepted groundwater modeling practice, severing the source of recharge from its original determination means that the 3-D model does not corroborate the recharge value—it has no provenance.

Because safe yield depends on the accuracy of basin-wide inflow estimates, this inconsistency directly affects the reliability of any safe yield figure derived from those recharge values. For that reason, the recharge estimates—and the safe yield opinions based upon them—do not provide a reliable foundation for the Court's Phase 2 determinations.

1 (g) *The U.S.'s and IWVGA's Water Budgets are Incomplete because*
2 *they Exclude Incidental Recharge.*

3 Dr. Tonkin will testify that the water budgets relied upon by the U.S. and IWVGA are
4 incomplete because they exclude widely recognized and quantitatively material sources of
5 incidental recharge, including irrigation return flows, conveyance losses, and system leakage.
6 (Ex. 125 at pp. 125-10, 125-13–125-15.) This exclusion is not the result of competing professional
7 judgments about magnitude; it is an *a priori* decision inconsistent with *San Fernando* and its
8 progeny, and leading to a methodological omission that necessarily understates total basin
9 recharge and, in turn, understates basin safe yield.

10 California groundwater practice, statutory definitions (Wat. Code, §§ 10721, 37900), DWR
11 guidance, and the technical literature—including McGraw et al. (2016), on which the U.S. and
12 IWVGA rely—recognize that recharge includes both natural and incidental components.
13 Incidental recharge is routinely included in basin-scale water budgets and adjudications when it
14 represents a material contribution to inflow. The hydrogeologic analyses relied upon by the
15 District and incorporated into the 2025 Ramboll Model reflect that settled practice.

16 Consistent with that practice, the District methodically researched and explicitly evaluated
17 incidental recharge as part of the Basin water budget using multiple lines of evidence. Those
18 analyses examined irrigation return flows, conveyance losses, and system leakage, drawing on
19 Basin-specific land use information, water delivery data, efficiency assumptions grounded in
20 hydrogeologic literature, and DWR guidance identifying incidental recharge as a standard water
21 budget component. The resulting estimate—on the order of approximately 2,600 AFY—was
22 incorporated into the District's basin-scale analyses and simulated in the 2025 Ramboll Model,
23 where it contributes materially to total Basin inflows reflected in long-term storage behavior and
24 groundwater level response.

25 By contrast, the U.S. and IWVGA experts categorically exclude incidental recharge from
26 their water budgets, not because it was evaluated and found immaterial, but because it was
27 assumed to be too unpredictable, delayed, or uncertain to consider. As Dr. Tonkin will explain, that
28 rationale is inconsistent with accepted hydrogeologic practice. Natural mountain front recharge—

1 the primary recharge mechanism that the U.S. and IWVGA fully endorse—is itself episodic,
2 highly variable, and subject to temporal lag. However, while variability and time lag affect the
3 ease of detection of recharge pulses, they do not dictate whether recharge occurs and therefore do
4 not provide a scientific basis for excluding incidental recharge from a long-term basin water
5 budget.

6 In sum, by discarding known and material sources of recharge that are recognized in
7 California adjudication practice and incorporated into scientifically sound basin-scale models, the
8 U.S.’s and IWVGA’s water budgets do not accurately represent actual Basin conditions and
9 therefore cannot provide a reliable foundation for the Court’s Phase 2 findings.

10 Accordingly, Dr. Tonkin will testify that the recharge and safe yield estimates offered by
11 the U.S. and IWVGA rest on methods that cannot be independently tested or reliably evaluated
12 and that systematically tend to understate basin inflows. His opinions do not turn on disagreements
13 over policy or advocacy choices, but on whether the methods employed provide a transparent,
14 testable, and scientifically sound basis for the Court’s Phase 2 determinations.

15 7. Volume of Groundwater in Storage

16 Building on the analyses presented in the 2024 TWG Storage Paper, the TWG conducted
17 additional work that yielded consistent estimates of groundwater in storage. Using the 2025
18 Ramboll Model, Dr. Tonkin estimated the total volume of groundwater stored within the Basin to
19 be approximately **51 MAF**. (Ex. 123 at p. 123-10.) He derived this estimate for the entire Basin,
20 excluding confined storage and HGZ4, which consists of deep geologic deposits containing water
21 of uncertain quality that may not readily yield stored groundwater. (Ex. 123 at pp. 123-40, 123-
22 41.)

23 Dr. Tonkin calculated groundwater in storage using the 2025 Ramboll Model based on
24 three primary inputs: (i) a three-dimensional numerical grid defining the Basin’s geographic extent
25 and aquifer depth; (ii) model-simulated groundwater elevations; and (iii) parameters representing
26 the storage properties of the Basin aquifers. For each three-dimensional model cell, the simulated
27 groundwater elevation was used to determine the saturated thickness of the water-bearing zone.

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1 The saturated thickness was calculated as follows:

- 2 • Where the simulated groundwater level lay within the cell (an unconfined condition),
3 the saturated thickness was calculated as the difference between the groundwater
4 level and the base of the cell;
- 5 • Where the groundwater level exceeded the top of the cell (a confined condition), the
6 full cell thickness was used as the saturated thickness; and
- 7 • Where the groundwater level was at or below the bottom of the cell, the cell was
8 treated as unsaturated and assigned a saturated thickness of zero (i.e., there is no
9 water in the cell).

