

No. 141, Original

In the

SUPREME COURT OF THE UNITED STATES

STATE OF TEXAS,

Plaintiff,

v.

STATE OF NEW MEXICO and

STATE OF COLORADO,

Defendants.

OFFICE OF THE SPECIAL MASTER

DECLARATION OF MARGARET BARROLL, Ph.D.

**IN SUPPORT OF JOINT MOTION OF THE STATE OF TEXAS,
STATE OF NEW MEXICO, AND STATE OF COLORADO FOR ENTRY
OF CONSENT DECREE SUPPORTING THE RIO GRANDE COMPACT**

November 14, 2022

I, Dr. Margaret (Peggy) Barroll, pursuant to 28 U.S. C. § 1746, hereby declare as follows:

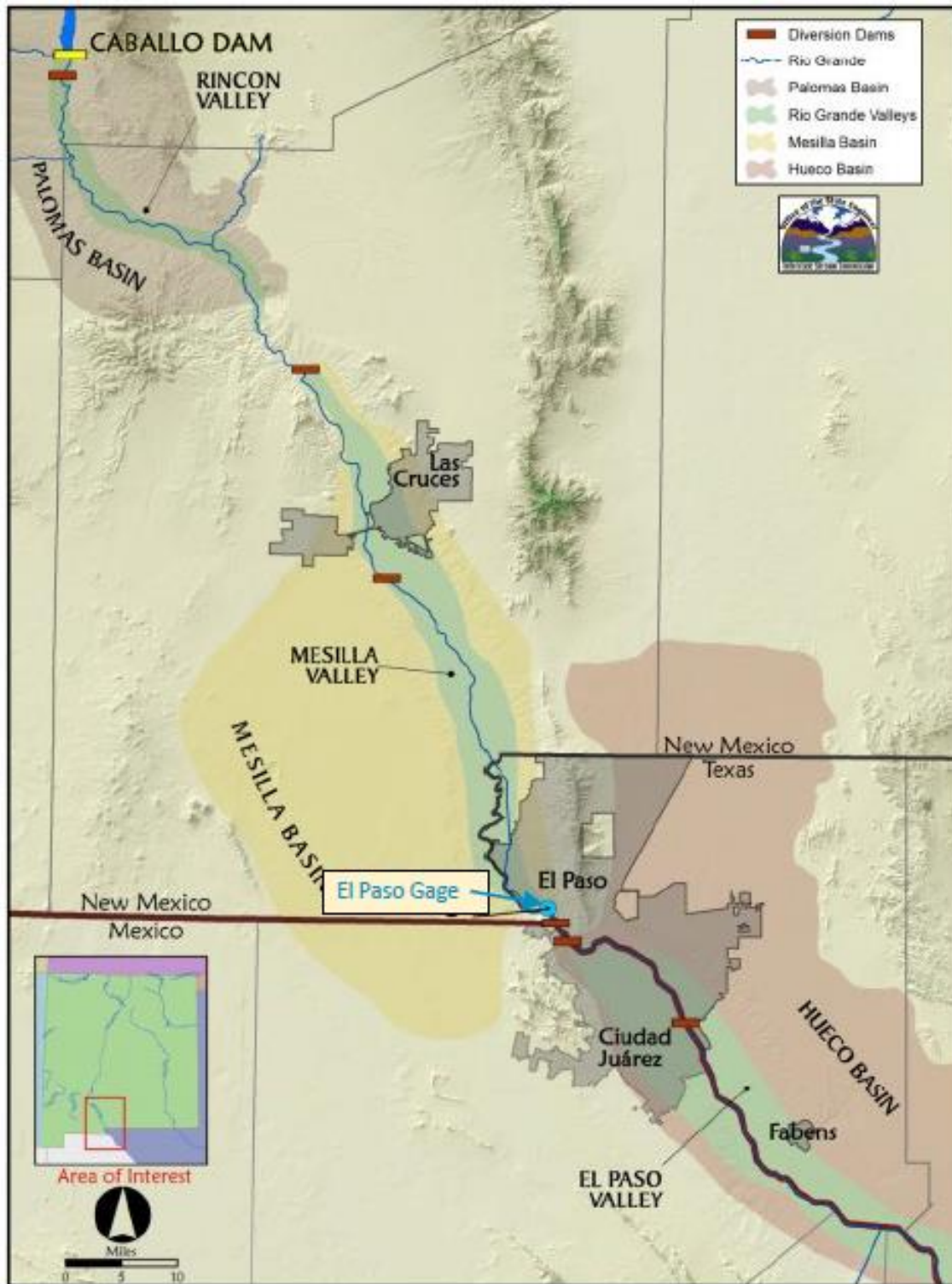
- 1) I am over 18 years of age and have personal knowledge of the facts stated herein.
- 2) I earned a Bachelor's degree (with Honors) in Physics from Swarthmore College, Pennsylvania, and a Master's degree and Ph.D. in Geophysics, from New Mexico Institute of Mining and Technology in Socorro, New Mexico. My Ph.D. work involved groundwater modeling.
- 3) From 1988 until 1991, I was a hydrologist employed by D.B. Stephens and Associates in New Mexico.
- 4) From 1991 to 2017, I worked for the New Mexico Office of the State Engineer ("OSE"). During my career with the State Engineer, I was a staff member of the Hydrology Bureau, and I developed groundwater models, including models that simulated the operations of surface water irrigation systems; I evaluated water right applications; and I provided support to the adjudication branch of the OSE and to the Interstate Stream Commission ("ISC").
- 5) Currently, I am a senior water resources hydrogeologist consultant performing technical analysis and consultation for the OSE on Rio Grande and Pecos River basin issues.
- 6) In addition to my involvement in this case, I have provided written and oral testimony as to my expert opinions in numerous water rights administrative hearings and cases in New Mexico, and been presented and accepted as an expert in hydrology and groundwater modeling. I have also provided expert testimony in the on-going New Mexico state water adjudication case relating to the Lower Rio Grande, *State of New Mexico ex rel. State Engineer v. Elephant Butte Irrigation District et al.*, No. D-307-CV-96-888 (the "LRG Adjudication").
- 7) My professional involvement with Lower Rio Grande issues within New Mexico and Texas began around 2000. My work has involved, among other things:

