IN THE OFFICE OF THE STATE ENGINEER
OF THE STATE OF NEVADA

IN THE MATTER OF APPLICATIONS 54003)
THROUGH 54021, INCLUSIVE, FILED TO)
APPROPRIATE THE UNDERGROUND)
WATERS OF THE SPRING VALLEY)
HYDROGRAPHIC BASIN (184), LINCOLN)
AND WHITE PINE COUNTIES, NEVADA.)

RULING

#6164

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 above. 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 above. 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 above. 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]

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[1] Exhibit No. SE_003.
[2] Exhibit No. SE_004.
[3] Exhibit No. SE_005.
[4] Exhibit No. SE_006.

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 above. 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 above. 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 above. 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 above. 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 above. The proposed point of diversion is described as

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[5] Exhibit No. SE_007.
[6] Exhibit No. SE_008.
[7] Exhibit No. SE_009.
[8] Exhibit No. SE_010.

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 above. 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 above. 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 above. 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 above. 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]

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[9] Exhibit No. SE_011.
[10] Exhibit No. SE_012.
[11] Exhibit No. SE_013.
[12] Exhibit No. SE_014.
[13] Exhibit No. SE_015.

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 above. 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 above. 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 above. 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 above. 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 above. The proposed point of diversion is described as

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[14] Exhibit No. SE_016.
[15] Exhibit No. SE_017.
[16] Exhibit No. SE_018.
[17] Exhibit No. SE_019.

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 above. 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 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 letter was estimated to be 1,400,000 persons by the year 2020.[20]

The Applications were originally filed by the LVVWD and are now held by the Southern Nevada Water Authority ("SNWA" or "Applicant").[21]

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[18] Exhibit No. SE_020.
[19] Exhibit No. SE_021.
[20] File Nos. 54003 through 54021, official records in the Office of the State Engineer.
[21] File Nos. 54003 through 54021, official records in the Office of the State Engineer.

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.[22]

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 order dated March 8, 2006, the State Engineer denied the request, noting that 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.[23] The State Engineer scheduled a hearing on the Spring Valley applications to begin on September 11, 2006.[24]

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.[25] 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.[26]

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.[27]

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,

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[22] *In re Applications 53987-53992 & 54003-54030*, State Engineer Intermediate Order & Hearing Notice, p. 1 (March 8, 2006).
[23] *Id.* at 7.
[24] *Id.* at 11.
[25] *In re Applications 53987-53992 & 54003-54030*, Protestants' Petition for Declaratory Order (July 6, 2006).
[26] *In re Applications 54003-54021*, State Engineer Intermediate Order No. 3, p. 2 (July 27, 2006).
[27] Exhibit No. SE_041.

54006, 54007, 54008, 54009, 54010, 54011, 54012, 54013, 54014, 54015, 54019, and 54020 subject to monitoring and mitigation requirements and staged pumping limitations.[28]

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 period for filing of protests in the Seventh Judicial District Court of the State of Nevada.[29] 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.[30]

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.[31] 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.[32]

On June 17, 2010, the Supreme Court granted, in part, the Applicant's and State Engineer's request for re-hearing.[33] 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.[34] The Supreme Court concluded that "the proper and most equitable remedy is that the State Engineer must re-notice the applications and re-open the protest period"

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[28] State Engineer Ruling No. 5726, p. 56, dated April 16, 2007, official records in the Office of the State Engineer.
[29] *Great Basin Water Network v. Taylor*, No. CV 0608119, Petition for Judicial Review (7th Judicial Dist. Ct. Nev. Aug. 22, 2006).
[30] *Great Basin Water Network v. Taylor*, No. CV 0608119, Order pp. 9-12 (7th Judicial Dist. Ct. Nev. May 30, 2007).
[31] *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).
[32] *Ibid.*
[33] *Great Basin Water Network v. Taylor*, 126 Nev. Adv. Op. 20, 234 P.3d 912, 913 (2010).
[34] *Id.* at 913-14.

and remanded the matter to District Court with instructions to remand it to the State Engineer for further proceedings.[35]

On remand, Applications 54003 - 54005 were sent for republication 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 republication 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.[36] 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.[37] The State Engineer further ordered that Protestants wishing to put on a case-in-chief notify the State Engineer by April 29, 2011.[38] 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.[39] 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.[40]

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 wish to use in this hearing, but need not exchange copies of the prior exhibits, as they were all available on the State Engineer's public website.[41] 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.[42] The State Engineer allowed the parties to file written opening statements by September 19, 2011.[43] The State Engineer allowed the parties to file written closing briefs by

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[35] *Id.* at 920.
[36] Exhibit No. SE_001, pp. 1, 3.
[37] Exhibit No. SE_001, p. 1.
[38] Exhibit No. SE_001, p. 3.
[39] Exhibit No. SE_001, p. 4.
[40] Exhibit No. SE_001, p. 5.
[41] Exhibit No. SE_100, p. 3.
[42] Exhibit No. SE_100, p. 5.
[43] Exhibit No. SE_100, p. 6.

December 23, 2011, and to file proposed rulings by January 27, 2012.[44] 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 Valley 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 (amended) 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 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.

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[44] Exhibit No. SE_100, p. 7.

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;[45] and Moapa Band of Paiute Indians.[46]

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);

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[45] Exhibit Nos. SE_022 through SE_040.
[46] File Nos. 54003 through 54021, official records in the Office of the State Engineer.

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 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).[47]

IV. WITHDRAWN PROTESTS

Of the above listed Protestants, several later withdrew their protests 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.[48] The protests by Moapa Band of Paiute Indians were withdrawn on April 11, 2006.[49] 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.[50] In response to the hearing questionnaire form sent out by the Nevada Division of Water Resources, Jane Lindley indicated she would like to withdraw her protest.[51] 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.[52] Pursuant to the Stipulation for Withdrawal of Protests dated September 15, 2011, the protests by the United States Department

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[47] Exhibit Nos. SE_060 through SE_078.
[48] File Nos. 54003 through 54021, official records in the Office of the State Engineer. *See,* agreement dated April 17, 2003, and recorded June 19, 2003, under Document Number 120315 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.
[49] File Nos. 54019 through 54021, official records in the Office of the State Engineer. *See,* Moapa Band of Paiutes' Withdrawal of Protests Regarding Spring and Snake Valleys, dated April 11, 2006.
[50] Exhibit No. SE_041.
[51] File No. 54007, official records in the Office of the State Engineer.
[52] File No. 54006, official records in the Office of the State Engineer.

of Agriculture – Forest Service, were withdrawn on Septe ıber 15, 2011.[53] The protests by Richard and Lesley Sears were also withdrawn.[54]

V. PARTICIPATING PROTI STANTS

The Protestants that indicated an intent to participate at the administrative hearing were: Confederated Tribes of the Goshute Reservation; Duckwat er Shoshone Tribe; Ely Shoshone Tribe; The Long Now Foundation; Nye County, Nevada; Cor oration of the Presiding Bishop of the Church of Jesus Christ of Latter-Day Saints, Utah; Eskl ale Center; Millard County, Utah; Juab County, Utah; Henry Vogler, IV; Great Basin Water N etwork, et al. (GBWN); County of White Pine and City of Ely (with GBWN); Defenders o: Wildlife (with GBWN); Preston Irrigation (with GBWN); Toiyabe Chapter Sierra Club (wi h GBWN); Orvan Maynard (with GBWN); Great Basin Business and Tourism Council (wi h GBWN); Terrance and Debora Steadman (with GBWN); Utah Audubon Council (with GB\ 'N); Govert Basset (with GBWN); Pete Delmue (with GBWN); Lund Irrigation and Water Co. (with GBWN); Roderick McKenzie (with GBWN); Patrick Fillman (with GBWN); Linda John son (with GBWN); Max & Diane Chipman (with GBWN); 2nd Big Springs Irrigation Co. with GBWN); Dean Baker (with GBWN); Abigail Johnson (with GBWN); Baker GID (witl GBWN); Border Inn, LLC (with GBWN); 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 GBWI); Kristine Fillman (with GBWN); League of Women Voters of Salt Lake City, Utah (with GI WN); White Pine County and the City of Ely (with GBWN); Mildred Valencia successor to Ir in Baker Edwards (with GBWN); Gary and Jo Ann Perea (with GBWN); Nevada Farm Burea 1 (with GBWN); Panaca Irrigation Company (with GBWN); Kathy Hiatt (with GBWN); Tho nas Baker (with GBWN); Walter Benoit (with GBWN); Louis Cole (with GBWN); Citizen's Education Project (with GBWN); Lois Weaver (with GBWN); Sportsworld (with GBWN); an l William and Katherine Rountree (with GBWN).[55]

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[53] Exhibit No. SE_095.
[54] File Nos. 54019 through 54021, official records in the Office of the Stat : Engineer.
[55] Exhibit Nos. SE_100, SE_022 through SE_040, and SE_060 through Sl _078.

