**IN THE OFFICE OF THE STATE ENGINEER**

**OF THE STATE OF NEVADA**

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| **IN THE MATTER OF APPLICATIONS 54003 THROUGH 54021, INCLUSIVE, FILED TO APPROPRIATE THE UNDERGROUND WATERS OF THE SPRING VALLEY HYDROGRAPHIC BASIN (184) SITUATED IN LINCOLN AND WHITE PINE COUNTY, NEVADA** | **)<br>)<br>)<br>)<br>)<br>)<br>)<br>)** | **SOUTHERN NEVADA WATER AUTHORITY'S PROPOSED SPRING VALLEY RULING** |

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## GENERAL

## I. DESCRIPTION OF APPLICATIONS

Application 54003 was filed on October 17, 1989, by the Las Vegas Valley Water District to appropriate 6 cubic feet per second ("cfs") of underground water from the Spring Valley Hydrographic Basin for municipal and domestic purposes within Clark, Lincoln, Nye and White Pine Counties as more specifically described and defined in Nevada Revised Statutes (NRS) 243.210-243.225 (Lincoln), 243.275-243.315 (Nye), 243.365-243.385 (White Pine), and 243.035-243.040 (Clark). The proposed point of diversion is described as being located within the NW1/4 NE1/4 of Section 20, T.8N., R.68E., M.D.B.&M, within Lincoln County.[1]

Application 54004 was filed on October 17, 1989, by the Las Vegas Valley Water District to appropriate 6 cfs of underground water from the Spring Valley Hydrographic Basin for municipal and domestic purposes within Clark, Lincoln, Nye and White Pine Counties as more specifically described and defined in Nevada Revised Statutes (NRS) 243.210-243.225 (Lincoln), 243.275-243.315 (Nye), 243.365-243.385 (White Pine), and 243.035-243.040 (Clark). The proposed point of diversion is described as being located within the NE1/4 SE1/4 of Section 25, T.9N., R.67E., M.D.B.&M, within Lincoln County.[2]

Application 54005 was filed on October 17, 1989, by the Las Vegas Valley Water District to appropriate 6 cfs of underground water from the Spring Valley Hydrographic Basin for municipal and domestic purposes within Clark, Lincoln, Nye and White Pine Counties as more specifically described and defined in Nevada Revised Statutes (NRS) 243.210-243.225 (Lincoln), 243.275-243.315 (Nye), 243.365-243.385 (White Pine), and 243.035-243.040 (Clark).

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[1] Exhibit No. SE_003.
[2] Exhibit No. SE_004.

The proposed point of diversion is described as being located within the NE1/4 NE1/4 of Section 14, T.9N., R.67E., M.D.B.&M, within Lincoln County.[3]

Application 54006 was filed on October 17, 1989, by the Las Vegas Valley Water District to appropriate 6 cfs of underground water from the Spring Valley Hydrographic Basin for municipal and domestic purposes within Clark, Lincoln, Nye and White Pine Counties as more specifically described and defined in Nevada Revised Statutes (NRS) 243.210-243.225 (Lincoln), 243.275-243.315 (Nye), 243.365-243.385 (White Pine), and 243.035-243.040 (Clark). The proposed point of diversion is described as being located within the SE1/4 SE1/4 of Section 22, T.10N., R.67E., M.D.B.&M, within White Pine County.[4]

Application 54007 was filed on October 17, 1989, by the Las Vegas Valley Water District to appropriate 6 cfs of underground water from the Spring Valley Hydrographic Basin for municipal and domestic purposes within Clark, Lincoln, Nye and White Pine Counties as more specifically described and defined in Nevada Revised Statutes (NRS) 243.210-243.225 (Lincoln), 243.275-243.315 (Nye), 243.365-243.385 (White Pine), and 243.035-243.040 (Clark). The proposed point of diversion is described as being located within the SE1/4 NW1/4 of Section 34, T.11N., R.66E., M.D.B.&M, within White Pine County.[5]

Application 54008 was filed on October 17, 1989, by the Las Vegas Valley Water District to appropriate 6 cfs of underground water from the Spring Valley Hydrographic Basin for municipal and domestic purposes within Clark, Lincoln, Nye and White Pine Counties as more specifically described and defined in Nevada Revised Statutes (NRS) 243.210-243.225 (Lincoln), 243.275-243.315 (Nye), 243.365-243.385 (White Pine), and 243.035-243.040 (Clark).

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[3] Exhibit No. SE_005.
[4] Exhibit No. SE_006.
[5] Exhibit No. SE_007.

The proposed point of diversion is described as being located within the SW1/4 SW1/4 of Section 1, T.11N., R.66E., M.D.B.&M, within White Pine County.[6]

Application 54009 was filed on October 17, 1989, by the Las Vegas Valley Water District to appropriate 6 cfs of underground water from the Spring Valley Hydrographic Basin for municipal and domestic purposes within Clark, Lincoln, Nye and White Pine Counties as more specifically described and defined in Nevada Revised Statutes (NRS) 243.210-243.225 (Lincoln), 243.275-243.315 (Nye), 243.365-243.385 (White Pine), and 243.035-243.040 (Clark). The proposed point of diversion is described as being located within the NW1/4 NE1/4 of Section 36, T.13N., R.66E., M.D.B.&M, within White Pine County.[7]

Application 54010 was filed on October 17, 1989, by the Las Vegas Valley Water District to appropriate 6 cfs of underground water from the Spring Valley Hydrographic Basin for municipal and domestic purposes within Clark, Lincoln, Nye and White Pine Counties as more specifically described and defined in Nevada Revised Statutes (NRS) 243.210-243.225 (Lincoln), 243.275-243.315 (Nye), 243.365-243.385 (White Pine), and 243.035-243.040 (Clark). The proposed point of diversion is described as being located within the SE1/4 SE1/4 of Section 25, T.14N., R.66E., M.D.B.&M, within White Pine County.[8]

Application 54011 was filed on October 17, 1989, by the Las Vegas Valley Water District to appropriate 6 cfs of underground water from the Spring Valley Hydrographic Basin for municipal and domestic purposes within Clark, Lincoln, Nye and White Pine Counties as more specifically described and defined in Nevada Revised Statutes (NRS) 243.210-243.225 (Lincoln), 243.275-243.315 (Nye), 243.365-243.385 (White Pine), and 243.035-243.040 (Clark).

[6] Exhibit No. SE_008.
[7] Exhibit No. SE_009.
[8] Exhibit No. SE_010.

The proposed point of diversion is described as being located within the NE1/4 SE1/4 of Section 14, T.14N., R.66E., M.D.B.&M, within White Pine County.[9]

Application 54012 was filed on October 17, 1989, by the Las Vegas Valley Water District to appropriate 6 cfs of underground water from the Spring Valley Hydrographic Basin for municipal and domestic purposes within Clark, Lincoln, Nye and White Pine Counties as more specifically described and defined in Nevada Revised Statutes (NRS) 243.210-243.225 (Lincoln), 243.275-243.315 (Nye), 243.365-243.385 (White Pine), and 243.035-243.040 (Clark). The proposed point of diversion is described as being located within the SE1/4 NE1/4 of Section 16, T.14N., R.67E., M.D.B.&M, within White Pine County.[10]

Application 54013 was filed on October 17, 1989, by the Las Vegas Valley Water District to appropriate 6 cfs of underground water from the Spring Valley Hydrographic Basin for municipal and domestic purposes within Clark, Lincoln, Nye and White Pine Counties as more specifically described and defined in Nevada Revised Statutes (NRS) 243.210-243.225 (Lincoln), 243.275-243.315 (Nye), 243.365-243.385 (White Pine), and 243.035-243.040 (Clark). The proposed point of diversion is described as being located within the SW1/4 SW1/4 of Section 25, T.15N., R.66E., M.D.B.&M, within White Pine County.[11]

Application 54014 was filed on October 17, 1989, by the Las Vegas Valley Water District to appropriate 6 cfs of underground water from the Spring Valley Hydrographic Basin for municipal and domestic purposes within Clark, Lincoln, Nye and White Pine Counties as more specifically described and defined in Nevada Revised Statutes (NRS) 243.210-243.225 (Lincoln), 243.275-243.315 (Nye), 243.365-243.385 (White Pine), and 243.035-243.040 (Clark).

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[9] Exhibit No. SE_011.
[10] Exhibit No. SE_012.
[11] Exhibit No. SE_013.

The proposed point of diversion is described as being located within the SW1/4 SW1/4 of Section 15, T.15N., R.67E., M.D.B.&M, within White Pine County.[12]

Application 54015 was filed on October 17, 1989, by the Las Vegas Valley Water District to appropriate 6 cfs of underground water from the Spring Valley Hydrographic Basin for municipal and domestic purposes within Clark, Lincoln, Nye and White Pine Counties as more specifically described and defined in Nevada Revised Statutes (NRS) 243.210-243.225 (Lincoln), 243.275-243.315 (Nye), 243.365-243.385 (White Pine), and 243.035-243.040 (Clark). The proposed point of diversion is described as being located within the SW1/4 NW1/4 of Section 14, T.15N., R.67E., M.D.B.&M, within White Pine County.[13]

Application 54016 was filed on October 17, 1989, by the Las Vegas Valley Water District to appropriate 6 cfs of underground water from the Spring Valley Hydrographic Basin for municipal and domestic purposes within Clark, Lincoln, Nye and White Pine Counties as more specifically described and defined in Nevada Revised Statutes (NRS) 243.210-243.225 (Lincoln), 243.275-243.315 (Nye), 243.365-243.385 (White Pine), and 243.035-243.040 (Clark). The proposed point of diversion is described as being located within the NE1/4 SW1/4 of Section 7, T.15N., R.67E., M.D.B.&M, within White Pine County.[14]

Application 54017 was filed on October 17, 1989, by the Las Vegas Valley Water District to appropriate 6 cfs of underground water from the Spring Valley Hydrographic Basin for municipal and domestic purposes within Clark, Lincoln, Nye and White Pine Counties as more specifically described and defined in Nevada Revised Statutes (NRS) 243.210-243.225 (Lincoln), 243.275-243.315 (Nye), 243.365-243.385 (White Pine), and 243.035-243.040 (Clark).

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[12] Exhibit No. SE_014.
[13] Exhibit No. SE_015.
[14] Exhibit No. SE_016.

The proposed point of diversion is described as being located within the NW1/4 SE1/4 of Section 25, T.16N., R.66E., M.D.B.&M, within White Pine County.[15]

Application 54018 was filed on October 17, 1989, by the Las Vegas Valley Water District to appropriate 6 cfs of underground water from the Spring Valley Hydrographic Basin for municipal and domestic purposes within Clark, Lincoln, Nye and White Pine Counties as more specifically described and defined in Nevada Revised Statutes (NRS) 243.210-243.225 (Lincoln), 243.275-243.315 (Nye), 243.365-243.385 (White Pine), and 243.035-243.040 (Clark). The proposed point of diversion is described as being located within the SE1/4 NE1/4 of Section 24, T.16N., R.66E., M.D.B.&M, within White Pine County.[16]

Application 54019 was filed on October 17, 1989, by the Las Vegas Valley Water District to appropriate 10 cfs of underground water from the Spring Valley Hydrographic Basin for municipal and domestic purposes within Clark, Lincoln, Nye and White Pine Counties as more specifically described and defined in Nevada Revised Statutes (NRS) 243.210-243.225 (Lincoln), 243.275-243.315 (Nye), 243.365-243.385 (White Pine), and 243.035-243.040 (Clark). The proposed point of diversion is described as being located within the SW1/4 NE1/4 of Section 32, T.12N., R.68E., M.D.B.&M, within White Pine County.[17]

Application 54020 was filed on October 17, 1989, by the Las Vegas Valley Water District to appropriate 10 cfs of underground water from the Spring Valley Hydrographic Basin for municipal and domestic purposes within Clark, Lincoln, Nye and White Pine Counties as more specifically described and defined in Nevada Revised Statutes (NRS) 243.210-243.225 (Lincoln), 243.275-243.315 (Nye), 243.365-243.385 (White Pine), and 243.035-243.040 (Clark).

[15] Exhibit No. SE_017.
[16] Exhibit No. SE_018.
[17] Exhibit No. SE_019.

The proposed point of diversion is described as being located within the SE1/4 SE1/4 of Section 14, T.14N., R.67E., M.D.B.&M, within White Pine County.[18]

Application 54021 was filed on October 17, 1989, by the Las Vegas Valley Water District to appropriate 10 cfs of underground water from the Spring Valley Hydrographic Basin for municipal and domestic purposes within Clark, Lincoln, Nye and White Pine Counties as more specifically described and defined in Nevada Revised Statutes (NRS) 243.210-243.225 (Lincoln), 243.275-243.315 (Nye), 243.365-243.385 (White Pine), and 243.035-243.040 (Clark). The proposed point of diversion is described as being located within the SW1/4 NE1/4 of Section 33, T.16N., R.66E., M.D.B.&M, within White Pine County.[19]

Additionally in Item 12, the remarks section of the Applications, the Applicant indicates that the water sought under the Applications shall be placed to beneficial use within the Las Vegas Valley Water District ("LVVWD") service area as set forth in Chapter 752, Statutes of Nevada 1989, or as may be amended. The Applicant also indicates that the water may be served to and beneficially used by lawful users within Clark, Lincoln, Nye and White Pine Counties, and that water would be commingled with other water rights owned or served by the Applicant or its designee.

By letter dated March 22, 1990, the Applicant further indicated, in reference to Item 12, that the approximate number of persons to be served is 800,000 in addition to the then-current service population of approximately 618,000 persons, that the Applications seek all the unappropriated water within the particular groundwater basins in which the water rights are sought and that the projected population of the Clark County service area at the time of the 1990

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[18] Exhibit No. SE_020.
[19] Exhibit No. SE_021.

letter was estimated to be 1,400,000 persons by the year 2020.[20] The Applicant submitted evidence at the hearing that by the year 2028, approximately 3,374,000 people in southern Nevada will be the recipients of the water sought in Applications 54003 – 54021 (the "Applications").[21]

The Applications were originally filed by the LVVWD and are now held by the Southern Nevada Water Authority ("SNWA" or "Applicant").[22]

## II. PROCEDURAL HISTORY

Many persons and entities protested the Applications during the original protest period, which ended in July, 1990. On January 5, 2006, the State Engineer held a pre-hearing conference to discuss issues related to hearings on the Applications. In the notice of the pre-hearing conference, the State Engineer asked Protestants to declare their intent to formally participate in the pre-hearing conference and future administrative hearings.[23]

At the pre-hearing conference, some of the Protestants requested that the State Engineer re-publish notice of the Applications and re-open the period for filing of protests. By an order dated March 8, 2006, the State Engineer denied the request, noting that the Nevada Revised Statutes did not authorize him to re-publish notice of the Applications and re-open the period for filing of protests. The State Engineer also found that protests do not run to any successor.[24] The

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[20] Administrative Records of the Nevada Division of Water Resources, Water Rights Files for each Application.
[21] Exhibit Nos. SNWA_189, p. 5-4; SNWA_209, p. 64; SNWA_215, p. vi.
[22] Administrative Records of the Nevada Division of Water Resources, Water Rights Files for each Application.
[23] *In re Applications 53987-53992 & 54003-54030*, State Engineer Intermediate Order & Hearing Notice, p. 1 (March 8, 2006).
[24] *In re Applications 53987-53992 & 54003-54030*, State Engineer Intermediate Order & Hearing Notice, p. 7 (March 8, 2006).

State Engineer scheduled a hearing on the Spring Valley applications to begin on September 11, 2006.[25]

On or around July 6, 2006, several of the Protestants petitioned for a declaratory order to re-publish notice of the Applications and re-open the period for filing of protests.[26] On July 27, 2006, the State Engineer issued an intermediate order stating that he would not reconsider the request to re-publish notice of the Applications and re-open the period for filing of protests.[27]

On or around September 8, 2006, the Applicant and four bureaus of the U.S. Department of Interior (National Park Service, Fish and Wildlife Service, Bureau of Land Management, and Bureau of Indian Affairs) entered into a stipulation by which the bureaus agreed to withdraw their protests against the Spring Valley applications in exchange for, among other things, implementation of monitoring, management, and mitigation plans.[28]

The State Engineer held hearings on the Spring Valley applications from September 11, 2006 to September 29, 2006. On April 16, 2007, the State Engineer issued a ruling rejecting Applications 54016, 54017, 54018, and 54021 and approving Applications 54003, 54004, 54005, 54006, 54007, 54008, 54009, 54010, 54011, 54012, 54013, 54014, 54015, 54019, and 54020 subject to monitoring and mitigation requirements and staged pumping limitations.[29]

On August 22, 2006, some of the Protestants filed a petition for judicial review of the State Engineer's denial of their request to re-publish notice of the Applications and re-open the

[25] *In re Applications 53987-53992 & 54003-54030*, State Engineer Intermediate Order & Hearing Notice, p. 11 (March 8, 2006).
[26] *In re Applications 53987-53992 & 54003-54030*, Protestants' Pet. for Decl. Order (July 6, 2006).
[27] *In re Applications 54003-54021*, State Engineer Intermediate Order No. 3, p. 2. (July 27, 2006).
[28] Exhibit No. SE_041.
[29] State Engineer Ruling No. 5726, p. 56 (April 16, 2007).

period for filing of protests in the Seventh Judicial District Court of the State of Nevada.[30] On May 30, 2007, the district court held, inter alia, that the State Engineer had given all the notice and time to file protests that the statutes required and that the denial of the request to re-publish and re-open the protest period did not violate due process and denied the petition for judicial review.[31]

Those Protestants appealed the district court's order to the Supreme Court of Nevada. The Supreme Court held that the State Engineer had violated his duty to act on the Applications within one year under Section 533.370 of the Nevada Revised Statutes and that a 2003 amendment that would provide an exception for the one year deadline did not apply to the Applications.[32] The Supreme Court reversed the district court's order and remanded to the district court to develop a proper remedy with respect to whether the Applicant must file new applications or the State Engineer must re-notice the Applications and re-open the protest period.[33]

On June 17, 2010, the Supreme Court granted, in part, the Applicant's and State Engineer's request for rehearing.[34] The Supreme Court withdrew its prior opinion and issued a new opinion in its place to clarify the scope of its opinion with respect to protested applications and the proper remedy.[35] The Supreme Court concluded that "the proper and most equitable remedy is that the State Engineer must re-notice the applications and reopen the protest period"

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[30] *Great Basin Water Network v. Taylor*, No. CV 0608119, Pet. for Judicial Review (7th Judicial Dist. Ct. Nev. Aug. 22, 2006).
[31] *Great Basin Water Network v. Taylor*, No. CV 0608119, Order 9-12 (7th Judicial Dist. Ct. Nev. May 30, 2007).
[32] *Great Basin Water Network v. Taylor*, 126 Nev. Adv. Op. 2, 222 P.3d 665, 670-72 (2010), *withdrawn and superseded by* 126 Nev. Adv. Op. 20, 234 P.3d 912 (2010).
[33] *Great Basin Water Network v. Taylor*, 126 Nev. Adv. Op. 2, 222 P.3d 665, 672 (2010), *withdrawn and superseded by* 126 Nev. Adv. Op. 20, 234 P.3d 912 (2010).
[34] *Great Basin Water Network v. Taylor*, 126 Nev. Adv. Op. 20, 234 P.3d 912, 913 (2010).
[35] *Great Basin Water Network v. Taylor*, 126 Nev. Adv. Op. 20, 234 P.3d 912, 913-14 (2010).

and remanded the matter to district court with instructions to remand it to the State Engineer for further proceedings.[36]

On remand, Applications 54003 - 54005 were sent for re-publication in the Lincoln County Record on January 26, 2011 and last published on February 24, 2011. On March 26, 2011, the protest period ended and Applications 54003 - 54005 became ready for action. Applications 54006 – 54021 were sent for re-publication in the Ely Times on January 26, 2011 and last published on February 25, 2011. On March 27, 2011, the protest period ended and Applications 54006 – 54021 became ready for action. On April 1, 2011, the State Engineer issued a notice setting a hearing to begin on September 26, 2011, and scheduling a pre-hearing conference for May 11, 2011.[37] The State Engineer ordered that successors in interest to water rights or domestic wells may pursue their predecessors' protests by filing a form with State Engineer by April 29, 2011.[38] The State Engineer further ordered that Protestants wishing to put on a case in chief notify the State Engineer by April 29, 2011.[39] The State Engineer ordered that an initial evidentiary exchange take place no later than July 1, 2011, and that a second, rebuttal evidentiary exchange take place no later than August 26, 2011.[40] The State Engineer scheduled oral public comment to take place on October 7, 2011, and ordered that written public comment must be submitted by December 2, 2011.[41]

After the pre-hearing conference, the State Engineer issued several procedural orders. The State Engineer ordered that parties must identify exhibits from the prior hearings that they

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[36] *Great Basin Water Network v. Taylor*, 126 Nev. Adv. Op. 20, 234 P.3d 912, 920 (2010).
[37] Exhibit No. SE_001, pp. 1, 3.
[38] Exhibit No. SE_001, p. 1.
[39] Exhibit No. SE_001, p. 3.
[40] Exhibit No. SE_001, p. 4.
[41] Exhibit No. SE_001, p. 5.

wish to use in this hearing, but need not exchange copies of the prior exhibits.[42] The State Engineer further ordered that pre-hearing motions must be served by September 2, 2011 and responses must be served by September 14, 2011.[43] The State Engineer allowed the parties to file written opening statements by September 19, 2011.[44] The State Engineer allowed the parties to file written closing briefs by December 23, 2011, and to file proposed rulings by January 27, 2012.[45] The State Engineer also set the hearing schedule and format for exhibits.

The State Engineer held a hearing on the Spring, Cave, Dry Lake, and Delamar valleys applications between September 26, 2011, until November 18, 2011.

## III. LIST OF PROTESTANTS

Applications 54003-54021 were originally published in 1990, and many protests were filed. The Applications were published again in 2011 and a second round of protests and updated protests were filed. Many persons or entities protested Applications 54003-54021; however, not every person protested every application. The Applications were protested by the following persons as identified below:

In 1990 one or more of Applications 54003-54021 were protested by: Abigail C. Johnson; Alton C. Leavitt; Amelia Sonnenberg; Art Kinder; Barlow White; Barry C. Isom; Bath Lumber Co.; Beatrice D. Mathis; Beverly R. Gaffin; Bidart Brothers; Bob Nichols; Bonnie J. Higdon; Boundy & Forman, Inc.; Bruce Ashby; Bruce Pencek; Bunny R. Hill; Candi Tweedy; Carter L. Perkins; Charlene R. Holt; Christine Hermansen; Chuck Marques; Cindy Cracraft; Citizen Alert; Clarence S. Prestwich; Clive Sprouse; Connie K. Stasiak; Cory Carson; Daniel

[42] Exhibit No. SE_100, p. 3.
[43] Exhibit No. SE_100, p. 5.
[44] Exhibit No. SE_100, p. 6.
[45] Exhibit No. SE_100, p. 7.

Maes; Daniel Weaver; Danny Cracraft; Danny E. Griffith; David Eldridge; Dean G. Neubauer; Debbie Rollinson; Delbert D. Eldridge; Dennis H. Eldridge; Dennis Mangum; Dewey E. Carson; Diana Barkley Crane; Diana Smith; Dolores A. Arnold; Don Cooper; Donald R. Carrick; Donald Terry Fackrell; Donna A. Nye; Donna Bath; Dr. Dan A. Love; Duane Reed; E. Unit; NV Cattlemens Assoc.; Edith Jean Hill; Edna Oxborrow; El Tejon Cattle Company; Elva J. Eldridge; Ely Shoshone Tribe; Evan R. Barton; Frances Murrajo; Fred Baca and John Theissen; Freddy Van Camp; Garland N. Hollingshead; George Eldridge & Sons, Inc.; Glen W. Harper; Gordon D. Eldridge; Harry James Hill; Helen Eldridge; Helen Hackett; Helen O'Connor; Irene Spaulding; Mildred Valencia successor to Irvin Baker Edwards; Jack Van Camp; James H. Bath; James I. Lee; James R. Fraser; Janell Ahlvers; Janet K. Neubauer; Jess Hiatt; Jim and Betty Nichols; Joan F. Hanson; John A. and Vivian A. Havens; John Barney; John G. Tryon; John M. Wadsworth; John Perondi; John R. McKay; Joseph I. Anderson; Joseph M. Boland; Juan M. Escobedo; Karen L. Prestwich; Karen Sprouse (now Karen Sprouse Bevis); Karma H. Hollingshead; Katherine A. Rountree; Kay Carson; Keith M. Anderson; Kelly Wiedmeyer; Kirkeby Ranch; Kristine P. Kaiser (now Fillman); Lance Burns; Larry Shew; Las Vegas Fly Fishing Club; Laurel Ann Mills; Lee Jensen; Lenora McMurray; Linda H. Isom; Linda Palczewski; Lois Weaver; Lory M. Free; Lyle Norcross; Marcia Forman; Margaret H. Jones; Margaret Rowe; Marietta Carson; Mark Schroeder; Marsha Lynn Sanders; Mary Collins; Mary Ellen Anderson; Mary Goeringer; Mary Goeringer; Mary Mosley; Mary R. Eldridge; Max Hannig; Merle C. Hill; Mildred L. Stevens; Monte Hansen; Moriah Ranches, Inc.; Nancy J. Eldridge; Nancy Overson; Neva Bida; NV Farm Bureau Federation; Nye County, Nevada; Panaca Irrigation Co.; Patricia Williams; Paula Williams; Pioche Town Board; Randy A. Weaver; Randy J. Heinfer; Richard W. Forman; Richie Forman; Rick Havenstrite; Robert L. and

Fern A. Harbecke; Robert N. Marcum; Roy Theiss; Rudolph E. Krause; Rutherford Day; Sally Gust; Sarah G. Bishop; Sarah Locke; Selena M. Forman; Selena Weaver; Sherlyn K. Fackrell; Sportsworld; Steve Collard; Tara Cutler; The City of Caliente; The Unincorp. Town Of Pahrump; Thomas R. Wiedmeyer; Tonya K. Tomlinson; Virginia B. Terry; Walter J. Benson; Wanda McKrosky; Wesley A. Holt; White Pine County & City of Ely; White Pine County Cowbelles; William R. Rountree; Jane Lindley; Lincoln County Board of Commissioners; Norman L. Lindley; Toiyabe Chapter Sierra Club; U. S. Fish & Wildlife Service; U.S. Bureau of Land Management; U.S. National Park Service;[46] and Moapa Band of Paiute Indians.[47]

In 2011 one or more of Applications 54003-54021 were protested by: 2nd Big Springs Irrigation Co.; Abigail Johnson (Amended Protest); Alyson Hammond; Baker GID; Baker Ranches Inc.; Border Inn LLC; Brandi Lewis; Cecelia D. Phillips; Christopher C. Wheeler; Citizen Education Project; Central Nevada Regional Water Authority; Col. James R Byrne; Confederated Tribes of the Goshute Reservation; Craig F. Baker; Darwin C. Wheeler; David H. Von Seggern; David Tilford; Dean Baker; Defenders of Wildlife; Douglas G. Smith; Duckwater Shoshone Tribe; Edith Tilford; Elko Band Council; Ely Shoshone Tribe; Eskdale Center; Gary and Jo Ann Perea; Geo Eldridge & Son Inc.; Govert Bassett; Great Basin Business & Tourism Council; Great Basin Water Network; Henry C. Vogler IV; Holly M. Wilson; Jeffrey C. Carlton; Jo Anne Garrett; John Gianoli; Julie Gianoli; John Hadder; Juab County, Utah; Kathleen M. Cole; Kathy C. Hiatt; Kodee Hiatt O’Connor; Las Vegas Fly Fishing Club (Amended Protest); League of Women Voters, Utah; Leland Rex Leonard; Linda Johnson; Lorena A. Stever; Louis Cole; Lund Irrigation and Water Co.; Mark E Rogers; Mary J. Feldman; Max and Diane

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[46] Exhibit Nos. SE_022 through SE_040.
[47] Administrative Records of the Nevada Division of Water Resources, Water Rights Files for Applications 54019-54021.

Chipman; Melissa Renfro; Millard County, Utah; Nevada Dept. of Wildlife; Orvan Maynard; Patrick Fillman; Pete T. Delmue; Peter Coroon; Preston Irrigation Co.; Richard A. Spilsbury; Richard and Lesley Sears; Richard Stever; Rob Mrowka; Robert and Sandra Benson; Roderick G. McKenzie; Rowena R. Leonard; Susan Rogers; Terrence Marasco; Terry and Debora Steadman; The Long Now Foundation; Thelma Matlin; Thomas D. Baker; Toiyabe Chapter of Sierra Club (Amended Protest); U.S. Department of Agriculture-Forest Service; Utah Audubon Council; Corporation of the Presiding Bishop of the Church of Jesus Christ of Latter-Day Saints, Utah; Walter Richard Benoit; White Pine County; and the City of Ely (Amended Protest).[48]

## IV. WITHDRAWN PROTESTS

Of the above listed protests, several were later withdrawn for various reasons. Pursuant to the Cooperative Agreement Among Lincoln County, the Southern Nevada Water Authority and the Las Vegas Valley Water District, the protests by Lincoln County Board of County Commissioners were withdrawn on July 15, 2003.[49] The protests by Moapa Band of Paiute Indians were withdrawn on April 11, 2006.[50] Pursuant to the Stipulation for Withdrawal of Protests dated September 8, 2006, the protests by U.S. Fish and Wildlife Service, Bureau of Land Management, Bureau of Indian Affairs, and the National Park Service, were withdrawn.[51] In response to the hearing questionnaire form sent out by the Nevada Division of Water Resources,

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[48] Exhibit Nos. SE_060 through SE_078.
[49] Administrative Records of the Nevada Division of Water Resources, *see* agreement dated April 17, 2003, and recorded June 19, 2003 under Document Number 120355 in the Official Records of the Lincoln County Recorder, Nevada, and as filed at the Office of the Nevada State Engineer on July 15, 2003 in the Water Rights files for the Applications.
[50] Administrative Record of the Nevada Division of Water Resources, Water Rights Files for Applications 54019-54021, *see* Moapa Band of Paiutes' Withdrawal of Protests Regarding Spring and Snake Valleys, dated April 11, 2006.
[51] Exhibit No. SE_041.

Jane Lindley indicated she would like to withdraw her protest.[52] Also, in response to the hearing questionnaire form sent out by the Nevada Division of Water Resources, Norman L. Lindley indicated he would like to withdraw his protest.[53] Pursuant to the Stipulation for Withdrawal of Protests dated September 15, 2011, the protests by the United States Department of Agriculture – Forest Service, were withdrawn on September 15, 2011.[54] The protests by Richard and Lesley Sears were also withdrawn.[55]

## V. PARTICIPATING PROTESTANTS

The Protestants that indicated an intent to participate at the hearing were: Confederated Tribes of the Goshute Reservation; Duckwater Shoshone Tribe; Ely Shoshone Tribe; The Long Now Foundation; Nye County, Nevada; Corporation of the Presiding Bishop of the Church of Jesus Christ of Latter-Day Saints, Utah; Eskdale Center; Millard County, Utah; Juab County, Utah; Henry Vogler, IV; Great Basin Water Network, et al (GBWN); County of White Pine and City of Ely (with GBWN); Defenders of Wildlife (with GBWN); Preston Irrigation (with GBWN); Toiyabe Chapter Sierra Club (with GBWN); Orvan Maynard (with GBWN); Great Basin Business and Tourism Council (with GBWN); Terrance and Debora Steadman (with GBWN); Utah Audubon Council (with GBWN); Govert Basset (with GBWN); Pete Delmue (with GBWN); Lund Irrigation and Water Co. (with GBWN); Roderick McKenzie (with GBWN); Patrick Fillman (with GBWN); Linda Johnson (with GBWN); Max & Diane Chipman (with GBWN); 2nd Big Springs Irrigation Co. (with GBWN); Dean Baker (with GBWN); Abigail Johnson (with GBWN); Baker GID (with GBWN); Border Inn, LLC (with GBWN);

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[52] Administrative Records of the Nevada Division of Water Resources, Water Rights File for Application 54007.
[53] Administrative Records of the Nevada Division of Water Resources, Water Rights File for Application 54006.
[54] Exhibit No. SE_095.
[55] Administrative Records of the Nevada Division of Water Resources, Water Rights Files for Applications 54019-54021.

Craig Baker (with GBWN); David Von Seggern (with GBWN); Amelia Sonnenberg (with GBWN); James & Donna Bath (with GBWN); Bath Lumber Company (with GBWN); JoAnne Garrett (with GBWN); Keith Anderson (with GBWN); Kristine Fillman (with GBWN); League of Women Voters of Salt Lake City, Utah (with GBWN); White Pine County and the City of Ely (with GBWN); Mildred Valencia successor to Irvin Baker Edwards (with GBWN); Gary and Jo Ann Perea (with GBWN); Nevada Farm Bureau (with GBWN); Panaca Irrigation Company (with GBWN); Kathy Hiatt (with GBWN); Thomas Baker (with GBWN); Walter Benoit (with GBWN); Louis Cole (with GBWN); Citizen's Education Project (with GBWN); Lois Weaver (with GBWN); Sportsworld (with GBWN); and William and Katherine Rountree (with GBWN).[56]

## VI. SUMMARY OF PROTEST GROUNDS

The Protestants filed hundreds of protests with many protest grounds that are summarized below:

1. The Protestants claim that the Applicant does not have the ability to access the points of diversion and rights of way that are needed to construct the works of diversion and move the water to the intended place of use.

2. Many Protestants state that eastern Nevada has had severe drought conditions for the past three years which has created hardships on all cattlemen. They argue that if the drought created the numerous hardships, the continual removal of the perennial yield by the Applicant will destroy all ranching operations as well as the whole environment of each basin.

3. The Protestants allege that, if granted, the allocation of all unappropriated waters in this groundwater basin would adversely affect the basin of origin and surrounding area by

[56] Exhibit Nos. SE_100, SE_022 through SE_040, and SE_060 through SE_078.

reducing the quality and quantity of water. They argue that the proposed use may: a) adversely affect the economic welfare of all farms and ranches; b) destroy the environmental balance by eliminating the natural surface moistures and reducing the humidity levels which creates the natural growing environment of the surrounding areas, thereby destroying the grazing lands, wetlands and farm lands; c) halt all potential agricultural growth; d) destroy each agricultural operation because the operators will be unable to continue to operate or expand; e) destroy environmental, ecological, scenic and recreational values that the State holds in trust for all its citizens; f) stunt growth in the impacted basins at their current levels, destroying the local economy and potential for growth; g) cause damage to or loss of wildlife areas that could cause a decline in tourist visits to the region; and h) adversely impact economic activity (current and future) of the water-losing area.

4. Millard and Juab Counties, Utah, in their protest, claim that granting the applications may interfere with interbasin flow from Spring Valley to Snake Valley and thereby unduly limit future growth and development.

5. Protestants Joan Hansen and Laurel Mills state that "Clark County should not be allowed to drain off water necessary for our counties' well being."

6. Protestant Eskdale Center feels that diversion and export of such a quantity of water will deprive both Spring and Snake Valleys of the water needed for its environmental and economic well being, and will unnecessarily destroy environmental, scenic and recreational values that the State and the Nation hold in trust for all its citizens.

7. Protestant Diana Crane states: "Leave the rural water alone as it ultimately flows to the growth center anyway. The rural water is the source of springs and artesian wells that surface here, and that first gave travelers and settlers their survival."

8. The Protestants feel that the Applicant has not implemented a sufficient conservation plan in the proposed place of use or to protect the affected basins and claim that current conservation programs instituted by the Applicant are ineffective public-relations oriented efforts that are unlikely to achieve substantial water savings. It was also asserted that the Applications should be denied because the current per capita water consumption rate of the Las Vegas area is double that of other southwestern municipalities.

9. Protestant Diana Crane also feels that any temporary mining of water is unacceptable due to excessive waste of water that is currently exhibited and will continue without foreseen change. She feels that conservation, coupled with recycling of water, as has been implemented in other areas of the Southwest and West, could support a population four-times the present number. This could be accomplished with current water resources without the additional rural water. Ms. Crane further states that "it will benefit the public best to conserve existing water demands starting at home, as I have done."

10. The appropriation and export of water proposed in the Applications is claimed by the Protestants to be detrimental to the public interest on environmental grounds in the basin of origin and in hydrologically connected and/or downwind basins, due to: harm to wildlife and wildlife habitat, degradation of air quality (dust storms), destruction of recreational and aesthetic values, degradation of water quality, degradation of cultural resources, harm to state wildlife management areas and parks and state and federal wildlife refuges and parks.

11. Protestants note that it is the public policy of the State of Nevada, per Governor Bob Miller's January 25, 1990, State of the State Address, to protect Nevada's environment, even at the expense of growth.

12. The granting or approval of the Applications is also asserted by the Protestants to be detrimental to the public interest in that it, individually and together with other applications of the water importation project, would jeopardize and harm endangered and threatened species, interfere with the conservation of those threatened or endangered species; and generally interfere with the purpose for which the federal lands are managed under federal statutes.

13. Protestants Juab and Millard Counties, Utah, feel that granting the Applications will interfere with interbasin flow from Spring Valley to Snake Valley. As a result they feel the appropriation will lower the water table to such an extent that it will substantially reduce groundwater-dependent vegetation. This reduction in vegetation they claim will destabilize soils and contribute to blowing dust resulting in reduced air quality in Juab and Millard County and northward into other Utah counties due to the alkali nature of the soils and potential radioactive fallout in the soils. They also allege that said reduction in the water table will thereby diminish and otherwise damage the phreatophytic vegetative species that depend on the water table as well as the wildlife and livestock that depend on those phreatophytic species, causing environmental harm, including harm to endangered and threatened species.

14. Protestants Juab and Millard Counties, Utah, feel that granting the Applications will interfere with interbasin flow from Spring Valley to Snake Valley and thereby deplete the quantity and quality of water flow in various springs and seeps throughout the basin targeted by the Applications and will thereby diminish and otherwise damage riparian areas and the riparian vegetation, riparian wildlife, migrating birds and livestock that depend upon those riparian areas.

15. Protestant Eskdale Center claims that groundwater dependent vegetation will be affected, changing the general ecology and providing opportunity for invasive or non-native

species to compete with both wildlife habitat and agricultural cropping, threatening the agricultural basis of the community and future economic development opportunities.

16. Protestant Diana Crane is concerned for the Great Basin National Park. She fears that its streams and pools will disappear if the water tables are lowered which would adversely affect all animal and plant life and destroy a national heritage. She requests an Environmental Impact Statement.

17. Protestant Diana Crane also states that Spring Valley Basin is home for the Swamp Cedar and Spring Valley Pupfish [sic] and that both species are extremely rare and uniquely indigenous. Survival of both depends on the water quality and levels that currently exist. She feels these species cannot tolerate less water than currently exists.

18. Protestant Diana Crane also feels that the applications should be denied because they will exceed the safe yield of the Spring Valley Basin and the Great Basin National Park, thereby adversely affecting their riparian zones and phreatophytes.

19. Protestant Citizen's Alert asserts that the subject application should be denied because Spring Valley lies downstream from the Great Basin National Park, and diversion of water here could result in drawdown of the water table in the Great Basin National Park, thus having a negative effect on migratory birds and the plant and animal species inhabiting and dependent on water resources in the National Park and the Spring Valley Basin, including some sensitive species and some species protected under the federal Endangered Species Act and related state statutes. On information and belief this would include but not be limited to the Spring Valley Pupfish [sic], Pennell's Draba, Nevada Greasebush and Swamp Cedar.

20. Protestant James Lee feels that the requested water is already being used and further pumping in large amounts would deplete the underground water, and dry up springs.

21. Protestant George Eldridge and Sons, Inc, states that to grant this application for withdrawal from an al1uvial-fan aquifer up-gradient from Davis Spring would not be in the public interest due to the probability of impacting the spring which serves wildlife, livestock, and irrigation uses.

22. It is stated on several protests that air pollution in Las Vegas Valley is so bad that the valley has been classified a non-attainment area for national and state ambient air-quality standards. Some Protestants feel that the State Engineer should deny the Applications and the other applications associated with the water importation project since more water means more growth, and therefore more air pollution.

23. It is stated on most protests that the appropriation of this water when added to the already approved appropriations and existing uses and water rights in the host water basin will exceed the annual recharge and safe yield of the basin.

24. Protestants Juab and Millard Counties, Utah feel that there is no groundwater left in the hydrographic area targeted by the Applications that can be safely appropriated above and beyond that which is already appropriated without disrupting the interbasin flow from Spring Valley to Snake Valley.

25. Protestants Barry Isom, Linda Isom, Lory M. Free, and Rudolph E. Krause feel that appropriation in Spring Valley, when added to the already approved appropriations and dedicated users in Basin 202, Pahranagat Valley, will exceed the annual recharge and safe yield of the basin.

26. Protestants Katherine Rountree, William Rountree, and Kristine P. Kaiser (now Kristine Fillman) state that the granting or approval of the Applications would conflict with or

tend to impair existing rights in the Snake Valley because if granted it would exceed the safe yield of the subject valley and unreasonably lower the static water level.

27. Many Protestants also state that the granting or approval of the Applications would sanction water mining.

28. Protestant Citizen's Alert feels that there is not sufficient unappropriated water available in the Spring Valley Basin to provide the water being sought. It asserts that due to cyclical drought, and long term climatic change, the water resource in this basin and all connecting basins is diminishing.

29. Protestant John Tryon feels that appropriation, even if limited to annual recharge, inevitably will damage plant and animal life on the surface. He asserts that wild and cultivated areas will be destroyed and that wildlife would be disturbed or killed off, thus impacting the lives of human residents and visitors. He feels that in this sense, the water is not available.

30. Protestant The Long Now Foundation states that the Applications seek to appropriate more groundwater than the perennial yield of the basin as currently recognized by the State Engineer.

31. Many Protestants state that appropriation and use of the requested water will lower the water table and degrade the quality of water from existing wells; cause negative hydraulic gradient influences; threaten springs, seeps and phreatophytes, which provide water and habitat critical to the survival of wildlife, grazing livestock, and other surface area existing uses; and further cause other negative impacts and adversely affect existing rights, sources and uses, in the basins of origin and surrounding valleys including areas in Utah.

32. The protests filed by the Confederated Tribes of the Goshute Reservation, the Ely Shoshone Tribe, and the Duckwater Shoshone Tribe, state that the appropriation and proposed use would violate the tribes' reserved water rights.

33. Protestant Nye County, Nevada, likens the Applications to the dewatering processes of the mining industry. It states that unlike mining, the subject applications are not temporary in nature, and return flows will not occur in the valleys; all water pumped will permanently leave the basin, effectively providing all of the adverse affects of mine dewatering with none of the mitigation capability of mine dewatering.

34. While the Applications are in Spring Valley, many Protestants have some protests grounds stating their fear that the appropriation and export of groundwater from Cave, Dry Lake, and Delamar Valleys could harm hydrologically connected areas including but not limited to: Pahranagat and Moapa National Wildlife Refuges, Pahranagat and White River Valleys and Lake Mead National Recreation Area, and Overton and Key Pittman and Wayne E. Kirsch Wildlife Management Areas, Railroad Valley wetlands areas, and Ash Meadows National Wildlife Refuge.

35. Many Protestants fear that the appropriation and export of groundwater from Spring Valley will harm existing permitted uses in the hydrologically connected areas including but not limited to Snake Valley and Great Basin National Park.

36. The protest filed by Col. James R. Byrne states that the applications should be denied because of potential impacts to the Indian Springs Valley Basin, which is already over allocated. Protestant Col. James R. Byrne feels that such impacts may harm rights owned by the U.S. Air Force in the Indian Springs Valley Basin.

37. Protestant John Wadsworth states that Panaca Big Spring comes from deep aquifers and this appropriation would very likely be detrimental to the spring.

38. It is also stated in some protests that the appropriation and diversion proposed may reduce the volume and velocity of groundwater flowing through the regional aquifer system which could begin the process of closing connected fractures and solution cavities, impairing the capacity of the aquifer to transmit water.

39. Protestants Katherine Rountree, William Rountree, and Kristine P. Kaiser (now Kristine Fillman) fear that approval of this application would jeopardize the community water supply that is now being developed in Snake Valley for the town of Baker, by means of the Baker General Improvement District.

40. Protestants Juab and Millard Counties, Utah, state that based on the interconnectivity of the hydrogeologic structures in the Great Basin as identified by the USGS BARCASS report and other such investigations and reports, granting this application will interfere with interbasin flow from Spring Valley to Snake Valley and thereby cause long-term detrimental effects on other groundwater resources and flows in other parts of Juab and Millard County and other Utah counties, negatively impacting the agricultural industry of Juab and Millard County and other Utah Counties. They also claim such appropriation of water will cause depletion of the county tax base in the area and potential damage to the ability of agricultural interests to develop and expand in the area of the proposed underground pumping.

41. Protestant Pioche Town Board states that the lack of water will also restrict further growth in the Pioche area.

42. Protestant The Long Now Foundation alleges that granting the Applications would threaten to prove detrimental to the public interest and the interests and rights of The Long

Now Foundation because among other things, it would: A) result in degraded air quality and adverse impacts to visual resources in the region; B) result in adverse economic impacts due to degraded air quality and visual resources; C) result in adverse impacts to hydrological, biological, cultural, and environmental resources; D) result in adverse impacts to the riparian vegetation and natural habitat that support sensitive plant and animal species in the region; E) result in adverse impacts to the water resources in adjacent basins; F) result in interference with artesian water sources, springs, and seeps in the region; and, G) otherwise adversely affect the interests of The Long Now Foundation.

43. Protestant Terrence Marasco states that he owns a business (motel and restaurant) which will be affected. He states that the business is based on tourism and "a desiccated Spring and Snake Valley will depreciate tourism." He fears impacts to the Great Basin National Park which will in turn depreciate the value and income from his business.

44. Protestant Eskdale Center states that the withdrawal of large quantities of groundwater from Spring Valley threatens the existing groundwater levels in Snake Valley. Being a nearby community with an agricultural support base, Eskdale Center fears it will be severely affected economically in the event of lowering of current groundwater levels due to the following: (i) current wells have produced consistently for over 50 years, (ii) the cost of drilling deeper wells has increased many fold over that 50-year period, (iii) the state-regulated community potable water supply quality would be jeopardized and domestic wells will be threatened, (iv) it would place unnecessary hardship on, and thereby threaten the economic survival of the protesting community if the Applications are approved, (v) it would threaten the groundwater supply in other areas of Snake Valley where the community has interests in water rights and economic and social relationships with other communities and individuals.

45. The Corporation of the Presiding Bishop owns and operates Cleveland and Rogers Ranches and associated grazing permits as part of a large livestock operation in north Spring Valley. The Corporation's holdings include vested rights, surface water rights and groundwater rights. Protestant the Corporation of the Presiding Bishop of the Church of Jesus Christ of Latter-Day Saints fears that since several applications are in proximity to their holdings they may have a detrimental effect on water availability for the Cleveland and Rogers Ranches and within the water basin.

46. Many Protestants fear that while the water taken from a basin may be within the perennial yield of that basin, areas as far away as 200 miles may experience drawdown, and the negative impacts associated with this phenomenon.

47. Protestant George Eldridge and Sons, Inc, state that some of the points of diversion are a few miles up-gradient from Deep Spring (aka Davis Spring). They fear that large-volume pumping from the valley-fill aquifers will adversely impact the flow and their water right from Davis Spring.

48. Protestant George Eldridge and Sons, Inc, fears that pumping will withdraw water from the alluvial fan from which numerous springs rise and flow to serve its water rights and to serve the pre-existing rights of others. It states that large-volume pumping from the alluvial-fan aquifers will adversely impact the flow from those springs. It also feels that to grant applications for withdrawal from alluvial-fan aquifer up-gradient from underground and spring sources previously appropriated would be detrimental to the public interest from the probability of impacting pre-existing rights.

49. Protestant Roy Theiss states that "Great Basin National Park is the State's only National Park. To divert and export water from it without a water resource plan will be sinful."

50. Protestant Nye County, Nevada, claims that the Applicant has said that the Applications are to be temporary in nature, but the Applications request permanent water rights, making the nature of the request unclear. It feels that the Applications should be denied because the public has been denied relevant information and due process because of the stated confusion.

51. It was claimed by several Protestants that the Applications fail to adequately include the statutorily required information, to wit: a) Description of proposed works; b) The estimated cost of such works; c) The estimated time required to construct the works and the estimated time required to complete the application of water to beneficial use; d) The approximate number of persons to be served and the future requirement; e) The dimensions and location of proposed water-storage reservoirs, the capacity of the proposed reservoirs, and a description of the lands to be submerged by impounded waters; and, f) Description of the place of use. Because of this alleged exclusion, it is asserted that the Applications should be denied. It is also stated by some that the lack of information denies the Protestants the meaningful opportunity to submit protests to the Applications and other applications associated with the water importation project.

52. Protestants Juab and Millard Counties, Utah feel that if the Applications are not denied outright, then any permitted use under these Applications should be conditioned upon and preceded by sufficient comprehensive studies of groundwater resources in the area and interbasin flow. They proposed that potential impacts on those resources can be limited by implementing incremental groundwater pumping and withdrawal to intermittent levels. No additional pumping should be allowed until it is proven through the studies that resources would not be damaged.

53. It is stated in many protests that inasmuch as a water extraction and transbasin conveyance project of this magnitude has never been considered by the State Engineer, it is

therefore impossible to anticipate all potential adverse affects without further information and study.

54. Protestants Katherine Rountree, William Rountree, and Kristine P. Kaiser (now Kristine Fillman) state that according to USGS studies cited in Water Related Scientific Activities of the USGS in Nevada, 1985-89, pp. 47, 48, 57, and 58, it is impossible to predict the consequences of exporting water in such quantities. "Comprehensive studies of this aquifer system have not been made, and little appropriate data are available."

55. Protestant John Tryon states he cannot anticipate potential impacts as no environmental impact study has been published.

56. Nye County, Nevada, Unincorporated Town of Pahrump, Nevada, and the City of Caliente, Nevada, feel that the Applications cannot be granted because the Applicant has failed to provide information to enable the State Engineer to safeguard the public interest properly. The adverse effect of the Applications and related applications associated with the proposed water appropriation and transportation project (the largest appropriation of groundwater in the history of the State of Nevada) cannot properly be evaluated without an independent, formal and publicly-reviewable assessment of: a) cumulative impacts of the proposed extraction; b) mitigation measures that will reduce the impacts of the proposed extraction; and c) alternatives to the proposed extraction, including but not limited to, the alternatives of no extraction and aggressive implementation of all proven and cost-effective water demand management strategies.

57. Protestants Juab and Millard Counties, Utah, argue that the State Engineer previously has found that there is too much uncertainty, too little sound data and too great a risk of unsustainable over-appropriation in the interbasin flow system of which this basin is a part, for

further appropriations to be permitted until substantial additional data were gathered and evaluated. Sufficient data gathering and evaluation have not been completed concerning interbasin flow from Spring Valley to Snake Valley, and until that happens it would be premature to permit any additional appropriation from hydrologically interconnected basins within the interbasin flow system and associated carbonate rock province.

58. Protestant Irvin Baker Edwards states in his protest that: “The subject application proposed has obviously been formed without prior consideration of long term impacts to surrounding counties. Nevada, known for its many miles of desert land, can’t put a price on water. This fact alone makes it impossible to project adverse affects on the static water tables, land owners, wildlife and natural habitat. Inasmuch as Las Vegas has willfully wasted valuable water and therefore created a shortage for Clark County, we feel it our right if not our duty to protest any extraction of water from our county.”

59. Protestant The Long Now Foundation states that the Applicant’s answer to “Question 12” does not provide sufficient details for the proposed project or proposed water usage, to allow the public, interested parties, protestants, and the State Engineer to make a proper evaluation of the potential impacts of approving the Applications.

60. Protestant The Long Now Foundation further claims that based on the scope and magnitude of the water exportation scheme proposed by the Applications, the Applicant should be required to conduct the Hydrologic and Environmental Studies specified by NRS 533.368, before the State Engineer makes a final determination on the Applications.

61. Many Protestants state that since the Applicant has a duplicative application filed in 2010 in this basin, that a duplicative hearing for the same groundwater may be required in the future.

62. Many Protestants claim that the Applicant has not demonstrated the good faith intent or financial ability and reasonable expectation to actually construct the work and apply the water to the intended beneficial use with reasonable diligence. Some Protestants further argue that with the economic downturn and resulting economic difficulties make funding of the project unlikely.

63. Many Protestants also claim that the Applicant has not shown a need for the water or the feasibility (technical and financial) of the water-importation project. Many further claim that the "simplistic water demand forecasts upon which the proposed transfers are based substantially overstate future water demand needs" and "are unrealistic and ignore numerous constraints to growth."

64. Some Protestants also state that the Applications should be denied because the costs of the project will result in water rate increases of such magnitude that demand will be substantially reduced, thereby rendering the water transfer unnecessary.

65. Protestants Juab and Millard Counties, Utah argue that because the Applicant announced in the BLM Environmental Impact Statement that it intends to use the requested water as a backup if other resources fail, the Applications should be denied absent clear proof satisfactory to the State Engineer that the Applicant intends in good faith to the carry out the development of the project.

66. Protestants Juab and Millard County, Utah also state that given the present economic downturn and halt in economic growth, the Applicant cannot justify the need to import water from another basin.

67. Several Protestants argue that the State Engineer must consider all of the future environmental and socioeconomic ramifications of the trans-basin transfer in order to protect the State of Nevada by not allowing these transfers.

68. Several Protestants feel that Clark County must grow only within the limits of their natural resources or the environmental and socioeconomic balance of the State of Nevada will be destroyed.

69. Nye County, Nevada, in its protests, feels that the State of Nevada should consider public-policy issues concerning dispersal of population, which are part of the debate on appropriation of the region's water.

70. Protestant Nye County, Nevada, also states that "The above-referenced Application and the other applications associated with the water-importation project should not be approved if said approval is influenced by the State Engineer's desire or need to ensure that there is sufficient water for those lots and condominium units created in Las Vegas Valley by subdivision maps. These maps were approved by the State Engineer, and he certified that there is sufficient water for the lots and units created by the maps. If there is not sufficient water for these lots and units, then Clark County water resources (e.g., water created by conservation, water saved by re-use, etc.) should be developed and assigned to the water-short lots and units."

71. Many Protestants state that "the proposed action is not an appropriate long-term use of Nevada's water."

72. Many Protestants also suggest that the State Engineer has a responsibility to all of the people of Nevada and must consider all adverse affects which the granting of these Applications will have on all areas in the State of Nevada.

73. Protestant Bruce Pencek states that: “California’s experiences suggest that large-scale water projects injure the state’s reputation, promote factious politics and allegations of corruption, waste tremendous quantities of water through leakage and evaporation, and foster the dangerous illusions that water supplies are limitless and are either free for the wasting or are allocated solely for the advantage of the rich and powerful.”

74. Protestant John Tryon argues that “Las Vegas Valley population is big enough. Further growth is not in the best interest of the Las Vegas community; neither will it benefit Nevada and the Nation. Rather than give Las Vegas Valley more water, the State should encourage growth control, water economy, a sustainable lifestyle, and the building up of other communities.”

75. James Lee feels that it is time for “Clark County to solve their problems there and not steal the good things rural Nevada offers.”

76. Protestant the Long Now Foundation argues that the full extent of the water exportation project is unknown at this time and it is uncertain how many additional groundwater and/or surface water appropriations or change applications will be filed in the future to supplement or change the current applications. Said protestant feels that before acting on the current Applications, the Applicant should further be required to detail the total duty of water sought for exportation for the entire project.

77. Protestant Diana Crane does not feel that the water will be put to good use.

78. Protestant Peter Coroon argues that the appropriation and export of water proposed in the Applications will jeopardize public health and be detrimental to the public interest

79. Protestants Nye County, Nevada, feels that the Applications should be outright denied because the State Engineer has previously denied other applications for water from the basin.

80. Nye County, Nevada, Unincorporated Town of Pahrump, Nevada, and the City of Caliente, Nevada, state that the granting or approval of the Applications would allow the Applicant to “lock up vital water resources for possible use sometime in the distant future beyond current planning horizons,” which is not in the public interest.

81. Confederated Tribes of the Goshute Reservation, the Ely Shoshone Tribe, and the Duckwater Shoshone Tribe feel that the appropriation and proposed use would have unduly negative impacts on cultural, historic, and religious resources which would harm the public interest.

82. Confederated Tribes of the Goshute Reservation, the Ely Shoshone Tribe, and the Duckwater Shoshone Tribe also claim that the appropriation and proposed use would unduly injure the tribes’ capacity for self-governance and would unduly injure the tribes’ sovereignty and ability to regulate their territory.

83. Confederated Tribes of the Goshute Reservation, the Ely Shoshone Tribe, and the Duckwater Shoshone Tribe also state that the appropriation and proposed use would violate federal and state laws that protect cultural, religious, and historic resources as well as violate the federal government’s trust responsibility to the tribes.

84. Citizen’s Alert, Confederated Tribes of the Goshute Reservation, the Ely Shoshone Tribe, and the Duckwater Shoshone Tribe feel that the Applications should be denied because they lie within the boundaries of land covered by the Treaty of Ruby Valley of 1863. On information and belief of the said Protestants, approving the Applications would conflict with

the reserved water rights of the Western Shoshone Tribes which are subject to the Treaty of Ruby Valley and Federal Statutes.

85. Protestant Richard Spilsbury states in his protest that Spring Valley has been the traditional home of the Native Newe (Western Shoshone) people since prehistoric times. He asserts that there are many prehistoric sites in the area, including ancient petroglyphs and graves. He fears that the Shoshone Cedars Sacred Historic Site will be completely devastated by pipeline construction and water withdrawal. He further feels that the State Engineer's office ignores Native American water rights as a matter of political expediency. He states that tribal ancestors have lived in the basin sustainably for 10,000 years and morally have existing water rights. He feels that Nevada water laws give away Native American and wildlife's water to the first capable of wasting it, for free.

## VII. PRE-HEARING ORDERS

On September 1, 2011, the Applicant filed several motions in limine. The Applicant filed a motion in limine to exclude an expert report by Dr. Lanner, identified as Spring Valley Exhibit 3040. The Applicant argued that this report should be excluded because: 1) the authoring expert would not testify and be subject to cross-examination; 2) no traditional hearsay exception applied; 3) admission would violate the State Engineer's regulations; 4) the report is not subject to administrative notice; and 5) the report is unfit as an expert report without testimony of the author.

The Applicant also filed a motion in limine to exclude expert reports by Dr. Charlet, identified as Delamar, Dry Lake, and Cave Valley ("DDC") Exhibits 1150 and 1230 and Spring Valley Exhibit 3030, and a report by Ms. Hutchins-Cabibi, identified as Spring Valley Exhibit 3064. The Applicant argued that these reports should be excluded because: 1) the authoring experts would not testify and be subject to cross-examination; 2) Ms. Hutchins-Cabibi was not qualified as an expert in the prior hearing and her report was not qualified as an expert report; 3) no traditional hearsay exception applied; 4) admission would violate the State Engineer's regulations; and 5) the reports are not subject to administrative notice.

The Applicant also filed a motion in limine to exclude an expert report by Dr. Mayer, identified as DDC Exhibit 501, expert reports by Dr. Krueger, identified as DDC Exhibits 539 and 559, and an expert report by Dr. Scoppettone, identified as DDC Exhibit 609. The Applicant argued that these reports should be excluded because: 1) the authoring experts would not testify and be subject to cross-examination; 2) no traditional hearsay exception applied: 3) admission would violate the State Engineer's regulations; and 4) the reports are not subject to administrative notice.

Finally, the Applicant filed an objection to expert witnesses Dr. Heilweil, Dr. Hurlow, Dr. Jones, Dr. Mayo, and Dr. Roundy and the expert reports by Dr. Heilweil (MILL Exhibit 10), Dr. Hurlow (MILL Exhibit 11), Dr. Myers (CTGR Exhibit 14), and Drs. Jones and Mayo (CPB Exhibit 11). The Applicant generally argued that these witnesses and reports were not rebuttal material and should have been disclosed during the initial evidentiary exchange and that CPB Exhibit 11 (Jones and Mayo report) was untimely exchanged.

The Corporation of the Presiding Bishop, the Confederated Tribes of the Goshute Reservation, and Millard and Juab Counties filed responses to the Applicant's objection. Great Basin Water Network filed a response to the Applicant's motions in limine.

The State Engineer granted the Applicant's motion in limine to exclude DDC Exhibits 501 (Mayer report), 539 (Kreuger report), 559 (Kreuger report), and 609 (Scoppettone report).[57] The State Engineer granted the Applicant's motion in limine to exclude DDC Exhibits 1150 (Charlet report) and 1230 (Charlet report) and Spring Valley Exhibits 3030 (Charlet report) and 3064 (Hutchins-Cabibi report) in part and denied it in part. The State Engineer ruled that DDC Exhibit 1230 (Charlet report) and Spring Valley Exhibit 3030 (Charlet report) would not be excluded, but that the transcript of the cross-examination of the authoring expert from the prior hearing would be admitted along with these exhibits. With respect to DDC Exhibit 1150 (Charlet report), the State Engineer denied the Applicant's motion to exclude. The State Engineer granted the Applicant's motion to exclude as to Spring Valley Exhibit 3064 (Hutchins-Cabibi report).[58] The State Engineer denied the Applicant's motion to exclude Spring Valley Exhibit 3040 (Lanner report), but also noted that only the first page of the exhibit is admissible.[59] Finally, the State Engineer overruled the Applicant's objections to expert witnesses Dr. Heilweil, Dr. Hurlow, Dr. Jones, Dr. Mayo, and Dr. Roundy and MILL Exhibit 10 (Heilweil report), MILL Exhibit 11 (Hurlow report), CTGR Exhibit 14 (Myers report), and CPB Exhibit 11 (Jones and Mayo report).[60]

## VIII. STATUTORY STANDARD TO GRANT

The State Engineer finds that NRS 533.370(1)(c) provides that the State Engineer shall approve an application submitted in proper form which contemplates the application of water to beneficial use if the applicant provides proof satisfactory of the applicant's intentions in good

[57] Exhibit No. SE_090, p. 7.
[58] Exhibit No. SE_090, p. 10.
[59] Exhibit No. SE_090, p. 12.
[60] Exhibit No. SE_090, p. 13.

faith to construct any work necessary to apply the water to the intended beneficial use with reasonable diligence, and his financial ability and reasonable expectation actually to construct the work and apply the water to the intended beneficial use with reasonable diligence.

## IX. STATUTORY STANDARD TO DENY

The State Engineer finds that NRS 533.370(5) (2010)[61] provides that the State Engineer shall reject an application and refuse to issue the permit where there is no unappropriated water in the proposed source of supply, or where the proposed use or change conflicts with existing rights or with protectable interests in existing domestic wells as set forth in NRS 533.024, or where the proposed use threatens to prove detrimental to the public interest.

## X. STATUTORY STANDARD FOR INTERBASIN TRANSFERS

The State Engineer finds that NRS 533.370(6) (2010)[62] provides that in determining whether an application for an interbasin transfer of groundwater must be rejected, the State Engineer shall consider: (a) whether the applicant has justified the need to import the water from another basin; (b) if the State Engineer determines a plan for conservation of water is advisable for the basin into which the water is imported, whether the applicant has demonstrated that such a plan has been adopted and is being effectively carried out; (c) whether the proposed action is environmentally sound as it relates to the basin from which the water is exported; (d) whether the proposed action is an appropriate long-term use which will not unduly limit the future growth

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[61] NRS 533.370(5) (2010) was moved to subsection (2) by 2011 Nev. Stat. Ch. 166. For ease of reference, for those statutes that were amended by the Nevada Legislature in 2011, the citation numbering used here will refer to the more familiar 2010 numbering instead of using the updated 2011 numbering. Citations without a "(2010)" designation have the same numbering in the 2010 and 2011 version of the statutes.

[62] NRS 533.370(6) (2010) was moved to subsection (3) by 2011 Nev. Stat. Ch. 166. For ease of reference, for those statutes that were amended by the Nevada Legislature in 2011, the citation numbering used here will refer to the more familiar 2010 numbering instead of using the updated 2011 numbering. Citations without a "(2010)" designation have the same numbering in the 2010 and 2011 version of the statutes.

and development in the basin from which the water is exported; and (e) any other factor the State Engineer determines to be relevant.

## FINDINGS OF FACT

### I. BENEFICIAL USE AND NEED FOR WATER

The Applicant must demonstrate a need to put the water from the Applications to beneficial use in Southern Nevada.[63] Beneficial use is the basis, the measure and the limit of the right to the use of water in the State of Nevada.[64]

The Applicant presented the following witnesses who testified regarding Southern Nevada's need for this water: (1) Patricia Mulroy, the Applicant's General Manager; (2) Richard Holmes, the Applicant's Deputy General Manager for Engineering and Operations, an expert in "water development and necessity of the Project"[65]; (3) John Entsminger, the Applicant's Senior Deputy General Manager, an expert in "Colorado River water resources"[66]; and (4) Kay Brothers, the Applicant's former Deputy General Manager of Engineering and Operations and now a consultant to the Applicant, an expert in "water planning purposes on the Colorado River."[67] These witnesses have all been responsible for managing Southern Nevada's water resource portfolio and each expressed an opinion that the Applicant would not be able to meet Southern Nevada's water needs without the water from the Applications.[68]

The Protestants presented the following witness who testified regarding Southern Nevada's need for this water: Dr. Peter Gleick, President of the Pacific Institute, an expert in

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[63] *See* NRS 533.030(1); NRS 533.035; NRS 533.045; NRS 533.060(1); NRS 533.070(1); NRS 533.370(6)(a) (2010).
[64] NRS 533.035.
[65] Transcript, Vol.1 p. 174:7-8 (State Engineer).
[66] Transcript, Vol.1 p. 191:1-3 (State Engineer).
[67] Transcript, Vol.1 p. 186:22-24 (State Engineer).
[68] Transcript, Vol.2 p. 328:1-4 (Holmes); p. 345:14-18 (Brothers); p. 347:3-20 (Entsminger).

"water conservation and efficiency." Dr. Gleick consults with governmental and non-governmental entities regarding water conservation and efficiency and he expressed an opinion that "a substantial amount of projected new supply needs could be eliminated" through conservation and efficiency improvements in Southern Nevada.[69]

The Applicant is a political subdivision of the State of Nevada and a joint powers agency which is governed by a seven member board of directors who represent the Applicant's seven member agencies.[70] The Applicant is responsible for ensuring that adequate water supplies are available to meet Southern Nevada's water needs. All of the Applicant's member agencies have determined that Southern Nevada needs this water and have adopted resolutions supporting the Applications.[71] Public advisory committees in Southern Nevada have determined that Southern Nevada needs this water and have recommended that the Applicant develop the project associated with the Applications.[72] The Applicant's board of directors has determined that the Applicant needs this water and has directed staff to pursue permitting of the Applications.[73]

The Applicant presented evidence to demonstrate that the water from the Applications is a critical component of the water resource portfolio for Southern Nevada and that the water is needed to protect against shortages on the Colorado River, meet projected demands, and replace temporary supplies.

### A. <u>Shortages on Colorado River</u>

In order to understand why Southern Nevada needs the water from the Applications, it is first necessary to understand the situation on the Colorado River. Southern Nevada is almost

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[69] Transcript, Vol.23 pp. 5127:22-5128:25 (Gleick).
[70] Exhibit No. SNWA_189, p. 2-1.
[71] Exhibit Nos. SNWA_223 through Exhibit No. SNWA_229.
[72] Exhibit No. SNWA_209, Appendix 2; Exhibit No. SNWA_201; Transcript, Vol.1 pp. 225:11-228:6 (Brothers).
[73] Exhibit No. SNWA_211; Transcript, Vol.1 pp. 235:25-236:4 (Brothers).

entirely dependent on the Colorado River to meet its water needs. The Colorado River is a highly regulated and complex water source that is shared by seven states and the country of Mexico. The Colorado River is divided into an upper basin and a lower basin, each of which is allocated 7.5 million acre-feet annually ("afa") from the river. The upper basin consists of Colorado, Utah, Wyoming and New Mexico. The lower basin consists of California, Arizona and Nevada. Nevada is entitled to just 300,000 afa of the 7.5 million afa allocated to the lower basin. Mexico is allocated 1.5 million afa. An estimated 1.5 million afa is lost to evaporation.[74] Taking into account the allocations to the upper and lower basins, the allocation to Mexico, and evaporation losses, there are 18 million acre-feet accounted for annually on the Colorado River.[75]

However, the Colorado River is over-appropriated. Historical records dating from 1905 to 2010 indicate that the average annual flow of the Colorado River is 15 million acre-feet.[76] Based on those historical records, the Colorado River is over-appropriated by roughly 3 million afa, i.e. 18 million acre-feet accounted for with only 15 million acre-feet available.[77]

Southern Nevada is almost entirely dependent on the Colorado River as it supplies 90% of Southern Nevada's water.[78] Pursuant to contract with the Bureau of Reclamation, the Applicant and its members receive 272,000 afa of Nevada's 300,000 acre-feet allocation, plus any surplus that becomes available to Nevada.[79] The Applicant receives additional Colorado River water through intentionally created surplus ("ICS") projects, whereby lower basin states can convey water resources to the Colorado River for credits which can then be used to withdraw

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[74] Transcript, Vol.2 p. 262:24-25 (Entsminger).
[75] Transcript, Vol.2 p. 264:6-8 (Entsminger).
[76] Exhibit No. SNWA_189, p. 8-2, Figure 8-1; Transcript, Vol.2 p. 264:11-13 (Entsminger).
[77] Exhibit No. SNWA_189, p. 8-2, Figure 8-1; Transcript, Vol.2 p. 264:14-16 (Entsminger).
[78] Exhibit No. SNWA_189, p. 7-1; Transcript, Vol.2 p. 260:20-22 (Entsminger).
[79] Exhibit No. SNWA_189, p. 3-1; Transcript, Vol.2 p. 261:13-16 (Entsminger).

Colorado River water.[80] In addition, the Applicant pays the Arizona Water Banking Authority to bank a portion of Arizona's Colorado River water in an underground aquifer for future use in Southern Nevada.[81] The Applicant has agreements with the Metropolitan Water District of Southern California and the Bureau of Reclamation which allow the Applicant to bank a portion of Nevada's unused Colorado River water in a reservoir for future use in Southern Nevada.[82] The Applicant also relies heavily on the use of return-flow credits on the Colorado River, whereby the Applicant returns treated wastewater to Lake Mead in exchange for the right to divert a corresponding amount of Colorado River water. The use of return flow credits allows the Applicant to extend its available water supplies by approximately 70%, which represents a significant portion of Southern Nevada's water resources.[83]

The Applicant diverts all of its Colorado River water from Lake Mead through a system of intake and conveyance facilities and delivers the water to its members for use in their respective service areas. Between 2000 and 2010, Lake Mead saw a drastic decline in water level elevation due largely to drought conditions. During this period, the average flow in the Colorado River was 69% of the normal average flow and in one year, 2002, the flow in the Colorado River was only 25% of the average flow.[84] The water level elevation in Lake Mead dropped by roughly 130-140 feet.[85] That decline is equal to a reduction in the capacity of Lake Mead by roughly 55-60%, which is a loss of nearly 15 million acre-feet of water.[86] As a point of reference, that reduction is equal to Nevada's Colorado River allocation for a period of 50

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[80] Exhibit No. SNWA_189, pp. 3-1, 3-4.
[81] Exhibit No. SNWA_189, p. 3-4.
[82] Exhibit No. SNWA_189, p. 3-5.
[83] Exhibit No. SNWA_189, p. 3-1; Transcript, Vol.2 p. 282:2-16 (Entsminger).
[84] Exhibit No. SNWA_232; Transcript, Vol.2 p. 266:19-22 (Entsminger).
[85] Exhibit No. SNWA_189, p. 7-1; Exhibit No. SNWA_232; Transcript, Vol.1 p. 194:25 (Holmes).
[86] Exhibit No. SNWA_189, p. 7-1; Exhibit No. SNWA_403; Transcript, Vol.1 p. 195:2-6 (Holmes).

years.[87] Even though the unofficial 2011 flow in the Colorado River was 140% of the normal average flow, the average flow for the last 12 years was only 75% of the normal average flow.[88]

In response to the drastic declines in Lake Mead water elevation, the lower basin states entered into negotiations and reached an agreement regarding the amounts of water that would be available to each state from the Colorado River during shortage conditions.[89] The water level elevation of Lake Mead now ultimately determines the amount of water that Nevada and the other lower basin states can divert from the Colorado River. When Lake Mead drops below 1,075 feet, 1,050 feet, and 1,025 feet, the Applicant's Colorado River allocation will be reduced by 13,000 acre-feet, 17,000 acre-feet, and 20,000 acre-feet, respectively. When Lake Mead drops below 1,025 feet, the Applicant's Colorado River allocation will be further reduced after consultation with the other lower basin states and the Secretary of the Interior.[90] The amounts of those reductions are uncertain but are anticipated to be significantly larger than those quantified in existing agreements.[91]

Shortage conditions would cause other reductions to the amount of water available to Southern Nevada. During shortage, the Applicant would lose water from System Efficiency ICS projects and any Extraordinary Conservation ICS projects.[92] If shortage conditions cause Arizona municipalities to receive less water, the Applicant would lose water from the Arizona water bank on a pro rata basis.[93] Furthermore, if Lake Mead elevation levels drop below 1,000 feet, which is the operational limit of the Applicant's pumping intake facilities, the Applicant

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[87] Transcript, Vol.1 p. 195:6-9 (Holmes).
[88] Transcript, Vol.2 pp. 266:23-267:3 (Entsminger).
[89] Exhibit Nos. SNWA_189, p. 2-2; SNWA_203; SNWA_204; Transcript, Vol.2 pp. 269:9-272:11 (Entsminger).
[90] Exhibit No. SNWA_189, p. 6-3; Transcript, Vol.2 pp. 269:19-21, 277:11-17 (Entsminger).
[91] Exhibit No. SNWA_189, p. 1-2; Transcript, Vol.2 p. 277:11-17 (Entsminger).
[92] Exhibit No. SNWA_189, p. 2-3; Transcript, Vol.2 p. 414:4-9 (Entsminger).
[93] Transcript, Vol.2 pp. 303:13-15, 414:20-415:1 (Entsminger).

might not be able to withdraw any of its Colorado River water from Lake Mead.[94] That would also preclude the use of return flow credits which would reduce the remaining water available to Southern Nevada by an additional factor of 70%. If the Applicant were to lose its ability to withdraw water from Lake Mead, the water from the Applications would not be sufficient to meet Southern Nevada's water needs but it would provide essential water for health and human safety during such a period.[95]

Drought conditions are likely to continue and intensify which would increase the frequency, severity, and duration of shortage conditions. Multi-decadal droughts can, and have, occurred on the Colorado River system.[96] Although 2011 was a wet year, it does not mean that the Colorado River system is no longer experiencing drought because it had just one wet year.[97] As severe as the current 11-year drought has been, there is evidence that droughts of greater severity than any in the last 100 years have previously occurred and that droughts have lasted as long as 50 years.[98] The Applicant has estimated, using a Bureau of Reclamation model, that based on past flow records, there is a 40 percent probability by 2020 and a 50 percent probability by 2025 that in any given year the lower basin will be in shortage,[99] which means the amount of Colorado River water available to the Applicant will be reduced. Climate change could further reduce the amount of Colorado River runoff due to precipitation changes and dust deposits. The Bureau of Reclamation published reports which state that the Colorado River basin is expected to warm between 5-6 degrees Fahrenheit during the 21st century which could have significant

[94] Exhibit No. SNWA_189, p. 7-2.
[95] Exhibit No. SNWA_189, p. 8-4; Transcript, Vol.2 p. 269:3-6 (Entsminger).
[96] Transcript, Vol.2 p. 268:10-12 (Entsminger).
[97] Transcript, Vol.2 pp. 267:24-268:6 (Entsminger), p. 333:14-21 (Brothers).
[98] Exhibit No. SNWA_189, pp. 7-2 to 7-3. Figure 7-1; Transcript, Vol.2 p. 334:4-9 (Brothers).
[99] Exhibit No. SNWA_189, pp. 7-2, A-5, A-6, Figure A-2.

effects on the availability of water supplies.[100] Although it is impossible to predict what will happen from year to year, there is a strong probability that over the long-term, drought will reduce the amount of water that will be available to meet Southern Nevada's water needs.