- a) In-depth review of Rio Grande Project records relating to Project allocation, accounting, operations and history.
 - b) Quantitative analysis of Rio Grande Project allocation and accounting, compilation of Project allocation and accounting data from numerous sources, and analysis of that data.
 - c) Numerous field visits to Rio Grande Project locations in both New Mexico and Texas generally for the purposes of identifying and inspecting critical infrastructure and observing farm management practices.
 - d) Numerous meetings and discussions with the personnel who manage Rio Grande Project water allocation, accounting, and distribution.
 - e) Review and analysis of data and studies related to Lower Rio Grande surface water hydrology.
 - f) Groundwater modeling of the Lower Rio Grande aquifer system in New Mexico, including the hydrologic effects of the operations of the Rio Grande Project.
 - g) Analysis of groundwater level data both spatially and temporally.
 - h) Trend analyses of groundwater pumping meter data.
- 8) My curriculum vitae is attached to this Declaration.
- 9) I have been retained by the State of New Mexico to provide expert consulting services pertaining to hydrologic and water resource matters presented in this case, and I have authored four reports presenting my analyses and opinions.
- 10) In this Declaration, I refer to the New Mexico District, and the Texas District, (jointly “Districts”) which are irrigation districts served by the Rio Grande Project (“Project”).
- 11) In this Declaration I refer to:
- a) D2 Period, which is the time period from January 1, 1951, through December 31, 1978.

- b) Project Water or Project Supply, which is water available for diversion for Project purposes (including delivery to Mexico) below Caballo Dam, and which includes water released from storage (“Caballo Release”) and inflows and return flows occurring below Caballo Dam.
- c) Caballo Release Period, which is that part of a year starting when Project Water is released from Caballo Reservoir and ending when the water from the final Caballo Release has reached the Texas District.
- d) Project Allocation, which is the annual amount of Project Water each District is entitled to order for delivery to its canal headings, or the process by which the United States Bureau of Reclamation (“Reclamation”) determines this amount.
- e) Project Accounting, which is the process by which deliveries to each District are accounted for and charged against each District’s Allocation.
- f) Project Carryover, which is generally the amount of unused Project Allocation a District carries over into the next calendar year, including consideration of the amount of Project Water in reservoir storage associated with that Allocation, and the rules and methodology for determining this amount.
- g) Current-Year Allocation, which is the amount of water allocated to each District each year, excluding Project Carryover.
- h) Total Allocation, which is the amount of water allocated to each District each year, which includes Carryover.
- i) Allocation Balance, which is the amount of a District’s Total Allocation that remains unorderd and unused at the end of the Caballo Release Period.
- j) Compact, which is the Rio Grande Compact.

- k) Decree, which is the proposed Consent Decree.
- l) EEPI, which is the Effective El Paso Index described in the Consent Decree.
- m) Elephant Butte, which unless specified includes both the dam and the reservoir.
- n) DCMI, which refers to Domestic, Commercial, Municipal and Industrial water use.
- o) El Paso Gage, which is the stream gage designated Rio Grande at El Paso (USGS 08364000, sometimes referred to as the Courchesne Gage; see Figure 1).
- p) Mesilla Basin, which is the larger Rio Grande groundwater basin that contains the Mesilla Valley (see Figure 1).
- q) Rincon Basin, which is a sub-part of the Palomas Basin, and is the Rio Grande groundwater basin located north of in the New Mexico Lower Rio Grande which contains the Rincon Valley (see Figure 1).
- r) Mesilla Valley, which is part of the Rio Grande Valley, upstream of the El Paso Gage, within the Mesilla Basin, containing most of the New Mexico District and a small part of the Texas District (see Figure 1).
- s) Texas Mesilla, which is the part of the Mesilla Basin that is in Texas, located upstream of the Rio Grande at El Paso stream gage, containing the smaller part of the Texas District.
- t) The El Paso Valley, which is the part of the Rio Grande Valley, located downstream of the El Paso Gage, containing the larger part of the Texas District (see Figure 1).
- u) The Hueco Bolson (or Hueco Basin), which is the larger Rio Grande groundwater basin that contains the El Paso Valley (see Figure 1).