VI. SUMMARY OF PROTEST GROUNDS

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

1. 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. Eastern Nevada has had severe drought conditions for the past three years, which has created hardships on all cattlemen. If the drought created numerous hardships, the continual removal of the perennial yield by the Applicant will destroy all ranching operations as well as the whole environment of the basin.

3. If granted, the allocation of all unappropriated waters in this groundwater basin would adversely affect the basin of origin and surrounding area by reducing the quality and quantity of water. 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. Granting the applications may interfere with interbasin flow from Spring Valley to Snake Valley and thereby unduly limit future growth and development.

5. Clark County should not be allowed to drain off water necessary for our counties' well being.

6. 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. Leave the rural water alone as it ultimately f ows to the growth center anyway. The rural water is the source of springs and artesian wells t at surface here, and that first gave travelers and settlers their survival.

8. The Applicant has not implemented a sufficie conservation plan in the proposed place of use to protect the affected basins and current cons rvation programs instituted by the Applicant are ineffective public-relations oriented efforts tha are unlikely to achieve substantial water savings. The Applications should be denied bec se the current per capita water consumption rate of the Las Vegas area is double that of othe southwestern municipalities.

9. Any temporary mining of water is unacceptal e due to excessive waste of water that is currently exhibited and will continue without forese n change. 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. It will benefit the public best to conserve existing water demands starting at home.

10. The appropriation and export of water propose l in the Applications is detrimental to the public interest on environmental grounds in the bas n of origin and in hydrologically connected and/or downwind basins, due to: harm to wildlife nd wildlife habitat, degradation of air quality (dust storms), destruction of recreational and aes hetic values, degradation of water quality, degradation of cultural resources, harm to state wildli e management areas and parks and state and federal wildlife refuges and parks.

11. It is the public policy of the State of Nevada, er Governor Bob Miller's January 25, 1990, State of the State Address, to protect Nevada's e vironment, even at the expense of growth.

12. The granting or approval of the Applications s 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 specie , interfere with the conservation of those threatened or endangered species; and generally interf re with the purpose for which the federal lands are managed under federal statutes.

13. Granting the Applications will interfere with terbasin flow from Spring Valley to Snake Valley. The appropriation will lower the water t ble to such an extent that it will substantially reduce groundwater dependent vegetation. his reduction in vegetation will

destabilize soils and contribute to blowing dust resulting i . reduced air quality in Juab and Millard County and northward into other Utah counties due) the alkali nature of the soils and potential radioactive fallout in the soils. Reduction in the w :er table will thereby diminish and otherwise damage the phreatophytic vegetative species that (pend on the water table as well as the wildlife and livestock that depend on those phreatophy ic species, causing environmental harm, including harm to endangered and threatened species.

14. Granting the Applications will interfere with ıterbasin flow from Spring Valley to Snake Valley and thereby deplete the quantity and quality f water flow in various springs and seeps throughout the basin targeted by the Applications and ill thereby diminish and otherwise damage riparian areas and the riparian vegetation, riparian wi llife, migrating birds and livestock that depend upon those riparian areas.

15. Groundwater dependent vegetation will be aff :ted, changing the general ecology and providing opportunity for invasive or non-native spec :s to compete with both wildlife habitat and agricultural cropping, threatening the agricultura ɔasis of the community and future economic development opportunities.

16. Regarding concern for the Great Basin Natior l Park: that streams and pools will disappear if the water tables are lowered, which would adve ely affect all animal and plant life and destroy a national heritage. The protest requests an Envi nmental Impact Statement.

17. Spring Valley Basin is home for the Swamp Cedar and Spring Valley Pupfish [sic] and both species are extremely rare and uniquely indige ıous. Survival of both depends on the water quality and levels that currently exist. These spe es cannot tolerate less water than currently exists.

18. The applications should be denied because th y will exceed the safe yield of the Spring Valley Basin and the Great Basin National Park, there y adversely affecting their riparian zones and phreatophytes.

19. The subject application should be denied beca se Spring Valley lies down-stream from the Great Basin National Park, and diversion of water h re could result in drawdown of the water table in the Great Basin National Park, thus having a ıegative effect on migratory birds and the plant and animal species inhabiting and dependent n water resources in the National Park and the Spring Valley Basin, including some sensitive pecies and some species protected under the federal Endangered Species Act and related state atutes. On information and belief

this would include, but not be limited to, the Spring Vall y Pupfish [sic], Pennell's Draba, Nevada Greasebush and Swamp Cedar.

20. The requested water is already being used an further pumping in large amounts would deplete the underground water, and dry up springs.

21. To grant an application for withdrawal from n alluvial-fan aquifer up-gradient from Davis Spring would not be in the public interest due) the probability of impacting the spring, which serves wildlife, livestock, and irrigation uses.

22. Air pollution in Las Vegas Valley is so bad t at the valley has been classified a non-attainment area for national and state ambient air-qualit standards. The Applications and the other applications associated with the water importation] oject should be denied since more water means more growth and, therefore, more air pollution.

23. The appropriation of this water when dded to the already approved appropriations and existing uses and water rights in the host vater basin will exceed the annual recharge and safe yield of the basin.

24. There is no groundwater left in the hydrograpl c area targeted by the Applications that can be safely appropriated above and beyond that wh h is already appropriated without disrupting the interbasin flow from Spring Valley to Snake V ley.

25. Appropriation in Spring Valley, when dded to the already approved appropriations and dedicated users in Basin 209 (Pahrana t Valley) will exceed the annual recharge and safe yield of the basin.

26. The granting or approval of the Applications v)uld conflict with or tend to impair existing rights in the Snake Valley because, if granted, it ' ould exceed the safe yield of the subject valley and unreasonably lower the static water level.

27. The granting or approval of the Applications v)uld sanction water mining.

28. There is not sufficient unappropriated water a ailable in the Spring Valley Basin to provide the water being sought. Due to cyclical drought, nd long term climatic change, the water resource in this basin and all connecting basins is dimi shing.

29. Appropriation, even if limited to annual recl rge, inevitably will damage plant and animal life on the surface. Wild and cultivated areas will)e destroyed and wildlife would be disturbed or killed off, thus impacting the lives of human re dents and visitors. In this regard, the water is not available.

30. The Applications seek to appropriate more groundwater than the perennial yield of the basin as currently recognized by the State Engineer.

31. The 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 appropriation and proposed use would violate the reserved water rights of the Confederated Tribes of the Goshute Reservation, the Ely Shoshone Tribe and the Duckwater Shoshone Tribe ("Tribes").

33. The Applications are like the dewatering processes of the mining industry; however, 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 states 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. 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 applications should be denied because of potential impacts to the Indian Springs Valley Basin, which is already over allocated. Such impacts may harm rights owned by the U.S. Air Force in the Indian Springs Valley Basin.

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

38. 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. The 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. Millard and Juab Counties, Utah assert 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 the applications 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. 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. The lack of water will restrict further growth in the Pioche area.

42. 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 Marasco 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 Valleys will depreciate tourism. Impacts to the Great Basin National Park will in turn depreciate the value and income from his business.

44. 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 asserts that it will be severely affected economically in the event of lowering of current groundwater levels due to the following: a) current wells have produced consistently for over 50 years, b) the cost of drilling deeper wells has increased many fold over that 50-year period, c) the state-regulated community potable water supply quality would be jeopardized and domestic wells will be threatened, d) it would place unnecessary hardship on, and thereby threaten the economic survival of the protesting community if the Applications are approved, e) 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 of the Church of Latter-Day Saints ("CPB") owns and operates Cleveland and Rogers Ranches and associated grazing permits as part of a large livestock operation in north Spring Valley. The CPB's holdings include vested rights, surface water rights and groundwater rights. 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. 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. Some of the points of diversion are a few miles up-gradient from Deep Spring (a.k.a. Davis Spring). Large-volume pumping from the valley-fill aquifers will adversely impact the flow and water rights from Davis Spring.

48. Pumping will withdraw water from the alluvial fan from which numerous springs rise and flow to serve George Eldridge and Sons, Inc. water rights and to serve the pre-existing rights of others. Large-volume pumping from the alluvial-fan aquifers will adversely impact the flow from those springs. 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. Great Basin National Park is Nevada's only National Park. To divert and export water from it without a water resource plan will be sinful.

50. 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. The Applications should be denied because the public has been denied relevant information and due process because of the stated confusion.

51. 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. 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. 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. The 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. 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. 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. Potential impacts cannot be anticipated as no environmental impact study has been published.

56. 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. 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. 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, cannot 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, some feel it is their right if not their duty to protest any extraction of water from the county.

59. 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. 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. The Applicant has duplicative applications filed in 2010 in this basin, that a duplicative hearing for the same groundwater may be required in the future.

62. 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. With the economic downturn and resulting economic difficulties funding of the project is unlikely.