Development and increased water use in the upper basin states is also expected to contribute to shortage conditions. Upper basin states have yet to develop their full 7.5 million acre-feet Colorado River allocation.[101] The amount that is currently not used by the upper basin states eventually flows down to Lake Mead for use by the lower basin states.[102] When the upper basin states begin using that water, it will no longer flow to Lake Mead. There is a strong probability that over the long-term, development and increased water use in the upper basin states will reduce the amount of water that will be available to meet Southern Nevada's water needs.

The Applicant needs the water from the Applications to protect against shortages on the Colorado River. The Applicant used the Bureau of Reclamation's Colorado River Simulation System ("CRSS") model to analyze the probability, frequency and duration of future shortages.[103] The Bureau of Reclamation uses the CRSS model to evaluate long-term policy and address long-term planning for the Colorado River system.[104] The CRSS model uses the Indexed Sequential Method to sample historical natural flow data from 1906 through 2007 in order to create a set of 102 separate simulations referred to as "traces" or "hydrological sequences."[105] CRSS allows the Bureau of Reclamation to evaluate proposed operating policies over a broad

[100] Exhibit No. SNWA_237, p. 25.
[101] Exhibit No. SNWA_189, p. 7-2; Transcript, Vol. 2 p. 336:18-22 (Brothers).
[102] Transcript, Vol.2 p. 336:18-22 (Brothers).
[103] Exhibit No. SNWA_189, p. A-1; Transcript, Vol.2 p. 337:4-11 (Brothers).
[104] Exhibit No. SNWA_189, p. A-1.
[105] Exhibit No. SNWA_189, p. A-1 to A-2.

range of possible future hydrologic conditions.[106] CRSS allowed the Applicant to simulate future conditions on the Colorado River system during its 50 year planning period.

The CRSS model results demonstrate that the probability, frequency and duration of shortages are significant. The CRSS model results show a 40 percent probability by 2020, and a 50 percent probability by 2025, that in any given year the Lake Mead water elevation level will be at or below 1,075 feet and the lower basin will be in shortage.[107] The CRSS model results show a 50 percent probability of shortage by 2035, with the probability of shortage reaching upwards of 60 percent by 2060.[108] Every “trace” or “hydrological sequence” created by the CRSS model shows at least one shortage sequence for the lower basin during the Applicant’s 50-year planning period. On average, the CRSS model results predict roughly two shortage sequences during the Applicant’s planning period, and that these shortage sequences would last, on average, over 15 consecutive years.[109] That means that the CRSS model predicts on average that 30 years of shortage will occur during the Applicant’s 50 year planning period.[110]

These shortage scenarios would result in significant reductions in the amount of water available to Southern Nevada. The Applicant analyzed the potential effects that shortage conditions would have on available water supplies.[111] As discussed above, the Applicant’s Colorado River allocation will be reduced by 13,000 acre-feet, 17,000 acre-feet, and 20,000 acre-feet when Lake Mead drops to 1,075 feet, 1,050 feet, and 1,025 feet, respectively. In the case of more severe and prolonged shortages, there is a significant degree of uncertainty regarding the

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[106] Exhibit No. SNWA_189, p. A-2.
[107] Exhibit No. SNWA_189, pp. A-5, A-6, Figure A-2.
[108] Exhibit No. SNWA_189, p. A-6, Figure A-2; Transcript, Vol.2 p. 339:10-13 (Brothers).
[109] Exhibit No. SNWA_189, pp. A-5 to A-6.
[110] Exhibit No. SNWA_189, p. A-6, Table A-1; Transcript, Vol.2 p. 340:16-21 (Brothers).
[111] Exhibit No. SNWA_189, Appendix A.

amount of water that would be available to Southern Nevada. In order to address that uncertainty, the Applicant used a series of assumptions in its analysis.[112] When Lake Mead remains at or below 1,025 feet for over two years, the Applicant's analysis assumes that its Colorado River allocation would be reduced by 40,000 acre-feet (twice as much as the 20,000 acre-feet reduction at 1,025 feet).[113] In the third year that Lake Mead remains at or below 1,025 feet, the Applicant's analysis assumes that water from the Arizona water bank would no longer be available because Arizona municipalities would likely be sharing in shortages, but the pro rata amount of the reductions is unknown.[114] When Lake Mead is below 1,000 feet, the Applicant's analysis assumes that no water would be available from Lake Mead because the Applicant would be taking emergency measures to deliver water from Lake Mead and the viability of those emergency measures is unknown.[115]

The Applicant's analysis graphically demonstrates the amount of water that the Applicant estimates could be available under shortage conditions on the Colorado River.[116] The Applicant's analysis includes spreadsheets showing the amount of water that could be available depending on the frequency, severity and duration of shortages as predicted by the CRSS model results.[117] The assumptions in the Applicant's analysis may overestimate or underestimate the reductions that would occur during shortage but the assumptions are reasonable for water planning purposes in light of the many uncertainties that exist. While the exact amounts of these

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[112] Exhibit No. SNWA_189, Appendix A, pp. A-3 to A-5.
[113] Exhibit No. SNWA_189, p. 8-4; Transcript, Vol.2 p. 343:14-20 (Brothers).
[114] Exhibit No. SNWA_189, p. 8-4.
[115] Exhibit No. SNWA_189, p. 8-4.
[116] Exhibit No. SNWA_189, p. 8-5, Figure 8-5.
[117] Exhibit No. SNWA_189, pp. A-10 to A-12.

reductions are unknown, the evidence clearly supports a conclusion that the reductions would be significant.

Colorado River issues are necessarily involved in almost every water management decision made by the Applicant. The severity of the current drought has taught the basin states, and Southern Nevada, that the Colorado River is a highly dynamic system with the potential for enormous fluctuations in the amount of water available.[118] In light of that fact, Southern Nevada's almost total reliance on the Colorado River has injected a high degree of uncertainty into Southern Nevada's water resource portfolio.

Southern Nevada needs a water resource that is independent of the Colorado River. The State Engineer agrees with the Applicant that it would not be advisable for the Applicant to continue to rely upon the Colorado River for 90% of Southern Nevada's water when that source is over-appropriated, highly susceptible to drought and shortage, and almost certain to provide significantly less water to Southern Nevada in the future.[119]

### B. Meeting Projected Demand

Even under normal (non-shortage) conditions on the Colorado River, the Applicant presented evidence to support a conclusion that available water supplies would be insufficient to meet projected future water demands without the water requested in these Applications.

The Applicant adopts a Water Resource Plan annually which forecasts water supply and demand over a 50-year planning period under both normal and shortage conditions on the Colorado River.[120] A 50-year planning period is considered to be reasonable and is used elsewhere in Nevada. Mr. Holmes testified that the Applicant uses a 50-year water planning

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[118] Transcript, Vol.2 p. 267:18-23 (Entsminger).
[119] Transcript, Vol.2 pp. 267:18-268:12 (Entsminger), pp. 334:4-335:15, 345:14-18 (Brothers).
[120] Exhibit No. SNWA_209.

horizon because it provides a long enough look into the future to assess potential water demand and to provide enough lead time to meet that demand.[121] Mr. Holmes further testified that other entities such as the City of Phoenix and White Pine County, as well as federal agencies, such as the Army Corps of Engineers, use a 50-year planning horizon.[122] Although the Water Resource Plan is reviewed annually, the previous year's plan may be adopted without revision if it remains effective for water planning purposes.[123] The current Water Resource Plan was revised in 2009 and that version was adopted without revision in 2010 and 2011.[124] To forecast available supply, the Water Resource Plan identifies all water supplies expected to be available during the planning period, including water supplies that are expected to be developed in the future. To forecast demand for the Water Resource Plan, projected population is multiplied by projected individual (per capita) use to create a demand-line. The Water Resource Plan presents this information in a chart which shows the available sources of supply in colored blocks under the projected demand-line.[125] The Applicant uses the Water Resource Plan to assure its members that it will be able to meet their water needs during the planning period.

The Applicant also presented an expert report that incorporates the projections in the Water Resource Plan and further analyzes the Applicant's projected sources of supply and projected water demands.[126] The State Engineer finds that the evidence demonstrates that without the water requested in these Applications, available resources would be insufficient to

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[121] Transcript, Vol. 2 pp. 307:19-308:5 (Holmes).
[122] Transcript, Vol. 2 pp. 308:6-15 (Holmes).
[123] Transcript, Vol.2 p. 249:13-18 (Entsminger).
[124] Transcript, Vol.2 p. 250:1-16 (Entsminger).
[125] Exhibit No. SNWA_209, p. 43, Figure 28.
[126] Exhibit No. SNWA_189.

meet projected future water demands under normal conditions on the Colorado River, and that shortfalls would be even greater under shortage conditions.

**1. Projected Supply**

The water resource portfolio for Southern Nevada includes all available sources of supply, including permanent and temporary supplies. Permanent supplies are resources that are replenished and available annually.[127] Permanent supplies available to the Applicant include Nevada's allocation of Colorado River water, return flow credits, conservation savings, Virgin/Muddy River Tributary Conservation ICS water, Coyote Spring Valley Imported ICS water, Las Vegas Valley groundwater, and other in-state groundwater.[128] Temporary supplies are one-time use resources that are not replenished and are used as a bridge until permanent supplies can be developed.[129] Temporary supplies available to the Applicant include Brock Reservoir System Efficiency ICS water, Arizona banked water, California banked water, and Southern Nevada banked water.[130] Because temporary supplies are one-time use resources, the Applicant must ensure that it has developed permanent supplies to satisfy demand after temporary supplies are exhausted. Additionally, because some temporary supplies are not available for use during declared shortages on the Colorado River, permanent supplies with no shortage use restrictions are necessary to replace these restricted temporary supplies.

The Water Resource Plan addresses both normal and shortage conditions on the Colorado River and assumes that the amount of water available from these permanent and temporary sources of supply will be constant. As shown in its Water Resource Plan, the Applicant expects

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[127] Exhibit No. SNWA_189, p. 3-1; Transcript, Vol.2 p. 251:16-18 (Entsminger).
[128] Exhibit No. SNWA_189, pp. 3-1 to 3-3; Exhibit No. SNWA_209; Transcript, Vol.2 pp. 248-306 (Entsminger).
[129] Exhibit No. SNWA_189, p. 3-3; Transcript, Vol.2 p. 251:19-22 (Entsminger).
[130] Exhibit No. SNWA_189, pp. 3-3 to 3-5; Exhibit No. SNWA_209; Transcript, Vol.2 pp. 248-306 (Entsminger).

to receive 272,000 afa from the Colorado River,[131] as well as a total of 50,000 afa of Virgin/Muddy River Tributary Conservation ICS water.[132] The Applicant expects to develop some 9,000 afa of Coyote Spring Valley groundwater Imported ICS.[133] There are 46,340 afa available from Las Vegas Valley groundwater rights held by the City of North Las Vegas and LVVWD.[134] The Applicant expects to receive 40,000 afa from the Arizona water bank during the planning period.[135] Conservation savings are also considered a permanent water supply and conservation is built into the demand-line as further discussed below.[136] The Applicant expects to achieve conservation savings of more than 276,000 afa by 2035.[137] Finally, the Applicant expects to develop in-state groundwater which includes 2,200 afa from Garnet and Hidden valleys, 10,600 afa from the Three Lakes and Tikaboo valleys, and the water requested in these Applications.[138] The Applicant expects that it will continue to use return flow credits to extend available water supplies by roughly 70%.[139]

The Water Resource Plan graphically demonstrates the amount of water that the Applicant expects will be available under normal and shortage conditions on the Colorado River.[140] These resources are represented by colored blocks and the diversion amounts of each resource are adjusted to reflect the 70% increase resulting from the Applicant's use of return-flow credits. There is no evidence that the Applicant has available supplies that are not included in the Water Resource Plan. As discussed above, shortage conditions would result in significant

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[131] Exhibit No. SNWA_189, p. 3-1; Transcript, Vol.2 p. 261:13-16 (Entsminger).
[132] Exhibit No. SNWA_189, p. 3-1; Transcript, Vol.2 p. 293:6-23 (Entsminger).
[133] Exhibit No. SNWA_189, p. 3-1; Transcript, Vol.2 p. 294:15-18 (Entsminger).
[134] Exhibit No. SNWA_189, p. 3-2; Transcript, Vol.2 p. 255:5-17 (Entsminger).
[135] Exhibit No. SNWA_189, p. 3-4; Exhibit No. SNWA_209, p. 26.
[136] Exhibit No. SNWA_189, p. 3-3; Transcript, Vol.2 pp. 254:22-255:4 (Entsminger).
[137] Exhibit No. SNWA_189, p. 6-1, Figure 6-1; Exhibit No. SNWA_209, p. 39, Figure 24.
[138] Exhibit No. SNWA_189, p. 3-2.
[139] Exhibit No. SNWA_189, p. 3-1; Transcript, Vol.2 pp. 289:3-290:5 (Entsminger).
[140] Exhibit No. SNWA_189, p. 4-9, Figure 4-9; Exhibit No. SNWA_209, p. 43, Figure 28.

reductions in the amount of water available to Southern Nevada from these supplies. The State Engineer finds that the Applicant's plans and projections regarding available water supplies are reasonable and reliable for water planning purposes.

**2. Projected Demand**

Forecasting water demands for a large metropolitan area comprised of nearly 2,000,000 people is not an exact science. There are numerous factors that may lead to under-forecasting or over-forecasting actual demand. The risk of under-forecasting demand is that the municipal water provider may not have developed sufficient supplies to meet actual demand which could result in catastrophic consequences for the community.[141] In the event that a municipal water provider under-forecasts demand, it may be difficult to correct that failure due to the long lead time involved in capital construction projects.[142] That is especially true for a project like the one at issue here, where the permitting and licensing efforts and projected construction timelines are estimated to take decades. The Applicant estimates future water demand based on two primary factors, population projections and average water use per customer. As described below, the State Engineer finds that the Applicant made reasonable assumptions to estimate projected water demand during its planning period.

**a. Projected Population**

The Applicant uses population forecasts prepared by the Center for Business and Economic Research ("CBER") at the University of Nevada, Las Vegas. CBER forecasts are based on a regional economic model that is widely accepted throughout the United States.[143] CBER has monitored the Clark County economy for more than 25 years and has prepared

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[141] Transcript, Vol.2 pp. 312:11-313:1 (Holmes).
[142] Transcript, Vol.2 p. 312:11-13 (Holmes).
[143] Exhibit No. SNWA_189, p. 5-1; Transcript, Vol.2 p. 311:15-16 (Holmes).

population forecasts annually since the 1990's.[144] The Applicant has used CBER forecasts for every Water Resource Plan that it has adopted since 1996.[145] CBER forecasts are only prepared for Clark County, and are therefore more specialized than other forecasts, such as those from the Nevada State Demographer.

Testimony and evidence indicates that CBER population forecasts have proven to be reliable and useful for water planning purposes, although CBER forecasts have historically under-forecasted actual population.[146] To protect against under-forecasting population, the Applicant conducts a continuous independent review of the CBER forecast and staff demographers make adjustments for water planning purposes.[147] In its current Water Resource Plan, prepared in 2009 and reviewed and adopted subsequently, the Applicant used the 2008 CBER forecast and then made adjustments to reflect the economic downturn and the lack of expected population increase in the short-term. The Applicant then adopted the annual population increases from the 2008 CBER forecast for the long-term without adjustment.[148]

In the short-term, there is a high degree of uncertainty regarding the population increases that will occur in Southern Nevada. However, a comparison of the CBER forecasts from 2008 and 2010, the Applicant adjusted forecasts in its current Water Resource Plan, and the Nevada State Demographer's forecasts from 2010 demonstrates that population forecasts converge in the long-term.[149] This means that although the current economic downturn has injected uncertainty into near-term population growth, in the long-term, the various population projections converge

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[144] Exhibit No. SNWA_189, p. 5-1; Transcript, Vol.2 pp. 310:24-311:22 (Holmes).
[145] Exhibit No. SNWA_189, p. 5-1.
[146] Exhibit No. SNWA_189, p. 5-2.
[147] Exhibit No. SNWA_189, p. 5-2; Transcript, Vol.2 pp. 312:17-313:1 (Holmes).
[148] Exhibit No. SNWA_189, p. 5-2; Transcript, Vol.2 p. 313:4-16 (Holmes).
[149] Exhibit No. SNWA_189, p. 5-4, Figure 5-1; Transcript, Vol.2 pp. 314:1-316:1 (Holmes).

to show a movement toward consensus on projected long-term population growth. Southern Nevada was one of the fastest growing regions in the country leading up to the current economic downturn.[150] Southwestern states are expected to continue to experience some of the fastest population growth in the country over the next 30-40 years.[151] Water managers focus on long-term population forecasts for water planning purposes.[152] The evidence supports a conclusion that, in the long-term, substantial population increases are likely to occur in Southern Nevada and that those population increases are reasonably reflected in the Applicant's population forecasts.

The Protestants claim that the Applicant is overestimating population increases in light of recent economic and demographic trends.[153] One report states "future demand projections have typically been based on assumptions of future population and housing expansions that may not materialize and are well above rates for the past few years."[154] During testimony, one of the witnesses for the Protestants stated that one of the factors that could eliminate need for the water is if population reached 3,130,000 by 2035.[155] However, no evidence was presented to support that number and the Protestants have not provided alternative population projections for the State Engineer to consider. The State Engineer recognizes that actual population increases may diverge from the population forecasts provided by the Applicant. However, the State Engineer also recognizes that actual population increases could be greater than forecasted, and there is no reliable evidence that actual population will be substantially less than the Applicant's forecasts.

[150] Exhibit No. SNWA_189, pp. 5-4 to 5-5;
[151] Exhibit No. SNWA_189, p. 5-5; Transcript, Vol.2 p. 318:15-22 (Holmes).
[152] Transcript, Vol.2 p. 317:3-8 (Holmes).
[153] Transcript, Vol.23 p. 5098:17-20 (Gleick).
[154] Exhibit No. GBWN_069, p. 5.
[155] Transcript, Vol.23 pp. 5124:22-5125:3 (Gleick).

From the perspective of a water manager, the risk of underestimating population increases is that the municipal water provider may not have developed sufficient water supplies to meet actual demand. The State Engineer finds that the population forecasts in the Water Resource Plan are reasonable and therefore appropriate for water planning purposes.

**b. Individual Water Use Estimates**

The Applicant calculates individual water use in terms of gallons per person per day or gallons per capita per day ("GPCD"). The Applicant calculates GPCD as total community water use, divided by the permanent community population, divided by 365 days per year.[156]

The Applicant uses GPCD to measure and compare its water use over time.[157] There is currently no standard measuring system for comparing water use between communities.[158] GPCD cannot be used to compare water use in different communities because of inconsistent water use accounting practices, varying climate conditions, demographics and other factors.[159] While no formal evaluation has been conducted, there is evidence that Southern Nevada's annual influx of an estimated 37 million tourists also inflates GPCD in Southern Nevada compared to per capita use in other communities.[160] Despite those limitations, GPCD is an effective tool for an individual community to use as a yardstick against its own water use.[161]

Conservation achievements affect the GPCD calculation, and in turn, the water demand projections for Southern Nevada. The Applicant's GPCD projections reflect past conservation achievements and future conservation goals. The Applicant's water conservation efforts have

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[156] Exhibit No. SNWA_189, p. 5-1; Transcript, Vol.2 p. 309:12-17 (Holmes).
[157] Exhibit No. SNWA_189, p. 5-1.
[158] Transcript, Vol.1 pp. 107:16-109:16 (Mulroy); Transcript, Vol.2 p. 321:10-23 (Holmes).
[159] Exhibit Nos. SNWA_189, p. 5-1; SNWA_15, p. 66; SNWA_397, p. 8; Transcript, Vol.2 pp. 321:24-323:6 (Holmes).
[160] Transcript, Vol.2 pp. 322:10-13 (Holmes); Transcript, Vol.23, pp. 5204:15-5205:9 (Gleick).
[161] Exhibit No. SNWA_189, p. 5-1.

been highly successful and nationally recognized as discussed in detail in "Interbasin Transfer Criteria – Conservation" below. Between 1991 and 2009, the GPCD in Southern Nevada decreased from 344 to 240 due largely to intensive conservation efforts.[162] In 2009, the Applicant set a conservation goal of 199 GPCD by 2035.[163] The Applicant believes that conservation goal is "challenging" but also "realistic."[164] The demand forecast in the Applicant's Water Resource Plan incorporates the conservation goal established in 2009 to achieve 199 GPCD by 2035.[165]

The Protestants allege that additional conservation efforts would allow the Applicant to further reduce its GPCD projections. The Protestants claim that the Applicant could achieve 166 GPCD by 2035. The Protestants point to the fact that 166 GPCD is "well in line with current practice in most western arid climate cities" and that 166 GPCD is higher than Los Angeles's current delivery rate and comparable to the current delivery rate in Albuquerque and Phoenix.[166] However, as explained above, GPCD cannot be used to compare per capita water use in different communities, so these comparisons do not support a conclusion that the Applicant could actually achieve 166 GPCD. The Protestants also identify a variety of conservation efforts that they believe would allow the Applicant to further reduce its GPCD projections. The Applicant has already achieved significant reductions in water use through its conservation efforts, as discussed below in the "Interbasin Transfer Criteria – Conservation" section.[167] Additional conservation savings will be necessary to achieve the goal of 199 GPCD by 2035.[168] Although the Applicant

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[162] Exhibit No. SNWA_189, p. 5-2.
[163] Exhibit No. SNWA_189, 5-2; Exhibit No. SNWA_004, p. 8-1; Transcript, Vol.2 p. 320:12-21 (Holmes).
[164] Transcript, Vol.2 p. 320:12-21 (Holmes).
[165] Exhibit No. SNWA_209, p. 39.
[166] Transcript, Vol.23 pp. 5100:16-20, 5124:22-25 (Gleick).
[167] Exhibit No. SNWA_189, p. 5-2.
[168] Exhibit No. SNWA_189, p. 5-2.

expects increased conservation in the future, the Applicant expects diminishing returns from its conservation efforts in light of the significant reductions it has already achieved.[169] Despite evidence from the Protestants, the State Engineer finds that the Applicant's per capita water use forecasts are sound, and are a proper basis for projecting future supply needs.

### 3. Projected Shortfall

Based on the evidence presented, available water supplies will not be sufficient to meet projected water demands in Southern Nevada during the Applicant's 50-year planning period. If these Applications are not approved, there will be shortfalls between water supply and demand in the water resource portfolio for Southern Nevada.[170] Shortfalls would be potentially catastrophic as the Applicant would not be able to supply water to meet the needs in Southern Nevada.

Under normal Colorado River conditions, the Applicant anticipates that as early as 2020, water from the Applications will be necessary to meet customer demand.[171] The Applicant anticipates that it could manage its use of temporary supplies in order to avoid shortfalls until 2028.[172] However, as explained above, temporary supplies are one-time use resources that are not replenished. Therefore, without water from the Applications, shortfalls would increasingly become greater over the planning period as there would be no permanent supplies available to replace temporary supplies after they are exhausted.[173]

Projected demand will require more and more water from these Applications until the full amount approved under the Applications is developed. By the end of the 50-year planning

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[169] Transcript, Vol.4 p. 896:4-7 (Bennett).
[170] Exhibit No. SNWA_189, p. 6-2, Figure 6-2; Exhibit No. SNWA_209, p. 43; Transcript, Vol.2 pp. 345:22-347:20 (Holmes, Brothers, Entsminger).
[171] Exhibit No. SNWA_189, p. 6-2, Figure 6-2; Exhibit No. SNWA_209, p. 43; Transcript, Vol.2 p. 326:13-18 (Holmes).
[172] Exhibit No. SNWA_189, p. 6-4, Figure 6-3; Transcript, Vol.2 p. 327:14-18 (Holmes).
[173] Transcript, Vol.2 p. 327:8-13 (Holmes).

period, customer demand is projected to require the diversion of 897,087 afa.[174] Without any additional water resources, that projected demand would exceed available supplies by approximately 275,000 afa.[175] Under shortage conditions, shortfalls are projected to be greater and to occur sooner.[176] The Applicant's analysis of the CRSS model results and potential water resource management under the various scenarios demonstrates that projected customer demand will require water from the Applications. Under a dry scenario on the Colorado River, customer demand exceeds available supply by 184,655 as early as the year 2021.[177] Under an average Colorado River scenario, customer demand exceeds available supply by more than 100,000 afa by the year 2041 and steadily increases to 313,914 afa by the year 2060.[178] Even under a wet scenario on the Colorado River, customer demand exceeds available supply by a range of 100,000 afa to 170,000 afa during 14 of the years in the 50-year planning period.[179] Water from the Applications would be needed to fill these supply gaps.

The Applicant has identified all available water supplies and has presented reasonable and appropriate water demand projections to demonstrate that it will not be able to meet Southern Nevada's water needs in the event that these Applications are not approved. A witness for the Protestants expressed opinions that combining reductions in both projected population and per capita demand may completely eliminate Southern Nevada's need for new water supplies.[180] However, this opinion was not supported by the same level of expertise, analysis, and documentation as was presented by the Applicant. Therefore, the State Engineer finds the

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[174] Exhibit No. SNWA_189, p. 6-4, Table 6-1.
[175] Exhibit No. SNWA_189, p. 6-4, Figure 6-3 and Table 6-1.
[176] Exhibit No. SNWA_189, p. 8-5, Figure 8-5, p. 6-5 and pp. A-10 to A-12.
[177] Exhibit No. SNWA_189, Appendix A, Table A-2.
[178] Exhibit No. SNWA_189, Appendix A, Table A-3.
[179] Exhibit No. SNWA_189, Appendix A, Table A-4.
[180] Transcript, Vol.23 p. 5124:18-21 (Gleick).

Applicant's evidence regarding population and customer use is substantially more credible and reliable than other evidence available, including the limited evidence presented by the Protestants. The Applicant's evidence shows that by the year 2028, under normal Colorado River conditions, without water from the Applications or other augmentation supplies, demands for water in Southern Nevada would not be met.[181] The evidence supports a conclusion that Southern Nevada's future water demands will exceed available supplies during the Applicant's planning period, and that water from the Applications is needed for beneficial use by the Applicant.

**C. <u>Replacing Temporary Supplies</u>**

The Applicant needs water from the Applications because it is a permanent resource that will allow the Applicant to replace temporary resources. As explained above, temporary resources are one-time use resources that are exhausted when used and provide a bridge supply until the Applicant can develop permanent water supplies.[182] The Applicant has been successful in negotiating for temporary supplies such as surplus water and ICS on the Colorado River and water banks with California and Arizona.[183] When those temporary supplies were negotiated, there was a clear expectation on the part of the other basin states that the Applicant would develop permanent supplies to meet its long-term water needs.[184] If the Applicant were to fail to develop permanent supplies to replace those temporary supplies as they are exhausted, unmet

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[181] Exhibit No. SNWA_189, p. 6-5.
[182] Transcript, Vol.2 pp. 251:19- 252:4 (Entsminger).
[183] Exhibit No. SNWA_189, pp. 3-3 to 3-5.
[184] Transcript, Vol.2 pp. 273:16-274:4 (Entsminger).

demand would continue to grow during the Applicant's planning period.[185] Therefore, the Applicant must develop water from the Applications to replace its temporary supplies.

Based on the evidence in the record, including but not limited to that cited above, the State Engineer finds that the Applicant has demonstrated that this water is a critical component of the water resource portfolio for Southern Nevada and that water from the Applications will be put to beneficial use to protect against shortages on the Colorado River, meet projected demands, and replace temporary supplies. The State Engineer further finds that even if the Applicant were to implement extraordinary conservation measures and decrease its GPCD to the level suggested by the Protestants, the Applicant would still need water from the Applications to protect against shortages on the Colorado River and to replace the Applicant's limited temporary water supplies.

## II. GOOD FAITH INTENTION AND FINANCIAL ABILITY

The Applicant must provide proof satisfactory to the State Engineer of the Applicant's (1) intention in good faith to construct any work necessary to apply the water to the intended beneficial use with reasonable diligence, and (2) financial ability and reasonable expectation actually to construct the work and apply the water to the intended beneficial use with reasonable diligence.[186] The purpose of these requirements is to protect against water speculation.

### A. <u>Good Faith Intention</u>

The Applicant's demonstrated need for this water may be the most compelling evidence of its intention. The Applicant is a government agency responsible for ensuring that adequate water supplies are available to meet Southern Nevada's water needs. As discussed above, the Applicant will have insufficient water available to meet Southern Nevada's water needs unless it

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[185] Transcript, Vol.2 p. 327:8-13 (Holmes); Transcript, Vol.1 p. 123 (Mulroy).
[186] NRS 533.370(1)(c).

puts the water from the Applications to beneficial use. Therefore, it is reasonable to conclude that the Applicant intends to construct the works necessary to put this water to beneficial use.

The support in Southern Nevada for the development of the Applications is also evidence of the Applicant's intention. In 2004, an Integrated Advisory Committee comprised of 29 stakeholder representatives recommended that the Applicant pursue development of the Applications.[187] The Big Bend Water District, the City of Boulder City, the City of Henderson, the City of Las Vegas, the City of North Las Vegas, the Clark County Water Reclamation District, and the LVVWD have all passed resolutions supporting development of the Applications.[188] These entities represent the interests of nearly 2 million people in Southern Nevada. The Applicant's board of directors has directed staff to pursue these Applications.[189] These recommendations, approvals and directions are evidence that the Applicant intends to construct the works necessary and put water from the Applications to beneficial use.

The fact that the Applicant has expended considerable resources pursuing the Applications is also evidence of its intentions. This is the second time that the Applicant has come to a hearing before the State Engineer on these Applications. The Applicant has generated hundreds of studies, analyses and expert reports for these hearings and in connection with the Applications generally. The Applicant has directed its staff to prepare multiple versions of development plans for the Applications as the legal and scientific landscape has evolved.[190] The Applicant has developed monitoring, management and mitigation plans for eventual pumping as described below. The Applicant has spent tens of millions of dollars purchasing land, surface

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[187] Exhibit No. SNWA_209, Appendix 2; Exhibit No. SNWA_201; Transcript, Vol.1 pp. 225:11-228:5 (Brothers).
[188] Exhibit Nos. SNWA_223 through SNWA_229.
[189] Exhibit No. SNWA_211; Transcript, Vol.1 pp. 235:24-236:4 (Brothers).
[190] Exhibit No. SNWA_190; Exhibit No. SNWA_190; SNWA_191; Transcript, Vol.1 pp. 204:16-205:13 (Holmes).

and groundwater rights, and grazing permits for use in monitoring, management and mitigation efforts.[191] The Applicant has gone through extensive federal permitting and procedural requirements as described below. Ms. Brothers testified regarding the long history of efforts by the Applicant in pursuing the Applications and expressed an opinion that the Applicant has a good faith intention to construct the infrastructure necessary to use water from the Applications.[192] This expenditure of considerable time, money and resources is evidence that the Applicant intends to construct the works necessary and put water from the Applications to beneficial use.

The Applicant's timeline for construction demonstrates reasonable diligence given the unique nature and scope of the diversion and delivery infrastructure. Construction is expected to take place in phases over an estimated 10 year period. The Applicant expects that, if necessary, it could begin putting the water to beneficial use by 2020 depending on the existence of shortage conditions on the Colorado River.[193] Based upon the evidence in the record, including but not limited to that cited above, the State Engineer concludes that the Applicant has provided proof satisfactory of its intention in good faith to construct the works necessary and apply the water to beneficial use with reasonable diligence.

### B. Financial Ability and Reasonable Expectation

#### 1. Plan of Development

The Applicant's engineering department has developed a conceptual plan of development for the Clark, Lincoln, and White Pine Counties Groundwater Development Project (the "Project"), which will provide the infrastructure needed to put water from the Applications to

[191] Transcript, Vol.1 p. 100:19-20 (Mulroy).
[192] Transcript, Vol.1 p. 238:14-18 (Brothers).
[193] Exhibit No. SNWA_195; Transcript, Vol.1 pp. 216:10-217:13 (Holmes).

beneficial use.[194] The engineering department is responsible for developing plans for the Applicant's capital construction projects.[195] The Applicant's and LVVWD's engineering departments have successfully developed 177 major capital projects since 1987.[196] Those projects include pumping stations, treatment plants, transmission lines and an assortment of other facilities. The engineering department is responsible for the planning, design, and construction management for some of the largest, most complex, and technically challenging water utility facilities in the country.[197]

The Applicant presented evidence that the conceptual plan of development for the Project is feasible. Although the Project is large in scale, its basic components are similar to other projects that the Applicant has successfully constructed.[198] There is no evidence that the Project will require technologies or construction methods that are unattainable and the Protestants did not present any evidence that the Project would not be technically feasible. The conceptual plan would allow the Applicant to divert and convey all of the water requested in these Applications.[199]

The Applicant is complying with all federal permitting requirements in connection with the Project. A draft Environmental Impact Statement has been published for the Project. The comment period is closed and the Applicant expects a final Environmental Impact Statement in 2012.[200] The Applicant is working with the Fish and Wildlife Service in connection with a

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[194] Exhibit No. SNWA_190; Transcript, Vol.1 pp. 201:16-204:15 (Holmes).
[195] Transcript, Vol.1 p. 198:3-5 (Holmes).
[196] Exhibit No. SNWA_235; Transcript, Vol.1 p. 199:4-6 (Holmes).
[197] Exhibit No. SNWA_235; Transcript, Vol.1 p. 198:19-200:1 (Holmes).
[198] Transcript, Vol.1 p. 201:6-14 (Holmes).
[199] Transcript, Vol.1 p. 204:5-12 (Holmes).
[200] Transcript, Vol.1 p. 217:18-25 (Holmes).

biological opinion which it also expects will be completed in 2012.[201] The Applicant has satisfied or is in the process of satisfying all federal permitting requirements at this stage of development of the Project. The State Engineer finds that construction of the Project has a feasible conceptual plan of development.

**2. Estimated Construction Costs**

The Applicant's engineering department has developed a cost estimate based on the conceptual plan of development for the Project.[202] The engineering department prepared this cost estimate using the same methods it has used to develop cost estimates for other capital construction projects.[203] The engineering department uses a cost estimating guide that contains "cost curves, or reasonable cost estimates, for various project components."[204] The guide is based on construction costs for various projects constructed in the southwestern United States from 1995 to 2003, including projects constructed by the Applicant during that time.[205] The guide was prepared in accordance with industry standards, including those set by the Association for Advancement of Cost Engineering ("AACE").[206] The engineering department has used this guide to generate cost estimates for projects since 2006, including projects in its 2011 Major Construction and Capital Plan.[207] The engineering department used this same cost estimating guide to develop the cost estimate for the Project.[208]

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[201] Transcript, Vol.1 p. 217:19-23 (Holmes).
[202] Exhibit No. SNWA_195; Transcript, Vol.1 pp. 211:18-25 (Holmes).
[203] Exhibit No. SNWA_195; Transcript, Vol.1 p. 214:18-22 (Holmes).
[204] Exhibit No. SNWA_194; Exhibit No. SNWA_195; Transcript, Vol.1 pp. 208:9-209:15 (Holmes).
[205] Exhibit No. SNWA_195, pp. 2-3; Transcript, Vol.1 p. 209:8-15 (Holmes).
[206] Exhibit Nos. SNWA_195, p. 2; SNWA_233; SNWA_234; Transcript, Vol.1 p. 210:3-15 (Holmes).
[207] Exhibit No. SNWA_195, p. 2; Transcript, Vol.1 pp. 207:25-208:19 (Holmes).
[208] Transcript, Vol.1 pp. 215:25-216:6 (Holmes).

The Applicant's engineering department estimates that the capital costs for the Project will be approximately $3.224 billion.[209] Including contingency (15%) and inflation (4%), the engineering department estimates that the cost to construct the Project would be approximately $6.45 billion.[210] The engineering department has developed schedules for phased construction of the Project based on the earliest timing that construction would likely occur and has prepared cost breakdowns for each phase.[211] The engineering department also developed cash flow projections to allow financial experts to evaluate potential funding requirements for the Project.[212]

The current Project cost estimate is a Class 4 estimate under the AACE guidelines which means that it is in the concept or feasibility study estimate category.[213] Under AACE guidelines regarding a Class 4 estimate, a reasonable expectation is that the actual cost of the Project could range from 50% above to 30% below the Class 4 cost estimate.[214] However, the Applicant's current cost estimate is the best available evidence regarding the cost of the Project. At this stage of development, it is not realistic to expect a concrete number and there is no evidence that the Applicant's current cost estimate is unreasonable. The Protestants did not present any evidence to support an alternative cost estimate. The Applicant's Deputy General Manager who oversees the Applicant's engineering department testified that "the current estimates are very reasonable" and that he is "very confident in the number that we have prepared."[215]

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[209] Exhibit No. SNWA_195, p. 4, Table 1; Transcript, Vol.1 p. 213:13-21 (Holmes).
[210] Exhibit No. SNWA_195, pp. 5, 7; Transcript, Vol.1 p. 214:4-6 (Holmes).
[211] Exhibit No. SNWA_195, pp. 3-5.
[212] Exhibit No. SNWA_195, pp. 5, 7, Table 2.
[213] Exhibit No. SNWA_195, p. 2.
[214] Exhibit No. SNWA_189, p. 2.
[215] Transcript, Vol.1 pp. 215:25-216:6 (Holmes).

The State Engineer finds that the evidence supports a conclusion that the Applicant's cost estimate is reasonable.

**3. <u>Ability to Finance Estimated Construction Costs</u>**

The Applicant provided the cost estimate, construction schedule and cash flow projections to John Bonow of Public Financial Management, and Guy Hobbs of Hobbs Ong and Associates.[216] Mr. Bonow and Mr. Hobbs are financial advisors to various Nevada municipalities, including the Applicant, and are recognized experts in the field of public finance. Together, they have been involved in hundreds of publicly financed projects which have required the issuance of tens of billions of dollars in municipal debt obligations.[217] Mr. Bonow and Mr. Hobbs have served as financial advisors to the Applicant for over a decade and have a specialized knowledge of the Applicant's financial condition and available revenue sources.[218]

Mr. Bonow and Mr. Hobbs prepared an expert report that analyzed the Applicant's ability to issue bonds to finance the estimated cost of the Project.[219] In their report, Mr. Bonow and Mr. Hobbs analyzed the Applicant's past financing history and its current credit status, and prepared a funding plan which demonstrates that the Project would be able to be financed via issuance of bonds. This is the same analysis that is undertaken by the Applicant each time it needs to access the capital markets.[220] This is the same methodology used by other financial advisors when determining whether any municipality has the financial ability to construct a large capital project.[221]

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[216] Exhibit No. SNWA_383; Transcript, Vol.13 p. 214:11-17 (Holmes).
[217] Transcript, Vol.13 pp. 2836:1-25 (Bonow); 2840:11-23 (Hobbs).
[218] Transcript, Vol.13 pp. 2837:5-2838:3 (Bonow); 2841:17-2842:11 (Hobbs).
[219] Exhibit No. SNWA_383.
[220] Transcript, Vol.13 p. 2842:22-2843:19 (Hobbs).
[221] Transcript, Vol.13 p. 2846:1-5 (Hobbs).

With regard to the Applicant's past financing history, the report analyzes the Applicant's ability to access the capital markets, the performance of bonds supported by the Applicant's revenues, and the past credit ratings of entities that have issued bonds on behalf of the Applicant.[222] That analysis describes the sources of revenue that are available to the Applicant, including various rates and charges to customers, and presents a summary of the revenues received over the past five years that were available to pay debt service on outstanding debt. Based on this review, Mr. Bonow and Mr. Hobbs concluded that the Applicant has never had a barrier to accessing the capital markets and that it has done so on agreeable terms, meaning a cost of capital (i.e. the interest rate on the bonds) that is low compared to the marketplace.[223]

With regard to the Applicant's current credit status, the report analyzes factors such as the Applicant's current plan of finance for capital projects and the most recent credit ratings of entities that have issued bonds on behalf of the Applicant.[224] The Applicant's current plan of finance is to fund 10% of initial construction costs through its commercial paper program and to then issue tax-exempt bonds every two years through LVVWD with level debt service over 30 years.[225] The Applicant uses that plan of finance and issues debt predominantly through LVVWD because doing so results in the lowest cost of capital at this time.[226] As of September 2011, LVVWD enjoyed a credit rating of AA+ and Aa2 from S&P and Moody's, respectively, which are among the highest ratings available from those agencies.[227] The Applicant has never failed to make full and timely payment on its debt obligations.[228] Based on this review, Mr.

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[222] Exhibit No. SNWA_383, Section I.
[223] Transcript, Vol.13 pp. 2844:11-15 (Bonow), p. 2854:18-20 (Hobbs).
[224] Exhibit No. SNWA_383, Section II.
[225] Exhibit No. SNWA_383, p. 22.
[226] Transcript, Vol.13 pp. 2847:23-2848:17 (Bonow).
[227] Exhibit No. SNWA_383, p. 22; Transcript, Vol.13 pp. 2853:11-19, 2860:10-15 (Hobbs).
[228] Transcript, Vol.13 p 2858:3-6 (Hobbs).

Bonow and Mr. Hobbs concluded that the Applicant currently accesses the capital markets on agreeable terms.[229]

In summary, Mr. Bonow and Mr. Hobbs expressed an opinion that debt supported by the Applicant's revenues is attractive to the capital markets because of five main factors: (1) the Applicant is an essential service provider which means that its revenues are reliable because customers place a high priority on receiving, and paying for, water service, (2) the Applicant has independent rate setting authority which means it does not have to go through multiple levels of state or federal approval to adjust its rates as necessary, (3) the Applicant has ample headroom to increase rates because current rate levels are modest which gives investors comfort that the Applicant can raise rates as necessary, (4) the Applicant is a high quality credit due to its past financing history and current status as a credit, and (5) the Applicant is contractually obligated to raise rates in certain circumstances which gives investors comfort that they will receive full and timely payment.[230] Mr. Bonow and Mr. Hobbs expect that these factors will allow the Applicant to remain attractive to the capital markets in the future and to finance the Project on agreeable terms.[231]

After analyzing the Applicant's past financing history and its current status as a credit, Mr. Bonow and Mr. Hobbs created a funding plan to analyze the Applicant's ability to finance its funding needs for all ongoing and planned projects, including the Project. The funding plan assumes that the Applicant would access the capital markets under the Applicant's typical plan of finance because that is the most cost effective approach at this time.[232] The funding plan

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[229] Transcript, Vol.13 p. 2860:12-15 (Hobbs).
[230] Transcript, Vol.13 pp. 2856:7-2858:2 (Hobbs).
[231] Transcript, Vol.13 p. 2845:3-6 (Bonow).
[232] Transcript, Vol.13 pp. 2865:7-2866:11 (Hobbs).

assumes that current market conditions, with the exception of an assumption about higher interest rates (as noted below), would be in place because predicting future market conditions would be a highly speculative exercise.[233]

The funding plan uses a series of assumptions regarding interest rates, projected growth and development that would affect growth related fees and the size of the customer base, available revenues, future refinancing and costs of issuance of the bonds. These assumptions demonstrate that the Applicant would have the financial ability to construct the Project even during challenging market conditions and periods of almost non-existent population growth.[234]

With regard to interest rates, the funding plan assumes a blended interest rate of roughly 6.25% for the bonds which is significantly higher than interest rates in the current marketplace.[235] When the Applicant last accessed the capital markets in 2011, it achieved an interest rate of 4.06%.[236] If that interest rate had been used in the funding plan, the resulting interest costs would have been about two-thirds of the costs identified in the funding plan.[237]

With regard to projected growth and development, the funding plan assumes almost non-existent population increases.[238] This assumption affects the amount of commodity charge revenues and connection charge revenues that are projected to be available under the funding plan.[239] Commodity charge revenues would be constrained because essentially only existing

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[233] Transcript, Vol.13 pp. 2846:21-24, pp. 2889:21-2891:16, pp. 2906:22-2907:9, p. 2910:18, p. 2921:13-15 (Bonow).
[234] Transcript, Vol.13 p. 2846:12-24 (Bonow, Hobbs).
[235] Exhibit No. SNWA_383, Appendix F; Transcript, Vol.13 p. 2868:14-16 (Hobbs).
[236] Transcript, Vol.13 p. 2869:10-11 (Hobbs).
[237] Transcript, Vol.13 p. 2869:16-19 (Hobbs).
[238] Exhibit No. SNWA_383, Appendix C.
[239] A "commodity charge" is a charge for each 1,000 gallons of potable water, from any source whatever, delivered by Henderson, North Las Vegas and LVVWD to their customers. A "connection charge" is a charge for each new connection within the service areas of Henderson, North Las Vegas and LVVWD to their customers. *See* Exhibit No. SNWA_383, p. 16.

customers would be paying these charges. Connection charge revenues would be almost non-existent because they are dependent on new customers connecting to the water system.[240] This assumption allowed the financial experts to analyze the Applicant's ability to finance the Project even if no growth occurs and the Project is built solely for drought protection purposes.[241] If moderate growth were to occur, it would increase the amount of revenues available to pay debt service on the bonds from sources other than the commodity charge. This would result in lower monthly water bills for southern Nevadans.

In addition, with regard to available revenues, the funding plan also assumes that only revenues from its commodity charge and reliability charge[242] would be used to pay debt service even though revenues from other charges could be available.[243] At the same time, only the commodity charge rate was adjusted to generate additional revenues meaning there was no increase to other rates that could be adjusted to generate revenues.[244] The funding plan assumes that neither accumulated reserves nor current reserves would be used to pay debt service even though those sources could be available to pay debt service.[245] The funding plan also assumed that revenues from the Applicant's 0.25% sales tax would not be available after the current tax sunsets in 2025 even though the Clark County board of commissioners is now authorized to extend the sales tax beyond 2025.[246] These assumptions depress the funding plans' projections regarding the amount of revenues available to pay debt service on the bonds. The result is that

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[240] Transcript, Vol.13 p. 2879:10-19 (Bonow).
[241] Transcript, Vol.13 p. 2872:15-24 (Hobbs).
[242] A "reliability charge" is an excise tax on all residential customers at 0.25% of the total water bill and at 2.5% for all other customer classes within Henderson, North Las Vegas and LVVWD. *See* Exhibit No. SNWA_383, p. 16.
[243] Exhibit No. SNWA_383, p. 29.
[244] Exhibit No. SNWA_383, p. 33; Transcript, Vol.13 pp. 2851:14-21, 2871:23-2872:14 (Hobbs).
[245] Transcript, Vol.13 p. 2861:10-13(Hobbs).
[246] Transcript, Vol.13 pp. 2880:18-2882:7 (Hobbs).

the commodity charge rate bears the full brunt of the cost of financing the Project under the funding plan.[247]

With regard to refinancing, the funding plan assumes that there would be no refinancing of the bonds prior to their final maturities when they are paid off.[248] The vast majority of bonds in the marketplace, approximately 95% of the bonds with a call option or prepayment feature, are refinanced at least once prior to maturity which allows the issuer to achieve interest cost savings.[249] If the Applicant were to refinance the bonds prior to maturity at a lower interest rate, it would likely result in lower financing costs for the Project, and lower monthly bills for southern Nevadans than were calculated in the financing report by Mr. Bonow and Mr. Hobbs.[250]

With regard to the projected debt coverage ratio, the funding plan does not reflect the fact that the commodity charge rate could decrease as bonds are retired and debt service levels decline. The Applicant is required to maintain a minimum debt coverage ratio of 1.00x, meaning pledged revenues must at least be equal to debt service requirements on outstanding bonds.[251] However, the funding plan reflects coverage ratios that exceed that requirement.[252] That means that over time, the commodity charge rate levels could decrease since those inflated debt coverage ratios would not be required.[253]

With regard to the cost of issuance of the bonds, the funding plan assumes roughly $800 million in additional bonds would be needed to finance costs of issuance, including costs of

[247] Transcript, Vol.13 p. 2896:21-23 (Hobbs).
[248] Transcript, Vol.13 pp. 2869:25-2870:10 (Hobbs).
[249] Transcript, Vol.13 p. 2870:2-4 (Hobbs).
[250] Transcript, Vol.13 p. 2870:4-10 (Hobbs).
[251] Exhibit No. SNWA_383, p. 15.
[252] Exhibit No. SNWA_383, p. 35.
[253] Transcript, Vol.13 pp. 2877:15-2878:2 (Hobbs).

capitalized interest and original issue discount.[254] If the Applicant's cash flow requirements do not require the use of capitalized interest or if investors prefer a bond pricing structure other than original issue discount bonds, other financing structures could be used that would significantly reduce those financing costs.[255]

Even though many of these assumptions depress revenue projections, the funding plan still demonstrates that the Applicant would be able to finance the Project. The funding plan includes tables showing the financing requirements for: (1) existing debt, (2) existing debt and planned capital projects other than the Project, and (3) existing debt and planned capital projects including the Project.[256] These tables demonstrate the annual principal and interest payments for the bonds, the amount of revenues that would be required for those payments, and the commodity charge rate increases that would be necessary to generate those revenues and maintain the required minimum 1.00x debt coverage ratio.[257] Under the assumptions discussed above: (1) the principal amount of the bonds issued for the Project would be estimated at approximately $7.283 billion; (2) the interest costs of the Project would be estimated at approximately $8.18 billion; and (3) the total cost of the Project would be estimated at approximately $15.463 billion.[258] The maximum commodity charge rate that would be required to pay debt service on existing debt and planned projects including the Project would be $4.67 per thousand gallons of water. If the commodity charge rate were increased to $4.67 per

[254] Exhibit No. SNWA_383, p. 34; Transcript, Vol.13 p. 2870:16-23 (Hobbs).
[255] Transcript, Vol.13 pp. 2870:19-2871:4 (Hobbs).
[256] Exhibit No. SNWA_383, p. 30, 33, 34-35.
[257] Transcript, Vol.13 pp. 2863:13-2865:4 (Hobbs).
[258] Exhibit No. SNWA_383, p. 35.

thousand gallons of water, the resulting average monthly residential water bill in Southern Nevada would be $90.62 by the year 2026.[259]

Mr. Bonow and Mr. Hobbs analyzed the ability of customers to pay increases in the commodity charge rate by comparing the current and projected average water bill in Southern Nevada to the current and projected average water bills in 50 of the largest U.S. metropolitan areas. The comparison used a survey prepared by Black and Veatch to identify average water bills for those areas in 2010 and then made adjustments to reflect rate increases that would, by assumption, occur in those areas in the future.[260] The comparison shows that as the commodity charge rate increases under the funding plan, the resulting average water bill in Southern Nevada would continue to compare favorably to the average water bills in other metropolitan areas.[261] Therefore, even with the assumptions in the funding plan, there is evidence that the resulting average water bill would continue to be affordable for customers in Southern Nevada.

To contest the analysis prepared by Mr. Hobbs and Mr. Bonow, the Protestants presented Sharlene Leurig, an expert in the "assessment of risk factors affecting municipal bond financing for water projects or water infrastructure."[262] Ms. Leurig is an analyst at CERES which is a "non-profit research and advocacy group."[263] She is the author of a report titled "The Ripple Effect: Water Risk in the Municipal Bond Market."[264] Ms. Leurig has only four years of experience with issues relating to municipal bonds.[265] She has never advised a municipality on

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[259] Exhibit No. SNWA_383, p. 36.
[260] Exhibit No. SNWA_383, p. 38; Exhibit No. SNWA_384; Transcript, Vol.13 pp. 2882:22-2885:18 (Bonow).
[261] Transcript, Vol.13 p. 2887:11-15 (Bonow).
[262] Transcript, Vol.22 p. 4831:1-3 (State Engineer).
[263] Transcript, Vol.22 p. 4868:19-21 (Leurig).
[264] Exhibit No. GBWN_116.
[265] Transcript, Vol.22 p. 4864:9-20 (Leurig).

how to access the capital markets. She has never prepared a funding plan for a municipality.[266] She is not an expert regarding the Applicant's financial condition or the process the Applicant uses to finance its capital construction projects.[267] She did not prepare an independent analysis regarding the Applicant's past financing history, its current status as a credit, or its ability to finance the Project.[268] She did not analyze the Applicant's rate levels, ability to raise rates, or how those rates compare to other municipalities.[269]

Ms. Leurig testified that the credit rating agencies and investors are not currently accounting for "water risks" relating to municipal utilities. However, the Applicant provided evidence that the credit rating agencies and investors have asked the Applicant about Southern Nevada's water supply issues which indicates an awareness of "water risks."[270]

Ms. Leurig pointed to a number of water related risk factors which she believes were not adequately addressed in the Applicant's funding model. Mr. Hobbs testified that "those are not the types of considerations or assessments of risk that the credit markets do take into account."[271] The Applicant's funding model is based on current market conditions. It would not be reasonable to base a funding model on hypothetical future market conditions because predicting future market conditions would be a highly speculative exercise. Ms. Leurig did not assert that financing the Project under current market conditions would be more expensive than the funding plan.

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[266] Transcript, Vol.22 p. 4865:6-9 (Leurig).
[267] Transcript, Vol.22 p. 4865:10-21 (Leurig).
[268] Transcript, Vol.22 p. 4866:9-23 (Leurig).
[269] Transcript, Vol.22 p. 4867:2-14 (Leurig).
[270] Transcript, Vol.1 pp. 93:17-95:7 (Mulroy).
[271] Transcript, Vol.13 p. 2889:6-13 (Hobbs).

Ms. Leurig testified that financing the Project may be more expensive than predicted in the funding plan because of factors she believes will be taken into account by investors in the future. However, Ms. Leurig did not express an opinion, either in her testimony or reports, that the Applicant would not have the financial ability to construct this Project and put the water to beneficial use, nor would she have the expertise to do so. When asked by the State Engineer whether she believed the Applicant has "the financial ability and reasonable expectation to construct the work," Ms. Leurig replied that the Applicant's "ability to actually finance the Project is somewhat tenuous."[272] However, based on Ms. Leurig's lack of qualifications and experience in the public financing field, the State Engineer gives this conclusion little weight.

Ms. Leurig's testimony and reports cannot support a determination that the Applicant lacks the requisite financial ability to finance the Project. There are any numbers of factors that may ultimately affect financing for the Project. The financing of the Project will take place over decades and there are unforeseen events, contingencies, and forces that could be realized during that time period. However, the Applicant's financial experts focused on factors that are known at this time and made revenue limiting assumptions to develop a funding model that would allow the Applicant to finance the Project. Those financial experts, unlike Ms. Leurig, have been involved in hundreds of publicly financed capital projects. Mr. Bonow and Mr. Hobbs provided a level of analysis that surpasses the level of analysis presented by any applicant in the history of water rights hearings before the State Engineer. They used the same analysis that is used anytime a municipality determines whether it has the financial ability to construct a large capital project.[273] Based on their funding model and analysis, it was the opinion of those two experts

[272] Transcript, Vol.22 p. 4891:1-13 (Leurig).
[273] Transcript, Vol.13 pp. 2842:20-2844:7, 2846:1-5 (Bonow).

that the Applicant would have the financial ability to construct the Project.[274] This evidence far outweighs the limited speculation presented by Ms. Leurig.

Based upon the evidence in the record, including but not limited to that cited above, the State Engineer finds that the Applicant has provided proof satisfactory of its financial ability and reasonable expectation actually to construct the Project and put this water to beneficial use with reasonable diligence.

## III. PERENNIAL YIELD

To grant the Applications, the State Engineer must find that there is unappropriated water in the proposed source of supply.[275] The amount of groundwater available for appropriation in a given hydrographic basin depends on two major components: 1) the perennial yield for the basin in question; and 2) the appropriated quantity of groundwater associated with existing rights in that basin. The first component, the perennial yield, is the maximum amount of groundwater that can be developed over a long period of time without depleting the resource.[276] Under natural predevelopment conditions, the groundwater system has recharge, which is water being added to the system over time from precipitation and groundwater flow into the basin. The inflows to the system also are balanced by groundwater discharge by which groundwater is withdrawn and consumed by plants or by groundwater that flows out of the basin to an adjacent downgradient basin. Components that add or remove water from the system are referred to as fluxes. Even though many of the basins within Nevada are bounded by mountain ranges, groundwater can flow between them. Such groundwater flow cannot be observed, but experts determine its occurrence based on geologic, hydrologic, and geochemical evidence. Where this occurs, the

[274] Transcript, Vol.13 pp. 2846:12-17, 2896:13-16 (Bonow).
[275] NRS 533.370(5) (2010).
[276] Exhibit No. SNWA_300, p. 13

groundwater flow is typically referred to as a boundary flux, or interbasin flow. Any extra water that remains in the system is stored in vast quantities in underground reservoirs called aquifers. This is commonly referred to as groundwater storage.

Perennial yield is a guideline that is used in Nevada to manage groundwater development. Perennial yield sets an upper limit on the amount of groundwater than can be developed in a groundwater basin. Since perennial yield is determined by the natural hydrologic conditions, limiting groundwater development to a basin's perennial yield ensures sustainable development of the groundwater resource. The use of perennial yield as an upper limit of groundwater use is a method that is more protective of the groundwater resource than other methods used in many other states, where groundwater development is not limited to perennial yield.

Perennial yield is estimated by developing a groundwater budget for a groundwater basin. Generally, groundwater systems are thought to be in steady state prior to human development of the resource. Steady state means that recharge to the groundwater system equals discharge; thereby resulting in a balanced groundwater budget. Accordingly, the groundwater budget and the perennial yield are typically first computed under these pre-development conditions. The Applicant and all Protestants agreed that the use of the groundwater budget method is the most appropriate to determine the range of perennial yield estimates for the basin. The State Engineer will use the groundwater budget method (also sometimes called the groundwater balance method) to make this determination.

Spring Valley is a basin with a large amount of groundwater discharge to the ground surface and a relatively small volume of subsurface outflow.[277] Groundwater discharges to the ground surface via evaporation from the soil or via transpiration through plants that draw groundwater through their roots. Evaporation and transpiration are often considered together and referred to as evapotranspiration ("ET"). Groundwater is recharged by precipitation that percolates through soil and into the aquifer. For basins like Spring Valley where most groundwater discharge is via ET, perennial yield is at least equal to the estimated annual groundwater ET, but is in no case larger than the estimated volume of annual groundwater recharge.[278]

To provide background and context for the determination of perennial yield in Spring Valley, the Applicant initially conducted a comprehensive literature review of prior investigations by the U.S. Geological Survey ("USGS").[279] The Applicant's witness, Mr. Andrew Burns[280], testified that he reviewed the following USGS reports: the Reconnaissance Series Reports, the Basin and Range Carbonate Aquifer System Study ("BARCASS") that was mandated by Congress, the Great Basin Regional Aquifer System Analysis ("RASA"), and sections of the Great Basin Carbonate and Alluvial Aquifer System study ("GBCAAS"), which is a recently published update to RASA.[281]

**A. <u>Groundwater ET</u>**

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[277] Exhibit No. SNWA_258, p. 10-1.
[278] *See* State Engineer's Ruling 5986, pp. 4-5.
[279] Transcript, Vol.3 p. 588:14-22 (Burns).
[280] Mr. Burns is a hydrologist for Southern Nevada Water Authority. Exhibit No. SNWA_256. He was qualified as an expert in surface water and groundwater hydrology. Transcript, Vol.3 p. 576:11-14 (State Engineer).
[281] Transcript, Vol.3 pp. 588:14-592:22 (Burns).

Groundwater ET is important because it is the only component in a groundwater balance calculation that can be observed and measured.[282] In 1965, Rush and Kazmi completed the first hydrologic study of the Spring Valley Hydrographic Basin as part of the Reconnaissance Report Series for the USGS. They estimated groundwater ET by mapping phreatophyte communities and applying a probable average rate of groundwater use to derive the total groundwater discharge via ET. Since 1965, there have been many advances in science and technology that allow for more accurate estimates of basin-wide groundwater ET.

To estimate groundwater ET in Spring Valley, the Applicant relied on five years of direct ET measurements using state-of–the-art Eddy Covariance Towers in Spring Valley, Snake Valley and White River Valley, and five years of satellite data to characterize vegetation health and density. Eddy Covariance Towers are towers equipped with calibrated sensors that measure energy-budget and meteorological parameters. Data collected from these towers are used to calculate ET rates of the vegetation and bare soil that occur in the area surrounding the tower. In essence, these towers measure the annual total ET rate for the vegetation and bare soil located at the tower location. The Applicant also presented an estimate of the spatial distribution of precipitation in Spring Valley based on the best tool available to estimate precipitation in the groundwater ET areas.

The Applicant initially delineated the extent of the potential groundwater-ET area of Spring Valley using mapping by previous investigators (Rush and Kazmi (1965) and Nichols (2000)). The Applicant then used satellite imagery and field investigations to refine and verify the groundwater ET extent boundaries based on the presence of phreatophytic vegetation and

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[282] Exhibit No. GBWN_103, p. 17; Transcript, Vol.17 p. 3794:6-11 (Myers); Transcript, Vol.24 p. 5413:19 (Bredehoeft).

consideration of the depth to groundwater. The Applicant delineated two areas of significant groundwater discharge which the Applicant referred to as the "Main" groundwater discharge area and the "Northern" groundwater discharge area.[283] The Main groundwater discharge area is located along the longitudinal axis of the valley, including the majority of the valley bottom. The much smaller Northern groundwater discharge area is also located along the longitudinal axis of the valley, but in the very northern part of the basin and is disconnected from the Main groundwater discharge area.[284] The Applicant determined that the total groundwater-ET extent boundary in Spring Valley is 172,605 acres, which is very similar to the area determined by prior investigations.[285]

The Applicant divided the groundwater-ET area into six land-cover classes: (1) open water; (2) bare soil/low density vegetation; (3) phreatophytic/medium density vegetation; (4) wetland/meadow; (5) agriculture; and (6) playa.[286] The Applicant conducted field checks to ensure that land-cover classifications based on satellites and prior mapping were accurate. The overall accuracy of the Applicant's land-cover delineations was 88 percent. The accuracies by class ranged from 78 percent for bare soil/low vegetation to 92 percent for open water. The accuracy was 88 percent for agriculture, 89 percent for phreatophyte/medium vegetation, and 90 percent for wetland/meadow. Generally, values above 85 percent are considered sufficiently accurate.[287] Most groundwater ET occurs in the phreatophyte/medium vegetation and wetland/meadow land-cover classes, for which the Applicant reports high accuracy. The State Engineer finds that the Applicant has provided an accurate and reliable delineation of land-cover

[283] Exhibit No. SNWA_258, p. 5-3.
[284] Exhibit No. SNWA_258, p. 5-4, Figure 5-1.
[285] Exhibit No. SNWA_258, p. 5-5.
[286] Exhibit No. SNWA_258, p. 5-3.
[287] Exhibit No. SNWA_258, p. D-5.

classes in Spring Valley groundwater discharge areas, particularly in the areas where the predominant amount of ET occurs.

Dr. Myers notes that phreatophytic areas vary in areal extent and plant density over time.[288] However, he did not question the accuracy of the Applicant's areal extents at the time they were made.[289]

The Applicant applied the same general approach used in previous investigations to estimate groundwater ET within the groundwater discharge areas by subtracting precipitation from annual total ET, but applied slightly different data processing steps for each groundwater discharge area.

For the Main groundwater discharge area of Spring Valley, the Applicant completed the following steps to estimate groundwater ET: (1) collect and process site-specific ET-rate data from ET-measurement sites located within the primary groundwater discharge areas of Spring, Snake, and White River valleys to derive annual total ET rates; (2) acquire and process satellite imagery to derive distributions of normalized difference vegetation indices ("NDVI"); (3) develop an empirical relationship between annual total ET measurements and NDVI values for the corresponding ET-measurement sites; (4) apply the empirical relationship to NDVI distributions to estimate the distribution of annual total ET-rates within the groundwater discharge area; (5) subtract the distributions of annual precipitation rates from the annual total ET rates to arrive at distributions of annual groundwater-ET rates for each year; and (6) calculate the annual average groundwater ET for the five-year period of ET data collection.

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[288] Exhibit No. GBWN_103, pp. 17–18.
[289] Transcript, Vol.17 pp. 3794:18-20 (Myers).

The Applicant estimated ET for wetland/meadow, phreatophytic/medium vegetation, and bare soil/low vegetation land-cover classes in the Main groundwater discharge area in Spring Valley using an empirical relationship developed in cooperation with the Desert Research Institute. The empirical relationship is expressed by a regression equation that represents the best fit relationship between footprint-weighted growing season average NDVI values and annual total ET measurements. NDVI is a vegetation index in which a number is assigned to a pixel in a satellite image that is intended to represent the physical character of the vegetation in the pixel (i.e. greenness, vegetation density). There are several vegetation indices that are used to represent vegetation cover based on satellite data. The regression equation is developed by comparing actual measurements of ET at a measurement site with the vegetation index values at those specific sites. The regression relationship is then used to estimate ET rates for other pixels in the ET areas based on the vegetation index value computed for each of those pixels.

Dr. Lynn Fenstermaker conducted the exercise of acquiring and processing the satellite imagery and performed a linear regression analysis to develop the empirical relationship. Dr. Fenstermaker is an Associate Research Professor at the Desert Research Institute.[290] She specializes in remote sensing which includes the use of satellite images to determine ET conditions on the ground. Her Ph.D. research at the University of Nevada, Las Vegas focused on remote sensing.[291] Dr. Fenstermaker has worked with remotely sensed data since 1981 and has specifically researched the use of remotely-sensed data to estimate ET at various scales since 1993.[292] She has conducted many studies and has authored several papers related to using remote

[290] Exhibit No. SNWA_311.
[291] Transcript, Vol.3 p. 654:13-15 (Fenstermaker).
[292] Transcript, Vol.3 p. 653:16-19 (Fenstermaker).

sensing to estimate properties of plant communities.[293] She was qualified by the State Engineer as an expert in ET estimates using remote sensing.[294]

In order to determine the best method for estimating total ET using remote sensing, Dr. Fenstermaker carefully evaluated the techniques that had been used in prior studies. After conducting a statistical evaluation of the accuracy of the prior studies, she determined the best approach is one that compares a growing-season average NDVI value for each ET tower footprint with the annual ET value measured at that ET tower.[295] NDVI is the most commonly used vegetation index.[296] Dr. Fenstermaker determined that NDVI provides better estimates of ET than the Enhanced Vegetation Index ("EVI") by performing an independent accuracy assessment on prior studies that had used either NDVI or EVI.[297] By relating a growing-season average NDVI value with an annual ET value, Dr. Fenstermaker accounts for all the variation in ET that occurs during the year. By using a footprint average rather than the single pixel average where the tower is located, Dr. Fenstermaker accounts for the fact that the ET measurements include contributions of ET from areas beyond the measurement site. By using a weighted average, Dr. Fenstermaker accounts for the fact that certain areas within the footprint contribute more to the ET measurement than others. The State Engineer finds this approach to be scientifically sound.

Dr. Fenstermaker used Eddy Covariance tower measurements of ET. The Eddy Covariance method "is the most direct and defensible way to measure fluxes of heat, water vapor

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[293] Transcript, Vol.3 p. 655:1-18 (2011Fenstermaker).
[294] Transcript, Vol.3 p. 657:7-9 (State Engineer).
[295] Exhibit No. SNWA_312, pp. 2-1 to 2-7; Transcript, Vol.4 pp. 807:1–808:5 (Fenstermaker).
[296] Transcript, Vol.3 p. 685:7-10 (Fenstermaker).
[297] Transcript, Vol.3 p. 696: 18-23 (Fenstermaker).

and gas concentrations and momentum between the atmosphere and biosphere."[298] Mr. Burns described the Eddy Covariance method as "state of the art."[299] The Eddy Covariance towers use sophisticated sensors to measure the components of ET.[300] The sensors were installed and calibrated according to manufacturer recommendations.[301] The ET measurements were taken from the UNLV; Desert Research Institute; and Southern Nevada Water Authority ET-measurement sites in Spring, White River, and Snake Valleys.[302] Seven of the towers were located in Spring Valley.[303] Dr. Fenstermaker testified that she was unaware of any other published study that used this many Eddy Covariance Towers.[304] The ET tower locations were chosen to represent a range of uniform-composition phreatophytic vegetation for defined land-cover classifications and are located within a sufficiently large area of each class.[305] The site selection was independently evaluated and approved by Dr. Travis Huxman of the University of Arizona.[306] Dr. Huxman has extensive experience in locating ET measurement sites in complex ecosystems.[307]

The ET measurement sites did not include agriculture, open water, or playa.[308] The State Engineer finds this is reasonable because these areas are small in comparison to the entire groundwater discharge area and represent a very small component of the groundwater discharge for the basin. ET estimates based on vegetation indices will not necessarily be reliable for areas

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[298] Exhibit No. SNWA_312, p. 3-1.
[299] Transcript, Vol.3 p. 670:11-13 (Burns).
[300] Exhibit No. SNWA_312, p. 3-2.
[301] Exhibit No. SNWA_312, p. 3-3; Transcript, Vol.4 pp. 796: 15–797:4 (Fenstermaker).
[302] Exhibit No. SNWA_312, pp. 3-1, 3-3.
[303] Exhibit No. SNWA_312, p. 1-2.
[304] Transcript, Vol.4 p. 759:8-10 (Fenstermaker).
[305] Exhibit No. SNWA_312, p. 3-3.
[306] Transcript, Vol.3 p. 675:3-16 (Fenstermaker).
[307] Transcript, Vol.3 pp. 674:25-675:12 (Fenstermaker).
[308] Exhibit No. SNWA_312, pp. 3-4 to 3-5.

of minimal or no vegetation, such as playa and open water. In addition, the goal of the approach was to estimate pre-development ET. Therefore, it is reasonable to exclude measurements at agriculture sites. The period of measurements at the sites was from 2006 to 2010, though not all sites have measurements for all years.[309] One tower in Spring Valley had measurements for all five years, two had measurements for four years, and four had measurements for three years.[310] Mr. Burns testified that the ET data collected was "excellent."[311] Dr. Myers did not question the Applicant's measurement of ET rates.[312]

Dr. Fenstermaker acquired satellite imagery from Landsat Thematic Mapper 5 scenes that are generated by the USGS Earth Resources Observation and Science Data Center. The presence of clouds and cloud shadows in the satellite images limits the utility of those images. The vegetation index value should be based on the radiation from the ground surface based on sunlight reflecting off of vegetation and soil. Such reflectance cannot be sensed in a satellite image if it is blocked by clouds. Though techniques can account for clouds and shadows, a large amount of cloud cover renders certain satellite images less reliable. Therefore, Dr. Fenstermaker excluded from her data set satellite images with 30 percent or more cloud cover. After excluding scenes with 30 percent or more cloud cover, 31 scenes remained for the growing season in Spring and Snake Valleys and 29 scenes remained for the growing season in White River Valley. Dr. Fenstermaker calibrated, corrected, and normalized the scenes using standard techniques and then calculated NDVI grids for each image. Dr. Fenstermaker then replaced clouds and cloud

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[309] Exhibit No. SNWA_312, pp. 3-3, 3-10.
[310] Exhibit No. SNWA_312, p. 3-10.
[311] Transcript, Vol.3 p. 683:8-11 (Burns).
[312] Transcript, Vol.17 p. 3794:18-19 (Myers).

shadows that remained in the images with the average NDVI values from cloud free dates.[313] The replacement pixels were based on the exact same location and were selected from images representing the same growing season. No adjacent pixel values were used to replace cloud-covered or cloud-shadow covered pixels.[314] Finally, Dr. Fenstermaker averaged the scenes for each year to obtain average growing-season NDVI images.[315] Based on this evidence, the State Engineer finds that the Applicant's method of determining average growing-season NDVI values for the basins is scientifically sound.

Dr. Fenstermaker and her colleagues then calculated the footprint-weighted growing season average NDVI values for each Eddy Covariance Tower. This approach was selected to account for the fact that the towers measure ET from an area surrounding the tower that is larger than the area directly below the towers. Using an equation of Hsieh et al. (2000), footprints were delineated based on wind speed and direction. The number of times each pixel contributed to a measurement was then used to compute a weighted-average NDVI value for each tower.[316] Dr. Fenstermaker concluded that this weighted approach is an improvement on all prior studies regarding calculation of the NDVI value for each ET tower. The State Engineer finds that the use of footprint-weighted NDVI values is appropriate.

Dr. Fenstermaker ended up with 38 data points of annual ET and growing-season average footprint-weighted NDVI values.[317] She reserved seven of the data points for independent accuracy assessment and performed a linear regression on the remaining 31 points. She concluded the resulting regression equation is an excellent fit to the data with an r-squared value

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[313] Exhibit No. SNWA_312, p. 4-13.
[314] Transcript, Vol.4 p. 770:1-5 (Fenstermaker)
[315] Exhibit No. SNWA_312, pp. 4-4 to 4-5.
[316] Exhibit No. SNWA_312, pp. 4-5 to 4-7.
[317] Exhibit No. SNWA_312, p. 5-1.

of 0.953.[318] Dr. Fenstermaker testified that the r-squared was an excellent fit and higher than the values she typically sees in studies regressing ground-based data with remotely-sensed data.[319] When evaluated against the seven reserved points, the analysis revealed no clear bias to over- or under-estimate.[320] Dr Fenstermaker testified that this accuracy assessment step was not completed in many prior studies, and that it is critical to determining the accuracy of the linear relationship that is derived from the data. Based on this expert opinion and the evidence submitted, the State Engineer finds that the accuracy assessment is scientifically sound and represents an improvement over past studies, and validates the accuracy of the Applicant's ET estimates.

The Applicant applied the regression equation to growing-season average NDVI grids after the removal of areas of agriculture, open water, and playa to obtain a total annual ET distribution for the remaining land-cover classes in the Main groundwater discharge area for each year in the period of record.[321] The Applicant queried the initial ET distribution grid to identify grid-cell values exceeding the average annual reference ET in Spring Valley of 4.2 feet as measured by the Eddy Covariance stations. For these grid-cells, the Applicant used the average annual reference ET.[322]

As noted, the Applicant's goal was to develop an estimate of groundwater ET for Spring Valley prior to human development. Therefore, estimates of ET for present-day agriculture had to be replaced with estimates of the ET that would occur within these areas prior to development. The Applicant estimated predevelopment ET rates for the agriculture land-cover class in Spring

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[318] Exhibit No. SNWA_312, p. 5-4.
[319] Transcript, Vol.4 p. 726:2–5 (Fenstermaker).
[320] Exhibit No. SNWA_312, p. 5-7; Transcript, Vol.4 p. 730:8–19 (Burns).
[321] Exhibit No. SNWA_258, p. D-16.
[322] Exhibit No. SNWA_258, pp. D-16 to D-17.

Valley by assigning the ET-rates derived from the empirical relationship for the natural vegetation surrounding the agricultural areas.[323] For areas of open-water, the Applicant assigned a consumptive-use rate of 4.70 feet per year based on Huntington and Allen (2010, Appendix 14, p. 246).[324] For playa areas, the Applicant assigned null values for ET rates. The Applicant later assigned groundwater-ET rates for playa during the derivation of the groundwater-ET distribution.[325]

The Applicant estimated an average total ET of 174,500 afa in the Main discharge area in Spring Valley for the period of record 2006 to 2010. The yearly total ET estimates, in acre-feet, were: 184,900 in 2006; 162,900 in 2007; 153,500 in 2008; 186,600 in 2009; and 184,700 in 2010.[326] Dr. Fenstermaker testified that these were very good estimates and that the regression equation will provide a more accurate estimate of annual ET in the region than those developed in prior studies.[327] Even Dr. Myers testified that the Applicant's total-ET estimates are probably as accurate as they can be.[328] The State Engineer finds that the Applicant provided the best available estimate of total ET in Spring Valley.