Figure 1. Map of the Project Area



New Mexico's Compact Article IV Obligations

- 12) Article IV of the Compact (modified by the 1948 Resolution¹) defines New Mexico's obligations to deliver water at Elephant Butte, more than 100 miles upstream of the New Mexico-Texas state line. The water delivered by New Mexico under Article IV supplies the Project, which allocates and distributes water to irrigation districts in New Mexico and Texas. Reclamation releases Project water from Caballo Dam, and delivers that water to diversion points in New Mexico and Texas.

Effective El Paso Index ("EEPI" or "Index")

- 13) On behalf of New Mexico, I participated as a primary member of the technical review and support committee that assisted counsel in extensive negotiations and drafting of the Consent Decree and supporting Effective El Paso Index ("EEPI" or "Index"). I worked closely with counsel and technical personnel on evaluating the Index methodology and analyzed all data supporting the calculations for the Index methodology. My evaluation included analysis of the methodology under diverse possible situations to assure Compact compliance in various hydrologic scenarios. The Consent Decree and EEPI are a result of my work with counsel and other technical experts. The statements in this declaration are my own opinions and derived from my direct involvement in evaluating and assisting with drafting the Consent Decree and supporting materials.
- 14) The EEPI quantifies, on an annual basis, the amount of water Texas is entitled to receive, as a function of the amount of Project Water released from Caballo Reservoir. The EEPI directly addresses how the water delivered by New Mexico to Elephant Butte, pursuant to the Compact, is divided between, and delivered to, southern New Mexico and to Texas.

¹ Resolution Adopted by the RGCC at the Annual Meeting held in El Paso, Texas, February 22-24, 1948, Changing Gaging Stations and Measurements of Deliveries by New Mexico.

- 15) I have reviewed the Consent Decree and analyzed the development of the EEPI, and the methods by which this Index would be implemented.
- 16) In his declaration, New Mexico's expert Mr. Greg Sullivan has described key provisions of the Consent Decree and the EEPI methodology, and provided pertinent technical analysis and conclusions. I have reviewed his declaration, and agree with his description and discussion of the EEPI methodology, and agree with his analysis and conclusions.
- 17) I have reviewed the November 2022 declaration of Dr. William Hutchison, expert for Texas, and I agree that his declaration accurately described and documents the EEPI and the development of the EEPI.
- 18) I have reviewed the November 2022 declaration of Dr. Robert Brandes, expert for Texas, and I generally agree with the conclusions he has reached concerning how the EEPI would be applied, and the effectiveness of the EEPI in ensuring each state can receive its apportioned water.
- 19) The EEPI is similar in form to Compact provisions for the reaches above Elephant Butte. The EEPI is based on inflow-outflow relationships, similar to the Colorado obligation relationships defined in Article III of the Compact, and New Mexico's obligation relationship defined in the 1948 RGCC Resolution.
- 20) The EEPI methodology includes the following quantities:
 - a) Index Delivery, which is the amount of water Texas receives each calendar year at the El Paso Gage, after Mexico's delivery has been accounted for (see below), minus Excess Flows (which are generally waters passing the El Paso Gage that are not available for use in Mexico or Texas), and adjusted for Texas depletions above the El Paso Gage (that is, in the Texas Mesilla).

- b) Index Obligation, which quantifies Texas’s annual entitlement to Index Delivery, and New Mexico’s obligation to deliver to Texas its share of Rio Grande water. The Index Obligation is calculated as a function of Caballo Release in the current and previous years, and the functional relationship is based on Index Deliveries during the D2 Period (January 1, 1951, through December 31, 1978).
 - c) Annual Index Departure, which is the difference between the Index Obligation and the Index Delivery for a given year, computed as the Index Delivery minus the Index Obligation.
 - d) Accrued Index Departure, which is the ongoing sum of Annual Index Departures, subject to a number of Index accounting provisions in the Consent Decree.
- 21) The Consent Decree provides that all positive or negative Accrued Index Departures will be extinguished when there is a Compact Spill [Decree II.E.4]. This provision is analogous to the way the Compact treats New Mexico and Colorado Compact Credits and Debits in cases of Compact Spill.

Mexican Deliveries

22) The United States delivers water to Mexico at the International Dam, a few miles downstream of the El Paso Gage, in accordance with the 1906 Convention between the United States and Mexico. The United States determines the amount to be delivered to Mexico each year (the “Mexican Delivery”), up to 60,000 acre-feet, based on the “D1 Curve,” which is a regression of water delivery data during the D2 Period. After the Mexican Delivery has been determined, the United States subsequently allocates the remaining Project Water to the New Mexico and Texas Districts. The United States has used the D1 Curve to determine the Mexican Delivery amount since approximately 1980, and the EEPI

methodology does not conflict with the United States' continued use of the D1 Curve for this purpose. The EEPI methodology described in the Consent Decree, and in Appendix 1 to that Consent Decree, calculates the Index Delivery to Texas as a remainder after accounting for deliveries to Mexico. The Consent Decree is consistent with the delivery of water to Mexico as required by the Treaty and will not interfere with it.