10 For each model cell with a non-zero saturated thickness, groundwater volume was
11 calculated by multiplying saturated thickness by cell area and specific yield. The total volume of
12 groundwater in storage was then calculated by aggregating the volumes across all active model
13 cells. (Ex. 123 at pp. 123-40–123-41.)

14 **VIII. THE U.S. AND IWVGA EXPERTS DO NOT OFFER INDEPENDENT OR**
15 **RELIABLE OPINIONS.**

16 Expert testimony is admissible only if it is: (1) based on matter reasonably relied upon by
17 experts; and (2) the product of reliable principles and methods properly applied. (Evid. Code,
18 §§ 801, 802.) Under *Sargon*, trial courts act as gatekeepers and must exclude expert testimony
19 where “the matter relied on...[does not] provide a reasonable basis for the opinion” or where there
20 is “too great an analytical gap between the data and the opinion proffered.” (*Sargon, supra*, 55
21 Cal.4th at pp. 770–771 [quoting *General Electric Co. v. Joiner* (1997) 522 U.S. 136, 146].) Courts
22 exclude opinions that are: (1) speculative; (2) based on unsupported assumptions; or (3) the result
23 of flawed reasoning. (*Id.* at pp. 771–772.)

24 Unlike the TWG’s coordinated body of evidence derived from multiple independent
25 methodologies, all grounded in measured data and observed Basin behavior, the IWVGA and U.S.
26 rely on a single, unproduced model and a fixed recharge assumption in support of their estimates of
27 safe yield.

1 **A. The 7,650 AFY Value Is Not a Scientific Result—It is a Fixed Assumption**
2 **Embedded in the DRI Modeling Framework.**

3 The record establishes that the IWVGA’s and U.S.’s recharge estimate of 7,650 AFY is not
4 the product of an independent scientific analysis or a recalculated modeling result. Instead, it is a
5 fixed assumption that has been carried forward unchanged through successive iterations of the
6 IWVGA/DRI modeling framework despite substantial revisions to the models themselves. That
7 distinction is critical.

8 A scientifically reliable groundwater model responds to changes in:

- 9 • basin geometry,
10 • aquifer thickness,
11 • storage properties,
12 • recharge distribution,
13 • ET formulation, and
14 • other hydrogeologic inputs.

15 Here, however, the 7,650 AFY recharge value remained unchanged notwithstanding
16 admitted revisions to all of those model components. The persistence of the same recharge value
17 across materially different model configurations demonstrates that the value functions as a
18 predetermined constraint imposed on the model—not as a result generated by it. The evidence
19 confirms this directly.

20 Dr. McKenna admitted that:

- 21 • the recharge value of 7,650 AFY was held constant across successive model
22 iterations; and
23 • he does not know why the recharge value was never reevaluated despite substantial
24 model revisions.

25 (McKenna Depo., 42:25–43:8; 46:3–7.)

26 Dr. McKenna further confirmed that the model’s safe yield estimate is effectively
27 predetermined by the recharge assumption itself:

- 28 • recharge is fixed at 7,650 AFY;

- 1 • the model is calibrated using that fixed value; and
- 2 • the resulting model output is then cited as support for the same 7,650 AFY
- 3 estimate.

4 (McKenna Depo., 47:5–17.)

5 This is not independent scientific validation. It is circular reasoning. The modeling process
6 proceeds as follows:

- 7 1. a recharge value of 7,650 AFY is assumed at the outset;
- 8 2. the model is calibrated to conform to that assumption; and
- 9 3. the calibrated model output is then presented as evidence confirming the original
- 10 assumption.

11 In other words: The model does not test the 7,650 AFY assumption—it reproduces it. A model
12 calibrated to confirm a fixed assumption cannot independently validate that assumption. That is a
13 fundamental modeling flaw.

14 The problem is compounded by the fact that the original recharge estimate originated from
15 the earlier, unproduced 2-D DRI model that neither the TWG experts nor this Court has been
16 permitted to evaluate. Thus, the IWVGA and U.S. continue to rely on a recharge value that:

- 17 • originated from an unavailable model;
- 18 • was never independently verified;
- 19 • was never recalculated after substantial model revisions; and
- 20 • was instead imposed repeatedly as a fixed constraint on later modeling efforts.

21 The significance of this point cannot be overstated. If changes to basin geometry, aquifer
22 thickness, storage parameterization, evapotranspiration representation, and recharge distribution
23 do not alter the recharge estimate, then the recharge estimate is not being derived from the model.
24 It is being imposed upon it.

25 **A value that does not change when the model changes is not a model result. It is a**
26 **predetermined assumption embedded into the modeling framework.** That is precisely what
27 occurred here. Accordingly, the 7,650 AFY figure cannot reasonably be characterized as an
28 independently derived estimate of Basin recharge or safe yield. Rather, it reflects a retained

1 modeling constraint carried forward through successive model iterations regardless of whether the
2 revised models themselves support it.