To estimate groundwater ET, precipitation has to be subtracted from the total ET estimates. The Applicant used the Parameter-elevation Regressions on Independent Slopes Model ("PRISM") 4-km precipitation grids to estimate the amount of precipitation over the groundwater-ET area for the period of record from 2006 to 2010.[329] PRISM is a model that

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[323] Exhibit No. SNWA_258, pp. 5-6 to 5-7.
[324] Exhibit No. SNWA_258, p. 5-7.
[325] Exhibit No. SNWA_258, p. 5-7.
[326] Exhibit No. SNWA_258, p. 5-7.
[327] Transcript, Vol.4 p. 731:8-17;731:25-732:8-11 (Fenstermaker).
[328] Transcript, Vol.20 p. 4442:6-7 (Myers).
[329] Exhibit No. SNWA_258, pp. 5-5, D-6 to D-15.

estimates how much precipitation falls on specific areas throughout the United States.[330] PRISM distributions are available in 4-km and 800-m grids. The 800-m PRISM grid is available for a thirty-year normal period from 1971 to 2001. The 4-km grid is available on an annual basis, including for the period of record of the Applicant's ET measurements.[331] Ms. Drici testified that PRISM provided the best available method to estimate the precipitation distribution over the areas of interest.[332] Dr. Myers testified that PRISM is generally a good tool and probably the best tool available to distribute precipitation, though he asserts that it underestimates or overestimates in certain areas.[333]

PRISM provides an estimate of precipitation based on a model. To assess the accuracy of the PRISM 4-km estimates in the groundwater-ET discharge areas within the basins of interest, the Applicant compared the PRISM estimates to actual valley floor measurements of precipitation at several UNLV, Desert Research Institute, SNWA and USGS precipitation measurement stations located in Spring Valley and White River Valley. After comparing the PRISM values to measured values using gages in Spring Valley, the Applicant found that PRISM overestimated precipitation on the valley floor in Spring Valley.[334] To account for this, the Applicant reduced the PRISM precipitation estimate by the average amount of overestimation for each year.[335] This removed the overestimation bias.[336] Dr. Myers appears to agree that PRISM overestimates precipitation in Spring Valley and does not suggest that the

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[330] Exhibit No. SNWA_258, p. B-2.
[331] Transcript, Vol.3 p. 608:4-13 (Drici).
[332] Transcript, Vol.3 p. 606:9-21 (Drici).
[333] Transcript, Vol.21 pp. 4649: 25–4650:15 (Myers).
[334] Exhibit No. SNWA_258, pp. 5-5, D-6 to D-15.
[335] Exhibit No. SNWA_258, pp. 5-5, D-6 to D-15.
[336] Transcript, Vol.3 p. 667:5-11 (Burns).

Applicant was wrong to adjust the PRISM results to remove the overestimation bias.[337] Given the evidence submitted regarding the accuracy assessment of PRISM and the adjustments applied by the Applicant based on determined overestimates in the ET discharge area of Spring Valley, the State Engineer finds that the Applicant's method of developing estimates of precipitation distribution for Spring Valley is scientifically sound.

After subtracting the precipitation distribution from the total ET distribution in the Main discharge area in Spring Valley, the Applicant assigned a groundwater-ET rate of 0.9 feet to the playa areas based on Deverel et al. (2005, p. 14).[338]

The Applicant's final estimate of average annual groundwater-ET in the Main groundwater discharge area of Spring Valley is 91,500 acre-feet for the period of record from 2006 to 2010. The yearly groundwater-ET estimates, in acre-feet, were: 104,400 in 2006; 99,700 in 2007; 104,700 in 2008; 92,000 in 2009; and 56,700 in 2010.[339] In cases where the local precipitation exceeded the local ET, a value of zero was assigned rather than assigning negative groundwater-ET.[340] The Applicant believes that its estimate is the best estimate to date because it is the only estimate to explicitly rely on observed vegetation, ET-rates, and precipitation data collected in Spring Valley for a record spanning several years.[341]

Landsat imagery was not acquired for the small groundwater discharge area in Northern Spring Valley; therefore, separate analysis steps were applied to estimate groundwater ET for this area, which are as follows:[342] (1) compute annual groundwater-ET rates for land-cover

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[337] Exhibit No. GBWN_103, pp. 15–18.
[338] Exhibit No. SNWA_258, p. 5-8.
[339] Exhibit No. SNWA_258, p. 5-8.
[340] Transcript, Vol.6 p. 1331:6-8 (Burns).
[341] Exhibit No. SNWA_258, p. 5-9; Transcript, Vol.4 pp. 752:17-753:6 (Burns).
[342] Transcript, Vol. 4, p. 745:20–23 (Burns).

classes comprising the Northern groundwater discharge area by subtracting the annual precipitation from total ET that was measured at ET-measurement sites located in Spring Valley; (2) compute the average annual groundwater-ET rate for each land-cover class; (3) estimate the average annual groundwater-ET volume by multiplying the average annual groundwater ET rate by the corresponding acreage of each land-cover class.

The Applicant derived average annual groundwater-ET rates for the land-cover classes comprising the Northern groundwater discharge area by subtracting precipitation measured at ET-measurement sites in Spring Valley from the measured ET-rates at those sites.[343] The Applicant calculated the average groundwater-ET rate for each land-cover class and multiplied it by the corresponding area to calculate the average annual groundwater-ET volumes.[344] The Applicant's final estimate of average annual groundwater-ET in the Northern groundwater discharge area of Spring Valley is 3,300 acre-feet.[345] Adding this estimate to the Applicant's estimate of 91,500 acre-feet of average annual groundwater-ET in the Main groundwater discharge area of Spring Valley yields the Applicant's average annual groundwater-ET estimate for Spring Valley of 94,800 acre-feet.

The Applicant's estimate of 94,800 afa of groundwater ET falls within the range of prior estimates. Rush and Kazmi provided a reconnaissance-level estimate of average annual groundwater ET of 70,000 acre-feet.[346] Nichols (2000) reported groundwater-ET estimates of 101,770 acre-feet and 77,460 acre-feet for 1985 and 1989, respectively.[347] Nichols' average is

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[343] Exhibit No. SNWA_258, p. D-17.
[344] Exhibit No. SNWA_258, p. D-17.
[345] Exhibit No. SNWA_258, p. 5-9.
[346] Exhibit No. SNWA_298, pp. 22–23.
[347] Exhibit No. SNWA_292, p. C44.

about 90,000 afa. Welch et al. (2007) estimated the average annual groundwater ET for Spring Valley to be approximately 75,600 acre-feet.[348]

Mr. Burns believes that the average annual groundwater ET estimate may be skewed lower by the low estimate for 2010 derived for the Main groundwater discharge area because extraordinary precipitation occurred in the basin during 2010. The method of determining annual groundwater ET by subtracting precipitation from total ET assumes that 100 percent of the precipitation is effectively discharged by ET and that none of it is retained as soil moisture or percolates to the groundwater table to be consumed in subsequent years. The assumption that 100 percent of precipitation is effectively consumed by ET during the same year may not be valid in years of high precipitation. Instead, some precipitation may remain as soil moisture or reach the groundwater table where it remains until consumed in subsequent years. There may be a maximum amount of precipitation that the vegetation can consume.[349] This means that more groundwater ET would actually occur than the amount determined by subtracting all precipitation from total ET. In this case, this would mean that more groundwater-ET occurred than estimated for 2010.[350]

Dr. Myers disagrees with this conclusion based on his belief that water stored in the ground would be consumed by ET the following year. Thus, though groundwater ET may be underestimated for wet years, it would be similarly overestimated the year following the wet period as precipitation reaching the groundwater system during the prior year would be discharged through ET.[351] Dr. Myers may be correct. Over the long run, the method and

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[348] Exhibit No. GBWN_001, p. 21; Exhibit No. SNWA_068, p. 45.
[349] Transcript, Vol.4 pp. 740:6–17, 811:3–12 (Burns).
[350] Exhibit No. SNWA_258, pp. 5-9 to 5-10.
[351] Exhibit No. GBWN_103, p. 18.

assumptions used may underestimate groundwater ET for wet years and overestimate for the following years due to holdover moisture. In the long term, these overestimates and underestimates would effectively cancel each other out. Accordingly, the State Engineer finds that the Applicant's method will result in an accurate long-term average.

Dr. Myers suggests that this holdover effect occurs from 2005, a wet year, to 2006 and from 2010 to 2011.[352] The holdover from 2010 is irrelevant in this case, however, because 2010 was the final year in the Applicant's period of record, so whatever overestimation of groundwater ET that might result in 2011 is not included in the Applicant's average.[353] There may be some holdover from 2005 that causes the Applicant's estimate for 2006 to overestimate groundwater ET. However, Dr. Myers did not quantify the affect of this possible holdover.

Dr. Myers also notes that the Applicant's calculation of average annual groundwater ET depends on several factors that may vary. He notes that phreatophytic areas change in areal extent and plant density and that ET, precipitation, and runoff vary with climate.[354] Dr. Myers points out that the Applicant's ET estimate varies from 153,500 to 186,600 afa, over the five year period, for a range that equaled 19% of the mean 174,500 afa. Dr. Myers argues that this range is too high to consider any year representative.[355] Dr. Myers, however, does not provide a recommendation on how to adjust the Applicant's groundwater-ET estimate to account for the representative average issue, nor does he provide analysis or a value that he believes is representative of long-term mean conditions.[356] He admits, however, that it may be appropriate

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[352] Transcript, Vol.20 pp. 4438: 16–4439:10 (Myers).
[353] Transcript, Vol.4 p. 741:10-25 (Burns).
[354] Exhibit No. GBWN_103, pp. 17–18.
[355] Exhibit No. GBWN_103, p. 18.
[356] Transcript, Vol.20 pp. 4438:4-12, 4443:9-13 (Myers).

to adjust the precipitation component of the groundwater-ET estimate based on variance from the long-term average.[357]

CPB's counsel argued that the amount of data collected is not enough to make a long term estimate of ET in Spring Valley. CPB instead suggested that the perennial yield should be 80,000 acre-feet, but none of CPB's expert witnesses provided any testimony as to why this estimate is better than the Applicant's estimate. This argument assumes that data collection has discontinued in Spring Valley. In fact, as stated below, data collection may continue and the State Engineer may adjust the perennial yield in Spring Valley up or down in the future based on the results of these data collection efforts. Based on the evidence submitted and testimony offered by Dr. Fenstermaker, the State Engineer finds the Applicant's ET measurements are scientifically sound.

The State Engineer finds that the Applicant has provided the most reliable estimate of groundwater ET in Spring Valley based on the best available science. The Protestants do not challenge this estimate and no better estimate of groundwater ET has been offered. The Applicant's estimate is the only estimate based on five years of direct ET measurements that include measurements in Spring Valley and five years of satellite data to estimate vegetation health and density. The Applicant has used state of the art Eddy Covariance Towers and satellite imagery to develop a scientifically sound estimate of ET in Spring Valley. The Applicant also presented a scientifically sound estimate of precipitation in Spring Valley. The five-year period represents a good long-term average for the basin.

The Applicant states that its estimate of groundwater ET is likely representative of the long-term average and that the five-year period represents a range of hydrologic conditions

[357] Transcript, Vol.20 pp. 4442: 24–4443: 13 (Myers).

indicative of long-term mean hydrologic conditions.[358] One way to determine whether the Applicant's estimate of groundwater ET is truly representative of a long-term average is to compare the Applicant's data with climate indices from the U.S. Climate Diagnostics Center/National Oceanic and Atmospheric Administration ("NOAA"). The Climate Diagnostics Center/NOAA maintains a database of climate data. Historical mean annual precipitation values are based on measurements made within each climate division and are available for all U.S. climate divisions.[359] Climate divisions intersecting the Project basins and the area of interest include Nevada Divisions 2, 3, and 4. The ET area in Spring Valley falls mostly within Division 2.[360]

Based on the undisputable nature of the NOAA climate division data, the State Engineer takes administrative notice of the Climate Diagnostics Center/NOAA data for the climate divisions that overlap the Project basins. Based on NOAA climate indices, the State Engineer finds that the period of record mean precipitation for Nevada Division 2 is 10.86 inches per year for the period 1895 through 2010. Nevada Division 2 includes the extent of the groundwater-ET areas within Spring Valley. By comparing the annual precipitation data with the long-term period of record mean precipitation for the Nevada Division 2 climate index, the State Engineer finds that precipitation was: 102 percent of the mean value for 2006; 77 percent of the mean value for 2007; 71 percent of the mean value for 2008; 110 percent of the mean value for 2009; and 120 percent of the mean value for 2010. For the Applicant's period of record, 2006-2010, the State Engineer finds that the average precipitation was 10.43 inches per year, or 96 percent of the long-term period of record mean value. Therefore, the 2006 to 2010 period is four percent

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[358] Transcript, Vol.4 pp. 739:2–9, 810:19–24 (Burns).
[359] Exhibit No. SNWA_258, p. B-18
[360] Exhibit No. SNWA_258, p. B-19.

dryer than the long-term period of record. Based on this precipitation data, the State Engineer finds that the Applicant's estimate of 94,800 afa does not perfectly represent the long-term average groundwater-ET.

However, since the period used for the Applicant's estimate of groundwater ET had precipitation rates that are very close to the NOAA long-term average, it may be representative of the current long-term average. Hence, the Applicant's estimate of 94,800 afa is sound, but more data will allow the State Engineer to determine with more certainty that the Applicant's estimate is representative of a long-term average.

Until more data are available, the State Engineer will set the average groundwater-ET discharge rate in Spring Valley at a slightly reduced rate. Because plants generally use easily available water from precipitation first and groundwater second, they use more groundwater when there is less precipitation. This is the case for the 2006 to 2010 period compared to the NOAA long-term mean. Therefore, the groundwater-ET estimate that the Applicant derived may be slightly larger than the long-term mean. To manage the basin, the State Engineer will consider the long-term average annual groundwater ET value to be 90,000 afa, approximately five percent less than the Applicant's estimate. Because the NOAA data suggests that the Applicant's estimate may be too high by approximately five percent, this provides more than adequate assurances that the perennial yield is not set above the long-term average groundwater ET. This decrease in the annual groundwater-ET estimate addresses Dr. Myers' and CPB's concern that the Applicant's five-year period is not a good representation of the long-term average and also minimizes the effect of any holdover precipitation from 2005 to 2006.

Dr. Myers further suggests that the Applicant fails to account for runoff in wet years. He suggests that during wet years, runoff could cause effective precipitation to exceed 100 percent because rainfall would find specific areas of the soil surface more receptive to seepage and become more effective (consumed by phreatophytes).[361] Dr. Myers also suggests that the Applicant fails to account for spring discharge in its estimate of groundwater ET. He suggests that spring run-on may enter wetlands and riparian areas in the groundwater-ET discharge area.[362]

In general, spring discharge within the groundwater discharge area will be accounted for as part of the ET estimate, as Dr. Myers admits.[363] Often the best measurement of total spring discharge is an estimate of ET.[364] Mr. Burns testified that surface water in the groundwater discharge area is accounted for in the ET measurements and that, based on his and his staff's observations over the course of many years, there is no overland sheet flow into the groundwater discharge area and such flow is unlikely.[365] Though the effects of runoff and spring run-on may create some uncertainty, Dr. Myers has not proposed a method of accounting for these factors or suggested that another estimate of ET better accounts for them. Therefore, the State Engineer finds that the Applicant's estimate is not invalidated by potential runoff and spring run-on.

Another potential estimate of groundwater ET in Spring Valley was produced in BARCASS. BARCASS provides an estimate of approximately 75,600 afa reported by Welch et al. (2007).[366] Welch et al. (2007) classified land cover into ET units based on vegetation and soil-moisture conditions.[367] The accuracy of the land classification in Nevada ranged from 18%

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[361] Exhibit No. GBWN_103, p. 18.
[362] Exhibit No. GBWN_103, pp. 18–19; Transcript, Vol.17 p. 3793:6-18 (Myers).
[363] Transcript, Vol.20 p. 4443:18-22 (Myers).
[364] Exhibit No. GBWN_009, p. 5; Transcript, Vol.24 p. 5413:17–20 (Bredehoeft).
[365] Transcript, Vol.4 pp. 743: 9–744:22, 783:13–784:21 (Burns).
[366] Exhibit No. GBWN_001, p. 21; Exhibit No. SNWA_68, p. 45.
[367] Exhibit No. SNWA_068, pp. 51, 56.

to 100%. The overall accuracy of ET unit delineation was 72 percent.[368] This is substantially less accurate than the Applicant's land classification accuracy of 88 percent.

BARCASS derived a range of ET rates for each ET unit from literature and data from six Eddy Covariance towers in White River, Spring, and Snake Valleys from September 1, 2005 to August 31, 2006.[369] Three of the towers were in Spring Valley.[370] The Applicant's estimate was based on a longer period of record and more ET measurement sites, including more measurement sites in Spring Valley.

In BARCASS, the ET rate within each ET unit was derived by linearly scaling the ET-rate range computed for the unit using an average Modified Soil Adjusted Vegetation Index based on satellite-imagery data.[371] To derive groundwater ET, Welch et al. (2007) calculated the difference between annual ET and local precipitation; which is the same general approach used by the Applicant.[372] A Desert Research Institute study found the coefficient of variation of total ground-water discharge to be 0.241, meaning BARCASS had a 24 percent error rate.[373] This 24 percent error was determined using the data BARCASS used to develop the ET estimate, not independent data.[374] The Applicant's percent error in Spring Valley was determined to be 15 percent. Furthermore, the Applicant's percent error was based on an assessment using independent data while BARCASS did not use independent data. Therefore, the State Engineer finds that the Applicant's estimate of groundwater ET is more accurate and reliable than the estimate found in BARCASS.

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[368] Exhibit No. SNWA_320, pp. 17–18.
[369] Exhibit No. SNWA_068, pp. 51, 56.
[370] Exhibit No. SNWA_321, p. 20.
[371] Exhibit No. SNWA_068, p. 59.
[372] Exhibit No. SNWA_068, p. 61.
[373] Exhibit No. SNWA_322, p. 13.
[374] Transcript, Vol.4 pp. 768: 15–769:3 (Fenstermaker).

The State Engineer finds that the Applicant's estimate of groundwater ET, adjusted to account for variance from the long-term average, is the best estimate currently available. It is the only estimate based on five years of direct ET measurements that include measurements in Spring Valley and five years of satellite data to estimate vegetation health and density.[375] Dr. Myers agreed that the Applicant's total ET estimates are probably as accurate as they can be.[376] Though measurements were not used from all ten Eddy Covariance Towers for all five years, the Applicant has still provided the most comprehensive data set available to the State Engineer. This level of data was not used by Rush and Kazmi or BARCASS when they made their groundwater ET estimates.[377] The availability of satellite images has improved the ability to map vegetation.[378] The methods of measuring phreatophyte discharge have greatly improved in the past 50 years.[379] The Applicant has used state of the art Eddy Covariance Towers and satellite imagery to develop a scientifically sound estimate of groundwater ET in Spring Valley. The Applicant also presented a scientifically sound estimate of precipitation in Spring Valley. No better estimate of groundwater ET has been offered. However, more data is needed to conclude that the five-year period relied on by the Applicant represents a long-term average. Therefore, the State Engineer finds that the groundwater ET for Spring Valley shall be set at the adjusted 90,000 afa for the purpose of determining perennial yield.

**B. <u>Interbasin Flow</u>**

Interbasin flow is another component of a groundwater budget analysis. Interbasin flow into and out of a groundwater basin, along with groundwater ET, are applied to the groundwater

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[375] Transcript, Vol.4 p. 75 2:3-13 (Burns).
[376] Transcript, Vol.20 p. 4442:6-7 (Myers).
[377] Transcript, Vol.4 pp. 752:19-753:1 (Burns).
[378] Exhibit No. GBWN_009, p.5.
[379] Exhibit No. GBWN_243, p. 1; Transcript, Vol.24 p. 5415:2-6 (Bredehoeft).

balance equation to derive an estimate of total recharge for the basin. The Applicant evaluated interbasin flow into and out of Spring Valley using available geologic, hydrologic, and geochemical evidence.

SNWA presented two witnesses, Dr. Peter Rowley and Mr. Burns, to support its conclusions about Spring Valley interbasin flow. Dr. Rowley, who the State Engineer qualified as an expert in geology and hydrogeology,[380] provided expert testimony on the geologic and hydrogeologic framework of Spring Valley and the surrounding area. Mr. Burns combined the geologic information supplied by Dr. Rowley with data and information regarding groundwater elevations, aquifer properties, and hydrologic features of the groundwater system to estimate amounts of interbasin flow as part of the Applicant's groundwater budget analysis for the basin.

The Protestants presented two witnesses, Dr. Meyers and Dr. Hurlow to support their conclusions about the region's geologic framework for their interbasin flow analysis. Dr. Meyers is a hydrogeolgist who has no prior experience in preparing geologic maps,[381] and no experience using gravity or audiomagnetotelluric ("AMT") studies to locate or interpret geologic features.[382] Dr. Meyers primarily relied upon BARCASS for geologic information and interbasin flow calculations.[383] Dr. Hurlow is a senior scientist at the Utah Geological Survey("UGS") and was qualified as an expert in hydrogeology by the State Engineer.[384] Dr. Hurlow is a senior scientist at UGS and is in charge of research projects on hydrogeologic studies of groundwater basins, involving summarizing the geology and hydrogeology and subsurface structure of various

[380] Transcript, Vol.5 pp. 974:11-12, 976:23-25 (Rowley).
[381] Transcript, Vol.20 p. 4444:6-8 (Myers).
[382] Transcript, Vol.20 p. 4444:9-11 (Myers).
[383] Transcript, Vol.20 p. 4479:7-10 (Myers).
[384] Transcript, Vol.16 p. 3593:1-6 (Hurlow).

groundwater basins and evaluating issues of groundwater flow and occurrence.[385] Dr. Hurlow has worked in the Snake Valley area since 2004, and based his opinions about interbasin flow in this area on his knowledge of the general geologic framework of the area, groundwater flow characteristics of geologic units, the role of faults, as well as interpretations of geophysical work such as gravity surveys and AMT data.[386] His opinion was that subsurface groundwater flow occurs from southern Spring Valley eastward into northern Hamlin Valley and southern Snake Valley,[387] but that only 10 to 25 percent of the groundwater resources present in southern Snake Valley comes from interbasin flow from southern Spring Valley.[388] He concluded that the most likely volume of interbasin flow in this area was in a range between 4,000 and 12,000 acre-feet. He also was aware of the BARCASS estimate that interbasin flow was 33,000 acre-feet, but he did not adopt that BARCASS interbasin flow estimate.[389]

The Applicant used the best available geologic information and analysis to support its interbasin flow analysis, including the best available geologic mapping, the most current geophysical data and most sophisticated geologic analysis.

(1) Mapping. The Applicant based its geologic interpretations on 1:250,000 scale mapping.[390] The Applicant's geologic maps incorporate all previous geologic mapping of the area and are the most comprehensive maps of the geology and hydrogeology of the region that are available.[391] Previous geologic mapping included many other 1:250,000 and 1:100,000 scale

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[385] Transcript, Vol.16 p. 3583: 18-23 (Hurlow).
[386] Transcript, Vol.16 p. 3582: 3-13 (Hurlow).
[387] Transcript, Vol.16 p. 3596: 3-5 (Hurlow)
[388] Transcript, Vol.16 pp. 3599-3600: 25-4 (Hurlow)
[389] Transcript, Vol.16 pp. 3632: 9-11 (Hurlow)
[390] Transcript, Vol.5 p. 1099:1-3 (Rowley).
[391] Exhibit No. SNWA_058, p. 3-4; Transcript, Vol.5 p. 983:5-9 (Rowley); Transcript, Vol.6 p. 1255:6-18 (Rowley); Transcript, Vol.16 pp. 3644:23-3645:10 (Hurlow).

maps that cover only portions of the Project basins.[392] The Applicant's 1:250,000 scale mapping includes previous work, provides greater detail, and shows the location of more faults than 1:500,000 scale mapping.[393] The Applicant's 1:250,000 scale geologic maps also show the location of confining units and aquifers and are more valuable than larger-scale maps in identifying features impacting interbasin flow.[394] The Applicant's mapping was digital, allowing the Applicant to directly transfer geologic information into the groundwater model.[395] Despite the existence of more detailed mapping, and his acknowledgment that a 1:250,000 scale mapping is superior, Dr. Meyers relied upon lower resolution 1:500,000 scale maps from Stewart and Carlson (1978) in his analysis of the Project area.[396] The State Engineer finds that it is not appropriate for a geologist, hydrogeologist, or hydrologist to rely solely on 1:500,000 mapping when a 1:250,000 map is available.[397]

Based on the evidence in the record, including but not limited to that cited above, the State Engineer finds that the Applicant's geologic mapping of Spring Valley and the surrounding area is the best science available for characterizing the geologic framework of the region because it provides 1:250,000-scale geologic and hydrogeologic mapping based on multiple sources and field verification. Dr. Meyers' characterization of the area's geologic framework lacks credibility and does not meet professional standards for a hydrogeologist because he used 1:500,000 geologic mapping even though higher resolution maps were available.

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[392] Transcript, Vol.5 p. 982:15-22 (Rowley).
[393] Transcript, Vol.5, pp. 985:4-12 (Rowley) (referencing Exhibit No. SNWA_061)
[394] Transcript, Vol.5, pp. 986:23-987:25; 987:1-4 (Rowley).
[395] Transcript, Vol.5 p. 1102:12-13 (Rowley).
[396] Transcript, Vol.20 p. 4445:1-3, 4446:16-25 (Myers) (acknowledging 1:250,000 scale superior); Exhibit No. GBWN_004, pp. 5-7 (Stewart and Carlson (1978) mapping); Transcript, Vol.20 p. 4444:24-4445:3, 4446:1-4 (Myers) (1:500,000 scale mapping also used in analysis of Spring Valley). Dr. Myers also relied on BARCASS for his analysis of the Project area, and the BARCASS report used 1:500,000 scale geologic mapping. Transcript, Vol.6 p. 1251:12-19 (Rowley).
[397] Transcript, Vol.5 p. 988:7-11 (Rowley).

(2) Geophysical Data. In addition to using more detailed mapping, the Applicant worked closely with the USGS to collect and analyze gravity and AMT data to help identify and interpret the region's subsurface geology.[398] AMT is a geophysical technique that uses the earth's natural electromagnetic fields as an energy source to determine the electrical resistivity structure of the subsurface.[399] AMT studies can indicate buried faults by mapping differences in resistivity or conductivity of the buried rock formations.[400] Gravity studies are an additional state-of-the-art geophysical approach that use gravity readings across a broad area to measure the density of the mass of the underlying rock.[401] Gravity maps characterize buried faults by indicating areas where there are changes in density.[402] The Applicant also used this technology to calculate the depth to basement rock in the Project basins.[403] Knowing the depth to basement rock allows the Applicant to determine the thickness of the basin-fill aquifers. Prior to the availability of gravity studies the primary way to determine depth to basement rock was to analyze drill hole data. Gravity studies allow for the collection of a broader range of data in areas without significant numbers of drill holes.

Based on the evidence in the record, including but not limited to that cited above, the State Engineer finds that the Applicant's use of AMT and gravity studies in Spring Valley and the surrounding area is the best science available for characterizing buried faults, depth to basement rock and the thickness of the basin-fill aquifers.

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[398] Transcript, Vol.5, pp. 989:1-15, 990:10-23 (Rowley).
[399] Transcript, Vol.5 pp.1093:23-1094:1 (Rowley).
[400] Transcript, Vol.5 p. 1095:15-16 (Rowley).
[401] Transcript, Vol.5 p.995:24-996:4; Transcript, Vol.5 p. 990:6-9 (Rowley).
[402] Transcript, Vol.5 p. 998:10-13 (Rowley).
[403] Transcript, Vol.5 pp. 997:13-998:9 (Rowley).

(3) Fault and Fracture Flow. The Applicant applied the principles of fracture flow as part of its interbasin flow analysis. Geologists use both fracture-flow and porous-media flow concepts to explain groundwater flow in basin-range topography.[404] However, most regional flow occurs via fracture flow.[405] The Project basins are characterized by basin-range topography and contain primarily north-south trending normal faults aligned with the basins and ranges.[406] USGS has used a fracture flow analysis to explain groundwater movement in the extensive studies completed at the Nevada Test Site.[407]

A fracture flow analysis assumes as a general rule that most groundwater flow in a basin-range region is affected by faults, orientation of the geologic structures, hydraulic gradients, and hydraulic properties of the rocks.[408] Both faults and the fractures generated by movement along the faults transmit groundwater. "Orientation of the geologic structures" refers to whether the hydraulic gradient is parallel or perpendicular to the fault-fracture zone. The general rule is that if the hydraulic gradient is parallel to the fault-fracture zone, the fault-fracture zone operates as a conduit to flow. If the hydraulic gradient is perpendicular to the fault-fracture zone, the fault-fracture zone can operate as a barrier to flow.[409] Despite this general rule, the experts in this case recognized there are no absolutes in nature.[410] Where the hydraulic gradient is perpendicular to a fault, the fault may not act as a perfect barrier, but in that instance the amount of cross-fault flow is likely small compared to fault-parallel flow.[411] There is extensive peer-reviewed scientific

[404] Transcript, Vol.5, p. 1112: 3-6 (Rowley); Exhibit No. SNWA_058, pp. 2-4 to 2-5.
[405] Exhibit No. SNWA_058, p. 2-5.
[406] Transcript, Vol.5 p. 1107: 12-13, 1112:7-10 (Rowley).
[407] Transcript, Vol.5, p. 1122:1-12 (Rowley).
[408] Transcript, Vol.5 pp. 1111:22-1113:18 (Rowley).
[409] Transcript, Vol.5 p. 1112: 13-25 (Rowley).
[410] Transcript, Vol.5 p. 1132:22-24 (Rowley).
[411] Exhibit No. MILL_011, p. 7.

literature that explains the fracture flow approach and the role of faults as barriers and/or conduits,[412] and both Protestant experts recognized the validity of the analytical method.[413]

The Applicant applied the general principle that if the hydraulic gradient is parallel to a fault-fracture zone, the fault-fracture zone operates as a conduit to flow. In instances where the hydraulic gradient is perpendicular, the fault-fracture zone can, but may not completely, operate as a barrier to flow. In instances in which the fault-fracture zone does not act as a complete barrier to groundwater flow perpendicular to the fault, the amount of cross-fault flow is likely small compared to fault-parallel flow.

Based on the evidence in the record, including but not limited to that cited above, the State Engineer finds that the principle of fracture flow is the best available science to describe the predominant mechanism of interbasin flow between groundwater basins. The State Engineer also recognizes that such flow can also be constrained by the hydraulic properties of the basin-fill material, particularly at significant depths where the permeability is likely reduced by overburden pressure.

(4) Geologic Likelihood of Interbasin Flow. The Applicant summarized its conclusions concerning the geologic likelihood of interbasin flow across certain boundaries as likely, unlikely or permissible.[414] The Applicant started its analysis with Dr. Rowley's development of a geologic framework and conceptual model based on fracture flow.[415] Mr. Burns then applied hydrologic information, including groundwater-elevations data, hydraulic gradients, and aquifer

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[412] Exhibit No. SNWA_058, p. 2-9; Exhibit No. SNWA_063, pp. 1025-1028.
[413] Transcript, Vol.16 p. 3643:8-20 (Hurlow); Transcript, Vol.20 p. 4448:22-4449:7 (Myers).
[414] Exhibit No. SNWA_058, p. 4-34, Figure 4-9.
[415] Transcript, Vol.5 p. 1134:7-23 (Rowley).

properties to Dr. Rowley's framework.[416] Where interbasin flow is classified as geologically likely, the basin boundary is generally topographically low; the bedrock at and beneath the surface of the boundary is an aquifer or otherwise permeable because of fracturing; and there is a hydrologic gradient parallel to the typical north-south trend of faults or east-west faults that allow groundwater to pass through the basin boundary.[417] Conversely, interbasin flow is unlikely where the basin boundary is topographically high, the bedrock making up the subsurface of the boundary is a confining unit, and the orientation of faults is perpendicular to the hydraulic gradient.[418] Areas of permissible flow occur in situations where topographic and geologic data indicates that a boundary possesses a significant likelihood for flow, but evidence of actual groundwater flow is not as definitive as in the areas of likely flow.[419]

BARCASS also produced a map depicting boundaries where groundwater flow may exist and referred to each potential flow area as "not permitted, permitted, and possible by subsurface geology."[420] These boundaries were based on obsolete, 40-year-old 1:500,000 geologic maps that did not portray existing faults in the digital file of the maps.[421]

Based on the evidence in the record, including but not limited to that cited above, the State Engineer finds that the Applicant's interbasin flow boundary map is more reliable and credible than the BARCASS map depicting interbasin flow boundaries.

**1. <u>Spring Valley to Hamlin Valley</u>**

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[416] Transcript, Vol.5 p. 1136:7-17 (Rowley).
[417] Transcript, Vol.5 p. 1134:7-23 (Rowley).
[418] Exhibit No. SNWA_058, p. 2-10, Figure 2.5.; Transcript, Vol.5 p. 1115: 20-24 (Rowley).
[419] Transcript, Vol.5 p. 1136:1-6 (Rowley).
[420] Exhibit No. SNWA_068, p. 34.
[421] Transcript, Vol.6 p. 1251:12-19 (Rowley).

The first potential area for interbasin flow is located on the border of southeastern Spring Valley and Hamlin Valley in an area commonly referred to as the Limestone Hills. None of the parties dispute that interbasin outflow occurs in this area, the only dispute involves the amount of such outflow. Previous investigations reported interbasin outflow estimates of 4,000 acre-feet (Rush and Kazmi, 1965); 8,000 to 12,000 acre-feet (Nichols, 2000); and 33,000 acre-feet (Welch, et al., 2007).[422]

The Applicant submitted geologic and hydrologic evidence supporting its interbasin flow estimate. The Applicant's geologic analysis concluded that the Limestone Hills is a horst made of east-dipping Devonian carbonate rock defined on either side by two north-trending basin-range range-front and subsidiary faults.[423] The Applicant mapped fault structures to the north and south ends of the Limestone Hills that likely support interbasin outflow to northern Hamlin Valley.[424] In between these areas interbasin flow is permissible, but due to the orientation of the fault structures and the hydraulic gradient, the Applicant considered flow to be minor.

With available hydrologic data, the Applicant applied Darcy's Law to calculate interbasin flow.[425] Darcy's Law is expressed as Q = (K x b) x I x W. Q is the quantity of groundwater flow, usually expressed in terms of afa. K is the hydraulic conductivity of the aquifer, expressed in terms of feet per day. Hydraulic conductivity is the rate at which water moves through the aquifer. The saturated thickness of the aquifer through which flow occurs is expressed as "b" in feet. The estimated saturated thickness is primarily dependent on the geologic formations in the flow section area. For compressible soil, like basin-fill material, groundwater is estimated to

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[422] Exhibit No. SNWA_258, p. 7-8
[423] Exhibit No. SNWA_258, p. 7-5, § 7.1.3.; Transcript, Vol.5 p. 1157:14-21 (Rowley).
[424] Exhibit No. SNWA_258, p. 7-5, § 7.1.3.
[425] Exhibit No. SNWA_258, pp. E-1 to E-2.

flow through 2,000 feet of saturated aquifer because the weight of the soil causes it to compress at depth and close the porous spaces in the aquifer that would otherwise allow groundwater to move below 2,000 feet. "I" is the horizontal hydraulic gradient, expressed in feet per feet, which is the slope of the water table. "W" is the width of the flow section also expressed in feet.[426] None of the parties disputed that Darcy's Law is an appropriate method for calculating groundwater flow. Rather, the Protestants disputed the values used by the Applicant in the Darcy analysis.

For this interbasin flow boundary, the hydraulic conductivity was determined from an aquifer test on a test well located in the northern part of the Limestone Hills that penetrated fractured carbonate rocks and a fault structure. The conductivity values derived from the aquifer test were considered representative of the fractured carbonate rocks comprising the sections of the Limestone Hills through which interbasin flow is likely.[427] Analysis of the aquifer-test data yielded estimates of hydraulic conductivity ranging from 7.6 to 8.0 feet per day.[428] The Applicant calculated a hydraulic gradient of 0.0008866 foot per foot using two carbonate wells located near the northern flow boundary, one located in Spring Valley and the other located in Hamlin Valley.[429] Darcy's Law calculations were completed for both the north and south flow sections using an estimated flow section width of 30,000 feet and 6,500 feet, respectively, and an estimated saturated aquifer thickness of 2,000 feet.[430] Applying these values to the Darcy equation, the Applicant calculated 3,600 acre-feet of outflow for the northern flow section and

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[426] Exhibit No. SNWA_258, p. E-1. The term (365/43560) is a unit conversion from $ft^3$ per day to acre-feet per year.
[427] Exhibit No. SNWA_258, p. 7-7, § 7.1.3.
[428] Exhibit No. SNWA_258, p. 7-7, § 7.1.3.
[429] Exhibit No. SNWA_258, p. 7-7, § 7.1.3.
[430] Exhibit No. SNWA_258, p. 7-7, § 7.1.3.

800 acre-feet of outflow for the southern flow section.[431] The Applicant's total outflow estimate was 4,400 acre-feet which is within the range of previously reported estimates.

Protestant Millard County's witness, Dr. Hugh Hurlow,[432] stated in his expert report that his preferred range of interbasin flow through the Limestone Hills area was 4,000 to 12,000 acre-feet.[433] Dr. Hurlow re-calculated the interbasin flow using Darcy's Law, but used an average of hydraulic gradients derived from USGS wells located in the vicinity of the Limestone Hills.[434] Dr. Hurlow's assumed gradients were approximately three times greater for the fault sections, and the wells that were used to make this calculation were, except for one, completed in the basin fill.[435] Given this evidence, Dr. Hurlow conceded that he could not rule out that the Applicant's hydraulic gradient was possibly correct.[436]

The State Engineer is concerned that Dr. Hurlow's hydraulic gradients are not representative of the hydraulic gradient in the carbonate rocks through which the interbasin flow occurs. Notably, the re-calculated gradients caused Dr. Hurlow's interbasin flow estimate, 14,325 acre-feet, to exceed his preferred range.[437] Therefore, the State Engineer finds that the Applicant's hydraulic gradient estimate is more accurate because it was estimated using wells completed in the carbonate rocks and resulted in an interbasin flow estimate that was within Dr. Hurlow's preferred range.

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[431] Exhibit No. SNWA_258, p. 7-7, § 7.1.3.
[432] Dr. Hurlow is a senior scientist at the Utah Geologic Survey. Dr. Hurlow was qualified as an expert in Hydrogeology by the State Engineer. Transcript, Vol.16 p. 3593:5-6 (Hurlow).
[433] Exhibit No. MILL_011, pp. 4 and 5.
[434] Exhibit No. MILL_011, p. 15.
[435] Exhibit No. MILL_011, pp. 14 and 17.
[436] Transcript, Vol.16 p. 3642:2–24 (Hurlow).
[437] Exhibit No. MILL_011, p. 17.

Dr. Myers, on the other hand, appears[438] to adopt BARCASS's estimate of 33,000 acre-feet of outflow, which is the equivalent of his estimated inflow from Steptoe and Lake Valleys to Spring Valley. The BARCASS estimate for interbasin flow was based on an imbalance in the groundwater budget for Steptoe Valley. The BARCASS groundwater budget estimated Steptoe Valley received an unprecedented amount of recharge, 154,000 acre-feet, and only discharged 101,000 acre-feet, leaving 53,000 acre-feet to discharge from the basin as interbasin flow.[439] According to BARCASS, "[g]roundwater outflow from central Steptoe Valley is to Jakes and northern White River Valleys; and outflow from southern Steptoe Valley is to Lake Valley and southern Spring Valleys. The latter two flow paths from central and southern Steptoe Valley have not been identified in previous investigations." These postulated flow paths are probably dependent on the accuracy of the postulated imbalance in the BARCASS groundwater budget for Steptoe Valley and the presence of carbonate rocks at the boundaries; however, no additional data were ever collected or analyzed to corroborate the flow paths. The analysis that resulted in this suggested flow path was subsequently updated by the USGS in GBCAAS.[440] The purpose of GBCAAS is to update "the previous RASA conceptual model integrating new findings from several recent basin-scale studies, the Death Valley Regional Flow System study, and BARCASS."[441] Using this information, GBCAAS recalculated the groundwater budget

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[438] The State Engineer notes that Dr. Myers' reports and testimony do not explicitly state his groundwater budget components for Spring Valley. Though Dr. Myers presented interbasin flow estimates from BARCASS, he testified that these were not necessarily his opinions as to what the interbasin flow actually is. Testimony of Thomas Myers, Transcript, Vol.20 pp. 4399:1–4401:15 (Myers). To develop his groundwater model parameters, Dr. Myers relied on BARCASS, Reconnaissance Reports, Kirk and Campana, and his own estimates for different basins. Transcript, Vol.21 pp. 4600:19–4610:3 (Myers).
[439] Exhibit No. SNWA_068, p. 44, Table 5; p. 45, Table 6.
[440] Exhibit No. SNWA_065; Exhibit No. MILL_038.
[441] Exhibit No. MILL_038, p. 1.

components for Steptoe Valley.[442] The new groundwater budget significantly reduced the estimated recharge in Steptoe Valley from 154,000 afa to 86,000 afa and slightly increased the estimated discharge from 101,000 afa to 110,000 afa.[443] The new groundwater budget for Steptoe Valley leaves a recharge deficit of 24,000 afa. Accordingly, interbasin inflow must occur *into* Steptoe Valley to balance the groundwater budget. Therefore, the USGS no longer finds that there is outflow from southern Steptoe Valley to Jakes and White River Valley. Dr. Myers did not update his analysis based on this new information from USGS.

The hydrogeology of the Limestone Hills cannot support Dr. Myers' estimate of 33,000 acre-feet of interbasin flow. BARCASS estimated that the saturated thickness of the aquifer in the Limestone Hills area is 15,000 feet (2.8 miles).[444] However, when questioned by the Applicant's counsel, Dr. Myers conceded that 2,000 feet is not an unreasonable assumption for saturated thickness of the aquifer if the groundwater flow is entering the Limestone Hills from the alluvial aquifer.[445] Dr. Hurlow also used 2,000 feet as the saturated thickness of the aquifer in this area.[446] Interestingly, Dr. Myers' groundwater model does not simulate 33,000 acre-feet of interbasin outflow through the Limestone Hills. Instead, Dr. Myers' groundwater model simulates 18,000 acre-feet from Spring Valley to Hamlin Valley at steady state.[447]

Given the lack of interbasin inflow from Steptoe and Lake Valleys, any outflow to Hamlin Valley is generated by precipitation recharge in the southern sub-basin of Spring Valley, which is defined by a groundwater divide approximately coinciding with the boundary of White

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[442] Exhibit No. MILL_033, p. 4; Exhibit No. MILL_034, p. 4.
[443] Exhibit Nos. MILL_033, p. 4; MILL_034, p. 4; SNWA_058, p. 44, Table 5; p. 45, Table 6.
[444] Exhibit No. SNWA_068, p. 73.
[445] Transcript, Vol.20 p. 4356:13-23 (Myers).
[446] Transcript, Vol.16 p. 3634: 1-4 (Hurlow).
[447] Exhibit No. GBWN_002, p. 37.

Pine and Lincoln counties. The permeability of the basin-fill aquifer decreases with depth and becomes negligible around 2,000 feet. The saturated depth of the aquifer is closer to 2,000 feet rather than 15,000 feet, making the BARCASS interbasin flow estimate unreasonable. The Applicant reported the following prior estimates of interbasin outflow for the Limestone Hills area: 4,000 acre-feet (Rush and Kazmi, 1965); 8,000 to 12,000 acre-feet (Nichols, 2000); 33,000 acre-feet (Welch, et al., 2007).[448] The State Engineer adopts the Applicant's interbasin flow estimate of 4,400 acre-feet because it is within the range of prior estimates and is based on the most comprehensive and accurate hydrologic and geologic study of interbasin flow through the Limestone Hills to date.

**2. Steptoe and Lake Valleys to Spring Valley**

Dr. Myers estimated that up to 33,000 acre-feet of groundwater flows into southern Spring Valley from Steptoe and Lake Valleys (29,000 acre-feet inflow from Lake Valley and 4,000 acre-feet directly from Steptoe Valley).[449] Dr. Myers adopted this estimate from BARCASS and suggested that this interbasin flow estimate is now accepted.[450] Dr. Myers did not identify any other studies prior to or after BARCASS that have accepted this interbasin flow estimate, and as discussed above, the USGS updated and modified the BARCASS understanding of flow in this area in the GBCAAS report.

As Dr. Myers acknowledged in his expert report, there are barriers to interbasin flow between southern Spring Valley and Lake and Steptoe Valleys. The first barrier is the Indian Peak Caldera Complex that comprises the southern half of the Fortification Range at the

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[448] Exhibit No. SNWA_258, p. 7-8, § 7.1.2.
[449] Transcript, Vol.19 pp. 4297: 24-4298:78 (Myers).
[450] Transcript, Vol.19 p. 4297:720-23 (Myers); Exhibit No. GBWN_001, p. 12.

southwest boundary of Spring and Lake Valleys.[451] According to Dr. Myers, the "[v]olcanic portions of the Fortification Range bound southwest Spring Valley and may impede flow between Spring and parts of Lake Valley."[452] The Applicant's witness, Dr. Rowley found that this caldera complex is likely a barrier to flow.[453]

Flow is also unlikely to the northwest of the Indian Peak Caldera Complex, through the northern half of the Fortification Range at the southwest boundary of Spring and Lake valleys. Dr. Myers conceded that "[n]orthwest of the Fortification Range along Lake Valley summit, there is carbonate rock (UCU), through which the postulated interbasin flow would occur, but with a 'thin Chainman Shale' layer which may slow or prevent flow through that region."[454] The Applicant's witness Dr. Rowley found that the northern Fortification Range is complexly faulted and has repeated sections of the Chainman Shale beneath the surface, likely preventing groundwater flow through the northern half of the range.[455] The State Engineer finds that the groundwater flow is likely minimal or negligible across the Fortification Range due to the caldera complex in the southern part and the Chainman Shale confining unit in the northern part of the range.

There are other barriers to flow between Spring Valley and Lake and Steptoe Valleys that Dr. Myers did not acknowledge. First, there are north-south striking normal faults on the western and eastern sides of the Fortification Range.[456] The hydraulic conductivities in these

[451] Exhibit No. SNWA_258, Plate 1.
[452] Exhibit No. GBWN_001, p. 23.
[453] Transcript, Vol.5 p. 1156:10-14 (Rowley); SNWA_058, p. 4-63.
[454] Exhibit No. GBWN_001:, p. 23.
[455] Exhibit No. SNWA_058, p. 4-60.
[456] Exhibit No. SNWA_426, p. 8.

faults are usually higher along the fault rather than across the fault.[457] Therefore, the preferential flow path for the water would be along these faults rather than across the faults, preventing any significant amount of interbasin flow.

Dr. Myers' groundwater model itself supports the idea that 33,000 acre-feet of interbasin flow from Steptoe and Lake Valleys to Spring Valley is unrealistic. Dr. Myers' groundwater model does not simulate this magnitude of interbasin flow from Steptoe Valley to Spring Valley. Dr. Myers' model simulates a flow of about 2,300 acre-feet from Steptoe Valley to Spring Valley and about 13,000 acre-feet from Lake Valley to Spring Valley.[458]

Also, the Applicant presented evidence of a groundwater divide that lies just north of the Chainman Shale in the northwestern part of the Fortification Range and crosses the entire width of Spring Valley.[459] The Applicant used gravity data to map the depth to basement rock in this area. The depth to basement rock decreases from approximately 7,500 feet (1.4 miles) to approximately 500 feet or (.1 miles) below ground surface.[460] The groundwater divide is marked by a groundwater elevation high of approximately 5,800 feet above mean sea level ("amsl") and defined by groundwater elevations in wells located to the north and south of 5,763 feet and 5,707 feet amsl, respectively.[461] This feature would further limit the ability of interbasin flow to move south through Spring Valley.

The State Engineer finds that the low-permeability rocks associated with the Indian Peak Caldera Complex and the Chainman Shale comprising the Fortification Range prevents

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[457] Exhibit No. SNWA_058, pp. 2-7, 2-8; Exhibit No. SNWA_063; Transcript, Vol.5 p. 1112:20-25 (Rowley). *see also* Section III, B. (3) above for discussion of fracture flow.
[458] Exhibit No. GBWN_002, p. 38.
[459] Exhibit No. SNWA_258, p. 8-3.
[460] Exhibit No. SNWA_258, p. 8-3.
[461] Exhibit No. SNWA_258, p. 8-2.

significant inflow from Lake and Steptoe Valleys through the Fortification Range into southern Spring Valley. Hydrogeologic features between Steptoe and Lake Valleys and southern Spring Valley, and the groundwater divide in Spring Valley, significantly limit the potential for interbasin flow in this area. The State Engineer finds there is no evidence that more than a minimal amount of inflow occurs from Steptoe and Lake Valleys to southern Spring Valley.

**3. Northern Spring Valley to Northern Snake Valley**

The Applicant evaluated the potential for outflow from northern Spring Valley to northern Snake Valley. Prior investigations reported interbasin outflow estimates of 4,000 acre-feet (Nichols, 2000); 6,000 acre-feet (Katzer and Donovan, 2003); and 16,000 acre-feet (Welch, et al 2007).[462] The Applicant's geologic data indicated that flow from northeastern Spring Valley to northern Snake Valley is permissible, with the depth and extent of the flow section limited due to the geologic framework. Granitic rocks of the Kern Mountains form the northern extent of the profile and Precambrian-Cambrian siliclastic rocks of the lower Snake Range form the southern extent.[463] In the middle, carbonate rocks are separated by Chainman Shale confining units.[464] Overlying these rocks are Tertiary volcanic rocks and younger sediments. The valley between the Kern Mountains and the Snake Range is a shallow basin with a shallow depth to basement rock.[465] These geologic features have low permeability. The State Engineer finds that the presence of these low-permeability geologic formations limit interbasin flow in this area.

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[462] Exhibit No. SNWA_258, p. 7-5, § 7.1.2.
[463] Exhibit No. SNWA_258, p 7-3, § 7.1.2.
[464] Exhibit No. SNWA_258, p. 7-3, § 7.1.2.
[465] Transcript, Vol.5 p. 1150:6-25 (Rowley); SNWA_058, p. 5-9; Fig. 5-6.

While groundwater flow through the younger sediments along an inferred northwest-southeast trending fault is permissible, there is no flow through this boundary originating in Spring Valley. The basin-fill wells in this area of Spring Valley, 184-197, 184-200, 184-195, and 184-186, show a prevailing gradient to the south toward the Main groundwater discharge area.[466] Any outflow in through this flow section likely originates in Tippett Valley where water levels in wells completed in the basin fill (wells 185-2, 185-4, 185-3, and 185-1) indicate a hydraulic gradient to the south and east. Along this hydraulic gradient, groundwater from Tippett Valley would flow on the east side of the Red Hills into northeastern Spring Valley between the Kern Mountains and the northern Snake Range and into western Snake Valley.

There is geochemical evidence that supports a finding that there is no outflow in this area from Spring Valley to Snake Valley. Jeremy M. Gillespie, an independent investigator, used available geochemical data to evaluate groundwater flow paths in Spring Valley and Snake Valley. With respect to the potential for interbasin flow in this area, Mr. Gillespie found that

> Interbasin flow from northern Spring Valley to northern Snake Valley . . . is unlikely and can readily be explained as deeply circulated groundwater that mixes with modernly recharged water prior to discharge. This interpretation suggests that interbasin flow does not occur from northern Spring Valley to Snake Valley and suggests that interbasin flow estimates suggested by Welch and Bright (2007) and Nichols (2000) should be reallocated or estimated water budgets should be reevaluated.[467]

Dr. Myers adopted the BARCASS outflow estimate of 16,000 acre-feet, which Mr. Gillespie concludes should be re-evaluated. Dr. Myers did not provide any geologic, hydrologic, or geochemical data to refute this finding. In fact, Dr. Myers' groundwater budget for Spring Valley appears to estimate 71,800 acre-feet of recharge and 75,600 acre-feet of groundwater

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[466] Exhibit No. SNWA_258, Plate 1.
[467] Exhibit No. SNWA_281, p. 37.

discharge, which cannot accommodate any outflow to either basin and would support the Applicant's no flow estimate.[468] Furthermore, Dr. Myers' groundwater model simulated zero interbasin flow through this boundary, and he conceded that interbasin flow is closer to zero at this location.[469] Therefore, the State Engineer finds that the hydrologic, geologic, and geochemical data all support the conclusion that there is no, or at most minimal, outflow from northern Spring Valley to northern Snake Valley.

**4. <u>Spring Valley to Tippett Valley</u>**

The Applicant has identified two permissible flow boundaries between Spring Valley and Tippett Valley on the west and east side of the Red Hills.[470] As stated above, the Applicant agrees that flow across the eastern boundary is permissible and may result in a minor amount of outflow to Snake Valley. For the western boundary, the Applicant's geologic analysis concluded the geologic framework in Tippett Valley is basin fill that may be, in part, underlain by caldera complexes,[471] that would limit or prevent outflow.[472] The potential for flow is not supported by the Applicant's hydrologic evidence either. The basin fill wells, Map ID's 184-197, 184-200, and 184-195, located to the south of the flow section in Spring Valley show a prevailing hydraulic gradient to the south in the direction of the groundwater discharge area in Spring Valley.[473]

Dr. Myers appears to adopt the BARCASS interbasin outflow estimate of 2,000 acre-feet from Spring Valley to Tippett Valley. As stated above, Dr. Myers' groundwater budget for

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[468] Exhibit No. GBWN_001, p. 19, Table 2; Exhibit No. GBWN_003, p. 4.
[469] Transcript, Vol.20 pp. 4423:18-22, 4424:19-25 (Myers).
[470] Exhibit No. SNWA_258, p. 7-1.
[471] Exhibit No. SNWA_058, p. 4-67
[472] Exhibit No. SNWA_258, p. E-3.
[473] Exhibit No. SNWA_258, Plate 1.

Spring Valley cannot support this outflow estimate. In addition, Dr. Myers' groundwater contour maps do not support this conclusion. Dr. Myers' intermediate-well contour map shows a hydraulic gradient from Spring Valley to Tippett Valley.[474] The Applicant's rebuttal report found that the northern most well on this contour map was geographically misplaced and that the actual location of the well was approximately four miles to the south of the plotted location.[475] Dr. Myers also conceded on cross-examination that the southern well was misplotted.[476] Dr. Myers further conceded that there were additional wells in this area that were not included in his analysis.[477] Based on this evidence, Dr. Myers admitted that the gradient does not exist and that the intermediate well contour map cannot be relied upon to indicate a gradient toward Tippett Valley.[478] Given this admission, the State Engineer finds the Applicant's hydrologic and geologic evidence persuasive and further finds that insufficient evidence exists to support a finding that outflow exists from Spring Valley to Tippett Valley.

### C. Recharge

The Applicant directly calculated recharge for Spring Valley by applying the estimate of average annual groundwater ET and interbasin flow to the groundwater balance equation.[479] Using this approach, the Applicant estimated 99,200 acre-feet of recharge for Spring Valley.[480] The Applicant reported the following recharge estimates from prior investigations: 81,339 acre-feet (SNWA 2009a); 75,000 acre-feet (Reconnaissance Series Reports and Scott, et. al, 1971); 61,636 acre-feet (Dettinger, 1989); 104,000 acre-feet (Nichols, 2000); 66,402 acre-feet, 93,840

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[474] Exhibit No. GBWN_001, p. 7.
[475] Exhibit No. SNWA_426, p. 3.
[476] Transcript, Vol.20 p. 4409:12-17 (Myers).
[477] Transcript, Vol.20 p. 4411:18-24 (Myers).
[478] Transcript, Vol.20 pp. 4409:25–4410:2; 4411:25–4412:6 (Myers).
[479] Exhibit No. SNWA_258, p. 6-10.
[480] Exhibit No. SNWA_258, p. 6-10.

acre-feet, 92,965 acre-feet, 53,335 acre-feet, and 139,194 acre-feet (Epstein, 2004); 66,987 acre-feet and 56,179 acre-feet (Flint et al., 2004); 72,000 acre-feet (Brothers et al., 1994); 93,000 acre-feet (Welch, et al. 2007); and 62,000 acre-feet (Mizell et al., 2007).[481] In addition, GBCAAS estimated that Spring Valley receives 110,000 acre-feet of recharge.[482] The Applicant's estimated recharge is within the range of prior estimates and less than the current USGS estimate.

Dr. Myers' groundwater budget for Spring Valley is based on the average of recharge estimates from prior studies.[483] This approach is inconsistent with his recharge analysis for other basins during the hearing. For Cave, Dry Lake, and Delamar Valleys, Dr. Meyers concluded that the Reconnaissance Report Series recharge estimates were the best estimates for these basins, but that the BARCASS estimates in other basins were appropriate.[484] If Dr. Myers had applied the same reasoning in Spring Valley and selected the BARCASS estimate of recharge instead of averaging, his recharge value for Spring Valley would have been 93,000 acre-feet.[485] Nevertheless, Dr. Myers' recharge estimate is low due to the fact that he did not include all available recharge estimates for his calculation of an average, including GBCAAS.[486]

Dr. Myers' averaging approach assigns equal weight to each estimate and does not account for uncertainties.[487] The State Engineer finds that he will adopt the best estimate for recharge in Spring Valley and not an average of prior estimates as this method does not account for advances in scientific approaches and data collection efforts. The State Engineer finds that

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[481] Exhibit No. SNWA_258, p. 6-12, Table 6-2.
[482] Exhibit No. MILL_033, p. 5.
[483] Transcript, Vol.20 p. 4432:8-9 (Myers).
[484] Exhibit No. GBWN_004, p. 35, Table 6; Transcript, Vol.20 pp. 4576:23–4577:45 (Myers).
[485] Exhibit No. SNWA_68, p. 44.
[486] Exhibit No. GBWN_001, p. 19; Exhibit No. SNWA_258, p. 6-12, Table 6-2; Exhibit No. MILL_033, p. 5.
[487] Transcript, Vol.20 p. 4431:3-18 (Myers).

that Applicant's estimate for recharge, 99,200 acre-feet, is the best estimate in Spring Valley because it is based on field measurements for groundwater ET and the most comprehensive geologic and hydrologic analysis of interbasin flow.

Based on the evidence in the record, including but not limited to the evidence cited above, the State Engineer finds that the Applicant presented the most comprehensive hydrologic investigation of Spring Valley to date. Based on that analysis, perennial yield may be determined based on the volume of estimated recharge in a basin, which in Spring Valley is 99,200 afa. In this case, however, because groundwater ET is a measured value, the State Engineer finds that the perennial yield in Spring Valley will be based on the groundwater ET estimate.

In vacated Ruling 5726, the State Engineer found that the perennial yield of Spring Valley was 80,000 afa. This finding was based on an average of the groundwater ET estimates from Nichols (2000), 90,000 afa, and the Rush and Kazmi (1965), 70,000 afa. However, the State Engineer is directed by Nevada law to consider the best available science in determining the available water in Spring Valley[488]. With very little doubt, the scientific approach that the Applicant used to measure groundwater ET in Spring Valley far surpasses previous studies, including Nichols (2000) and Rush and Kazmi (1965). Therefore, the State Engineer finds that 80,000 afa is not the best estimate of groundwater ET in the basin and should not be the basis for perennial yield.

The Applicant's groundwater ET estimate of 94,800 afa is sound. However, more data will allow the State Engineer to determine with confidence that the Applicant's estimate is representative of a long-term average. To account for the possibility that the Applicant's

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[488] NRS 533.024(1)(c)

estimate of groundwater ET represents a higher amount than the long-term average, the State Engineer will set the current groundwater ET to 90,000 afa. This will prevent over-appropriation of the resource. As more data is collected, this number may be raised or lowered as an average value is developed from the additional data. Thus, the State Engineer finds that perennial yield for Spring Valley is 90,000 afa.

**D. Time to Reach Equilibrium**

The Protestants suggest that the perennial yield of a basin is further limited to the amount of groundwater discharge that the proposed pumping will actually capture in a reasonable amount of time.[489] The Applicant suggests that the perennial yield of a basin is at least as much as the amount of groundwater-ET discharge and no more than the amount of recharge.[490] The Applicant argues that the perennial yield guideline for managing groundwater basins is an accounting assumption and it does not imply that pumping must literally capture all discharge.[491] The Applicant further argues that the definition of perennial yield is unrelated to the system reaching a new equilibrium within a specific time frame and notes that if the goal were to reach equilibrium within a short amount of time, this goal could be achieved by increasing pumping to levels beyond the perennial yield until the new equilibrium is reached.[492]

Assuming climatic conditions remain reasonably constant, under natural conditions, inflow to a groundwater system should equal outflow over the long term.[493] Capture refers to the pumping that results in a reduction of ET discharge due to a lowering of the water table. Transitional storage refers to "the quantity of water in storage in a particular ground water

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[489] Exhibit No. GBWN_003, p. 3; Transcript, Vol.24 pp. 5369:16–5370:8 (Bredehoeft).
[490] Exhibit No. SNWA_258, pp. 10-1 to 10-2.
[491] Exhibit No. SNWA_407, p. 3.
[492] Exhibit No. SNWA_407, p. 2.
[493] Exhibit No. SNWA_300, p. 12.

reservoir that is extracted during the transition period between natural equilibrium conditions and new equilibrium conditions under the perennial-yield concept of ground water development."[494] Pumping of transitional storage is equivalent to using a "bridge" on the way to a new equilibrium.

The State Engineer finds that there is no requirement that pumping reach a new equilibrium in any set amount of time. Water rights may allow pumping indefinitely and new pumping may not cause an unreasonable lowering of the water table such that it conflicts with existing rights. The protection of existing water rights is assured by this requirement, not a requirement that a new equilibrium be reached in a set amount of time.

A conceptual problem exists with the Protestants' time to equilibrium argument. Drs. Bredehoeft and Myers testified that true equilibrium, where absolutely no water is withdrawn from storage, is impossible. Even in a finite aquifer, a small amount of water will continue to be removed from storage indefinitely.[495] And model predictions regarding time to equilibrium are misleading. For instance, Dr. Myers simulates that 1,310 afa continues to be pumped from storage after simulating pumping for 10,200 years using his model.[496] As discussed below, mathematical equilibrium, where 0% of pumping is removed from storage, is virtually impossible. Even though Dr. Myers simulated about only 1.4 percent of the pumping amount continues to be removed from storage, he represents this projection to be evidence that equilibrium is never achieved. Given the imprecise nature of groundwater models, such a projection should be considered equilibrium. Furthermore, groundwater models are not precise when predictions are carried out so far into the future and involve such large geographic regions.

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[494] Exhibit No. SNWA_300, p. 13.
[495] Transcript, Vol.21 pp. 4644: 19–4645:57 (Myers); Transcript, Vol.24 pp. 5447:25-5448:9 (Bredehoeft).
[496] Exhibit No. GBWN_003, p. 24.

In addition, Dr. Myers' model over-simulates time to equilibrium because it simulates pumping in excess of recharge and continuous pumping for the entire 10,200 year projection period. The State Engineer finds that Dr. Myers' simulations have little weight toward determining the time to equilibrium.

In addition, hydrologic considerations weigh against requiring that equilibrium be reached in a certain amount of time. Dr. Bredehoeft testified that it was initially believed by hydrologists that a new equilibrium could be reached in a short amount of time in Nevada. Later experience challenges this belief. The time to reach a new equilibrium is greater for larger systems and must be considered on a case-by-case basis. Dr. Myers testified that the reasonableness of time to equilibrium depends on a case-by-case analysis.[497] Even when simulating pumping distributed across the basin, within the groundwater ET discharge area, Dr. Myers' model still simulates equilibrium not being reached for thousands of years. Spring Valley is similar to other basins in Nevada, which would take similarly long to reach equilibrium.[498] Ignoring the uncertainty regarding Dr. Myers' predictions for a moment, this suggests that whatever assumptions regarding time to capture may have underlain early thoughts on perennial yield in Nevada, they are clearly no longer valid. The State Engineer finds that it will often take a long time to reach near-equilibrium in large basins and flow systems, and that this is no reason to deny water right applications.

Furthermore, there is no apparent reason why, all else being equal, a longer time to reach equilibrium alone would favor denial of water right applications. A pumping regime that lowers the water table one tenth of an inch for 100 years is no more harmful to existing rights and the

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[497] Transcript, Vol.20 pp. 452 5:21–452 7:6 (Myers).
[498] *See* Transcript, Vol.24 pp. 5371:11–23, 5441: 6–5446: 17, 5485:23–5486:2 (Bredehoeft).

environment than a regime that lowers the water table 10 inches in one year. In many ways, the slower lowering of the water table is less harmful to existing rights and the environment as it allows for slow, gradual adjustments in plant communities. Thus, the State Engineer finds that the estimated time a pumping project takes to reach a new equilibrium does not affect the perennial yield of a basin.

### E. <u>ET Capture</u>

The State Engineer finds that there is no requirement that the Applicant must show that the proposed well placement will actually be able to fully capture discharge. Such a requirement is impractical both from a hydrodynamics/aquifer properties perspective and a land ownership perspective. The exact pumping response depends on the hydrologic conditions affecting the groundwater system and the hydraulic properties of the aquifer, as well as management decisions made during the life of the pumping project.[499] For large projects like the one at issue, the detailed hydraulic properties are simply not known well enough to precisely predict the dynamic response of pumping. In addition, the groundwater in a basin may be appropriated by many different individuals and entities. There is no practical way to require them to manage their groundwater operations collectively to reach full capture. Moreover, the location of the small amount of private land in Nevada limits where wells can be placed to capture ET.

Furthermore, the statutes require the State Engineer to consider the "unappropriated water in the proposed source of supply." The amount of water available is based on what is in the supply, not on the specifics of the method of extraction. The State Engineer thus manages groundwater on a basin-wide scale. Each basin has a perennial yield based on its hydrology. It is not practical, nor the intent of the perennial yield concept, to determine separate perennial

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[499] *See* Exhibit No. GBWN_009, p. 3; Exhibit No. GBWN_013, p. 342; Transcript, Vol.24 p. 5371:3-5 (Bredehoeft).

yields for each applicant based on the placement of their proposed wells. In sum, the unappropriated water in the proposed source of supply may be developed anywhere in the basin, and the State Engineer finds that the Applicant is not required to prove capture of ET as a prerequisite to approval of the Applications.[500]

## IV. EXISTING RIGHTS

To determine the amount of water available for appropriation in a groundwater basin, the State Engineer must determine the amount of committed groundwater rights in the basin.[501] Committed groundwater rights are the portion of groundwater rights that actually deplete water from the groundwater reservoir. The Applicant undertook a complete and comprehensive evaluation of committed groundwater rights in Spring Valley. The Applicant's evaluation was presented through exhibits and the testimony of expert water rights surveyor Michael Stanka of Stanka Consulting, LTD.[502] Mr. Stanka presented an expert report which quantified the total amount of committed groundwater rights in Spring Valley.[503] Mr. Stanka's report identified every groundwater right in Spring Valley and then made adjustments for (i) groundwater rights that are supplemental to other groundwater rights, (ii) groundwater irrigation rights that are supplemental to surface water irrigation rights, (iii) the amount of groundwater that is estimated to be consumed for irrigation uses, and (iv) the amount of groundwater from domestic wells that is estimated to be consumed for domestic uses.[504]

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[500] *See* Exhibit No. SNWA_460, Cave Valley Inventory p. 1, at p. 186 ("Groundwater is managed by the State Engineer on a basin-wide scale, and can be developed anywhere in the basin, with certain practical considerations such as accessibility, the location of aquifers or existing rights.").
[501] NRS 533.370(5) (2010); NRS 534.110(3).
[502] Mr. Stanka holds professional engineering licenses in Nevada and Florida and is a water rights surveyor in the state of Nevada. He was qualified by the State Engineer as an expert in water rights research and quantification. Exhibit No. SNWA_096; Transcript, Vol.2 p. 420:19-21 (Qualification of Mr. Stanka).
[503] Exhibit No. SNWA_097.
[504] Exhibit No. SNWA_097, p. 1-7.

In addition, the State Engineer has undertaken an independent evaluation and has prepared an inventory of all water rights in Spring Valley pursuant to NRS 533.364.[505] The results of Mr. Stanka's analysis are similar to the results of the basin inventory prepared by the State Engineer. Thus, these hearings have yielded the most current and accurate estimate of committed groundwater rights in Spring Valley.

When calculating the total amount of committed groundwater rights in a basin, it is inappropriate to simply sum the number of acre-feet listed on each water right. Each water right has a place of use limitation and a total combined duty limitation so that even if a certain place of use has more than one water right associated with it, the amount of water used on that piece of land is limited by the total combined duty. In order to accurately account for the total amount of committed groundwater rights in a basin, a water rights surveyor adjusts the total water rights by accounting for water rights limited by total combined duties, water rights that are supplemental (i.e. not used every year), and for consumptive use.

### A. <u>Active Water Rights</u>

Mr. Stanka reviewed the on-line database and physical files of the Division of Water Resources and identified every single water right and record in Spring Valley, including applications, permits, certificates, claims of reserved rights and claims of vested rights. Mr. Stanka listed those water rights and records in various tables and appendices in his report based on the manner of use, source of the water, and status of the water right or record. Mr. Stanka then identified the total duty of the permits, certificates, claims of reserved rights and claims of vested rights.[506] Mr. Stanka did not identify the total duty of applications currently pending in

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[505] Exhibit No. SNWA_460.
[506] Exhibit No. SNWA_097, Section 5.2, pp. 5-4 to 5-10; Transcript, Vol.2 p. 425:21-23 (Stanka).

the office of the State Engineer. The State Engineer finds this was the correct approach because an application is not a committed groundwater right, but rather is simply a record of a pending application to acquire a water right or to change an existing water right.[507] Thus, an application may never result in a water right and it would be speculative and thus improper to attempt to quantify them.

**B. Groundwater Rights Supplemental to Groundwater Rights**

Mr. Stanka identified every groundwater right that is supplemental to another groundwater right in Spring Valley.[508] A groundwater right is not a committed groundwater right to the extent that it is supplemental to another groundwater right because the supplemental amount exceeds the maximum allowed duty. A water right holder is prohibited from pumping and applying more water than allowed by the duty, so amounts in excess of the maximum duty can never be used and are therefore available for appropriation by other water users.[509]

For groundwater rights with a manner of use other than irrigation ("non-irrigation groundwater rights"), Mr. Stanka reviewed the terms of the water right permits or certificates to determine whether they were supplemental to another groundwater right.[510] If two or more groundwater rights have a combined duty not to exceed a certain amount, then the total duty in excess of that amount is supplemental. Mr. Stanka identified a total of 2,601.18 afa of non-irrigation groundwater rights in Spring Valley.[511] Based upon a review of the terms of the permits and certificates, Mr. Stanka identified 1,901.25 afa of non-irrigation groundwater rights

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507 Exhibit No. SNWA_097, p. 5-4; Transcript, Vol.2 p. 430:5-18 (Stanka).
508 Transcript, Vol.2 p. 449:4-9 (Stanka).
509 Transcript, Vol.2 pp. 439:12-440:5 (Stanka).
510 Exhibit No. SNWA_097, Section 5.2, pp. 5-4 to 5-10; p. 5-19, Table 5-10.
511 Exhibit No. SNWA_097, p. 5-6, Table 5-3.

that are not supplemental, and the remaining 699.93 afa of non-irrigation groundwater rights are supplemental.[512]

For groundwater rights with a manner of use of irrigation ("groundwater irrigation rights"), Mr. Stanka reviewed the terms of the permit or certificate and identified which groundwater irrigation rights had places of use within the same 40 acre subdivision.[513] In many cases, the terms of the permit or certificate state the supplemental amount of the groundwater irrigation right. However, Mr. Stanka also mapped the place of use of the groundwater irrigation rights.[514] For certificates, Mr. Stanka mapped the actual place of use identified in the terms of the certificate and the Proof of Beneficial Use ("PBU") maps. For permits, Mr. Stanka mapped the potential place of use identified in the terms of the permit and the application map. Mr. Stanka overlaid the maps of the places of use of the groundwater irrigation rights and determined the acreage of the overlapping area using computer software. If two groundwater irrigation rights had overlapping places of use, the rights associated with the overlapping number of acres were multiplied by the duty per acre in order to calculate the supplemental portion.[515] Using the approaches described above, Mr. Stanka identified all groundwater irrigation rights that are supplemental to other groundwater irrigation rights in Spring Valley. Mr. Stanka identified a total of 26,883.59 afa of groundwater irrigation rights in Spring Valley.[516] Mr. Stanka identified 19,772.473 afa of groundwater irrigation rights that are not supplemental, with the remaining 7,111.117 afa being supplemental to other groundwater irrigation rights.[517]

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[512] Exhibit No. SNWA_097, p. 5-19, Table 5-10.
[513] Exhibit No. SNWA_097, Section 5.3, pp. 5-11 to 5-18; Transcript, Vol.2 pp. 437:19-438:22 (Stanka).
[514] Exhibit No. SNWA_097, p. 5-11; Transcript, Vol.2 pp. 445:8-23 (Stanka).
[515] Transcript, Vol.2 pp. 446:16-447:11 (Stanka).
[516] Exhibit No. SNWA_097, p. 5-6, Table 5-3.
[517] Exhibit No. SNWA_097, p. 5-19, Table 5-9; Transcript, Vol.2 pp. 450:7-12 (Stanka).

Therefore, Mr. Stanka determined that a total of 7,811.047 afa of existing groundwater rights (7,111.117 afa for irrigation and 699.93 afa for non-irrigation) are supplemental to other groundwater rights. Therefore, the State Engineer finds that 7,811.047 afa of supplemental rights are not committed groundwater rights are thus available for appropriation.

### C. Groundwater Irrigation Rights Supplemental to Surface Water Rights

Mr. Stanka identified every groundwater irrigation right that is supplemental to a surface water irrigation right in Spring Valley.[518] The extent to which groundwater irrigation rights will be used to supplement surface water irrigation rights varies from year to year and depends on various factors including the amount of precipitation that occurs and resulting surface water flows. Mr. Stanka identified the extent to which those supplemental groundwater irrigation rights would be expected to be used to supplement surface water irrigation rights in an average irrigation season.[519] The State Engineer finds that a portion of a groundwater irrigation right is not a committed groundwater right if it is (i) supplemental to a surface water irrigation right, and (ii) not expected to be used in an average irrigation season.

Mr. Stanka reviewed the terms of permits and certificates and identified which groundwater irrigation rights had a place of use within the same 40 acre subdivision as the place of use of a surface water irrigation right.[520] Mr. Stanka then mapped the place of use of the surface water irrigation rights in those 40 acre subdivisions.[521] For certificates, Mr. Stanka mapped the actual place of use identified in the terms of the certificate and the PBU map. For permits, Mr. Stanka mapped the potential place of use identified in the terms of the permit and

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[518] Exhibit No. SNWA_097, Section 5.5, pp. 5-19 to 5-25; Transcript, Vol.2 p. 471:5-8 (Stanka).
[519] Exhibit No. SNWA_097, Section 5.6, pp. 5-25 to 5-31; Transcript, Vol.3 p. 484:1-4 (Stanka).
[520] Exhibit No. SNWA_097, Appendix 55; Transcript, Vol.2 pp.454:24-455:15 (Stanka).
[521] Transcript, Vol.2 p. 459:18-25 (Stanka).

the application map. Mr. Stanka overlaid the maps of the places of use of the surface water irrigation rights and the maps of the places of use of the groundwater irrigation rights and determined the acreage of the overlapping area using computer software.[522] If two water rights had overlapping places of use, the rights associated with the overlapping number of acres were multiplied by the duty per acre in order to calculate the supplemental portion.[523] The groundwater irrigation right, rather than the surface water irrigation right, was assumed to be supplemental because (i) groundwater priority dates are junior to surface water priority dates for the vast majority of irrigation water rights, and (ii) it is more expensive to pump groundwater so available surface water rights are normally used first.[524] The process used to analyze each groundwater right that might be supplemental to a surface water irrigation right was presented in an appendix to Mr. Stanka's report.[525] Using this analysis, Mr. Stanka determined that a total of 9,950.45 afa of groundwater irrigation rights are supplemental to surface water irrigation rights.[526]

Mr. Stanka then analyzed the extent to which those supplemental groundwater irrigation rights would be expected to be used to supplement surface water irrigation rights in an average irrigation season.[527] The best way to determine the amount of groundwater that would be used to supplement surface water in an average irrigation season would be to look at records of the actual amounts of groundwater that have been pumped to supplement actual surface water flows in the basin over an extended period of time. However, there are no such pumping records

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[522] Exhibit No. SNWA_097, Appendix 64-70; Transcript, Vol.2 pp. 460:6-10, 465:8-12 (Stanka).
[523] Transcript, Vol.2 p. 465:13-19 (Stanka).
[524] Exhibit No. SNWA_097, p. 5-22; Transcript, Vol.3 pp. 486:23-487:12 (Stanka).
[525] Exhibit No. SNWA_097, Appendix 56.
[526] Exhibit No. SNWA_097, p. 5-24, Table 5-12; Transcript, Vol.2 p. 471:1-4 (Stanka).
[527] Exhibit No. SWNA_097, Section 5.6, pp. 5-25 to 5-31.

available for Spring Valley.[528] Therefore, Mr. Stanka analyzed information from available hydrographs to estimate the amount of surface water flows in Spring Valley and the amount of groundwater that would be need to be pumped to supplement those flows during an average irrigation season.[529] Mr. Stanka prepared two alternative approaches for this analysis.