EEPI Baseline

- 23) The Index Obligation is determined using data from the D2 Period. This is the time period that Reclamation has historically used as the basis for developing methods of Project Allocation since approximately 1980, and was explicitly the basis for Project Allocation in the 2008 Project Operating Agreement.²
- 24) The hydrologic conditions and the state of water use and groundwater development during the baseline D2 Period are incorporated into the Index Obligation [Decree, II.B.2.e]. This constrains the amount of New Mexico water use and groundwater development to that which will allow compliance with the Consent Decree and the Index Obligation, as described in Mr. Michael Hamman's declaration.
- 25) The Consent Decree states that the Project Annual Allocated Water is the apportionment of Rio Grande water to Texas and New Mexico below Elephant Butte. During the D2 Period, approximately 57% of Project deliveries went to the New Mexico District, and approximately 43% of Project deliveries went to the Texas District. This division of water is consistent with the percentage of Project-authorized acreage in each state, the normal operations of the Project that historically provided each Project acre with an equal

² 2008 Operating Agreement for the Rio Grande Project, Agreement between Elephant Butte Irrigation District, El Paso County Water Improvement District No, 1, and the United States through the Bureau of Reclamation, signed March 10, 2008.

entitlement to water, and also with the 1938 Downstream Contract,³ which provides for a 57% - 43% distribution of water in the event of a shortage.⁴

- 26) The D2 Period includes the first significant drought or low-surface-water supply years that the Project faced, and there were a number of years in which the Project water available was insufficient to supply the irrigated acreage of the Project. As water-short conditions continued and deepened, more irrigation wells were drilled within the Project, and groundwater became an integral part of the water supply to Project farmers in both Texas and in New Mexico, as is described in the Rio Grande Project Histories.⁵
- 27) During the D2 Period, estimated DDMI pumping in the Rincon Basin and the New Mexico part of the Mesilla Basin increased gradually from approximately 3,000 acre-feet per year in 1951 to 21,000 acre-feet per year in 1978.
- 28) The D2 Period is a reasonable baseline period for the development of the Index Obligation, because the distribution of Project Water between the states during this time is equitable and consistent with the 1938 Downstream Contract, and because the water use during this period includes the groundwater pumping necessary to support the Project during drought. The amount of groundwater pumping that occurred during the D2 Period is consistent with the successful performance of the EEPI.

³ March 18, 1938, Contract for Distribution of Water, between Elephant Butte Irrigation District and El Paso County Water Improvement District No. 1.

⁴ The 1938 Downstream Contract provides that in the event of a shortage, 67/155 of available supply should be distributed to the Texas District (El Paso County Water Improvement District No. 1, or EPCWID) and 88/155 of available supply should be distributed to the New Mexico District (Elephant Butte Irrigation District, or EBID).

⁵ Rio Grande Project Histories, or “RGP Histories,” were annual reports produced by Reclamation dealing with all aspects of Project operations.

EEPI Methodology: Negative Departure Limits

- 29) The Consent Decree provides for Negative Departure Limits, which are the limits on the negative Accrued Index Departure which determine whether or not New Mexico is in compliance with the Consent Decree [Decree, II.C]. The Negative Departure Limits are analogous to the limits on New Mexico and Colorado accrued debits contained in Article VI of the Compact.
- 30) The Negative Departure Limit for the first 5 years of Consent Decree implementation is 150,000 acre-feet, and 120,000 acre-feet thereafter. These Negative Departure Limits are based in part on the observed behavior of Accrued Index Departures during the D2 Period, which were determined by comparing the Index Deliveries for each year during the D2 Period to the Index Obligation calculated by the regression formula. Calculations using historical data (provided in the spreadsheet attached to Dr. Hutchison's November 2022 declaration, and shown in Figure 1 of Dr. Brandes' November 2022 declaration) show that during the D2 Period the maximum negative Accrued Departure was approximately 154,000 acre-feet. Thus, the Negative Departure Limits are well supported by operational history for the baseline period used to determine the Index Obligation.
- 31) The Negative Departure Limit decreases from 150,000 acre-feet to 120,000 acre-feet after the first 5 years of implementation because it is reasonable to assume that operations of the Project, and water management within New Mexico, will have adapted within 5 years to allow closer conformance with the EEPI than may occur initially.
- 32) If the Negative Departure Limit is exceeded, New Mexico is out of compliance with the Consent Decree. If the Negative Departure Limit is exceeded for three (3) or more consecutive years, New Mexico must deliver a specified additional amount of water to

Texas. With the agreement of Texas, this delivery may take the form of a transfer of Project Allocation from the New Mexico District to the Texas District.