3 **B. The Model’s Lack of Sensitivity to Observed Conditions Confirms Its**
4 **Unreliability.**

5 Even without access to the underlying model, the record demonstrates that the IWVGA’s
6 DRI modeling framework is insensitive to observed Basin behavior. Monitoring data show that
7 groundwater levels respond to episodic wet-year precipitation through measurable recoveries. Yet
8 those responses are not reflected in the IWVGA modeling results. In a basin where recharge is
9 driven by mountain-front processes and episodic precipitation, a model that does not respond to
10 wet-year inflows is not physically realistic. A model that cannot reproduce observed basin
11 behavior cannot reliably predict safe yield.

12 **C. The 7,650 AFY Estimate Cannot Support a Safe Yield Determination.**

13 Taken together, these defects establish that the 7,650 AFY value is derived from an
14 unproduced model, is not independently verifiable, is held constant regardless of model revisions,
15 is confirmed through circular reasoning, and does not reflect observed Basin response. This is not
16 a matter of competing expert interpretations. It is the absence of a reliable technical foundation.
17 Because the IWVGA and U.S. safe yield opinions depend entirely on this value, those opinions
18 cannot assist the Court in determining safe yield and must be excluded or afforded no weight.

19 **D. Sean McKenna, Ph.D.**

20 **1. Dr. McKenna’s Safe Yield was Pre-Determined from the Recharge Rate**
21 **of 7,650 AFY, Both of which have Been Held Constant Since 2016**
22 **Despite Revisions to DRI’s Model.**

23 The recharge estimate of 7,650 AFY that Dr. McKenna derived from the DRI 2-D Model
24 pre-determined his estimate of safe yield. He confirmed at deposition:

25 Q: Looking at the second sentence, it says “Calibrated values of
26 specific yield are in part a function of the recharge rate, and
27 the **recharge rate is defined by the modeler**. As a
28 consequence, when calibrated specific yield values are used
to estimate Safe Yield, the **estimate of Safe Yield is**
effectively pre-determined by the assigned recharge
rate.”

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Do you **agree with that statement?**

A: **Yes.**

Q: Okay. And in this case you utilized a **predetermined recharge rate of 7,650 that emanated from the 2016 model**, correct?

A: **Yes.**

(McKenna Depo., 47:5–17.)

Moreover, the estimate of total Basin recharge used in DRI’s groundwater modeling has remained unchanged at 7,650 AFY since 2016, notwithstanding multiple substantive revisions to the DRI model. Between 2016 and 2025, DRI released at least three model iterations that modified basin geometry, aquifer thickness, storage parameterization, ET formulation, fault representation, and the spatial distribution of recharge. Revisions of this scope would ordinarily be expected to affect calculated recharge, storage behavior, or basin response.

Despite these changes, total Basin recharge and, therefore, safe yield, were *identical* in each version. (See Ex. 410.) Dr. McKenna admitted at deposition:

Q: The **recharge value of 7,650 was held constant** through all three models, correct?

A: **Yes.**

Q: Why was that done?

A: I don’t know the reasoning on that.

* * *

Q: Was there any attempt during the course of preparation of the 2025 model to reanalyze the inflow figure of 7,650?

A: I don’t know.

Q: And same question for 2020. Do you know if there was any attempt to analyze or reinvestigate the inflow figure of 7,650 from the time of the 2016 McGraw report?

A: I don’t know, no.

1 (McKenna Depo., 42:25–43:8, 46:3–7.) The absence of any change in aggregate recharge across
2 materially different model structures indicates that recharge was not recalculated as an outcome of
3 revised basin representation, but instead remained fixed across iterations.

4 The fixed recharge assumption is also inconsistent with observed Basin behavior.
5 Monitoring data show that groundwater levels in multiple wells respond to episodic wet-year
6 precipitation through measurable recoveries. While those responses are reproduced in the 2025
7 Ramboll Model, they are not reflected in the 2025 DRI Model, which exhibits limited sensitivity
8 to precipitation variability. In a terminal basin where recharge is dominated by mountain front
9 processes, insensitivity to episodic inflow limits the model’s usefulness for evaluating long-term
10 basin response.

11 The record indicates that the 7,650 AFY recharge figure represents a retained constraint
12 rather than a recalculated result of successive model refinements. As a result, the DRI model
13 iterations do not independently test whether the recharge level is consistent with observed Basin
14 behavior under revised hydrogeologic assumptions.

15 **2. The Recharge Value Adopted by Dr. McKenna is an Unexplained**
16 **Outlier Relative to Other Basin Studies.**

17 The recharge estimate derived from the DRI 2-D Model is not consistent with other
18 published estimates for the Basin. Independent analyses show that the values produced by the DRI
19 2-D Model fall well below the range reported by other studies, with differences on the order of
20 thousands of AFY. Dr. McKenna admitted, however, that he accepted the DRI 2-D Model recharge
21 values “at face value” and did not—and could not—evaluate or verify the calculations underlying
22 those values. (McKenna Depo., 91:9–16, 92:4–7.)