For the first approach, Mr. Stanka analyzed the amount of groundwater that would be needed to supplement flows on Cleve Creek which is a surface water source in Spring Valley.[530] There are more than 40 years of stream gauge information available for Cleve Creek.[531] The Cleve Creek hydrograph is similar to other hydrographs in Spring Valley because Cleve Creek is located near the valley floor and runoff is attributable to snowpack.[532] Therefore, it is reasonable to conclude that the same percentage of groundwater that would be needed to supplement flows on Cleve Creek would also be needed to supplement flows on other surface water sources in Spring Valley. Using conservative assumptions, Mr. Stanka identified the maximum monthly amount of water that would be needed during a given month of the irrigation season, and then calculated the portion of that amount that would need to be supplied by groundwater after the peak flow of Cleve Creek had occurred.[533] This approach resulted in an estimate that 39.1 percent of all supplemental groundwater irrigation rights would be used to supplement surface water irrigation rights in Spring Valley during an average irrigation season.[534]

Based upon testimony received at the hearing from the primary Cleve Creek water rights holder, there are applications for supplemental groundwater rights that were granted in 2007 but

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[528] Transcript, Vol.3 p. 483 (Stanka).
[529] Transcript, Vol.3 p. 484:7-10 (Stanka).
[530] Exhibit No. SNWA_097, Section 5.6.1, pp. 5-26 to 5-27; Transcript, Vol.3 pp. 484-495 (Stanka).
[531] Exhibit No. SNWA_097, p. 5-26; Transcript, Vol.3 p. 485:6-8 (Stanka).
[532] Transcript, Vol.3 p. 489:11-21 (Stanka).
[533] Exhibit No. SNWW_097, p. 5-27, Figure 5-8 and Table 5-14.
[534] Exhibit No. SNWW_097, p. 5-27, Table 5-14; Transcript, Vol.3 p. 494:17-21 (Stanka).

have not yet been used.[535] The Cleveland Ranch managers testified that it would not be necessary to operate the supplemental wells every year because of the supplemental nature of the rights.[536] This testimony, and the fact that supplemental water rights are not even used at all in certain years, supports a conclusion that actual use may very well be less than 39.1 percent of the supplemental groundwater rights.

For the second approach, Mr. Stanka analyzed data regarding supplemental groundwater usage for a surrogate surface water source not located in Spring Valley, Daggett Creek, and then normalized that data for application to surface water sources in Spring Valley.[537] Daggett Creek was selected because (i) Daggett Creek surface and groundwater use is metered and documented, (ii) surface water is directly related to snow pack runoff, and (iii) groundwater rights are fully supplemental to surface water.[538] There are 40 years of stream gauge information available for Daggett Creek.[539] The Nevada Division of Water Resources has previously determined that the percentage of the total duty of supplemental groundwater used on Daggett Creek ranges from 9.3 percent to 26.7 percent annually with an average of 18.0 percent annually.[540] After determining the percentage of supplemental groundwater used on Daggett Creek during an average irrigation season, Mr. Stanka applied a formula to account for the differences in post peak flow between Daggett Creek and Cleve Creek in order to estimate the amount of groundwater that would be used to supplement flows in Spring Valley during the average irrigation season.[541] This was necessary because the average post peak flow on Daggett Creek is greater, on a percentage basis,

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[535] Transcript, Vol.28 pp. 6246-:16-22, 6247:12-17, 6248:8-9 (Cooper).
[536] Transcript, Vol.28 pp. 6247:24-6248:7 (Cooper).
[537] Exhibit No. SNWA_097, Section 5.6.2, pp. 5-28 to 5-30; Transcript, Vol.3 pp. 495-504 (Stanka).
[538] Exhibit No. SNWA_097, p. 5-28; Transcript, Vol.3 pp. 496:23-497:1 (Stanka).
[539] Exhibit No. SNWA_097, p. 5-29; Transcript, Vol.3 p. 499:8-10 (Stanka).
[540] Exhibit No. SNWA_097, p. 5-28; Transcript, Vol.3 pp.497:19-498:6 (Stanka).
[541] Exhibit No. SNWA_097, p. 5-30, Eq. 5-1.

than the average post peak flow on Cleve Creek, and therefore, more groundwater would likely need to be used to supplement surface water post peak flow in Spring Valley.[542] This approach resulted in an estimate that 27.4 percent of all supplemental groundwater irrigation rights in Spring Valley would be used to supplement surface water irrigation rights during an average irrigation season.[543]

Both of these approaches are reasonable. However, Mr. Stanka used the 39.1 percent results from the Cleve Creek approach for his analysis because it results in a larger amount of groundwater estimated to be used to supplement surface water and is therefore more conservative.[544] Additionally, Cleve Creek is located within Spring Valley and is therefore more likely than Daggett Creek to be representative of surface water flows in Spring Valley. The State Engineer agrees that the higher percentage should be used. Although application of this higher figure will likely result in at least a 1,164 afa underestimation of the water available for appropriation, the State Engineer prefers to accept the more conservative figure advanced by the Applicant.

Multiplying 39.1 percent by the total 9,950.45 afa of supplemental groundwater irrigation rights means that 3,890.63 afa are expected to be used in an average year and that 6,059.82 afa are not expected to be used in an average year.[545] The State Engineer finds that the 6,059.82 afa that are not expected to be used are therefore not committed groundwater rights and are available for appropriation.

**D. <u>Consumptive Use of Groundwater Irrigation Rights</u>**

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[542] Transcript, Vol.3 pp. 499:24-500:19 (Stanka).
[543] Exhibit No. SNWA_097, p. 5-30; Transcript, Vol.3 p. 504:7-11 (Stanka).
[544] Exhibit No. SNWA_097, p. 5-30; Transcript, Vol.3 pp. 504:12-505:15 (Stanka).
[545] Exhibit No. SNWA_097, p. 5-31, Table 5-15; Transcript, Vol.3 pp. 505:20-506:11 (Stanka).

The Applicant estimated the amount of groundwater irrigation rights that are consumptively used in Spring Valley.[546] The portion of a water right that is not consumptively used is not a committed groundwater right because it returns to the basin and is available for appropriation by another user.[547] The State Engineer has established a list of net irrigation water requirements for crops in Spring Valley. The net irrigation water requirements are equal to the consumptive use requirements of the crop minus the amount of those water requirements that are supplied by precipitation.[548] Mr. Stanka divided the net irrigation water requirements by the total duty of the water rights in order to establish a consumptive use ratio for all groundwater irrigation rights in Spring Valley.[549]

Mr. Stanka then multiplied those consumptive use ratios by (i) all groundwater irrigation rights that are not supplemental to other groundwater irrigation rights in Spring Valley, and (ii) all groundwater irrigation rights expected to be used to supplement surface water irrigation rights during an average irrigation season.[550] Mr. Stanka identified a total of 13,712.653 afa of groundwater irrigation rights that were either (i) not supplemental to other groundwater irrigation rights, or (ii) expected to be used to supplement surface water irrigation rights during an average irrigation season. Mr. Stanka applied the consumptive use ratios to those groundwater irrigation rights and determined that 10,850.26 afa are consumptively used, with the remainder of 2,862.393 afa not consumptively used.[551] The State Engineer finds that the 2,862.393 afa of

[546] Exhibit No. SNWA_097, Section 5.7, pp. 5-31 to 5-33.
[547] Transcript, Vol.3 pp. 508:22-509:9 (Stanka).
[548] Exhibit No. SNWA_097, p. 5-31; Transcript, Vol.3 pp. 509:14-510:20 (Stanka).
[549] Exhibit No. SNWA_097, p. 5-31, Table 5-16; Transcript, Vol.3 pp. 510:21-511:12 (Stanka).
[550] Exhibit No. SNWA_097, p. 5-33, Table 5-19; Transcript, Vol.3 pp. 511:13-513:4 (Stanka).
[551] Exhibit No. SNWA_097, p. 5-33, Table 5-19; Transcript, Vol.3 pp. 513:5-514:18 (Stanka).

groundwater irrigation rights that will not be consumptively used are not committed groundwater rights and are available for appropriation.

**E. <u>Consumptive Use from Domestic Wells</u>**

In Nevada, the owner of a domestic well has a statutory right to pump up to 2 afa from the domestic well without having to apply for a water right permit from the State Engineer.[552] When the State Engineer is examining the amount of unappropriated water available in a groundwater basin, only the amount of groundwater consumed by domestic wells is treated as a committed groundwater right. This does not impact domestic well users because their ability to divert up to 2 afa is not restricted or changed in any manner.

Mr. Stanka estimated the amount of water that is consumptively used by domestic wells in Spring Valley by estimating the acre-foot amount of water pumped at a given well minus the acre-foot amount of water returned to the groundwater system through secondary recharge via septic systems.[553] This estimate is necessary because data does not exist regarding the actual number of domestic wells, pumping records for those wells, and measurements for recharge to the groundwater system from the septic systems.[554] It was not appropriate to assume that each domestic well actually used 2 afa because evidence showed that while domestic wells are allowed to pump up to 2 afa without a permit, domestic wells do not actually consume and depelete 2 afa from the aquifer.

To estimate the amount of water pumped from domestic wells, Mr. Stanka multiplied the estimated number of wells in Spring Valley by the estimated number of people per well by the

[552] NRS 534.180.
[553] Exhibit No. SNWA_097, Section 5.8, pp. 5-34 to 5-35.
[554] Exhibit No. SNWA_097, p. 5-34; Transcript, Vol.3 pp. 515-:4-12, 516:13-24 (Stanka).

estimated per capita water use.[555] The estimated number of wells in Spring Valley was equal to the number of wells identified in the Nevada Division of Water Resources Well-Driller Log database with a casing diameter of 5 to 9 inches, which is within the diameter range for a domestic well casing.[556] Mr. Stanka reviewed the mean number of people per household in six Nevada counties as identified by the State Demographer and then, in order to not underestimate water use, Mr. Stanka assumed that the estimated number of people per well in Spring Valley was equal to the highest mean number identified.[557] The estimated per capita water use in Spring Valley was equal to per capita water use estimates prepared by Brown and Caldwell (2005) for Carson City, Lyon County and Douglas County.[558] As a result of this analysis, Mr. Stanka estimated that 28.5 afa are being pumped from domestic wells in Spring Valley.[559]

To estimate the amount of water returned to the groundwater system through secondary recharge, Mr. Stanka divided an estimate for the secondary recharge by an estimate for the average household usage in gallons per day. The estimate for the secondary recharge came from a U.S. Geological Survey Open File Report.[560] The estimate for the average household usage in gallons per day was the result of multiplying the estimated per capita use by the estimated number of people per household and then converting that number into gallons per day.[561] By dividing the estimate for the secondary recharge by the estimate for the average household usage, Mr. Stanka estimated that 40 percent of groundwater pumped from domestic wells in Spring

[555] Exhibit No. SNWA_097, p. 5-34.
[556] Exhibit No. SNWA_097, p. 5-34; Transcript, Vol.3 p. 517:6-16 (Stanka).
[557] Exhibit No. SNWA_097, p. 5-34; Transcript, Vol.3 p. 517:17-23 (Stanka).
[558] Exhibit No. SNWA_097, p. 5-34; Exhibit No. SNWA_098; Transcript, Vol.3 pp. 517:24-518:4 (Stanka).
[559] Exhibit No. SNWA_097, p. 5-34.
[560] Exhibit No. SNWA_097, p. 5-34; Transcript, Vol.3 p. 521:3-522:4 (Stanka).
[561] Exhibit No. SNWA_097, p. 5-35, Eq. 5-2.

Valley is returned to the groundwater system through secondary recharge, and that 60 percent is consumptively used.[562]

The result of this analysis is that Mr. Stanka estimates that 17.1 afa from domestic wells (60 percent of 28.5 afa) are committed groundwater rights because while 28.5 afa may be pumped, only 17.1 afa would be consumptively used. The remaining 11.4 afa would return to the groundwater basin via secondary recharge. The State Engineer finds that the remaining 11.4 afa that is not consumptively used are not committed groundwater rights and are available for appropriation.[563]

**F. <u>Springs Rights in Discharge Area</u>**

Mr. Stanka also prepared an analysis to quantify the total amount of committed spring water rights in the discharge area of Spring Valley.[564] Additionally, the State Engineer has undertaken an independent evaluation of spring water rights as part of his inventory of all water rights in Spring Valley pursuant to NRS 533.364.[565] Mr. Stanka identified all spring water rights in the discharge area of Spring Valley and then made adjustments for supplemental and consumptive use using generally the same methodology and approach that was used to identify committed groundwater rights.[566] Based upon that analysis, Mr. Stanka estimated that there are a total of 6,069.78 afa of committed spring water rights in the discharge area of Spring Valley.[567]

Dr. Myers estimated there are "a total of 122,695 af/y of certificated, permitted, reserved and vested water rights" associated with springs in Spring Valley.[568] However, Dr. Myers did

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[562] Exhibit No. SNWA_097, p. 5-35; Transcript, Vol.3 pp. 522:22-523:6 (Stanka).
[563] Exhibit No. SNWA_097, p. 5-35; Transcript, Vol.3 p. 523:7-16 (Stanka).
[564] Exhibit No. SNWA_423; Transcript, Vol.3 pp. 532-540 (Stanka).
[565] Exhibit No. SNWA_460.
[566] Transcript, Vol.3 pp. 534:2-8, 534:25-535:10 (Stanka).
[567] Exhibit No. SNWA_423, p. 13, Table 8; Transcript, Vol.3 pp. 534:19-24 (Stanka).
[568] Exhibit No. GBWN_001, p. 41; Transcript, Vol.3 p. 533:16-17 (Stanka).

not conduct any analysis of the individual water rights and did not make any adjustments for supplemental or consumptive use. Dr. Myers clarified during his testimony that he did not intend to claim that the quantity of existing spring rights was that high and that the large number was primarily the result of counting the rights related to the spring complex held by CPB multiple times.[569] Therefore, the State Engineer finds that Dr Myers' estimates cannot be relied upon to determine the amount of committed spring water rights in Spring Valley.

**G. <u>Results and Comparison to State Engineer's Basin Inventory</u>**

In order to determine the entire amount of committed groundwater rights in Spring Valley, Mr. Stanka added (i) the non-supplemental groundwater rights with a non-irrigation manner of use, (ii) the consumptive use portion of the non-supplemental groundwater rights with an irrigation of manner of use, (iii) the supplemental groundwater rights adjusted for the percentage expected to be used during an average irrigation season, and (iv) the groundwater rights expected to be consumptively used by domestic wells. The result is that Mr. Stanka identified a total of 12,768.61 afa of committed groundwater rights in Spring Valley.[570]

The results of Mr. Stanka's analysis are similar to the results of the basin inventory prepared by the State Engineer pursuant to NRS 533.364.[571] These two analyses were prepared independently and the basin inventory was not yet available when Mr. Stanka prepared his expert report. Each of the analyses identified all groundwater rights in Spring Valley and then adjusted for supplemental use and consumptive use. As explained above, Mr. Stanka's analysis identified 12,768.61 afa of committed groundwater rights, while the State Engineer's basin inventory

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[569] Exhibit No. GBWN_001, p. 41; Transcript, Vol.17 pp. 3877:18-3878:15 (Myers); Transcript, Vol.3 pp. 535:17-536:6 (Stanka).
[570] Exhibit No. SNWA_097, p. 5-35, Table 5-22.
[571] Exhibit No. SNWA_460.

identified 14,207 afa of committed groundwater rights.[572] Therefore, the difference is only 1,439.61 afa, which was primarily due to two differences in the analyses. The first difference is that Mr. Stanka's analysis identified additional groundwater irrigation rights that are supplemental to surface water irrigation rights.[573] The second difference is that Mr. Stanka's analysis estimated that 39.1 percent of supplemental groundwater irrigation rights would be used in Spring Valley during an average irrigation season, while the State Engineer's basin inventory estimated that 50 percent would be used.[574] However, the State Engineer's inventory did not document the assumptions or analysis used to identify groundwater irrigation rights that are supplemental to surface water rights, or to arrive at the 50 percent conclusion regarding the percentage of supplemental groundwater rights expected to be used in an average irrigation season. The fact that two analyses were prepared independently but arrived at similar results provides strong evidence of the reliability of those results. As a result of the evidence and detailed explanations submitted at this hearing, the State Engineer has elected to apply the methodology utilized by Mr. Stanka to determine the amount of committed groundwater rights in Spring Valley.

The Protestants did not present any evidence quantifying the committed groundwater rights in Spring Valley. Dr. Myers commented on existing rights but conceded his numbers are not accurate and he did not adjust those amounts for supplemental and consumptive uses, and he did not estimate the amount of groundwater used from domestic wells.[575] Therefore, the State

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[572] Exhibit No. SNWA_097, p. 6-2, Table 6-1; Exhibit No. SNWA_460, Spring Valley, p. A-3, Table A1.
[573] Transcript, Vol.3 pp. 452:15-454:2, p. 530:22-531:3 (Stanka).
[574] Exhibit No. SNWA_460, Spring Valley, p. 3; Transcript, Vol.3 pp. 530:22-531:2121 (Stanka).
[575] Transcript, Vol.19 pp.4285:17-4286:8 (Myers); Transcript, Vol. 17 pp. 3858:25-3859:3 (Myers); Transcript, Vol. 17, pp.3877:18-3878:18 (Myers); Transcript, Vol.3 pp. 535:17-536:6 (Stanka).

Engineer finds that Dr. Myers' estimates cannot be relied upon to determine the amount of committed groundwater rights in Spring Valley and he rejects Dr. Myers' estimates.

The Corporation for the Presiding Bishop ("CPB") did present a report prepared by Resource Concepts Inc. ("RCI") and related testimony from Bruce Scott, P.E., an expert in "water rights research and quantification," and his employee Jeremy Drew.[576] The RCI report and testimony urged the State Engineer to use the results of the State Engineer's basin inventory as the committed groundwater rights in Spring Valley, instead of Mr. Stanka's analysis because it would be a more conservative estimate regarding the committed groundwater rights.[577] However, neither the RCI report nor Mr. Scott's testimony provided any additional evidence or analysis to support that position other than the fact that there would be more committed groundwater rights in the Spring Valley, and therefore less groundwater available for appropriation.[578] There is no evidence to support a conclusion that the estimate in the State Engineer's basin inventory is more reliable than the estimate in Mr. Stanka's analysis. The State Engineer's basin inventory was a reasonable estimate of the groundwater rights in Spring Valley. However, the State Engineer finds that Mr. Stanka's analysis provides additional evidence and supporting analysis regarding the committed groundwater rights in Spring Valley. The State Engineer finds that the methodology used by Mr. Stanka is reasoned, thorough, documented, and transparent and the State Engineer will use the results of Mr. Stanka's analysis to determine the amount of groundwater available for appropriation in the Spring Valley Basin.

### H. Application to Junior Rights

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[576] Transcript, Vol.23 p. 6149:11-18 (Qualification of Mr. Scott).
[577] Exhibit No. CPB_011, p. 9; Transcript, Vol.27 pp. 6207:9-22, 6208:5-20, 6210:19-21 (Scott)
[578] Exhibit No. CPB_011, p. 9; Transcript, Vol.27 pp. 6208:21-6209:1, 6210:23-6211:15 (Scott)

The Nevada water rights appropriation system is based on the principle of first in time, first in right. Applications to appropriate water are given priority based on the date they are filed with the State Engineer.[579] When an application is approved and a permit issued, the priority date of the permit is the date the application was filed. If water is appropriated pursuant to the permit terms, the State Engineer will issue a certificate with the same priority date as the underlying permit and application.[580] Relative to each other, a water right with a priority date earlier in time to another water right is senior to the junior right. Senior rights are afforded privileges and protections in relation to junior rights should a conflict arise between senior and junior appropriations.

Under normal circumstances, the State Engineer would act on water right applications in order of their date of filing so that senior applications would be acted on first. In that context, only senior water rights would be considered to be committed groundwater rights. For that purpose, Mr. Stanka's analysis distinguished between water rights with a priority date before and after October 17, 1989 (the priority date of the Applications).[581] However, these are special circumstances because junior groundwater irrigation rights were approved in Spring Valley after Ruling 5726 was issued. These junior groundwater irrigation rights were issued subject to existing rights, which would include the Applications. However, Ruling 5726 was vacated but these junior rights remained in existence despite the fact that the senior Applications granted under Ruling 5726 had been vacated. In order to take a conservative approach, the State Engineer will treat these junior groundwater irrigation rights as committed groundwater rights.

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[579] NRS 534.080(3) ("[T]he date of priority of all appropriations of water from an underground source . . . is the date when application is made in proper form and filed in the Office of the State Engineer").
[580] NRS 533.425; NRS 533.430.
[581] Transcript, Vol.2 pp. 426:12-427:2 (Stanka).

However, those rights will remain junior in priority to the water rights granted to the Applicant and the Applicant will be afforded all privileges and protections of a senior appropriator under the Nevada law should a conflict arise between junior and senior pumping.

Based on the evidence in the record, including but not limited to that cited above, and on the State Engineer's water right files, the State Engineer finds that there are a total of 12,768.61 afa of committed groundwater rights in Spring Valley, including water rights that are both junior and senior to the Applications.

## V. IMPACTS TO EXISTING RIGHTS

When considering new applications to appropriate water, the Nevada State Engineer must deny the applications if development of the new applications will conflict with existing water rights or with protectable interests in existing domestic wells.[582] To address this requirement, the Applicant prepared an expert report describing a three part analysis.[583] First, a qualitative analysis was performed, which assessed potential conflicts based on water right ownership, geographical location, and priority date.[584] Second, a quantitative analysis was performed with the Applicant's groundwater model, using the model to identify potential conflicts with existing water rights and sensitive environmental areas.[585] Third, a qualitative site specific analysis of each of the areas of concern identified in the model was performed to assess the potential for conflicts.[586] Additionally, the Applicant prepared a management plan for Spring Valley that included hydrologic monitoring components, management tools, and mitigation options. The Applicant requested that the State Engineer make the Hydrologic Monitoring and Mitigation

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[582] NRS 533.370(5) (2010).
[583] Exhibit No. SNWA_337, p. 1-1, 3.
[584] Transcript, Vol. 11, p. 2540:16-18 (Watrus).
[585] Transcript, Vol. 11, p. 2540:18-19 (Watrus).
[586] Transcript, Vol. 11, p. 2540:19-21 (Watrus).

Plan for Spring Valley (Hydrographic Area 184) (the "Management Plan") part of the permit terms for the Applications.[587]

**A. Spring Valley Management Program**

The Project proposed by the Applicant is of a size and scope that requires a comprehensive management plan that will control development of the Applications long after the Applications are permitted. The State Engineer has required such plans to effectively manage other large scale water development projects in Nevada, particularly for the mining industry. The management program in this case is designed to promote sustainable development of the resource while protecting existing rights. The data collected from the plan will allow the State Engineer to make real time assessments of the spread of drawdown within the basin as well as make predictions, using data collected under the monitoring plan, as to the location and magnitude of drawdown in the future under different pumping regimes. The State Engineer finds that in order to determine that the Applications will not conflict with existing rights, a regulatory regime must be in place to control Project development. For that reason, an effective management program that includes monitoring activities, management tools and mitigation options is critical to the determination that the Applications will not conflict with existing water rights or with protectable interests in existing domestic wells.

The Applicant's primary witness regarding hydrologic aspects of the Spring Valley Management Plan was Mr. James Prieur. Mr. Prieur is an expert in hydrogeology and, more specifically, hydrologic monitoring and management.[588] The record reflects that Mr. Prieur has extensive professional experience in this field. Mr. Prieur is currently a senior hydrologist for

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[587] Exhibit No. SNWA_149, p.1; Transcript, Vol.8 p. 1795:18-21 (Prieur).
[588] The State Engineer qualified Mr. Prieur as an expert in hydrogeology, which covered hydrologic monitoring and management. Transcript, Vol.8 p. 1788:22-23 (qualification of Mr. Prieur).

the Applicant.[589] Mr. Prieur developed and implemented the Applicant's hydrologic monitoring program in Spring Valley.[590] He is responsible for the monitoring program that includes hydrologic monitoring, permit compliance, and reporting, as well as the aquifer testing program in Spring Valley.[591] Mr. Prieur also manages the hydrologic monitoring, permit compliance, and reporting for the Applicant's artificial recharge and recovery program in the Las Vegas Valley.[592]

Prior to his work with SNWA, Mr. Prieur's experience included a variety of monitoring and management projects with the Safe Drinking Water Program in Illinois,[593] the Argonne National Laboratory,[594] and Superfund Projects managed by N.U.S. Corporation, a Halliburton subsidiary.[595] Mr. Prieur also gained extensive experience with carbonate aquifers. Mr. Prieur performed aquifer testing and implemented a monitoring program for a contaminated carbonate aquifer well field in Puerto Rico and in other locations.[596] Mr. Prieur also co-founded a company that specialized in hydrogeologic and hydrologic investigations, remedial investigations, aquifer restoration, water resource assessments, and sustainability assessments.[597] For this company, Mr. Prieur primarily worked in the carbonate aquifers of Florida.[598] Mr. Prieur also consulted and performed volunteer work around the world on water resource issues and environmental issues.[599] Based on his extensive experience in monitoring and management projects, and in

[589] Transcript, Vol.8 p. 1778:14-16 (Prieur).
[590] Transcript, Vol.8 p. 1781:8-10 (Prieur).
[591] Transcript, Vol.8 pp. 1779: 24-1780:2 (Prieur).
[592] Transcript, Vol.8 p. 1780:8-12 (Prieur).
[593] Transcript, Vol.8 p. 1782:13-15 (Prieur).
[594] Transcript, Vol.8 p. 1782:21-25 (Prieur).
[595] Transcript, Vol.8 p. 1783:11-19 (Prieur).
[596] Transcript, Vol.8 pp. 1783:20-1784:3 (Prieur).
[597] Transcript, Vol.8 p. 1784:10-17 (Prieur).
[598] Transcript, Vol.8 p. 1784:20-22 (Prieur).
[599] Transcript, Vol.8 p. 1785:4-8 (Prieur).

particular his work with carbonate aquifers, the State Engineer finds that Mr. Prieur has significant expertise in assessing the effectiveness of the Management Plan in Spring Valley

The record reflects that the Applicant has been collecting data related to groundwater hydrology in Spring Valley since it filed the Applications.[600] Mr. Prieur testified that systematic data collection started in 2007, with project development and the implementation of a monitoring plan for Spring Valley.[601] The monitoring plan was initially completed as a component of the Stipulation between the Applicant and the Bureau of Indian Affairs, the National Park Service, the Bureau of Land Management, and the U.S. Fish and Wildlife Service ("Federal Agencies") that resulted in the withdrawal of the Federal Agencies' protests against the Applications.[602] The monitoring plan was finalized to comply with permit terms for the Applications after the Applications were approved in Ruling 5726.

The State Engineer is not a party to the Stipulation with the Federal Agencies. While the Stipulation is binding on the Applicant and the Federal Agencies, it is not binding on the State Engineer. However, the Stipulation is important to the consideration of the Applications for a number of reasons. First, the Stipulation formed the process for the initial development of the Spring Valley Management Plan. Second, the Stipulation addresses how the Federal Agencies and the Applicant will resolve issues between themselves that are related to federal water rights and resources. Third, the Stipulation provides a forum through which critical information can be collected from hydrologic and biological experts that the State Engineer can utilize to assure development of the Applications will not conflict with existing water rights or with protectable interests in existing domestic wells.

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[600] Transcript, Vol.8 p. 1797:20-21 (Prieur).
[601] Exhibit No. SNWA_151; Transcript, Vol.8 p. 1797:20-24 (Prieur).
[602] Exhibit No. SE_041; Transcript, Vol.8 p. 1798:5-11 (Prieur).

By its terms, the Stipulation and attached exhibits, A and B, set forth the guidelines for the elements of the monitoring plan. Exhibit A established the technical framework and structure for the hydrologic elements of the monitoring, management and mitigation program.[603] Exhibit B provided the same technical structure and management elements for the biologic portion of the plan.[604] The parties agreed upon mutual goals to guide the development of these monitoring plans. The common hydrologic goals of the parties are: 1) to manage the development of groundwater by SNWA in the Spring Valley hydrographic basin without causing injury to Federal Water Rights and/or any unreasonable adverse effects to Federal Resources; 2) to adequately characterize the groundwater gradient from Spring Valley to Snake Valley via Hamlin Valley; and 3) to avoid effects on Federal Resources located within the boundaries of Great Basin National Park.[605]

The Stipulation established a Technical Review Panel ("TRP"), for the hydrologic plan, a Biological Work Group ("BWG"), for the biological plan, and an Executive Committee to oversee implementation and execution of the agreement.[606] The TRP and BWG are composed of subject matter experts who act as representatives from each of the parties to the Stipulation who review, analyze, interpret, and evaluate information collected under the plan. The technical panels will also evaluate model results and make recommendations to the Executive Committee.[607]

The technical review teams for both the hydrologic component and the biologic component work together to accomplish the goals of the Stipulation. For example, Mr. Prieur

[603] Transcript, Vol.8 p. 1799:14-22 (Prieur).
[604] Exhibit No. SE_041.
[605] Transcript, Vol.8 pp. 1803:19-1804:6 (Prieur).
[606] Transcript, Vol.8 p. 1800:8-12 (Prieur).
[607] Transcript, Vol.8 p. 1802:8-12 (Prieur).

testified that during development of the monitoring plan, the teams conducted joint field trips to identify springs that were of biologic interest and should be included in the hydrologic monitoring plan network.[608] The Applicant's representatives regularly meet with the TRP and the BWG to discuss ways to best utilize each group's data and to discuss any additional hydrologic data that may be needed under the plan.[609]

The Executive Committee reviews TRP recommendations pertaining to technical and mitigation actions. The Executive Committee also resolves disputes in the event the TRP cannot reach a consensus on monitoring requirements, research needs, technical aspects of study design, interpretation of results or appropriate actions to minimize or mitigate unreasonable adverse effects on federal resources or injury to federal water rights.[610] If the Executive Committee cannot reach a consensus, a dispute resolution procedure directs such a matter to be forwarded for resolution to the State Engineer or another qualified third party.[611]

This process was questioned by the Corporation of the Presiding Bishop ("CPB") as not requiring any type of resolution and not protecting existing rights.[612] First, CPB is not a party to the Stipulation, and the Stipulation was not intended to address non-federal water rights. The Stipulation was executed to protect federal resources, not CPB water rights.[613] Second, the State Engineer will oversee groundwater development in Spring Valley and is required by law to take action if groundwater withdrawal conflicts with CPB's existing rights.[614] The Stipulation in no way limits the State Engineer's obligations or authority to protect CPB water rights. For

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[608] Transcript, Vol.8 p. 1837:13-19 (Prieur).
[609] Transcript, Vol.8 p. 1837:20-25 (Prieur).
[610] Transcript, Vol.8 pp. 1802:19-1803:10 (Prieur).
[611] Exhibit No. SE_041, Exhibit A, p. 14, II(2).
[612] Transcript, Vol.29 pp. 6438:11-6439:14 (Hejmanowski).
[613] Exhibit No. SE_041; Transcript, Vol.11 p. 2499:21-24 (State Engineer).
[614] Transcript, Vol.11 p. 2498:22-2499:15 (State Engineer).

instance, in addition to making the Spring Valley Management Plan part of the permit terms for these Applications, the State Engineer can require additional monitoring as needed to protect CPB water rights.

The Tribes argue that the Stipulation was executed by the Federal Agencies without proper consultation with the Tribes. The Tribes also argue that the Stipulations should not have been admitted into evidence based on the Tribes' interpretation of language in the Stipulation. The State Engineer finds that the Stipulation is relevant to the consideration of the Applications for the reasons stated above. Whether proper consultation occurred with the Tribes before the Stipulation was executed is a matter between the Tribes and the Federal Agencies and does not require resolution in order to consider the Applications. Whether admission of the Stipulation at these hearings was contrary to terms of the Stipulation is an issue between the parties to that agreement, not the State Engineer, and does not require resolution in order to consider the Applications.

**1. <u>Monitoring Plan Requirements</u>**

As indicated previously a monitoring plan for the Applications was finalized to comply with permit terms for the Applications after the Applications were approved in Ruling 5726. That plan was approved by the State Engineer on February 9, 2009.[615] The Applicant submitted an updated monitoring and mitigation plan for this hearing and requested that the State Engineer include compliance with the plan as part of the permit terms.[616] The proposed monitoring and mitigation plan includes all of the elements from the previous plan, and was updated to include

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[615] Exhibit No. SNWA_153; Transcript, Vol.8 p. 1840:14-17 (Prieur).
[616] Exhibit No. SNWA_149.

survey information and construction information obtained since the plan was approved. Additionally, the plan addresses non-federal water rights.[617]

Data collection is a key component of the monitoring plan. Mr. Prieur testified that the purpose of data collection at this time is to provide a baseline characterization of the hydrologic system, including seasonal as well as climatological events, which will be used as background information to assess changes to the system once groundwater production commences.[618] The Applicant is collecting different types of data which include water level measurements in wells completed in the basin fill and carbonate aquifers, surface water discharge measurements from springs and streams, regional precipitation measurements, and water chemistry samples.[619] The plan also includes a gain loss study in the area around Big Springs Creek, Lake Creek, and Pruess Lake in Snake Valley. The gain loss study will evaluate how groundwater contributes to this surface water system in order to judge, over time, whether changes occur to the interaction between groundwater and surface water in this area after groundwater production commences in Spring Valley.

The monitoring plan includes a well monitoring network to characterize and monitor groundwater conditions. Mr. Prieur testified that the well network is designed to provide spatial distribution of monitoring across the valley in different hydrologic and geologic settings.[620] Importantly, the majority of the wells are clustered in the area of the proposed points of diversion.[621] Fourteen of these wells are equipped for continuous monitoring, which allows the

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[617] Transcript, Vol.8 pp. 1838:14–1839:9 (Prieur).
[618] Transcript, Vol.8 pp. 1840:25-1841:6 (Prieur).
[619] Transcript, Vol.8 p. 1841:9-14 (Prieur).
[620] Transcript, Vol.8 p. 1843:17-19 (Prieur).
[621] Exhibit No. SNWA_147, p. 2-5.

Applicant to assess hourly water level variations in these wells.[622] In addition, once production starts, water elevations in the proposed production wells will be continuously monitored.[623]

Information on water level variation assists in assessing the horizontal and vertical hydraulic gradients (i.e. direction of groundwater flow) in the basin.[624] The information may also assist in evaluating confining units in the aquifer which will have an influence on the propagation of effects from water withdrawals.[625] The goal of the monitoring network is to provide a three-dimensional understanding of the groundwater flow in the basin.[626] Mr. Prieur testified that the Applicant spent well over $10,000,000 to develop the monitoring and test well network and to characterize the area hydrogeology.[627]

In addition to the monitoring well network, the plan also calls for a test well network. Test wells will provide geologic data and hydrologic aquifer property data.[628] Similar to the monitoring wells, these wells collect water level elevation information that is plotted on a hydrograph.[629] Mr. Prieur testified that historical hydrographs can show seasonal recharge impulses at the well site, which can be used to develop different pumping regimes to meet peak water demand.[630] This information can also be used to help manage groundwater production, such as how much water is pumped, when it is pumped, and where it is pumped.[631]

The monitoring network also includes surface water monitoring sites. These monitoring efforts covers sites throughout the valley, but are mainly concentrated around the Applicant's

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[622] Exhibit No. SNWA_147, pp. 2-5, and 2-6; Transcript, Vol.8 pp. 1846:17-19 (Prieur).
[623] Exhibit No. SNWA_147, p. 2-7.
[624] Transcript, Vol.9 p. 2029:19-22 (Prieur).
[625] Transcript, Vol.9 p. 2030:2-6 (Prieur).
[626] Transcript, Vol.9 p. 2029:19-22 (Prieur).
[627] Transcript, Vol.8 pp. 1845:24-1846:5 (Prieur).
[628] Transcript, Vol.9 p. 2072:3-7 (Prieur).
[629] Transcript, Vol.9 p. 2073:13-17 (Prieur).
[630] Transcript, Vol.9 pp. 2073:15-2074:9 (Prieur).
[631] Transcript, Vol.9 p. 2075:16-(20 (Prieur).

proposed points of diversion.[632] The spring monitoring sites were selected in consensus with the TRP, BWG, and the State Engineer's office.[633] The criteria used to select the springs included the spatial distribution, the biologic importance, the hydrogeologic setting, and the areas of concern.[634]

Thirteen of the sites, including one site on Cleveland Ranch, have piezometers, or small wells, installed near the spring for the purpose of comparing water level measurements with spring discharge and evaluating the spring response under varying climatic conditions.[635] This information is compared against other spring monitoring sites and data near pumping areas to determine if they are hydrologically connected and to what degree they are connected.[636] Ultimately, impacts to springs on the range front or valley floor are dependent on three criteria: 1) whether there is a saturated material in the aquifer between the area that is being pumped and the spring; 2) whether there is a high enough hydraulic conductivity to propagate effects through the geologic material, and 3) whether the spring is within the area of influence of pumping.[637] In other words, impacts to springs are not determined solely by whether there is a water table decline or drawdown.

As required by the State Engineer, the monitoring plan already includes additional monitoring to protect existing non-federal water rights.[638] As part of the development of the approved monitoring plan, the State Engineer required the Applicant to monitor in the area of Cleveland Ranch. The State Engineer required two monitoring wells, one shallow and one deep,

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[632] Exhibit No. SNWA_147, p. 2-8.
[633] Transcript, Vol.8 p. 1864:13-15 (Prieur).
[634] Transcript, Vol.9 p. 2059:13-17 (Prieur).
[635] Transcript, Vol.8 pp. 1866:23-1867:6 (Prieur).
[636] Transcript, Vol.8 p. 1867:7-12 (Prieur).
[637] Transcript, Vol.9 p. 2060:1-16 (Prieur).
[638] Transcript, Vol.8 p. 1839:10-12 (Prieur).

at two different sites. The State Engineer also required two flumes to measure spring discharge and a shallow piezometer.[639] The State Engineer also required regular spring discharge monitoring at Turnley Springs, which is a privately owned water source.[640] In addition, once the final pumping configuration is determined for the Applications, the State Engineer required installation of one additional monitoring well on the east side of the valley one mile north of the northernmost production well.[641] Also, throughout the development of the water rights, the State Engineer has the option and authority to add additional permit terms including but not limited to additional monitoring.

The monitoring plan includes other hydrologic elements that provide a comprehensive view of the hydrologic system. For example, there is a requirement in the plan to establish a precipitation measurement network. There is also a requirement to collect three rounds of water chemistry data from 40 sites at six month intervals, prior to groundwater production and every five years thereafter.[642] These additional data collection efforts will provide a well-rounded view of the hydrologic system.

The data collection process is subject to quality assessment and quality control procedures. The Applicant implemented a quality control process for collection of field data. The Applicant has standard procedures for site monitoring; instrumentation preparation, calibration and maintenance; and data recording and collection.[643] The Applicant also has standard procedures for database entry and management. The collected data is brought to the

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[639] Transcript, Vol.8 p. 1838:14-24 (Prieur).
[640] Transcript, Vol.8 p. 1839:4-9 (Prieur).
[641] Transcript, Vol.8 pp. 1838:25-1839:3 (Prieur).
[642] Transcript, Vol.9 p. 2062:7-23 (Prieur).
[643] Transcript, Vol.9 pp. 2066:6-2067:11 (Prieur).

office and entered into the database.[644] Once it is entered into the database it is checked at two levels by other professionals and reviewed to make sure the quality processes were completed properly.[645] The hourly continuous data is processed using Aquarius software and then it is placed into the database.[646] Any erroneous data must go through an audit process in order for it to be removed from the database.[647]

A report is submitted to the State Engineer on a yearly basis that updates the status of each element of the monitoring program and documents daily averages of continuous water level readings, current and historical hydrographs, spring and stream discharge records, any water chemistry analysis, and a summary of precipitation data provided by other agencies.[648] These reports have been submitted to the State Engineer for 2008, 2009, 2010, and 2011 and are available to the public.[649] Electronic data is also provided to the State Engineer on a quarterly basis.

Dr. Bredehoeft, a witness for Great Basin Water Network, provided general opinions that monitoring will not be effective. Dr. Bredehoeft implied in his written report that monitoring may not effectively detect pumping signals at long distances or if detected, it may be too late to effectively react to it. However, during his testimony he admitted that the system can indeed be monitored effectively in Spring Valley.[650]

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[644] Transcript, Vol.9 p. 2067:11-15 (Prieur).
[645] Transcript, Vol.9 pp. 2067:19-2068:2 (Prieur).
[646] Transcript, Vol.9 p. 2068:8-11 (Prieur).
[647] Transcript, Vol.9 p. 2068:20-22 (Prieur).
[648] Transcript, Vol.9 pp. 2068:25-2069:17 (Prieur).
[649] Exhibit Nos. SNWA_154 through SNWA_157; Transcript, Vol.9 pp. 2068:25-2069:2 (Prieur).
[650] Transcript, Vol.24 pp. 5400:17-5401:7, 5409:8–5409:12, 5455:20-24, 5495:16-5496:6 (Bredehoeft).

Dr. Bredehoeft provided a simple hypothetical model of a groundwater system to support his conclusions.[651] Dr. Bredehoeft testified that, based on his hypothetical example, impacts due to pumping may not be detected for up to 75 years.[652] Though this hypothetical model illustrates some general principles, it carries little weight when considering the specific effects of the proposed pumping. Dr. Bredehoeft testified that his hypothetical model differs from the conditions found in Spring Valley, and that these differences would affect the results in some instances.[653] Mr. Prieur testified that Dr. Bredehoeft's example does not reflect the reality of Spring Valley because Spring Valley has more dispersed recharge, more dispersed springs, more dispersed wells, and an extensive network of monitoring wells.[654]

Dr. Bredehoeft's example also does not reflect the variation in hydrogeologic conditions in Spring Valley. It does not replicate the proposed pumping regime. Specifically, it allows pumping to continue without any management decisions or maintenance periods and has pumping occur directly in between the sole recharge area and the sole discharge area represented in the system. Local hydrogeologic conditions affect the pumping response.[655] Because local hydrogeologic conditions are not reflected in Dr. Bredehoeft's example, it does not demonstrate the response that can be expected in Spring Valley due to the proposed pumping. Furthermore, the State Engineer has available detailed models designed to represent the Project basins and surrounding basins and the proposed pumping plan. Therefore, the State Engineer finds Dr. Bredehoeft's hypothetical examples are of little value.

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[651] Exhibit No. GBWN_109, p. 9; *see, e.g.*, GBWN_011.
[652] Transcript, Vol.24 pp. 5400:17–5401:7 (Bredehoeft).
[653] Transcript, Vol.24 pp. 5450:1–5455:5 (Bredehoeft).
[654] Transcript, Vol.11 pp. 2367:15–2368:24 (Prieur).
[655] *See* Exhibit No. GBWN_009, p. 3; Exhibit No. GBWN_013, p. 342; Exhibit No. SNWA_428, p. 4; Transcript, Vol.24 pp. 5370:23-5371:5 (Bredehoeft).

In addition, Dr. Bredehoeft's example only uses either monitoring at the spring itself or one monitoring point two miles from the spring and 48 miles from the pump site.[656] With a network of monitoring wells, deviations among different wells at different locations can be compared to determine the likely source of the effect.[657] Even with Dr. Bredehoeft's example of a single monitoring point nearly 50 miles from the pumping source and very close to the spring of interest, early detection of drawdown at the monitoring well allows the water manager to halt pumping and prevent significant impacts to the spring.[658] Dr. Bredehoeft testified that if one placed a monitoring well between the pumping site and the area of interest, one could see the propagation of the drawdown cone prior to it reaching the area of interest.[659] One could then determine the level of impact at the monitoring site that would lead to a certain impact at the site of interest and cease or reduce pumping once that impact is seen at the monitoring well to prevent the impact from reaching the site of interest.[660] More monitoring wells closer to the pumping would allow for even earlier detection.[661]

Though monitoring may be more difficult the further away the monitoring point is from the pumping site, the propagation of drawdown is greatest near the well. The rate of drawdown decreases logarithmically with time and with distance from the well.[662] Therefore, monitoring is more effective where drawdowns are expected to be greatest. Monitoring can adequately detect the largest impacts closer in time to the start of pumping and closer in distance to the wells and

[656] Exhibit No. GBWN_011.
[657] Exhibit No. SNWA_428, pp. 17–18.
[658] Exhibit No. SNWA_428, p. 19; Transcript, Vol.11 pp. 2372:6–2375:20 (Prieur).
[659] Transcript, Vol.24 p. 5458:2–8 (Bredehoeft).
[660] Transcript, Vol.24 pp. 5479:19–5480:15 (Bredehoeft).
[661] Transcript, Vol.11 pp. 2375:21–2376:9 (Prieur).
[662] Exhibit No. SNWA_428, p. 7; Transcript, Vol.11 pp. 2378:18–2379:13 (Prieur).

then management decisions can be made to mitigate impacts as necessary. Therefore, monitoring, even at distance, will be effective.[663]

Dr. Bredehoeft highlights some difficulties in monitoring, but these difficulties can be overcome. The State Engineer finds that the Applicant's monitor well network is scientifically sound, particularly because of the spatial distribution across Spring Valley and dense distribution of monitoring wells near the points of diversion. Information from these wells will provide the State Engineer with knowledge of the characteristics of groundwater flow in this area for the purpose of diagnosing and addressing potential impacts to existing rights. The State Engineer finds that the Applicant's spring and stream monitoring sites are well distributed throughout Spring Valley. In addition, the Applicant has provided significant hydrologic data regarding Spring Valley for four years. Finally, the State Engineer finds that the Applicant has provided persuasive scientific evidence that the monitoring efforts and data collection in Spring Valley will provide scientifically sound baseline information from which changes to the system and potential impacts can be diagnosed, assessed, and addressed. In summary, the State Engineer finds that the Applicant's monitoring plan will be effective.

In addition to the general monitoring program discussed above, the Management Plan has specific requirements at the following locations.

**a. Cleveland Ranch Monitoring Activities**

After consultation with CPB and the State Engineer, the Applicant installed monitoring equipment which is designed to protect CPB's existing water rights in the vicinity of Cleveland Ranch. The Applicant located the monitoring points with assistance from the State Engineer and

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[663] Exhibit No. SNWA_428, p. 18.

CPB representatives.[664] As mentioned above, the State Engineer required two monitoring well site locations. Wells SPR7030M and M2 were located at the toe of the Cleve Creek alluvial fan approximately 100 feet from the nearest spring.[665] These wells were completed as one deep well and one shallow well for the purpose of evaluating the vertical hydraulic gradient at this location.[666] The water elevations in these wells will be compared with spring discharge records to define the relationship between water elevation variability and spring discharge variability for springs at the toe of the Cleve Creek alluvial fan.[667]

The Applicant completed a geologic data analysis report for these wells.[668] The geology of a well site is important in analyzing how impacts from pumping will propagate in that area. This report documented onsite lithologic observations, (i.e. visual observations of geologic features), and drilling parameters, which document how the drill bit moves through the soil to assess how hard or soft the rock is.[669] The Applicant prepares reports such as these for all of the monitoring wells drilled by the Applicant in Spring Valley.[670]

Mr. Prieur testified that the geologic stratigraphic column for the deeper of the two wells, SPR7030M2, shows interbedded sands and clays at this site.[671] In this well, there are clay layers, from 40 to 60 feet and 160 to 190 feet, which are considered potentially impermeable layers. The well has flowing artesian conditions, which indicates an upward vertical gradient that may

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[664] Transcript, Vol.8 p. 1849:2-4 (Prieur).
[665] Exhibit No. SNWA_149, p. 32; Transcript, Vol.8 p. 1851:10-12 (Prieur).
[666] Transcript, Vol.8 p. 1851:15-22 (Prieur).
[667] Transcript, Vol.8 pp. 1851:23-1852:3 (Prieur).
[668] Exhibit No. SNWA_179; Transcript, Vol.8 p. 1852:4-7 (Prieur).
[669] Exhibit No. SNWA_179, pp. 1, 7, 16.
[670] Transcript, Vol.8 p. 1853:15-17 ((Prieur).
[671] Transcript, Vol.8 p. 1855:4-5 (Prieur).

be the result of the confining clay units.[672] These confining clay units are important because they may act to shield the springs from pumping impacts.

These monitoring wells are located approximately a mile to a mile and a half from the Applicant's nearest proposed point of diversion.[673] Based on the stratigraphy of the well, and specifically the location of the confining units, Mr. Prieur concluded that it may be possible for the Applicant to pump from one confined unit and not impact another confined unit depending on the lateral extent of the clay layers, the leakage between the clay layers, and the pumping rate and duration.[674] Mr. Prieur further concluded that pumping stresses must be placed on the system for an extended period of time to determine with any certainty the potential impacts on groundwater and surface water sources in that area.[675] The State Engineer finds that continued monitoring at this location in conjunction with limited initial development in a staged development program will provide the data required to assure the Applications can be developed without conflicting with CPB's existing rights.

The second set of wells, SPR7029M and M2, are located approximately a mile and half to two miles to the west of SPR7030M and M2.[676] The location of these monitoring wells is coincident with the point of diversion for Application 54017.[677] The Applicant completed a hydrologic aquifer test at this location.[678]

Mr. Prieur explained the tremendous amount of work that must be completed for just one of these tests. Prior to the aquifer test, the Applicant must assess background conditions and

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[672] Transcript, Vol.8 p. 1855:5-15 (Prieur).
[673] Transcript, Vol.8 p. 1856:4-6 (Prieur).
[674] Transcript, Vol.8 pp. 1855:22-1856:3 (Prieur).
[675] Transcript, Vol.8 p. 1856:17-23 (Prieur).
[676] Exhibit No. SNWA_149, p. 32; Transcript, Vol.8 p. 1857:17-19 (Prieur).
[677] Transcript, Vol.8 p. 1858:8-10 (Prieur).
[678] Transcript, Vol.8 p. 1858:11-12 (Prieur).

make sure the well is completely developed, meaning that the conditions in the well are stable.[679] Once these preliminary tasks are completed, the Applicant performs a step drawdown test, which pumps the well at different pumping rates for one to two hour intervals.[680] This step drawdown test yields well loss coefficients and well efficiency coefficients.[681] These coefficients are used to determine the rate water may be pumped during the constant rate pumping test without receiving a prohibitive amount of well loss and well interference, which will distort the test results.[682] For this aquifer test, the Applicant selected a constant rate of 500 gallons per minute ("gpm").[683] Following the step drawdown test, the well was allowed to recover to its static state.[684] The Applicant then pumped at a constant rate of 500 gpm for 120 hours to document drawdown in the test well and the monitoring well for the purpose of assessing aquifer properties, such as transmissivity and storage coefficients.[685] Following the test, well recovery measurements were performed and regional monitoring continues.[686]

The results of the test are documented in a hydrologic analysis report. These reports are prepared for each aquifer test. Drawdown data is generally reported on a log or semi-log plot, which shows the change in water level over time.[687] For this test, the drawdown in the monitoring well showed minimal or non-existent drawdown after five days of pumping stress at 500 gpm.[688] Given the relative lack of drawdown, Mr. Prieur concluded that it would be useful to pump the location at a higher rate and duration to observe the response in the aquifer for the

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[679] Transcript, Vol.8 pp. 1858:14-1859:2 (Prieur).
[680] Transcript, Vol.8 p. 1859:6-8 (Prieur).
[681] Transcript, Vol.8 p. 1859:6-9 (Prieur).
[682] Transcript, Vol.8 p. 1859:19-21 (Prieur).
[683] Transcript, Vol.8 p. 1859:19-21 (Prieur).
[684] Transcript, Vol.8 p. 1859:12-13 (Prieur).
[685] Transcript, Vol.8 p. 1859:13-15 (Prieur).
[686] Transcript, Vol.8 pp. 1859:22-1860:4 (Prieur).
[687] Transcript, Vol.8 p. 1860:12-15 (Prieur).
[688] Transcript, Vol.8 p. 1861:7-9 (Prieur).

purpose of assessing whether the alluvial aquifer may be pumped without significantly reducing the hydraulic head, which supports spring discharge at the toe of the fan.[689] He further concluded that the role of monitoring is critical in determining the influence pumping the aquifer has at different pumping rates and durations.[690] The State Engineer finds that this additional monitoring is appropriate and should be conducted concurrently with staged pumping development at the points of diversion located near Cleveland Ranch.

The monitoring plan also included spring and stream monitoring in and around Cleveland Ranch. Mr. Prieur testified that spring monitoring efforts in the vicinity of Cleveland Ranch include the west Spring Valley complex, south Millick Spring, Unnamed Spring, Unnamed # Five Spring, and Four-Wheel Drive Spring, which are part of the spring monitoring network described above.[691] In addition, the plan required maintenance of a continuous gauging station at Cleve Creek.[692] The purpose of continuous monitoring at Cleve Creek is to establish variations in stream discharge over time with varying precipitation.[693]

The spring and stream monitoring efforts associated with Cleveland Ranch cost the Applicant approximately $200,000. Mr. Prieur found that the monitoring around Cleveland Ranch will allow for a determination as to how development of the Applications near Cleveland Ranch will impact that area.[694] The State Engineer finds that the monitoring and aquifer testing performed by the Applicant provide assurances that pumping less than 500 gpm at the points of diversion near Cleveland Ranch will not conflict with existing rights. The State Engineer also

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[689] Transcript, Vol.8 p. 1863:9-12 (Prieur).
[690] Transcript, Vol.8 p. 1864:1-3 (Prieur).
[691] Transcript, Vol.8 p. 1867:20-24 (Prieur).
[692] Transcript, Vol.8 p. 1868:2-5 (Prieur).
[693] Transcript, Vol.8 p. 1868:15-25 (Prieur).
[694] Transcript, Vol.8 pp. 1869:21-1870:1 (Prieur).

finds that the current monitoring program in the Cleveland Ranch area will allow the State Engineer to assess any impacts from water development at the proposed points of diversion around the Cleveland Ranch. Continuing monitoring and data gathering in this area will be required in order to determine if an additional quantity of water can be developed in this area without causing a conflict with existing rights.

**b. <u>Turnley Spring</u>**

In addition to the Cleveland Ranch area, the State Engineer previously required additional monitoring in the Turnley Spring area which is the primary source of water for property owned by Katherine and William Rountree.[695] Turnley Spring is located in the mountain block on Sacramento Pass.[696] The purpose of monitoring at this location is to protect the Rountree's domestic water right and to provide another spring discharge monitoring point in the mountain block to assess baseline conditions and long term variations in discharge.[697] The Applicant has collected spring discharge data at Turnley Spring since 2008.[698] The State Engineer finds that the Applicant is in compliance with this monitoring requirement and that continued monitoring will allow that State Engineer to continue to assure that development of the Applications will not conflict with these existing rights.

**c. <u>Shoshone Ponds</u>**

The Monitoring Plan requires monitoring wells in the area of Shoshone Ponds, which is an area of critical environmental concern.[699] Shoshone Ponds exists due to free flowing artesian wells that were drilled between 1935 and 1971. These wells form a free flowing well field that is

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[695] Transcript, Vol.9 p. 2032:5-17 (Prieur).
[696] Exhibit No. SNWA_149, p. 31; Transcript, Vol.9 p. 2032:9-10 (2011Prieur).
[697] Transcript, Vol.9 pp. 2032:18-2033:2 (Prieur).
[698] Exhibit No. SNWA_147, p. 2-7.
[699] Exhibit No. SNWA_147, pp. 2-4, 2-5; Transcript, Vol.9 p. 2036:23-25 (Prieur).

the source of water for the Ponds.[700] A monitoring location in the Ponds area was selected in consensus with the TRP and the State Engineer's Office.[701] It is located approximately one mile to the southeast of the Shoshone Ponds area.[702] The area near Shoshone Ponds is also a BLM Area of Critical Environmental Concern, which prevented the Applicant from selecting a site closer to the Ponds.[703] The monitoring point is positioned between Shoshone Ponds and the point of diversion for Application 54019. The monitoring location was selected to provide early warning of drawdown at the Ponds from pumping at Application 54019.[704]

Mr. Prieur testified that this monitoring location provides effective monitoring for Shoshone Ponds because the alluvial environment in the area indicates a more direct flow path between the point of diversion and Shoshone Ponds.[705] Dr. Myers, however, suggested that there may be an alternative flow path along the mountain front.[706] In response to this concern, Mr. Prieur testified that the monitoring wells were placed to the east of Shoshone Ponds to monitor any alternative flow along the mountain front and then to the west.[707] Two wells were completed at this site, a shallow well, SPR7024M, and a deep well, SPR7042M2, for the purpose of assessing the vertical hydraulic gradient.[708] Baseline conditions for Shoshone Ponds have not been obtained due to the unregulated flow of the artesian wells and the lack of quality data, among other reasons.[709] Mr. Prieur testified that the geologic conditions in this area are similar to Cleveland Ranch, where there is interbedded sands and clays near Shoshone Ponds and

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[700] Transcript, Vol.9 p. 2034:10-13 (Prieur).
[701] Transcript, Vol.9 p. 2040:18-20 (Prieur).
[702] Transcript, Vol.9 p. 2035:2-3 (Prieur).
[703] Transcript, Vol.9 pp. 2036:23-2037:3 (Prieur).
[704] Transcript, Vol.9 p. 2035:13-19 (Prieur).
[705] Transcript, Vol.9 p. 2037:5-7 (Prieur).
[706] Transcript, Vol.9 p. 2040:7-9 (Prieur).
[707] Transcript, Vol.9 p. 2037:7-10 (Prieur).
[708] Transcript, Vol.9 p. 2035:5-10 (Prieur).
[709] Transcript, Vol.9 p. 2039:1-25 (Prieur).

coarser sand and gravel material up the alluvial fan to the east where the monitoring wells are located.[710] Ultimately, Mr. Prieur concluded that the location of the monitoring wells will provide for effective monitoring of any spread of drawdown toward Shoshone Ponds.[711] The State Engineer agrees and finds that the positioning of the monitoring wells in proximity to Shoshone Ponds and the point of diversion for Application 54019 is appropriate and will provide the data necessary to assure development of the Applications will not conflict with existing water rights at Shoshone Ponds.

**d. <u>Interbasin Monitoring Zone</u>**

The Management Plan includes monitoring of the hydraulic gradient from Spring Valley to Hamlin and Snake Valleys in an area referred to as the "Interbasin Monitoring Zone."[712] This area is important to understanding how impacts from development of the Applications may propagate out of Spring Valley and into Hamlin and Snake Valleys in this "Zone." The Monitoring Plan includes six monitoring wells in the "Zone." One well has already been completed in the carbonate aquifer. Three additional wells will be completed in carbonate rock and two will be completed in basin fill material.[713] In addition, four additional basin-fill wells in the Zone were selected as part of the monitoring well network.[714]

Part of the hydraulic gradient analysis requires a geologic investigation. The Applicant has already drilled one monitor and one test well in the Interbasin Monitoring Zone, and has collected geologic data as part of those test well projects. The hydrologic report for test well 184W101 provides a summary of the geologic data collected during the well drilling process for

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[710] Transcript, Vol.9 p. 2036:2-12 (Prieur).
[711] Transcript, Vol.9 p. 2041:7-12 (Prieur).
[712] Exhibit No. SNWA_149, p. 15; Transcript, Vol.9 pp. 2041:24-2042:8 (Prieur).
[713] Transcript, Vol.9 p. 2042:21-23 (Prieur).
[714] Transcript, Vol.9 p. 2042:23-25 (Prieur).

test wells in the Zone.[715] The hydrologic report documents the borehole stratigraphic column for this well, which is based on on-site observations by geologists, downhole geophysics, and drilling parameter observations.[716] Downhole geophysics uses instrumentation to provide a more accurate description of the rock formations penetrated during well drilling than a normal driller's log, which is based on visual observations by the well driller or an on-site geologist.[717] The formation and fluid information obtained from the downhole geophysics test is compared against on-site observations and drilling parameters to develop the stratigraphic column for the well.[718] Drilling parameters document the depth of any change in the penetration rate of the drill bit signaling a change in material.[719] Drilling parameters also document the depth of water for the purpose of assessing potential production zones.[720]

The Applicant also performed a surface geophysical profile as part of the geologic analysis to determine the resistivity of the rock around the well for the purpose of assessing the geology of the area.[721] By combining this information with hydraulic testing, Mr. Prieur testified that the Applicant was able to gain a deep understanding of the hydrogeologic conditions at the site. The cost to develop the new Zone monitor wells will be approximately $1.3 to $1.4 million.[722]

There are two "near zone monitoring wells" included in the Management Plan.[723] These wells will be sited between the nearest carbonate production well and the nearest basin fill

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[715] Transcript, Vol.9 p. 2044:8-10 (Prieur).
[716] Transcript, Vol.9 p. 2044:13-16 (Prieur).
[717] Transcript, Vol.9 pp. 2044:17-2047:3; 2049:13-20 (Prieur).
[718] Transcript, Vol.9 p. 2047:4-6 (Prieur).
[719] Transcript, Vol.9 p. 2047:8-16 (Prieur).
[720] Transcript, Vol.9 p. 2048:14-18 (Prieur).
[721] Transcript, Vol.9 p. 2050:6-2051:1 (Prieur).
[722] Transcript, Vol.9 p. 2051:4-6 (Prieur).
[723] Exhibit No. SNWA_149, p. 17; Transcript, Vol.9 p. 2052:6-8 (Prieur).

production well to the Zone. The wells will provide two more monitoring points in addition to the 14 other monitoring points located in the area where the Applicant identified the preferential flow paths between Spring, Hamlin, and Snake valleys.[724]

In addition to the Applicant's wells, the USGS drilled two additional wells in the vicinity of Big Springs as part of a new Southern Nevada Public Lands Management Act study. The study's purpose is to assess various aspects of the hydrology in the area of the Great Basin National Park and Snake Valley.[725] These wells have provided new information about the potential interbasin flow in this area. The preliminary findings of that study suggest that the Basin and Range Carbonate Aquifer System Study ("BARCASS") overestimated the potential interbasin flow in the Limestone Hills area between Spring Valley and Hamlin Valley and that the preferential flow path is similar to the flow path identified by the Applicant.[726]

Millard County witness, Dr. Hurlow, recommended additional monitoring to account for potential impacts to the groundwater and surface water system in the Utah portion of Snake Valley.[727] Dr. Hurlow is a geologist for the Utah Geological Survey ("UGS"). In addition to the Zone monitoring that is included in the Management Plan, Dr. Hurlow recommended that the State Engineer add UGS monitoring sites 15, 23, 2, and 28 to the plan.[728] Dr. Hurlow testified that information from these wells is currently collected by UGS and he recommended the data reports that are submitted by the Applicant annually pursuant to the Management Plan include that information. The State Engineer finds that if UGS provides the data to the Applicant, the

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[724] Transcript, Vol.9 p. 2052:25-2053:9 (Prieur).
[725] Transcript, Vol.9 p. 2053: 12-20 (Prieur).
[726] Transcript, Vol.9 p. 2056:16-21 (Prieur).
[727] Exhibit No. MILL_011, pp. 8-9.
[728] Exhibit No. MILL_011, pp. 9, 13.

Applicant should include the UGS data in the Applicant's annual data reports required under the Management Plan.

The State Engineer finds that the Management Plan is comprehensive and will protect federal and non-federal existing water rights in Snake Valley, because it includes approximately 16 monitoring sites and a test well solely dedicated to monitoring changes to the hydraulic gradient and interbasin flow from Spring to Snake Valley. Any impacts to existing rights in Snake Valley would necessarily be detected by the monitoring sites that are located in the flow path between the valleys. The State Engineer finds that the additional monitoring data suggested by Dr. Hurlow, if provided by UGS, will further assist the State Engineer in managing groundwater development in Spring Valley.

**e. <u>Big Springs</u>**

The Management Plan requires a synoptic discharge study, or a gain loss study, for the Big Springs System in Snake Valley every five years during the irrigation and non-irrigation season to assess impacts to Big Springs from development of the Applications in Spring Valley.[729] However, Mr. Prieur testified that recent information collected by the Applicant and Dr. Prudic, with the USGS, suggested that the primary source for Big Springs is local recharge in southern Snake Valley.[730] Given the monitoring that is occurring in the Zone and around Big Springs, the State Engineer finds that the Management Plan and USGS study will further define the primary and secondary sources of water to Big Springs and the potential for impacts from pumping of the Applications in southern Spring Valley.

**f. <u>Tribal Resources</u>**

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[729] Exhibit No. SNWA_147.
[730] Transcript, Vol.9 p. 2058:12-19 (Prieur).

The Management Plan also includes monitoring designed to protect the water resources of the Confederated Tribes of the Goshute Reservation ("CTGR"), which is located in basins north of Spring Valley. There is a significant distance between the Applications' points of diversion in Spring Valley and the CTGR resources located in Deep Creek Valley. There are also monitoring points in northern Spring Valley that were specifically requested by the Bureau of Indian Affairs between the Application points of diversion in that portion of Spring Valley and the CTGR's reservation in Deep Creek Valley.[731] The State Engineer finds that the monitoring points in northern Spring Valley will detect any spread of drawdown in the direction of the CTGR reservation. The State Engineer further finds that the significant distance between the Application points of diversion and the CTGR reservation will provide adequate lead time to prevent any potential conflicts with CTGR water rights on the reservation.

**2. <u>Management Plan Requirements</u>**

The Management Plan requires the data collection efforts from the monitoring plan to be coordinated with the development and refinement of a groundwater model for the purpose of managing the water resource in Spring Valley.[732] The State Engineer will use the groundwater model to assess where additional data is needed, to identify potential areas of impact, to review the appropriate location of new wells, and to optimize pumping at current well sites without causing impacts.[733] Mr. Prieur testified that stressing the aquifer with large scale pumping will increase the model's predictive capability because longer term pumping stresses provide aquifer response parameter data. With this information, the groundwater model will be used as a management tool.

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[731] Transcript, Vol.11 p. 2479:11-14 (Prieur).
[732] Transcript, Vol.9 p. 2063:23-25 (Prieur).
[733] Transcript, Vol.9 p. 2064:1-9 (Prieur).

The State Engineer acknowledges that it received two models into evidence at the hearing. Though the models are poor tools to make local predictions at present, they can be improved. The Applicant's model will be improved in the future as more data is collected.[734] Once the Applicant begins to pump, the model can be calibrated with a stress of the appropriate magnitude to develop a much more certain representation of hydrogeologic parameters.[735] Dr. Myers admitted that once data from large-scale stresses are available, the Applicant's model could be calibrated to allow experts to make local scale predictions on impacts from pumping.[736] Dr. Bredehoeft also stated that models can be improved through an iterative process of monitoring.[737] As the model continues to improve, it will be used as a management tool by the Applicant to monitor and manage its pumping in order to prevent impacts to existing rights and environmentally sensitive areas.

The State Engineer finds that the Applicant will be required to improve and use its model as a management tool, which will prevent many of the impacts currently predicted by the models in this hearing. For the reasons stated below, the State Engineer will use the Applicant's model for monitoring and management purposes in the development of the Applications. The State Engineer further finds that stressing the aquifer will improve the predictive capabilities of the model. The State Engineer requires that the model be updated and run every five years to incorporate collected data and run predictive drawdown simulations for the purpose of assessing any emerging potential conflicts with existing rights.

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[734] Exhibit No. SNWA_087, pp. 1, 20.
[735] Exhibit No. SNWA_428, p. 10; Transcript, Vol.20 pp. 4473:22–4474:15 (Myers).
[736] Transcript, Vol.21 pp. 4598:13–4599:10 (Myers).
[737] Exhibit No. GBWN_009, p. 7.

Protestants GBWN and CPB assert that the absence of quantitative standards, or triggers, in the Applicant's Management Plan will limit its effectiveness. However, GBWN's expert witness, Dr. Robert Harrington, acknowledged that the Applicant has neither the ability nor the need to set quantitative standards at the present time and at this stage in the development process.[738] Dr. Harrington, a Protestant witness, is the Director of the Inyo County Water Department and has experience with implementation of monitoring and management plans for the Owens Valley project.[739] In order to set quantitative standards, well locations and other variables, such as pumping timing and duration, must be known. Stress placed on the system through pumping also helps determine these standards because it shows how the aquifer responds to pumping. Additionally, the natural variability in the system must be documented to ensure that any observed changes are due to pumping, rather than natural fluctuations due to seasonal recharge or other factors. The high volume of pumping activity prior to adoption of the monitoring and management plan allowed quantitative standards to be set in monitoring plans for the Owens Valley project.[740] The same situation is not present in Spring Valley. Because well locations and pumping amounts have not been determined, and no large-scale pumping has occurred in Spring Valley, it would be premature to complete a pumping management program.[741] Therefore, it is not currently possible to set quantitative standards or triggers for mitigation actions.

Further, because the Applicant's proposed pumping will not begin for many years, there is ample time for studies to be conducted to determine a baseline as well as quantitative

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[738] Transcript, Vol.23 pp. 5291:21-5292:15 (Harrington).
[739] Transcript, Vol.23 p. 5278:3-5 (Harrington).
[740] Transcript, Vol.23 p. 5294:15-21 (Harrington).
[741] Transcript, Vol.23 p. 5307:17-24 (Harrington).

thresholds.[742] Dr. Harrington agreed that the collection of baseline data prior to groundwater withdrawal makes the Project far better positioned than the Owens Valley project to ensure water development occurs in a sustainable manner.[743] The proper time to address pumping management concerns, including quantitative standards or triggers for mitigation, is when pumping determinations are made for each well.[744] Dr. Harrington stated that inclusion of quantitative standards in a plan for well operations would satisfactorily address any concerns he had regarding such standards.[745]

The State Engineer finds that it is premature to attempt to set quantitative standards or triggers for mitigation actions in the management plan at this time.

**3. Mitigation Requirements**

In the event mitigation is needed, Mr. Prieur testified that there is clear language in the Management Plan that outlines the mitigation process.[746] The State Engineer has authority under Nevada law to order mitigation measures for the Project, independent of whether or not a description of mitigation measures is included in the Applicant's Management Plan.[747] Mr. Prieur and Dr. Harrington both agreed that the need for mitigation actions will be assessed on a case-by-case, or a site-by-site basis.[748] Mr. Prieur testified that there is a wide range of mitigation alternatives.[749] Dr. Harrington also agreed that determining whether mitigation is needed in the first place and then determining what type of mitigation to implement is done on a

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[742] Transcript, Vol.23 p. 5292:10-15 (Harington).
[743] Transcript, Vol.23 pp. 5286:18 - 5287:7 (Harrington).
[744] Transcript, Vol.23 p. 5308:11-17 (Harrington).
[745] Transcript, Vol.23 p. 5308:11-15 (Harrington).
[746] Transcript, Vol.9 p. 2078:8-14 (Prieur).
[747] NRS 533.370(5); 534.110(6) (2010).
[748] Transcript, Vol. 9 p. 2078:19-23 (Prieur); Transcript, Vol. 23 pp. 5301:3-5302:15 (Harrington).
[749] Transcript, Vol.9 p. 2078:19-23 (Prieur).

site by site basis.[750] Possible mitigation alternatives could include modifying the pumping regime, changing the location of pumping, drilling new wells, lowering a pump, or providing alternative sources of water.[751] A wide range of environmental mitigation alternatives also are available, and are discussed in the "Environmental Soundness" section below.

The Applicant has demonstrated a financial commitment to monitoring, management and mitigation if necessary. To summarize, the Applicant spent over $10,000,000 for the monitoring, exploratory and test well network, and $200,000 for the monitoring points around Cleveland Ranch. The Applicant spent approximately $78,000,000 to acquire ranches in Spring Valley with surface water and groundwater rights, as well as grazing allotments that can be used as part of the mitigation process.[752] In addition, the Applicant has demonstrated that it has substantial experience with monitoring, management and mitigation, and is aware of the potential costs associated with these projects.[753]

Dr. Bredehoeft testified for GBWN and said that mitigation measures will be ineffective. Dr. Bredehoeft asserted that recovery may take a long time at locations a great distance from pumping wells. However, these impacts will be the least in magnitude. Recovery will be quicker and more effective near the wells,[754] where drawdowns are expected to be greatest. Dr. Bredehoeft believes that reduction of pumping is unrealistic due to a lack of political will to stop or lessen water imports once they are started.[755] These opinions are not based on hydrology. Dr. Bredehoeft testified that reducing or ceasing pumping is a technically feasible way to mitigate

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[750] Transcript, Vol.23 p. 5302:8-15 (Harrington).
[751] Transcript, Vol.9 p. 2079:2-11 (Prieur).
[752] Transcript, Vol.11 p. 2397:2-8 (Entsminger).
[753] Transcript, Vol.11 pp. 2397:18-2398:9 (Entsminger).
[754] Exhibit No. SNWA_428, p. 9; Transcript, Vol.11 p. 2379:14–23(Prieur).
[755] Exhibit No. GBWN_009, p. 9.

impacts of pumping and that stopping pumping would allow the basin to recover.[756] He notes, however, that it may not achieve full recovery and that recovery may take a long time.[757] Dr. Bredehoeft also testified that the Endangered Species Act may effectively force the reduction or cessation of pumping.[758] In addition, the federal stipulations may require the Applicant to reduce pumping.[759] Also, it may be in the Applicant's own interests to reduce or cease pumping in order to prevent extreme drawdown and the associated increased costs of pumping. Mr. Prieur testified that there have been examples where ceasing pumping has been an effective mitigation measure. In particular, pumping impacts were successfully mitigated in northeastern Illinois by ceasing pumping and substituting surface water. Mr. Prieur testified that the hydraulic properties of this aquifer are similar to those found in Nevada.[760]

Though Dr. Bredehoeft states that artificial recharge is not a realistic solution, he testified that he has been involved in successful artificial recharge programs in his professional career.[761] He also testified that there may be some water in the playa in Spring Valley that could be used for artificial recharge.[762] In Spring Valley, some runoff reaches Yelland Dry Lake and, to a lesser extent, Baking Soda Flats.[763] This water may be used to recharge the groundwater system.[764] Harrington also testified that artificial recharge programs have been an effective part of the water management program for Owens Valley.[765] For these reasons, the State Engineer

[756] Transcript, Vol.24 pp. 5464:22–5465:4 (Bredehoeft).
[757] Transcript, Vol.24 p. 5378:1–17, 5402:9–13 (Bredehoeft).
[758] Transcript, Vol.24 p. 5465:13–23 (Bredehoeft).
[759] Transcript, Vol.11 p. 2384:8–25 (Prieur).
[760] Transcript, Vol.11 pp. 2385:1–2389:12 (Prieur).
[761] Transcript, Vol.24 pp. 5461:14–5462:19 (Bredehoeft).
[762] Transcript, Vol.24 p. 5461:7–13 (Bredehoeft).
[763] Exhibit No. SNWA_428, p. 13–14.
[764] Transcript, Vol.11 pp. 2383: 22–2384:7 (Prieur).
[765] Transcript, Vol.23 p. 5309:14-24 (Harrington).

finds that reduction of pumping and artificial recharge programs are realistic mitigation methods that will be effective in Spring Valley.

Dr. Bredehoeft also doubts that augmentation will be conducted on a large enough scale to prevent degradation of vegetation.[766] No specific evidence, however, was presented to support Dr. Bredehoeft's contention. However, the Applicant owns a substantial amount of surface water rights in Spring Valley that it may use to augment the water sources for vegetation or other environmental areas of interest. The State Engineer finds that the Applicant has established that it can reasonably use augmentation to mitigate negative impacts of pumping.