EEPI Methodology: Triggers

- 33) The Consent Decree provides that if the Accrued Index Departure exceeds specified “Trigger” amounts, then certain water management actions are initiated to reduce the departures.
- a) The negative Trigger amount is 80,000 acre-feet. If the negative Accrued Index Departure exceeds 80,000 acre-feet, then New Mexico will initiate the additional water management necessary to reduce the negative Accrued Index Departure to less than 16,000 acre-feet. Transfers of Project Allocation from the New Mexico District to the Texas District will occur if necessary to effect transfer of New Mexico’s apportioned water to Texas [Decree, II.D.2].⁶
- b) The positive Trigger amount is 30,000 acre-feet. If the positive Accrued Index Departure exceeds 30,000 acre-feet in two (2) consecutive calendar years, then transfers of Project Allocation from the Texas District to the New Mexico District will occur to effect transfer of Texas’ apportioned water to New Mexico [Decree, II.D.3].
- 34) The purpose of the negative Trigger is to ensure that measures are taken by New Mexico to reduce the possibility of New Mexico falling out of compliance with the Consent Decree.
- 35) The purpose of the positive Trigger is to adjust Project Allocation so that Texas does not receive more water than its Compact apportionment.

⁶ For 3 years after Trigger exceedance, New Mexico will take management actions and may, with the agreement of Texas, effect Allocation Transfers. Following this 3-year period, Allocation Transfers will be the mechanism to ensure the negative Accrued Index Departure is reduced to less than 16,000 acre-feet.

36) Transfers of Project Allocation from one District to the other (“Allocation Transfers”) may be necessary to ensure that when water apportioned to New Mexico is transferred to Texas, it becomes available for diversion and use by Texas water users when needed, or vice versa.

EEPI Methodology: Allocation Transfers and Escrow Accounts

37) The EEPI methodology described in the Consent Decree provides for Allocation Transfers, by which water apportioned to one state may be transferred to the other state, thus giving the water users in second state access to that water when it is needed. Allocation Transfers are to be implemented in order to remedy Accrued Index Departures that exceed specified amounts. However, my analysis suggests that an Allocation Transfer alone may not have an immediate or short-term impact on the Accrued Index Departure.

a) In the case of an Allocation Transfer from the New Mexico District to the Texas District, if the Texas District accrues Carryover Allocation in the year of the Allocation Transfer, then the Allocation Transfer will have little impact on the amount of water passing the El Paso Gage, and little impact on the Accrued Index Departure.

b) Similarly, in the case of an Allocation Transfer from the Texas District to the New Mexico District, the Allocation Transfer may have little immediate impact on the amount of water passing the El Paso Gage, and thus little impact on the Accrued Index Departure in the short term.

38) In order to ensure that an Allocation Transfer has a timely impact on an Accrued Index Departure, the Consent Decree provides that at the same time an Allocation Transfer is made, there will be an automatic adjustment of the Accrued Index Departure in an amount equal to the Allocation Transfer. This automatic adjustment will cause the Allocation Transfer to have immediate impact on Accrued Index Departure, as well as providing water users in the

state receiving the Allocation Transfer access to additional water [Decree II.D.2.c and II.D.3.b].

- a) Furthermore, in order to ensure that the impact of an Allocation Transfer on the EEPI is not accounted for twice (for example: once when the automatic EEPI adjustment occurs, and again when the transferred Allocation is ordered and received by Texas), a system of Escrow Accounting has been developed. Under the Escrow Accounting system, when an Allocation Transfer to the Texas District results in near-term positive Annual Index Departures, then those positive Annual Index Departures are reduced by the amount of automatic EEPI adjustments that have already been made. Similarly, when an Allocation Transfer to the New Mexico District results in near-term negative Annual Index Departures, then those negative Annual Index Departures are reduced by the amount of automatic EEPI adjustments that have already been made [Decree II.D.2.c and II.D.3.b].
- b) This Escrow Accounting system is time-limited, so that it does not apply after three (3) years have passed since the last Allocation Transfer. The time limit is applied in order to ensure that Escrow-related reductions in Annual Index Departure do not continue long after Allocation Transfers have ceased, by which time Annual Index Departures would be more likely to result from causes other than delivery of transferred Allocation. Applying a time limit also compensates for not calculating evaporative losses on the water associated with Allocation Transfers [Decree II.D.2.c.iv and II.D.3.b.4].
- c) Based on the analyses I have performed and my professional judgement, I conclude that this methodology will temper fluctuations in the Accrued Index Departure and facilitate compliance with the Consent Decree, while still allowing both states to have fair access to the water apportioned to them.

39) I conclude that the proposed EEPI is a practicable method of determining compliance with the Compact, and successful performance of the Consent Decree will provide each state with its share of the waters of the Rio Grande below Elephant Butte. It is my understanding that the EEPI serves as the means to ensure that New Mexico and Texas receive their Compact apportionments below Elephant Butte.