23 Critically, because the DRI 2-D Model itself has not been produced, there is no way to
24 determine why its results deviate so substantially from the broader body of scientific work. The
25 presence of an unexamined outlier—combined with the absence of any ability to investigate its
26 basis—further demonstrates that Dr. McKenna’s reliance on this estimate is not grounded in
27 reliable scientific methodology.

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1 **3. Dr. McKenna’s Reliance on Recharge-Based Methods Systematically**
2 **Underestimates Basin Recharge.**

3 Dr. McKenna’s analysis is grounded in a recharge-based framework that relies on estimates
4 of inflows and outflows that cannot be directly measured and are subject to significant uncertainty.
5 By contrast, alternative methodologies—such as the change-in-storage approach—are based on
6 measurable data, including actual pumping records and observed groundwater level changes.
7 Because recharge estimates depend on multiple uncertain variables and assumptions, while
8 observed groundwater levels reflect the net effect of all hydrologic processes, reliance on the
9 recharge method without reconciliation to observed data produces results that lack empirical
10 validation. This disconnect demonstrates that Dr. McKenna’s methodology does not reliably
11 capture the Basin’s actual response to pumping and recharge.

12 Building on this flaw, the methods and assumptions underlying Dr. McKenna’s recharge
13 estimates systematically underestimate total Basin inflow. This bias arises from a combination of
14 methodological limitations, including reliance on simplified empirical relationships, incomplete
15 water budgets, and restrictive assumptions that artificially constrain recharge to limited sources
16 and conditions.

17 First, Dr. McKenna’s approach relies on generalized empirical relationships that are not
18 tailored to the Basin’s specific hydrogeologic conditions. These methods apply threshold-based
19 precipitation assumptions and basin-wide averages without incorporating key site-specific
20 variables, such as soil structure, topography, vegetation, or temporal variability. As a result, they
21 fail to capture important recharge mechanisms—particularly episodic, storm-driven recharge
22 events that are well-recognized in arid and semi-arid basins.

23 Second, Dr. McKenna’s framework selectively excludes recharge falling outside the
24 assumed parameters of his methodology. This includes both lower-intensity precipitation and
25 intermittent high-flow events, each of which can contribute meaningfully to recharge over time.
26 Modern hydrologic practice recognizes that recharge occurs across a range of conditions and is
27 often driven by variability rather than steady-state processes. By omitting these components, Dr.
28

1 McKenna’s analysis departs from accepted hydrogeologic principles and fails to represent the
2 Basin’s actual behavior.

3 Third, Dr. McKenna’s analysis omits well-established sources of recharge, including
4 anthropogenic contribution, such as irrigation return flows, system leakage, and other incidental
5 inflows. These sources are widely recognized as measurable and recurring components of
6 groundwater recharge in comparable California basins and are routinely incorporated into basin-
7 wide water budgets. Their exclusion results in an incomplete accounting of Basin inflows and
8 further depresses the resulting recharge estimate.

9 Fourth, Dr. McKenna further constrains recharge by imposing an assumed upper bound
10 derived from speculative estimates of pre-development ET. These estimates rely on sparse and
11 indirect data from more than a century ago, when hydrologic conditions in the Basin were not as
12 well documented. Using such uncertain historical discharge values as a limiting condition
13 introduces an additional layer of speculation and disconnects the analysis from observed Basin
14 behavior. Moreover, independent modeling indicates that actual discharge conditions may have
15 been substantially higher than the values used to constrain recharge, meaning that the imposed
16 limitation artificially caps inflows without empirical support.

17 Taken together, these limitations demonstrate that Dr. McKenna’s methodology is not a
18 comprehensive or reliable assessment of Basin recharge. By systematically excluding multiple
19 categories of inflow and relying on non-site-specific methods, his analysis produces a downward-
20 biased estimate that diverges from both observed Basin behavior and accepted hydrogeologic
21 practice.

22 **4. Dr. McKenna Did Not Perform Key Analyses Necessary to Evaluate**
23 **Safe Yield.**

24 Despite his assignment, Dr. McKenna did not perform certain fundamental analyses
25 relevant to determining Basin conditions, including work related to storage or changes in storage
26 over time. Dr. McKenna’s deposition testimony confirms that he did not independently perform
27 the underlying analyses and instead relied upon work performed by others. (See, e.g., McKenna
28 Depo., 25:13–22, 44:21–25.) He further testified that his role did not include building or rerunning

1 any of the DRI models and that he conducted no additional modeling work beyond reviewing
2 existing materials. (McKenna Depo., 17:21–18:12.)

3 The omission of these analyses is significant because groundwater storage and changes in
4 storage are central to evaluating basin response to pumping and determining safe yield under the
5 governing legal standard. By failing to evaluate these components, Dr. McKenna’s analysis does
6 not incorporate critical aspects of the hydrologic system and therefore cannot provide a complete
7 or reliable assessment of safe yield.