Dr. Bredehoeft believes cloud-seeding may provide some mitigation through increased precipitation, but only up to about 10 percent.[767] The Applicant has not presented evidence or testimony that suggests it plans to use cloud-seeding as a mitigation technique. The State Engineer finds that cloud-seeding may be a potential mitigation method, but that it is not presently contemplated.

The State Engineer finds that the Applicant has presented the most comprehensive monitoring, management and mitigation plan for a municipal water development project in Nevada. The State Engineer finds that the monitoring network is scientifically sound and designed in such a manner to provide monitoring coverage, from a basin-wide scale to a site specific scale, from groundwater to surface water, and from the valley floor to the mountain block. The State Engineer further finds that the data collection efforts of the Applicant demonstrate a commitment to sustainable development of the resource. The State Engineer finds that the Applicant is committed to managing the development of the Applications in a

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[766] Exhibit No. GBWN_009, p. 9.
[767] Exhibit No. GBWN_009, p. 9.

sustainable manner, and will take steps to manage the Project in a method to avoid conflicts with existing rights.[768] While the State Engineer is not a party to the Applicant's Stipulation with the Federal Agencies, the State Engineer finds that it provides a forum through which critical information can be collected from hydrologic experts, and used to assure development of the Applications will not conflict with existing water rights or with protectable interests in existing domestic wells. The State Engineer finds that mitigation measures listed in the Management Plan will be effective, and that the Applicant is required to perform any mitigation activities that may be necessary to avoid conflicts with existing rights.[769] Accordingly, in addition to other permits terms that will be required, the State Engineer will make the Spring Valley Management Plan a part of the permit terms for the Applications.

**B. <u>Analysis for Conflicts with Existing Rights</u>**

In addition to developing a Management Plan to assure the development of the Applications will not conflict with existing rights, the Applicant completed a specific analysis of every existing groundwater right and environmental area of interest located in Spring Valley. The Applicant's expert, Mr. James Watrus,[770] conducted a conflicts analysis by first identifying the Application points of diversion, existing rights and environmental areas of interest within Spring Valley.[771] The existing rights were queried from the Division of Water Resources database in September, 2010 and updated in April, 2011.[772] Federal water rights and resources

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[768] Transcript, Vol.11 pp. 2398:10-2399:1 (Entsminger).
[769] *See* NRS 534.120(1) (State Engineer's authority to designate a basin for special administration); NRS 534.120(1) (State Engineer may regulate a basin where groundwater is being depleted); NRS 534.110(6) (2010) (where pumping exceeds recharge, State Engineer may restrict pumping based on priority rights); and NRS 534.110(5) (2010) (unreasonable adverse effects to domestic wells may be mitigated or pumping limited).
[770] Mr. Watrus is a senior hydrologist with the Southern Nevada Water Authority. The State Engineer qualified Mr. Watrus as an expert in groundwater hydrology. Transcript, Vol.11 pp. 2537: 3-2538:6 (State Engineer).
[771] Transcript, Vol.11 p. 2540:14-16 (Watrus).
[772] Exhibit No. SNWA_337, Appendix A; Transcript, Vol.11 p. 2551:7-9 (Watrus).

were included in this analysis.[773] The location of the environmental areas of interest were provided by Mr. Marshall and Ms. Luptowitz and further explained in the "Environmental Soundness" section of this ruling.[774] Mr. Watrus testified that he analyzed all of the identified water rights and environmental areas of interest in his conflicts analysis.[775] Protestants have not challenged this assertion. The State Engineer finds that Mr. Watrus performed a comprehensive review of the existing water rights and environmental areas of interest potentially impacted by groundwater development.

With this information, Mr. Watrus followed three steps in his analysis. First, he conducted a qualitative analysis, which assessed potential conflicts based on water right ownership, geographical location, and priority date.[776] Second, he conducted a quantitative analysis with the Applicant's groundwater model, using the model to identify potential conflicts with existing water rights and sensitive environmental areas.[777] Third, he completed a qualitative site specific analysis of each of the areas of concern identified in the model to assess the potential for conflicts.[778]

### 1. Initial Qualitative Analysis

The first step in the conflicts analysis was to identify the existing water rights that would not be in hydrologic or legal conflict with the Application points of diversion. Water rights that were owned by the Applicant were excluded from further analysis.[779] Water rights that were junior in priority to the Applications were excluded from further analysis since Nevada follows

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[773] Transcript, Vol.11 p. 2551:1-4 (Watrus).
[774] Exhibit No. SNWA_337, pp. 3-6, 7; Transcript, Vol.11 p. 2550:19-23 (Watrus).
[775] Transcript, Vol.11 pp. 2552:12-2554:14 (Watrus).
[776] Transcript, Vol.11 p. 2540:16-18 (Watrus).
[777] Transcript, Vol.11 p. 2540:18-19 (Watrus).
[778] Transcript, Vol.11 p. 2540:19-21 (Watrus).
[779] Transcript, Vol.11 p. 2573:20-23 (Watrus).

the doctrine of prior appropriation.[780] The prior appropriation doctrine does not protect a junior water right from impacts caused by a senior appropriator. Instead, the prior appropriation system ensures that senior water rights are satisfied first before a junior water right may be pumped. Accordingly, Nevada law does not require a review of potential impacts from the Applications on junior water rights. For hydrologic reasons, Mr. Watrus concluded that water rights located in the mountain block would not be impacted by development of the Applications because mountain block springs are likely perched and not in connection with the regional groundwater aquifer.[781] Since mountain block springs are likely perched and fed from a different water source than the Applications, there can be no impact on these springs. None of the Protestants disputed this step of the analysis, and Dr. Mayo admitted that the CPB water rights located in the mountain block would indeed not be impacted by the Applications.[782] After the first qualitative analysis was complete, there were 114 water rights in Spring Valley that were subject to further conflicts analysis. The State Engineer finds the Applicant's first qualitative analysis was necessary and appropriate for assessing potential conflicts between the development of the Applications and existing rights.

**2. <u>Quantitative Analysis with Groundwater Model</u>**

The Applicant next used a groundwater model to evaluate the development of the Applications. Numerical groundwater models are computer models that are used to approximately simulate groundwater systems. They can be used to test concepts about groundwater flow or to make predictions regarding the effects of future stresses on the groundwater system. Two numerical groundwater models were submitted for this hearing to

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[780] Transcript, Vol.11 pp. 2572:23-2573:6 (Watrus).
[781] Transcript, Vol.11 p. 2572:5-7 (Watrus).
[782] Transcript, Vol.27 p. 6068:8-14 (Mayo).

simulate pumping in Spring Valley: the Applicant's model, originally designed for the BLM's Draft Environmental Impact Statement ("DEIS"), and Dr. Myers' Spring and Snake Valleys model. Both of the models contain significant uncertainties when used to predict the effects of the proposed pumping, but the State Engineer finds that the Applicant's model is the most reliable.

**a. BLM DEIS Model**

The Applicant's numerical model was originally developed for the U.S. Bureau of Land Management ("BLM") in order to comply with the National Environmental Policy Act ("NEPA") and the Endangered Species Act ("ESA"). The Applicant submitted a right-of-way request to the BLM for the construction of the proposed Project.[783] The Applicant provides assistance as needed to BLM as BLM complies with NEPA by preparing a DEIS that considers the environmental consequences of the BLM's decision and provides an opportunity for public involvement.[784] As part of the DEIS process, the BLM determined that a groundwater model was needed.[785]

Ms. Luptowitz is the Environmental Resources Division Manager for the Applicant.[786] Ms. Luptowitz testified that the purpose of the groundwater model for the DEIS is to provide a broad-scale, programmatic analysis of the indirect effects of issuing the right-of-way for the proposed pipeline Project.[787] The site-specific locations of the wells are not yet known for DEIS purposes so the BLM uses the model to identify regional patterns and compare alternatives.[788]

[783] Exhibit No. SNWA_089, p. 1-1.
[784] Transcript, Vol.9 pp. 1881:4–1882:1 (Luptowitz).
[785] Transcript, Vol.9 p. 1882:7–9 (Luptowitz).
[786] Exhibit No. SNWA_362.
[787] Transcript, Vol.9 pp. 1882:24–1883:11 (Luptowitz).
[788] Transcript, Vol.9 p. 1883:12–18 (Luptowitz).

The BLM will conduct more specific analysis when site-specific right-of-way applications are made for wells.[789] Under NEPA, the BLM can grant the right-of-way even if the model simulates impacts to existing rights and environmental resources.[790] Ms. Luptowitz testified that "the model is used for general regional drawdown patterns and trends, but it is not necessarily appropriately used to attempt to identify a specific effect at a specific location or a specific point in time."[791] For the purposes of the current DEIS, the model does not need to predict absolute or specific values at specific locations.[792]

The DEIS model was developed through a collaborative process involving many experts and significant effort. The DEIS model was developed by Earth Knowledge, Inc., the Applicant, and the BLM's Hydrology Technical Group. The Hydrology Technical Group consisted of representatives from the BLM and consulting experts.[793] A representative from the State Engineer's office also participated in technical meetings on model development.[794] The model was reviewed by the cooperating agencies for the NEPA process.[795] The Applicant prepared the groundwater model under the direction of the BLM Hydrology Technical Group. The BLM is ultimately responsible for the groundwater model.[796]

The Hydrology Technical Group collaborated on the model development from November 2006 to November of 2009, including an 18-month period of intense collaboration.[797] The Hydrology Technical Group consisted of local, regional, and national representatives from the

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[789] Transcript, Vol.9 pp. 1883:19–1885: 3 (Luptowitz).
[790] Transcript, Vol.9 pp. 1887:16–1888:2 (Luptowitz).
[791] Transcript, Vol.9 p. 1887:1–4 (Luptowitz).
[792] Transcript, Vol.9 p. 1887:10–13 (Luptowitz).
[793] Exhibit No. SNWA_087, p. 5; Transcript, Vol.9 pp. 1895:18–1896:18 (D'Agnese).
[794] Exhibit No. SNWA_087, p. 6.
[795] Exhibit No. SNWA_087, p. 2.
[796] Transcript, Vol.9 pp. 1882:10–20 (Luptowitz), 1899:9–11 (D'Agnese).
[797] Exhibit No. SNWA_087, p. 5; Transcript, Vol.9 pp. 1898:2–1899:4 (D'Agnese).

BLM as well as Dr. Eileen Poeter from the Colorado School of Mines and Dr. Keith Halford from the USGS.[798] Dr. Poeter has been involved in hydrogeologic and groundwater research for 30 years and is considered an international authority in groundwater modeling.[799] Dr. Halford is an experienced groundwater modeler who has developed and published numerous models in many parts of the country.[800] In addition, representatives from the State Engineer's office participated as observers.[801] Earth Knowledge, Inc. itself spent approximately 15,000 person-hours on the project.[802] Dr. D'Agnese, President of Earth Knowledge and an expert in groundwater modeling, [803] testified that development of this model probably involved more time and discussion than any other model he had worked on in his 20 years of experience.[804] He opined that the level of time and collaboration significantly benefited the model.[805]

The model was developed using the MODFLOW-2000 modeling code with some customizations.[806] The development of the model was completed according to Hill and Tiedeman's 14 Guidelines for effective model calibration.[807] Dr. D'Agnese testified that Hill and Tiedeman's 14 Guidelines are accepted as authoritative in the field of groundwater modeling.[808] The State Engineer finds that following Hill and Tiedeman's 14 Guidelines enhances the reliability of a groundwater model.

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[798] Transcript, Vol.9 p. 1896:10-18 (D'Agnese).
[799] Transcript, Vol.9 p. 1897:9-14 (D'Agnese).
[800] Transcript, Vol.9 pp. 1897:21–1898:1 (D'Agnese).
[801] Transcript, Vol.9 p. 1896:15-18 (D'Agnese).
[802] Transcript, Vol.9 p. 1900:5–8 (D'Agnese).
[803] Exhibit No. SNWA_86; Transcript, Vol.9 p. 1895:11–12 (State Engineer). Dr. D'Agnese was the lead technical coordinator in the development of the Applicant's groundwater model. Transcript, Vol.9 pp. 1895:18–1896:2 (D'Agnese).
[804] Transcript, Vol.9 pp. 1899:12–19 (D'Agnese).
[805] Transcript, Vol.9 pp. 1899:24–1900:2 (D'Agnese).
[806] Exhibit No. SNWA_087, pp. 4–5.
[807] Exhibit No. SNWA_087, pp. 4, 15.
[808] Transcript, Vol.9 p. 1913:13–21 (D'Agnese).

For purposes of the hearing on the Applications, the Applicant used a model that differed slightly from the model used by BLM for the DEIS. During the NEPA process, the BLM requested that the Applicant modify the representation of Big Springs, which it did for the DEIS.[809] For reasons discussed in more detail below, the Applicant selected the original un-modified version of the DEIS model for the analysis the Applicant presented to the State Engineer (hereinafter referred to as the "Applicant's model"). Dr. Myers criticizes the Applicant's model for not completely implementing the Applicant's conceptual flow model and suggests that the Applicant altered the conceptual model to increase recharge in the targeted basin.[810] Dr. Myers notes that the per-basin recharge in the Applicant's numerical model is different than that in the Applicant's conceptual model.[811] The State Engineer finds that the groundwater modeling exercise is not meant to exactly replicate the conceptual model. Instead, the model is designed to closely match observations in the system and to have parameters that are in the acceptable range of the conceptual model. Therefore, the mere fact that a numerical model may differ from a conceptual model does not mean that the numerical model is inadequate.

### 1 <u>Scope of BLM DEIS Model</u>

In light of the model's purpose - to support analysis under NEPA at a broad programmatic level - the Applicant's model is a regional model. It does, however, incorporate intermediate features that are connected to regional features. It does not include perched and

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[809] Exhibit No. SNWA_090, pp. 3-1 to 3-3.
[810] Exhibit No. GBWN_103, p. 27; Exhibit No. GBWN_104, p. 15.
[811] Exhibit No. GBWN_104, p. 10.

local features that are not connected to the regional features.[812] Due to its regional nature, the Applicant's numerical model is not designed to simulate perched systems, predict drawdown at specific pumping wells or springs, derive steady-state budgets, or derive new basin or flowsystem boundaries. Dr. D'Agnese testified that predictions in cells where wells are located should not be relied on.[813]

The model covers 20,688 square miles, including Spring, Cave, Dry Lake, and Delamar valleys.[814] Though there are other regional models of similar size in the United States, they typically have much more available data.[815] The model grid-cells are each one kilometer by one kilometer.[816] The Applicant's model has 474 rows, 202 columns, and 11 layers with a total of 589,391 active cells.[817] Dr. D'Agnese testified that the data resolution for the area did not justify using smaller grid cell sizes.[818] He testified that given the size and amount of available data, the model should only be used to evaluate regional patterns and trends in drawdowns and changes in water budgets due to natural or human stresses.[819]

The complexity and large size of the region modeled and the sparseness of available data result in uncertainties in the Applicant's model simulations.[820] Furthermore, the lack of good historical data on anthropological uses of groundwater provides further uncertainty to the model simulations.[821] Because of the model's regional scale, local-scale features are not accurately simulated. For instance, Dr. D'Agnese testified that it would not be appropriate to use the model

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[812] Exhibit No. SNWA_087, p. 1; Transcript, Vol.9 p. 1909:18–25 (D'Agnese).
[813] Exhibit No. SNWA_087, p. 2; Transcript, Vol.9 p. 1909:7-10 (D'Agnese).
[814] Exhibit No. SNWA_089, pp. 1-2, 4-2; Transcript, Vol.9 p. 1902:20–21 (D'Agnese).
[815] *See* Transcript, Vol.9 p. 1903:1–1906:6 (D'Agnese).
[816] Exhibit No. SNWA_087, p. 11; Exhibit No. 089, p. 4-1; Transcript, Vol.9 p. 1907:2–4 (D'Agnese);.
[817] Exhibit No. SNWA_089, pp. 3-4, 4-2.
[818] Exhibit No. SNWA_087, p. 11; Transcript, Vol.9 pp. 1907:5–1908:11 (D'Agnese).
[819] Transcript, Vol.9 pp. 1906:20–1907:1, 2026:9–2027:15 (D'Agnese).
[820] Exhibit No. SNWA_087, p. 9.
[821] Exhibit No. SNWA_087, p. 12.

to make drawdown predictions at Cleveland Ranch or spring flow predictions for the Gandy Warm Springs and McGill Springs.[822]

All layers in the Applicant's model are simulated as confined.[823] Dr. Myers states that the use of a confined top layer biases the Applicant's model to under-predict drawdowns.[824] Dr. D'Agnese stated that the Applicant's model had convergence issues when the top layer was simulated as unconfined. The Applicant addressed this by changing the layer to confined and then took measures to minimize any errors this could cause.[825] The use of a confining layer was directed and approved by the many groundwater modeling experts on the BLM's Hydrology Technical Group. Dr. D'Agnese testified that it is a common practice among modelers to simulate the top layer as confined due to model convergence issues. He did not believe the use of a confined layer for the top layer made the model inappropriate to use for this hearing.[826] Dr. Myers also noted that his model had convergence issues due to the use of an unconfined layer for layer 1. However, Dr. Myers determined that this would have no affect on model results.[827] The State Engineer finds that the use of a confined top layer in the Applicant's model does not limit its usefulness in the consideration of the Applications.

The Applicant's model uses average conductances from the top of a cell to the bottom of a cell. Dr. Myers asserts that in thick cells the top and bottom may be grossly different and the average is essentially meaningless.[828] Dr. Myers also states that the Applicant's model structure

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[822] Transcript, Vol.9 pp. 1911:2–15, 1915:7–9 (D'Agnese).
[823] Exhibit No. SNWA_089, p. 4-2.
[824] Transcript, Vol.18 pp. 4090:25–4091:3, 4094:2–10 (Myers).
[825] Exhibit No. SNWA_089, pp. 4-2, 4-4.
[826] Transcript, Vol.9 pp. 1918:17–1919:16 (D'Agnese).
[827] Transcript, Vol.18 pp. 4107:25–4109:16 (Myers).
[828] Exhibit No. GBWN_104, pp. 14–15.

is far too complex for the quantity and quality of hydrologic data used to calibrate it.[829] The State Engineer finds that the scope of the Applicant's model carries with it inherent uncertainties involving representation of local conditions and the coarseness of its grid. However, the State Engineer finds that the level of detail in the Applicant's model is appropriate for a regional model and reflects the data available for the region.

### 2 Model Construction

The Applicant used Horizontal Flow Barriers ("HFB") to represent geologic faults when they were considered to be barriers to groundwater flow.[830] Dr. Myers criticizes the Applicant's use of HFBs to represent faults in several ways. Dr. Myers asserts that the Applicant's model contains several faults that are supported by "very little data" or that simplify complex geologic features.[831] For instance, Dr. Myers criticizes the Applicant's model for not following the geology of Rowley et al. (2011) by including an HFB between Steptoe and Spring Valleys that does not result in a mounding of contours.[832] Dr. D'Agnese, however, explained that the model was completed prior to the completion of Rowley et al. (2011) and so could not have relied on it. He also stated that the HFB is not meant to be a complete barrier to groundwater flow; it is only meant to impede flow.[833]

The State Engineer finds that the Applicant's use of HFBs to represent geologic faults is appropriate. HFBs are not always intended to act as complete barriers to flow. Furthermore, the HFBs approximate faults, but the model is not expected to exactly reflect the large groundwater

[829] Exhibit No. GBWN_104, p. 15.
[830] Exhibit No. SNWA_089, p. 4-16.
[831] Exhibit No. GBWN_104, pp. 4–8, 15; Transcript, Vol.18 p. 4092:15–22 (Myers).
[832] Exhibit No. GBWN_104, p. 9; Transcript, Vol.18 pp. 4085:17–4086:19 (Myers).
[833] Transcript, Vol.9 pp. 1922:9–1923:12 (D'Agnese).

system on a local scale. The State Engineer finds that Dr. Myers has not pointed out any material problems with faults in the Applicant's model.

Dr. Myers also alleges that the Applicant's use of a specific storage value of 0.015 for lower layers indicates a bias in the model. Dr. Myers states that this value is more typical of plastic clay and that the fill should typically have a lower specific storage value. This results in the model releasing more water form storage per foot of drawdown.[834] Dr. D'Agnese testified that the storage parameters were selected based on analysis of literature and aquifer test results with the concurrence of the Hydrology Technical Group.[835] The State Engineer finds that the Applicant has adopted reasonable storage values for its model.

Dr. D'Agnese testified that if a model is to be used for predictions, it typically should be calibrated both to steady state conditions and to transient conditions.[836] Calibration refers to the process of trying to match simulated values in the model to actual observed field values. For example, if a spring was flowing at the rate of two cubic feet per second, an ideally calibrated model would simulate flow at that spring as two cubic feet per second, not one or three cubic feet per second. The Applicant's model was calibrated to steady-state and transient development conditions.[837] The Applicant used both manual trial-and-error and automated-regression methods to calibrate the model.[838] The Applicant used 2,707 hydraulic head observations, 4,301 hydraulic drawdown observations, 126 groundwater ET discharge observations, 44 steady-state spring flow observations, 27 transient spring flow change observations, 16 model flow boundary

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[834] Exhibit No. GBWN_104, p. 9; Transcript, Vol.18 pp. 4084:21–4085:9 (Myers).
[835] Transcript, Vol.9 pp. 1923:22–1924:14 (D'Agnese).
[836] Transcript, Vol.9 pp. 1914:17–1915:2 (D'Agnese).
[837] Exhibit No. SNWA_087, p. 3.
[838] Exhibit No. SNWA_087, p. 6.

observations, and 144 spring or stream flow observations to constrain the model calibration.[839] The Applicant weighted observations so that more reliable measurements were given more weight during calibration.[840] Only a subset of the regional and intermediate springs in the model was used for calibration targets.[841] If springs are not included as steady state calibration targets, then the existing spring flow is not necessarily accurately represented as a starting point in the model. Thus, one can have little confidence in the precision of spring flow predictions for such springs that were not included in the calibration process.[842]

Dr. D'Agnese testified that the model simulates the regional intermediate spring flows that were used as calibration targets quite well over time.[843] He also states that, though the model does not accurately simulate individual ET locations, it simulates aggregate ET well.[844] Dr. Myers asserts that the Applicant's model has a bias toward positive unweighted residuals in the north of Spring Valley and the mountain front of Snake Valley. However, he notes that these areas would not be affected much by the proposed pumping.[845] The State Engineer finds that the Applicant's model provides a reliable tool to examine potential effects on the groundwater system. However, the model contains many uncertainties that must be kept in mind as it is used to analyze the system.

#### b. Application of Model to Consider Impacts from Project

[839] Exhibit No. SNWA_087, p. 17.
[840] Exhibit No. SNWA_087, p. 7.
[841] Transcript, Vol.9 pp. 1910:1–1911:1 (D'Agnese).
[842] Exhibit No. 407, p. 5.
[843] Transcript, Vol.9 p. 1915:16–24 (D'Agnese).
[844] Exhibit No. SNWA_087, p. 14.
[845] Exhibit No. GBWN_104, p. 3; Transcript, Vol.18 p. 4082:14–23 (Myers).

Two model simulations were run, one using a baseline scenario and one that simulated pumping the full volume of the Applications.[846] Drawdown maps were prepared based on the difference in model results between the two scenarios.[847] In addition, changes in spring flow volumes were analyzed.[848] Mr. Watrus used the baseline pumping scenario to set the initial conditions of the water table.[849] He then used the full volume scenario to simulate the water elevations under pumping stresses.[850] The full volume pumping scenario simulated staged development of the resource based on the projected water demand in the Applicant's 2009 Water Resource Plan.[851] The baseline water level elevations and spring flows were subtracted from the pumping water elevations and spring flows to determine drawdown of the aquifer and changes in spring flow resulting from simulated pumping of the Applications.[852]

The Applicant selected the original version of the DEIS model for the analysis. During the NEPA process, the BLM requested that the Applicant modify the representation of Big Springs (in Snake Valley), which it did for the DEIS.[853] The original version, unlike the modified version of the model, simulated full discharge at Big Springs, which was an area of concern in the model analysis.[854] Dr. Myers testified that the original version used by the Applicant during this hearing is likely a more accurate representation of the hydrogeology of Big Springs.[855]

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[846] Transcript, Vol.11 p. 2574:13-15 (Watrus).
[847] Transcript, Vol.11 p. 2574:16-18 (Watrus).
[848] Transcript, Vol.11 p. 2574:18-19 (Watrus).
[849] Transcript, Vol.11 p. 2555:5-10 (Watrus).
[850] Transcript, Vol.11 pp. 2555:17-2556:15 (Watrus); Exhibit No. SNWA_337, p. 4-3 and 4-4.
[851] Transcript, Vol.11 p. 2556:22-24 (Watrus).
[852] Transcript, Vol.11 p. 2555:11-15 (Watrus).
[853] Exhibit No. SNWA_090, pp. 3-1 to 3-3.
[854] Transcript, Vol.11 p. 2550:12-13 (Watrus).
[855] Transcript, Vol.18 p. 4087:8–12 (Myers).

Dr. Myers suggested that the conflicts analysis should have used the pumping scenarios identified in the DEIS.[856] The DEIS alternative pumping scenarios mainly simulate distributed pumping throughout Spring Valley.[857] The only pumping scenario that simulated pumping at the Application points of diversion also included pumping in Snake Valley. The Snake Valley Applications are not before the State Engineer for consideration at this time, and simulated pumping at those points of diversion may influence drawdown simulations from the Spring Valley Applications.[858] The State Engineer finds that this decision only involves the Application points of diversion in Spring Valley. None of the DEIS pumping scenarios analyze just pumping at the Spring Valley Application points of diversion. Accordingly, the State Engineer finds that the Applicant properly constructed a new model run in order to analyze the specific decision that is before the State Engineer at this time.

The Applicant selected a 75 year simulation period beyond full build-out of the project, which occurs in the year 2042. This simulation period was selected based upon the expected lifespan of the project and the reduced certainty in model results for longer simulation periods.[859] Mr. Holmes testified that the Applicant uses a 50 year water planning horizon because it provides a long enough look into the future to assess potential water demand and to provide enough lead time to meet that demand.[860] Mr. Holmes further testified that other entities such as the City of Phoenix and White Pine County, as well as federal agencies, such as the Army Corps of Engineers, use a 50 year planning horizon.[861] On the other hand, Dr. Myers and Dr. Jones ran

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[856] Exhibit No. GBWN_110, p. 15.
[857] Transcript, Vol.11 pp. 2562:19-2563:2 (Watrus).
[858] Transcript, Vol.11 pp. 2562:19-2563:2 (Watrus).
[859] Transcript, Vol.11 p. 2559:3-9 (Watrus).
[860] Transcript, Vol.2 pp. 307:24-308:7 (Holmes).
[861] Transcript, Vol.2 p. 308:10-15 (Holmes).

model simulations to 200 years beyond full build-out.[862] None of the Protestants provided a practical justification for running a 200 year simulation period and it is undisputed that the 200 year simulation periods were less certain than the 75 year simulation period.[863] The uncertainty with longer prediction periods relates in part to the fact that no actual data exists for large-scale pumping, so predicting conditions many hundreds of years into the future only compounds the uncertainty caused by lack of data. The State Engineer finds that the 75 year simulation period is appropriate for this conflicts analysis given the practical considerations provided by the Applicant and the substantial amount of uncertainty for longer prediction periods. Further, the State Engineer will require model updates every 5 years following the start of groundwater production and longer simulation periods may be required if it appears to the State Engineer that because the model was updated with actual pumping data, predictions for longer simulation periods become more certain.

Some adjustments had to be made to the model to represent full pumping of the Application points of diversion. Specifically, the model framework could not support pumping at Application 54021. The Applicant's model locates points of diversion in the center of the modeling cell, which in this case was an impermeable rock layer.[864] For the simulation, the Applicant moved the Application point of diversion into alluvial material.[865] The geology in the actual location of the point of diversion is alluvial material, which, according to Mr. Watrus, is suitable for production.[866] Dr. Myers confronted a similar problem at more than one point of

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[862] Exhibit No. GBWN_003, p.5; Transcript, Vol.27 p. 6009:13-18 (Jones).
[863] Transcript, Vol.20 p. 4489:1-3 (Myers).
[864] Exhibit No. SNWA_337, p. 4-5; Transcript, Vol.11 p. 2561:7-23 (Watrus).
[865] Exhibit No. SNWA_337, p. 4-5; Transcript, Vol.11 p. 2561:7-23 (Watrus).
[866] Exhibit No. SNWA_337, p. 4-5; Transcript, Vol.11 p. 2561:7-23 (Watrus).

diversion in his simulations and used a similar technique to resolve the problem.[867] The State Engineer finds that for simulation purposes, it was appropriate for the Applicant to move the point of diversion for Application 54021 as described above.

There are limitations in the model predictions that must be accounted for in the conflicts analysis. First, at full-build out, the model simulated continuous pumping at maximum volume throughout the simulation period. As explained by Mr. Watrus, the model cannot account for human-driven management decisions to reduce, relocate, or stop pumping to prevent impacts to existing water rights or environmental areas of interest. In reality, the Project would be developed in a manner that responded to impacts before the drawdowns that are predicted in the model would occur.[868]

Second, Mr. Watrus testified that the volume of precipitation recharge that is simulated in the model is 82,600 afa as opposed to the current estimate of 99,200 afa.[869] In essence, this imbalance between recharge to the aquifer and pumping from the aquifer magnifies simulated impacts. If the model simulated the current estimate of recharge, the drawdown predictions would be less. Further, the full application volume pumping scenario simulated 91,224 acre-feet of pumping in Spring Valley.[870] Mr. Watrus testified that the imbalance between recharge (82,600 acre-feet) and pumping volume (91,224 acre-feet) would cause the model to over-simulate impacts as a whole simply because the simulation includes pumping greater than perennial yield.[871] A simulation that includes more recharge, and pumping at the rate that is

[867] Exhibit No. GBWN_003, p. 6.
[868] Transcript, Vol.11 pp. 2557:24-2558:8; 2558:13-16 (Watrus).
[869] Transcript, Vol.11 p. 2566:4-7 (Watrus).
[870] Transcript, Vol.11 p. 2566:10-12 (Watrus).
[871] Transcript, Vol.11 p. 2566:20-21 (Watrus).

ultimately approved by the State Engineer for these Applications, would predict less drawdowns or decreases in spring flows.

Third, as stated above, the model is a regional model that cannot make site-specific predictions. The model cannot currently represent the complex geologic stratification on the valley floor in Spring Valley.[872] Therefore, the model represents uniform drawdown in an area that has potentially numerous confined units which would influence and limit potential drawdown.[873] Other limitations include a lack of historical pumping drawdown data to determine how consumptive uses affect the aquifer over time, and a lack of variation in recharge over time to assess how increased or decreased recharge will influence drawdown under different pumping regimes.[874]

The State Engineer understands that the Applicant's model is not a perfect predictor of reality and that there are practical water management considerations that simply cannot be accounted for in the model simulations. The State Engineer finds that these model limitations cause the model to exaggerate pumping impacts and that the conflicts analysis must be viewed in this light.

Given the limitations associated with the model, Mr. Watrus testified that the model should be used to identify areas of concern that require more detailed qualitative analysis and consideration of whether adequate monitoring exists to protect such areas of concern.[875] Mr. Watrus did not consider the model results sufficiently accurate to predict specific drawdowns

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[872] Transcript, Vol.11 p. 2584:19-24 (Watrus).
[873] Transcript, Vol.11 p. 2584:19-24 (Watrus).
[874] Transcript, Vol.11 pp. 2565:20-24, 2568:9-14 (Watrus).
[875] Transcript, Vol.11 p. 2575:3-7 (Watrus).

and specific spring discharges.[876] This opinion is consistent with that of the model's author, Dr. D'Agnese, who testified that analyzing drawdown at specific sites was not an appropriate use of the model. Given all of these limitations of the model, and the model's predictive accuracy, Mr. Watrus determined that the proper use of the model was to determine which existing right points of diversion or environmental areas of interest have a simulated drawdown of more than 50 feet or a simulated reduction in spring discharge of greater than 15 percent.

For the DEIS analysis, different threshold values were used. In particular, the DEIS used a drawdown threshold of 10 feet and a five percent change in spring discharge for the purpose of comparing the potential impacts from the different pumping scenarios.[877] Ms. Luptowitz testified that the difference in threshold values depends on the purpose of the model simulation results. She testified that the DEIS thresholds were selected to compare the potential range of effects between the different alternatives.[878] Ms. Luptowitz testified that the conflicts analysis for this hearing analyzed specific points of diversion and required greater certainty in model results, which the threshold values used for this hearing provided.[879] The State Engineer finds that the purposes of the DEIS are different than the purpose of this hearing. The DEIS is meant to disclose a regional comparison of alternatives without having site-specific pumping locations.[880] The BLM may grant the right-of-way even if some impacts are shown. The DEIS was not intended to determine if there would be unreasonable effects to existing rights under the Nevada law.[881] On the other hand, the State Engineer must look at the specific Applications

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[876] Transcript, Vol.11 pp. 2574:23-2575:2 (Watrus).
[877] Transcript, Vol.9 p. 1890:4-7 (Luptowitz).
[878] Transcript, Vol.9 p. 1890:4-7 (Luptowitz).
[879] Transcript, Vol.9 p. 1890:20-23 (Luptowitz).
[880] Exhibit No. SNWA_337, p. 6-2; Transcript, Vol.9 pp. 1889:7–1890:7 (Luptowitz).
[881] Exhibit No. SNWA_408, p. 3.3-93.

before him. He is statutorily required to reject applications if impacts to existing rights are shown. Therefore, the State Engineer requires a greater amount of certainty in predicted impacts than what the modeling results provide.

Dr. Jones testified that screening criteria are appropriate for analyzing the results of the model, but also testified that he thought the Applicant's criteria were arbitrary.[882] Dr. Jones further testified that the screening criteria should be used in conjunction with the actual drawdown numbers.[883] However, Dr. Jones did not provide any recommendations to the State Engineer as to alternative screening criteria, and did not address Ms. Luptowitz's testimony on this issue.

The State Engineer finds that predictions of the models are so uncertain beyond a period of 75 years that they cannot be used as a basis to reject the Applications in this instance. The State Engineer further finds that model predictions of drawdowns of less than 50 feet and spring flow reductions of less than 15% are highly uncertain for this time period. Furthermore, a drawdown of less than 50 feet over a 75-year period is generally a reasonable lowering of the static water table, but this determination must be made on a case-by-case basis. Therefore, the State Engineer will not reject the Applications based on model predictions of drawdowns of less than 50 feet or spring reductions of less than 15 percent. The State Engineer acknowledges that Protestants provided detailed model predictions that predicted an exact numeric amount of drawdown at points of diversion for their water rights and environmental areas of interest.[884] However, because the model is unable to represent local-scale geologic and hydrogeologic features that control whether or not a drawdown will actually occur in reality, these exact

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[882] Transcript, Vol.27 p. 6001:22-24 (Jones).
[883] Transcript, Vol.27 p. 6001:24-25 (Jones).
[884] Transcript, Vol.27 p. 6002:7-11 (Jones).

numeric drawdown predictions are unreliable. Even if the model simulates, for example, a 45 foot drawdown at a specific water right location, because of the limitations and uncertainties in the model predictions, the State Engineer finds the model predictions at that level of specificity are not credible. The State Engineer recognizes that there is conflicting evidence between what the model predicts and what the hydrogeologic understanding of the area shows. Because of the uncertainty in the models, when model simulations contradict the hydrogeologic understanding of an area, the State Engineer finds that the hydrogeologic understanding is more persuasive and reliable.[885]

Therefore, the State Engineer finds that the Applicant's approach to the conflicts analysis is appropriate given the limitations in the model and the purpose of this analysis.

### 3. <u>Site-Specific Qualitative Analysis of Impacts to Existing Rights and Environmental Areas of Interest</u>

As a result of the quantitative analysis, 31 out of 114 water rights were located in an area where the model simulated greater than 50 feet of drawdown and three were located where the model simulated a reduction in spring discharge in excess of 15 percent.[886] These 31 water rights and three spring locations were further examined on a qualitative basis to determine whether pumping under the Applications conflicted with existing rights. One of the purposes of this further qualitative analysis was to determine if there were features or conditions that are not represented in the model that could affect the level of impact from pumping under the Applications. Another purpose was to determine whether sufficient monitoring exists at these locations to protect against impacts. The State Engineer finds that no Protestant provided this additional level of qualitative analysis.

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[885] *See* Exhibit No. SNWA_337, p. 6-2; Exhibit No. SNWA_408, p. 3.3-111.
[886] Exhibit No. SNWA_337, p. 6-4.

**a. <u>Groundwater Rights</u>**

The Applicant first qualitatively analyzed the underground water rights in areas with greater than 50 feet of simulated drawdown. The analysis of the CPB underground water rights in these areas will be discussed in the "Cleveland Ranch" section below. NRS 534.110 (2010) states that groundwater rights "must allow for a reasonable lowering of the static water level" and the section "does not prevent the granting of permits to applicants later in time on the ground that the diversions under the proposed later appropriations may cause the water level to be lowered at the point of diversion of a prior appropriator, so long as any protectable interests in existing domestic wells . . . and the rights of holders of existing appropriations can be satisfied under such express conditions." This statute indicates even if a new application for groundwater will cause a reasonable amount of drawdown at an existing water right, such a drawdown will not prevent the State Engineer from granting a permit for the new appropriation.

Permit 29371 (Cert. 10328) and 29567 (Cert. 10329) share a well, which corresponds to driller's log 10816 that is available in the State Engineer's records.[887] The driller's log indicates that the well is completed to a depth of 238 feet and has a static water level of 64 feet.[888] The saturated depth of this well is 174 feet. The State Engineer finds that this well can accommodate a reasonable lowering of the water table at this location without causing a conflict to these existing rights. Application 31239 corresponds with driller's log 17124.[889] For this well, the completion depth is 535 feet and the static water level is 231 feet.[890] Again, the State Engineer finds that the saturated depth of this well, 304 feet, can accommodate a reasonable lowering of

[887] Exhibit No. SNWA_337, p. 6-6.
[888] Exhibit No. SNWA_341; Transcript, Vol.11 p. 2581:12-19 (Watrus).
[889] Exhibit No. SNWA_341; Transcript, Vol.11 p. 2583:3-4 (Watrus).
[890] Exhibit No. SNWA_341; Transcript, Vol.11 p. 2583:10-13 (Watrus).

the water table. The State Engineer also finds that any effects to these water rights will be monitored and addressed pursuant to the required Management Plan.

The next group of water rights, Permit 7446 (Cert. 1515), 8075 (Cert. 1366), and 8077 (Cert. 1368), are located on the valley floor.[891] The water rights are small volume stock water rights.[892] There is no driller's log for these wells, and the Applicant determined that the wells were completed at shallow depths.[893] Given their location on the valley floor, it is likely that these wells are located in an area with multiple confining clay layers, which may influence impacts at this location. The State Engineer finds that if unreasonable impacts occur at this location, the small volume of water allocated to these water rights may be mitigated in any number of ways including deepening the current wells, drilling substitute wells, or simply replacing the water with water provided by the Applicant.[894] Further, by placing pumping stresses on the hydrologic system and studying the interaction of the clay layers in the vicinity of Cleveland Ranch, the State Engineer finds that the Applicant and the State Engineer will be in a better position to assess potential impacts at this site, and to manage pumping in a manner to avoid unreasonable lowering of the water table for these existing rights.

Other than CPB rights, which are discussed below, the final underground right, Permit 45496 (Cert. 11965), is located at the interface of the valley floor and the alluvial fan.[895] The water right is a stock water right with an annual duty of 86.24 acre-feet.[896] The well for this water right is completed to a depth of 495 feet and has a static water level of 407 feet below

[891] Transcript, Vol.11 pp. 2583:25-2584:2 (Watrus).
[892] Transcript, Vol.11 p. 2585:15-16 (Watrus).
[893] Transcript, Vol.11 p. 2584:7-11 (Watrus).
[894] Transcript, Vol.11 p. 2585:13-17 (Watrus).
[895] Exhibit No. SNWA_337, p. 6-6; Transcript, Vol.11 p. 2586:3-6 (Watrus).
[896] Exhibit No. SNWA_337, p. 6-6; Transcript, Vol.11 p. 2585:24-25 (Watrus).

ground surface ("bgs").[897] The saturated depth of the well, 88 feet, could accommodate some lowering of the water table. The first simulation period in which the right is impacted is in the year 2082.[898] This estimate is premature given the fact that the model oversimulates pumping and there are potentially multiple aquifers in this area. Based on this evidence, the State Engineer finds that there is lead time in the model simulation to determine whether this right will be impacted. The State Engineer further finds that the Applicant's monitoring pursuant to the Management Plan will identify any potential conflicts during this time.

With respect to domestic wells, the Applicant reviewed the presence of domestic wells and determined that no domestic wells would be impacted by the Project. Protestants submitted no evidence to indicate the Project will conflict with protectable interests in existing domestic wells.

**b. <u>Spring Rights</u>**

The next group of water rights are spring rights. The model simulated greater than 50 feet of drawdown at federal reserved rights associated with Unnamed Spring, Four Wheel Drive Spring, and Spring Creek Spring.[899] The Applicant entered into stipulations with the Federal Agencies and the USFS regarding these reserved rights.[900] The State Engineer finds that any conflicts with federal reserved rights will be managed by the parties pursuant to those stipulations, and that if these water rights are impacted by pumping pursuant to the Applications, the Applicant will be required to address the impacts to the satisfaction of the State Engineer.

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[897] Exhibit No. SNWA_337, p. 6-6; Transcript, Vol.11 p. 2586:6-8 (Watrus).
[898] Exhibit No. SNWA_337, p. 6-8
[899] The Federal Reserve Water Rights are R05274, R05237, R05269, R05272, R05278, R05279, R05280, R05292, R05292, R05292. Exhibit No. SNWA_337, p. 6-8. The State Engineer notes that none of these rights have been adjudicated. Transcript, Vol.11 p. 2589:17-22 (Watrus).
[900] Exhibit No. SE_041; Exhibit No. SE_095.

The model also simulated a reduction in spring flow greater than 15 percent at north and south Millick Springs, which are located on the valley floor.[901] There are CPB water rights on these springs. Also, Applications 10921 and 10993, not owned by CPB, have their source from north and south Millick Springs. While the model runs simulated a reduction of 15 percent at these springs, these springs were not included as calibration targets in the model and there is no certainty that this simulation is accurate.[902] The accuracy of this simulation is further called into question by the fact that the model simulates very little drawdown in the water table in this area.[903] The State Engineer notes that this drawdown is exaggerated due to oversimulated pumping in the model and the lack of simulated geologic complexity on the valley floor. Given the relatively minimal simulated drawdown in this area after 75 years of continuous full volume pumping, the State Engineer finds with relative certainty that these water rights are unlikely to be impacted. The State Engineer further finds that there is a significant amount of monitoring occurring between these rights and the Application points of diversion, which will help detect the spread of drawdown toward these rights for the purpose of preventing impacts or implementing mitigation measures, if needed.

**c. <u>Stream Rights</u>**

The final group of water rights analyzed are stream rights. The model simulated greater than 50 feet of drawdown at Cleve Creek, Bastian Creek, and Willard Creek.[904] Cleve Creek and Bastian Creek will be discussed in the Cleveland Ranch section below. The model simulated

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[901] Exhibit No. SNWA, p. 337.
[902] Transcript, Vol.11 p. 2590:24-2591:16 (Watrus).
[903] Exhibit No. CPB_011, p. 27.
[904] Exhibit No. SNWA_337, p. 6-10.

drawdown in excess of 50 feet at Willard Creek.[905] There are two senior water rights associated with Willard Creek, Permit 983 (Cert. 171) and Permit 1052 (Cert. 244).[906] The depth to groundwater in the vicinity of these rights is 14 feet and 80 feet, respectively.[907] CPB expert, Dr. Alan Mayo agreed that one of the requirements for impacts to stream rights from groundwater pumping is a saturated continuum between the stream and the groundwater table.[908] The parties did not dispute that there is no saturated continuum between the creek bed and the groundwater table. Therefore, the State Engineer finds that there will be no conflict with these existing water rights near Willard Creek.

The qualitative analysis results for the remaining steam rights owned by CPB are presented in later sections of this ruling.

**d. <u>Environmental Areas of Interest</u>**

There were a total of 36 environmental areas of interest within the model domain that were quantitatively analyzed. Only four of these environmental areas of interest were located in an area of Spring Valley where the model either simulated drawdown in excess of 50 feet or a spring discharge reduction in excess of 15 percent.[909] All of these springs will be monitored in accordance with the Monitoring Plan and the Stipulated Agreements between the Applicant and the Federal Agencies and the USFS. A more detailed analysis of these areas of interest is included in the "Environmental Soundness" section of this ruling.

**e. <u>Cleveland Ranch and CPB water rights</u>**

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[905] Exhibit No. SNWA_337, p. 6-10.
[906] Exhibit No. SNWA_337, p. 6-10.
[907] Transcript, Vol.11 p. 2594:6-23 (Watrus).
[908] *See* Transcript, Vol.27 p. 6085:3-15 (Mayo).
[909] Exhibit No. SNWA_337, p. 6-12

The Corporation of the Presiding Bishop ("CPB") filed protests to Applications 54009-18 and 54020-21, which are located in the vicinity of the CPB-owned Cleveland and Rogers Ranches in northern Spring Valley, Nevada.[910] The basis for each of the protests is the assertion that development of the Applications will conflict with CPB's existing rights associated with these ranches.[911] The general geographic locations of the CPB protested applications are shown on page 10 of CPB Exhibit 11.[912] In vacated Ruling 5726, the State Engineer denied Applications 54016, 54017, 54018 and 54021, which are located on the Cleve Creek alluvial fan because there was uncertainty associated with the potential impacts of pumping of these points of diversion.[913] The State Engineer found that the remaining applications were located in areas where the monitoring and mitigation plan would provide early warning of potential impacts to existing rights and provide for mitigation of unforeseen unreasonable impacts.[914]

Drs. Norman Jones and Alan Mayo[915] testified on behalf of CPB regarding potential impacts on the CPB water rights. Dr. Jones used the Applicant's groundwater model to generate drawdown maps for the area of Spring Valley where the CPB spring rights and groundwater rights are located.[916] Three modeling scenarios were used for the analysis: 1) a scenario representing the development of the full application volume for the Applications; 2) a scenario representing the development of the full application volume for all of the Applications except Applications 54016-18 and 54021 which were previously denied; and 3) a scenario representing

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[910] CPB Protests to Applications 54009-54018, and 54020-21 (filed March 28, 2011).
[911] CPB Protests to Applications 54009-54018, and 54020-21 (filed March 28, 2011).
[912] Exhibit No. CPB_011, p. 10.
[913] *See vacated Ruling 5726*, p. 36.
[914] *See vacated Ruling 5726*, p. 37.
[915] Dr. Alan Mayo was qualified by the State Engineer as an expert in hydrogeology. Transcript, Vol.27 p 5977:7-11 (State Engineer). Dr. Norman Jones was qualified by the State Engineer as an expert in ground water modeling. Transcript, Vol.27 pp. 5980:5-6;, 5981:13-14 (State Engineer).
[916] Exhibit No. CPB_011, pp. 23-35.

the development of the full application volume for all of the Applications except Applications 54009-18 and 54020-21 that were protested by CPB.[917]

Using a groundwater model appropriately is essential to any conflicts analysis. Dr. Frank D'Agnese testified that the Applicant's model cannot be used to make local scale predictions at springs, wells and ET areas that do not derive their source from the regional aquifer.[918] This testimony is corroborated by the report that documents the development of the model. Dr. D'Agnese also testified that the model is not designed to simulate drawdown at the local scale and indicated that was not inappropriate for CPB to use the Applicant's model for local scale predictions at Cleveland Ranch.[919] Similarly, Drs. Jones and Mayo acknowledged in their expert report that the model should only be used to analyze overall drawdown trends.[920] Dr. Jones admitted there is a "tremendous amount of uncertainty" in looking at each of the site specific results in isolation; however, Dr. Jones suggested that viewing the site specific results in the aggregate could provide relevant information on drawdown trends.[921] In spite of Dr. Jones' testimony, it is still unclear to the State Engineer how site specific results become better when viewed in the aggregate if the aggregate area being examined in the model is still local, for example the Cleveland Ranch area. Therefore, the State Engineer finds that the Applicant's model is appropriate to determine areas of concern from regional drawdown trends; however, the model cannot provide any definitive analysis of specific drawdown near Cleveland Ranch at the local scale.

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[917] Exhibit No. CPB_011, p. 22.
[918] Transcript, Vol.9 pp. 1908:14-1909:10 (D'Agnese).
[919] Transcript, Vol.9 pp. 1908:14-1909:10 (D'Agnese).
[920] Exhibit No. CPB_011, p. 47.
[921] Transcript, Vol.27 p. 6010:20-24 (Jones).

By simulating the full pumping scenario for the life of the project, or 75 years beyond full build-out, the Applicant's drawdown maps show that the spring and well rights on the Cleve Creek alluvial fan exist primarily in an area that is transitioning from relatively low drawdown, in the range of approximately one to 50 feet, to intermediate drawdown in the range of approximately 50 to 100 feet.[922] In year 2042, when simulated full build-out of the project occurs, there is generally low drawdown in the area of these CPB water rights and minimal cause for concern over potential impacts.[923] By year 2062, the water rights are in an area that is transitioning from low drawdown to intermediate drawdown, which presents concern over potential impacts.[924] The State Engineer finds that this 20 year window after full build-out is sufficient time to study the aquifer and adjust pumping regimes so as to not affect existing rights.[925] The window is likely larger due to the fact that the model over simulates drawdown.

South of the Cleve Creek alluvial fan, CPB has vested claims on Unnamed Spring #7 and #8, Layton Spring and South Bastian Spring[926] as well as groundwater rights associated with Permits 18841, 18842, and 18843.[927] Groundwater Permits 18841 through 18843 were analyzed as part of the Applicant's conflicts analysis.[928] The wells corresponding to these water rights are listed as flowing under artesian pressure on the water right certificates.[929] The water bearing zones for these wells may be completely confined and insulated from the effects of pumping.[930] However, in the event the wells are susceptible to impacts from pumping at the proposed points

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[922] Exhibit No. CPB_011, p. 26.
[923] Exhibit No. CPB_011, p. 24.
[924] Exhibit No. CPB_011, p. 25.
[925] Exhibit No. CPB_011, p. 25.
[926] Exhibit No. CPB_011, p. 4, Table 1- Addendum, V010073, V010074, V010075, V010076, V010077.
[927] Exhibit No. SNWA_337, Plate 1; Exhibit No. CPB_11, p. 5; V010073, V010074, V010075, V010076, V010077.
[928] Exhibit No. SNWA_337, pp. 6-5, 6-7.
[929] Exhibit No. SNWA_337, p. 6-5.
[930] Exhibit No. SNWA_337, p. 6-5.

of diversion, each of the wells have completion depth greater than 200 feet and can accommodate a reasonable lowering of the water table.[931] Mitigation measures will be required as needed to make any impacted water right whole.

CPB recently filed vested claims for water rights on Unnamed Spring #7 and #8, South Bastian Spring, South Bastian Spring 2, and Layton Spring. Federal reserved water rights R05278, R05272 and R05269 are associated with or in the vicinity of Unnamed Springs in this area.[932] The reserved rights are for 67.24, 67.24 and 3.59 acre-feet of spring discharge, respectively.[933] Pursuant to the Stipulation for Withdrawal of Protests between the Applicant and the Federal Agencies, a common goal of the Parties is "1) management the development of groundwater by [the Applicant] in the Spring Valley HB without causing injury to Federal Water Rights…"[934] In accordance with the Stipulation, a monitoring plan was developed by the Applicant and approved by the State Engineer.[935] The Applicant's Management Plan incorporates all of the elements from the approved plan.[936] Under that plan, a piezometer was installed at Four Wheel Drive Spring which is located a quarter mile from Unnamed Springs.[937] The vested rights to discharge from these springs have not been adjudicated; therefore, the State Engineer cannot determine whether the CPB has any right to the spring discharge from Unnamed Spring #7 and #8.[938] However, in order to take a conservative approach, the State Engineer will treat the vested claims as if they had been adjudicated. The State Engineer finds that the mandates of the Stipulation and the Management Plan will protect these rights. Finally, CPB has

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[931] Exhibit No. SNWA_337, p. 6-5, 6-7.
[932] Exhibit No. SNWA_337, Plate 1.
[933] Exhibit No. SNWA_337, p. 6-8.
[934] Exhibit No. SE_041, p. 3, G.
[935] Exhibit No. SNWA_153.
[936] Transcript, Vol.8 p. 1840:12-17 (Prieur).
[937] Exhibit No. SNWA_337, p. 6-9.
[938] Transcript, Vol.11 p. 2589:17-22 (Watrus).

vested claims to water rights on South Bastian and Layton Springs. Both of these sites have been selected for monitoring.[939] Mr. Watrus testified that these monitoring efforts will help the Applicant determine the aquifer characteristics and the connection of these surface water features with groundwater development.[940] The State Engineer finds that the potentially impacted CPB water rights are or will be monitored and that this monitoring will allow for early warning of potential impacts to these water rights. By including the Management Plan as part of the permit terms, the State Engineer has the authority to require additional monitoring points to protect these existing rights and will exercise this authority as needed.

The next group of water rights is located north and east of the Cleve Creek alluvial fan.[941] The existing rights are located in an area where CPB experts predicted a drawdown of less than 20 feet after 75 years of continuous pumping from full build-out.[942] Given the limitations in the model, it is unlikely that impacts will actually be experienced at these water rights from pumping at the existing Application points of diversion. Nevertheless, the State Engineer finds that there is comprehensive monitoring occurring between the Application points of diversion and these water rights, which will provide the State Engineer with data to detect the spread of drawdown and take action to prevent unreasonable impacts. By including the Management Plan in the permit terms for the subject water rights, the State Engineer has the authority to require additional monitoring points to protect existing rights and will exercise this authority as needed.

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[939] Exhibit No. SE_095, Exhibit A, p. 5.
[940] Transcript, Vol.11 p. 2589:10-13 (Watrus).
[941] Recent vested claims in this area include V010086, V010087. Recent filed claims include the Fera Well. The remaining rights were analyzed as part of the Applicant's conflicts analysis. Exhibit No. CPB_011, p. 4; Exhibit No. SNWA_337, Appendix B.
[942] Exhibit No. CPB_011, p. 27

A final group of water rights in this area is located on Cleve Creek alluvial fan.[943] The local-scale alluvial aquifer dynamics at this location are still largely unknown. However, the parties do not dispute that Cleve Creek is not in connection with the regional groundwater aquifer; therefore the rights[944] associated with this creek will not be impacted.[945] CPB recently filed a vested claim to the water right of Cleveland Well. This well is over 600 feet deep and can accommodate a reasonable lowering of the water table.

With respect to the rights at the toe of the alluvial fan that are potentially within an area where the model predicted greater than 50 feet of drawdown,[946] both parties acknowledge that the geology at the interface of the alluvial fan and the valley floor is highly stratified.[947] The Applicant submitted geologic data for monitoring wells SPR7030M and M2.[948] These wells are located at the base of the alluvial fan.[949] The water levels in both wells are shown as artesian indicating that the wells penetrate confining units.[950] Both wells show significant clay layers in the range of 10 to 30 feet and 40 to 60 feet below ground surface.[951] In addition, the deeper of the two wells, SPR 7030M2, has clay layers at 110 to 120 feet; 160 to 190 feet and 220 to 230 feet.[952]

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[943] Recent vested claims in this area include V010082, V010083, V010084, V010085, V010078, V010079, V010080, V010081. Recent filed claims include the Cleveland well.
[944] Exhibit No. CPB_011, p. 3.
[945] Transcript, Vol.20 pp. 44991:21-4492:6 (Myers); Transcript, Vol.27 p. 6085:3-6 (Mayo).
[946] Recently claims V010082, V010083, V010084, V010085, V010078, V010079, V010080, V010081, and three rights identified by the Applicant V02821, V02824, V02825; Exhibit No. CPB_011, p. 4; Exhibit No. SNWA_337, p. 6-8.
[947] Exhibit No. CPB_011, p. 16; Exhibit No. SNWA_179.
[948] Exhibit No. SNWA_179.
[949] Exhibit No. SNWA_149, p.32.
[950] Exhibit No. SNWA_179, pp. 9, 18.
[951] Exhibit No. SNWA_179, pp. 9, 18.
[952] Exhibit No. SNWA_179, p. 18.

This stratification is also shown in well log 111291 corresponding to CPB Permit 54024 on the Cleveland Ranch.[953] The well log shows clay layers from 115 feet to 140 feet; 215 to 217 feet; 230 to 237 feet; 345 to 360 feet; 365 to 375 feet; and 550 to 575 feet below ground surface.[954] The clay layers in SPR7030M and M2 do not exactly line up with the clay layers shown in well log 111291 indicating there may not be lateral continuity between these clay layers on valley floor-alluvial fan interface. However, the existence of so many clay layers in this area makes it possible that pumping in one area will capture water in a confined layer and not impact water rights that have their source of water in another confining layer.

There is also some question about the reach of these clay layers up the alluvial fan toward the mountain block. The Applicant's stratigraphic column for test well SPR7029M2, located about half way up the Cleve Creek alluvial fan, did not encounter any clay layers within the depth of the borehole which was 440 feet of the ground surface.[955] However, the Cleveland Well is also located in the vicinity of SPR7029M2.[956] It is screened from 100 feet to about 600 feet below the ground surface and is a flowing artesian well indicating that the well penetrates a confining unit[957] The State Engineer finds that there may be multiple groundwater systems in the Cleve Creek alluvial fan; however, further study is needed to define the location of these systems.

Depending on the lateral continuity of the clay layers and their reach into the alluvial fan, the Applicant's witness, Mr. Prieur, opined that the Applicant could design a pumping regime to

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[953] Exhibit No. SNWA_468.
[954] Exhibit No. SNWA_468.
[955] Exhibit No. SNWA_180, p. 18.
[956] Exhibit No. CPB_011, p. 5.
[957] Exhibit No. CPB_011, p. 15.

avoid impacts to existing rights that derive their source above the clay layers[958] Dr. Harrington agreed that specific pumping management controls are best addressed in a Pumping Plan.[959] Dr. Myers agrees that the water which supplies the springs at the toe of the fan is perched, and not connected to the groundwater system.[960] On the other hand, CPB witness Dr. Mayo believed that pumping below the clay layers would cause the cone of depression to extend up the alluvial fan beyond the clay layers to the head of the system and intercept younger water destined to reach the springs at the base of the fan.[961] However, Dr. Mayo's opinion is more theoretical than practical, as he did not offer an opinion on the rate or duration of pumping it would take for the cone of depression to extend this far upgradient on the alluvial fan. Further, while Dr. Mayo suggested that pumping the older deeper water in the system is groundwater mining,[962] from both a hydrologic and policy standpoint, there is no precedent for distinguishing between older water and younger water for the purpose of determining perennial yield in a basin. If there is older water in the aquifer that exists below a clay layer or multiple clay layers and that water can be developed without causing injury to existing rights, then the State Engineer finds that the Applicant should be allowed to develop it.

Developing this water from the current points of diversion will not necessarily cause groundwater mining as suggested by Dr. Mayo. In response to questioning from staff, Dr. Mayo conceded that lowering the regional water table could lower the water table at the surface where

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[958] Transcript, Vol.8 pp. 1855:22–1856:14 (Prieur).
[959] Transcript, Vol. 23 p.5308:7-17 (Harrington).
[960] Transcript, Vol.20 pp. 4491:24-4492:69 (Myers).
[961] Transcript, Vol.27 p. 6032:1-23 (Mayo).
[962] Transcript, Vol.27 p. 6031:5-25 (Mayo).

young water is discharged through evapotranspiration.[963] Therefore, the State Engineer finds development of this older water will not necessarily result in a groundwater mining situation.

The real issue is to what extent the Applicant can develop the water on the alluvial fan without causing harm to CPB water rights. As mentioned previously, the Applicant performed a 120-hour constant rate aquifer test of 500 gpm at test well SPR7029M2.[964] The response observed in the monitor well that is 110 feet from the test well was negligible.[965] This aquifer test indicates a possibility that water can be developed on the alluvial fan without causing enough drawdown to affect discharge at the springs at the toe of the fan. Mr. Prieur testified that it would be useful to perform an aquifer test from the nearest Application point of diversion at higher rates and durations than the previous test to observe the response in the aquifer at the monitoring wells.[966] The State Engineer finds that the negligible drawdown observed in the monitoring well during the constant rate aquifer test is evidence that pumping the deeper water in the aquifer may be possible without affecting the discharge of the springs at the base of the fan.

CPB witness Dr. Mayo admitted that there is some level of pumping that is acceptable from the Application points of diversion that CPB protested.[967] However, he concluded that specific conditions should be met in order to develop the groundwater.[968] The conditions are as follows: 1) calibrate the model using a much finer grid space; 2) design a pumping scheme with more wells at shallower depths with a wider distribution to capture ET; and 3) test this design against the local model.[969]

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963 Transcript, Vol.27 p. 6146:17-25 (Mayo).
964 Exhibit No. SNWA_177.
965 Exhibit No. SNWA_177, Appendix D, p. 3, Figure D-3.
966 Transcript, Vol.8 p. 1863:7-12 (Prieur).
967 Transcript, Vol.27 p. 6138:17-23 (Mayo).
968 Transcript, Vol.27 p. 6046:8-23 (Mayo).
969 Transcript, Vol.27 p. 6046:8-23 (Mayo).

These conditions can be achieved within the framework of the proposed monitoring and management program. According to the Applicant,

> The model will be further refined as water resource development activities generate additional data. The established Spring Valley Monitoring Plan provides a long-term network which is generating data to enhance the reliability and predictive capability of the regional groundwater flow model.[970]

From a management standpoint, the Applicant stated that its objective is

> The basin characterization information derived from POD site development and additional hydrogeologic investigations, coupled with operations data from production wells and the monitoring network will further refine the predictive capability of the numerical groundwater model to further improve the operations plan. [971]

The State Engineer finds that the Applicant's Management Plan encompasses the elements set forth by CPB's experts for the development of the Applications in the vicinity of Cleveland Ranch. Further, the State Engineer finds that sufficient monitoring evidence has been developed to indicate an initial small amount of water can be developed pursuant to Applications 54016, 54017, 54018 and 54021 without conflicting with existing rights. However, the State Engineer finds that pumping stresses must be placed on the system to develop the local-scale model needed to address whether larger amounts of water can be developed. Therefore, the State Engineer finds that conditions similar to those suggested by CPB should be met concurrently with the development of these Applications, but that the wells should be designed to pump from the deeper aquifer.

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[970] Exhibit No. SNWA_147, p. 2-15.
[971] Exhibit No. SNWA_147, p. 4-4.

CPB has argued that the monitoring and management program will not be effective at protecting existing rights.[972] However, CPB employees assisted in locating monitoring points around the Cleveland Ranch, which ultimately cost the Applicant approximately $200,000.[973] In addition, the State Engineer stated on the record, in relevant part, that:

> The regulation of these water rights are within our purview. If there's adverse impacts to existing rights…we're not going to be sitting on our hands. I mean, we're going to [be] out there being proactive. And we can assess penalties, we can require cease and desist, curtailment of pumping, et cetera.[974]

Accordingly, the State Engineer finds that there is no merit to CPB's position that the monitoring and management plan, from either a technical or administrative point of view, will be ineffective. Based on the evidence submitted by the Applicant, and the testimony of CPB's expert Dr. Mayo, the State Engineer finds that the Applications can be developed without conflicting with existing rights. Nevada law provides that, "the State Engineer may limit the initial use of water to a quantity that is less than the total amount approved for the application."[975] Additional use "may be authorized by the State Engineer at a later date if additional evidence demonstrates to the satisfaction of the State Engineer that the additional amount of water" can be developed in accordance with Nevada water law.[976] To make that determination, "the State Engineer may establish a period during which additional studies may be conducted or additional evidence provided to support the application."[977]

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[972] Transcript, Vol.29 p. 6438:11-17 (Hejmanowski).
[973] Transcript, Vol.8 pp. 1848:25-1849:15; 1864:6-7 (Prieur).
[974] Transcript, Vol.11 p. 2499:2-8 (State Engineer).
[975] NRS 533.3705. (2010).
[976] NRS 533.3705. (2010).
[977] NRS 533.3705. (2010).

Based on this legal framework, the State Engineer is authorized to approve the Applications, but limit the amount of water than can be initially developed by the Applicant. Based on that authority, the State Engineer will approve the applications located near Cleveland Ranch subject to the following conditions. Initial development of Applications 54016, 54017, 54018 and 54021 will be limited to 500 afa per well. Results of a five day aquifer test performed at the Cleve alluvial fan location SPR7029M2 at 500 gallons per minute (equivalent to approximately 807 afa with continuous pumping) indicated no significant drawdown at a monitor well located 110 feet from the test well. Limiting initial pumping to 500 afa per well (310 gallons per minute if pumped continuously over a year) would be expected to result in insignificant or no impacts to the Cleveland Ranch operations and provide longer term response data to assess the optimal future pumping rates at these locations. The Applicant shall implement and comply with all provisions of the Management Plan for this area to confirm that initial development does not conflict with existing rights. Before additional volumes of water can be developed at the current points of diversion for these four applications, the Applicant shall 1) construct and calibrate a local-scale groundwater model with pumping stresses using a much finer grid space, 2) develop an Operations Plan for these four applications that is based on a pumping scheme that may require wells at deeper depths, 3) submit to the State Engineer model projections using the local-scale model that evaluates impacts from pumping additional volumes of water pursuant to the pumping scheme in an Operations Plan for these four wells and 4) receive approval of that Operations Plan by the State Engineer. The Applicant shall complete tests, concurrent with initial and any subsequent development of these four applications, sufficient for the State Engineer to make a determination whether an additional quantity of water can be developed from these points of diversion without causing impacts to existing CPB water rights. CPB will have an opportunity to respond to this data and analysis and make its own recommendations to the State Engineer.

#### f. EskDale Center

Protestant EskDale Center represents the interests of the EskDale Community and its associated agricultural activities which are located in western Millard County, Utah, within Snake Valley. EskDale Center participated in the hearing on the Applications and contended that approval of the Applications as part of the Applicant's groundwater Project would conflict with EskDale's water rights in Snake Valley. However, EskDale Center also admitted that they are "not likely to be directly affected by removal of groundwater from Spring Valley from the specific points of diversion specified in the Applications."[978] This lack of impact was confirmed by modeling results.[979] Based on the evidence in the record, and because the State Engineer may only consider the Applications that are before him, the State Engineer finds that approval of the Applications will not conflict with EskDale's existing water rights in Snake Valley.

### 4. Myers Spring and Snake Model

Dr. Myers developed a groundwater model of the Spring and Snake Valleys to predict future conditions in the valleys due to pumping.[980] Dr. Myers developed his model using the MODFLOW-2000 modeling code with additional packages.[981]

#### a. Review of Construction of Myers' Model

Dr. Myers also purported to comply with Hill and Tiedeman's 14 Guidelines for effective model calibration.[982] Dr. D'Agnese, however, notes that in many cases Dr. Myers did not fully

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[978] EskDale Center Closing Statement at p.1.
[979] Transcript Vol.16 p. 3734:20-3745:2 (Anderson); Transcript Vol. 21, p. 4665:18-4666:8 (Myers).
[980] Exhibit No. GBWN_002, p. 1.
[981] Exhibit No. GBWN_002, p. 2.

comply with the guidelines.[983] For instance, Guideline 2 recommends the use of a broad range of information to constrain the objective function and Guideline 4 recommends the inclusion of many kinds of data as observations in the regression. Flow observations should be included as constraints. However, Dr. Myers only used hydraulic head observations as constraints in his automatic regression.[984]

In addition, Guideline 6 recommends the assignment of weights to observations that reflect uncertainty in the measurement so that more precise measurements are given more weight than more questionable measurements. Dr. Myers, however, assigned every observation in his model a weight of 1 or, if he completely excluded it, effectively a weight of zero.[985] In Dr. Myers model, all included observations were given the same weight despite their relative certainty.[986] Dr. Myers notes that Halford and Plume describe setting observation weights as a "fool's errand."[987] The State Engineer finds, however, that weighting if done properly, can improve a groundwater model as predictive tool. Certainly some older measurements relying on topographic maps will be less reliable than measurements made using modern methods, and it would therefore be appropriate to weight the newer, modern measurements more heavily.

In addition, though the value of assigning weights to observations may be in dispute, the Applicant, unlike Dr. Myers, provided both weighted and unweighted residuals for evaluation.[988] Dr. D'Agnese also points out that it is often not clear whether a feature is perched or not.[989] Therefore, probabilistic weighting may be better than a binary decision to either include or

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[982] Exhibit No. GBWN_002, p. 3.
[983] Transcript, Vol.9 pp. 1950:22–1951:2 (D'Agnese).
[984] Exhibit No. SNWA_404, p. 15.
[985] Transcript, Vol.17 p. 3908:2–9 (Myers).
[986] Exhibit No. SNWA_404, p. 16; Transcript, Vol.20 p. 4468:2–12 (Myers).
[987] Exhibit No. SNWA_104, p. 2.
[988] *See* Exhibit No. GBWN_104, p. 2.
[989] Exhibit No. SNWA_087, p. 13.

exclude the observation. Dr. D'Agnese further points out that Dr. Myers either failed to fully implement the remaining guidelines or failed to provide enough documentation to allow the reviewer to make that determination.[990]

Dr. Myers' model covers Spring and Snake Valleys and the surrounding area. Dr. Myers' model has grid cell sizes ranging from one-quarter mile square to four miles square. The smaller cells are centered around the proposed pumping areas. His model has seven layers. The top layer is simulated as unconfined.[991] Dr. Myers testified that the coarseness of his model causes some wells to be simulated in dry cells right at the edge of saturation.[992]

Like the Applicant, Dr. Myers used HFBs to represent geologic faults.[993] Dr. D'Agnese points out that many of the HFBs in Dr. Myers' model are discontinuous. According to Dr. D'Agnese, these discontinuities are likely an indication of modeling error.[994] Though a fault tip might cause the location of HFBs to shift between layers, Dr. D'Agnese testified that he checked for this and determined that the discontinuities in Dr. Myers' HFBs were not explained by fault tips.[995] Dr. Myers testified that the discontinuous HFBs do not affect his model but admitted that he would have fixed them if he had known about them earlier.[996] The State Engineer finds that these HFBs represent modeler error, but since they are not near the simulated pumping, they do not significantly affect the results of Dr. Myers' model for the purpose of this hearing.

Dr. Myers used both trial-and-error and automatic regression to calibrate his model at steady state. He used hydraulic head observations and spring fluxes to calibrate, but he did not

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[990] Exhibit No. SNWA_404, pp. 15–18.
[991] Exhibit No. GBWN_002, p. 5; *see also* Transcript, Vol.17 p. 3888:20-21 (Myers).
[992] Exhibit No. GBWN_002, p. 32.
[993] Exhibit No. GBWN_002, p. 10.
[994] Exhibit No. SNWA_404, pp. 8–9; Transcript, Vol.9 pp. 1943:16–1945:2 (D'Agnese).
[995] Transcript, Vol.9 p. 2007:7–12 (D'Agnese).
[996] Transcript, Vol.20 pp. 4466:1–4467:3 (Myers).

use the spring flux observations in the automatic regression.[997] Many of the simulated spring discharge rates are not close to the target rates, and even the target rates themselves may not match actual conditions, making an unmatched target even worse. For example, Dr. Myers' model simulates approximately half of the target flow rate for Big Springs and Cleve Creek Springs and less than half for Gandy Warm Springs.[998] Dr. Myers had difficulty modeling Gandy Warm Springs and Big Springs due to the scale of his model.[999] Dr. Myers notes that this difference is not necessarily an indication of a poor simulation because the target includes ET and spring flow.[1000] However, Dr. Myers did not quantify the amount of the target flux that is composed of ET. If springs are not well-represented after the steady state calibration, then the existing spring flow is not necessarily accurately represented as a starting point in the model. Thus, one can have little confidence in the precision of spring flow predictions for these springs.[1001] The State Engineer finds that he can place little weight on predictions at springs using Dr. Myers' model because he cannot fully assess how closely the spring simulations matched observations at steady state.

Dr. Myers also conducted a transient calibration exercise based on seasonal variation and past pumping in the valleys.[1002] Dr. Myers notes that the data to calibrate to transient conditions is sparse and that no stresses remotely close to the magnitude of the proposed pumping are available.[1003] He only used data from Snake Valley in his transient calibration; he did not use

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[997] Exhibit No. GBWN_002, p. 29; Transcript, Vol.17 p. 3908:10–12, Vol.20 pp. 4379:22–25, 4452:15–22 (Myers).
[998] Exhibit No. GBWN_002, p. 38; Transcript, Vol.20 pp. 4380:18–4384:16 (Myers).
[999] Transcript, Vol.17 pp. 3909:23–3910:24, Vol.20 pp. 4451:19–4452:1 (Myers).
[1000] *See, e.g.,* Transcript, Vol.17 p. 3903:4–6, Vol.18 pp. 4078:14–4079:12, Vol.20 pp. 4382:20–4384:16 (Myers); *see* Exhibit No. GBWN_002, p. 22.
[1001] Exhibit No. SNWA_407 p. 5.
[1002] Exhibit No. GBWN_002, pp. 41–43.
[1003] Exhibit No. GBWN_002, pp. 1, 42.

any Spring Valley observations.[1004] Dr. Myers testified that some wells in his model ended up in dry cells but were close to wet cells, which made it difficult to calibrate.[1005] The State Engineer finds that Dr. Myers' model is not well-calibrated and thus its predictions carry little weight.

In the basin and range aquifer, conductivity generally decreases with depth.[1006] Dr. D'Agnese notes that Dr. Myers' model has several instances of increased conductivity at depth. For example, Dr. Myers' model has a greater hydraulic connection in Layer 7 between Northern Spring Valley and Northern Snake Valley than in Layer 2.[1007] However, Dr. Myers notes that the Applicant's model also contains examples of a groundwater divide in the upper layers but a hydraulic connection at depth.[1008]

Dr. Myers also has increasing conductivity in Spring Valley at depth in layer 3, allowing effects to propagate quickly within the zone.[1009] The justification for the increased conductivity at depth in Dr. Myers model is not documented.[1010]

Dr. D'Agnese criticizes the presence of a higher conductivity zone in the bottom layer of Dr. Myers' model between northern Snake Valley and Deep Creek Valley.[1011] Dr. Myers testified that the higher conductivity in layer 7 into Deep Creek is based on geologic features: carbonate rock at depth and a dip.[1012] During cross examination, the Protestants examined Dr. D'Agnese on possible geologic justification for higher conductivity at depth between northern Snake Valley and Deep Creek Valley using a plate from Dr. Rowley's report. Dr. D'Agnese

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[1004] Transcript, Vol.17 p. 3921:13–25 (Myers).
[1005] Transcript, Vol.17 pp. 3911:20–3912:11 (Myers).
[1006] Transcript, Vol.9 p. 1934:5–9 (D'Agnese); Transcript, Vol.20 pp. 4452:23–4453:13 (Myers).
[1007] Transcript, Vol.9 pp. 1945:3–1946:8 (D'Agnese).
[1008] Exhibit No. GBWN_104, p. 9.
[1009] Transcript, Vol.9 pp. 1933:15–1934:1, 1934:10–17 (D'Agnese); Transcript, Vol.20 pp. 4455:22–4456:12 (Myers).
[1010] Transcript, Vol.9 p. 1934:18–21 (D'Agnese).
[1011] Exhibit No. SNWA_404, pp. 4–5.
[1012] Transcript, Vol.17 p. 3871:2–17 (Myers); Transcript, Vol.18 p. 4075:11–25 (Myers).

testified, however, that Dr. Rowley's plate did not show Devonian carbonate at depth between Deep Creek and Snake Valleys and thus did not justify Dr. Myers' use of higher conductivity at depth in layer 7 of his model.[1013]

Dr. Myers' model has an area of higher recharge across the southern end of Spring Valley. This recharge is in the middle of the valley floor.[1014] Dr. Myers testified that this represents runoff.[1015] It is unusual to have high recharge in the middle of the valley floor. Dr. Myers testified that no documentation or evidence supports this high recharge area in the middle of the valley.[1016] The State Engineer finds that this does not reflect reality and represents an error in the development of Dr. Myers' model.