Project Operations to Comport with EEPI Methodology

40) In order to facilitate compliance with the EEPI, the Consent Decree contains provisions that are intended to ensure that Project Allocation and Accounting are generally consistent with the EEPI, and so do not interfere with the delivery of the states' apportioned water. The issues addressed by these provisions include the following:

- a) The amount of Project Supply allocated to the Texas District should generally comport with the Index Obligation. Project Allocation that is based on the two-year regression between Caballo Release and Project Supply for the D2 Period (2-year or lag-one D2 relationship),⁷ would be substantially closer to the EEPI Index Obligation, which is based on a two-year regression between Caballo Release and Index Delivery to Texas for that same period. There will be large Index Departures that relate solely to the discrepancies between the EEPI Index Obligation and Project Allocation and Accounting methodologies unless the Project Allocation is modified to comport with the EEPI.
- b) **Project Deliveries to the El Paso Valley:** Project deliveries to the Texas District for its water users in the El Paso Valley should be measured and accounted for at the El Paso Gage, just as the majority of the Index Delivery is measured at the El Paso Gage. New Mexico, in its counterclaims and history of negotiations with Texas regarding Rio Grande

⁷Dr. Hutchison's Declaration describes the derivation of the 2-year D2 regression.

issues, has alleged that several activities within Texas have negatively impacted New Mexico as detailed in the expert reports submitted in this litigation. Moving the charge point to the El Paso Gage is an elegant solution to these issues, assuring that New Mexico and Texas are each held responsible only for the actions within their state, and assures that Project operations will be consistent with the Index. It resolves New Mexico's First Counterclaim regarding unauthorized depletions in Texas, and New Mexico's Seventh Counterclaim regarding violations of the Miscellaneous Purposes Act.

- c) As a result moving the El Paso Valley charge point to the El Paso Gage, all Project accounting charges and credits associated with Texas actions downstream of the El Paso Gage would become superfluous and should be eliminated (e.g., groundwater pumping impacts, the "Haskell Street Credit" and the "American Canal Extension Credit").
- d) Moving the El Paso Valley charge point to the El Paso Gage will also resolve the impacts of Texas groundwater pumping in the Hueco Bolson on Project Supply, and on New Mexico's share of Project Supply. Eliminating Project Accounting credits in the El Paso Valley will eliminate any negative impact of such credits on New Mexico's apportioned share of water. Such changes will resolve many of the technical issues with Project Accounting that I raised in my expert reports.
- e) **Project Deliveries to the Texas Mesilla:** Project deliveries to the Texas District in the Texas Mesilla, above the El Paso Gage, are and should continue to be measured and accounted for as the Texas share of Project diversions at Mesilla Dam (which serves lands in both the Texas and New Mexico Districts), consistent with historical practices. No specific Project Accounting for irrigation well pumping in the Texas Mesilla is

required, given that irrigation well pumping necessary to support Project lands is part of the EEPI Baseline, and is consistent with EEPI performance.

- f) The method by which the Project accounts for agricultural water use in the Texas Mesilla is slightly different than the method by which the EEPI is adjusted for agricultural water use in the Texas Mesilla. Project Accounting deals with the diversion of water, while the EEPI deals with the depletion of water above the El Paso Gage. This difference in calculation is necessary to ensure that the Texas District continues to be fairly charged for diversions in the Texas Mesilla consistent with historical practices, while the EEPI Index Delivery is adjusted for depletions in the Texas Mesilla.
- g) **Texas Mesilla DDMI Impacts:** The Texas District must be charged in Project Accounting for all depletions to the Rio Grande and Project Supply that occur above the El Paso Gage caused by DDMI water use in the Texas Mesilla. The calculation of DDMI depletions above the El Paso Gage may include consideration of (or credit for) return flows above the El Paso Gage, but not of return flows that reach the Rio Grande below the El Paso Gage. Credit for return flows reaching the Rio Grande below the El Paso Gage may only be taken into account in this calculation if the use of these return flows in the El Paso Valley is explicitly charged to the Texas District.
- h) If the Texas District is properly charged for the impact of DDMI pumping in the Texas Mesilla as provided for in the Consent Decree, then this pumping will not have any negative impacts on the delivery of New Mexico's apportioned share of water, and resolves these issues as detailed in my expert reports relating to the Canutillo Well Field.
- i) My review and analysis of the Project operations and EEPI methodology show that if Project Allocation and Accounting are made generally consistent with Index Obligation

calculation and Index Delivery accounting, as described above, some discrepancies between Project Accounting and Index Delivery accounting will remain.

- i) Calculation of the Project Accounting charges associated with Texas water use in the Texas Mesilla will not be exactly equal to the EEPI term associated with Texas water use in the Texas Mesilla. This difference between the two is on the order of 10,000 acre-feet per year, and will tend to reduce positive Index Departures and increase negative Index Departures.
- ii) Project Accounting only includes deliveries and depletions during the Caballo Release Period. Index Deliveries, however, include deliveries and depletions during the entire calendar year. At present, the flows at the El Paso Gage outside of the Caballo Release Period are relatively small (5,000 acre-feet to 10,000 acre-feet annually). This discrepancy between Index Deliveries and Project Accounting will have an impact on Index Departures, tending to reduce negative Index Departures and increase positive Index Departures. If the flows at the El Paso Gage outside of the Caballo Release Period cause significant positive departure, that may be remedied by the Allocation Transfers that occur when positive Accrued Departures exceed the Trigger of 30,000 acre-feet, which will transfer allocation to New Mexico to address this issue. If off-season flows at the El Paso Gage increase substantially, it may be necessary to modify Project Allocation methods in order to avoid such perpetual Allocation Transfers.
- j) Discrepancies between Project Accounting and determination of Index Deliveries may generate some amount of Index Departure. However, the EEPI methodology as described

in the Consent Decree provides mechanisms to address such Index Departures in the Trigger and Allocation Transfer provisions.