8 **E. Todd Kincaid, Ph.D.**

9 **1. Dr. Kincaid Performed No Original Work.**

10 The IWVGA instructed its expert, Dr. Kincaid, to provide an opinion on groundwater
11 inflow *based on existing studies*, undertake “a *cursory review*” of the 2025 DRI Model and the
12 2025 Ramboll Model, and “[p]rovide a *preliminary opinion* regarding the differences between the
13 two models.” (Ex. 80 at p. 80-3 [emphasis added].)¹²

14 Dr. Kincaid’s core opinion is that safe yield “is likely between 6,100 and 8,400 AFY.”
15 (*Ibid.*) As described below, Dr. Kincaid’s opinion suffers from numerous flaws.

16 **2. Dr. Kincaid Did Not Complete his Review of the 2025 DRI Model and**
17 **the 2025 Ramboll Model.**

18 At his deposition, Dr. Kincaid admitted that he did not complete his work reviewing the
19 models. He explained that he was still “in the process of,” and “hope[d] to continue, reviewing”
20 the 2025 Ramboll Model, comparing its output files to the 2025 DRI Model’s output files, and
21 continuing a general review of the two models. (Kincaid Depo., 13:6–14:9.) Additionally,
22 Dr. Kincaid had not completed his review of documentation concerning application of the BCM to
23 various reports and to the work performed by the District. (*Id.*, 13:6–15:17.)

24 **3. Dr. Kincaid’s Safe Yield Range is Biased Low.**

25 Dr. Kincaid arrived at his asserted range through nothing more than (a) cherry-picking
26 certain existing estimated recharge values and (b) using basic math. He merely averaged his

27 _____
28 ¹² Dr. Kincaid’s initial report (Aug. 2025) is Exhibit 80, and his second report (Dec. 2025) is Exhibit 84.

1 “cherry-picked” values, bounded that average by one standard deviation, and then reduced those
2 values by an arbitrary 15 percent (purportedly to account for discharge to ET in the playa). (Ex. 80
3 at pp. 80-7, 80-22–80-23.)

4 To be certain, this was a result-oriented approach. Dr. Kincaid intentionally omitted all
5 values he deemed “exceptionally high” calculated based on use of the Change in Groundwater
6 Storage equation. (Ex. 80 at p. 80-23.) He also categorically excluded all recharge estimates
7 published prior to 1989. Dr. Kincaid openly acknowledged that he excluded those studies because
8 “estimates of both mountain front recharge and total groundwater inflow have been declining
9 since 1989.” (*Ibid.*) He further notes that, by excluding the pre-1989 studies, “the average drops by
10 more than 500 AFY.” (*Ibid.*) **Dr. Kincaid selected values for the express reason that they
11 resulted in a lower calculated average recharge value.**

12 Dr. Kincaid mused that the lower values “reflect[] a progressive scientific understanding of
13 the hydrologic processes relevant to the [Basin],” but this self-serving assertion is unsupported and
14 speculative: He provided no expert analysis individually describing why these later studies are
15 somehow more reliable than the excluded studies.

16 Ironically, by categorically excluding all pre-1989 studies, Dr. Kincaid omitted one of the
17 two estimates of recharge that he opines is most reliable. In his second report, he criticizes use of
18 the Groundwater Storage Method, contending the “[r]esults require unreasonably large total
19 recharge to the [Basin].” (Ex. 84 at p. 84-1.) In making this argument, Dr. Kincaid asserts “[t]he
20 **most reliable estimate of total recharge** to the [Basin] are those rendered **by Kunkel and Chase
21 (1969)** and McGraw and others (2016) on the basis of detailed study and estimation of total [ET]
22 ... in the playas that likely occurred prior to the onset of groundwater pumping.” (*Ibid.* [emphasis
23 added].)

24 Dr. Kincaid admitted at his deposition: “[O]ne of the reasons the Kunkel and Chase, in my
25 opinion, is -- I rely on and I go back to, and I think they are an authoritative reference, is because
26 they were simply closer in time. They did a very detailed study at a time period that was closer to
27 the -- much closer to the predevelopment period than -- than today.” (Kincaid Depo., 105:5–
28 106:12.)

1 Yet, in cherry-picking his 10 studies based on recentness, Dr. Kincaid omitted the highly
2 “reliable” Kunkel and Chase (1969) estimates – where the reliability was directly tied to that study
3 *not* being recent, but rather being closer temporally to predevelopment conditions. In considering
4 why he would take this approach, it is not surprising the Kunkel and Chase (1969) values
5 significantly exceed Dr. Kincaid’s chosen range of estimates. Using one method, Kunkel & Chase
6 (1969) estimated natural recharge to be **11,000 AFY**, and, using another method, estimated it could
7 be up to **15,000 AFY**. (Ex. 80 at pp. 80-52–80-57.)

8 **4. Dr. Kincaid’s Safe Yield Range Attempts to Justify the 7,650 AFY from**
9 **the Unproduced DRI 2-D Model.**

10 Dr. Kincaid is fundamentally no different than Dr. McKenna; his job was likewise to
11 support the IWVGA’s “black box” 7,650 AFY recharge estimate.