Dr. D'Agnese points out that, based on the Applicant's observations, Dr. Myers' model over-simulates water levels in Tippett Valley, northern Spring Valley, southern Spring Valley, northern Hamlin Valley, southern Snake Valley, and northern Snake Valley, but under-simulates water levels in large expanses in the valley bottoms of Spring and Snake valleys. This under-simulation leads to an under-simulation of ET in those areas.[1017] Dr. Myers argues that it is unfair to evaluate his model using a different set of well observations than those he used to develop the model, but admits that the observations should be similar.[1018] The State Engineer finds that Dr. Myers' model contains significant residuals which further suggest that simulations using Dr. Myers' model are highly uncertain.

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[1013] Transcript, Vol.9 pp. 2003:12–2005:11 (D'Agnese).
[1014] Exhibit No. GBWN_002, p. 21.
[1015] Transcript, Vol.21 pp. 4656:23–4657:16 (Myers).
[1016] Transcript, Vol.21 pp. 4657:17–4658:17 (Myers).
[1017] Exhibit No. SNWA_404, p. 10; Transcript, Vol.9 pp. 1946:25–1948:25 (D'Agnese).
[1018] Transcript, Vol.17 p. 3915:17–25 (Myers).

No groundwater model is a perfect representation of the groundwater system it models.[1019] In addition, when looking at models of this large scale in the Great Basin, many uncertainties arise from the coarse model resolution necessary and the lack of detailed understanding of the hydrogeology of the system. However, the State Engineer finds that a better developed and calibrated model such as the Applicant's will provide more reliable predictions.

Dr. D'Agnese states that the limitations of the Applicant's numerical model are predominantly inherent and unavoidable due to the size of the modeled region and the sparseness of data.[1020] Despite the inherent limitations, he states that the Applicant's model uses the best available science and considers the model to be the most up-to-date representation of hydrogeologic data for the region.[1021] He opines that Dr. Myers' Spring and Snake Valley model would provide unreliable predictions and should not be used at all to predict effects due to pumping.[1022] Dr. D'Agnese states that Dr. Myers model suffers from model construction errors, subjective hydrogeologic features that over-constrain the model, and significant documentation omissions that render it unreliable as a predictive tool.[1023]

Dr. Myers believes that his Spring and Snake Valley numerical model provides predictions that are accurate, but not precise.[1024] He concludes that the model will accurately estimate the effects of pumping in Spring and Snake Valleys.[1025] Dr. Myers argues that his Spring and Snake Valley model is superior to the Applicant's model because it has a finer

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[1019] *See* Transcript, Vol.20 p. 4418:12–21 (Myers).
[1020] Exhibit No. SNWA_087, p. 14.
[1021] Exhibit No. SNWA_087, pp. 9–10, 20.
[1022] Transcript, Vol.9 pp. 1949:1–6, 1951:3–11 (D'Agnese).
[1023] Exhibit No. SNWA_404, p. 1.
[1024] Exhibit No. GBWN_002, p. 1.
[1025] Exhibit No. GBWN_002, p. 44.

discretization around the pumping wells and in the uppermost layers.[1026] Dr. Myers also argues that his model is superior because he simulates the top layer as unconfined while the Applicant simulated its top layer as confined.[1027] Dr. D'Agnese, however, testified that though a finer discretization in a groundwater model allows for a more precise calculation of drawdowns because of the smaller cell size, it does not make the model more accurate. The accuracy of the model depends on the underlying data and the calibration.[1028]

Dr. Myers also provides a statistical comparison of hydraulic heads in his Spring and Snake Valley model to the Applicant's model. While the Applicant's model has a higher mean residual, mean absolute error, and root mean square error, Dr. Myers' model has a higher root mean square error as a percentage of the data range.[1029] The State Engineer finds that the accuracy of any particular prediction will depend on the specifics of the prediction, thus these general statistics reveal little.[1030] Furthermore, Dr. Myers only compares residuals of hydraulic heads, not of ET, spring flow, and interbasin flow residuals. Such a comparison by Dr. Myers would have been more useful, and may have revealed a very different picture that is more favorable to the Applicant's model.

Dr. D'Agnese testified that documentation of a model is more important than the model itself because it informs any potential user of the model's strengths and weaknesses, capabilities, resolution, and underlying data.[1031] Dr. Myers also testified that documentation is important.[1032]

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[1026] Exhibit No. GBWN_104, pp. 1, 15; Transcript, Vol.18 pp. 4092:23–4094:1, Vol.21 p. 4642:3–7 (Myers).
[1027] Exhibit No. GBWN_104, pp. 1–2.
[1028] *See* Exhibit No. SNWA_405, p. 3; Transcript, Vol.9 p. 1956:2–11 (D'Agnese); Transcript, Vol.20 pp. 4501:18–4502:22 (Myers).
[1029] Exhibit No. GBWN_104, p. 2; Transcript, Vol.18 p. 4094:6–23 (Myers).
[1030] *See* Transcript, Vol.9 p. 1975:1–19 (D'Agnese).
[1031] Transcript, Vol.9 p. 1901:18–25 (D'Agnese).
[1032] Transcript, Vol.19 p. 4319:10-13, Vol.21 p. 4640:9–21 (Myers).

Dr. Myers admitted that the Applicant's model is more fully documented than his.[1033] The level of documentation does not alter the accuracy of a model's predictions.[1034] It only allows others to better understand the model's capabilities and meaning. But the lack of documentation means that the State Engineer cannot fully understand the potential limitations and appropriate uses of Dr. Myers' model. Therefore, the State Engineer is unable to rely heavily on predictions of impacts from Dr. Myers' Spring and Snake Valley model.

After considering both models, the State Engineer finds that the Applicant's model generally provides a more reliable basis to predict regional-scale impacts resulting from the Applicant's proposed pumping. The Applicant's model relies on the best data and techniques, was developed through a rigorous collaborative process with the BLM and internationally known modeling experts, and is accompanied by thorough documentation. Dr. Myers' Spring and Snake Valley model did not have the same benefit of a time-intensive collaborative process and a diversity of expert input. Dr. Myers' model contains some errors in the representation of faults using HFBs, did not strictly adhere to Hill and Tiedeman's 14 Guidelines, and had convergence problems. The State Engineer, however, finds that it is beneficial to examine the results of both models, as long as they are viewed in the context of their limitations and uncertainties. In any regard, the models' drawdown results are similar in many areas, at least when viewed at the regional level.[1035] Thus, the State Engineer will use both models' Spring Valley pumping simulations for the purpose of this hearing, but the Applicant's model will generally be given more weight.

**b. <u>Review of Utility of Myers' Model</u>**

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[1033] Transcript, Vol.20 p. 4469:7–14 (Myers).
[1034] Transcript, Vol.21 pp. 4640:22–4641:6 (Myers).
[1035] Transcript, Vol.18 pp. 4111:23–4112:12, Vol.19 p. 4260:147-12, Vol.21 pp. 4668:13–4669:5 (Myers).

In addition to determining the relative predictive reliability of the numerical groundwater models presented, the State Engineer must determine the appropriate use of the models. The Applicant's model and Dr. Myers' Spring and Snake Valley model, like all models, contain uncertainty in their representations of the groundwater system and their predictions of effects of pumping into the future.[1036] The uncertainty largely arises from the coarseness of the models and the lack of pumping stress data at a similar magnitude as the proposed pumping to calibrate the model.[1037] In addition, due to the regional nature of the models, it is inappropriate to make detailed, local-scale predictions with them.[1038] Though Dr. Myers characterizes his Spring and Snake Valley model and the Applicant's model as "intermediate" rather than "regional," he admits that they were not designed for detailed, local-scale predictions.[1039] Dr. D'Agnese notes that the reliability of predictions depends on the specific prediction because certain areas have more data and are better represented than others.[1040] Furthermore, the models fail to account for management decisions to reduce or move pumping over the life of the project. Instead, they simulate full pumping 24 hours a day, 365 days a year. This does not reflect reality.[1041]

In addition, the reliability of model predictions decreases the farther out into the future they are made, especially when the period of future simulations exceeds the period of available pumping data.[1042] A general rule of thumb is that one can use a model to make a predictions with confidence for a period into the future equal to the period of data available to calibrate the model. For example, if one has ten years of data to build the model, it can generally be used to

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[1036] *See* Transcript, Vol.17 p. 3882:19–21; Vol.21 p. 4639:7–15 (Myers).
[1037] Exhibit No. GBWN_002, pp. 1, 42; Transcript, Vol.20 p. 4479:8–12 (Myers).
[1038] Transcript, Vol.18 p. 4090:5–24 (Myers).
[1039] Transcript, Vol.20 p. 4418:12–21, 4459:12–18 (Myers).
[1040] Transcript, Vol.9 p. 1975:1–19 (D'Agnese).
[1041] *See* Transcript, Vol.18 pp. 4105:15–4106:3, Vol.20 p. 4391:3–12, 4476:12–24 (Myers).
[1042] Transcript, Vol.20 pp. 4471:13–4472:19, Vol.21 p. 4645:6–11 (Myers); Transcript, Vol.24 p. 5421:8–14 (Bredehoeft); *see also* Exhibit No. GBWN_012, p. 1.

predict ten years into the future.[1043] This is known as history matching. Dr. Bredehoeft testified that predictions that go out a thousand years are beyond the possibility of history matching.[1044] Long-term model projections are subject to the greatest error.[1045]

The Applicant suggests that the model should be used to simulate up to 75 years of pumping. The Applicant argues that 75 years is the expected lifetime of the equipment and infrastructure for the proposed Project and that predictions beyond 75 years are made at a reduced confidence level.[1046] Ms. Mulroy and Mr. Holmes testified that 50 years is a proper planning horizon for water development projects because it allows for a reasonable enough timeframe to be able to look at what future demands are, ascertain what future conservation will be, and develop a resource plan.[1047]

Dr. Myers admits that predictions become uncertain for periods beyond 75 years and that the predictions are less certain for a 200-year period than for a 75-year period.[1048] Dr. Myers, however, does not believe that the Project will only last 75 years and, in any regard, suggests that even though the model predictions are uncertain, they provide the only tool available to examine trends far into the future.[1049] The State Engineer finds that model simulations of more than 75 years of pumping after full buildout are too uncertain to carry much weight.

As stated above, because of the uncertainty and regional nature of the models, the Applicant also suggests that predicted drawdowns of less than 50 feet and predicted reductions in

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[1043] *See* Transcript, Vol.24 p. 5422:21–25 (Bredehoeft).
[1044] Transcript, Vol.24 p. 5423:20–23 (Bredehoeft).
[1045] Transcript, Vol.24 pp. 5423:24–5424:1 (Bredehoeft).
[1046] Exhibit No. SNWA_337, p. 4-4.
[1047] Transcript, Vol.1 p. 71:5–18 (Mulroy); Transcript, Vol.2 pp. 307:24–308:19 (Holmes);
[1048] Transcript, Vol.17 p. 3780:3–5, Vol.20 pp. 4488:25–4489:3 (Myers).
[1049] Transcript, Vol.18 p. 4107:12–16; Vol.20 pp. 4418:22–4419:2 (Myers)

spring flow of less than 15 percent should not be considered.[1050] Dr. Myers suggests that the State Engineer examine drawdowns of 1 foot. However, he admits that such predictions are imprecise.[1051] Dr. Myers notes that even a 12-foot drawdown may result in springs going dry.[1052] He states that even though drawdowns of less than 10 feet, or even 20 feet, are within the scope of seasonable variability, they should be considered as superimposed on the existing seasonal variability.[1053] However, he also admitted that it may be proper not to consider drawdowns of less than ten feet.[1054]

In addition, NRS 534.110 states that groundwater rights "must allow for a reasonable lowering of the static water level" and the statute "does not prevent the granting of permits to applicants later in time on the ground that the diversions under the proposed later appropriations may cause the water level to be lowered at the point of diversion of a prior appropriator, so long as any protectable interests in existing domestic wells . . . and the rights of holders of existing appropriations can be satisfied under such express conditions." This suggests that a reasonable amount of drawdown over a long period of time will not prevent the State Engineer from granting a permit to appropriate groundwater. Therefore there is no need to examine simulated drawdowns of one foot, as Dr. Myers suggests. Simulated drawdowns of less than 50 feet are too uncertain to carry much weight.

**c. <u>Predictions from Myers' Model</u>**

Dr. Myers presents his results relative to the simulated steady state of his model. Thus, his results do not represent actual water levels or fluxes or changes from actual water levels or

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[1050] Exhibit No. SNWA_337, p. 6-1.
[1051] Transcript, Vol.18 p. 4107:12–16, Vol.20 pp. 4418:22–4419:2 (Myers).
[1052] Transcript, Vol.19 p. 4237:11-21 (Myers).
[1053] Transcript, Vol.21 p. 4634:5–8 (Myers).
[1054] Transcript, Vol.20 pp. 4477:2–4478:8 (Myers).

fluxes. Instead they represent changes from the simulated water levels or fluxes.[1055] Dr. Myers presented drawdown contours, spring flow hydrographs, and aggregate change in discharge and storage data. He did not, however, analyze—or even identify—the simulated effects of pumping on specific existing water rights.

In general, if groundwater is developed such that the amount pumped does not exceed perennial yield, a new equilibrium will be reached.[1056] Dr. Myers simulated recharge and discharge in Spring Valley such that the Applicant's proposed pumping exceeds recharge by 27 percent and discharge by 20 percent.[1057] This requires the pumping to induce inflow and reduce outflow.[1058] The assumption that pumping will exceed perennial yield leads to increased simulated impacts. In practice, the Applicant's pumping will not be permitted to exceed perennial yield. This means that either the Applicant must show that perennial yield is in fact equal or greater than its proposed pumping amounts or that the State Engineer will limit the Applicant's pumping to the perennial yield established by the evidence. Thus, Dr. Myers simulations generally overestimate impacts due to pumping.

Dr. Myers' simulations also overestimate impacts due to pumping because they do not account for any management decisions during the simulation period that would result in reduced pumping or shifts in pumping locations in order to protect existing water rights and environmental resources, or simply to conduct maintenance on pumping wells.[1059] This problem is not unique to Dr. Myers' simulations. Because the groundwater models do not simulate management decisions, they generally overestimate impacts.

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[1055] Exhibit No. GBWN_003, pp. 7–8.
[1056] Transcript, Vol.21 pp. 4596:4–4597:15 (Myers).
[1057] Exhibit No. GBWN_003, p. 4.
[1058] Exhibit No. GBWN_003, pp. 16, 27–28.
[1059] Transcript, Vol.18 pp. 4105:15–4106:3 (Myers); Transcript, Vol.20 pp. 4391:3–12, 4476:12–24 (Myers).

In addition, Dr. Myers' model failed to converge during transient simulations and had trouble simulating pumping in certain cells. Though the model failed to converge, Dr. Myers states that it almost converged and the failure to converge did not cause a water balance error.[1060] Four wells could not be pumped at their full amounts at the initial locations due to the presence of simulated low-conductivity zones, so Dr. Myers adjusted their locations.[1061] The State Engineer finds that these issues do not significantly reduce the reliability of Dr. Myers' model on their own, but further add to the uncertainty of the model.

Dr. Myers notes that in some cases the simulated drawdown at wells is greater than the layer bottom but that the model was allowed to continue the pumping simulation of these wells. This caused the simulation at these wells of drawdown cones that are deeper but less extensive than would realistically occur. Dr. Myers notes, however, that the difference is probably not substantial.[1062]

When examining the model simulations for a 75-year pumping period and looking at 50-foot drawdown contours, Dr. Myers' model simulation generally shows similar impacts as the Applicant's simulations.[1063] After 75 years of simulated pumping at the full application amounts, Dr. Myers model simulates a 50-foot drawdown area in central Spring Valley of about 10 by 15 miles in layer 2.[1064]

Dr. Myers also presents drawdown contours for 1-foot, 5-foot, 10-foot, and 20-foot drawdowns. Mr. Watrus and Ms. Drici argue that 1-foot contours are of no value due to their

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[1060] Exhibit No. GBWN_003, p. 6.
[1061] Exhibit No. GBWN_003, p. 6.
[1062] Exhibit No. GBWN_003, p. 7.
[1063] Transcript, Vol.18 pp. 4111:23–4112:12, Vol.19 p. 4260:9–14 (Myers).
[1064] Exhibit No. GBWN_003, p. 8.

uncertainty.[1065] Dr. Myers admits that there is imprecision in one-foot drawdowns, as well as all drawdown contours.[1066] He admits that anything within ten feet is within seasonable variability and measurement accuracy.[1067] However, he argues that the predicted drawdowns are superimposed on the seasonable variability and measurement accuracy and should still be considered. He argues that even a lowering of one foot could dry up a spring but does not provide evidence as to what springs would be impacted in such a way.[1068]

The groundwater model simulations have a high level of uncertainty. The uncertainty increases as smaller impacts are considered. The models are not designed to make local-scale predictions. As Dr. Myers admits, ten foot drawdowns are within the scope of seasonal and measurement variability. When a drawdown is within seasonal or measurement variability, that means there is no way to tell whether the drawdown is real or is being caused by measurement error, for example. Therefore, little is gained by examining drawdown contours of less than 50 feet. Simulated drawdowns of 50 feet and greater, though still uncertain, represent a higher level of certainty that impacts will occur in those areas. Thus, Dr. Myers' drawdown contours of less than 50 feet will be given little weight. Furthermore, 50-foot drawdowns provide a good general picture of what the effects of pumping will look like on a regional scale. In addition, the Applicant's conflicts analysis utilized 50 foot drawdowns to analyze impacts to specific existing rights. Dr. Myers did not conduct an analysis of effects on specific existing rights at all. Thus, the Applicant's conflicts analysis using 50-foot drawdowns provides the only available comprehensive analysis of conflicts to specific existing rights available.

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[1065] Exhibit No. SNWA_407, p. 3.
[1066] Transcript, Vol.18 p. 4107:11–16 (Myers).
[1067] Transcript, Vol.20 pp. 4477:2–4478:8 (Myers).
[1068] Exhibit No. GBWN_003, p. 7; Transcript, Vol.19 p. 4237:11-21 (Myers).

But, even considering Dr. Myers' drawdown contours of less than 50 feet, the impacts simulated due to the proposed Spring Valley pumping appear reasonable. Dr. Myers' model simulates the ten-foot drawdown due to pumping in Spring Valley as essentially contained within Spring Valley.[1069]

Dr. Myers also provides simulated impacts for pumping periods beyond 75 years. The Applicant limited simulations to 75 years of pumping because that is the expected life of the equipment and infrastructure and because predictions become increasingly uncertain the further into the future they are made. Little is gained by examining pumping simulations of greater than 75 years. Dr. Myers Spring and Snake Valley Model is already extremely coarse and uncertain. Simulations beyond 75 years become more uncertain. In addition, 75-year simulations provide the State Engineer with an adequate basis to determine the probable impacts of pumping. The Applicant's conflicts analysis utilized a 75-year simulation combined with a qualitative analysis to analyze impacts to specific existing rights. Dr. Myers did not conduct an analysis of effects on specific existing rights at all. Thus, Dr. Myers' simulated impacts for pumping periods of more than 75 years will be given little weight.

By 100 years, Dr. Myers' model simulates that Cleve Creek Springs and Millick Springs go dry.[1070] The Applicant also simulates impacts to Cleve Creek Springs and Millick Springs.[1071] Dr. Myers' model, however, simulated Cleve Creek Springs at less than half his targeted rate at steady state.[1072] It is likely that Dr. Myers groundwater model does not accurately simulate the local hydrogeology that controls the Cleve Creek Springs. Dr. Myers' model is not designed to

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[1069] Exhibit No. GBWN_003, p. 9.
[1070] Exhibit No. GBWN_003, pp. 14–15.
[1071] Exhibit No. SNWA_337, pp. 6-9 to 6-10.
[1072] Exhibit No. GBWN_002, p. 38.

make local scale simulations. Dr. Myers admits that there is stratified lithology in the area of Cleve Creek and that flow in the fan may be partly perched.[1073] Thus, the State Engineer finds that Dr. Myers' simulation of drying of Cleve Creek Springs is not reliable.

After 200 years of simulated pumping at the full application amounts, Dr. Myers model simulates a 50-foot drawdown area in central Spring Valley of about 15 by 15 miles and a smaller 50-foot drawdown area in southern Spring Valley in layer 2.[1074] Even looking at Dr. Myers' ten-foot drawdown, simulated impacts are contained within Spring Valley and the western edge of Hamlin Valley.[1075]

Dr. Myers testified that a small amount, approximately 3,000 afa, of water is induced to flow into Spring Valley from Steptoe Valley after 200 years of simulated pumping.[1076] After 200 years, Dr. Myers model simulates essentially no impacts to Deep Creek Valley, Tippett Valley, or the Eskdale Center.[1077] Though such predictions are highly uncertain, it is worth noting that even after 200 years of simulated pumping, South Spring Valley Springs and Big Springs continue to flow in Dr. Myers' simulation.[1078] Simulated flow at South Spring Valley Springs has reduced to about 2,000 afa from about 15,000 afa after 200 years.[1079] This impact is likely exaggerated due to Dr. Myers' use of a low-conductivity groundwater divide in Spring Valley.[1080]

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[1073] Exhibit No. GBWN_001, p. 39; Transcript, Vol.20 p. 4492:3–12 (Myers).
[1074] Exhibit No. GBWN_003, p. 8.
[1075] Exhibit No. GBWN_003, p. 10.
[1076] Transcript, Vol.18 p. 4119:5–10 (Myers).
[1077] Transcript, Vol.20 pp. 4415:19–4419:11, Vol.21 p. 4666:7–16 (Myers).
[1078] Exhibit No. GBWN_003, p. 15.
[1079] Exhibit No. GBWN_003, p. 23.
[1080] *See* Transcript, Vol.20 pp. 4343:24–4344:11 (Myers).

Dr. Myers' model simulates flow at Big Springs decreasing from about 1,500 afa to about 1,100 afa after 200 years.[1081] However, Dr. Myers' simulated flow at Big Springs is unreliable. Recent observed flow at Big Springs has ranged from about 9.5 to 10.5 cubic feet per second,[1082] or to about 6,900 to 7,600 afa. Dr. Myers used a target discharge rate for Big Springs of 443,000 cubic feet per day or about 3,700 afa.[1083] Dr. Myers' pre-development target is thus about half of the actual observed flow at Big Springs post-development. Moreover, Dr. Myers' model simulated initial discharge at Big Springs as less than half his target discharge rate—about 1,500 afa.[1084] Dr. Myers' simulated reduction in flow is only about 10 percent of the target rate for Big Springs and only about 5 percent of the actual observed flow at Big Springs after 200 years.[1085] The State Engineer does not have confidence in Dr. Myers' conceptualization of Big Springs. Though Dr. Myers concludes that development is presently impacting Big Springs, he mistakenly believed that development to the southeast was to the west of Big Springs and he did not thoroughly investigate development in the area.[1086] In addition, the impact to Big Springs is likely exaggerated due to Dr. Myers' use of a high-conductivity corridor from Steptoe and Lake Valleys, through southern Spring Valley, and into Hamlin and southern Snake Valley, as discussed above.[1087]

Even after 1,625 years of simulated pumping, the 50-foot drawdown contour of Dr. Myers model is essentially contained in Spring and Hamlin Valleys.[1088] After 10,200 years of pumping, Dr. Myers' model is close to a new equilibrium. It simulates 1,310 afa being pumped

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[1081] Exhibit No. GBWN_003, p. 24; Transcript, Vol.20 pp. 4384:24–4385:8 (Myers).
[1082] Transcript, Vol.20 pp. 4376:16–4379:21 (Myers).
[1083] Exhibit No. GBWN_002, p. 38.
[1084] Exhibit No. GBWN_002, p. 38; Transcript, Vol.20 pp. 4380:18–4382:19 (Myers).
[1085] Transcript, Vol.20 pp. 4387:9–4389:17 (Myers).
[1086] Transcript, Vol.20 pp. 4370:11–4379:21 (Myers).
[1087] Exhibit No. SNWA_407, p. 6.
[1088] Exhibit No. GBWN_003, pp. 25–26.

from storage, or about 1.4 percent of the pumping amount. The model simulates that over 90,000,000 acre-feet are removed from storage after 10,200 years of continuous pumping.[1089] Dr. Myers states that his model simulated an increase in inflow from Steptoe Valley and Lake Valley and a decrease in outflow to Snake Valley and Tippett Valley due to pumping at the full application amounts.[1090] Even after long-term pumping simulations, Dr. Myers testified that there are essentially no predicted impacts to the reservation of the Confederated Tribes of the Goshute Reservation.[1091]

Dr. Myers also simulated pumping at 60,000 and 30,000 afa in his Spring and Snake Valley model by reducing the rate of each well proportionately.[1092] Reducing the pumping rates decreases the drawdown extent of the five-foot contour in the north of Spring Valley by about 2 to 5 miles and significantly reduces the extent of drawdown in the southern part of Spring Valley. The 50-foot drawdown contour is decreased more substantially.[1093] The lower pumping rates approach equilibrium faster and remove less water from storage.[1094] The lower rates reduce simulated discharge at springs more slowly.[1095]

In addition, Dr. Myers provided many simulations of pumping at alternative points of diversion.[1096] At this time, the State Engineer is only considering the points of diversion for the Applications before him. If the Applicant wishes to change the points of diversion of the Applications, it must submit further applications to change the points of diversion to the State Engineer pursuant to NRS 533.345. If such applications are submitted, the State Engineer will

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[1089] Exhibit No. GBWN_003, p. 24.
[1090] Exhibit No. GBWN_003, pp. 16, 27–28.
[1091] Transcript, Vol.26 pp. 5957:7–5958:6 (Myers).
[1092] Exhibit No. GBWN_003, p. 7.
[1093] Exhibit No. GBWN_003, pp. 16–19.
[1094] Exhibit No. GBWN_003, p. 20.
[1095] Exhibit No. GBWN_003, pp. 21–22.
[1096] *See* Exhibit No. GBWN_105; Exhibit No. CTGR_014.

consider pumping at the new points of diversion. Alternative points of diversion are irrelevant to the analysis of whether the proposed pumping unreasonably conflicts with existing rights for this hearing.

Dr. Myers also presents simulations of recovery after pumping ceases. Dr. Myers' model simulates that full recovery does not occur within 600 years. However, drawdowns of 50 feet and greater are greatly reduced after 230 years of recovery and essentially eliminated after 600 years of recovery.[1097] After about 230 years of recovery, Millick and Cleve Creek Springs begin to flow again in Dr. Myers' model. After 600 years of recovery, spring discharge in Spring Valley has mostly recovered.[1098] The State Engineer is not required to specifically consider recovery once pumping ceases. However, Dr. Myers' simulation essentially shows that recovery is possible, though it may take longer than the period of pumping.

Dr. Myers's model simulates that Big Springs discharge reaches its minimum about 150 years after pumping ceases and the basin is allowed to recover.[1099] Recovery then occurs slowly in his model, with the rate still being less than 85% of the steady state rate 600 years after pumping ceases.[1100] These extreme time periods suggest there may be a problem in Dr. Myers' model representation of Big Springs that leads to these extreme lag times.

In sum, Dr. Myers' simulations do not alter the State Engineer's analysis of impacts. The impacts simulated by Dr. Myers are all highly uncertain or unreasonable given the amount of simulated drawdown or reduction in flow spread over hundreds or thousands of years. In

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[1097] Exhibit No. GBWN_003, pp. 11–14.
[1098] Exhibit No. GBWN_003, p. 15.
[1099] Exhibit No. GBWN_003, p. 14.
[1100] Exhibit No. GBWN_003, p. 24.

addition, any predicted impacts may be dealt with through monitoring, management, and mitigation as discussed above.

In conclusion, based on the evidence in the record, including but not limited to that cited above, the State Engineer finds that pumping under the Applications will not conflict with existing rights, will not unreasonably lower the static water table, and will not interfere with protectable interests in existing domestic wells.

**5. <u>Addressing Uncertainty</u>**

Although the State Engineer has set the perennial yield of Spring Valley to an amount that is approximately five percent lower than the Applicant's suggested perennial yield (94,800 afa to 90,000 afa), to further protect against over-appropriation of the groundwater resource, staged development of the Applications is required. Staged development is also necessary to assure the Applications will not conflict with existing rights or domestic wells, and to assure pumping is environmentally sound. A staged and gradual lowering of the water table will assure the Project is environmentally sound and that the propagation of effects will be observed by the hydrologic monitoring network well in advance of any possible effects impacting the existing rights in Spring Valley. However, a significant amount of initial pumping is required to discern pumping effects and provide reliable transient state data and information to calibrate a groundwater model for local-scale applications. To achieve this purpose, the State Engineer will require two staged development plans, a plan for Applications 54016, 54017, 54018 and 54021, located on the Cleve Creek alluvial fan near the Cleveland Ranch; and a plan for the remaining applications.

For Applications 54016, 54017, 54018, and 54021, initial development will be limited to 500 afa per well. This pumping rate is less than the 500 gpm, or 807 afa, used during the aquifer test the Applicant conducted on the Cleve Creek alluvial fan, which indicated no significant drawdown at an observation point 110 feet from the test well. The Applicant shall complete tests concurrent with this development and any subsequent development of these Applications that are sufficient for the State Engineer to determine that pumping more than 500 afa at the current points of diversion will not cause impacts to CPB existing water rights. Prior to any additional diversions, the Applicant will construct and calibrate a local-scale groundwater model with pumping stresses using a much finer grid space; develop an Operations Plan for these four applications; submit to the State Engineer model projections, using the local scale model, that evaluates impacts from pumping additional volumes of water pursuant to the pumping schemes in the Operations Plan; and receive approval of the Operations Plan from the State Engineer.

For the remaining Applications, half of the amount permitted under the Appliations, 38,500 afa, will be initially developed over a five year period where the Applicant will be required to pump at least 85 percent, but not more than 100 percent of the 38,500 afa (32,725 afa to 38,500 afa). The 85 to 100 percent range of required pumping will provide the Applicant needed flexibility in the maintenance and operation of the production wells and appurtenant facilities, while at the same time ensuring sufficient pumping stresses. These pumping stresses will allow for collection of reliable transient state data and effective calibration of the Applicant's groundwater model. The second stage of development will authorize the Applicant to pump an additional 19,431 afa, which represents half of the remaining permitted groundwater. The Applicant will be required to pump at least 85 percent (49,241 afa), but not more than 100 percent (57,931 afa) for a five year period. The procedure will be repeated for stage three, which will require the Applicant to pump 85 percent, but not more than 100 percent of 67,431 afa, which represents an additional half of the remaining permitted groundwater. The fourth stage of development will allow the Applicant to develop the remaining permitted groundwater. Pumping during the fourth stage may be adjusted by the State Engineer to reflect the outcome of the additional five years of ET data collection and analysis by the Applicant. Based on the evidence in the record, including but not limited to that cited above, the State Engineer finds that staged development of the resource allows for further data collection to alleviate any uncertainty associated with the current analyses related to conflicts to existing rights, domestic wells, environmental soundness, as well as the perennial yield of the resource.

## VI. PUBLIC INTEREST

According to NRS 533.370 the State Engineer must reject an application if the proposed use "threatens to prove detrimental to the public interest." There are many elements that comprise the public interest, both on a statewide level and on a county specific basis. Evidence was presented by the Applicant and the Protestants regarding economic and environmental factors and tribal concerns. The economic and tribal concerns are addressed here, while the environmental issues are addressed below in the Environmental Soundness section.

### A. Economic Public Interest Issues

Both the Applicant and the Protestants presented evidence regarding the economic effects of approving or denying the Applications. As described in detail above in this ruling, the Applicant anticipates a significant shortage in water supply in southern Nevada absent water from these Applications.[1101] The Applicant called Jeremy Aguero to testify to the possible economic consequences of a water shortage. Mr. Aguero is a principal analyst at Applied Analysis, an economic and fiscal policy research firm, and was qualified by the State Engineer as

[1101] Exhibit No. SNWA_022, pp. 2–3.

an expert in economic analysis.[1102] He explained that the exact economic impacts of a future shortage cannot be forecasted.[1103] However, any water shortage will likely result in economic impacts in southern Nevada.[1104] The exact nature of the water limitation could be anything that leads to a water shortage in southern Nevada, including drought or the failure to construct the groundwater Project in order to meet demand.[1105] Mr. Aguero provided a range of economic impacts over a three-year period from a 1.7 percent to 10.5 percent reduction in economic output based on a water supply limitation.[1106] However, he did not attempt to tie these percentage declines to any specific amounts of decline in the water supply.[1107]

Mr. Aguero opined that the effects of such a water limitation in southern Nevada would be "devastating."[1108] The total economic output in the Las Vegas-Paradise metropolitan statistical area was $91.7 billion in 2009.[1109] Using the predicted range of declines in economic output, the southern Nevada region's annual economic output would decline by $1.6 billion to $9.6 billion due to a water supply interruption.[1110]

As of March 2011, the Las Vegas-Paradise metropolitan statistical area had approximately 800,000 employees.[1111] Using the predicted range of declines in economic output, the southern Nevada region would suffer 14,000 to 84,000 jobs lost.[1112] This would also

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[1102] Exhibit No. SNWA_021; Transcript, Vol.15 pp. 3477:20-3478:6 (Aguero).
[1103] Transcript, Vol.15 pp. 3544:10-21 (Aguero).
[1104] Exhibit No. SNWA_022, pp. 6–7.
[1105] Transcript, Vol.15 p. 3483:11-25 (Aguero).
[1106] Exhibit No. SNWA_022, p. 8.
[1107] Transcript, Vol.15 pp. 3544:22-3546:24 (Aguero).
[1108] Transcript, Vol.15 p. 3484:1-5 (Aguero).
[1109] Exhibit No. SNWA_022, p. 6.
[1110] Exhibit No. SNWA_022, p. 9.
[1111] Exhibit No. SNWA_022, p. 6.
[1112] Exhibit No. SNWA_022, p. 9.

result in a decline in the area's wages and salaries by $480 million to $3.0 billion, or $590 million to $3.6 billion if payments such as employer contributions to pensions are included.[1113]

Mr. Aguero testified that every business in southern Nevada is dependent on a reliable supply of water.[1114] Uncertainty in water supply—both real and perceived—discourages business investment in southern Nevada.[1115] In addition, 10-k forms show that many businesses in southern Nevada are concerned with the stability of their water supply.[1116]

Any impact to the hospitality and tourism sector will affect the entire state. Southern Nevada's largest single sector in terms of gross domestic product, employment and wages and salaries is the tourism and hospitality sector. This sector is heavily dependent on water.[1117] Southern Nevada draws nearly 40 million visitors per year who account for nearly 16 percent of statewide sales and use tax.[1118] Approximately 18 percent of the visitors to Las Vegas are international.[1119] The average visitor to Las Vegas spends approximately $1,018 per trip or $220 per day.[1120] Nevada's resort industry provides approximately 46.2 percent of state general fund tax revenues through the payment of more than $2 billion annually in sales tax, property tax and gaming tax.[1121] Water limitations in southern Nevada would likely result in a decline in hotel occupancy.[1122] Mr. Aguero testified that for every one percent decline in occupancy, Las Vegas hotels and casinos would lose $163 million.[1123]

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[1113] Exhibit No. SNWA_022, p. 10.
[1114] Transcript, Vol.15 pp. 3489:18-3490:1 (Aguero).
[1115] Exhibit No. SNWA_022, pp. 10, 18; Transcript, Vol.15 pp. 3497:7-3499:22 (Aguero).
[1116] Exhibit Nos. SNWA_025 through SNWA_031.
[1117] Exhibit No. SNWA_022, p. 10.
[1118] Exhibit No. SNWA_022, p. 13.
[1119] Exhibit No. SNWA_393, p. 8.
[1120] Exhibit No. SNWA_393, p. 21.
[1121] Exhibit No. SNWA_022, p. 13.
[1122] Transcript, Vol.15 pp. 3493:11-3495:24 (Aguero).
[1123] Transcript, Vol.15 p. 3496:6-21 (Aguero).

In addition, impacts to southern Nevada would be felt statewide via effects on tax revenue. Nevada already reports the largest general fund deficit percentage in the nation at a $1.5 billion shortfall for fiscal year 2012.[1124] Clark County accounts for 74 percent of statewide sales tax. In general, approximately three-quarters of major fiscal revenues from other sources, such as room tax, gaming tax and property tax are collected in Clark County, with the remaining 16 counties in the state accounting for about one-fourth.[1125] An economic output decline of 1.7 percent due to water uncertainty would result in at least a 9.7 percent decline in local and state government fiscal revenues.[1126]

The economic benefit to southern Nevada of a water supply secured by these Applications would be shared by Lincoln and White Pine Counties. Mr. Aguero notes that Lincoln and White Pine Counties stand to see an influx of investment for construction, management, and design of the Project which would generate thousands of jobs and other direct and indirect beneficial economic impacts throughout the areas of the Project.[1127] Under Nevada's education funding plan, tax generated in Clark County subsidizes per-student funding in Lincoln and White Pine Counties. Under Nevada's Medicaid Disproportionate Share Hospital allocation system, Clark County provides financial support in excess of its share to hospitals throughout rural Nevada. In addition, Lincoln and White Pine Counties are Guaranteed Counties which are subsidized by Point of Origin Counties like Clark County under Nevada's consolidated tax system.[1128] Under this system in 2009, Clark County subsidized the balance of

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[1124] Exhibit No. SNWA_022, p. 14.
[1125] Exhibit No. SNWA_022, p. 13.
[1126] Exhibit No. SNWA_022, pp. 13–-14.
[1127] Exhibit No. SNWA_393, p. 2.
[1128] Exhibit No. SNWA_393, p. 3.

the state by approximately $704 million.[1129] Should Clark County no longer be able to provide as much revenue to these systems, Lincoln and White Pine County will experience a negative impact.

Mr. Aguero concludes that the perception that southern Nevada does not have sufficient water resources has the potential to cause dramatic loss of jobs, loss of income, and decline in Nevada's economy.[1130] He determined that receiving water from the Applications would protect 290,000 jobs, $11.5 billion in wages and salary payments, and $37.5 billion in economic activity.[1131] Mr. Aguero opined that the failure to secure a stable water supply for southern Nevada could slow the state's fragile economic recovery or put Nevada into a relatively significant recession.[1132] As noted, impacts to southern Nevada will affect the entire state.[1133] The public interest will be served by the Applicant's proposed Project in many ways.

The Protestants do not dispute the economic figures and predictions provided by Mr. Aguero. GBWN's economics expert Dr. Maureen Kilkenny presented evidence in an attempt to show the potential economic detriment that Lincoln and White Pine Counties may suffer due to the proposed Project. Further, she too acknowledged the strength of perceptions regarding the economy and that southern Nevada suffers from the same threat of expectations if the denial of these Applications leads to fear of a future shortage.[1134]

Through her reports and testimony, Dr. Kilkenny advanced a passionate plea, concluding that approving the Applications would result in the loss of all water, even existing water rights,

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[1129] Transcript, Vol.15 p. 3508:11-19 (Aguero).
[1130] Transcript, Vol.15 pp. 3536:16-3537:11 (Aguero).
[1131] Transcript, Vol.15 pp. 3537:12-3538:2 (Aguero).
[1132] Transcript, Vol.15 pp. 3538:21-3540:9 (Aguero).
[1133] Transcript, Vol.15 pp. 3540:10-3541:3 (Aguero).
[1134] Transcript, Vol.22 pp. 4988:6-4989:16, 5010:11-23 (Kilkenny).

not only in the Project basins, but on a countywide basis in White Pine and Lincoln Counties.[1135] None of these assertions are supported by hydrologic evidence. Dr. Kilkenny's initial report suggests an economic loss of $74 million annually and a loss of about 3,400 jobs if the Applications are approved.[1136] Both in her report and in her testimony she states that these estimates likely underestimate the actual values at risk.[1137] She further states that the mere threat of the proposed groundwater project may already be causing negative economic effects in Lincoln and White Pine Counties.[1138] Her analysis, however, is misplaced and overbroad in that it is premised upon the erroneous belief that approving these Applications will "strip the water" from Lincoln and White Pine Counties and her understanding that "[i]t appears that the land becomes useless without the water in this location."[1139]

Dr. Kilkenny presented evidence that White Pine County has a population of 10,030 and employs 5,074 people.[1140] Dr. Kilkenny concludes that 19 percent of jobs in White Pine County depend on water in the county—the mining, ranching and farming, forestry, and hunting sectors.[1141] She states that tourism, recreation, and retail activity are associated with these sectors.[1142] She estimates a total employment impact of 2,676 jobs lost in the county due to a total loss in local water.[1143] She defers to the evidence submitted by the Applicant with regard to the actual population of Spring Valley.[1144] While the analysis in Dr. Kilkenny's report focused on impacts to the counties as a whole, during her testimony she suggested that based upon her

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[1135] Exhibit No. GBWN_066; Transcript, Vol.22 p. 4989:17-25 (Kilkenny).
[1136] Exhibit No. GBWN_066, p. 17.
[1137] Exhibit No. GBWN_066, p. 17; Transcript, Vol.22 p. 5008:11-17 (Kilkenny).
[1138] Exhibit No. GBWN_114, p. 2.
[1139] Transcript, Vol.22 pp. 5008:18-5009:22 (Kilkenny).
[1140] Exhibit No. GBWN_066, p. 4.
[1141] Exhibit No. GBWN_066, p. 5.
[1142] Exhibit No. GBWN_066, p. 5.
[1143] Exhibit No. GBWN_066, p. 5.
[1144] Transcript, Vol.22 p. 5028:10-13 (Kilkenny).

understanding of the evidence presented at the hearing the scope of impacts may not be as broad as what was suggested in her report. To remedy this problem, she suggested that the State Engineer could "scale" her estimated impacts.[1145] However, even this suggestion is misplaced as it appears to be, at least in part, based upon the belief that even agricultural production using existing water rights will be eliminated if the Applications are granted.[1146]

Similar to White Pine County, Dr. Kilkenny presented evidence that Lincoln County has a population of 5,345 and employs 2,172 people.[1147] Dr. Kilkenny concludes that 10 percent of jobs in Lincoln County depend on water in the county—the mining, ranching and farming, forestry, hunting, and recreation sectors.[1148] She states that tourism, recreation, and retail activity are associated with these sectors.[1149] She estimates a total employment impact of 746 jobs lost in the county due to a total loss of groundwater.[1150] The Lincoln County analysis has the same flaws as the White Pine County estimates.

Dr. Kilkenny's countywide analysis is derived from economic values for groundwater in the basins from: (1) income and employment which she estimates as directly related to the use of water by businesses such as agriculture and mining; (2) expenditures of the hunters and recreational users required to enjoy the natural resources; (3) indirect or inter-industry multiplier linkages that arise when businesses or people involved in direct use buy local inputs or services, or pay local employees; (4) the non-market use value that people who visit the areas derive from

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[1145] Transcript, Vol.22 p. 5031:10-20 (Kilkenny).
[1146] Transcript, Vol.22 pp. 4997:16-4998:15, 5033:15-5034:7, 5041:6-5042:6 (Kilkenny).
[1147] Exhibit No. GBWN_066, p. 6.
[1148] Exhibit No. GBWN_066, p. 6.
[1149] Exhibit No. GBWN_066, p. 6.
[1150] Exhibit No. GBWN_066, p. 7.

experiencing the natural amenities; and (5) the non-use non-market value that people anywhere place on the existence of the natural amenities.[1151]

Dr. Kilkenny did not provide an analysis of the economic activity specific to Spring Valley, but concludes that the groundwater in the counties have an agriculture production value of $30,511,000 with an additional indirect value of $22,273,030.[1152] Thus, Dr. Kilkenny's concludes that the agricultural sector in the two counties has a value of $53 million and supplies 518 jobs.[1153] Dr. Kilkenny concludes in her report that the groundwater in the Project basins has a hunting and fishing expenditure value of $4,900,000 with an additional indirect value of $3,000,000 for a total of $7.9 million annually.[1154] To arrive at this number, she assumes that each hunter in the area spent $70 per day and then uses an output multiplier to account for indirect effects.[1155] She testified that her report, in general, was not original work and was not prepared using the process she would have for original work.[1156] In particular with regard to the values for hunting and fishing she testified that she relied upon the prior work of Karen Rajala for the basis of these figures.[1157] On cross examination this information was shown to have both minor and significant errors and in the words of Dr. Kilkenny "relatively sloppy reporting."[1158]

Dr. Kilkenny concludes that the groundwater in the Project basins supports a park visitation expenditure value of $6,750,000 with an additional indirect value of $4,000,000.[1159] As described below, the State Engineer finds this conclusion unsupported. Dr. Kilkenny finds

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[1151] Exhibit No. GBWN_066, p. 3.
[1152] Exhibit No. GBWN_066, p. 4.
[1153] Exhibit No. GBWN_066, p. 8.
[1154] Exhibit No. GBWN_066, pp. 4, 10.
[1155] Exhibit No. GBWN_066, p. 10.
[1156] Transcript, Vol.22 pp. 4994:2-4, 5020:7-5021:7 (Kilkenny).
[1157] Transcript, Vol.22 pp. 4999:16-5002:9, 5043:6-5053:4 (Kilkenny).
[1158] Transcript, Vol.22 pp. 5043:6-5053:4 (Kilkenny).
[1159] Exhibit No. GBWN_066, p. 4.

that there are 55,633 party visitor days to the Great Basin National Park and assumes that each party spends $70 per day for a total of $3.89 million.[1160] After applying a multiplier to account for indirect effects, she concludes that the total economic annual impact of visitors to Great Basin National Park is $6.2 million.[1161] However, as with the valuations for hunting and fishing, her testimony related to Park visitation revealed that although she had based her work upon the information obtained in 2006 by Ms. Rajala she had again departed from that base data, resulting in Dr. Kilkenny's conclusion of a larger possible impact.[1162] Though Ms. Rajala assumed the loss in visitors would be 25%, in her calculations, Dr. Kilkenny assumed there would be a 100% loss in visitors if the Applications were granted. Again, she suggested in testimony that her use of 100% rather than 25% would allow for the "people to scale linearly."[1163] It is noted by the State Engineer that Dr. Kilkenny admitting during her testimony that the term "scaling" was not used in her report,[1164] and that the Applicant was therefore denied a meaningful opportunity to address whether such "scaling" would be appropriate.

In Spring Valley, Dr. Kilkenny conceded to an error of an order of magnitude, tenfold, regarding her calculation of visitation to Cleve Creek.[1165] Thus, her calculations regarding Cleve Creek and Mt. Moriah Wilderness Area were also incorrect. Dr. Kilkenny relied upon Ms. Rajala's assumption that each visitor party spends $70 per day, and even though Dr. Kilkenny did not know the basis for that figure, and could not explain it, Dr. Kilkenny chose to adopt it.[1166]

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[1160] Exhibit No. GBWN_066, p. 10.
[1161] Exhibit No. GBWN_066, p. 11.
[1162] Transcript, Vol.22 pp. 5053:5-5056:19 (Kilkenny).
[1163] Transcript, Vol.22 p. 5055:19-25 (Kilkenny).
[1164] Transcript, Vol.22 pp. 5078:17-5079:10 (Kilkenny).
[1165] Transcript, Vol.22 pp. 5001:24-5002:9, 5056:21-5058:5 (Kilkenny).
[1166] Transcript, Vol.22 pp. 4999:16-5000:25, 5053:20-5055:3 (Kilkenny).

Mr. Aguero, however, notes that the $70 is actually based on the National Park Service's figure of $67.85 per party day expenditures for the camp-in segment. Mr. Aguero notes that the nature of the recreational areas at issue may be closer to the back-country camper segment, which the National Park Service determined a per party day expenditure of $31.43.[1167] Mr. Aguero suggests that even this number is high as it includes $6.54 for souvenirs and $6.25 for restaurants and bars, which do not exist within Spring Valley. Mr. Aguero suggests that a more realistic number for visitor per day expenditure might be $20.[1168] The State Engineer recognizes the significant value of Great Basin National Park to Nevada and the country, but finds that the per party day expenditures at Great Basin National Park or at the other parks and recreation areas cannot be determined based on the evidence presented by Dr. Kilkenny. The State Engineer does not find Dr. Kilkenny's work persuasive or credible and it has been given little weight. Likely the true value lies somewhere within the range presented. However, whether it is truly closer to $70 or $20, it does not alter the final analysis of the public interest criterion.

Dr. Kilkenny concludes that the groundwater in the project basins has a recreational non-market value of $756,000.[1169] This is the economic value that people who visit the areas derive from their experience.[1170] Dr. Kilkenny admits that these values are difficult to measure.[1171] To do so, she relies on a benefit transfer study performed by Dr. Moeltner in 2006.[1172] Dr. Moeltner himself relied on a benefit transfer study done by Rosenberger and Loomis in 2001.[1173] The Rosenberger and Loomis study provided benefit measures for 21 recreational activities based on

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[1167] Exhibit No. SNWA_393, pp. 19-20.
[1168] Exhibit No. SNWA_393, pp. 20-21.
[1169] Exhibit No. GBWN_066, p. 4.
[1170] Exhibit No. GBWN_066, p. 14.
[1171] Exhibit No. GBWN_066, p. 14.
[1172] Exhibit No. GBWN_066, p. 14.
[1173] Exhibit No. GBWN_068, p. 11.

individual studies but was not designed to estimate benefits for a specific site or policy context.[1174] Dr. Moeltner took the average of the study's per person, per visitation day values for camping ($40) and picnicking ($45.50) to arrive at a figure of approximately $42.[1175] He computed low and high ends for the range of $6 to $202 and noted that he would expect the actual benefits to be in the lower half of the range.[1176] Adopting a per visitation day use-value of $42 and rounding up the visitation counts in the Cleve Creek Campground and the Sacramento Pass Recreation Area to 6,000 and 12,000 respectively, Dr. Kilkenny finds that the non-market use values for these areas is $756,000 per year.[1177]

Mr. Aguero points out that Dr. Kilkenny has assigned a visitor expenditure value for visitors to Cleve Creek as well as a non-market value for visitors to Cleve Creek Campground. This may result in some double-counting of economic value.[1178] He also notes that this value does not refer to any real money that is actually spent by anyone and that this value does not correspond to any actual jobs.[1179] Dr. Kilkenny agrees but argues that it has value even though no one pays.[1180]

Dr. Kilkenny's report concludes that the groundwater in the project basins has an existential non-market non-use value of approximately $2,000,000.[1181] Non-market non-use value refers to the value that people anywhere in the world place on knowing that certain natural amenities exist, even if they will never personally visit them. Dr. Kilkenny relied on Dr. Moeltner's 2006 meta-regression benefit transfer study to estimate the non-market non-use value

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[1174] Exhibit No. GBWN_068, p. 12.
[1175] Exhibit No. GBWN_068, p. 12.
[1176] Exhibit No. GBWN_068, p. 12.
[1177] Exhibit No. GBWN_066, pp. 14-15.
[1178] Exhibit No. SNWA_393, p. 24.
[1179] Transcript, Vol.15 pp. 3525:5-3526:3 (Aguero).
[1180] Transcript, Vol.22 p. 5002:20-23 (Kilkenny).
[1181] Exhibit No. GBWN_066, p. 4.

of the Swamp Cedar Natural Area and the Shoshone Ponds Natural Area.[1182] However, as with the information she relied upon from Ms. Rajala, Dr. Kilkenny failed to include all of the foundational information in her report or completely describe the limitations of Dr. Moeltner's study.[1183] Consequently, the State Engineer finds Dr. Moeltner's original report, which explains its limitations, rather than Dr. Kilkenny's summary of it, of greater assistance.

Dr. Moeltner used nine surveys of willingness-to-pay to develop his regression. He recognizes that this sample is smaller than ideal.[1184] In addition, Dr. Moeltner relied on survey studies on areas in Kentucky, Nebraska, California, Wisconsin, South Dakota, Minnesota, West Virginia, and Canada.[1185] The studies did not address areas in Nevada or Utah. He notes that the assumption that the underlying study populations have the same preferences for wetland preservation as households in the Great Basin is questionable.[1186] He further notes that the small sample size and lack of detailed information on specific attributes of the wetland areas prevented a thorough examination of the effect of features other than acreage. He states that "[e]ach of the wetlands underlying these studies is unique in some sense, and wetland size in acres alone is not necessarily a reliable proxy for wetland quality attributes."[1187] Dr. Moeltner even finds problems with the acreage factor, noting that "the true impact of wetland size on [willingness-to-pay] is not well captured by our model."[1188]

Dr. Moeltner developed a willingness-to-pay estimate for Nevada and Utah households of $1.35 based on his meta-regression. Dr. Moeltner's willingness-to-pay estimate for just Nevada

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[1182] Exhibit No. GBWN_066, p. 15.
[1183] Transcript, Vol.22 pp. 5064:8-5074:25 (Kilkenny).
[1184] Exhibit No. GBWN_068, p. 6.
[1185] Exhibit No. GBWN_068, p. 16.
[1186] Exhibit No. GBWN_068, p. 10.
[1187] Exhibit No. GBWN_068, p. 10.
[1188] Exhibit No. GBWN_068, p. 10.

households was $1.20 and his estimate for just the four counties surrounding the wetlands was $0.61.[1189] He assumes that one percent of the population on Nevada and Utah also actually visit the sites "[i]n the absence of any existing information on actual visitation," but does not address this potential for double counting non-market non-use and non-market use values.[1190] Dr. Kilkenny adopts the average willingness to pay of $1.35 per household per year and applies it to every household in Utah and Nevada for a total estimated non-market non-use value of $1,966,122.[1191] While testifying, in addition to agreeing with the caveats contained in the original work, Dr. Kilkenny also discussed some additional limitations and pitfalls to this statistical method.[1192] These included the problem of non-response bias and how that can bias results, small sample size, a concern Moeltner voiced in his report, and the fact that it appears clear that this concern may be compounded as four of his 12 data points came from the same study of the same group of Kentuckians.[1193]

Dr. Moeltner notes that his estimates of non-market non-use values "cannot fully substitute for thorough primary data collection and research."[1194] He argues that "primary valuation studies in the Spring Valley area are both warranted and justified."[1195] He stresses "the need to conduct a primary valuation study for these areas."[1196] In regards to the wetlands in Spring Valley, he states that "the shortcomings of our secondary data set, the uniqueness of the wetlands under consideration, and the distinctly unique policy context in this case call for a primary, survey based valuation study to allow for the computation of more accurate estimates of

[1189] Exhibit No. GBWN_068, p. 19.
[1190] Exhibit No. GBWN_068, p. 8; Transcript, Vol.15 p. 3529:5-20 (Aguero).
[1191] Exhibit No. GBWN_066, p. 16.
[1192] Transcript, Vol.22 pp. 5066:22-5071:11 (Kilkenny).
[1193] Transcript, Vol.22 pp. 5067:2-5071:11 (Kilkenny).
[1194] Exhibit No. GBWN_068, p. 2.
[1195] Exhibit No. GBWN_068, p. 2.
[1196] Exhibit No. GBWN_068, p. 13.

the economic benefits flowing from Spring Valley wetlands."[1197] In regard to the recreational areas, he states "a primary study with direct focus on these two sites would be able to generate more accurate estimates of economic values, and a better understanding of the underlying population of users."[1198] Despite Dr. Moeltner's admonitions, no primary study of non-market non-use values for Spring Valley wetlands has been presented to the State Engineer.

Mr. Aguero acknowledges that surveys to determine non-market non-use values are often used in environmental impact assessments. However, he notes that the method is subject to significant criticism regarding its validity and reliability and the effects of bias and errors.[1199] Mr. Aguero further notes that even if the non-market non-use value is represented accurately, it represents a value that will never be financially recognized.[1200] The non-market non-use value will never create a single job nor correspond to payment of a single dollar in wages or salary.[1201] The State Engineer finds that Dr. Moeltner's method of determining non-market non-use value is generally sound but recognizes it is subject to a great deal of uncertainty and was not applied appropriately by Dr. Kilkenny.

However, the State Engineer finds that the proper inquiry is the value of the areas to the people of Nevada, not those of Utah. As Dr. Kilkenny herself points out: "[t]he owners of the groundwater in the basins of origin are the citizens of the entire state of Nevada."[1202] Even if the State Engineer were to accept the figures in Dr. Moeltner's study, considering only Nevada

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[1197] Exhibit No. GBWN_068, p. 11.
[1198] Exhibit No. GBWN_068, p. 12.
[1199] Exhibit No. SNWA_393, pp. 12-14.
[1200] Exhibit No. SNWA_393, p. 14.
[1201] Transcript, Vol.15 pp. 3528:24-3529:4 (Aguero).
[1202] Exhibit No. GBWN_114, p. 5; *see* NRS 533.025 ("The water of all sources of water supply within the boundaries of the State whether above or beneath the surface of the ground, belongs to the public.").

households' willingness-to-pay would reduce the total estimated value by over one half.[1203] In the ultimate analysis, however, whether the estimate of non-market non-use value includes Utah households or not does not alter the State Engineer's public interest conclusion.

All of Dr. Kilkenny's valuations are generally aggressive in that when a range of values is possible, she uses the value at the highest end. Dr. Kilkenny's analysis assumes a total loss of water in White Pine and Lincoln Counties if the Applications are approved. She then assumes that the result of the total loss of water will completely obliterate the agriculture, mining, ranching, farming, forestry, hunting, tourism, recreation, lodging, and restaurant sectors in the entirety of White Pine and Lincoln counties. She further assumes that the result of the total loss of water will reduce to zero visitor spending and the value individuals derive from the 75-million acre[1204] Great Basin National Park, Swamp Cedar Natural Area, Shoshone Pond Natural Area, Cleve Creek Recreation Area, and Sacramento Pass Recreation Area to zero. She suggests that the proper scope of consideration is, at a minimum, the counties containing the four project basins.[1205]

The State Engineer finds that Dr. Kilkenny's estimated values are a clear overestimate and contain great uncertainty. This uncertainty is only compounded by the inclusion and reliance upon the transfer of results from a willingness to pay study and the failure to present a primary willingness-to-pay study that is specific to Spring Valley. Though Dr. Kilkenny explained several times during her testimony that her estimates can be "scaled" to derive values that are actually calibrated to a level other than a 100% negative impact, she did not provide instructions, evidence, or the methodology for doing so. The State Engineer finds Dr.

[1203] Exhibit No. GBWN_068, pp. 19-20.
[1204] Exhibit No. SNWA_393, p. 22.
[1205] Exhibit No. GBWN_114, p. 4.

Kilkenny's work to be unreliable, incomplete, and fraught with errors. Therefore, the State Engineer is unable to place a value on the water proposed to be diverted from Spring Valley and questions the assumption that the unused water, if it remains idle, has value to White Pine or Lincoln Counties.

Many Protestants testified that they and the organizations they represent do not object to the granting of additional water rights in Spring Valley, but they did object to the granting of the Applications filed by SNWA and the use of the water outside of Spring Valley.[1206] Others candidly testified to their belief that "water should be developed ….for cows and for wildlife" and similar uses, but not to support development in Las Vegas.[1207] Others testified directly to their view of the public policy issues. A representative of the Nevada State Farm Bureau presented the policy position of his organization and confirmed that organization's support for the first in time first in right law and policy of the State of Nevada.[1208] Mr. Busselman also confirmed the Nevada State Farm Bureau's support of the existing laws regarding appropriation of water generally including those related to interbasin transfer.[1209] This same position was generally echoed by the representative of the Nevada Cattlemen's Association.[1210] These organizations also called for the development of a baseline and an inventory of the current water rights in the basin.[1211] The State Engineer has completed an inventory for each basin and the Applicant has also undertaken an independent review and inventory of the existing rights. Thus, these public interest issues have been considered by the State Engineer and are addressed in

[1206] Transcript, Vol.16 pp. 3739:7-3740:6 (Anderson); Transcript, Vol.21 p. 4764 (Wadsworth); Transcript, Vol.21 p. 4780:14-24, 4782:21-4783:13 (Carter); Transcript, Vol.22 p. 4911:7-4911:20 (Poulsen); and Transcript, Vol.24 pp. 5520:21–5522:22 (Gloekner).
[1207] Transcript, Vol.22 pp. 4921:9-4922:24 (Hatch).
[1208] Transcript, Vol.23 pp. 5210-5218:16 (Busselman).
[1209] Transcript, Vol.23 p. 5220:3-5220:13 (Busselman).
[1210] Transcript, Vol.24 pp. 5527-5538:3 (Spratling).
[1211] Transcript, Vol.23 p. 5218:17-5219:17 (Busselman); Transcript, Vol.24 pp. 5531-5532 (Spratling).

greater detail elsewhere in this ruling. As to these public policy concerns raised by the Protestants, the State Engineer finds that interbasin transfers of water are not illegal and that Nevada water law must be applied fairly and equally to all water right applicants.

The Applicant presented evidence of the economic value of the Project to the State of Nevada and Protestants presented evidence of potential economic harms to Lincoln and White Pine Counties. The Protestants' evidence of economic harm to Lincoln and White Pine Counties, however, is not credible. The State Engineer finds that there is no credible or persuasive evidence of any threatened economic detriment to the public interest due to the proposed Project. Additionally, though not dispositive, the economic benefits of the proposed Project to the entire State of Nevada are large. The State Engineer finds that the economic benefits Las Vegas provides to the public interest of the state are compelling and these economic benefits outweigh any alleged detriment, but this is not the deciding factor in the public interest determination. Because the State Engineer is required to focus on possible detriments to the public interest, the State Engineer is not relying on this information in reaching a decision. Instead, the State Engineer finds that the Protestants did not submit credible and persuasive evidence of any threatened economic detriment to the public interest due to approval of the Applications. Therefore, from an economic standpoint, the State Engineer finds the proposed use of the water does not threaten to prove detrimental to the public interest.

**B. Tribal Issues**

The Tribal Protestants (the Confederated Tribes of the Goshute Reservation, the Duckwater Shoshone Tribe, and the Ely Shoshone Tribe) assert many arguments against the Applications under the broad category of threats to the public interest. They argue that the proposed pumping will negatively affect their hunting, gathering, and cultural traditions in

Spring Valley and conflict with their reserved water rights. They also argue that the Applications should be denied because the federal government did not properly consult with them or consider their interests during the federal environmental review of the proposed Project and the execution of the Stipulations with the Applicant.

**1. <u>Hunting, Gathering, and Cultural Interests in Spring Valley</u>**

The Tribal Protestants argue the State Engineer should consider their aboriginal hunting and gathering rights and ceremonial use and historic value of natural resources as part of the public interest analysis.[1212] Though the Tribal Protestants' present reservation lands are not located in Spring Valley,[1213] the Tribal Protestants presented evidence regarding past and present use of natural resources in Spring Valley and suggest that tribal treaty rights protect these uses.[1214] The State Engineer finds that he does not have jurisdiction to determine whether or not the Tribal Protestants have protected treaty rights to the natural resources in Spring Valley. However, in order to take a conservative approach, the State Engineer's consideration of Tribal interests in hunting and gathering in Spring Valley applies in the same manner for Tribal Protestants as it does for all other Protestants. Therefore, the State Engineer will consider the Tribal Protestants' claims and determine whether approving the Applications threatens to prove detrimental to the public interest.

The Applicant presented testimony on vegetation and biota relevant to Tribal Protestants' concerns by two expert witnesses, Dr. Terry McLendon and Mr. Zane Marshall. Dr. McLendon has 40 years of research and consulting experience in the areas of plant ecology, restoration of disturbed lands, ecological modeling, ecological risk assessment, range and land management,

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[1212] *See, e.g.*, Transcript, Vol.1 48:13-20 (Echohawk) (discussing the importance of elk hunting to the Tribes).
[1213] *See* Duckwater/Ely Joint Closing Statement, p. 4 (Dec. 23, 2011).
[1214] *See* Exhibit No. CTGR_001; Exhibit No. CTGR_005.

watershed dynamics, and statistical ecology.[1215] Dr. McLendon was qualified by the State Engineer as an expert in the areas of ecology and range science.[1216] He testified about the effect of change in depth to water ("DTW") on individual plant species and plant communities (including swamp cedars) and plant succession. Mr. Marshall, director of the Applicant's Environmental Resources Department, was qualified by the State Engineer as an expert in the area of biological resources, including conservation biology, environmental compliance, and environmental monitoring.[1217] He testified about the effect of change in DTW on animal species and communities. The Tribal Protestants presented no expert testimony on plant or animal species or communities they contend will be impacted by the Project.

The Tribes are concerned that the swamp cedars, pickle weed and pine nut gathering areas in Spring Valley will not survive the lowering of the water table. They also argue that an increase of DTW may cause the mule deer, rabbits, sage grouse and other animals hunted today to perish or to leave Spring Valley. They also argue that springs and water sources are important sacred sites and that pumping pursuant to the Applications will cause them to disappear, and that granting the Applications will impact existing rights.

Dr. McLendon testified that swamp cedars are the local name for Rocky Mountain juniper, the most widespread type of juniper in the western United States.[1218] The species has a wide range all over the western United States and is adapted to many different environmental conditions.[1219] The rooting depth of swamp cedars is unknown, but Rocky Mountain junipers

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[1215] Exhibit No. SNWA_036.
[1216] Transcript, Vol.7 p. 1611:23-25 (McLendon).
[1217] Transcript, Vol.8 p. 1776:15-24 (Marshall).
[1218] Transcript, Vol.8 pp. 1676:13-1677:4 (McLendon).
[1219] Transcript, Vol.8 p. 1677:17-19 (McLendon).

have a maximum rooting depth of 20 meters.[1220] While it is possible that the swamp cedars are a distinct ecotype adapted to high groundwater levels in Spring Valley, there have been no genetic or field ecotypic studies that have drawn that conclusion.[1221] In Spring Valley, Rocky Mountain juniper appear in both the valley floor where they are known as swamp cedars and in some higher elevation non-valley floor locations.[1222] The valley floor populations occur in two clusters, one in about the center of Spring Valley and the other around Shoshone Ponds.[1223] The Shoshone Ponds cluster is sustained in part by flows from artesian wells in the area.[1224] The highest cover values for junipers are in the wetter lowland sites.[1225] In drier sites the density and the cover values decrease.[1226] This indicates that junipers respond to increased water supply in the lowland sites but can tolerate drier conditions.[1227] However, where standing water occurred the trees were dying.[1228] In the event that pumping had an effect on swamp cedars, Mr. Marshall testified the Applicant could mitigate the impacts by regulating grazing and using surface water or the wells in the area to irrigate the trees.[1229]

Neither the Tribal Protestants nor any other Protestant presented a witness that testified about the water requirements of swamp cedars, contradicted Dr. McLendon's testimony concerning the potential effects of increased DTW on swamp cedars, or questioned the effectiveness of the mitigation measures proposed by Dr. McLendon and Mr. Marshall. Based on the evidence in the record the State Engineer finds any increase in DTW that effects the

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[1220] Transcript, Vol.8 p. 1681:5-9 (McLendon).
[1221] Transcript, Vol.8 p. 1677:5-15 (McLendon).
[1222] Transcript, Vol.8 p. 1676:1-12 (McLendon).
[1223] Transcript, Vol.8 p. 1676: 1-6 (McLendon).
[1224] Transcript, Vol.8 p. 1740:13-17 (McLendon).
[1225] Transcript, Vol.8 p. 1678:15-23 (McLendon).
[1226] Transcript, Vol.8 p. 1678:15-23 (McLendon).
[1227] Transcript, Vol.8 pp. 1678:24-1679:1 (McLendon).
[1228] Transcript, Vol.8 pp. 1678:2- 1679:6 (McLendon).
[1229] Transcript, Vol.12 p. 2803:2-21 (Marshall); *see also* Transcript, Vol.8 p. 1704:8-16 (McLendon).

swamp cedars will result in a decrease of density and cover, not the elimination of the swamp cedars. Furthermore, the Applicant has the ability to mitigate impacts to swamp cedars through regulating grazing and using surface water or the wells in the area to irrigate the trees. The State Engineer finds that the Protestants' use of these Spring Valley natural resources will not be unreasonably impacted.

Tribal Protestants also are concerned about pickleweed and pinon nuts, but did not present an expert witness to testify regarding where these plants were located. No evidence was presented that these plants are located in the valley floor or in areas reliant on groundwater that would be susceptible to impacts from pumping. Neither species was listed as threatened or endangered.[1230] Dr. McLendon testified that within the woodland biome, the only trees on the valley floor in the potential groundwater-influenced areas besides Rocky Mountain juniper were cottonwoods and Russian olives.[1231] In the event that pickleweed is located in the valley floor in areas reliant on groundwater, the Applicant testified that it could mitigate impacts to vegetation by regulating grazing and using surface water or the wells in the area to irrigate.[1232] Based on the evidence in the record, the State Engineer finds there is no credible evidence that an increase in DTW will adversely affect pickleweed and pinon nuts.

As to the concerns that the Project will cause mule deer, rabbits, sage grouse and other animals hunted today to perish or to leave Spring Valley, the Tribal Protestants did not provide evidence to support this conclusion. The Applicant provided evidence that if effects of the Project cause a transition in plant communities, the transition would be a gradual transition in the

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[1230] *See* Exhibit No. SNWA_363, Chapter 4.10.1 *Endangered, Threatened, and Sensitive Plant Surveys*, at pp. 4-27 to 4-29.
[1231] Transcript, Vol.8 pp. 1674:19-1675:2 (McLendon).
[1232] *See* Transcript, Vol.12 p. 2803:2-21 (Marshall); Transcript, Vol.8 p. 1704:8-16 (McLendon).

species composition of plant communities.[1233] The plant communities will still support terrestrial wildlife, bird and bat populations, and big game.[1234] The ecosystem will continue to be functioning and healthy.[1235]

Based on the evidence in the record, including but not limited to that cited above, the State Engineer finds that approval of the Applications will not cause mule deer, rabbits, sage grouse, and other animals hunted today to perish or to leave Spring Valley. Any impacts to the environment will be gradual and reasonable, allowing for the viable plant and animal communities to continue to be functioning and healthy throughout Spring Valley and adjacent basins.

While the Tribes presented testimony that springs and water sources are important sacred sites, they did not present evidence showing that these springs are connected to the regional groundwater system. In the absence of evidence showing that these springs are connected to the regional system and that they would be affected by pumping under the Applications, the State Engineer is unable to conclude that approving the Applications would harm these cultural resources. The State Engineer finds that the simple "risk" of a lower water table affecting springs or wells hundreds of years in the future is not substantial evidence of a conflict.

**2. <u>Conflicts with Existing Rights</u>**

The Tribal Protestants also argue that approving the Applications will negatively impact their existing reserved water rights. The State Engineer notes that the Tribes' reserved water rights have not been formally adjudicated, and it is unclear whether the Tribal Protestants own reserved water rights. However, the State Engineer finds that in the absence of an adjudication

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[1233] Transcript, Vol.12 p. 2811:24-2812:11 (Marshall).
[1234] Transcript, Vol.12 p. 2811:24-2812:11 (Marshall).
[1235] Transcript, Vol.12 p. 2811:24-2812:11 (Marshall); Transcript, Vol.8 p. 1704:4-7 (McLendon).

of tribal reserved water rights, he will take a conservative approach and assume that each tribe has reserved water rights on their reservations, and will then determine whether pumping pursuant to the Applications will impact these water rights.

The State Engineer notes that it appears that the Tribal Protestants are concerned with pumping in Spring Valley and not in any of the other Project basins.[1236] The land of the Confederated Tribes of the Goshute Reservation is located in Deep Creek, Tippett, Pleasant, and Snake valleys.[1237] The Duckwater Shoshone Tribe's reservation is located in Duckwater Valley/Railroad Valley in Nye County, Nevada.[1238] The Ely Shoshone Tribe's lands are located near the City of Ely in Steptoe Valley and in White River Valley in White Pine County, Nevada.[1239] No evidence was presented at the hearing that suggests any unreasonable impacts to the Tribal Protestants' reservation lands or reserved water rights due to pumping pursuant to the Applications. On cross-examination, the Tribal Protestants' own witness, Dr. Myers, indicated that there are essentially no predicted impacts to the Tribal Protestants' reservation lands.[1240] Dr. Myers' model results show essentially no drawdown in central Tippett Valley and Deep Creek Valley for over 100 years of simulated pumping. The results show only minimal drawdown in Deep Creek Valley, even after 10,000 years of pumping.[1241] No evidence was presented showing drawdown near the City of Ely or Railroad Valley.[1242] Therefore, no evidence was presented to support the Tribal Protestants' allegation of impacts to their reserved water rights.

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[1236] *See* Transcript, Vol.25 pp. 5793:19-5794:4 (Marques); Transcript, Vol.25 p. 5778:5-17 (Sanchez).
[1237] Exhibit No. SE_060 (Confederated Tribes of the Goshute Reservation Protest to Application 54003, at 3).
[1238] Exhibit No. SE_060 (Duckwater Shoshone Tribe Protest to Application 54003, at 1–2).
[1239] Exhibit No. SE_060 (Ely Shoshone Tribe Protest to Application 54003, at 3).
[1240] Transcript, Vol.26 pp. 5957:8-5958:7 (Myers).
[1241] Exhibit No. CTGR_014, p. 3.
[1242] *See* Transcript, Vol.25 pp. 5813:23-5814:3 (Chairman Alvin Marques, testifying that the fear that the proposed pumping will affect the water supply for the City of Ely and therefore his tribe is not based on hydrologic data);

The Tribal Protestants also suggest that where potential impacts are uncertain to their interests, they should not bear the risk that any future impacts occur.[1243] However, the State Engineer is unable to deny a water right application in the absence of credible evidence of impacts due to the remote possibility of impacts. The State Engineer finds that no credible evidence was presented of conflicts with reserved water rights of the Tribal Protestants and thus the Applications will not be denied on this ground.

**3. <u>Federal laws and duties</u>**

In addition, the Tribal Protestants argue that the State Engineer should deny the Applications because the BLM and other federal agencies have not complied with federal law and because the U.S. Bureau of Indian Affairs has violated its trust responsibility to the Tribal Protestants.

The Tribes argue that the BLM has not complied with the government to government consultation process during the federal permitting process for the Project. The Tribal Protestants argue that they have cultural interests in the Project area, and that the BLM has not complied with the consultation process that protects those interests during the federal permitting process for the Project. The Tribal Protestants presented expert testimony from Dr. Sylvester Lahren, who was qualified as an ethnographer.[1244] Dr. Lahren provided testimony on the Tribes' cultural and historical connections to Spring Valley. Dr. Lahren recommended that to protect the Tribes' cultural interests in Spring Valley, the swamp cedars area should be considered for designation

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Transcript, Vol.25 p. 5784:1-5 (Chairwoman Virginia Sanchez, testifying that she is aware of no model showing impacts to Railroad Valley due to the proposed pumping).
[1243] Closing Argument of the Confederated Tribes of the Goshute Reservation p. 3.
[1244] Transcript, Vol.26 pp. 5854:24-5855:7 (Lahren).

under federal law as a Traditional Cultural Property ("TCP").[1245] A TCP is generally defined as a property which has cultural or spiritual significance to a living community that is rooted in that community's history and is important to that community's ongoing cultural identity.[1246]

The Applicant presented testimony by Ms. Lisa Luptowitz, the Applicant's Environmental Resources Division Manager, who specializes in environmental compliance and permitting. Ms. Luptowitz provided testimony about environmental compliance and permitting activities, including federal permitting processes that protect tribal cultural interests in the Project area. Ms. Luptowitz testified about the Applicant's support of federal agencies' government to government consultation efforts with respect to the Project and about TCP designations associated with Spring Valley swamp cedars.