Project Carryover

- 41) One of the differences between Project operations during the baseline D2 Period and current Project Allocation and operations is the recent addition of Project Carryover. Since 2006, each District maintains a Project Carryover Account, in which part of its end-of-season Allocation Balance is saved as that District's Carryover Allocation in the following year, and such water is not available for Allocation to the other District. Project Carryover has the potential for interfering with the EEPI compliance; we have analyzed the issue and the Decree contains mechanisms to mitigate it. The Texas District may be allocated an amount of water consistent with the Index Obligation and may choose not to order part of its Allocation but instead put that unused Allocation into its Carryover Account; that water will not be released from Project Storage and will not reach the El Paso Gage. This in turn will result in New Mexico being delivered a larger proportion and Texas a smaller proportion of the Caballo Release. My own analysis of this issue, and analysis by Greg Sullivan that I have reviewed, indicate that in such a case a negative Annual Index Departure is likely to result. This negative Index Departure may be mitigated when the Texas District orders and receives that Carryover Allocation, but could result in exceedance of Trigger levels or exceedance of the Negative Departure Limit before such mitigation occurs.
- 42) Project Carryover can be beneficial to the Texas and New Mexico Districts, and Project water users, in that it provides an incentive for water conservation and can provide stability to water supply from one year to the next. The Consent Decree allows for Project Carryover to continue, provided that Project Carryover is undertaken in a manner so as to “not interfere

with Texas and New Mexico rights and entitlements defined in the Compact and this Decree,” including the performance of the EEPI. The Consent Decree includes a number of provisions that will mitigate interference by Project Carryover in the performance of the EEPI, such as:

- a) Project Carryover Allocations must continue to be limited in amount.
- b) Project Carryover Allocations must be adjusted for evaporation.
- c) Project Carryover Allocations must be adjusted to reflect changes in Project performance between the years in which that Carryover was accrued (that is, the year in which the end-of-season Allocation Balance was accumulated) and the year in which the Carryover Allocation is ordered and received.
- d) In the case that the Texas District has large amounts of Carryover Allocation over several years, such that Texas District’s Allocation Balance averaged over three years exceeds 180,000 acre-feet, any negative Accrued Index Departure is extinguished [Decree, II.C.3.c]. The purpose of this provision is to mitigate the effects of large amounts of Carryover Allocation on Accrued Index Departures. Furthermore, if the Texas District has such a large amount of Carryover Allocation for such a long period, it is clear that Texas water users are not being deprived of water by any action of New Mexico’s, and therefore it is appropriate to absolve New Mexico of its current negative Accrued Index Departure.
- e) The impact of the Texas District’s Carryover Allocation must be considered when the negative Accrued Index Departure has exceeded the limits set in the Consent Decree (120,000/150,000 acre-feet) [Decree III A, and Appendix 1]. One possible way to calculate this impact would be by making a comparison of the Index Obligation and

Index Delivery that would have occurred had the Texas District ordered that Carryover Allocation in the previous year.

- f) When determining whether New Mexico is out of compliance with the Consent Decree, the Carryover impact must be subtracted from the negative Accrued Index Departure. It is my opinion that this is a reasonable and necessary consideration, and if it is not applied, it is possible that New Mexico would be held responsible for under-deliveries to Texas under the EEPI at a time when Texas water users had access to, through their Project Carryover Allocation, enough water to remedy New Mexico's under-deliveries, but had declined to take that water.
 - g) In my professional opinion, these provisions of the Consent Decree largely mitigate the impact of Carryover on the performance of the EEPI and generally protect New Mexico from adverse effects of Carryover by the Texas District, and may have the added benefit of discouraging the Texas District from locking up large amounts of Carryover for multiple years.
- 43) Based on my evaluation and analysis of the EEPI methodology, it is my opinion that the EEPI provides a workable and comprehensive system for ensuring that both New Mexico and Texas have fair access to the water apportioned to them by the Rio Grande Compact.

I declare under penalty of perjury under the laws of the United States of America that the foregoing is true and correct. Executed this 14th day of November, 2022, at Santa Fe, New Mexico.

/s/ Margaret Barroll, Ph.D.
Margaret Barroll, Ph.D.

Margaret (Peggy) Barroll, Ph.D.