63. The Applicant has not shown a need for the water or the feasibility (technical and financial) of the water-importation project. Further, 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. 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. Because the Applicant announced in the U.S. Bureau of Land Management ("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. Given the present economic downturn and halt in economic growth, the Applicant cannot justify the need to import water from another basin.

67. 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. Clark County must grow only within the limits of its natural resources or the environmental and socioeconomic balance of the State of Nevada will be destroyed.

69. 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. 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 reuse, etc.) should be developed and assigned to the water-short lots and units.

71. The proposed action is not an appropriate long-term use of Nevada's water.

72. 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. 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. 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. It is time for Clark County to solve their problems there and not steal the good things rural Nevada offers.

76. 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. 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. The water will not be put to good use.

78. The appropriation and export of water proposed in the Applications will jeopardize public health and be detrimental to the public interest

79. The Applications should be outright denied because the State Engineer has previously denied other applications for water from the basin.

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

82. The Tribes assert 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. The Tribes allege 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. The Applications should be denied because they lie within the boundaries of land covered by the Treaty of Ruby Valley of 1863. It is alleged that 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. Spring Valley has been the traditional home of the Native Newe (Western Shoshone) people since prehistoric times. There are many prehistoric sites in the area, including ancient petroglyphs and graves. The Shoshone Cedars Sacred Historic Site will be completely devastated by pipeline construction and water withdrawal. It is asserted that the State Engineer's office ignores Native American water rights as a matter of political expediency. Tribal ancestors have lived in the basin sustainably for 10,000 years and morally have existing water rights. Nevada water laws give away Native American and wildlife's water to the first capable of wasting it, for free. When the water is gone, people will look back at the Project as a mistake.

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 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 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. 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 CPB, 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).[56] 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).[57] 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.[58] 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).[59]

VIII. STATUTORY STANDARD TO GRANT

Nevada Revised Statute 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 faith to construct any work necessary to apply the water to the intended beneficial use with reasonable

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

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

Nevada Revised Statute 533.370(2) 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

Nevada Revised Statute 533.370(3) provides that in determining whether an application for an interbasin transfer of groundwater must be rejected, the State Engineer shall consider: (1) whether the applicant has justified the need to import the water from another basin; (2) 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; (3) whether the proposed action is environmentally sound as it relates to the basin from which the water is exported; (4) whether 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; and (5) any other factor the State Engineer determines to be relevant.

XI. GUIDING PRINCIPLES IN THE APPLICATION OF THE WATER LAW TO THIS DECISION

The Nevada Division of Water Resources (NDWR) is headed by the State Engineer who supervises the appropriation of water in Nevada. The mission of the NDWR is to conserve, protect, manage and enhance the water resources of the state for Nevada's citizens through the appropriation and reallocation of the public waters. The State Engineer is responsible for reviewing all applications to appropriate water and, in conjunction with the water law and policies of Nevada, approving or rejecting such applications. The Nevada Legislature has expressed many guiding principles in the development of water resources in Nevada and has developed the statutory criteria the State Engineer must apply when approving or denying applications for a project involving the beneficial use of water. The following summarizes many

of the guiding principles and statutory criteria that the State Engineer will follow in making the decision on the subject applications.

Nevada water law is first and foremost founded on the doctrine of prior appropriation. The most significant principles of the prior appropriation doctrine are as follows: (1) "first in time, first in right," in other words, priority controls the use of water in times of shortage; (2) beneficial use is the basis, the measure, and the limit of the right to the use of water; and (3) the "use it or lose it" principle, i.e., water not placed to beneficial use may be lost through cancellation, forfeiture or abandonment. In Nevada, the waters of all sources of water supply within the boundaries of the state belong to the public. NRS 533.025. Subject to existing rights, and other statutory criteria, all water may be appropriated for beneficial use. NRS 533.030. Nevada Revised Statutes 533.370(3), 533.007 specifically provide for the interbasin transfer of water, which is defined as the transfer of groundwater for which the proposed point of diversion is in a different basin than the proposed place of beneficial use. In this matter, the Applicant has lawfully filed for an interbasin transfer of groundwater for a beneficial public use of water.

Nevada Revised Statute 540.011 establishes a basic legislative policy, which recognizes the relationship between the critical nature of the state's limited water resources and the increasing demands placed on these resources as the population of the state continues to grow. The legislature further recognizes the important role of water resource planning and that such planning must be based upon identifying current and future needs for water. The State Engineer believes that the legislative declarations of policy establish the importance of protecting existing water rights, supporting water conservation, and acknowledging the role of water planning. The State Engineer will determine whether unappropriated water within the subject basins is available for the Applicant's future water supply plans to protect against shortages on the Colorado River, meet projected demands, and replace temporary water supplies, and whether this can be done in a responsible manner utilizing all the tools at his disposal, including monitoring, adaptive management and, if necessary, mitigation to ensure that there is no conflict with existing water rights or other provisions of Nevada water law.

The legislature declared that it is the policy of this state to encourage the State Engineer to consider the best available science in rendering decisions concerning the available surface and underground sources of water in Nevada. NRS 533.024(1)(c). Understanding the hydrology of this region is critical in evaluating the potential hydrological impacts of groundwater

development. Both the Applicant and Protestants submitted thousands of pages of scientific information, evidence and testimony for consideration during a record long six weeks of administrative hearing. This area has been under study for decades and voluminous published scientific reports were made available as evidence for review. The State Engineer will weigh the evidence presented at the administrative hearing and utilize the best available science that has been correctly applied and evaluated for accuracy in rendering his decision on this matter in accordance with stated legislative policies.

Nevada is the driest state in the nation and has been one of the fastest growing. Due to its relative scarcity, water is Nevada's most precious resource and must be managed wisely and to its fullest extent to maximize efficient use of its water. It is imperative that the State Engineer maximize the beneficial use of all waters within the state, otherwise, it could unnecessarily stymie economic growth, eliminate recreational opportunities, hinder the use of water for environmental concerns, and be generally detrimental to the state as a whole. However, maximizing the beneficial use of Nevada's water resources shall not be done to the detriment of the other criteria found in Nevada's water law.

Over 70% of the State's economy is generated in Clark County[60] and the export of water as proposed will directly benefit 7 of 10 Nevadans. The Las Vegas area currently relies on the Colorado River for 90% of its water supply. The right to divert water from the Colorado River is limited, with Nevada's share allocated at 300,000 acre-feet annually ("afa") of the 7,500,000 afa allocated to the lower basin states of Arizona, Nevada and California. Steps have been taken to augment this allocation, but the supply of water within the Colorado River itself is ultimately limited by up-stream use and precipitation patterns. Historical flow records indicate that the Colorado River is over-appropriated and recent drought conditions on the Colorado River have caused that over-appropriation to be exacerbated. Conditions will worsen as the Colorado Basin states begin to use more of their previously unused allocations. It is clear from the evidence and testimony, and as discussed in greater detail in this ruling, that Southern Nevada needs an alternative water source. The all-encompassing question that first must be answered is whether unused in-state water resources can be appropriated to provide that additional source of water for Southern Nevada. In reading and listening to the public comment submitted as part of the

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[60] Exhibit No. SNWA_459, Slide 10 (Aguero).

administrative hearing, it was suggested by many people that the SNWA should look to California and Mexico for desalinization or other water strategies, should look to other users on the Colorado River for additional supply, and should look at other options outside of Nevada. However, the evidence and testimony provided indicates that other strategies for developing alternative water sources have been explored and vetted by the SNWA, but not one alternative has been found to be more viable than in-state water resources at this time. In addition, the SNWA is continuing to explore other water supply strategies, including many of the options suggested by the public, as planning for future water supply is a continuous process. The State Engineer considers the use of in-state resources to augment and diversify the water portfolio of Southern Nevada to be of vital interest to Nevada and the use of water in the project is consistent with various legislative declarations and proclamations, as discussed above. However, the State Engineer will balance the needs of Southern Nevada with the protections necessary, and provided for by statute, and by utilizing his authority under NRS 533.3705.

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.[61] Beneficial use is the basis, the measure and the limit of the right to the use of water in the State of Nevada.[62]

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;[63] (3) John Entsminger, the Applicant's Senior Deputy General Manager, an expert in Colorado River water resources;[64] 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.[65] These witnesses have all been responsible for managing Southern Nevada's water-resource

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[61] *See,* NRS 533.030(1); NRS 533.035; NRS 533.045; NRS 533.060(1); NRS 533.070(1); NRS 533.370(3)(a).
[62] NRS 533.035.
[63] Transcript, Vol.1 p. 174:7-8 (State Engineer).
[64] Transcript, Vol.1 p. 191:1-3 (State Engineer).
[65] Transcript, Vol.1 p. 186:22-24 (State Engineer).