Federal permitting processes protect tribal cultural interests that relate to Spring Valley and adjacent basins. Through a programmatic agreement being promulgated in accordance with the National Historic Preservation Act,[1247] the Tribes have been invited to participate, to both help identify and assess impacts to historic properties in Spring Valley and adjacent basins, and to participate in the preservation of those properties.[1248] This process, known as the Section 106 process, affords tribes an opportunity to participate in the federal environmental review processes associated with the Project.[1249] The draft programmatic agreement reflects that the Tribal Protestants in this hearing were invited to participate in the Section 106 process.[1250] Indeed, Ms. Luptowitz testified that the swamp cedars area, recommended by Dr. Lahren for

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[1245] Transcript, Vol.26 p. 5893:20-25 (Lahren).
[1246] Transcript, Vol.12 p. 2781:18-23 (Luptowitz).
[1247] Exhibit No. SNWA_408, pp. 29-75.
[1248] Transcript, Vol.12 p. 2773:8-12 (Luptowitz)
[1249] Transcript, Vol.12 p. 2774:2-6 (Luptowitz).
[1250] Exhibit No. SNWA_408, pp. 71-73 (Programmatic Agreement, Appx. C); Transcript, Vol.12 p. 2780:6-17 (Luptowitz).

consideration as a TCP designation, has been identified as a TCP that is potentially eligible for listing on the National Register of Historic Places.[1251]

Although the consultation process is conducted on a government to government basis between tribal governments and the federal government, and the Applicant is not a participant in the process, the Applicant has provided funding for the BLM to conduct a workshop for the Tribes to educate them about the NEPA process and assist in identifying for them how they may participate in the process and provide comments.[1252] The Applicant has also funded the preparation of an ethnographic assessment report, which is a specific report that is conducted by interviewing Tribes to identify properties of concern to the Tribes, also known as TCPs, in the Project area.[1253] The Applicant has contributed more than $420,000 and numerous staff hours in support of these efforts.[1254] Funding provided by the Applicant has directly compensated tribal members for their participation in the tribal consultation process, including reimbursement for travel time and expenses so they can attend meetings, workshops and field trips.[1255]

Tribal Protestants argue government to government consultation did not occur. However, there was evidence presented of ongoing tribal consultation activities.[1256] In any event, the State Engineer finds he does not have jurisdiction to review the actions of the BLM or BIA in complying with the National Historic Preservation Act and other federal statutes, and he declines to rule on this issue.

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[1251] Transcript, Vol.12 p. 2782:6-11 (Luptowitz).
[1252] Transcript, Vol.12 p. 2774: 9-24 (Luptowitz).
[1253] Transcript, Vol.12 pp. 2774:24-2775:5 (Luptowitz).
[1254] Transcript, Vol.12 p. 2775:6-16 (Luptowitz).
[1255] Transcript, Vol.12 pp. 2775:20-2776:3 (Luptowitz).
[1256] Exhibit No. SNWA_408, pp. 76-80 (DEIS Appx. F3.17).

Whether or not the federal government has met its trust responsibilities to the Tribal Protestants, the State Engineer's obligation to the Tribal Protestants is to accord them due process of law and consider their evidence and protests as required by Nevada law. Ed Naranjo, Tribal Council member and Tribal Administrator for the Goshute, testified that the State Engineer listened to and heard the concerns of the Tribes.[1257] The Tribes participated in the process of consideration of the Applications by filing a written protest.[1258] The Tribes presented testimony during both the public comment session and through direct examination by their attorney.[1259] The Tribes presented expert testimony by two expert witnesses,[1260] and they cross-examined the Applicant's witnesses.[1261]

The Tribal Protestants also argue that the State Engineer should not have admitted the Stipulations between the Applicant and the federal agencies into evidence. The Tribal Protestants claim they were not involved with the Stipulations and the monitoring and management programs that came out of the Stipulations. The Tribal Protestants also allege certain terms of the Stipulations were violated.[1262] Whether or not the parties to the Stipulations have violated provisions of the Stipulations is not relevant to the State Engineer's determination. The State Engineer is not a party to the Stipulations and must independently review the Applications and comply with Nevada law. The parties to the Stipulations must address any violations among themselves. While both the Applicant and the Tribal Protestants offered

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[1257] Transcript, Vol.25 p. 5748:8-13 (Naranjo).
[1258] Transcript, Vol.25 p. 5749:1-4 (Naranjo).
[1259] Transcript, Vol.25 pp. 5749:7-5752:11 (Naranjo).
[1260] Transcript, Vol.25 pp. 5749:19-5750:1 (Naranjo).
[1261] *E.g.*, Transcript, Vol.1 pp. 144:10-151:11 (Mulroy); Transcript, Vol. 25 p. 5751:19-23 (Naranjo).
[1262] Duckwater/Ely Joint Closing Statement pp. 7-9.

evidence and testimony regarding the federal Stipulations, the State Engineer declines to rely on this evidence in order to make his public interest determination.

The State Engineer finds that no credible evidence was presented that suggests any negative impacts to the Tribal Protestants' interests in the natural resources of Spring Valley or any reserved water rights that the Tribal Protestants may possess. In addition, the State Engineer finds that it is not his responsibility to ensure that the federal government fulfills its responsibilities to the Tribal Protestants; determinations regarding violations of the trust responsibility and consultation requirements the federal government has towards the Tribal Protestants is beyond the State Engineer's jurisdiction and such alleged violations do not affect his determination to grant or deny an application pursuant to Nevada law.

Based on the evidence in the record, including but not limited to that cited above, the State Engineer finds that approving the Applications will not threaten to prove detrimental to the public interest.

## VII. INTERBASIN TRANSFER CRITERIA

Water from all sources within the boundaries of the State of Nevada, whether above or beneath the surface of the ground, belongs to the public.[1263] Water in a groundwater basin does not belong exclusively to the inhabitants of that basin. Instead, the water belongs to the people of the State of Nevada. Nevada water law explicitly provides for the interbasin transfer of groundwater to the places where water is needed for beneficial use and provides procedural requirements for such transfers.[1264] Interbasin transfers of groundwater are necessary in most metropolitan areas of this country. With the exception of cities located on a water source like the

[1263] NRS 533.025.
[1264] NRS 533.007; NRS 533.364; NRS 533.370.

Great Lakes, interbasin transfers are necessary in order to allow metropolitan areas to grow. Other metropolitan areas such as Phoenix, Tucson, Scottsdale, Long Beach, Los Angeles, San Francisco, Oakland and New York City have all developed water from outside the basin in which those cities are located.[1265] The State Engineer finds that southern Nevada must now do the same.

## VIII. JUSTIFICATION OF NEED TO IMPORT WATER

The Applicant has justified its need to import water from another basin.[1266] As discussed in the "Beneficial Use and Need for Water" section above, the Applicant has demonstrated a need to beneficially use this water. The Applicant has justified its need to import water from another basin because there are no other water supplies available in the Las Vegas Valley - Hydrographic Basin 212.

For the reasons stated in the "Beneficial Use and Need for Water" section above, the State Engineer has already determined that the Applicant's projected water demands will exceed available water supplies and that the Applicant will need to put this water to beneficial use during the Applicant's planning period. The Applicant presented evidence of how this water will be used as part of the water resource portfolio in Southern Nevada.[1267] The Applicant presented evidence that if the water from the Applications is not available, there will be shortfalls between projected demands and available supplies during normal conditions on the Colorado River and that shortfalls would be even greater during shortage conditions on the Colorado River.[1268]

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[1265] Transcript, Vol.1 pp. 91:10-92:13 (Mulroy).
[1266] NRS 533.370(6)(a) (2010).
[1267] Exhibit No. SNWA_189, p. 6-2, Figure 6-2; Exhibit No. SNWA_209, p. 43, Figure 28.
[1268] Exhibit No. SNWA_189, p. 6-4, Figure 6-3, p. 6-5, Figure 6-4.

There are no other water supplies available in the Las Vegas Valley - Hydrographic Basin 212. The Applicant has maximized local groundwater and surface water resources in the Las Vegas Valley. The Las Vegas Valley groundwater basin is fully appropriated.[1269] There are simply no additional groundwater resources available in the Las Vegas Valley to meet Southern Nevada's water needs.

The Applicant cannot expect to receive additional Colorado River water. First, it is not realistic for Southern Nevada to expect to receive an increased allocation from the Colorado River. The Colorado River basin states are highly protective of their Colorado River allocations. The Colorado River basin states view their Colorado River allocation as their "birth right" and if Southern Nevada were to gain water, it means that another basin state would lose water.[1270] The basin states are prepared to litigate in front of the U.S. Supreme Court to protect their water rights if necessary.[1271] Even if certain states were somehow able to reach agreement, any amendment to the Colorado River Compact would require ratification by seven state legislatures, seven governors, the United States Congress, and the President of the United States.[1272] Second, it is not realistic for Southern Nevada to expect that transfers and exchanges will allow it to receive additional Colorado River water from users in other states. Even if a user were willing to sell Colorado River rights, the user would lack the power to transfer those rights outside of the state because the states are the ultimate owners of the rights and users are simply licensees.[1273] Third, system augmentation projects are long-term projects between the basin states that are not

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[1269] Exhibit No. SNWA_189, p. 3-2.
[1270] Transcript, Vol.2 pp. 264:24-266:1 (Entsminger).
[1271] Transcript, Vol.2 pp. 265:23-266:1 (Entsminger).
[1272] Transcript, Vol.2 p. 265:10-13 (Entsminger).
[1273] Transcript, Vol.2 p. 266:5-12 (Entsminger).

expected to make additional water available on the Colorado River for decades.[1274] These augmentation projects have been described as "conceptual in nature" and cannot be reasonably relied upon by water managers for immediate or intermediate water planning purposes.[1275] At the same time, even if the Applicant were able to develop additional Colorado River water, such as through desalination or another method, it would not resolve supply issues relating to drought and shortage conditions on the Colorado River because Lake Mead water levels need to be sufficient to allow withdrawal of the new water.[1276]

Southern Nevada cannot expect that the federal government or other states will solve its water supply issues. The other basin states are facing their own water supply issues and have expressed a reluctance to help Nevada unless Nevada helps itself by developing permanent in-state supplies.[1277] The only way for Southern Nevada to become self-sufficient is to develop available in-state water supplies. There are no available water supplies in Las Vegas Valley. Therefore, an interbasin transfer is the only way for the Applicant to develop in-state water supplies and provide for Southern Nevada's water needs. Based on the evidence in the record, including but not limited to that cited above, the State Engineer finds that the Applicant has justified its need to import water from another basin.

## IX. CONSERVATION

In determining whether an application for an interbasin transfer of groundwater must be rejected, the State Engineer shall determine whether a plan for conservation of water is advisable for the basin into which the water is to be imported, and if so "whether the applicant has

[1274] Transcript, Vol.2 pp. 297:9-298:23 (Entsminger).
[1275] Transcript, Vol.2 p. 299:2-7 (Entsminger).
[1276] Exhibit No. SNWA_189, p. 3-3.
[1277] Transcript, Vol.1 p. 137:15-23 (Mulroy); Vol.2 pp. 234:23-235:11, 361:7-23 (Brothers).

demonstrated that such a plan has been adopted and is being effectively carried out."[1278] The State Engineer determines that a plan for conservation of water is advisable for the basin into which the water is to be imported, and the Applicant has demonstrated that such a plan has been adopted and is being effectively carried out.

The Applicant presented expert testimony on this subject by Mr. Douglas Bennett. Mr. Bennett is the Applicant's Conservation Manager. Mr. Bennett was qualified by the State Engineer as an expert in water conservation planning, municipal water conservation, and xeriscaping.[1279] Mr. Bennett testified about the Applicant's Conservation Plan and the many programs promulgated under the plan, its rate-setting practices, and reductions in southern Nevada's water use. Great Basin Water Network presented expert testimony on this subject from Dr. Peter Gleick. Dr. Gleick was qualified by the State Engineer as an expert on water conservation and efficiency.[1280] Dr. Gleick testified about the Applicant's conservation program and his organization's 2007 Hidden Oasis report on the Applicant's conservation program. However, he admitted that he has never read the Applicant's 2009-2013 Conservation Plan.[1281]

The Applicant has had a Conservation Plan in effect since 1999.[1282] In accordance with NRS Chapter 540, the Applicant has submitted a conservation plan to the State Engineer for approval at five-year intervals since 1999.[1283] The State Engineer last approved the Applicant's Conservation Plan on April 22, 2009.[1284] In addition, pursuant to the Reclamation Reform Act, § 210(a) & (b) and 43 C.F.R. § 427.1, the Bureau of Reclamation requires the Applicant to develop

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[1278] NRS 533.370(6)(b) (2010).
[1279] Transcript, Vol.4 p. 823:16-19 (Joseph-Taylor).
[1280] Transcript, Vol.23 p. 5091:10-12 (Joseph-Taylor).
[1281] Transcript, Vol. 23, p. 5145:21-25 (Gleick).
[1282] Exhibit No. SNWA_004, p. 1-1; Transcript, Vol.4 pp. 825:3-5 (Bennett).
[1283] Exhibit No. SNWA_005 (State Engineer approval of SNWA's Conservation Plan for the years 2009-2013); Transcript, Vol.4 pp. 824:17–825:1 (Bennett).
[1284] Exhibit No. SNWA_006.

"appropriate water conservation measures," resulting from the "full consideration and incorporation of prudent and responsible water conservation measures." The Bureau of Reclamation found the Applicant has met these requirements, and approved the Applicant's Conservation Plan on May 14, 2009.[1285]

The Applicant's conservation planning has made a significant difference in the way Southern Nevadans use water.[1286] Conservation "is not an event for [SNWA]. This is a journey."[1287] The Applicant has set and achieved aggressive conservation goals over time. Achieving these goals has resulted in what Protestants' conservation expert Dr. Peter Gleick acknowledged to be a "dramatic reduction" in per capita water use.[1288] In 1990, the Applicant service area's gallons-per-capita-per-day ("GPCD") use was 347.[1289] Mr. Bennett, the Applicant's Conservation Manager, testified the Applicant's first conservation goal was to reduce use to 291 GPCD by 2010.[1290] The Applicant exceeded that goal six years ahead of schedule.[1291] In 2005, the Applicant adopted a new goal of 250 GPCD by 2010 and again surpassed the goal ahead of schedule. Once again, in response to achieving its goal ahead of schedule, the Applicant established a new, more aggressive goal of 199 GPCD by 2035.[1292] When compared to the 274 GPCD use of 2004, the 199 GPCD goal will reduce annual demand by 276,000 acre-feet of water by the year 2035.[1293] The Pacific Institute report "Municipal Deliveries of Colorado River Basin Water," recognized the Applicant has achieved a 31 percent

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[1285] Exhibit No. SNWA_007.
[1286] Transcript, Vol.1 p. 69:24-25 (Mulroy).
[1287] Transcript, Vol.1 p.70:9-10 (Mulroy).
[1288] Exhibit No. GBWN_118, p. 3.
[1289] Transcript, Vol.4 p. 894:4-7 (Bennett).
[1290] Transcript, Vol.4 p. 894:8-10 (Bennett).
[1291] Transcript, Vol.4 p. 894:11-14 (Bennett).
[1292] Transcript, Vol.4 pp. 894:15-22, 895:20 (Bennett).
[1293] Exhibit No. SNWA_209, p. 39; Transcript, Vol.4 p. 895:21-25 (Bennett).

reduction in per capita deliveries in southern Nevada from 1990 to 2008 over a period when total population increased by almost 160 percent.[1294] Those savings outpace the seven Colorado River basin states as a whole, where from 1975 to 2005 per capita water use declined by 21 percent.[1295]

The Applicant has achieved this dramatic success through effective implementation of its Conservation Plan. The Applicant has a Conservation Plan in place that employs a four-part strategy to ensure active, community-wide participation in conservation.[1296] The four interwoven strategies are regulation, pricing, incentives and education.[1297] Protestants asserted the Applicant's efforts with respect to these strategies could be more robust, but many of their criticisms were proved to be unfounded. Protestants' expert Dr. Gleick concurred that the Applicant had already adopted many of the recommendations in the Hidden Oasis report that had formed the basis for his criticisms of the Applicant's Conservation Plan.[1298]

Indeed, Dr. Gleick admitted he had not read or reviewed the Applicant's Conservation Plan prior to opining on the Applicant's conservation efforts.[1299] In addition, Dr. Gleick admitted he failed to update his analysis of SNWA member agencies' rate structures in his initial expert report[1300] and his rebuttal report[1301] to reflect two subsequent rate adjustments that enhanced the conservation effect of SNWA member agencies' rate structures.[1302] Dr. Gleick's reports relied on the Hidden Oasis report, prepared in 2007, for most of the analysis,[1303] and, thus, did not adequately consider the current status of the Applicant's conservation efforts,

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[1294] Exhibit No. SNWA_397, p. 25.
[1295] Exhibit No. SNWA_397, p. 3.
[1296] Exhibit No. SNWA_004, p. 2-1; Transcript, Vol.4 pp. 831:22-832:9 (Bennett).
[1297] Exhibit No. SNWA_004, p. 2-1; Transcript, Vol.4 p. 832:1-2 (Bennett).
[1298] Transcript, Vol.23 p. 5199:17-22 (Gleick).
[1299] Transcript, Vol.23 p. 5148:21-25 (Gleick).
[1300] Exhibit No. GBWN_069.
[1301] Exhibit No. GBWN_118.
[1302] Transcript, Vol.23 pp. 5176:14 - 5177:2 (Gleick).
[1303] Transcript, Vol.23 pp. 5129:19-5130:3 (Gleick).

including its 2009-2013 Conservation Plan. Dr. Gleick also lacked familiarity with and understanding of the impact of the Applicant's re-use return flow credits on the Applicant's water portfolio.[1304] Accordingly, the State Engineer finds that Dr. Gleick lacks credibility, and his opinions will be given minimal weight.

Contrary to Protestants' assertion that approval of the Applications will encourage the willful waste of water, regulatory programs throughout the SNWA service area curb consumptive use through development codes and water use restrictions.[1305] Examples of Las Vegas Valley-area development codes include the Clark County Unified Development Code[1306] and the Henderson Municipal Code.[1307] These examples are representative of the development codes adopted by other member agencies throughout the SNWA service area.[1308] These development codes restrict turfgrass to no more than 50% of the landscape area of residential backyards, and prohibit turfgrass altogether on residential front yards and commercial properties.[1309] They restrict the use of water for ornamental water features and man-made lakes.[1310] They limit the size and scale of swimming pools.[1311] And they require resort hotels to submit water efficiency plans describing their current or projected uses of water and their water efficiency plans.[1312]

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[1304] Transcript, Vol.23 pp. 5207:18-5208:7 (Gleick), (conceding upon questioning by Mr. Felling that reducing indoor use does not increase SNWA's water portfolio, permitting the service of new users who, necessarily, must engage in some consumptive uses).
[1305] Exhibit No. SNWA_004, p. 3-1.
[1306] Exhibit No. SNWA_012.
[1307] Exhibit No. SNWA_013.
[1308] Transcript, Vol.4 p. 846:22-25 (Bennett).
[1309] Transcript, Vol.4 pp. 841:6-842:5 (Bennett).
[1310] Transcript, Vol.4 p. 845:14-15 (Bennett).
[1311] Transcript, Vol.4 p. 845:16-17 (Bennett).
[1312] Transcript, Vol.4 p. 845:18-24 (Bennett).

Water use restrictions throughout the Las Vegas Valley limit customers' water use through mandatory landscape watering groups.[1313] They also prohibit water waste, sanctioning violators who allow water to run down the street or flow off the customer's property.[1314] Enforcement of water waste restrictions is aggressive; the Las Vegas Valley Water District assesses fees in excess of $5,000 per violation to chronic violators.[1315] They have assessed more than $400,000 a year in penalty fees against water wasters.[1316] Golf courses that violate water waste restrictions by exceeding their water budgets can be fined up to 900 percent of their top tier water rate.[1317]

Pricing of water throughout the SNWA service area encourages conservation and discourages water waste. The Applicant is not a retail rate-setting agency, but through a Memorandum of Understanding, all SNWA member agencies have committed to using tiered block-rate structures.[1318] In accordance with the water resource policy of the State of Nevada, member agencies' water pricing maximizes water conservation with due consideration to the essential service needs of customers and the economic burdens on businesses, public services, and low-income households.[1319] The rate structures have remained affordable in the first pricing tier, which is intended to meet basic health and sanitation needs, and in the upper tiers the rate structure has been steepened and compressed over time to incentivize conservation.[1320] Top tier rates may be 350 percent more costly than the first tier.[1321] Member agencies have committed to

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[1313] Transcript, Vol.4 p. 842:14-24 (Bennett).
[1314] Transcript, Vol.4 p. 843:4-8 (Bennett).
[1315] Exhibit No. SNWA_004, pp. 3-4; Transcript, Vol.4 p. 857:1-22 (Bennett).
[1316] Transcript, Vol.4 pp. 860:23-861:1 (Bennett).
[1317] Transcript, Vol.4 p. 863:2-5 (Transcript).
[1318] Exhibit No. SNWA_004, p. 4-1; Transcript, Vol.4 p. 864:10-12 (Bennett).
[1319] *See* NRS 540.011.
[1320] Transcript, Vol.4 pp. 865:10-867:1 (Bennett).
[1321] Exhibit No. SNWA_395, p. 7.

reviewing and adjusting rates frequently to ensure the conservation effect is sustained.[1322] The member agencies have to balance their desire for conservation with a public utilities' obligation to raise adequate operating revenue without exceeding their actual costs.[1323] Protestants conceded they did not consider these factors in their analysis.[1324] Protestants also conceded their criticisms of SNWA member agencies' tiered rate structures were based on rates as reported in 2004[1325] and they did not update their analysis in either their initial report[1326] or rebuttal report[1327] to reflect the two subsequent adjustments steepening the rate tiers.[1328]

The Applicant has created substantial, long-term water savings by providing financial incentives and products to customers.[1329] Its Water Smart Landscapes program has incentivized customers to replace high water-use lawns with water-efficient xeric landscaping, resulting in the removal of more than 150 million square feet of turfgrass and a demand reduction of more than 127,000 acre-feet of water over the past ten years.[1330] It is the largest incentive program in the nation, paying customers an average of $16 million per year for turfgrass conversion.[1331] The Applicant appropriately focuses on the program because of its effectiveness in reducing consumptive use; studies showed the program results in a 75 percent reduction in outdoor, consumptive water demand.[1332] Recent changes to the program allowing for re-conversion will

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[1322] Exhibit No. SNWA_395, p. 7.
[1323] Transcript, Vol.4 p. 920:12-19 (Bennett).
[1324] Transcript, Vol.23 pp. 5174:21-5175:13 (Gleick).
[1325] Transcript, Vol.23 p. 5176:10-13 (Gleick).
[1326] Exhibit No. GBWN_069.
[1327] Exhibit No. GBWN_118.
[1328] Transcript, Vol.23 pp. 5176:14-5177:2 (Gleick).
[1329] Exhibit No. SNWA_004, p. 5-1.
[1330] Exhibit No. SNWA_004, p. 5-1; Transcript, Vol.4 pp. 872:19-873:18 (Bennett).
[1331] Transcript, Vol.4 pp. 869:20-21, 870:16-22 (Bennett).
[1332] Transcript, Vol.4 p. 872:16-18 (Bennett).

allow participants greater flexibility and may incentivize more customers to participate in the landscape conversion program.[1333]

Protestants' criticisms that the Water Smart Landscapes program must do more in order to be considered effective are without merit. Dr. Gleick indicated that the Water Smart Landscapes program should pay participants more per square foot, although he conceded the program as a whole outspends other programs.[1334] The State Engineer finds it is not economically rational, nor is it necessary, to increase incentives when the savings achieved by the program demonstrate the current incentive level already encourages large-scale participation.

Consumptive water use, the type targeted by the Water Smart Landscapes program, justifiably is the primary focus of the Applicant's conservation efforts because reducing consumptive use extends water resources.[1335] Reducing non-consumptive uses, such as indoor household uses, does not extend the Applicant's water resources because the Applicant receives return flow credits for its treated wastewater, nearly 100 percent of which is directly or indirectly reused.[1336] In response to Mr. Felling's question concerning whether indoor conservation would actually allow the Applicant to serve more customers, Dr. Gleick acknowledged that conservation of non-consumptive uses would allow the Applicant to serve new customers only if those new customers added no consumptive uses,[1337] which would be implausible under even the most conservative scenarios.

Even though indoor conservation does not reduce overall consumptive use of water, as part of its commitment to fostering a conservation ethic, the Applicant promotes indoor

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[1333] Transcript, Vol.4 pp. 876:10-879:4 (Bennett).
[1334] Transcript, Vol.23 p. 5107:4-11 (Gleick).
[1335] Transcript, Vol.4 p. 833:10-13 (Bennett).
[1336] Exhibit No. SNWA_004, p. ES-1; Exhibit No. SNWA_402; Transcript, Vol.2 pp. 283:21-284:22 (Entsminger).
[1337] Transcript, Vol.23 pp. 5207:18-5208:7 (Gleick).

conservation as well.[1338] Protestants' charges that the Applicant has "largely ignore[d] the potential for indoor efficiency improvements,"[1339] are without merit. The Applicant produced evidence of indoor conservation programs and incentives including its Water Efficient Technologies program, which has facilitated large-scale conservation efforts primarily for commercial and industrial clients, and indoor retrofit kits providing free components for indoor water efficiency retrofits that exceed current plumbing standards.[1340]

Similarly to its incentive programs, the Applicant's education programs ensure community-wide participation in conservation efforts throughout the Las Vegas Valley. Protestants suggested the Applicant should "[c]reate a culture of conservation by developing a consistent message about the importance of indoor and outdoor conservation" and "[o]ffer public awards for innovative conservation programs."[1341] The Applicant demonstrated it has already implemented this recommendation. Its award-winning website logs more than 450,000 visits annually; it produces a Water Smart Living quarterly newsletter; it circulates an annual calendar with water-saving tips; and it has located community demonstration gardens throughout the Las Vegas Valley to maximize exposure to xeriscaping techniques.[1342] Public/private partnerships, including the Water Upon Request and Water Smart Homes programs, help promote the conservation message.[1343] Awards that encourage community conservation include the Water

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[1338] Transcript, Vol.4 p. 834:6-20 (Bennett).
[1339] Exhibit No. GBWN_072, p.2.
[1340] Exhibit No. SNWA_004, pp. 5-3 to 5-4; Exhibit No. SNWA_399.
[1341] Exhibit No. GBWN_072, p. 4.
[1342] Exhibit No. SNWA_004, p. 6-1; Transcript, Vol.4 pp. 887:18-888:22 (Bennett).
[1343] Exhibit No. SNWA_004, pp. 7-1 to 7-2; Transcript, Vol.4 pp. 889:21-891:11 (Bennett).

Hero Award and the annual SNWA Landscape Awards, now in its fourteenth year.[1344] Indeed, Protestants' Hidden Oasis Report, in its Appendix A[1345] acknowledged many of these programs.

"One of the major conclusions" of Dr. Gleick's rebuttal report "was per capita water use is declining, but more can be done."[1346] This conclusion was founded on Dr. Gleick's comparison of the Applicant's system-wide GPCD with the system-wide GPCDs of other water agencies, such as Denver, Albuquerque, Tucson, and Los Angeles.[1347] Dr. Gleick opined, "there's nothing inherently special or different about the Las Vegas Valley that justifies this higher per capita use."[1348] However, Dr. Gleick did recognize that, "a city in a hot, dry climate like Las Vegas, would likely have higher outdoor demand requirements than a city in a cool, wet climate."[1349]

The Applicant challenged Dr. Gleick's use of cross-utility GPCD comparison. The Applicant introduced evidence from authoritative sources, including publications by the American Water Works Association ("AWWA") and the organization Dr. Gleick founded and leads, the Pacific Institute, stating that cross-utility GPCD comparisons are inappropriate due to such differences as climate and functional population, the measure of population that takes into account a high influx of daily visitors that normally are not included in population for GPCD calculations.[1350] Mr. Bennett testified that if the Applicant accounted for functional population, the Applicant's GPCD would be reduced by as much as 40 GPCD.[1351] In response to questioning from the State Engineer, Dr. Gleick stated that he had no reason to dispute Mr.

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1344 Exhibit No. SNWA_395, p. 9; Transcript, Vol.4 p. 891:15-23 (Bennett).
1345 Exhibit No. SNWA_396.
1346 Transcript, Vol.23 p. 5099:1-3 (Gleick).
1347 Exhibit No. GBWN_118, pp. 5-6; Transcript, Vol.23 p. 5099: 3-12, p. 5102:7-15 (Gleick).
1348 Transcript, Vol.23 p. 5099:13-15 (Gleick).
1349 Exhibit No. GBWN_072, p. 18; Transcript, Vol.23 p. 5141:7-13 (Gleick).
1350 Exhibit No. SNWA_014, pp. 8-14; Exhibit No. SNWA_397, p. 8.
1351 Transcript, Vol.4 p. 904:6-8 (Bennett).

Bennett's calculation of the 40 GPCD reduction due to functional population.[1352] Dr. Gleick also testified on cross examination that he had failed to account for either functional population or climatic differences in his analysis.[1353]

Dr. Gleick testified that in addition to system-wide GPCD, he also compared the cross-utility uses in the single family sector in order to correct for many of the biases in cross-utility GPCD comparisons. He testified that this made the single-family account GPCD metric a relatively valuable one for comparing the effectiveness of different conservation programs.[1354] However, on cross-examination, Dr. Gleick admitted that a recent AWWA article found that even comparisons of single-family use accounts did not eliminate differences across different utilities due to local climate conditions and the influence of several other factors such as housing density or average lot size, average number of people per household, marginal price of water availability, cost of reclaimed irrigation water, median household income, and other characteristics of the single-family residential sector.[1355]

The State Engineer finds that due to the inaccuracies inherent in comparing GPCD between utilities, the fact that the Applicant has a higher GPCD than other western cities does not mean that the Applicant's Conservation Plan is ineffective.

Mr. Bennett opined that the Applicant has effectively carried out its Conservation Plan judged by the progress at reducing water demand by 30 percent. This has resulted in a savings of more than 9.5 billion gallons a year.[1356] Even Protestants' expert, after acknowledging that the Applicant has adopted most of the suggestions made in the Hidden Oasis report, admitted that

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[1352] Transcript, Vol.23 p. 5204:22-21 (Gleick).
[1353] Transcript, Vol.23 pp. 5142:24-5143:2, 4134:4-6 (Gleick).
[1354] Transcript, Vol.23 p. 5203: 7-11 (Gleick).
[1355] Transcript, Vol.23 p. 5145:12-22 (Gleick).
[1356] Transcript, Vol.4 p. 912:14-23 (Bennett).

pieces of the Applicant's Conservation Plan were effectively carried out.[1357] Dr. Gleick's main argument is that the Applicant could do even more.[1358]

However, the statutory standard does not require the Applicant to develop and effectively implement the most severe Conservation Plan possible, or to outpace every conservation effort in the nation.[1359] There is substantial evidence that, not only does the Applicant have a Conservation Plan in place that is effectively implemented, it has also addressed, at least in part, every recommendation offered by Protestants to improve its conservation efforts. Based on the evidence in the record, including but not limited to that cited above, the State Engineer finds a plan for conservation of water is advisable for the basin into which the water is imported and finds the Applicant has demonstrated that such a plan has been adopted and is being effectively carried out.

## X. ENVIRONMENTAL SOUNDNESS

The State Engineer must consider whether the approval of the Applications is environmentally sound as it relates to Spring Valley – the basin from which the water is exported.[1360]

The Applicant presented expert testimony on this subject by three witnesses, Mr. Zane Marshall, Ms. Lisa Luptowitz and Dr. Terry McLendon. Mr. Marshall is the director of the Applicant's Environmental Resources Department. Mr. Marshall was qualified by the State Engineer as an expert in the area of biological resources, including conservation biology,

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[1357] Transcript, Vol.23 p. 5200:3 (Gleick).
[1358] Transcript, Vol.23 p. 5203:21 (Gleick).
[1359] NRS 533.370(6)(c) (2010).
[1360] NRS 533.370(6)(c) (2010).

environmental compliance and environmental monitoring.[1361] Mr. Marshall testified about the Applicant's baseline investigations, the nature of the environmental areas of interest, the projected impacts on the environmental resources in Spring Valley and adjacent basins, the tools available to the Applicant to minimize or mitigate environmental impacts, the oversight by other agencies on the environmental monitoring and adaptive management plans and the Applicant's commitment to operating an environmentally sound Project. Ms. Luptowitz testified about the federal, state and local environmental permitting for the Project and how the Bureau of Indian Affairs and tribal governments were involved in the federal permitting processes. Dr. McLendon was qualified by the State Engineer as an expert in the areas of ecology and range science.[1362] Dr. McLendon testified about the effect of change in depth to water ("DTW") on individual plants and plant communities, plant succession and blowing dust from playas and dry lake beds.

GBWN presented expert testimony on this subject from three witnesses, Dr. James Deacon, Dr. Duncan Patten and Dr. Robert Harrington. The Long Now Foundation presented expert testimony on this subject from two witnesses, Mr. Clifford Landers and Dr. Clay Robinson. Other Protestants provided lay testimony about the feared impact on the environmental resources of Spring Valley and adjacent basins. Dr. Deacon was qualified by the State Engineer as an expert in the area of desert aquatic ecology.[1363] Dr. Deacon testified about the fragility of springsnails and fish species in general, potential impacts of decreasing spring flow on springsnail and fish species, the effectiveness of the federal oversight process and the history in Nevada of species extinction caused by water diversions. Dr. Patten was qualified by

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[1361] Transcript, Vol.8 p. 1776:15-24 (Marshall).
[1362] Transcript, Vol.7 p. 1611:23-25 (McLendon).
[1363] Transcript, Vol.19 p. 4140:17-12 (Deacon).

the State Engineer as an expert in the area of plant ecology and hydroecology.[1364] Dr. Patten testified about the effect of change in DTW on individual plants and plant communities, plant succession and the effectiveness of monitoring and mitigation plans for preventing impacts to desert vegetation communities. Mr. Landers was qualified by the State Engineer as an expert in the area of soil science.[1365] Mr. Landers testified about the effect of change in DTW on blowing dust on playas and dry lake beds. Dr. Robinson was qualified by the State Engineer as an expert in the area of soils and plant ecology.[1366] Dr. Robinson testified about the effect of change in DTW on individual plants and plant communities, plant succession and how plant succession could cause blowing dust.

**A. <u>Environmental Baseline</u>**

The Applicant has performed significant work toward establishing the environmental baseline in the basins from which water is to be exported, and in adjacent basins, as well.[1367] The Applicant has studied a broad array of biotic communities within Spring Valley and adjacent basins. Areas of focus included: aquatic ecosystems;[1368] amphibians;[1369] birds;[1370] mammals, including bats and small mammals;[1371] reptiles;[1372] fish, including the Pahrump poolfish and Moapa dace;[1373] invertebrates, including terrestrial and aquatic invertebrates;[1374] and vegetation, including endangered, threatened and sensitive plant species, cactus and yucca, weeds and

[1364] Transcript, Vol.18 p. 3938:20-21 (Patten).
[1365] Transcript, Vol.28 pp. 6266:22-6267:1 (Landers).
[1366] Transcript, Vol.28 6309:16-20 (Robinson).
[1367] Exhibit No. SNWA_363, pp. 4-1 to 4-43; Transcript, Vol.12 pp. 2681:17–2691:2, 2723:3–2724:20 (Marshall).
[1368] Exhibit Nos. SNWA_363, pp. 4-2 to 4-5; SNWA_422; SNWA_374; Transcript, Vol.12 pp. 2691:5–2697:13 (Marshall).
[1369] Exhibit No. SNWA_363 pp. 4-5 to 4-8; Transcript, Vol.12 pp. 2697:14–2698:5 (Marshall).
[1370] Exhibit No. SNWA_363 pp. 4-8 to 4-17; Transcript, Vol.12 pp. 2698:6–2706:10 (Marshall).
[1371] Exhibit No. SNWA_363, pp. 4-17 to 4-21; Transcript, Vol.12 pp. 2706:11–2713:12 (Marshall).
[1372] Exhibit No. SNWA_363, pp. 4-22 to 4-24; Transcript, Vol.12 pp. 2713:13–2714:11 (Marshall).
[1373] Exhibit No. SNWA_363, pp. 4-25 to 4-26; Transcript, Vol.12 pp. 2714:12–2717:2 (Marshall).
[1374] Exhibit No. SNWA_363, pp. 4-25, 4-27 to 4-28; Transcript, Vol.12 p. 2717:3-25 (Marshall).

phreatophytic vegetation.[1375] The Applicant also assessed environmental areas of interest throughout Spring Valley and adjacent basins,[1376] focusing on groundwater-influenced habitats and associated special status species, including federally threatened, endangered, proposed or candidate species under the Endangered Species Act ("ESA"), Nevada BLM sensitive species, Nevada and Utah state-protected species, and species ranked critically imperiled or imperiled across their entire range by NatureServe.[1377] These environmental areas of interest provide a good representation of the key groundwater-influenced habitats and areas of focus in and around the Project basins.[1378] The State Engineer finds that the Applicant's effort and investment in gathering baseline information has been unprecedented and greatly expands knowledge of the region's biota.[1379]

GBWN argued in their written closing that the baseline data was inadequate in kind and quality,[1380] but they did not provide an expert witness opinion, report or exhibit that explained or substantiated that argument. In fact, Dr. Deacon testified he had no criticism of Dr. McLendon or Mr. Marshall's baseline work.[1381] Dr. Patten similarly testified he had no criticism of Dr. McLendon's work.[1382]

Based on the evidence in the record, including but not limited to that cited above, the State Engineer finds that the Applicant gathered and presented the appropriate environmental resource baseline material and that the environmental resource baseline information provides a

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[1375]Exhibit No. SNWA_363, pp. 4-27, 4-29 to 4-36; Transcript, Vol.12 pp. 2718:1–2722:2 (Marshall).
[1376] Exhibit No. SNWA 363, pp. 2-3 to 2-11 (Spring Valley), pp. 2-20 to 2-22 (Snake Valley), pp. 2-23 to 2-25 (Hamlin Valley), pp. 2-26 to 2-27 (Lake Valley); Transcript, Vol.12 p. 2728:15–2738:7 (Spring Valley), 2745:17–2747:15 (Snake Valley)(Marshall).
[1377] Exhibit No. SNWA_363, p. 2-1.
[1378] Transcript, Vol.12 p. 2752:2-4 (Marshall).
[1379] Transcript, Vol.12 p. 2723:6-16 (Marshall).
[1380] GBWN Closing Statement, p. 24.
[1381] Transcript, Vol.19 pp. 4174:18-4177:23 (Deacon).
[1382] Transcript, Vol.18 pp. 4028:4-4029:11 (Patten).

platform for sound, informed decision-making. Notwithstanding this finding, the State Engineer reserves the right to require additional types and/or years of baseline information as set forth below.

### B. Permitting

The baseline information collected by the Applicant was presented to federal, state and local resource managers[1383] who have permitting authority over the Project.[1384] Federal and state laws, including the National Environmental Policy Act ("NEPA"), the ESA, the Clean Water Act ("CWA"), and Nevada water law, require environmental protection through comprehensive permitting and regulatory processes.[1385] These permitting processes impose strict environmental controls on the Project that ensure it will be environmentally sound.[1386] Protestants' witness Rebecca Mills, former superintendent at Great Basin National Park, conceded it is the mission of federal agencies to zealously enforce the environmental protections with which they are charged.[1387]

NEPA requires a full consideration of environmental impacts resulting from the Project.[1388] NEPA compliance will result in substantive protections that can ensure environmental soundness. For instance, an Environmental Impact Statement can identify and consider mitigation measures and those mitigation measures become part of a Record of

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[1383] Transcript, Vol.12 p. 2723:20-24 (Marshall).
[1384] Transcript, Vol.12 pp. 2752:21-2753:1 (Luptowitz).
[1385] Exhibit No. SNWA_363, p. 5-3, Table 5-2: Potentially Required Federal and State Permits and Reviews.
[1386] Transcript, Vol.12 pp. 2783:25-2784:8 (Luptowitz) (federal agency oversight of the project has been rigorous, resulting in a lengthy, thorough, comprehensive permitting process).
[1387] Transcript, Vol.22 p. 4952:15-20 (Mills); *see also* Transcript, Vol.25 p. 5743:7-10 (Naranjo) (federal employees do their best to follow the law).
[1388] Transcript, Vol.12 p. 2763:10-21 (Luptowitz) (the EIS for the project will assess direct, indirect and cumulative effects of the project, and will consider the human, biological, and physical environment).

Decision for the Project and are then required under the terms of any right of way grant.[1389] With respect to the Project, the Applicant has prepared more than 300 Applicant Committed Measures aimed at minimizing and mitigating Project impacts.[1390]

The ESA imposes strict substantive protections, in the form of reasonable and prudent alternatives, that include minimization and mitigation measures that prevent jeopardy to listed species or their critical habitat.[1391] The Applicant agreed to inclusion of even non-listed species for the Project ESA consultation, resulting in an even greater breadth of coverage.[1392]

Protestants' expert Dr. James Deacon raised concerns regarding the extinction of species due to water development, but those concerns arise in the context of historical water development practices that preceded the ESA.[1393] The Applicant's expert Mr. Marshall noted that the Applicant has learned from others' mistakes of the past to act in a more environmentally sound manner.[1394] Protestants' expert Dr. Bredehoeft agreed that under the ESA, federal agencies would exercise their power to alter Project operations to curtail impacts to listed species.[1395]

Protestants have argued that NEPA, the ESA and other federal and state permitting requirements do not relieve the State Engineer of his responsibility to determine the Project is environmentally sound.[1396] Protestants also expressed doubts about a future State Engineer's resolve to halt groundwater withdrawals if adverse environmental impacts occurred.[1397]

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[1389] Transcript, Vol.12 pp. 2764:23-2765:11 (Luptowitz)
[1390] Transcript, Vol.12 p. 2765:16-24 (Luptowitz).
[1391] Transcript, Vol.12 pp. 2755:21-2756:1, 2756:22-2757:2 (Luptowitz).
[1392] Transcript, Vol.12 p. 2758:8-16 (Marshall).
[1393] Transcript, Vol.12 pp. 2823:22-2824:3 (Marshall).
[1394] Transcript, Vol.12 pp. 2823:22-2824:7 (Marshall).
[1395] Transcript, Vol.24 p. 5465:20-23 (Bredehoeft).
[1396] GBWN Closing Statement, p. 21.
[1397] GBWN Closing Statement, p. 26.

Based on the evidence in the record, including but not limited to that cited above, the State Engineer finds that he has the jurisdiction and responsibility to determine the Project's environmental soundness independently of other federal and state permitting requirements and will do so. The State Engineer considers the regulatory background of the Project as evidence that other agencies with diverse regulatory responsibility and environmental expertise will also exercise continuous authority to regulate the Project in a manner that protects the environment. While the State Engineer rejects the argument that he should consider the possibility that some future State Engineer may not have the resolve to perform statutory duties, the ongoing jurisdiction of the diverse state and federal agencies with regulatory authority over the Project demonstrates redundancies in environmental regulation of the Project that will ensure continuous oversight regardless of the resolve of a future State Engineer.

Based on the evidence in the record, including but not limited to that cited above, the State Engineer finds that the oversight provided by federal and state agencies will supplement the State Engineer's ability to ensure the environmental soundness of the Project. The State Engineer's water right permitting requirements will ensure the Project's environmental soundness.

### C. Compliance with the Federal Stipulation

On September 8, 2006, SNWA and four Department of the Interior agencies, the U.S. Fish and Wildlife Service, the Bureau of Indian Affairs, the Bureau of Land Management, and the National Park Service entered into a Stipulation for Withdrawal of Protests regarding Application Nos. 54003-54021 in Spring Valley.[1398]

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[1398] The Tribes argue the Stipulation is not properly in evidence. SNWA explained that the Stipulation provides it "may be used in any future proceeding to interpret and/or enforce its terms." Exhibit No. SE_041, p. 12. In any

Goals of the Spring Valley Stipulation included:

• To manage the development of groundwater by the Applicant in Spring Valley without causing injury to Federal Water Rights and/or unreasonable adverse effects to Federal Resources in the Area of Interest;

• To accurately characterize the groundwater gradient from Spring Valley to Snake Valley via Hamlin Valley;

• To avoid any effect on Federal Resources located within the boundaries of Great Basin National Park from groundwater withdrawal by the Applicant in Spring Valley;

• To manage the development of groundwater by the Applicant in Spring Valley in order to avoid unreasonable adverse effects to wetlands, wet meadow complexes, springs, streams, and riparian and phreatophytic communities (referred to as Water-dependent Ecosystems) and maintain the biological integrity and ecological health of the Area of Interest over the long term;

• To avoid any effects to Water-dependent Ecosystems within the boundaries of Great Basin National Park; and,

• To manage the development of groundwater by the Applicant in Spring Valley to avoid an unreasonable degradation of the scenic values of the visibility from Great Basin National Park due to a potential increase in airborne particulates and loss of surface vegetation which may result from groundwater withdrawals by the Applicant in Spring Valley.

The Stipulation created a Biological Work Group ("BWG"), which includes representatives from SNWA, the Bureau of Indian Affairs, the Bureau of Land Management, the National Park Service, and the U.S. Fish and Wildlife Service.[1399] These representatives are biologists who provide scientific and technical expertise.[1400] The Nevada Department of Wildlife, the Utah Division of Wildlife Resources and the Nevada State Engineer have also

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event, because the State Engineer's ruling relies on the incorporation of the BMP, rather than the Stipulation, arguments about the admissibility of the Stipulation are not relevant to the State Engineer's environmental soundness determination.

[1399] Exhibit No. SNWA_365, p. 1-2; Transcript, Vol.8 p. 1809:11-15 (Marshall).

[1400] Transcript, Vol.8 p. 1809:10-19 (Marshall).

participated in BWG meetings developing and implementing the Biological Monitoring Plan ("BMP").[1401] The State Engineer finds that he can utilize the biological expertise of the BWG as an advisory panel throughout the administration of the Project.

The role of the BWG is to develop and implement a BMP.[1402] The BMP requires the development of conceptual models and the identification of indicators and ecological attributes to be monitored throughout Spring Valley and adjacent basins that will allow for the thorough assessment of the health and integrity of the full range of groundwater-influenced resources in Spring Valley and adjacent basins.[1403] In addition, the BMP contains a detailed monitoring plan which has been in use for two and half years. Development of the monitoring plan involves significant interaction between the BWG and the hydrologic Technical Review Panel ("TRP"). This interaction is integral to enhancing the technical understanding of monitoring processes and results under the BMP.[1404] The coordination between hydrologic and biologic experts improves the ability of the State Engineer to assure that environmental resources will be properly protected as the hydrologic decisions are made to regulate the Project. Detailed management and mitigation approaches will be included in the BMP when enough data and information has been gathered to support their development. The BMP envisions and establishes a framework for such management and mitigation approaches.[1405]

The BMP provides for monitoring potential impacts to both Spring Valley and adjacent basins.[1406] The Spring Valley BMP establishes an Initial Biologic Monitoring Area ("IBMA")

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[1401] Exhibit No. 365, p. 1-2; Transcript, Vol.8 p. 1809:15-19 (Marshall).
[1402] *See* Spring Valley Stipulation, Exhibits A & B; DDC Stipulation, Exhibit A.
[1403] Exhibit No. SNWA_365, pp. 2-1 to 2-4.
[1404] Transcript, Vol. 8, p. 1813:8-12 (Marshall).
[1405] Exhibit No. SNWA_365 (Spring Valley BMP), § 8.4; Transcript Vol.8 p. 1810:12-15 (Marshall).
[1406] Exhibit No. SNWA_365, p. 1-6; Transcript, Vol.8 p. 1810:5-11 (Marshall).

that encompasses the Spring Valley Hydrographic Basin (HB #184), the northern portion of the Hamlin Valley Hydrographic Basin (HB #196), and the Big Spring Creek sub-watershed in southern Snake Valley (HB #195).[1407] The IBMA contains portions of Hamlin and Snake Valley because of potential interbasin groundwater flow from Spring Valley.[1408] Notably, 95% of the land in the IBMA is federally held; only 4% is private land.[1409] Protestants' expert, Dr. James Deacon, agreed the monitoring sites identified by the BMP will produce a "good body of information."[1410]

The State Engineer approved the Spring Valley BMP on January 23, 2009.[1411] The Applicant has demonstrated its commitment to implementing the BMP in the Spring Valley Biological Monitoring Plan Annual Reports it filed even after the reversal of the prior Spring Valley ruling (Ruling 5726). These reports reflect the extensive work on data collection, conceptual model formulation and determination of representative monitoring locations.[1412] These reports provide valuable information to the State Engineer, which will inform his continued regulatory control over the Project. Through this ruling, the State Engineer expressly incorporates the Spring Valley BMP into the terms of the approved permits.

Based on the evidence in the record, including but not limited to that cited above, the State Engineer finds the monitoring and reporting aspects of the BMP comprehensively address the groundwater-influenced environmental resources of Spring Valley and adjacent basins. The sites and species identified for monitoring are representative of sites and species found

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[1407] Exhibit No. SNWA_365, p. 1-6.
[1408] Exhibit No. SNWA_365, p. 1-6.
[1409] Exhibit No. SNWA_365, p. 1-6.
[1410] Transcript, Vol.19 p. 4181:22-24 (Deacon).
[1411] Exhibit No. SNWA_367.
[1412] Exhibit Nos. SNWA_368; SNWA_369; SNWA_418.

throughout the federal, state and private resources within Spring Valley and adjacent basins. The State Engineer finds that incorporation of the BMP in the permit terms for the Applications, and the State Engineer's continued regulatory control over pumping under the Applications, will ensure proper monitoring and oversight of the Project and its environmental soundness as it relates to groundwater-influenced resources.

### D. Adaptive Management

The BMP provides flexibility for future modifications to the monitoring plan based on new information and technologies and future management considerations.[1413] In addition, the monitoring methodology instituted by the BMP provides an adaptive management framework, in other words, instituting the steps of setting goals and priorities, developing monitoring and conservation strategies, taking needed action, measuring results, and refining the plan.[1414] Protestants' expert Dr. Patten emphasized that monitoring is a critical element of adaptive management, which can result in the successful management of systems if resource managers adhere to the steps of researching, learning, testing ideas, adapting, reconsidering conceptual ideas, and trying again.[1415] A central component of the BMP, adaptive management calls for continual evaluation of the BMP and its success, and it provides for alteration of the BMP as necessary to achieve environmental soundness-related goals.[1416]

Protestants assert adaptive management plans are not "learn-as-you-go" plans, and criticize the Applicant's BMP on this ground. However, Dr. Patten conceded repeatedly that learning, and adapting to what scientists learn through monitoring, is an important part of

[1413] Exhibit No. SNWA_365, p. 1-6.
[1414] *See* Exhibit No. SNWA_365, p. 3-3.
[1415] Exhibit No. SNWA Ex. 461, p. 17; Transcript, Vol.18 pp. 4024:20-4025:24 (Patten).
[1416] Transcript, Vol.8 p. 1815:10-16 (Marshall).

understanding the ecological function of systems and managing those systems.[1417] Dr. Patten further conceded that monitoring programs can achieve ecological sustainability of spring areas through appropriate water management.[1418] Protestants' witness, Dr. Robert Harrington, Director of the Inyo County Water Department, acknowledged that the adaptive management process is one he employs in the Owens Valley,[1419] and that adaptive management has had success there.[1420]

Based on the evidence in the record, including but not limited to that cited above, the State Engineer finds the adaptive management approach incorporated in the BMP is an accepted scientific approach that is appropriate and advisable for managing a long-term Project such as this one. The State Engineer finds that adaptive management is the best way to ensure water development occurs in a manner that is environmentally sound. This finding is subject to the discussion below on triggers and thresholds, and subject to the right to review, approve, deny and/or modify the adaptive management plan and BMP as warranted throughout the life of the Project.

### E. Triggers and Thresholds

The BMP lays out a process for developing triggers for action in the event an unreasonable adverse impact to a resource is anticipated.[1421] The process includes the identification of conservation targets and their key ecological attributes and indicators and the development of adequate baseline data.[1422] The BWG agreed to collect at a minimum seven

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[1417] Transcript, Vol.18 pp. 4023:10-4025:20 (Patten).
[1418] Exhibit No. GBWN_059, p. 12; Transcript, Vol.18 pp. 4027:10-4028:1 (Patten).
[1419] Transcript, Vol.23 p. 5271:2-14 (Harrington).
[1420] Transcript, Vol.23 pp. 5208:23-5209:13 (Harrington).
[1421] Exhibit No. SNWA_365, pp. 8-4, 8-5.
[1422] Transcript, Vol.8 p. 1815:4-16 (Marshall).

years of baseline data prior to groundwater development in Spring Valley.[1423] The BWG has already collected two years of data.[1424] The BWG is fully engaged in the process of data development.[1425]

Protestants argue the BMP provides inadequate assurances of the Project's environmental soundness because it has not yet identified the specific quantifiable standards that will be used to provide early warning to impacts in the ecosystem.[1426] However, under the BMP, the BWG is working to develop suitable conservation targets and parameters that in concert with hydrologic monitoring will provide early warning of impacts to the ecosystem.[1427] Factors such as natural variation in the environmental resources must be understood before any standards or triggers are set.

Selecting specific standards before a full baseline is developed would be premature.[1428] It would not lead to sound scientific decisions.[1429] Indeed, Protestants' expert Cliff Landers stated, "[Y]ou really have to have baseline data in order to be able to make intelligent decisions."[1430] Dr. Robert Harrington agreed the collection of baseline data prior to groundwater withdrawal makes the Project far better positioned to ensure water development occurs in a sustainable manner than was the case in the Owens Valley.[1431]

Based on the evidence in the record, including but not limited to that cited above, the State Engineer finds that the BMP establishes a sound process for developing triggers and

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[1423] Transcript, Vol.8 p. 1829:18-22 (Marshall).
[1424] Transcript, Vol.8 p. 1835:11 (Marshall).
[1425] Transcript, Vol.8 p. 1829:4-14 (Marshall).
[1426] Transcript, Vol.23 p. 5276: 6-17 (Harrington).
[1427] Transcript, Vol.8 p. 1836:3-15 (Marshall).
[1428] Transcript, Vol.12 p. 2683:16-21, Vol.14 p. 3211:7-15 (Marshall).
[1429] Transcript, Vol.12 p. 2686: 2-9 (Marshall).
[1430] Transcript, Vol.28 p. 6289:10-11 (Landers).
[1431] Transcript, Vol.23 pp. 5286:22-5287:5 (Harrington).

decisional thresholds to be employed in the adaptive management plan for the Project. Furthermore, it is premature to set management triggers and decision thresholds until additional years of data have been collected and natural variation and other factors are thouroughly understood. The State Engineer finds that failure to set triggers or thresholds at this time does not invalidate the BMP or undercut the development of an effective adaptive management plan, to the contrary, it demonstrates the Applicant's determination to proceed in a scientifically informed, environmentally sound manner.

**F. Enforcement and Dispute Resolution**

Protestants argued the protections provided by the BMP are inadequate because the Stipulation between SNWA and the Department of the Interior agencies lacks adequate enforcement mechanisms.[1432] However, as Mr. Marshall identified, the Applicant "is bound by any decision made by the State Engineer."[1433] As the State Engineer admonished, the regulation of water rights is in the State Engineer's purview, and the State Engineer proactively monitors impacts to existing rights and the environment.[1434] The State Engineer always retains the authority to monitor water rights and any impact to them, and the dispute resolution process in the Stipulation has no impact on that authority.[1435]

Although Dr. Deacon has criticized the Stipulation based on his belief that final or controversial decisions would be made by management personnel rather than scientists, Mr. Marshall testified that decision-makers act on the basis of the recommendations made by the scientifically trained staff that comprise the technical committees, such as the biologists who

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[1432] *See* Transcript, Vol.11 p. 2495:1-10 (Hejmanowski).
[1433] Transcript, Vol.11 p. 2496:13-14 (Marshall).
[1434] Transcript, Vol.11 p. 2499:7-22 (State Engineer King).
[1435] Transcript, Vol.11 p. 2499:16-22 (State Engineer King).

develop and implement the BMP.[1436] Protestants' witness, former Great Basin National Park superintendent Rebecca Mills, acknowledged that federal agency management takes seriously and follows the recommendations of scientific personnel.[1437]

The State Engineer finds that enforcement of the Stipulation is a matter between the parties to it, and that he is not relying on the Stipulation to make his environmental soundness determination. The State Engineer finds that any future disputes regarding the environmental soundness of the Applications will be addressed through the ongoing jurisdiction of the State Engineer over pumping pursuant to the Applications, and that this is adequate to ensure the environmental soundness of the Project.

**G. <u>Environmental Effects Analysis</u>**

The Applicant identified those environmental areas of interest in Spring Valley and adjacent basins that could be sensitive to groundwater withdrawal.[1438] The Applicant applied both a qualitative and a quantitative analysis to predict whether environmental areas of interest were susceptible to impacts from pumping pursuant to the Applications.[1439] Under the qualitative approach, hydrologists assessed local hydrology, specifically connectivity to the regional aquifer, to determine whether a site could be impacted by groundwater withdrawal.[1440] If a site lacked connectivity to the regional aquifer, no quantitative analysis was warranted because no impacts can occur when the site is not linked to the regional aquifer.[1441] If quantitative analysis was warranted, results from the Applicant's groundwater model were

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[1436] Transcript, Vol.12 pp. 2822: 25-2823:17 (Marshall).
[1437] Transcript, Vol.22 p. 4953:13-23 (Mills).
[1438] Exhibit No. SNWA_363, pp. 2-3 to 2-11 (Spring Valley), pp. 2-19 to 2-22 (Snake Valley), pp. 2-23 to 2-25 (Hamlin Valley), pp. 2-26 to 2-28 (Lake Valley); Transcript, Vol.12 pp. 2728:15–2738:7 (Spring Valley), 2745:18–2747:15 (Snake Valley)(Marshall).
[1439] Transcript, Vol.12 p. 2796:11-17 (Marshall).
[1440] Transcript, Vol.12 pp. 2796:21-2797:1 (Marshall).
[1441] Transcript, Vol.12 p. 2797:2-4 (Marshall).

consulted, using criteria reflective of the limitations in using a regional model.[1442] This criteria was a 50-foot or greater drawdown in depth to groundwater or a 15 percent reduction in spring flow.[1443] This 50-foot, 15 percent criteria did not provide the definition of a reasonable or unreasonable impact, it does not set monitoring priorities or establish monitoring sites, and it does not form the basis for biological evaluations.[1444] The Applicant used the 50-foot, 15 percent criteria for an initial evaluation of the appropriateness of the monitoring network established by the BWG.[1445] Due to the inability of the groundwater model to make site-specific predictions, the Applicant, the federal regulators and the State Engineer's office will rely on the broad monitoring network put in place by the BWG to determine the actual environmental effects and the mitigation required.[1446]

This measured approach to assessing impacts contrasts sharply with the impacts analysis provided by Protestants' expert, Dr. James Deacon.[1447] Dr. Deacon did not use a qualitative or quantitative approach. Instead he assumed all springs, even mountain block springs that are disconnected from the regional aquifer, would dry up and thus all species dependent on those springs would die.[1448] He did not do any other analysis on the effect of merely reducing flows or of drying up some springs as opposed to all springs. Dr. Deacon's analysis is generalized, and it relies on the results from Dr. Myers' modeling, which the State Engineer has already found carry little weight.[1449] However, even Dr. Myers did not assume that the Applicant's pumping would

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[1442] Transcript, Vol.12 p. 2797:7-8 (Marshall).
[1443] Transcript, Vol.12 p. 2797:12-14 (Marshall).
[1444] Transcript, Vol.12 pp. 2797:25-2799:15 (Marshall).
[1445] Transcript, Vol.12 p. 2798:18-23 (Marshall).
[1446] Transcript, Vol.12 pp. 2799:9-19 (Marshall).
[1447] *See* Exhibit No. GBWN_014.
[1448] *See* Exhibit No. GBWN_014, pp. 2-3; Exhibit No. GBWN_138, pp. 5-8; Exhibit No. GBWN_248, pp. 4, 6-7; Transcript; Vol.12 p. 2820-21:14-21 (Marshall).
[1449] Transcript, Vol.19 p. 4162: 2-5 (Deacon).

dry up mountain block springs.[1450] Dr. Deacon stated that even if Dr. Myers was wrong he would not change his opinion, because Dr. Myers' modeling conclusions were consistent with the BLM DEIS model results.[1451] However Dr. Deacon conceded on cross examination that the BLM cautioned their model results "did not have the level of accuracy required to predict absolute values at specific points in time (especially decades or centuries into the future)."[1452] He also agreed that because of the regional nature of the groundwater model it is not possible to accurately predict site specific changes in flow for springs and streams.[1453] As a result, Dr. Deacon concluded on cross examination that groundwater models only permit a generalized understanding and therefore require testing through a monitoring plan.[1454] The State Engineer finds Dr. Deacon's opinion concerning the affect on aquatic species due to Project pumping effects is not credible because no evidence in the record supports his underlying assumptions that all springs would go dry and he did no further analysis to quantify the impacts of pumping on any particular species at any specific location.

Dr. Deacon also relied on Dr. Bredehoeft's erroneous application of the "time to capture" theory.[1455] He acknowledged the models upon which he relied so extensively for site-specific analysis provide predictions that, applied even more generally, are "uncertain at best."[1456] His report does not take into consideration the realities of federal and state environmental compliance and the authority that the State Engineer holds.[1457] Accordingly, his analysis lacks

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[1450] Transcript, Vol.20 p. 4468:22-25 (Myers).
[1451] Transcript, Vol.19 p. 4162:10-13, 4190:2-12 (Deacon).
[1452] Transcript, Vol.19 p. 4184:12-22 (Deacon).
[1453] Transcript, Vol.19 p. 4185:11-18 (Deacon).
[1454] Transcript, Vol.19 p. 4186:1-8 (Deacon).
[1455] Transcript, Vol.19 p. 4189:6-15 (Deacon).
[1456] Transcript, Vol.19 pp. 4185:17-4186:4 (Deacon).
[1457] Exhibit No. GBWN_014, p. 4.

scientific rigor.[1458] Dr. Deacon also demonstrated he did not understand that the 50-foot, 15 percent criteria formed the basis for an effects analysis, rather than the definition of an unreasonable impact.[1459] The State Engineer finds Dr. Deacon's testimony lacks credibility, and it is given minimal weight.

The Applicant's effects analysis predicted possible impacts to four valley floor areas: Swamp Cedar North, Unnamed #5 Spring, Four Wheel Drive Spring, and South Millick Spring.[1460] Special status species at some of these sites include northern leopard frog, birds, and bats.[1461] Big game use some of these habitats from time to time.[1462] Groundwater drawdown and reduced spring flow at these sites has the potential to further degrade existing habitat and cause the redistribution of mobile species.[1463] However, the aquatic habitats in this area are relatively small, and through the use of the available monitoring and management tools, unreasonable adverse effects can be avoided and/or mitigated to ensure the sustainable management of the associated biological resources.[1464] For instance, mitigation techniques for reducing impacts to swamp cedars could include irrigation with surface water and fencing out herbivores such as cattle and deer that might graze on juvenile swamp cedars.[1465]

Sites where the 50-foot, 15 percent criteria indicated no impacts would occur also will be monitored.[1466] For instance, several types of monitoring data collection efforts occur at the

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[1458] Transcript, Vol.12 p. 2820:18-24 (Marshall).
[1459] Transcript, Vol.19 pp. 4179:11-4181:2 (Deacon).
[1460] Transcript, Vol.12 p. 2800:4-14 (Marshall).
[1461] Transcript, Vol.12 pp. 2800:22-2801:7 (Marshall).
[1462] Transcript, Vol.12 p. 2801:8-14 (Marshall).
[1463] Exhibit No. SNWA_363, p. 8-2; Transcript, Vol.12 pp. 2801:20-2803:1 (Marshall).
[1464] Exhibit No. SNWA_363, p. 8-2.
[1465] Transcript, Vol.12 p. 2803: 2-21 (Marshall).
[1466] Transcript, Vol.12 p. 2798:10-15 (Marshall).

Shoshone Ponds site, home to the Pahrump pool fish.[1467] These efforts include monitoring of Pahrump pool fish, relict dace, and leopard frog.[1468] A number of vegetative transects have been placed across the aquatic, wetland, and meadow habitats, as well.[1469]

The Applicant's adjacent basins analysis predicted no impacts to Snake, Hamlin, and Lake Valley environmental areas of interest.[1470] However, even though no sites met or exceeded the 50-foot, 15 percent criteria, monitoring is in place to provide early warning of any unanticipated effects,[1471] and the BMP applies to ensure there would be adequate monitoring, management, and mitigation.

In addition to the Applicant's environmental effects analysis, the State Engineer considered the effects analysis prepared by the BLM as part of its DEIS.[1472] This analysis by its nature more broadly describes all possible impacts and includes pumping alternatives that are not being considered by the State Engineer during this hearing.[1473] The DEIS analysis did not consider the State Engineer's ability to curtail injurious well depletions or impose protective terms and conditions.[1474] While the DEIS included many useful analyses, because it was prepared for a different function than the State Engineer's environmental soundness determination, the State Engineer places minimal weight on the DEIS effects analysis.

Based on the evidence in the record, including but not limited to that cited above, the State Engineer finds that the Applicant has adequately described the potential environmental

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[1467] Transcript, Vol.12 p. 2804:1-5 (Marshall).
[1468] Transcript, Vol.12 p. 2804:4-6 (Marshall).
[1469] Transcript, Vol.12 p. 2804:6-8 (Marshall).
[1470] Transcript, Vol.12 pp. 2806:18-2807:2 (Snake Valley), 2807:19-2808:2 (Hamlin Valley), 2808:8-19 (Lake Valley) (Marshall).
[1471] Transcript Vol. 12, p. 2807:3-8 (Snake Valley); p. 2808:3-7 (Hamlin Valley) (Marshall).
[1472] *See generally* Exhibit No. GBWN_110.
[1473] Exhibit No. GBWN_110, p. 1 (Letter from Penny Woods, Project Manager, BLM, to Reader, dated June 10, 2011).
[1474] Transcript, Vol.12 pp. 2814:24-2815:3 (Marshall).

effects of the Project in a manner that allows the State Engineer to make an informed environmental soundness determination.

### H. A Viable Ecosystem Will Remain

The Applicant presented substantial evidence that plant communities will receive adequate water to avoid unreasonable adverse effects. In Spring Valley, development of the baseline and understanding of change in depth to water ("DTW") concepts creates the ability to plan for effective adaptive management.[1475] The Applicant's stated goal for the management of plant succession that may occur is the maintenance of healthy and functioning ecosystems. If there is a transition, it would be a gradual transition in the species composition of shrub communities, which still support terrestrial wildlife, bird and bat populations, and big game so that the ecosystem continues to be functioning and healthy.[1476]

There is no one-to-one relationship between DTW and plant function.[1477] This means that impacts to plant function cannot be predicted based solely on projected water table declines. Precipitation impacts the relationship of plants to DTW because many plants in arid environments prefer to use precipitation-derived water over groundwater.[1478] Anthropogenic factors, especially irrigation, impact the location and type of vegetation.[1479]

Where change may occur, it would follow orderly succession patterns.[1480] Succession does not result in a denuded landscape; as one plant type is reduced, there is a shift to other plant

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[1475] Transcript, Vol.7 p. 1628:15-18 (McLendon).
[1476] Transcript, Vol.12 p. 2812:5-11 (Marshall).
[1477] Exhibit No. SNWA_039, p. 7; Exhibit No. SNWA_044, p. G24; Transcript, Vol.7 pp. 1633:25-1634:2 (McLendon).
[1478] Exhibit No. SNWA_039, p. 7; Exhibit No. SNWA_044, p. G24; Transcript, Vol.7 pp. 1628:21-1629:3 (McLendon).
[1479] Transcript, Vol.8 pp. 1648:24–1649:4 (McLendon).
[1480] Transcript, Vol.8 1691:2-11 (McLendon).

types better adapted to the altered conditions.[1481] Changes in cover values do not equate to a lack of plant life; roots underground hold soil in place and collect moisture.[1482] There is no dispute in the scientific community that diverse, stable communities, not barren land, result from the plant succession process.[1483]

The aquatic and wetland communities would be most sensitive to change,[1484] but these are subject to monitoring, management and mitigation.[1485] Most of the wet meadows and grasslands in Spring Valley are sustained by irrigation and surface water runoff, so if irrigation continues, these would persist despite any change in groundwater levels.[1486]

Protestants argued that swamp cedars were also susceptible to adverse impacts from an increased DTW. The Applicant's plant expert Dr. McLendon testified that swamp cedars are the local name for Rocky Mountain juniper, the most widespread type of juniper in the Western United States[1487]. The species has a wide range all over the western United States and is adapted to many different environmental conditions[1488]. While the rooting depth of swamp cedars in Spring Valley is unknown, Rocky Mountain junipers have a maximum rooting depth of 20 meters.[1489] While it is possible that the "swamp cedars" are a distinct ecotype adapted to high groundwater in Spring Valley, there have been no genetic or field ecotype studies that have drawn that conclusion[1490]. In Spring Valley, Rocky Mountain juniper appears in both the valley floor where they are known as swamp cedars and in some higher elevation non-valley floor

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[1481] Transcript, Vol.7 pp. 1624:10-18 (McLendon).
[1482] Transcript, Vol.8 pp. 1672:19-1673:1 (McLendon).
[1483] Transcript, Vol.8 p. 1706:5-9 (McLendon).
[1484] Transcript, Vol.8 pp. 1710:23–1711:2 (McLendon).
[1485] Transcript, Vol.8 pp. 1713:19–1715:5 (McLendon).
[1486] Transcript, Vol.8 p. 1655:5-16, 1657: 8-25 (McLendon).
[1487] Transcript, Vol.8 p. 1677:3-4 (McLendon).
[1488] Transcript, Vol.8 p. 1677:17-19 (McLendon).
[1489] Transcript, Vol.8 p. 1681:5-9 (McLendon).
[1490] Transcript, Vol.8 p. 1677: 9-11 (McLendon).

locations.[1491] The valley floor populations occur in two clusters, one about in the center of Spring Valley and the other around Shoshone Ponds.[1492] The Shoshone Ponds cluster is sustained in part by flow from artesian wells.[1493] The highest cover values for junipers are in the wetter lowland sites.[1494] In drier sites the density and the cover values decrease.[1495] This indicates that junipers respond to increased water supply in the lowland sites but can tolerate drier conditions. However, where standing water occurred the trees were dying.[1496] In the event that pumping has an effect on swamp cedars, Mr. Marshall testified that the Applicant could mitigate the impacts by regulating grazing and using the wells or surface water sources in the area to irrigate the trees.[1497]

Protestants did not present a witness that testified about swamp cedars or contradicted Dr. McLendon's description of swamp cedars and how they use water. Based on the evidence in the record, including but not limited to that cited above, the State Engineer finds that any increase in DTW that effects the swamp cedar will result in a decrease of density and cover, not the elimination of the swamp cedar. Furthermore, the Applicant has the ability to mitigate impacts to swamp cedars through regulating grazing and using the wells or surface water sources in the area to irrigate the trees.

Protestant CPB argued that approving the Applications would decrease the amount of forage available for their cattle to eat and would result in cheatgrass infestation. However, Dr.

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[1491] Transcript, Vol.8 p. 1676: 7-12 (McLendon).
[1492] Transcript, Vol.8 p. 1676:1-6 (McLendon).
[1493] Transcript, Vol.8 p. 1740:15-17 (McLendon).
[1494] Transcript, Vol.8 p. 1678:17-18 (McLendon).
[1495] Transcript, Vol.8 p. 1678:19-23 (McLendon).
[1496] Transcript, Vol.8 pp. 1678:15-1679:4 (McLendon).
[1497]Transcript, Vol.12 p. 2803:2-17 (Marshall).

McLendon testified that cheatgrass would not result from a change in DTW.[1498] External factors (soil disturbance, heavy grazing) result in domination of a site by cheatgrass, but those factors can be controlled.[1499] Understanding how cheatgrass functions allows management of it.[1500] With regard to cattle forage, some forage types are not phreatophytes. Since they do not rely on groundwater, any change in DTW would not affect these types of forage. Most of the wet meadows in Spring Valley are created via surface water irrigation techniques or surface water runoff, [1501] which would not change due to an increase in DTW. The State Engineer finds that in the absence of any specific site-by-site analysis of different forage types and their dependence on the regional groundwater system, the general plant succession evidence presented by Dr. McLendon is persuasive.

The 75-year vision for Spring Valley is of a landscape that looks much the same, with perhaps some bigger and smaller meadows, perhaps some different composition of shrublands, and aquatic and wetland habitats still in place.[1502] Many wetlands in Spring Valley are supported by surface water diversions, and these wetlands would not be changed by declines in DTW.[1503] A slow, gradual change in DTW will lead to a healthy transition in the plant community, indicating that hydrologic management of the Project should focus on slow, gradual declines in DTW to ensure environmental soundness.[1504] Overall, this would lead to a greater presence of shrublands.[1505] In some instances, such as where greasewood shrublands are ultimately replaced

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[1498] Transcript, Vol.8 p. 1694:6-10 (McLendon).
[1499] Transcript, Vol.8 pp. 1694:14–1696:10 (McLendon).
[1500] Transcript, Vol.8 pp. 1696:19–1697:7 (McLendon).
[1501] Transcript, Vol.8 pp. 1655:5-16, 1657:19-25 (McLendon).
[1502] Transcript, Vol.8 pp. 1767:11-1768:5 (McLendon).
[1503] Transcripts, Vol.8 pp. 1767:20-1768:19 (McLendon).
[1504] Transcript, Vol.12 p. 2812:5-11 (Marshall).
[1505] Transcript, Vol.8 pp. 1769:4-15 (McLendon).

by big sagebrush shrublands, ecological benefits in the form of increased vertebrate density may be realized.[1506]

In those areas where surface flows to aquatic habitats may be substantially diminished, a decline in species diversity can result.[1507] However, as described in the Effects discussion above, impacts will not result in habitat or population reductions throughout Spring Valley and adjacent basins, but will be more limited in scope. For instance, although there may be a reduction in leopard frog habitat quality or quantity in discrete areas, mitigation techniques could be used in other areas to improve or increase overall leopard frog populations.[1508] Although there might be localized impacts to individuals at a specific site, there would be little impact to bird and bat populations in Spring Valley because birds and bats are mobile species and could reach other springs and water sources throughout Spring Valley and the adjacent basins.[1509] For species that lack mobility, such as fish, in addition to its approach of avoidance and minimization, the Applicant plans proactive steps, such as working with the Nevada Department of Wildlife to enhance habitat to improve species resiliency.[1510]

Based on the evidence in the record, including but not limited to that cited above, including the adoption of the BMP and adaptive management techniques discussed herein, the State Engineer finds that despite any increase in depth to water, viable plant and wildlife communities will remain, and the Project will be environmentally sound. The State Engineer finds that even in those areas where impacts may occur, wildlife will retain access to habitat, water and food.

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[1506] Exhibit No. SNWA_363, p. 8-1.
[1507] Exhibit No. SNWA_363, p. 8-1.
[1508] Transcript, Vol.12 pp. 2801:20-2802:13 (Marshall).
[1509] Transcript, Vol.12 pp. 2802:20-2803:1 (Marshall).
[1510] Transcript, Vol.12 p. 2810:8-20 (Marshall).

## I. Ability to Mitigate Potential Effects

In both Spring Valley and adjacent basins, the Applicant will implement effective monitoring, management and mitigation programs that will protect environmental areas of interest. Dr. Patten, Dr. Harrington and Mr. Landers all acknowledged the effectiveness of monitoring, management and mitigation programs.[1511] The Applicant's approach is first avoidance, then minimization, then mitigation of impacts, avoiding as many conflicts as possible as the Project is developed.[1512]

Voluntary commitments by the Applicant pursuant to its participation with Fish Recovery Implementation Teams and as a signatory to Candidate Conservation Agreements with Assurances provide an additional layer of environmental protections to such species as the Greater Sage-Grouse, the least chub, the Columbia spotted frog, and the Big Springs spinedace.[1513]

The Applicant has acquired extensive properties in Spring Valley and other basins that include land, surface water and groundwater rights, and grazing allotments ("Northern Resources"), which give numerous options for implementing management and mitigation actions that will protect the environment.[1514] The Northern Resources provide a platform for using integrated resource management techniques. Integrated resource management techniques coordinate the management of water, land, vital ecosystems, special status species, and other related natural resources to ensure their long-term sustainability.[1515]

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[1511] Exhibit No. GBWN_59, p. 12; Transcript, Vol.18 pp. 4027:10-4028:1 (Patten); Transcript, Vol.23 pp. 5308:23-5309:13 (Harrington); Transcript, Vol.28 p. 6297:19-22 (Landers)
[1512] Transcript, Vol.12 pp. 2799:20-2800:1 (Marshall).
[1513] Exhibit No. SNWA_363, p. 6-1, Table 6-1: Conservation Initiatives in which SNWA Voluntarily Participates; Transcript Vol.12 pp. 2784:12-2785:14 (Marshall).
[1514] Exhibit No. SNWA_363, p. 6-5; Transcript, Vol.12 pp. 2790:23–2791:3 (Marshall).
[1515] Exhibit No. SNWA_363, p. 6-5; Transcript, Vol.12 pp. 2789:22–2790:11 (Marshall).