12 Referring back to the above discussion of Kunkel & Chase (1969), the other “most reliable
13 estimate” of recharge, according to Dr. Kincaid, is, predictably, McGraw (2016), the origin of the
14 7,650 AFY value hardwired into his client’s model. McGraw (2016) was among the 10 studies
15 Dr. Kincaid chose for his calculated average, and Kincaid’s range unsurprisingly brackets 7,650
16 AFY quite nicely.

17 Of course, Dr. Kincaid can offer no more substantiation for 7,650 AFY than Dr. McKenna,
18 because that value was generated by the vanished 2-D DRI Model. As described above, the 2-D
19 DRI Model *not* made available to the TWG experts. *Drs. Kincaid or McKenna did not review the*
20 *2-D DRI Model either.* Dr. McKenna has no basis to opine that 7,650 is reliable, because he
21 doesn’t know how that estimate was generated. (Kincaid Depo., 193:17–196:25 [emphasis
22 added].)

23 **5. Dr. Kincaid Applied an Arbitrary 15 Percent Reduction.**

24 Dr. Kincaid explained that his “proposed estimate for safe yield [] reflects a 15% reduction
25 from my estimate of total recharge” to account for losses to ET. (Ex. 80 at p. 80-7.) His 15 percent
26 reduction is arbitrary and unsupported; Dr. Kincaid admitted that *he just picked a number out of*
27 *“[t]hin air.”* (Kincaid Depo., 81:6–22 [emphasis added].) Again, Dr. Kincaid employed an
28 approach resulting in a lower calculated range without any expert foundation.

1 **6. The “Recharge Method” is Less Reliable than the Change in**
2 **Groundwater in Storage Method.**

3 Studies Dr. Kincaid selected for his average employed what he calls the “Recharge
4 Method.” He states his general preference for the Recharge Method for evaluating safe yield rather
5 than the Change in Groundwater Storage approach. (Ex. 80 at pp. 80-9–80-10.)

6 While the Change in Groundwater Storage approach uses measured data, Dr. Kincaid
7 acknowledged at deposition that the Recharge Method entails significant uncertainty because it is
8 necessary to estimate each component of the groundwater budget. (Kincaid Depo., 145:25–148:1.)
9 That’s because “[n]one of the water budget components typically can be directly measured.”
10 (*Ibid.*) Dr. Kincaid acknowledges that the extent of the uncertainty associated with estimating each
11 of the groundwater budget items is unknown, and Dr. Kincaid agrees that, “when you’re
12 estimating each of those elements of the groundwater budget, you have compounding levels of
13 uncertainty as you go.” (*Ibid.*)

14 Dr. Kincaid relied on involved estimates of **discharge to ET occurring prior to 1920.**
15 (Ex. 80 at pp. 80-18–80-20.) He assumed that, prior to 1920, the Basin was in a steady-state, pre-
16 development condition unaffected by groundwater pumping. (*Ibid.*) Dr. Kincaid further assumed
17 this time period included no annual change in groundwater storage, such that annual recharge was
18 equal to annual discharge to ET. Based on these assumptions, the concept is that, if discharge to
19 ET can be reliably estimated, that value is equivalent to predevelopment recharge.

20 Estimating pre-1920 discharge to ET involves mapping the extent and types of vegetation
21 existing in the playa in the 1910s. Kunkel and Chase (1969) performed this task in reliance on
22 aerial photography. It is also necessary to apply assumptions about soil types, soil moisture, and
23 ET rates. Dr. Kincaid acknowledges that discharge to ET cannot be directly measured, and this
24 approaches entails “significant uncertainty.” (Kincaid Depo., 146:15–147:3.)

25 This is obviously quite a contrast to the empirically driven Change in Groundwater Storage
26 approach. Dr. Kincaid agreed that Change in Groundwater Storage approach involves, in part,
27 measured data concerning changes in groundwater level rather than estimations based on wet/dry
28 mapping. (Kincaid Depo., 148:2–11.)

1 It is notable that, despite trumpeting the Recharge Method as more reliable, Dr. Kincaid
2 conspicuously excluded both of the foundational studies evaluating discharge to ET pre-1920.
3 Those estimates were made by Lee (1912) and Kunkel and Chase (1969), and Dr. Kincaid
4 excluded both because their estimates are higher than his cherry-picked range.

5 The uncertainties in the Recharge Method estimates are acknowledged and uncontested.
6 Indeed, in justifying his decision to base his opinion on a calculated range of existing estimates,
7 rather than a single value, Dr. Kincaid explained that “[n]early all [of the researchers] have stated
8 that, given the **uncertainties associated with estimating and simulating the water budget**
9 **components, additional data should be collected** to better constrain the estimation of recharge
10 and discharge in the [Basin], **which to date has not been forthcoming.**” (Ex. 80 at p. 80-22
11 [emphasis added].)