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.[66]

The Protestants presented Dr. Peter Gleick, President of the Pacific Institute, an expert in water conservation and efficiency, who testified regarding Southern Nevada's need for this water. 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.[67]

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.[68] 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.[69] 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.[70] The Applicant's board of directors has determined that the Applicant needs this water and has directed staff to pursue permitting of the Applications.[71]

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 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

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[66] Transcript, Vol.2 p. 328:1-4 (Holmes); p. 345:14-18 (Brothers); p. 347:3-20 (Entsminger).
[67] Transcript, Vol.23 pp. 5127:22-5128:25 (Gleick).
[68] Exhibit No. SNWA_189, p. 2-1.
[69] Exhibit Nos. SNWA_223 through SNWA_229.
[70] Exhibit No. SNWA_209, Appendix 2; Exhibit No. SNWA_201; Transcript, Vol.1 pp. 225:11-228:6 (Brothers).
[71] Exhibit No. SNWA_211; Transcript, Vol.1 pp. 235:25-236:4 (Brothers).

Mexico. The Colorado River is divided into an upper basin and a lower basin, each of which is allocated 7.5 million 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.[72] 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.[73]

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.[74] 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.[75]

Southern Nevada is almost entirely dependent on the Colorado River as it supplies 90% of Southern Nevada's water.[76] 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.[77] 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 Colorado River water.[78] 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.[79] 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.[80] 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

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[72] Transcript, Vol.2 p. 262:24-25 (Entsminger).
[73] Transcript, Vol.2 p. 264:6-8 (Entsminger).
[74] Exhibit No. SNWA_189, p. 8-2, Figure 8-1; Transcript, Vol.2 p. 264:11-13 (Entsminger).
[75] Exhibit No. SNWA_189, p. 8-2, Figure 8-1; Transcript, Vol.2 p. 264:14-16 (Entsminger).
[76] Exhibit No. SNWA_189, p. 7-1; Transcript, Vol.2 p. 260:20-22 (Entsminger).
[77] Exhibit No. SNWA_189, p. 3-1; Transcript, Vol.2 p. 261:13-16 (Entsminger).
[78] Exhibit No. SNWA_189, pp. 3-1, 3-4.
[79] Exhibit No. SNWA_189, p. 3-4.
[80] Exhibit No. SNWA_189, p. 3-5.

the Applicant to extend its available water supplies by approximately 70%, which represents a significant portion of Southern Nevada's water resources.[81]

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.[82] The water-level elevation in Lake Mead dropped by roughly 130-140 feet.[83] 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.[84] As a point of reference, that reduction is equal to Nevada's Colorado River allocation for a period of 50 years.[85] 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.[86]

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.[87] 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.[88] The amounts of those reductions are uncertain, but are anticipated to be significantly larger than those quantified in existing agreements.[89]

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[81] Exhibit No. SNWA_189, p. 3-1; Transcript, Vol.2 p. 282:2-16 (Entsminger).
[82] Exhibit No. SNWA_232; Transcript, Vol.2 p. 266:20-23 (Entsminger).
[83] Exhibit No. SNWA_189, p. 7-1; Exhibit No. SNWA_232; Transcript, Vol.1 p. 194:25 (Holmes).
[84] Exhibit No. SNWA_189, p. 7-1; Exhibit No. SNWA_403; Transcript, Vol.1 p. 195:2-6 (Holmes).
[85] Transcript, Vol.1 p. 195:6-9 (Holmes).
[86] Transcript, Vol.2 pp. 266:23-267:5 (Entsminger).
[87] Exhibit Nos. SNWA_189, p. 2-2; SNWA_203; SNWA_204; Transcript, Vol.2 pp. 269:9-272:11 (Entsminger).
[88] Exhibit No. SNWA_189, p. 6-3; Transcript, Vol.2 p. 269:21-23, p. 277:8-21 (Entsminger).
[89] Exhibit No. SNWA_189, p. 1-2; Transcript, Vol.2 p. 277:11-17 (Entsminger).

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.[90] 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.[91] Furthermore, if Lake Mead elevation levels drop below 1,000 feet, which is the operational limit of the Applicant's current pumping intake facilities, the Applicant might not be able to withdraw any of its Colorado River water from Lake Mead.[92] 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.[93]

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.[94] 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.[95] 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.[96] The Applicant has estimated, using a Bureau of Reclamation model, that based on past flow records, there is a 40% probability by 2020 and a 50% probability by 2025 that in any given year the lower basin will be in shortage,[97] 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 that state that the Colorado River basin is expected to warm between five to six degrees Fahrenheit during the 21st century, which could have significant

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[90] Exhibit No. SNWA_189, p. 2-3; Transcript, Vol.2 p. 414:4-9 (Entsminger).
[91] Transcript, Vol.2 p. 303:10-12, p. 414:4-10 (Entsminger).
[92] Exhibit No. SNWA_189, p. 7-2.
[93] Exhibit No. SNWA_189, p. 8-4; Transcript, Vol.2 p. 269:6-9 (Entsminger).
[94] Transcript, Vol.2 p. 268:10-12 (Entsminger).
[95] Transcript, Vol.2 p. 268:1-8 (Entsminger), p. 333:12-19 (Brothers).
[96] Exhibit No. SNWA_189, pp. 7-2 to 7-3. Figure 7-1; Transcript, Vol.2 p. 334:4-9 (Brothers).
[97] Exhibit No. SNWA_189, p. 7-2, p. A-5, p. A-6, Figure A-2.

effects on the availability of water supplies.[98] 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.[99] 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.[100] 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.[101] The Bureau of Reclamation uses the CRSS model to evaluate long-term policy and address long-term planning for the Colorado River system.[102] 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."[103] CRSS allows the Bureau of Reclamation to evaluate proposed operating policies over a broad range of possible future hydrologic conditions.[104] 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% probability by 2020 and a 50% 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.[105] The CRSS model results show a 50% probability of shortage by 2035 with the probability of shortage reaching upwards of 60%

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[98] Exhibit No. SNWA_237, p. 25.
[99] Exhibit No. SNWA_189, p. 7-2; Transcript, Vol. 2 p. 336:16-20 (Brothers).
[100] Transcript, Vol.2 p. 336:16-20 (Brothers).
[101] Exhibit No. SNWA_189, p. A-1; Transcript, Vol.2 p. 337:2-10 (Brothers).
[102] Exhibit No. SNWA_189, p. A-1.
[103] Exhibit No. SNWA_189, pp. A-1 to A-2.
[104] Exhibit No. SNWA_189, p. A-2.
[105] Exhibit No. SNWA_189, p. A-5, p. A-6, Figure A-2.

by 2060.[106] 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.[107] That means that the CRSS model predicts on average that 30 years of shortage will occur during the Applicant's 50-year planning period.[108]

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.[109] 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 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.[110] 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).[111] 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.[112] 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.[113]

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[106] Exhibit No. SNWA_189, p. A-6, Figure A-2; Transcript, Vol.2 p. 339:10-13 (Brothers).
[107] Exhibit No. SNWA_189, pp. A-5 to A-6.
[108] Exhibit No. SNWA_189, p. A-6, Table A-1; Transcript, Vol.2 p. 340:16-21 (Brothers).
[109] Exhibit No. SNWA_189, Appendix A.
[110] Exhibit No. SNWA_189, Appendix A, pp. A-3 to A-5.
[111] Exhibit No. SNWA_189, p. 8-4; Transcript, Vol.2 p. 343:14-20 (Brothers).
[112] Exhibit No. SNWA_189, p. 8-4.
[113] Exhibit No. SNWA_189, p. 8-4.

The Applicant's analysis graphically demonstrates the amount of water that the Applicant estimates could be available under shortage conditions on the Colorado River.[114] 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.[115] The assumptions in the Applicant's analysis may over-estimate or under-estimate 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 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.[116] 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.

The State Engineer finds Southern Nevada needs a water resource that is independent of the Colorado River and 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.