Senior Water Resource Hydrologist

Professional Resume

Peggy Barroll
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Education:

Ph.D. Geophysics, with concentration in groundwater hydrology, 1989, New Mexico Tech, Socorro, New Mexico. Dissertation: "Analysis of the Socorro Hydrothermal System, Central New Mexico"

M.S. Geophysics, 1984, New Mexico Tech, Socorro, New Mexico

B.A. Physics, Honors, 1980, Swarthmore College, Swarthmore Pennsylvania

Award: 2020 New Mexico Earth Sciences Achievement Award

Employment:

2020-Current: Principle: Peggy Barroll, Water Resources Consultant

Fall 2017 -2019: Balleau Groundwater Inc. and West Consultants Inc. -- Senior Water Resource Hydrologist

1991 – 2017: New Mexico Office of the State Engineer -- Senior Water Resource Hydrologist

1988-1991: D.B. Stephens and Associates -- Hydrologist (part-time)

Relevant Expertise:

1) Computer model development and effective model use for scientific evaluation of hydrogeologic systems

- a. New Mexico Administration: Lower Rio Grande Basin
 - i. Principal scientist in the development of multiple MODFLOW groundwater models for the Lower Rio Grande (LRG) aquifers
 1. Development of farm budgets and groundwater pumping inputs for these groundwater models
 2. Committee member of modeling experts for 2007 LRG Groundwater Model
 - ii. Completed in depth analysis of irrigation water demand and water use through
 1. Analysis of well meter data
 2. Calculation of irrigation well pumping for periods prior to well metering
 - iii. Provided hydrogeologic consultation to developers of models to simulate Rio Grande Project operations
 - iv. Provided hydrogeologic consultation to developers of salinity models

- v. Created compilations of hydrologic data: groundwater pumping, groundwater levels, surface water flows, etc.
- vi. Testifying Expert in the Consumptive Irrigation Requirement Determination in the Lower Rio Grande adjudication
 - 1. Prepared technical exhibits for Adjudication Court related to irrigation water use
- b. New Mexico Administrative Middle Rio Grande Basin
 - i. Principal scientist in the revision of the pre-existing USGS Middle Rio Grande groundwater MODFLOW model for determination of impairment in Office of the State Engineer (OSE) water right application proceedings
 - ii. Collaborated with the United States Geological Survey (USGS) in development of updated groundwater MODFLOW model of Middle Rio Grande Basin
- c. Taos Valley
 - i. Principal scientist for the OSE in the development and refinement of the Taos Valley MODFLOW groundwater model
 - ii. Collaborated with multi-agency Technical Committee (Federal, State and local representatives) on the creation and calibration of the Taos Valley MODFLOW groundwater model and associated processing tools
 - iii. Technically sound consultation and work product for assistance in the Taos adjudication settlement negotiations
- d. Pecos River Basin
 - i. Principal scientist for the OSE in the development, calibration, application and update of the Carlsbad Area Groundwater MODFLOW model and associated creation of preprocessing software necessary to initiate model runs
 - ii. Senior scientist for the OSE collaborating in the development, application and update of the Roswell-Artesian Basin Groundwater MODFLOW model
 - iii. Senior scientist for the OSE collaborating in the development of RiverWare model of the Pecos River
 - iv. Senior scientist for the OSE in the development, support and technical management the Pecos Decision Support System (PDSS). The PDSS is comprised of four independent models, the Carlsbad Area Groundwater MODFLOW model, the Roswell-Artesian Basin Groundwater MODFLOW model, the Pecos River RiverWare Model, and a water balance model of the Pecos River from Carlsbad, NM to the New Mexico-Texas state line. The PDSS was developed to inform negotiators of the Pecos River Settlement Agreement of the impacts of various proposals for New Mexico's compliance with the United States Supreme Court's Amended Decree from Original Action No. 65

2) Groundwater resources development, management and protection

- a. Lower Rio Grande
 - i. Analysis of Rio Grande Project Operations, historical and present, within New Mexico and Texas

- ii. Utilized the application of models to provide the SE information on historic and proposed Lower Rio Grande water management issues
 - iii. Provided technically sound consultation and work product in the development of administrative guidelines, and proposed rules for the Lower Rio Grande within the OSE's jurisdiction
 - iv. As the Principal scientist, provided technical evaluation and input on District Specific Rules developed under the OSE's framework rule set for the State of New Mexico's Active Water Resource Management
 - v. Engaged with stakeholders from the Lower Rio Grande region on the development of rules for alternative administration of water rights in the OSE's jurisdiction and provided multiple presentations on the 2008 Operating Agreement and associated Operations Manuals
- b. Middle Rio Grande
 - i. Development of State Engineer Water Right Application Guidelines for the Middle Rio Grande Administrative area
 - ii. Guideline technical basis stemmed from groundwater water modeling
 - iii. Determined Critical Management Areas where groundwater pumping is constrained to ensure limits of aquifer drawdown
- c. Miscellaneous assignments as Principal scientist for New Mexico Office of the State Engineer
 - i. Hydrologic assessments for pending water right applications.
 - ii. Hydrologic assessments for adjudications, subdivision water availability determinations
 - iii. Technically sound consultation and work product for SE consideration in water resource management and supervision
 - iv. Technically sound consultation and work product for the Office of the State Engineer litigation activities, including interrogatory questions and responses, technical memoranda, exhibits and expert reports, written and oral testimony