12 **7. The Basin Was Not in a Pre-Development Condition Leading up to**
13 **1920.**

14 The reliability of a pre-1920 discharge to ET estimates is further undermined by the fact
15 that, contrary to one of the foundational assumptions, evidence strongly indicates that significant
16 pumping was already occurring in the basin before 1920. When a basin is already affected by
17 significant pumping, there is no basis to assume that discharge to ET is equal to recharge. As Dr.
18 Kincaid acknowledged in his initial report: “The storage method for estimating safe yield may be
19 the only option in cases where the pre-pumping water budget cannot be reasonably estimated....”
20 (Ex. 80 at p. 80-17.)

21 **8. Assessing Pre-1920 Safe Yield Misses the Mark.**

22 As part of the safe definition, the relevant inquiry in assessing safe yield is current
23 conditions, i.e., climate, cultural conditions, etc., Dr. Kincaid’s client has publicly acknowledged
24 in its GSP the uncertainty about whether precipitation is increasing or decreasing as a result of
25 climate change. (Ex. 108, at p. 108-182.) What is certain is that those changes, whatever they are,
26 are not accounted for in Dr. Kincaid’s pre-development discharge to ET assessment. Likewise, all
27 anthropogenic sources of recharge are categorically excluded.
28

1 In contrast, the TWG’s Change in Groundwater Storage assessments are based on data
2 from the current period, and the effects of climate change and anthropogenic recharge are baked-in
3 to the analysis. As Dr. Kincaid noted in his initial report: “The storage method for estimating safe
4 yield may be the only option in cases where ... hydrologic conditions are believed to be
5 significantly different at present than during the pre-pumping period....” (Ex. 80 at p. 80-17.)

6 **9. Dr. Kincaid Failed to Account for Anthropogenic Sources of Recharge.**

7 California safe yield definition requires that all sources of recharge be accounted for in
8 assessing safe yield. Indeed, even the different definition Dr. Kincaid included in his initial report
9 provides that the inquiry encompasses “total” recharge, inclusive of natural and “artificial[]”
10 sources. (Ex. 80 at p. 80-7 [quoting Wat. Code, § 37900].) Nevertheless, he “did not undertake to
11 evaluate or quantify the anthropogenic sources of recharge to the basin,”¹³ and admits that his
12 selected pre-development recharge methodology “wouldn’t be the optimal choice” where a
13 material portion of a basin’s recharge is from anthropogenic sources. This is yet another reason for
14 why the Change in Groundwater Storage / Thiessen Polygon Method is superior in choice for
15 estimating safe yield. As Dr. Kincaid acknowledged at deposition, Mr. Teasdale’s approach does
16 not require quantitation of these various sources of recharge; they are baked-in to the water level
17 change measurements, and therefore either contribute to what’s being measured, or they don’t.
18 (Kincaid Depo., 133:5–135:8.)

19 **10. Dr. Kincaid’s Criticisms related to Sy Values Demonstrate the**
20 **Groundwater in Storage Method is Conservative.**

21 In his initial report, Dr. Kinkaid included a section headed “4.2.2.3. *Problem with the*
22 *Storage Method*” he wrote:

23 **Application of the storage method will likely result in an over-**
24 **estimation of safe yield** because the uncertainties associated with
25 **because field tests are typically performed on production wells**
26 **that are intentionally located in the more productive parts of an**
aquifer, and, in heterogeneous settings, the tests themselves tend to

27 ¹³ Indeed, studies Dr. Kincaid used to calculate his average included estimates of certain types of
28 anthropogenic recharge, but he categorically excluded those recharge estimates before doing his
math.

1 measure the more productive zones. Extrapolation of those values
2 across the parts of an aquifer that are not directly tested can result in
3 significant over-estimations of the aquifer storage capacity.

4 (Ex. 80 at p. 80-15 [emphasis added].) During his deposition, Dr. Kincaid acknowledged that he
5 stated this backwards; *the tendency to overestimate Sy values actually has the effect of*
6 underestimating safe yield.

7 **IX. THE IWVGA WATER RESOURCES MANAGER AND MODELER DO NOT**
8 **OFFER ANY VALID EXPERT OPINIONS BUT MAKE SIGNIFICANT**
9 **ADMISSIONS.**

10 The IWVGA hired Stetson and its CEO, Mr. Stephen Johnson, as the Water Resources
11 Manager to develop the GSP. The IWVGA did not designate Mr. Johnson as a witness for this
12 trial; rather, the IWVGA fought vigorously and unsuccessfully to prevent Mr. Johnson from
13 testifying altogether.

14 Similarly, the IWVGA did not designate Stetson employee Jean Moran as a retained
15 expert, despite her role overseeing Stetson's GSP modeling analysis. (Ex. 15.)

16 IWVGA's motivations to hide or minimize Stetson's role at trial are clear. Neither Mr.
17 Johnson nor Ms. Moran developed or independently verified the 7,650 AFY sustainable yield
18 figure. They merely accepted that figure as provided to them by DRI and then hard-wired it into
19 the GSP.

20 **A. Jean Moran, PG, CHG**

21 IWVGA's "non-retained percipient" expert, Ms. Moran will testify that although she has
22 decades of experience with Stetson, her role in developing the GSP was limited to acting as a
23 facilitator and reviewer, not an independent analyst or decision-maker. She did not prepare any
24 expert report, and she was not asked to develop or present independent opinions at trial. Instead,
25 her involvement consisted primarily of coordinating meetings, compiling input from others, and
26 reviewing model outputs generated by third parties.