B. Meeting Projected Demand

Even under normal (non-shortage) conditions on the Colorado River, the Applicant presented evidence to support a finding 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.[117] 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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[114] Exhibit No. SNWA_189, p. 8-5, Figure 8-5.
[115] Exhibit No. SNWA_189, pp. A-10 to A-12.
[116] Transcript, Vol.2 p. 267:18-23 (Entsminger).
[117] 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.[118] 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.[119] 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.[120] The current Water Resource Plan was revised in 2009 and that version was adopted without revision in 2010 and 2011.[121] 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.[122] 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.[123] The State Engineer finds that the evidence demonstrates that the Applicant's current available supplies would be insufficient to 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.[124] 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

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[118] Transcript, Vol.2 pp. 307:19-308:5 (Holmes).
[119] Transcript, Vol.2 p. 308:6-15 (Holmes).
[120] Transcript, Vol.2 p. 249:13-18 (Entsminger).
[121] Transcript, Vol.2 p. 250:1-16 (Entsminger).
[122] Exhibit No. SNWA_209, p. 43, Figure 28.
[123] Exhibit No. SNWA_189.
[124] Exhibit No. SNWA_189, p. 3-1; Transcript, Vol.2 p. 251:16-18 (Entsminger).

water, Las Vegas Valley groundwater, and other in-state groundwater.[125] Temporary supplies are one-time use resources that are not replenished and are used as a bridge until permanent supplies can be developed.[126] Temporary supplies available to the Applicant include Brock Reservoir System Efficiency ICS water, Arizona banked water, California banked water, and Southern Nevada banked water.[127] 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 to receive 272,000 afa from the Colorado River,[128] as well as a total of 50,000 afa of Virgin/Muddy River Tributary Conservation ICS water.[129] The Applicant expects to develop some 9,000 afa of Coyote Spring Valley groundwater Imported ICS.[130] There are 46,340 afa available from Las Vegas Valley groundwater rights held by the City of North Las Vegas and LVVWD.[131] The Applicant expects to receive 40,000 afa from the Arizona water bank during the planning period.[132] Conservation savings are also considered a permanent water supply and conservation is built into the demand-line as further discussed below.[133] The Applicant expects to achieve conservation savings of more than 276,000 afa by 2035.[134] 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

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[125] Exhibit No. SNWA_189, pp. 3-1 to 3-3; Exhibit No. SNWA_209; Transcript, Vol.2 pp. 248-306 (Entsminger).
[126] Exhibit No. SNWA_189, p. 3-3; Transcript, Vol.2 p. 251:19-22 (Entsminger).
[127] Exhibit No. SNWA_189, pp. 3-3 to 3-5; Exhibit No. SNWA_209; Transcript, Vol.2 pp. 248-306 (Entsminger).
[128] Exhibit No. SNWA_189, p. 3-1; Transcript, Vol.2 p. 261:13-16 (Entsminger).
[129] Exhibit No. SNWA_189, p. 3-1; Transcript, Vol.2 p. 293:6-23 (Entsminger).
[130] Exhibit No. SNWA_189, p. 3-1; Transcript, Vol.2 p. 294:14-17 (Entsminger).
[131] Exhibit No. SNWA_189, p. 3-2; Transcript, Vol.2 p. 255:5-17 (Entsminger).
[132] Exhibit No. SNWA_189, p. 3-4; Exhibit No. SNWA_209, p. 26.
[133] Exhibit No. SNWA_189, p. 3-3; Transcript, Vol.2 pp. 254:22-255:4 (Entsminger).
[134] Exhibit No. SNWA_189, p. 6-1, Figure 6-1; Exhibit No. SNWA_209, p. 39, Figure 24.

Applications.[135] The Applicant expects that it will continue to use return-flow credits to extend available water supplies by roughly 70%.[136]

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.[137] 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. As discussed above, shortage conditions would result in significant 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 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.[138] 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.[139] 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 ("UNLV"). CBER forecasts are based on a regional economic model that is widely accepted throughout the United

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[135] Exhibit No. SNWA_189, p. 3-2.
[136] Exhibit No. SNWA_189, p. 3-1; Transcript, Vol.2 pp. 289:3-290:5 (Entsminger).
[137] Exhibit No. SNWA_189, p. 4-9, Figure 4-9; Exhibit No. SNWA_209, p. 43, Figure 28.
[138] Transcript, Vol.2 p. 312:8-23 (Holmes).
[139] Transcript, Vol.2 p. 312:8-11 (Holmes).

States.[140] CBER has monitored the Clark County economy for more than 25 years and has prepared population forecasts annually since the 1990s.[141] The Applicant has used CBER forecasts for every Water Resource Plan that it has adopted since 1996.[142] 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.[143] 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.[144] 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.[145]

In the short-term, there is a high degree of uncertainty regarding the population increases that will occur in Southern Nevada. Southern Nevada was one of the fastest growing regions in the country leading up to the current economic downturn.[146] Southwestern states are expected to continue to experience some of the fastest population growth in the country over the next 30 to 40 years.[147] Water managers focus on long-term population forecasts for water planning purposes.[148] 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 over-estimating population increases in light of recent economic and demographic trends.[149] One report states "future demand projections

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[140] Exhibit No. SNWA_189, p. 5-1; Transcript, Vol.2 p. 311:12-13 (Holmes).
[141] Exhibit No. SNWA_189, p. 5-1; Transcript, Vol.2 pp. 310:24-311:22 (Holmes).
[142] Exhibit No. SNWA_189, p. 5-1.
[143] Exhibit No. SNWA_189, p. 5-2.
[144] Exhibit No. SNWA_189, p. 5-2; Transcript, Vol.2 p. 312:14-23 (Holmes).
[145] Exhibit No. SNWA_189, p. 5-2; Transcript, Vol.2 p. 313:1-13 (Holmes).
[146] Exhibit No. SNWA_189, pp. 5-4 to 5-5.
[147] Exhibit No. SNWA_189, p. 5-5; Transcript, Vol.2 p. 318:11-18 (Holmes).
[148] Transcript, Vol.2 p. 317:3-8 (Holmes).
[149] Transcript, Vol.23 p. 5098:17-20 (Gleick).

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."[150] The State Engineer recognizes that actual population increases may diverge from the population forecasts provided by the Applicant. From the perspective of a water manager, the risk of under-estimating 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 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.[151]

The Applicant uses GPCD to measure and compare its water use over time.[152] There is currently no standard measuring system for comparing water use between communities.[153] 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.[154] While no formal evaluation has been conducted, there was testimony 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.[155] Despite those limitations, GPCD is an effective tool for an individual community to use as a yardstick against its own water use.[156]

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 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

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[150] Exhibit No. GBWN_069, p. 5.
[151] Exhibit No. SNWA_189, p. 5-1; Transcript, Vol.2 p. 309:10-15 (Holmes).
[152] Exhibit No. SNWA_189, p. 5-1.
[153] Transcript, Vol.1 pp. 107:16-109:16 (Mulroy); Transcript, Vol.2 p. 321:8-21 (Holmes).
[154] Exhibit Nos. SNWA_189, p. 5-1; SNWA_15, p. 66; SNWA_397, p. 8; Transcript, Vol.2 pp. 321:24-323:6 (Holmes).
[155] Transcript, Vol.2 p. 322:10-13 (Holmes); Transcript, Vol.23, pp. 5204:15-5205:9 (Gleick).
[156] Exhibit No. SNWA_189, p. 5-1.

decreased from 344 to 240 due largely to intensive conservation efforts.[157] In 2009, the Applicant set a conservation goal of 199 GPCD by 2035.[158] The Applicant believes that conservation goal is challenging but also realistic.[159] The demand forecast in the Applicant's Water Resource Plan incorporates the conservation goal established in 2009 to achieve 199 GPCD by 2035.[160]

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.[161] However, as explained above, GPCD cannot be used to accurately 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.[162] Additional conservation savings will be necessary to achieve the goal of 199 GPCD by 2035.[163] Although the Applicant 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.[164] 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.

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[157] Exhibit No. SNWA_189, p. 5-2.
[158] Exhibit No. SNWA_189, 5-2; Exhibit No. SNWA_004, p. 8-1; Transcript, Vol.2 p. 320:12-21 (Holmes).
[159] Transcript, Vol.2 p. 320:12-21 (Holmes).
[160] Exhibit No. SNWA_209, p. 39.
[161] Transcript, Vol.23 p. 5100:16-20, p. 5124:22-25 (Gleick).
[162] Exhibit No. SNWA_189, p. 5-2.
[163] Exhibit No. SNWA_189, p. 5-2.
[164] Transcript, Vol.4 p. 896:4-7 (Bennett).

There will be shortfalls between water supply and demand in the water-resource portfolio for Southern Nevada.[165] 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, additional water will be necessary to meet customer demand.[166] The Applicant anticipates that it could manage its use of temporary supplies in order to avoid shortfalls until 2028.[167] However, as explained above, temporary supplies are one-time use resources that are not replenished. Therefore, without additional water, 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.[168]

By the end of the 50-year planning period, customer demand is projected to require the diversion of 897,087 afa.[169] Without any additional water resources, projected demand would exceed available supplies by approximately 275,000 afa.[170] Under shortage conditions, shortfalls are projected to be greater and to occur sooner.[171] 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 additional water resources. Under a dry scenario on the Colorado River, customer demand exceeds available supply by 184,655 afa as early as the year 2021.[172] 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.[173] 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.[174] Water from the Applications could be used to fill these supply gaps.

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[165] 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).
[166] Exhibit No. SNWA_189, p. 6-2, Figure 6-2; Exhibit No. SNWA_209, p. 43; Transcript, Vol.2 p. 326:13-18 (Holmes).
[167] Exhibit No. SNWA_189, p. 6-4, Figure 6-3; Transcript, Vol.2 p. 327:14-18 (Holmes).
[168] Transcript, Vol.2 p. 327:8-13 (Holmes).
[169] Exhibit No. SNWA_189, p. 6-4, Table 6-1.
[170] Exhibit No. SNWA_189, p. 6-4, Figure 6-3 and Table 6-1.
[171] Exhibit No. SNWA_189, p. 8-5, Figure 8-5, p. 6-5 and pp. A-10 to A-12.
[172] Exhibit No. SNWA_189, Appendix A, Table A-2.
[173] Exhibit No. SNWA_189, Appendix A, Table A-3.
[174] Exhibit No. SNWA_189, Appendix A, Table A-4.