The Applicant purchased private landholdings totaling approximately 23,500 acres in Spring, Dry Lake, and Steptoe Valleys.[1516] These deeded properties encompass, in part, the majority of Stonehouse Spring Complex; the majority of Minerva Spring Complex; a portion of Keegan Spring Complex; portions of Swamp Cedar North and Swamp Cedar South; Swallow Spring; and Unnamed #5 Spring.[1517] Four of the ranch properties are base properties to federal grazing allotments that are managed by BLM or U.S. Forest Service.[1518] The grazing allotments span eight hydrographic areas (Tippett, Spring, Steptoe, Hamlin, Lake, Dry Lake, Patterson, and Pahroc Valleys) and total approximately 900,000 acres, or 1,400 square miles.[1519] The majority of these grazing allotments are in Spring Valley (>60 percent) and northern Dry Lake Valley (>30 percent).[1520] Approximately 40 percent (over 4,500 acres) of the wetland/meadow habitats in Spring Valley occur on the Applicant's deeded property and 40 percent (approx. 60,000 acres) of the phreatophytic shrublands on the valley floor and valley floor / alluvial fan interface in Spring Valley occur within the Applicant's grazing allotments.[1521] These grazing allotments encompass, in part, Shoshone Ponds; Blind Spring; Four Wheel Drive Spring; a portion of Keegan Spring Complex; a small portion of Minerva Spring Complex; South Millick Spring; portions of Swamp Cedar North and Swamp Cedar South; a downstream channel of Unnamed #5 Spring; and Willow Spring.[1522] In addition, a conservation easement, the Cave Valley Ranch

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[1516] Exhibit No. SNWA_363, p. 6-6.
[1517] Exhibit No. SNWA_363, p. 6-6.
[1518] Exhibit No. SNWA_363, p. 6-6.
[1519] Exhibit No. SNWA_363, p. 6-6.
[1520] Exhibit No. SNWA_363, p. 6-6.
[1521] Exhibit No. SNWA_363, p. 6-6.
[1522] Exhibit No. SNWA_363, p. 6-6.

Conservation Easement, totaling approximately 1,480 acres, encompasses part of the Parker Station Spring Complex and the headwaters of Cave Spring, all in Cave Valley.[1523]

The Applicant's Northern Resources are used by the aquatic special status species northern leopard frog and relict dace; the Toquerville pyrg; the terrestrial special status species Greater Sage-Grouse; valley-floor Rocky Mountain juniper trees; and big game.[1524] The Applicant can use the Northern Resources to irrigate with surface water or groundwater differently, and restrict grazing and enhance existing habitat as a way to avoid, minimize or mitigate potential Project impacts on the environmental areas of interest.[1525] The Applicant can also use the Northern Resources to manage succession of plant species through such techniques as modifying grazing and irrigation practices to reduce stress to meadow habitats, to improve meadows and wetlands, and to improve wildlife habitat.[1526]

Based on the evidence in the record, including but not limited to that cited above, the State Engineer finds that the Applicant has the ability to identify impacts of the Project through its environmental monitoring plan. If the Applicant is unable to avoid or minimize the impacts, it has the resources in place to mitigate any unreasonable impact.

**J. <u>Air quality</u>**

Protestants argued that the Project is not environmentally sound because it may cause air pollution through additional blowing dust. The State Engineer's authority in the review of water right applications is generally limited to considerations identified in Nevada's water law. Air quality is not a consideration identified in Nevada's water law; rather, it is under the jurisdiction

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[1523] Exhibit No. SNWA_363, p. 6-6.
[1524] Exhibit No. SNWA_363, p. 6-6.
[1525] Exhibit No. SNWA_363, p. 6-5; Transcript, Vol.12 pp. 2789:22–2790:11 (Marshall).
[1526] Transcript, Vol.12 pp. 2791:8 – 2791:11 (Marshall).

of the Nevada Department of Environmental Protection. Accordingly, these considerations are not properly before the State Engineer, and are not a basis for denying water rights applications.

Even if they were, however, substantial evidence showed that the project will not create a dust emissions problem. Although Protestants charged that dust problems at Owens Lake show that the Project also will create dust emissions problems, Protestants' experts agreed with Dr. Terry McLendon that there are many differences between Owens Valley and Spring Valley.[1527]

Based on hydrologists' potentiometric maps, Dr. McLendon concluded Spring Valley playas are predominantly dry playas.[1528] Protestant expert Mr. Clifford Landers acknowledged the data he reviewed on the Spring Valley playas was insufficient for site-specific evaluation.[1529] The data he reviewed was insufficient for making a definitive determination as to whether playas should be categorized as wet or dry playas.[1530]

Dr. McLendon testified that playas do not produce dust unless the surface is disturbed.[1531] And although there was some disagreement as to whether to divide playas into just wet and dry playas or three different categories,[1532] there was no disagreement that a change in depth to water may decrease, rather than increase, the propensity to blowing dust.[1533] Accordingly, experts arrived at the same end result: whether the playas are wet or dry, lowering the water table should reduce dust emissions.

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[1527] Transcript, Vol.8 p. 1697:13-17 (McLendon); Transcript, Vol.28 p. 6271:13-22 (Landers).
[1528] Transcript, Vol.8 p. 1700:18-21 (McLendon).
[1529] Transcript, Vol.28 pp. 6363:20-6364:12 (Landers).
[1530] Transcript, Vol.28 p. 6368:2-14 (Landers).
[1531] Exhibit No. SNWA_411; Transcript, Vol.8 p. 1701:3-5 (McLendon).
[1532] Transcript, Vol.28 p. 6377:5-9 (Landers).
[1533] Exhibit No. SNWA_411; Transcript, Vol.8 p. 1701:9-12 (McLendon); Transcript, Vol.28 pp. 6389:23-6390:1 (Landers).

The Applicant has demonstrated its commitment to environmental sustainability and informed, scientifically sound decision-making.[1534] The State Engineer finds that by requiring 1) the collection of biological baseline data in concert with hydrologic data; 2) a significant monitoring, management and mitigation plan through the incorporation of the BMP as conditions to development of the Applications; and 3) staged development and associated studies, there are sufficient safeguards in place to ensure that the interbasin transfer of water from Spring Valley will be environmentally sound. The State Engineer finds that any impacts to hydrologically related environmental resources in Spring Valley and adjacent basins will be reasonable, and the basins will remain environmentally viable.

## XI. FUTURE GROWTH AND DEVELOPMENT IN THE BASIN OF ORIGIN

Pursuant to NRS 533.370(6)(d) (2010), in determining whether to approve or reject an application for an interbasin transfer of groundwater, the State Engineer must consider whether the proposed action is an appropriate long-term use of the water, which will not unduly limit the future growth and development in the basin from which the water is exported. In considering the criterion of NRS 533.370(6)(d) (2010), the State Engineer has reviewed the evidence presented by the Applicant and the Protestants to determine whether the evidence supports the conclusion that there will be any future growth or development in Spring Valley which would be unduly limited by approving the Applications.

The Protestant position, generally, is that some or all of the Applications should be denied; arguing that the granting of the Applications will limit growth, adversely affect growth and development which has already occurred, and that the threat of these Applications have affected growth during their pendency. The Applicant argues that future development in Spring

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[1534] Transcript, Vol.12 p. 2724:9-20 (Marshall).

Valley that requires significant new water resources is highly unlikely to occur in the foreseeable future and, therefore, the use of water as described in the Applications is an appropriate long-term use that will not unduly limit future growth and development in Spring Valley.

In reviewing what constitutes future growth and development, the State Engineer has elected to adopt a broad, conservative interpretation; however, the State Engineer has determined that a definition encompassing every type of potential growth and development that might possibly occur at some point in the future is too broad and speculative. The State Engineer need not accept anything anyone can think up as a possibility and leave water in a basin for that purpose in hopes that the proposed or hoped for use someday occurs. Such a policy would be wasteful and contrary to Nevada law as water which could have been put to beneficial use would likely never be used.[1535] The State Engineer considers evidence of growth that is reasonably foreseeable to occur given current and historic conditions and trends. This includes projects that are planned or being developed and are currently or likely in the future to be economically, financially and technically feasible.

Additionally, the State Engineer notes that the Nevada Legislature has not mandated that any water be reserved for the basin of origin.[1536] Rather, pursuant to statute the State Engineer is required to consider "[w]hether the proposed action is an appropriate long-term use which will not unduly limit the future growth and development in the basin from which the water is exported."[1537] In determining the likelihood of future growth and development in Spring Valley, the State Engineer has considered the evidence submitted relevant to residential, commercial, industrial, agricultural and other categories of growth and development. The State Engineer has

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[1535] NRS 533.025 *et seq.* (2010)
[1536] NRS 570.370(6)(d).
[1537] NRS 570.370(6)(d).

then, based upon that evidence, determined what, if any, future water needs may be reasonably foreseeable to occur given current and historic conditions and trends.

The Applicant undertook a complete and comprehensive evaluation of the future rural economic development that would require significant water resources in Spring Valley, also referred to as the basin of origin.[1538] Among other things, the Applicant submitted evidence related to future agricultural use. This evidence primarily took the form of an investigation by experts retained by the Applicant, their summary report, and their supporting testimony.[1539] The Applicant submitted evidence regarding commercial, industrial, and alternative energy development within Spring Valley.[1540] The Applicant offered evidence related to possible residential development within Spring Valley.[1541] The Applicant also submitted evidence related to possible economic development and growth issues related to mining, manufacturing, tourism, hunting and general population growth.[1542] The Applicant also presented evidence and foundational testimony from Mr. Dylan Frehner regarding Lincoln County and the Lincoln County Water District's intentions in Spring Valley.[1543] In other words, the evidence submitted by the Applicant provided the State Engineer with a comprehensive evaluation of economic development and growth issues for Spring Valley and included an analysis of all current and proposed categories of development known to be relevant to the basin.

**A. <u>Future Economic Activity in Spring Valley</u>**

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[1538] Exhibit No. SNWA_241.
[1539] Exhibit Nos. SNWA_103, 104, 105, 241; Transcript, Vol.13 pp. 2947-3053 (Peseau and Carter). *See also*, Transcript, Vol.15 pp. 3357-3361 (Holmes).
[1540] Exhibit No. SNWA_113 through Exhibit No. SNWA_142, Exhibit No. SNWA_241; *See also*, Transcript, Vol.14 pp. 3273-3331, Vol.15 pp. 3321-3390 (Holmes); Transcript, Vol.13 pp. 3053-3083, Vol.14 pp. 3084-3144 (Linvill and Candelaria).
[1541] Exhibit No. SNWA_241; Transcript, Vol.14 pp. 3273-3331, Vol.15 pp. 3321-3390 (Holmes).
[1542] Exhibit No. SNWA_241; Transcript, Vol.14 pp. 3273-3331, Vol.15 pp. 3321-3390 (Holmes).
[1543] Exhibit No. SNWA_346; Exhibit No. SNWA_347; Transcript, Vol.14 pp. 3146, 3153-3157 (Frehner).

The Applicant undertook a comprehensive review of the historic and existing economic activity in Spring Valley. The Applicant submitted its findings and Mr. Richard Holmes[1544] testified regarding the examination he and his staff had undertaken. Mr. Holmes testified that it is very unlikely that residential, commercial and industrial development will occur within Spring Valley in the foreseeable future that would require additional water resources to be reserved for the basin.

In determining the likelihood of future economic growth and development in Spring Valley, Mr. Holmes reviewed federal, state and local publications and data resources and applied that information to general growth factors that he determined were particularly relevant in assessing the economic growth and development trends in Spring Valley.[1545] Mr. Holmes testified that the most fundamental factors which would lead to economic growth within Spring Valley include close proximity to large, established metropolitan centers and markets, sufficient population size, an educated labor force, a diversity of employment opportunities, location along the major transportation corridor, and substantial infrastructure, including electricity, roads, access to modern communications and the availability of basic public utilities and services.[1546]

In applying those factors to Spring Valley, Mr. Holmes testified that the presently declining population in Spring Valley is unlikely to show an upward trend.[1547] To support this conclusion, Mr. Holmes testified that the State of Nevada was the fastest growing state in the country for each of the last five decades, yet the population in Spring Valley remained virtually

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[1544] Mr. Holmes holds bachelor degrees in civil engineering and industrial economics as well as a master's degree in urban planning. Mr. Holmes additionally has approximately 40 years of experience working as a city and rural planner—20 years of which was spent as a planner in Clark County, Nevada, which has ranked as one of the fastest growing counties in the history of the United States. Exhibit No. SNWA_186. He was qualified by the State Engineer as an expert in land use planning. *See* Transcript, Vol.14 pp. 3279:4-5 (Holmes).
[1545] Exhibit No. SNWA_241, pp. 1-1 to 1-2; Transcript, Vol.14 pp. 3285-3299 (Holmes).
[1546] Exhibit No. SNWA_241, p.2-1; Transcript, Vol.14 pp. 3285-3299 (Holmes).
[1547] Exhibit No. SNWA_241, pp. 2-6 to 2-11; Transcript, Vol.14 pp. 3305-3308, Vol.15 pp. 3321-3332 (Holmes).

unchanged—in fact it decreased in population—during this period of extreme growth within the state.[1548] Because the population in Spring Valley did not increase even in this time of fast growth for the state as a whole, Mr. Holmes concluded that it is unlikely Spring Valley would experience an increase in population in the future.[1549] The Protestant witness Dr. Maureen Kilkenny not only conceded that the population statistics utilized by Mr. Holmes were correct, but she deferred to his numbers when presenting rebuttal testimony.[1550] Thus, based on the extremely low population of Spring Valley, Mr. Holmes concluded that there is little to no labor force for future business expansion within Spring Valley.[1551]

Furthermore, Mr. Holmes testified that Spring Valley is extremely isolated and is located well over 250 miles from the nearest metropolitan city.[1552] The extreme isolation of Spring Valley is further exacerbated by the lack of infrastructure within the valley, the lack of access to utilities such as sewer, electricity and natural gas, as well the absence of basic services such as medical services and police and fire protection.[1553] Mr. Holmes further testified that given the high expenses associated with developing the infrastructure and services needed to support economic growth within Spring Valley, it is unlikely that there will be any public or private investment to develop such infrastructure as Spring Valley will not generate significant return on the investment.[1554] Furthermore, Mr. Holmes concluded that there is limited potential for the establishment of new types of land uses or expansion of existing land uses in Spring Valley in the foreseeable future. For example, Mr. Holmes testified that water consumption for tourism

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[1548] Exhibit No. SNWA_241, pp. 2-6 to 2-11; Transcript, Vol.14 pp. 3305-3308, Vol. 15 pp. 3321-3332 (Holmes).
[1549] Transcript, Vol.14 pp. 3305-3308; Vol.15 pp. 3321-3332 (Holmes); Exhibit No. SNWA_241, pp. 2-6 to 2-11
[1550] Transcript, Vol.22 p. 5028 (Kilkenny).
[1551] Transcript, Vol.15 p 3332:8-12 (Holmes).
[1552] Exhibit No. SNWA_241, p. 2-4; Transcript, Vol.14 pp. 3301-3302 (Holmes).
[1553] Transcript, Vol.14 pp. 3294-3305(Holmes).
[1554] Transcript, Vol.15 pp. 3347-3349 (Holmes).

and recreation within Spring Valley will be minimal as the basin has stagnant hunting and fishing numbers and there are low visitor numbers at Great Basin National Park in adjacent Snake Valley. Additionally there are few mining operations in the basin despite the current high demand for metals.[1555] As such, based on all these factors, Mr. Holmes concluded that it is highly unlikely that Spring Valley will sustain any economic growth requiring significant water resources in the foreseeable future.[1556]

The Protestants provided evidence and testimony from Dr. Kilkenny to rebut Mr. Holmes' evaluation of the likelihood of future growth and development within Spring Valley. Dr. Kilkenny argued that the Applicant failed to consider the Central Place Theory Model and Rank-Size rule to predict future urban areas in Nevada.[1557] Dr. Kilkenny further argued in her rebuttal report that Mr. Holmes conceded in his expert report that the approval of the Applications will impact water resources in surrounding areas such as Ely, Baker and Caliente.[1558] Dr. Kilkenny additionally contends that the appropriate geographic scope for the analysis of the economic and social impact of the proposed water withdrawals and transfers is, at a minimum, the rural counties of White Pine and Lincoln.[1559] Finally, Dr. Kilkenny testified that the threat of these Applications has affected growth during their pendency.[1560]

The Applicant provided testimony and evidence to rebut Dr. Kilkenny's arguments and demonstrated that Dr. Kilkenny's testimony and expert report was based on fundamental errors.[1561] It is evident from Mr. Holmes' report and testimony that the Applicant does not

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[1555] Exhibit No. SNWA_241, p. 3-8 to 3-11; Transcript, Vol.14 pp. 3375-3381 (Holmes).
[1556] Exhibit No. SNWA_241, pp. 5-1 to 5-2; Transcript, Vol.15 pp. 3380-3381 (Holmes).
[1557] Exhibit No. GBWN_114, pp. 12-13.
[1558] Exhibit No. GBWN_114, p. 54
[1559] Exhibit No. GBWN_114, pp. 4-6.
[1560] Transcript, Vol.22 pp. 4988-4989, 5022-5023 (Kilkenny).
[1561] Transcript, Vol.15 pp. 3349-3355 (Holmes), Vol.13 pp. 3009-3013 (Peseau and Carter).

concede that the approval of the Applications will impact water resources in areas such as Ely, Baker and Caliente; rather, Mr. Holmes was referring to the impacts of increased tourism and recreation, not to the impacts of groundwater pumping.[1562] Additionally, Dr. Kilkenny testified that her arguments were misunderstood and that she did not intend to argue that hydrologic impacts would occur in the areas surrounding Spring Valley.[1563] While NRS 533.370(6)(d) (2010) does not require the State Engineer to look beyond the basins in examining future growth and development, the Applicant utilized county-wide data in assessing future growth and development when appropriate, and considered economic development within the counties containing Spring Valley.[1564] In contrast, Dr. Kilkenny admitted to speculation, utilized unduly strong and unsupported statements in her report, failed to correctly extrapolate figures from the source material she was updating, and admitted to numerous errors in her report.[1565] Critically, Dr. Kilkenny rests her conclusions upon a fundamental misunderstanding or disregard of Nevada water law and the prior appropriation doctrine. This is clear from her report and testimony, as she assumed the loss of all water in both White Pine and Lincoln counties as a result of pumping under the Applications.[1566] Additionally, Dr. Kilkenny's testimony regarding the lack of growth within the basins due to the mere threat of the Applications is highly speculative.[1567] Moreover, it is beyond the purview of the State Engineer. The State Engineer must make rulings based upon fact and science. The State Engineer cannot control or police the beliefs of the public and, contrary to the assertion of Dr. Kilkenny, the State Engineer cannot make decisions based upon

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[1562] Transcript, Vol.15 pp. 3352-3354 (Holmes).
[1563] Transcript, Vol.23 pp. 5234-5236 (Kilkenny).
[1564] Exhibit No. SNWA_241, p. 1-1; Transcript, Vol.14 pp 3285-3291, Vol.15 pp. 3435-3438 (Holmes).
[1565] Transcript, Vol.22 pp. 4999-5002, 5039-5040, 5043-5058 (Kilkenny).
[1566] Exhibit No. GBWN_066, p. 1; Transcript, Vol.22 pp. 5008-5009, 5023-5024 (Kilkenny).
[1567] Transcript, Vol.22 pp. 4988-4989 (Kilkenny).

those beliefs rather than the evidence submitted.[1568] As such, the State Engineer finds that Dr. Kilkenny did not provide any opinion regarding the likelihood of future growth and development within Spring Valley, nor did she provide evidence of specific future growth and development which was planned, being considered, or which might even occur.

In addition, the Applicant presented testimony and evidence as to White Pine County's land use plans to show that White Pine County does not have any plans for development which would require significant new water resources in Spring Valley.[1569] Instead, development in White Pine County is more targeted towards Steptoe Valley.[1570] The Applicant additionally presented testimony from Lincoln County Water District General Counsel Dylan Frehner, who testified that Lincoln County has no current plans to utilize water from the Applications in the Lincoln County portion of Spring Valley.[1571] Resolutions passed by Lincoln County and the Lincoln County Water District state that the Lincoln County Water Plan does not anticipate any proposed development or use of water within the Lincoln County portion of Spring Valley.[1572] The Protestants have not presented any contradicting evidence or testimony to refute the lack of any current development plans in Spring Valley. Instead, testimony provided through White Pine County Commissioner Gary Perea merely discussed the development of the Pattern Energy wind project within Spring Valley, which does not utilize significant water in its operation.[1573] Furthermore, in response to a question from the State Engineer regarding the amount of water identified in the White Pine County Water Plan for future growth and development in Spring

[1568] Transcript, Vol.22 pp. 4988-4989 (Kilkenny).
[1569] Exhibit No. SNWA_252; Transcript, Vol. 15 pp. 3372-3373 (Holmes).
[1570] Transcript, Vol.15 pp. 3372-3373 (Holmes).
[1571] Exhibit No. SNWA_353; Transcript, Vol.14 pp. 3151-3153 (Frehner).
[1572] Exhibit No. SNWA 346; Exhibit No. SNWA_347.
[1573] Transcript, Vol.21 p. 4682:1-23 (Perea).

Valley, Mr. Perea could not identify any water and instead testified that White Pine County is not opposed to interbasin water transfers.[1574] White Pine County Economic Diversification Director Mr. Jim Garza additionally failed to testify to any economic plans that White Pine County has for Spring Valley.[1575]

### B. Renewable Energy Development in Spring Valley

The Applicant offered the expert testimony of Dr. Carl Linvill and Mr. John Candelaria to address the possible future water needs of Spring Valley related to future alternative energy development.[1576] The State Engineer finds that the approach utilized by Dr. Linvill and Mr. Candelaria for determining the likelihood of renewable energy development within Spring Valley in the foreseeable future is fundamentally sound. In reaching their conclusions, Dr. Linvill and Mr. Candelaria reviewed and relied upon numerous sources, which have been submitted as exhibits.[1577] These included, for example, the information published by the Western Electric Coordinating Council, also known as WECC. This source shows demand for renewable energy in each of the western states and how much remaining unmet demand there is in those states.[1578] They also relied upon information from the National Renewable Energy Lab, which evaluates the effectiveness of renewable energy technologies and evaluates policies relative to renewable energy resources and the effect of those policies on renewable energy development in the western United States.[1579] They referenced the Renewable Energy Transmission Initiative in California which brings together persons from varying interests to

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[1574] Transcript, Vol.21 pp. 4692:10-4693:6 (Perea).
[1575] Transcript, Vol.21 pp. 4693-4757 (Garza).
[1576] Exhibit No. SNWA_113; Transcript, Vols. 13-14 pp. 3053-3144 (Candelaria and Linvill).
[1577] Exhibit No. SNWA_114 through 142.
[1578] Transcript, Vol.13 pp. 3075:10-3076:20 (Candelaria and Linvill).
[1579] Transcript, Vol.13 pp. 3076:21-3077:10 (Candelaria and Linvill).

evaluate renewable energy and transmission in California.[1580] They also considered the Western Renewable Energy Zone, Resource Plans filed by NV Energy, Sierra Pacific Power Company, Nevada State Office of Energy, and Regional plans by Lincoln County and White Pine County utility companies, and Western States' legislative policies with emphasis on Nevada and California for regional portfolio standards for renewable energy.[1581]

The evidence submitted by the Applicant demonstrates to a reasonable certainty that the quality of renewable energy resources available in Spring Valley are not as competitive as those available in other areas within Nevada and the western region and, therefore, development of these resources in a fashion that would require significant water resources is very improbable. Furthermore, Mr. Candelaria testified and submitted cost figures to demonstrate that utility companies prefer to use geothermal energy as it produces a constant output much like conventional resources, whereas solar and wind power are more intermittent.[1582] Mr. Candelaria testified that solar energy is currently the most costly renewable energy to develop.[1583] Based on the high cost to develop solar energy and the general preference in developing geothermal over solar and wind energy, the experts' report at Figure 1-3 demonstrates that Nevada produces over 10,000 GWh of highly competitive geothermal energy, and these resources make up the bulk of Nevada's renewable energy portfolio standard.[1584]

Dr. Linvill's testimony and Figures 1-6 and 1-7 in his report demonstrate that the highest quality solar resources within any of the four basins that were the subject of the hearing are

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[1580] Transcript, Vol.13 pp. 3077:11-3079:22 (Candelaria and Linvill).
[1581] Transcript, Vol.13 pp. 3079–3082 (Candelaria and Linvill).
[1582] Transcript, Vol.14 pp. 3098:17-3101:13 (Candelaria and Linvill).
[1583] Transcript, Vol.14 p. 3099:7-9 (Candelaria and Linvill).
[1584] Exhibit No. SNWA_113, Figures 1-3 and 4-2.

located in Delamar Valley.[1585] Dr. Linvill and Mr. Candelaria explained that even this higher quality Delamar Valley resource is not competitive and will not likely be developed.[1586] Dr. Linvill's testimony and Figure 1-1 of his report explain that solar energy primarily utilizes two different technologies, concentrated solar technologies (trough system) and photovoltaic ("PV").[1587] PV bypasses the turbine process and requires little to no water.[1588] The Applicant presented evidence and testimony that the only water required for PV-based solar energy is approximately 1.9 gal/MWh of water use for mirror/panel washing.[1589] Furthermore, the evidence demonstrates that PV costs are rapidly declining, making the technology more competitive than concentrated solar.[1590] Based upon this evidence, the State Engineer concludes that the quality of the solar resource in Spring Valley is such that it is not competitive and will not likely be developed. Furthermore, the Applicant has presented sufficient evidence that even if eastern Nevada solar energy were to become competitive in the energy market, such development would be PV-based, occur in the very distant future, and require very little to no water given emerging cleaning technologies.[1591] Thus, the State Engineer finds that no reservation of water will be necessary, even in the distant future, to support the development of solar power resources in Spring Valley.

Dr. Linvill also provided testimony regarding the high quality wind resources that exist in Spring Valley.[1592] This resource and its development and water usage was also the subject of

[1585] Exhibit No. SNWA_113, p. 1-5; Transcript, Vol.14 p. 3103:12-19 (Candelaria and Linvill).
[1586] Exhibit No. SNWA_113 pp.1-5 to 1-8; Transcript Vol.14, pp. 3103-3105 (Candelaria and Linvill).
[1587] Exhibit No. SNWA_113, p.1-10; Transcript, Vol.14 pp. 3090:20-3092:9 (Candelaria and Linvill).
[1588] Transcript, Vol.14 pp. 3090-3094 (Candelaria and Linvill).
[1589] Exhibit No. SNWA_113, p.1-10; Transcript Vol.14 pp. 3090:17-3094:22 (Candelaria and Linvill).
[1590] Exhibit No. SNWA_113, p. 1-9; Transcript, Vol.14 pp. 3094-3099 (Candelaria and Linvill).
[1591] Exhibit No. SNWA_113, p. 7-1 to 7-5.
[1592] Transcript, Vol.14 p. 3090:9-16 (Candelaria and Linvill).

testimony from Protestant witnesses.[1593] Dr. Linvill explained that after construction, the operation of wind energy facilities requires little to no water.[1594] Testimony of several witnesses established that water for development of the current wind project in Spring Valley was supplied through a temporary change of use of an existing agricultural water right.[1595] It is likely that any future wind power projects in Spring Valley would be able to do the same.

The State Engineer notes that there was no evidence presented by any Protestant demonstrating current or even future alternative energy development plans in Spring Valley which would require additional water resources. Based upon the evidence received, the State Engineer finds that it is improbable that future development will occur that would require additional water resources and that no water should be reserved for future renewable energy development within Spring Valley.

### C. Agricultural Development in Spring Valley

The Applicant submitted the testimony of two economic experts who examined the likelihood from an economic perspective of future agricultural development which would require additional water resources.[1596] The State Engineer finds that the Applicant's approach for determining the likelihood of agricultural development within Spring Valley in the foreseeable future is fundamentally sound. Dr. Dennis Peseau and George Carter explained that they researched and reviewed data and literature which they believed would be particularly relevant to analyze agricultural operations in Spring Valley and White Pine County and memorialized their

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[1593] Transcript, Vol.27 pp. 6189:18-6191:6 (Scott and Drew).
[1594] Transcript, Vol.14 p. 3090:9-16 (Candelaria and Linvill).
[1595] Transcript, Vol.27 pp. 6189:18-6191:6 (Scott and Drew).
[1596] Transcript, Vol.13 pp. 2947-3053 (Carter and Peseau).

research in their report.[1597] The information reviewed and relied upon included U.S. Department of Agriculture ("USDA") historical data and trends, and University of Nevada, Reno and University of California, Davis extension studies prepared to assist farmers in determining typical expenses for starting and maintaining an operation.[1598] Additionally, Dr. Peseau and Mr. Carter visited Spring Valley and reviewed satellite maps to determine terrain and existing infrastructure and current operations within Spring Valley.[1599]

The Applicant has presented the best available evidence to show that Nevada is among the lowest ranking alfalfa producers in the Western United States and that White Pine County, which holds most of Spring Valley, is among the lowest producing counties within the state.[1600] Mr. Carter testified that a comparison of regional markets is important because the regional market affects market prices for a potential grower in Spring Valley.[1601]

The Applicant submitted uncontroverted evidence that the primary crop grown within Spring Valley is hay and, in particular, alfalfa.[1602] Mr. Carter additionally provided evidence and testimony regarding the historic trends which reveal a decline in alfalfa production in White Pine County over the last decade.[1603] The evidence supports the conclusion that White Pine County and Spring Valley likely have lower production due to soil conditions and high altitude, which equates to a shorter growing period.

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[1597] Exhibit No. SNWA_103, pp. 26-28; Transcript, Vol.13 pp. 2959-2961, 2965-2967 (Carter and Peseau).
[1598] Exhibit No. SNWA_103, pp. 26-28; Transcript, Vol.13 pp. 2959:14-2960:15 (Carter and Peseau).
[1599] Transcript, Vol.13 pp. 2966:4- 2968:1 (Carter and Peseau).
[1600] Exhibit No. SNWA_103, pp.1-8; Transcript, Vol.13 pp. 2971-2974 (Carter and Peseau).
[1601] Transcript, Vol.13 pp. 2968:22-2970:5 (Carter and Peseau).
[1602] Exhibit No. SNWA_103, p. ES-1 toES-2; Transcript, Vol.13 pp. 2967:15- 2968:5 (Carter and Peseau).
[1603] Exhibit No. SNWA_103, p. 6; Transcript, Vol.13 pp. 2978:7-16 (Carter and Peseau).

On direct examination, the relatively high current prices for alfalfa were discussed.[1604] Mr. Carter offered his opinion that although alfalfa is currently enjoying very high market prices, such prices are due to unusual factors that likely will not create a trend.[1605] However, Mr. Carter testified that despite these high prices in alfalfa, White Pine County is not showing any increase in production.[1606]

The Applicant has utilized the most relevant factors to determine that it is highly unlikely that there will be future agricultural growth and development in Spring Valley. In addition to the factors discussed above, the Applicant's conclusion is based upon the fact that new investment in agricultural projects within Spring Valley will not result in positive economic returns and therefore it is unlikely that new money will be invested in such a venture.[1607] Dr. Peseau and Mr. Carter base this opinion in large measure upon studies published by the University of Nevada, Reno.[1608] These documents were each based upon practices and materials considered typical of a well-managed farm and ranch in the region, as determined by a producer panel.[1609] Dr. Peseau and Mr. Carter explained that utilizing the establishment and maintenance costs of these studies compared to the USDA alfalfa market prices demonstrates unfavorable economic circumstances for establishing new alfalfa stands in White Pine County and Spring Valley.[1610]

Dr. Peseau also provided testimony regarding his review of external factors that might be relevant to agricultural growth in Spring Valley.[1611] He testified that the USDA prediction of contraction of the dairy market will likely negatively impact alfalfa demand and is not likely to

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[1604] Transcript, Vol.13 pp. 2978:24-2982:5 (Carter and Peseau).
[1605] Transcript, Vol.13 pp. 2978:24-2982:5 (Carter and Peseau).
[1606] Transcript, Vol.13 pp. 2978:24–2982:5 (Carter and Peseau).
[1607] Exhibit No. SNWA_103; Transcript, Vol.13 pp. 2958:16- 2958:13 (Carter and Peseau).
[1608] Exhibit Nos. SNWA_104; SNWA_105; Transcript, Vol.13 pp. 2964:12-2966:3 (Carter and Peseau).
[1609] Exhibit Nos. SNWA_104; SNWA_105; Transcript, Vol.13 pp. 2964:12-2966:3 (Carter and Peseau).
[1610] Exhibit No. SNWA_103; Transcript, Vol.13 pp. 2987-2999 (Carter and Peseau).
[1611] Transcript, Vol.13 pp. 2983:10-2985:19 (Carter and Peseau).

drive growth in this basin.[1612] The State Engineer also received testimony that limitations on grazing allotments will negatively impact the demand for alfalfa as a supplemental winter feed in Spring Valley.[1613] This opinion was consistent with the Protestant testimony that grazing allotments have been reduced in recent years.[1614]

No Protestant submitted any credible evidence indicating the likelihood of expansion of agriculture within Spring Valley which would require additional water resources. Mr. Jim Garza did testify on behalf of White Pine County regarding his calculations of the amount of water available in Spring Valley and the amount of alfalfa that in his view could be grown using that water.[1615] The State Engineer notes that Mr. Garza, although a county official, was not designated as an expert, did not produce or provide an expert report, and was not qualified as an expert in any discipline by the State Engineer. The information upon which Mr. Garza based his calculations was not marked or submitted into the record, as it was not exchanged pursuant to the State Engineer's Pre-hearing Order.[1616] It is also of relevance to the State Engineer that Mr. Garza, although the Director of Community and Economic Development for White Pine County, admitted he was unfamiliar with any White Pine County planning document.[1617] The testimony of Mr. Garza has been given little weight by the State Engineer because Mr. Garza's calculations simply showed what he speculated could be done in Spring Valley with a certain amount of water. Mr. Garza's calculations were simply a mathematical exercise and were unsupported by

[1612] Exhibit No. SNWA_103, pp.12-13; Transcript, Vol.13 pp. 2999:8-3002:1 (Carter and Peseau).
[1613] Transcript, Vol.13 pp. 2984:11-2985:11 (Carter and Peseau).
[1614] Transcript, Vol.24 p. 5507:12-15 (Gloeckner).
[1615] Transcript, Vol.21 pp. 4705:24-4711:20 (Garza).
[1616] Exhibit No. SE_001.
[1617] Transcript, Vol.21 pp. 4753:18-4756:21 (Garza).

any evidence that the development he suggested was possible could ever occur, even if these Applications were denied.[1618]

Although on cross-examination there was a suggestion by counsel for the Corporation of the Presiding Bishop ("CPB") that the motivation to expand ranching operations for the CPB may be different from a for-profit operation, there was no evidence submitted by CPB or any protestant of any current plan or intent to expand operations.[1619] Indeed, the Cleveland Ranch exhibits and testimony confirmed that its operations do not include any alfalfa production and there was no evidence of a desire by the CPB to expand its operation.

Finally, several Protestant witnesses testified that they believed that approving the Applications will harm and/or "dry up" the existing vegetation on their ranching operations.[1620] However, none of these Protestant witnesses provided testimony or evidence regarding future expansion of their existing operations or future economic or agricultural development plans which would require significant additional water resources.[1621] Accordingly, the State Engineer finds that the Protestant witnesses have not presented evidence that approving the Applications will unduly limit growth and development of existing ranching operations within Spring Valley. Based upon the evidence submitted, the State Engineer concludes that it is unlikely that significant sums of additional water will be necessary for future crop development purposes in Spring Valley.

As with crop-based agriculture, the uncontroverted evidence demonstrates that the cow/calf market in Spring Valley is unlikely to grow in the foreseeable future. Mr. Carter

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[1618] Transcript, Vol.21 pp. 4705:24-4711:20 (Garza).
[1619] Transcript, Vol.13 pp. 3029:9-3031:12 (Carter and Peseau).
[1620] Transcript, Vol.24 pp. 5503:11-5516:7 (Gloeckner); Vol.24 pp. 5541-5551 (Rountree).
[1621] Transcript, Vol.24 pp 5503:11-5516:7 (Gloeckner); Vol.24 pp. 5541-5551 (Rountree).

provided testimony and USDA trends for cow/calf grazing.[1622] These trends are downward and do not support likely growth. The Applicant again relies in part on information published by University of Nevada, Reno for establishment and maintenance costs of a cattle operation in White Pine County.[1623] Dr. Peseau and Mr. Carter then contrasted this information with USDA cow/calf market prices and the resulting conclusion, like the alfalfa operation, demonstrates the generally unfavorable economic circumstances for establishing new cattle operations in Spring Valley. Although on cross-examination counsel for GBWN asked Dr. Peseau about grazing allotments and Dr. Peseau's knowledge of proposals to expand grazing operations, Dr. Peseau indicated he had no information and at no point did GBWN or any Protestant, including the representative of the Nevada Cattlemen's Association, submit evidence of intent to expand cattle operations which would result in a need for additional water resources within the basin.[1624]

Lastly, Dr. Peseau and Mr. Carter submitted their analysis of the economics of a new joint alfalfa and cow/calf operation.[1625] Similar to each type of operation singularly, this analysis demonstrates to a reasonable certainty that a joint alfalfa and cow/calf operation is still not economic, even though certain expenses and overhead can be shared, and therefore it is unlikely that there will be future development of such operations.[1626]

The evidence and conclusions of Dr. Peseau and Mr. Carter were uncontroverted by any opposing expert. Dr. Kilkenny testified on behalf of GBWN. Although she testified to her opinion that the pendency of these Applications has affected growth and development in the basins as an abstract concept, she did not quantify that growth nor could she indicate what had

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[1622] Transcript, Vol.13 pp. 3002:15-3009:5 (Carter and Peseau).
[1623] Exhibit No. SNWA_104.
[1624] Transcript Vol. 13 pp. 3037-3038 (Carter and Peseau).
[1625] Exhibit No. SNWA_103; Transcript, Vol.13 pp. 3013:13-3016:24 (Carter and Peseau).
[1626] Exhibit No. SNWA_103; Transcript, Vol.13 pp. 3013:13-3016:24 (Carter and Peseau).

been the effect.[1627] On cross examination, Dr. Peseau and Mr. Carter testified to the contrary that the pendency of these Applications has not been a factor in depressing investment in agriculture in the basins of origin.[1628] Dr. Kilkenny criticized the method employed by Dr. Peseau and Mr. Carter, suggesting that they had only considered 10 to 12 years of a typical cattle cycle, but she did not offer a contrary opinion regarding the conclusions they reached.[1629] In fact, Dr. Kilkenny provided testimony consistent with the conclusion advanced by the Applicant, suggesting that such operations are marginally profitable at best and often in the red.[1630] Similarly, she offered no contrary opinion or rebuttal report regarding the economics of new crop-based agriculture in the basins. The absence of any contrary opinion is notable given her considerable experience and education in Agricultural and Applied Economics.[1631] Rather, the evidence submitted both through the testimony of Dr. Kilkenny and all of the Protestants focused on the currently existing economic activity and not on future activity which might be negatively impacted by the granting of these Applications.[1632]

The State Engineer finds that the Applicant has presented substantial uncontroverted evidence supported by expert testimony that it is highly improbable that there will be any additional investment in new agricultural endeavors in Spring Valley and that numerous factors including the unfavorable economics of such operations, and not the availability of water, is and will continue to be the factor limiting additional agricultural development in Spring Valley.[1633] The State Engineer concludes that based upon the evidence in the record, including but not

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[1627] Transcript, Vol.22 pp. 4988-4989 (Kilkenny).
[1628] Transcript, Vol.13 pp. 3047-3048 (Carter and Peseau).
[1629] Transcript, Vol.22 pp. 4991-4992 (Kilkenny).
[1630] Transcript, Vol.22 p. 4991:21-22 (Kilkenny).
[1631] Exhibit No. GBWN_067.
[1632] Exhibit Nos. GBWN_066; GBWN_068; GBWN_114; Transcript, Vol.22 p. 4991:21-22 (Kilkenny); Transcript, Vol.28 pp. 6226-6260 (Cooper and Sanders).
[1633] Transcript, Vol.13 pp. 3021-3022 (Carter and Peseau).

limited to that cited above, it is unlikely that there will be any new agricultural development in Spring Valley and therefore the granting of these Applications will not unduly limit such development.

### D. Change of Use for Existing Water Rights

In reaching the conclusion that granting the Applications will not unduly limit future growth and development, the State Engineer has considered not just the prospects and trends for future growth, but also the water rights already established within Spring Valley that will remain within the basin for current and future uses. The Protestants focused upon the existing water rights and the effects should those rights be lost; however, existing water rights are protected under the law and approving the Applications does not undermine any of those rights or their priority. The existing water rights in Spring Valley will remain available not only for their current use, but also for different permanent and temporary uses through a change of use application. Many basins in Nevada have grown and developed in this fashion, with agricultural water rights being changed to a different purpose when a demand arises. Over 12,768 afa of existing water rights are available within Spring Valley and will remain in the basin even after these Applications are granted. Although it is not required by statute that any amount of water be reserved for the basin of origin, the existing water rights as well as the water described in the following section, will be available to support any unforeseen future use that was not known or contemplated at the time these Applications were considered.

### E. Reserving Water for Future Uses

GBWN offered the testimony of Dr. Kilkenny regarding basin of origin issues. By her own admission, Dr. Kilkenny completed no original work.[1634] Rather, as she concedes, her effort was an attempt to update information which had been previously compiled by others.[1635] Notably, Dr. Kilkenny did not provide any opinion regarding the likelihood of future growth and development within Spring Valley, nor did she provide any evidence of specific future growth and development which was planned, being considered, or which might even occur. Rather, she speculated that the pendency of these Applications has had an effect upon the growth and development of the basin.[1636] Dr. Kilkenny explained that she did not attempt to quantify the economic activity within Spring Valley; instead, she presented county-wide information for White Pine and Lincoln counties.[1637] Dr. Kilkenny conceded that when she authored her report she did not understand the geographic extent of Spring Valley.[1638] Dr. Kilkenny's testimony revealed numerous errors and misstatements in her report and her report and testimony has been given little weight by the State Engineer.

Multiple non-expert witnesses testified to their concerns that granting the Applications would impact their existing water rights and water uses.[1639] Such was the testimony of the representatives of the CPB which operates the Cleveland Ranch. In the case of CPB, like the other Protestants, its concerns and evidence focused upon its existing rights and the impact to those rights rather than evidence that the Applications should be denied in order to ensure future growth and development of the basin of origin.[1640] Little evidence of even speculative future

[1634] Transcript, Vol.22 pp. 5020:18-5021:7 (Kilkenny).
[1635] Transcript, Vol.22 pp. 5020:18-5021:7 (Kilkenny).
[1636] Transcript, Vol.22 pp. 4988-4989, 5023 (Kilkenny).
[1637] Transcript ,Vol.22 pp. 5033-5038 (Kilkenny).
[1638] Transcript, Vol.22 pp. 5024-5026 (Kilkenny)
[1639] [1639] *See*, for example, Transcript, Vol.16 pp. 3712:16-3733:19 (Anderson), Vol.24 pp. 5589-5602 (Dean Baker).
[1640] Transcript, Vol.28 pp. 6226-6260 (Cooper and Sanders).

growth was submitted by any Protestant. Instead, the Protestants focused upon the current and past uses of water in Spring Valley, rather than arguing the need for water to support future growth. The Protestants' evidence of the need to protect established water rights in Spring Valley is understood, appreciated and acknowledged by the State Engineer. However, the protection of those senior rights is provided for under Nevada law and the issue of impacts to existing rights is addressed fully in this ruling.

No Protestant identified a specific quantity of water that should be reserved for protection of future growth and development in Spring Valley. Although NRS 533.370(6)(d) (2010) does not expressly authorize the State Engineer to reserve water in the basin of origin for future growth and development, the State Engineer has determined it is appropriate to reserve a quantity of water within Spring Valley. This quantity of water is established to ensure that future growth and development which is not currently foreseeable or anticipated is not unduly limited as a consequence of the approval of the Applications. The amount of water hereby reserved should more than adequately support even unexpected growth and development within Spring Valley. It is also noted by the State Engineer that should he receive applications for future mining and/or milling uses, which are by their nature temporary, the approval of the Applications will not affect the availability of water for such temporary mining and milling uses.

As the evidence submitted does not support any reasonable expectation for growth and development in Spring Valley in the foreseeable future and, therefore, there are no foreseeable additional water needs in the basin, the State Engineer finds that the reservation of 300 afa is appropriate. Because no Protestant submitted evidence in support of a specific quantity of water that should be reserved in Spring Valley, the only evidence in the record was supplied by the Applicant. A reservation of 300 afa is consistent with the testimony of the Applicant witness Mr.

Holmes. Mr. Holmes presented at Table 4-1 of his expert report the non-agricultural water rights that have been granted in Spring Valley for the past 50 years.[1641] While Mr. Holmes concluded no water is required to be reserved for future uses, based on the historic use of water in the basin he also demonstrated that 300 afa would be more than enough water for any unforeseen future uses in Spring Valley. Accordingly, the State Engineer has elected to reserve 300 afa of water for unforeseeable future growth in Spring Valley.[1642] The State Engineer finds that based upon the evidence presented, the currently existing rights and the trend of the last 50 years, this reserve of water should more than adequately meet any unexpected demand. As accurately described in the evidence submitted, this amount of water in Spring Valley is enough to support 800 new, individual residences. The State Engineer finds that this is a sufficient amount of water to reserve as the evidence demonstrated that currently there are less than 80 persons residing in the basin.[1643] Alternatively, this amount of water could support 15 new commercial uses within the basin.[1644] The State Engineer finds that this is a sufficient amount of water to reserve as the evidence demonstrated that there are currently two such uses in Spring Valley.[1645] This amount of water would also support an increase of 13,000 additional head of cattle or 66,000 sheep.[1646] It is recognized this particular future use is very unlikely unless there was a significant increase in the amount of forage that could be utilized for grazing. This reserved water is in addition to the 12,768 afa of water rights which already exist within Spring Valley and which are primarily

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[1641] Exhibit No. SNWA_241, pp. 4-1 to 4-2.
[1642] Exhibit No. SNWA_241, pp. 4-1 to 4-2.
[1643] Exhibit No. SNWA_241, pp. 2-11, 4-1 to 4-2.
[1644] Exhibit No. SNWA_241, pp. 4-1 to 4-2.
[1645] Exhibit No. SNWA_241, pp. 4-1 to 4-2.
[1646] Exhibit No. SNWA_241, pp. 4-1 to 4-2.

associated with agriculture and could be repurposed to a different manner of use if future development required it.

The State Engineer finds that based on the quantity of existing water rights in Spring Valley, and the additional reservation of 300 afa for future growth and development, sufficient water exists to meet virtually any unforeseen demand that might occur in the future. Therefore, based on the evidence in the record, including but not limited to that cited above, the State Engineer finds that approving the Applications will not unduly limit future growth and development in Spring Valley.

## XII. PLACE OF USE (LINCOLN COUNTY)

The Applications were filed for municipal and domestic uses in Clark, Lincoln, Nye, and White Pine Counties. During the administrative hearing on these Applications, evidence was provided to support a place of use in both Clark and Lincoln counties.

Mr. Dylan Frehner, General Counsel for the Lincoln County Water District, provided testimony on behalf of Lincoln County and the Lincoln County Water District (collectively, "Lincoln County"). That testimony described Lincoln County's agreement with the Applicant that would assign a portion of the Applications to Lincoln County.[1647] Mr. Frehner also described Lincoln County's intentions to put any water it received from the Applications to beneficial use within Lincoln County. Mr. Frehner testified regarding two resolutions: one from the Lincoln County Board of County Commissioners, and one from the Lincoln County Water District.[1648] Both resolutions identified and confirmed Lincoln County's lack of current plans for

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[1647] Exhibit No. SNWA_352.; Transcript, Vol.14 pp. 3149:18-3152:9 (Frehner).
[1648] Exhibit No. SNWA_346; Exhibit No. SNWA_347; Transcript, Vol.14 pp. 3153:4-3157:7 (Frehner).

growth and development in that portion of Spring Valley which resides in Lincoln County.[1649] In that regard, evidence indicated that Lincoln County does not anticipate development for municipal use of water within the Lincoln County portion of Spring Valley.[1650] Rather, this evidence supported Lincoln County's intention to put the water to beneficial use elsewhere within Lincoln County, specifically within Coyote Spring Valley.[1651]

The agreement between SNWA and Lincoln County was admitted into evidence as Exhibit No. SNWA_352. In accordance with this agreement, the use of the water by Lincoln County is limited to Lincoln County in general or the applicable basin of origin.[1652] Through the testimony of Mr. Frehner and the evidence submitted, Lincoln County has indicated that it does not anticipate projects or development in Spring Valley, and further has indicated its intent to use any water obtained pursuant to these Applications within the Lincoln County/Coyote Springs Consolidated General Improvement District.[1653] The evidence submitted confirmed that Lincoln County still expects the Coyote Springs development to proceed.[1654]

With regard to the Coyote Springs development, the testimony and evidence submitted was consistent with State Engineer Ruling No. 5918 and the determination made therein that the Coyote Springs development has a need to import water into Coyote Spring Valley where it will be placed to beneficial use in Lincoln County.[1655] The evidence also supported the resolution of the Coyote Springs General Improvement District Board of Trustees that when developed,

[1649] Exhibit No. SNWA_346, Exhibit No. SNWA_347; Transcript, Vol.14 pp. 3153:4-3157:7 (Frehner).
[1650] Transcript, Vol. 14, pp. 3153:4-3157:7 (Frehner).
[1651] Transcript, Vol. 14, pp. 3153:4-3157:7 (Frehner).
[1652] Exhibit No. SNWA_352; Transcript, Vol.14 p. 3152:14-3153:2 (Frehner).
[1653] Exhibit No. SNWA_346; Exhibit No. SNWA_347; Transcript, Vol.14 pp. 3152-3157 (Frehner).
[1654] Exhibit No. SNWA_354; Transcript, Vol.14 pp. 3158-3159 (Frehner).
[1655] Exhibit No. SNWA_358; Transcript, Vol.14 pp. 3159-3160 (Frehner).

Coyote Springs would adopt a plan of conservation.[1656] The evidence confirms that the water from these Applications to be assigned to Lincoln County pursuant to the agreement between the Applicant and Lincoln County is currently contemplated to be put to beneficial use in the Lincoln County/Coyote Springs General Improvement District.[1657] Accordingly, the State Engineer finds that the Applicant has presented sufficient evidence that the Place of Use of the Applications will include Lincoln County.

## XIII. OTHER PROTEST GROUNDS

### A. <u>The Applications are in Proper Form</u>

The Protestants allege that the Applications should be denied because they fail to adequately describe the place of use, proposed works, the cost of such works, estimated time required to construct the works and place the water to beneficial use, and the approximate number of persons to be served. The application form used by the Office of the State Engineer only requires a brief explanation of the description of the proposed works of diversion and delivery of water. On its Applications, the Applicant described that the water was to be diverted via a cased well, pump, pipelines, pumping stations, reservoirs and distribution system. The Applicant estimated the cost of each well and indicated it believed it would be a minimum of 20 years to construct the works of diversion and place the water to beneficial use.[1658]

Applicants who request an appropriation for municipal water use are required by NRS 533.340(3) to provide information approximating the number of persons to be served and the

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[1656] Exhibit No. SNWA_358; Transcript, Vol.14 pp. 3160-3162 (Frehner).

[1657] The State Engineer, however, notes the obligation of Lincoln County under the cooperative agreement between Lincoln County and the Southern Nevada Water Authority and the Las Vegas Valley Water District towards the Basin of Origin. Exhibit No. SNWA_352 at p. 1 (Sec. 4.3.1.4).

[1658] *See, e.g.*, Exhibit No. SE_003 (Spring); Exhibit No. SE_042 (Cave); Exhibit No. SE_044 (Dry Lake); Exhibit No. SE_046 (Delamar).

future requirement. While the Applicant did not have this information physically on its application, by letter dated March 22, 1990, the Applicant supplemented its Applications and indicated the approximate number of persons to be served was 800,000 in addition to the 618,000 persons it was currently serving. The population of southern Nevada already exceeds this projection as it now is nearing 2 million citizens. The State Engineer finds for the purposes of the application form, the Applications adequately describe the proposed works, the cost of such works, estimated time required to construct the works and place the water to beneficial use and the approximate number of persons to be served.

### B. Access to Federal Land

Some of the Protestants alleged that the Applicant has not demonstrated the ability to access land containing the points of diversion or a right-of-way from the BLM for the Project. Testimony was provided that the Lincoln County Lands Act identified a utility corridor for this and other utilities and that the Act required issuance of a right-of-way for the Project within the area designated by the Act.[1659] The Applicant submitted evidence that it is complying with NEPA and a DEIS has been prepared as part of the process to obtain from the BLM the rights-of-way to gain access to federal land for the Project.[1660] The State Engineer finds the evidence indicates the Applicant is pursuing the right-of-way in good faith and with reasonable diligence.

### C. Need for Further Study/More Information

Protestants allege that the Applicant has not completed sufficient analysis of its need for this water, and sufficient information about the aquifers at issue does not presently exist to allow the State Engineer to make an intelligent judgment as to the effects of granting the Applications.

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[1659] Exhibit No. SNWA_351.
[1660] Transcript, Vol.1 p. 217:16-25 (Holmes).

Protestants argue that granting the Applications in absence of further comprehensive study and planning and an independent, formal and publicly-reviewable assessment would prove detrimental to the public interest. The State Engineer finds there is no evidence that the State Engineer or the public has been denied relevant information. The State Engineer finds there is no provision in Nevada water law that requires comprehensive water-resource development planning prior to the granting of a water right application. Furthermore, the evidence shows that the Applicant has engaged in comprehensive long-range planning.[1661] The State Engineer finds there is nothing in Nevada water law that requires water resource evaluation by an independent entity, but rather that is the responsibility of the State Engineer; therefore, this protest claim is dismissed. The State Engineer finds that additional study is not needed to grant the Applications. The Applicant has already conducted valuable study of the hydrology and environment of the area. The State Engineer finds that additional study will be required going forward in the form of the monitoring and management program. Therefore, this protest ground is overruled.

**D. Las Vegas is Big Enough**

Protestants argue that Las Vegas is large enough and further growth is not in the best interest of the Las Vegas Valley, that Clark County should only grow within the limits of its local resources, and that the state should encourage growth control, use of local resources, and sustainability rather than give Las Vegas more water. The State Engineer finds no evidence was provided in support of the protest claim that the population of Las Vegas is big enough and future growth is not in the interest of the Las Vegas community, the state or the nation. In addition, the State Engineer finds he has not been delegated the responsibility to control growth and has not been delegated the responsibility for land use planning in Nevada. The decisions as

[1661] Exhibit No. SNWA_209; Transcript, Vol.2 pp. 248:20-250:2 (Entsminger).

to growth control are the responsibility of other branches of government. Therefore, these protest claims are overruled.

### E. Corruption and Reputational Harm as Seen in California

Protestants argue that the proposed water project will injure the state's reputation, promote factious politics and allegations of corruption, waste tremendous quantities of water through leakage and evaporation, and foster the dangerous illusion that water supplies are limitless or that supplies are allocated solely for the advantage of the rich and powerful. The Protestants state that these consequences are evident by California's large scale water project experience. The State Engineer finds that though some evidence was presented regarding water projects in California, those projects are not analogous to the proposed Project before the State Engineer. For example, unlike the Owens Valley water projects in California, this Project does not involve large-scale export of both ground and surface water. Unlike the Owens Valley project, the Applicant will engage in thorough monitoring and management before pumping even commences. The State Engineer finds that no evidence was presented that the proposed Project is similar to any water project in California and no evidence was presented suggesting that the proposed Project will lead to the same negative results as any water project in California. Therefore this protest ground is overruled.

### F. Denial of Prior Applications

Protestants argue that the Applications should be denied because the Division of Water Resources has already denied water appropriations in this basin. No evidence was presented, however, that prior applications were denied in the basin for reasons that are applicable to the Applications at issue. The State Engineer has denied several applications in the basin based on the Desert Land Entry Act and the Carey Act for failure to establish a reasonable expectation to put the water to beneficial use based on lack of control of the point of diversion. In this case, the Applicant is actively pursuing right-of-ways to the points of diversion. Therefore this protest ground is overruled.

**G. Duplicate Applications**

Protestants argue that the Applications should be denied because the Applicant filed duplicate applications in 2010. The Applicant likely did this because of uncertainty as to the status of the Applications at issue during the appeals process after the last hearing. Regardless, the State Engineer is not required to reject Applications because later-filed duplicate applications were filed. Therefore, the State Engineer overrules this protest ground.

**H. Subdivision Maps**

The State Engineer finds no evidence was provided in support of the protest claim that the Applications should not be approved if said approval is influenced by the State Engineer's "desire or need" to ensure there is sufficient water for new lots and condominium units created in the Las Vegas Valley by subdivision maps. The State Engineer finds it is his responsibility and obligation to follow the law, not his "desire or need"; therefore, the protest claim is dismissed.

**I. Impacts to Indian Springs, Nellis Air Force Base and Lake Mead**

A Protestant has argued that the Applications should be denied because of potential impacts to the Indian Springs Valley Basin which may harm rights owned by the U.S. Air Force in the basin. No evidence was presented of impacts to Indian Springs Valley Basin. Therefore, the State Engineer finds that this protest ground is overruled. Protestants argued that the Applications should be denied because of impacts to Lake Mead National Recreation Area and Moapa Wildlife Refuge. No evidence was presented showing any specific impacts to these areas. Therefore, the State Engineer finds that this protest ground is overruled.

### J. Climate Change

Protestants allege, as a protest ground, that cyclical drought and long term climatic change are causing a diminishment of water resources in this basin and all connecting basins. No evidence was submitted that the groundwater resources in Spring Valley are diminishing due to climate change or drought. Therefore, this protest ground is overruled.

## XIV. SUMMARY OF PUBLIC COMMENT

Pursuant to the Hearing Notice dated April 1, 2011, the State Engineer indicated that he would receive both verbal and written public comment regarding the hearing of the Applications.[1662] Thereafter, the State Engineer announced on his website that it would be holding a public hearing on Friday, October 7, 2011. On the first day of the hearing, September 26, 2011, the hearing officer, Susan Joseph-Taylor announced that the hearing would offer the time for the public to comment on the Applications and related protests.[1663]

On October 7, 2011 at 8:00 a.m., the public comment proceeded as scheduled.[1664] The public comment was simulcast over the internet as well as from the hearing room in Carson City, a remote site in Ely, a remote site in Las Vegas, and a remote site in Caliente.[1665] The public comment was attended by the State Engineer Jason King, Chief Hydrologist Rick Felling, Deputy State Engineer Kelvin Hickenbottom, as well as the chief hearing officer Susan Joseph-Taylor. Also in attendance were representatives and counsel for the Applicant and counsel for Protestant Great Basin Water Network.

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[1662] Exhibit No. SE_001.
[1663] Transcript, Vol.1 p. 7:6-17 (Joseph-Taylor).
[1664] Transcript, Vol.10 p. 2098 *et. seq.*
[1665] Transcript, Vol.10 p. 2098 *et. seq.*

On October 7, 2011, the State Engineer heard public comment from the different sites from 8:00 a.m. until 3:06 p.m. The State Engineer heard public comment from 96 persons. Public comment was closed when there was no additional person who wished to offer public comment. At that point, the hearing officer reminded the public that written public comment would be accepted until December 2, 2011 and could be filed at the Elko office, the Las Vegas office or the Carson City office.[1666]

The State Engineer received written public comment until December 2, 2011, receiving over 25,000 pieces of correspondence. The State Engineer has reviewed and considered all written comments and the oral comments received on October 7, 2011 prior to issuing this ruling.

In determining whether to approve or reject an application for an interbasin transfer of groundwater, the State Engineer must make rulings based upon fact and science. While the State Engineer will acknowledge and consider public comment, the State Engineer cannot make decisions based upon speculative beliefs rather than the evidence submitted. The State Engineer will not make a decision based solely on how many letters are received for or against the Project. The public input process is designed to allow a person to express their general support or opposition to the Project; it is not designed to provide for an opportunity to "vote" on whether or not the Project should be built.[1667]

The State Engineer took comment from tribal leaders and members who spoke against the Project as well as from public officials and individuals from White Pine and Lincoln Counties, and from other persons from around the state, including Las Vegas. These persons

[1666] Transcript, Vol.10 p. 2322 (Joseph-Taylor).
[1667] *See* NAC 533.060; NRS 532.120; NRS 533.365 (2010).

raised various concerns including the protection of water rights, environmental concerns, and concerns centering upon traditional Native American culture and concerns that the Applications may interfere with their ability to observe and participate in those activities and, in the case of the protection of water rights, the ability to earn a living. These concerns are acknowledged and are addressed elsewhere in this ruling.

The State Engineer additionally took comment and received letters from various unions and organizations, state municipalities, and large employers within the state—all of which expressed support of the Project. These entities and organizations represent not only the respective interests of each organization and entity, but also hundreds of thousands of constituents who are members and/or employees of each.[1668] For example, the State Engineer heard testimony and received letters from large employers that employ more than 50,000 employees. These are employers within the state, including the Bank of America of Southern Nevada, Bank of Nevada, Boyd Gaming, Caesars Entertainment, KB Homes, Las Vegas Convention and Visitors Authority, and Wynn Resorts.[1669] The representatives from these entities are in support of the Project because they believe a water shortage within the Las Vegas area would have a devastating impact on the gaming, resort and construction industries, and therefore on the entire state's economy.[1670] The State Engineer heard testimony and received letters from labor unions, including the Culinary Workers Union, AFL-CIO and IBEW Local 357, which represent over 250,000 Nevadans. The State Engineer heard testimony and received letters from organizations including the Associated General Contractors, Las Vegas Chamber of Commerce, Latin Chamber of Commerce, North Las Vegas Chamber of Commerce, Southern

[1668] Transcript, Vol.10 pp. 2226-2232 (Valentine and Foley).
[1669] Transcript, Vol.10 pp. 2143-2145; 2226-2232 (Wyatt, Valentine and Foley).
[1670] Transcript, Vol.10 pp. 2143-2145; 2226-2232 (Wyatt, Valentine and Foley).

Nevada Building and Construction Trades Company, and Southern Nevada Home Builders Association.[1671] The Nevada Resort Association also submitted a letter in support of the Project, and the Resort Association represents all the major casino and resort properties in Nevada. The State Engineer also received letters from all the municipalities in southern Nevada, representing a majority of the state's population, including Clark County, the City of Las Vegas, the City of Henderson, the City of North Las Vegas and Boulder City.[1672] These organizations echoed the opinion that a water shortage in Las Vegas would have severe economic impacts within the state.[1673]

## XV. UNAPPROPRIATED WATER

The Applicant estimates average annual groundwater ET in Spring Valley is 94,800 afa. While this estimate is sound, it may vary by as much as five percent from the long-term average annual groundwater ET value for Spring Valley. Additional data will allow the State Engineer to determine with greater confidence the representative long-term average. Until five additional years of data are available, the State Engineer will set the perennial yield of Spring Valley at 90,000 afa, which is nearly five percent less than the Applicant's estimate.

Therefore, the State Engineer finds the perennial yield of Spring Valley is 90,000 afa. The amount of committed groundwater associated with existing rights with priority dates before and after October 17, 1989, is 12,768.61 afa. The amount of water to be reserved for unforeseen future growth and development is 300 afa. Accordingly, the State Engineer finds that there is 76,931 afa of water available for appropriation in Spring Valley pursuant to the Applications.

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[1671] Transcript, Vol.10 pp. 2143-2145; 2226-2232 (Wyatt, Valentine and Foley).
[1672] Transcript, Vol.10 pp. 2226-2232 (Wyatt, Valentine and Foley).
[1673] Transcript, Vol.10 pp. 2143-2145; 2226-2232 (Wyatt, Valentine and Foley).

## CONCLUSIONS OF LAW

### I.

The State Engineer has jurisdiction over the parties and the subject matter of this action and determination.[1674]

### II.

The State Engineer is prohibited by law from granting an application to appropriate the public waters where:[1675]

A. there is no unappropriated water at the proposed source;
B. the proposed use or change conflicts with existing rights;
C. the proposed use or change conflicts with protectable interests in existing domestic wells as set forth in NRS 533.024; or
D. the proposed use or change threatens to prove detrimental to the public interest.

The State Engineer concludes there is unappropriated water for export from Spring Valley, there is no substantial evidence the proposed use will conflict with existing rights, that existing rights are sufficiently protected by the Applicant's monitoring, management, and mitigation plan, there is no substantial evidence that the proposed use will conflict with protectable interests in existing domestic wells, or that the use will threaten to prove detrimental to the public interest. Therefore, there is no reason to reject the Applications under NRS 533.370(5) (2010).

### III.

The State Engineer concludes that the Applicant provided proof satisfactory of its intention in good faith to construct any work necessary to apply the water to the intended beneficial use with reasonable diligence, and its financial ability and reasonable expectation

[1674] NRS Chapters 533 and 534.
[1675] NRS 533.370(5) (2010).

actually to construct the work and apply the water to the intended beneficial use with reasonable diligence. Therefore, if all other statutory requirements are fulfilled, NRS 533.370(1) requires the Applications to be approved.

### IV.

The State Engineer concludes that the Applicant has justified the need to import water from Spring Valley, that an acceptable conservation plan is being effectively carried out, that the use of the water is environmentally sound as it relates to the basin of origin, and that by reserving 300 afa in the basin of origin, that the export of water will not unduly limit the future growth and development of Spring Valley. Therefore, there is no reason to reject the Applications under NRS 533.370(6) (2010).

## RULING

The protests to Applications 54003-54021 are hereby overruled in part and the Applications are hereby granted in the following amounts and subject to the following conditions:

1. The Applications are granted subject to existing rights.
2. The Applicant shall pay the statutory fees.
3. The State Engineer has reviewed and approves the Hydrologic Monitoring and Mitigation Plan for Spring Valley[1676] that was prepared by the Applicant. The Applications are granted conditioned upon the Applicant's compliance with that Plan, and any amendments to that Plan that the State Engineer requires at a later date pursuant to his authority under Nevada law.

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[1676] Exhibit No. SNWA_149.

4. The State Engineer has reviewed and approves the Biological Monitoring Plan for Spring Valley[1677] that was prepared by the Applicant. The Applications are granted conditioned upon the Applicant's compliance with that Plan, and any amendments to that Plan that the State Engineer requires at a later date pursuant to his authority under Nevada law.

5. The Applicant shall file an annual report with the State Engineer by March 31st of each year detailing the findings of the approved Hydrologic and Biological Monitoring Plans.

6. Prior to the Applicant exporting any groundwater resources from Spring Valley, biological and hydrologic baseline studies shall be completed and approved by the State Engineer. A minimum of two years of biological and hydrologic baseline data shall be collected by the Applicant in accordance with the approved monitoring plans and will be submitted to the State Engineer and approved by the State Engineer prior to the Applicant exporting any groundwater resources from Spring Valley. Data collected prior to the approval of the monitoring plans by the State Engineer qualifies as baseline data, provided the data was collected in accordance with the subsequently approved plans.

7. The Applicant shall update a computer groundwater flow model approved by the State Engineer once before groundwater development begins and every five years thereafter, and provide predictive results for 10-year, 25-year and 100-year periods.

8. The Applicant shall collect an additional five years of ET data. This data may be used by the State Engineer to adjust the perennial yield of Spring Valley, either increasing it or decreasing it, from the 90,000 afa set as the perennial yield herein. Any change to the perennial yield will be accounted for in the authorized final Stage 4 development amount.

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[1677] Exhibit No. SNWA_365.

9. There is 12,768.61 afa of committed groundwater associated with existing rights. An additional 300 afa must be reserved for unforeseen future uses in Spring Valley. Therefore, the amount of groundwater available for appropriation under the Applications is 76,931 afa.

10. A staged approach to development of the Applications will assure the Applications will not conflict with existing rights or domestic wells. A staged and gradual lowering of the water table will also assure that development of the Applications is environmentally sound and that propagation of effects will be observed by the monitoring network well in advance of any possible adverse impacts. However, a large amount of initial pumping is required to discern pumping effects and provide reliable transient-state data and information to calibrate a groundwater flow model for local-scale applications. With these competing considerations in mind, and consistent with NRS 533.3705, Applications 54003 through 54021 shall be permitted for a total combined duty of 76,931 afa, subject to the 4-Stage development plan described below:

a. <u>Stage 1 Development</u>: Pumping pursuant to the Applications shall be limited to approximately one half of the permitted amount of 76,931 afa, which is 38,500 afa, to provide for a pumping stress that will allow for collection of reliable transient-state data and effective calibration of a groundwater flow model. Before the increase in pumping associated with Stage 2 development can occur, the Applicant will be required to pump at least 85% but not more than 100% of the Stage 1 development amount (32,725 afa – 38,500 afa) for a period of five years. Data from those five years of pumping will be submitted to the State Engineer as part of the annual hydrologic monitoring report. Data from those five years of pumping will be reviewed by the State Engineer and, unless the State Engineer determines additional pumping will conflict with existing rights or domestic wells, or is not environmentally sound, the Applicant may increase pumping to the Stage 2 development level at the end of the fifth year of pumping.

b. Stage 2 Development: Pumping pursuant to the Applications shall be limited to a total of 57,931 afa, which is the Stage 1 development level plus approximately one half of the remaining permitted amount of 38,431 afa, which is 19,431 afa. This pumping will provide additional pumping stresses that will allow for collection of reliable transient-state data and continued calibration of a groundwater flow model. The Applicant will be required to pump at least 85% but not more than 100% of the combined Stage 1 and Stage 2 development amounts (49,241 afa - 57,931 afa) for a period of five years. Data from those five years of pumping will be submitted to the State Engineer as part of the annual hydrologic monitoring report and reviewed by the State Engineer. Unless the State Engineer determines additional pumping will conflict with existing rights or domestic wells or is not environmentally sound, the Applicant may increase the authorized pumping to the Stage 3 development level at the end of the tenth year of pumping.

c. Stage 3 Development: Pumping pursuant to the Applications shall be limited to a total of 67,431 afa, which is the combined Stage 1 and 2 development levels, plus approximately one half of the remaining permitted amount of 19,000 afa, which is 9,500 afa. This pumping will provide for additional pumping stresses that will allow for collection of reliable transient-state data and continued calibration of a groundwater flow model. The Applicant will be required to pump at least 85% but not more than 100% of the combined Stage 1, 2 and 3 development amounts (57,316 afa – 67,431 afa) for a period of five years. Data from those five years of pumping will be submitted to the State Engineer as part of the annual hydrologic monitoring report and reviewed by the State Engineer. Unless the State Engineer determines additional pumping will conflict with existing rights or domestic wells or is not environmentally sound, the Applicant may increase the authorized pumping to the final Stage 4 development level at the end of the fifteenth year of pumping.

d. Stage 4 Development: Pumping pursuant to the Applications shall be limited to the full permitted amount of 76,931 afa. Additionally, this final Stage 4 development amount may be adjusted by the State Engineer to reflect the outcome of the additional required five years of ET data collection by the Applicant.

11. Pursuant to NRS 533.3705, initial development of Applications 54016, 54017, 54018 and 54021 will be limited to 500 afa (maximum continuous pumping of 310 gallons per minute) per well. Before additional volumes of water can be developed at the current points of diversion for these four applications, the Applicant shall collect data from the initial development allowed under this ruling so that the State Engineer can make a determination that pumping more than 310 gpm (500 afa) at the current points of diversion for these applications will not conflict with existing CPB water rights. Before additional volumes of water can be developed at the current points of diversion, the Applicant shall:

a. construct and calibrate a local-scale groundwater flow model with pumping stresses using a much finer grid space;

b. develop an Operations Plan for these four application points of diversion;

c. submit to the State Engineer model projections using the local-scale model that evaluates impacts from pumping additional volumes of water pursuant to the pumping scheme in the Operations Plan; and

d. receive approval of the Operations Plan by the State Engineer.

12. The State Engineer shall consider any alleged conflict from the Applications with an existing water right or domestic well, and any allegation that pumping pursuant to the Applications is environmentally unsound. The Applicant shall provide information regarding monitoring, model runs, management and mitigation measures, and other information that is needed to evaluate the allegations. The State Engineer will evaluate such concerns on a case-by-case basis with site specific evidence. Part of that analysis will be a determination of what a reasonable lowering of the static water table would be in each case,[1678] and what level of impact to an environmental area of interest is reasonable and environmentally sound. If necessary, the State Engineer will then determine on a case-by-case basis whether a management plan is required to protect against a specific allegation, and that plan may include thresholds and triggers to manage groundwater development under the Applications.

13. If pumping conflicts with existing rights, conflicts with the protectable interests in domestic wells as set forth in NRS 533.024, threatens to prove detrimental to the public interest or is found to be environmentally unsound, the Applicant will be required to curtail pumping and/or mitigate the impacts to the satisfaction of the State Engineer.

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[1678] *See* NRS 534.110.

Respectfully submitted this 26th day of January, 2012

By: Dana Walsh

DANA R. WALSH, ESQ.
Nevada State Bar No. 10228
SOUTHERN NEVADA WATER AUTHORITY
1001 South Valley View Boulevard, MS #485
Las Vegas, Nevada 89153
(702) 875-7080 – Telephone
(702) 862-7444 – Facsimile

PAUL G. TAGGART, ESQ.
Nevada State Bar No. 6136
TAGGART & TAGGART, LTD.
108 North Minnesota Street
Carson City, Nevada 89703
(775) 882-9900 – Telephone
(775) 883-9900 – Facsimile

ROBERT A. DOTSON, ESQ.
Nevada State Bar No. 5285
LAXALT & NOMURA, LTD.
9600 Gateway Drive
Reno, Nevada 89521
(775) 322-1170 – Telephone
(775) 322-1865 – Facsimile

STEVEN O. SIMS, ESQ.
Colorado State Bar No. 9961, *admitted pro hac vice*
BROWNSTEIN HYATT FARBER
SCHRECK, LLP
410 Seventeenth Street, Suite 2200
Denver, Colorado 80202
(303) 223-1100 – Telephone
(303) 223-1111 – Facsimile
***Attorneys for SNWA***

**CERTIFICATE OF SERVICE**

I hereby certify that on this 26 day of January, 2012, a true and correct copy of SOUTHERN NEVADA WATER AUTHORITY'S PROPOSED SPRING VALLEY RULING was served on the following by Fed Ex overnight delivery as follows:

Simeon Herskovits
Advocates for Community and Environment
94 Hwy 150, Suite 8
El Prado, New Mexico 87529

J. Mark Ward
Utah Association of Counties
5397 Vine Street
Murray, Utah 84107

Jerald Anderson
EskDale Center
1100 Circle Drive
EskDale, Utah 84728

Henry C. Vogler, IV
HC 33 Box 33920
Ely, Nevada 89301

Severin A. Carlson
Kaempfer Crowell Renshaw Gronauer & Fiorentino
50 West Liberty Street, Suite 900
Reno, Nevada 89501

Paul Echohawk
EchoHawk Law Office
505 Pershing Avenue, Suite 100
Pocatello, Idaho 83205

Aaron Waite
The Cooper Castle Law Firm, LLC
5275 South Durango Drive
Las Vegas, Nevada 89113

George Benesch
190 West Huffaker Lane, Suite 408
Reno, Nevada 89511-2092

DATED this 26 day of January, 2012.

Emily Clark
Employee of the Southern Nevada Water Authority