27 Ms. Moran did not run the 2020 GSP modeling scenarios and did not have direct access to
28 the DRI model files during the development of the GSP. During her deposition, Ms. Moran
29 testified that the Navy owned the GSP modeling tool and that only the Navy and DRI had direct

1 access to the GSP model files. She testified that Stetson only had access to GSP modeling *output*
2 files. (Moran Depo., 117:17–119:5.)

3 Further, Ms. Moran testified at her deposition that DRI still maintains control of the
4 original, unchanged GSP 2020 model files, which she referred to as the “golden copy.” Ms. Moran
5 further testified that Stetson also now has a copy of those files. (Moran Depo., 120:10–122:1.)

6 Ms. Moran admitted that the 7,650 AFY sustainable yield figure adopted by the IWVGA
7 was not independently derived by Stetson. It was nonetheless carried forward unchanged into the
8 2025 GSP model update, even as other aspects of the GSP model were revised.

9 Ms. Moran will likely attempt to paint the IWVGA TAC as having reached consensus on a
10 “recharge” figure of 7,650 AFY to be used for the 2020 GSP modeling process. She admitted at
11 her deposition, however, that the TAC members never had access to the DRI model, that TAC
12 discussions reflected substantial uncertainty, and that TAC members did not agree on all technical
13 aspects under review. Ms. Moran’s testimony demonstrates that the 7,650 AFY figure is not the
14 product of a robust, independently validated analysis, but rather the result of a constrained, pre-
15 determined model built on inherited assumptions, limited data access, and significant reliance on
16 third-party work.

17 **B. Stephen Johnson, PE**

18 Mr. Johnson will also testify that GSP groundwater modeling and its recharge estimation
19 was performed by third parties. He acknowledged at his deposition that Stetson relied heavily on
20 DRI’s work and incorporated foundational assumptions directly into the GSP, including DRI’s
21 Basin recharge value. (Ex. 110 at p. 110-31; Ex. 108 at p. 108-148, table 3-3.) Mr. Johnson will
22 concede that he did not independently verify these underlying technical inputs.

23 Mr. Johnson admitted at his deposition that he lacks personal knowledge regarding the
24 basis for many of the GSP’s most critical conclusions. Most notably, he did not determine—and
25 cannot meaningfully explain—the origin or calculation of the 7,650 AFY sustainable yield figure,
26 beyond general statements that it represents “inflow water supply to the basin.” (Johnson Depo.,
27 39:18–25.) He acknowledged that Stetson did not possess or review the underlying DRI 2-D
28 Model that was used to develop that recharge estimate. (Johnson Depo., 38:18–39:17.)

1 Mr. Johnson acknowledged that the GSP “minimum thresholds” for water level declines
2 and loss of groundwater in storage were derived from specific *management* model scenarios run
3 through the DRI model—particularly GSP Model Scenario 6.2 and not independently developed
4 from observed data. (Johnson Depo., 79:19–83:7, 89:22–90:24.) Mr. Johnson further admitted that
5 as of January 2020 (when the GSP was adopted), water levels at each of the GSP representative
6 monitoring wells in the 2020 GSP figures were **above** the IWVGA-selected “minimum
7 thresholds.” (Ex. 110 at pp. 110-47–110-56, figs. 4-5a–4-5j.)

8 Mr. Johnson acknowledged that TWG members and many other stakeholders submitted
9 extensive, detailed and technical public comments on the GSP prior to its adoption by the IWVGA
10 in January 2020. (Exs. 118, 119.) Those comments were largely ignored or met with a cursory
11 response from Stetson and the IWVGA: “Comment noted.” (Ex. 117.)

12 In short, Mr. Johnson’s testimony demonstrates that the GSP 7,650 AFY sustainable yield
13 value was derived from DRI modeling, unverified assumptions, and decision-making processes
14 that even the Water Resources Manager cannot explain. Mr. Johnson cannot offer any meaningful
15 testimony that would support 7,650 AFY as a safe yield value for the Basin.

16 **X. THE BASIN SAFE YIELD IS CONSERVATIVELY 15,400 AFY, AND NO LESS**
17 **THAN 14,300 AFY.**

| TWG Party | Expert | Estimated Safe Yield (AFY) |
|-------------|----------|----------------------------|
| Meadowbrook | Teasdale | 15,400 |
| District | Tonkin | 14,375 |
| District | Parker | 14,300 |

22 **XI. CONCLUSION**

23 The experts for the U.S. and IWVGA offer opinions conflicting with the well-defined
24 standard pronounced by the California Supreme Court in *San Fernando*. Moreover, the opinions of
25 the IWVGA’s expert, whatever probative value they may have, are the result of an advocacy-
26 driven exercise designed to validate a desired outcome. By their own admission, the experts for
27 the U.S. and IWVGA entirely rely upon a now missing, unproduceable, unreviewable 2-D model.
28 Against this inadequate offering, the TWG presents experts with leading experience in multiple