The Applicant has identified all available water supplies and has presented reasonable water-demand projections to demonstrate that it will not be able to meet Southern Nevada's water needs. 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.[175] The State Engineer finds 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.

II. GOOD FAITH INTENTION AND FINANCIAL ABILITY

The Applicant must provide proof satisfactory to the State Engineer of the Applicant's intention in good faith to construct any work necessary to apply the water to the intended beneficial use with reasonable diligence, and financial ability and reasonable expectation actually to construct the work and apply the water to the intended beneficial use with reasonable diligence.[176] The purpose of these requirements is to protect against water speculation.

A. Good Faith Intention to Place the Water to Beneficial Use

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 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.[177] 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.[178] 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.[179]

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[175] Transcript, Vol.23 p. 5124:18-21 (Gleick).
[176] NRS 533.370(1)(c).
[177] Exhibit No. SNWA_209, Appendix 2; Exhibit No. SNWA_201; Transcript, Vol.1 pp. 225:11-228:5 (Brothers).
[178] Exhibit Nos. SNWA_223 through SNWA_229.
[179] Exhibit No. SNWA_211; Transcript, Vol.1 pp. 235:24-236:4 (Brothers).

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.[180] 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 and groundwater rights, and grazing permits for use in monitoring, management and mitigation efforts.[181] 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.[182] 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 ten-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.[183] The State Engineer finds 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.

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[180] Exhibit No. SNWA_190; Exhibit No. SNWA_190; SNWA_191; Transcript, Vol.1 pp. 204:16-205:13 (Holmes).
[181] Transcript, Vol.1 p. 100:19-20 (Mulroy).
[182] Transcript, Vol.1 p. 238:14-18 (Brothers).
[183] Exhibit No. SNWA_195; Transcript, Vol.1 pp. 216:10-217:13 (Holmes).

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 beneficial use.[184] 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.[185] 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.[186] The State Engineer finds that construction of the Project has a feasible conceptual plan of development.

a. Estimated Construction Costs

The Applicant's engineering department has developed a cost estimate based on the conceptual plan of development for the Project.[187] The engineering department prepared this cost estimate using the same methods it has used to develop cost estimates for other capital construction projects.[188] The engineering department uses a cost estimating guide that contains cost curves, or reasonable cost estimates, for various project components.[189] 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.[190] The guide was prepared in accordance with industry standards, including those set by the Association for Advancement of Cost Engineering ("AACE").[191] The engineering department has used this guide to generate cost estimates for projects since 2006, including projects in its 2011 Major

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[184] Exhibit No. SNWA_190; Transcript, Vol.1 pp. 201:16-204:15 (Holmes).
[185] Transcript, Vol.1 p. 201:6-14 (Holmes).
[186] Transcript, Vol.1 p. 204:5-12 (Holmes).
[187] Exhibit No. SNWA_195; Transcript, Vol.1 p. 211:18-25 (Holmes).
[188] Exhibit No. SNWA_195; Transcript, Vol.1 p. 214:18-22 (Holmes).
[189] Exhibit No. SNWA_194; Exhibit No. SNWA_195; Transcript, Vol.1 pp. 208:9-209:15 (Holmes).
[190] Exhibit No. SNWA_195, pp. 2-3; Transcript, Vol.1 p. 209:8-15 (Holmes).
[191] Exhibit Nos. SNWA_195, p. 2; SNWA_233; SNWA_234; Transcript, Vol.1 p. 210:3-15 (Holmes).

Construction and Capital Plan.[192] The engineering department used this same cost estimating guide to develop the cost estimate for the Project.[193]

The Applicant's engineering department estimates that the capital costs for the Project will be approximately $3.224 billion.[194] Including contingency (15%) and inflation (4%), the engineering department estimates that the cost to construct the Project would be approximately $6.45 billion.[195] 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.[196] The engineering department also developed cash-flow projections to allow financial experts to evaluate potential funding requirements for the Project.[197]

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.[198] 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.[199] 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 they have prepared.[200]

The State Engineer finds that the Applicant's cost estimate is reasonable.

b. <u>Ability to Finance Estimated Construction Costs</u>

The Applicant provided the cost estimate, construction schedule and cash-flow projections to John Bonow and Guy Hobbs.[201] Mr. Bonow and Mr. Hobbs prepared an expert

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[192] Exhibit No. SNWA_195, p. 2; Transcript, Vol.1 pp. 207:25-208:19 (Holmes).
[193] Transcript, Vol.1 pp. 215:25-216:6 (Holmes).
[194] Exhibit No. SNWA_195, p. 4, Table 1; Transcript, Vol.1 p. 213:13-21 (Holmes).
[195] Exhibit No. SNWA_195, p. 5, p. 7; Transcript, Vol.1 p. 214:4-6 (Holmes).
[196] Exhibit No. SNWA_195, pp. 3-5.
[197] Exhibit No. SNWA_195, p. 5, p. 7, Table 2.
[198] Exhibit No. SNWA_195, p. 2.
[199] Exhibit No. SNWA_189, p. 2.
[200] Transcript, Vol.1 pp. 215:25-216:6 (Holmes).
[201] Exhibit No. SNWA_383; Transcript, Vol.13 p. 214:11-17 (Holmes).

report that analyzed the Applicant's ability to issue bonds to finance the estimated cost of the Project.[202] 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.[203] 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.[204]

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.[205] 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.[206]

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.[207] 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.[208]

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.[209] The Applicant's current plan of

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[202] Exhibit No. SNWA_383.
[203] Transcript, Vol.13 p. 2836:1-25 (Bonow); p. 2840:11-23 (Hobbs).
[204] Transcript, Vol.13 pp. 2837:5-2838:3 (Bonow); pp. 2841:17-2842:11 (Hobbs).
[205] Transcript, Vol.13 pp. 2842:22-2843:19 (Hobbs).
[206] Transcript, Vol.13 p. 2846:1-5 (Hobbs).
[207] Exhibit No. SNWA_383, Section I.
[208] Transcript, Vol.13 p. 2844:11-15 (Bonow), p. 2854:18-20 (Hobbs).
[209] Exhibit No. SNWA_383, Section II.

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 the LVVWD with level debt service over 30 years.[210] 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.[211] As of September 2011, the 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.[212] The Applicant has never failed to make full and timely payment on its debt obligations.[213] Based on this review, Mr. Bonow and Mr. Hobbs concluded that the Applicant currently accesses the capital markets on agreeable terms.[214]

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 has a high quality credit rating due to its past financing history and current status as a credit risk; 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.[215] 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.[216]

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

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[210] Exhibit No. SNWA_383, p. 22.
[211] Transcript, Vol.13 pp. 2847:23-2848:17 (Bonow).
[212] Exhibit No. SNWA_383, p. 22; Transcript, Vol.13 p. 2853:11-19, p. 2860:10-15 (Hobbs).
[213] Transcript, Vol.13 p 2858:3-6 (Hobbs).
[214] Transcript, Vol.13 p. 2860:12-15 (Hobbs).
[215] Transcript, Vol.13 pp. 2856:7-2858:2 (Hobbs).
[216] Transcript, Vol.13 p. 2845:3-6 (Bonow).

typical plan of finance because that is the most cost-effective approach at this time.[217] The funding plan 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.[218]

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.[219]

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.[220] When the Applicant last accessed the capital markets in 2011, it achieved an interest rate of 4.06%.[221] 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.[222]

With regard to projected growth and development, the funding plan assumes almost non-existent population increases.[223] This assumption affects the amount of commodity charge revenues and connection charge revenues that are projected to be available under the funding plan.[224] Commodity charge revenues would be constrained because essentially only existing 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.[225] 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.[226] If

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[217] Transcript, Vol.13 pp. 2865:7-2866:11 (Hobbs).
[218] Transcript, Vol.13 p. 2846:21-24, pp. 2889:21-2891:16, pp. 2906:22-2907:9, p. 2910:18, p. 2921:13-15 (Bonow).
[219] Transcript, Vol.13 p. 2846:12-24 (Bonow, Hobbs).
[220] Exhibit No. SNWA_383, Appendix F; Transcript, Vol.13 p. 2868:14-16 (Hobbs).
[221] Transcript, Vol.13 p. 2869:10-11 (Hobbs).
[222] Transcript, Vol.13 p. 2869:16-19 (Hobbs).
[223] Exhibit No. SNWA_383, Appendix C.
[224] 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.
[225] Transcript, Vol.13 p. 2879:10-19 (Bonow).
[226] Transcript, Vol.13 p. 2872:15-24 (Hobbs).

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.

In addition, with regard to available revenues, the funding plan also assumes that only revenues from its commodity charge and reliability charge[227] would be used to pay debt service even though revenues from other charges could be available.[228] 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.[229] 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.[230] 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.[231] These assumptions depress the funding plans' projections regarding the amount of revenues available to pay debt service on the bonds. The result is that the commodity-charge rate bears the full brunt of the cost of financing the Project under the funding plan.[232]

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.[233] 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.[234] 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.[235]

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

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[227] 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.
[228] Exhibit No. SNWA_383, p. 29.
[229] Exhibit No. SNWA_383, p. 33; Transcript, Vol.13 p. 2851:14-21, pp. 2871:23-2872:14 (Hobbs).
[230] Transcript, Vol.13 p. 2861:10-13 (Hobbs).
[231] Transcript, Vol.13 pp. 2880:18-2882:7 (Hobbs).
[232] Transcript, Vol.13 p. 2896:21-23 (Hobbs).
[233] Transcript, Vol.13 pp. 2869:25-2870:10 (Hobbs).
[234] Transcript, Vol.13 p. 2870:2-4 (Hobbs).
[235] Transcript, Vol.13 p. 2870:4-10 (Hobbs).

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.[236] However, the funding plan reflects coverage ratios that exceed that requirement.[237] That means that over time, the commodity charge rate levels could decrease since those inflated debt coverage ratios would not be required.[238]

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 capitalized interest and original issue discount.[239] 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.[240]

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.[241] 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.[242] 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.[243] 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

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[236] Exhibit No. SNWA_383, p. 15.
[237] Exhibit No. SNWA_383, p. 35.
[238] Transcript, Vol.13 pp. 2877:15-2878:2 (Hobbs).
[239] Exhibit No. SNWA_383, p. 34; Transcript, Vol.13 p. 2870:16-23 (Hobbs).
[240] Transcript, Vol.13 pp. 2870:19-2871:4 (Hobbs).
[241] Exhibit No. SNWA_383, pp. 30, 33, 34-35.
[242] Transcript, Vol.13 pp. 2863:13-2865:4 (Hobbs).
[243] 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.[244]

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.[245] 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.[246] 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.[247] Ms. Leurig is the Senior Manager, Insurance Program at CERES, which is a non-profit research and advocacy group. [248,249] She is the author of a report titled *The Ripple Effect: Water Risk in the Municipal Bond Market.*[250] Ms. Leurig has experience in engaging with insurers on investment and asset management opportunities related to climate change, including energy-efficiency financing, renewable energy, investments and adaptation investments, including water infrastructure.[251] She has experience with issues relating to municipal bonds, but has never advised a municipality on how to access the capital markets.[252] She is not an expert regarding the Applicant's financial condition or the process the Applicant uses to finance its capital construction projects,[253] and did not prepare an independent analysis regarding the Applicant's past financing history, its current status as a credit risk, or its ability to

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[244] Exhibit No. SNWA_383, p. 36.
[245] Exhibit No. SNWA_383, p. 38; Exhibit No. SNWA_384; Transcript, Vol.13 pp. 2882:22-2885:18 (Bonow).
[246] Transcript, Vol.13 p. 2887:11-15 (Bonow).
[247] Transcript, Vol.22 p. 4831:1-3 (State Engineer).
[248] Exhibit No. GBWN_125.
[249] Transcript, Vol.22 p. 4868:19-21 (Leurig).
[250] Exhibit No. GBWN_116.
[251] Exhibit No. GBWN_125.
[252] Transcript, Vol.22 p. 4864:9-20 (Leurig).
[253] Transcript, Vol.22 p. 4865:10-21 (Leurig).

finance the Project.[254] Lastly, she did not analyze the Applicant's rate levels, ability to raise rates, or how those rates compare to other municipalities.[255]

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.[256]

Ms. Leurig pointed to a number of water-related risk factors that 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.[257] 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 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. 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.[258]

Ms. Leurig's testimony and reports do not support a determination that the Applicant lacks the requisite financial ability to finance the Project. Based on the funding model and analysis, it was the opinion of the Applicant's financial experts that the Applicant would have the financial ability to construct the Project.[259] The State Engineer finds that this evidence outweighs the testimony and evidence presented by Ms. Leurig.

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[254] Transcript, Vol.22 p. 4866:9-23 (Leurig).
[255] Transcript, Vol.22 p. 4867:2-14 (Leurig).
[256] Transcript, Vol.1 pp. 93:17-95:7 (Mulroy).
[257] Transcript, Vol.13 p. 2889:6-13 (Hobbs).
[258] Transcript, Vol.22 p. 4891:1-13 (Leurig).
[259] Transcript, Vol.13 p. 2846:12-17, p. 2896:13-16 (Bonow).

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

Nevada Revised Statute 533.370(2) provides that the State Engineer must reject an application where there is no unappropriated water in the proposed source of supply. In determining the amount of groundwater available for appropriation in a given hydrographic basin ("basin"), the State Engineer relies on available hydrologic studies to provide relevant data to determine the perennial yield of a basin. The perennial yield of a groundwater reservoir may be defined as the maximum amount of groundwater that can be salvaged each year over the long term without depleting the groundwater reservoir. Perennial yield is ultimately limited to the maximum amount of natural discharge that can be salvaged for beneficial use. The perennial yield cannot be more than the natural recharge to a groundwater basin and in some cases is less. If the perennial yield is exceeded, groundwater levels will decline and steady state conditions will not be achieved, a situation commonly referred to as groundwater mining. Additionally, withdrawals of groundwater in excess of the perennial yield may contribute to adverse conditions such as water quality degradation, storage depletion, diminishing yield of wells, increased pumping costs, and land subsidence.

Under natural pre-development 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 down-gradient 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 directly, but experts determine its occurrence based on geologic, hydrologic, and geochemical evidence. Where this occurs, the groundwater flow is typically referred to as a boundary flux, or interbasin flow.

Perennial yield is a guideline that is used in Nevada to manage groundwater development. 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.

Perennial yield is estimated by developing a groundwater budget for a hydrographic 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 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.[260] 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.[261]

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").[262] The Applicant's witness, Mr. Andrew Burns,[263] 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.[264]

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[260] Exhibit No. SNWA_258, p. 10-1.
[261] *See*, State Engineer's Ruling 5986, pp. 4-5, dated April 29, 2009, official records in the Office of the State Engineer.
[262] Transcript, Vol.3 p. 588:14-22 (Burns).
[263] 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.
[264] Transcript, Vol.3 pp. 588:14-592:22 (Burns).

A. Groundwater ET

Groundwater ET is important because it can be more accurately measured than groundwater recharge or subsurface flow.[265] In hydrologically closed basins, groundwater ET is equal to recharge. 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 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 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.[266] 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

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[265] Exhibit No. GBWN_103, p. 17; Transcript, Vol.17 p. 3794:6-11 (Myers); Transcript, Vol.24 p. 5413:19 (Bredehoeft).
[266] Exhibit No. SNWA_258, p. 5-3.

axis of the valley, but in the very northern part of the basin and is disconnected from the Main groundwater discharge area.[267] 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.[268]

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.[269] 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%. The accuracies by class ranged from 78% for bare soil/low vegetation to 92% for open water. The accuracy was 88% for agriculture, 89% for phreatophyte/medium vegetation, and 90% for wetland/meadow. The Applicant argues values above 85% are considered sufficiently accurate.[270] Most groundwater ET occurs in the phreatophyte/medium vegetation and wetland/meadow land-cover classes for which the Applicant reports high accuracy.

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

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[267] Exhibit No. SNWA_258, p. 5-4, Figure 5-1.
[268] Exhibit No. SNWA_258, p. 5-5.
[269] Exhibit No. SNWA_258, p. 5-3.
[270] Exhibit No. SNWA_258, p. D-5.

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.

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. She was qualified by the State Engineer as an expert in ET estimates using remote sensing.[271]

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.[272] NDVI is the most commonly used vegetation index.[273] 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.[274] 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

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[271] Transcript, Vol.3 p. 657:7-9.
[272] Exhibit No. SNWA_312, pp. 2-1 to 2-7; Transcript, Vol.4 pp. 807:1–808:5 (Fenstermaker).
[273] Transcript, Vol.3 p. 685:7-10 (Fenstermaker).
[274] Transcript, Vol.3 p. 696: 18-23 (Fenstermaker).

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 and gas concentrations and momentum between the atmosphere and biosphere.[275] Mr. Burns described the Eddy Covariance method as state of the art.[276] The Eddy Covariance towers use sophisticated sensors to measure the components of ET.[277] The sensors were installed and calibrated according to manufacturer recommendations.[278] 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.[279] Seven of the towers were located in Spring Valley.[280] Dr. Fenstermaker testified that she was unaware of any other published study that used this many Eddy Covariance Towers.[281] 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.[282] The site selection was independently evaluated and approved by Dr. Travis Huxman of the University of Arizona.[283] Dr. Huxman has extensive experience in locating ET measurement sites in complex ecosystems.[284]

The ET measurement sites did not include agriculture, open water, or playa.[285] 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 of minimal or no vegetation, such as playa and open water. In addition, the goal of the approach

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[275] Exhibit No. SNWA_312, p. 3-1.
[276] Transcript, Vol.3 p. 670:11-13 (Burns).
[277] Exhibit No. SNWA_312, p. 3-2.
[278] Exhibit No. SNWA_312, p. 3-3; Transcript, Vol.4 pp. 796: 15–797:4 (Fenstermaker).
[279] Exhibit No. SNWA_312, pp. 3-1, 3-3.
[280] Exhibit No. SNWA_312, p. 1-2.
[281] Transcript, Vol.4 p. 759:8-10 (Fenstermaker).
[282] Exhibit No. SNWA_312, p. 3-3.
[283] Transcript, Vol.3 p. 675:3-16 (Fenstermaker).
[284] Transcript, Vol.3 pp. 674:25-675:12 (Fenstermaker).
[285] Exhibit No. SNWA_312, pp. 3-4 to 3-5.

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.[286] One tower in Spring Valley had measurements for all five years, two had measurements for four years, and four had measurements for three years.[287] Mr. Burns testified that the ET data collected was excellent.[288] Dr. Myers did not question the Applicant's measurement of ET rates.[289]

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% or more cloud cover. After excluding scenes with 30% 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. She then replaced clouds and cloud shadows that remained in the images with the average NDVI values from cloud free dates.[290] 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.[291] Finally, Dr. Fenstermaker averaged the scenes for each year to obtain average growing-season NDVI images.[292]

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

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[286] Exhibit No. SNWA_312, pp. 3-3, 3-10.
[287] Exhibit No. SNWA_312, p. 3-10.
[288] Transcript, Vol.3 p. 683:8-11 (Burns).
[289] Transcript, Vol.17 p. 3794:18-19 (Myers).
[290] Exhibit No. SNWA_312, p. 4-13.
[291] Transcript, Vol.4 p. 770:1-5 (Fenstermaker)
[292] Exhibit No. SNWA_312, pp. 4-4 to 4-5.

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.[293] 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.[294] 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 of 0.953.[295] She 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.[296] When evaluated against the seven reserved points, the analysis revealed no clear bias to over-estimate or under-estimate.[297] 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.[298] 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.[299]

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[293] Exhibit No. SNWA_312, pp. 4-5 to 4-7.
[294] Exhibit No. SNWA_312, p. 5-1.
[295] Exhibit No. SNWA_312, p. 5-4.
[296] Transcript, Vol.4 p. 726:2–5 (Fenstermaker).
[297] Exhibit No. SNWA_312, p. 5-7; Transcript, Vol.4 p. 730:8–19 (Burns).
[298] Exhibit No. SNWA_258, p. D-16.
[299] Exhibit No. SNWA_258, pp. D-16 to D-17.

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 pre-development ET rates for the agriculture land-cover class in Spring Valley by assigning the ET rates derived from the empirical relationship for the natural vegetation surrounding the agricultural areas.[300] 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).[301] For playa areas, the Applicant assigned null values for ET rates. The Applicant later assigned groundwater-ET rates for playa areas during the derivation of the groundwater-ET distribution.[302]

The Applicant estimated an average total ET of 174,500 afa in the Main groundwater 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.[303] 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.[304] Protestants' witness Dr. Myers testified that the Applicant's total-ET estimates are probably as accurate as they can be.[305] The State Engineer finds that the Applicant provided a scientifically sound 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.[306] PRISM is a model that estimates how much precipitation falls on specific areas throughout the United States.[307] 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,

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[300] Exhibit No. SNWA_258, pp. 5-6 to 5-7.
[301] Exhibit No. SNWA_258, p. 5-7.
[302] Exhibit No. SNWA_258, p. 5-7.
[303] Exhibit No. SNWA_258, p. 5-7.
[304] Transcript, Vol.4 p. 731:8-17; pp. 731:25-732:8-11 (Fenstermaker).
[305] Transcript, Vol.20 p. 4442:6-7 (Myers).
[306] Exhibit No. SNWA_258, p. 5-5, pp. D-6 to D-15.
[307] Exhibit No. SNWA_258, p. B-2.

including for the period of record of the Applicant's ET measurements.[308] Ms. Drici testified that PRISM provided the best available method to estimate the precipitation distribution over the areas of interest.[309] The Applicant provided evidence comparing PRISM modeled precipitation to actual measurement sites, and demonstrated that there is very little difference. The PRISM measurement sites all use bulk storage precipitation gages. Dr. Myers testified that PRISM is generally a good tool and probably the best tool available to distribute precipitation, though he asserts that it under-estimates or over-estimates in certain areas.[310]

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 over-estimated precipitation on the valley floor in Spring Valley.[311] To account for this, the Applicant reduced the PRISM precipitation estimate by the average amount of over-estimation for each year.[312] The Applicant's witness testified that this step removed the over-estimation bias.[313] However, the precipitation gages in use on the valley floors in those basins were not all of the bulk-storage type; several were of the tipping-bucket type. The Applicant measured precipitation at several locations where both bulk collection and tipping bucket precipitation gages were utilized simultaneously.[314] Measured differences between tipping buckets and bulk storage precipitation gages are shown in Table 1.

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[308] Transcript, Vol.3 p. 608:4-13 (Drici).
[309] Transcript, Vol.3 p. 606:9-21 (Drici).
[310] Transcript, Vol.21 pp. 4649: 25–4650:15 (Myers).
[311] Exhibit No. SNWA_258, pp. 5-5, D-6 to D-15.
[312] Exhibit No. SNWA_258, pp. 5-5, D-6 to D-15.
[313] Transcript, Vol.3 p. 667:5-11 (Burns).
[314] Exhibit No. SNWA_313, Appendices B and C.

Table 1. Precipitation data from co-located tipping bucket and standard bulk-storage gages

Site	Year	Measured precipitation at tipping bucket gage (inches) [a]	Measured precipitation at standard bulk storage gage (inches) [b]	Percent difference
WRV2	2008	4.54	6.44	42%
	2009	7.13	9.02	27%
	2010	13.91	14.13	2%
SV1	2008	4.74	6	27%
	2009	5.84	8.17	40%
	2010	11.25	12.6	12%
	2010	7.37	8.42	14%
SV3	2008	2.72	3.17	17%
	2009	6.56	7.78	19%
	2010	7.96	10.17	28%
SV2b	2008 [c]	7.33	2.79	
	2009 [c]	3.11	7.51	
SNV1	2008	4.21	5.13	22%
	2009	4.92	6.3	28%
	2010	7.68	11	43%
SNV2	2008	3.01	4.08	36%
	2009	4.7	5.74	22%
	2010	7.39	7.35	-1%
			Average	**23%**

[a] Exhibit SNWA 313, Table B-2

[b] Exhibit SNWA 313, Table C1-C3

[c] Site SV2b had several months of missing data and is excluded from this comparison.

For simultaneous measurements in Spring, Snake and White River Valleys, the data show that bulk gages collect 23% more precipitation than tipping buckets.[315] When the Applicant adjusted PRISM to match measured data in Spring Valley, they did not account for their own measurements of undercatch by tipping buckets. Table 2 replicates the Applicant's Table D-4 in Exhibit No. SNWA_258 with tipping bucket data adjusted by a factor of 1.23. Highlighted cells are the adjusted tipping bucket measured precipitation depths.

[315] Exhibit No. SNWA_313, Appendices B and C.

Table 2. Comparison of 4-km annual PRISM precipitation to station data with tipping buckets adjusted by 1.23

Station Name	2006			2007			2008			2009			2010		
	Station	PRISM	Difference	Station	PRISM	Difference	Station	PRISM	Difference	Station	PRISM	Difference	Station	PRISM	Difference
SV1	7.52	8.35	-0.83	6.15	7.25	-1.10	6.00	5.90	0.10	8.17	10.68	-2.51	12.60	11.60	1.00
SV2b	--	--	--	6.48	6.04	0.44	2.79	4.62	-1.83	7.51	10.98	-3.47	8.42	11.60	-3.18
SV3	--	--	--	5.18	5.54	-0.36	3.17	4.55	-1.38	7.78	9.60	-1.82	10.17	10.84	-0.67
SV4	--	--	--	7.12	6.67	0.45	6.30	5.55	0.75	8.56	10.29	-1.73	--	--	--
SV5	--	--	--	6.69	6.70	-0.01	4.31	5.91	-1.61	10.70	10.63	0.07	--	--	--
SV6	--	--	--	6.45	6.33	0.12	4.15	5.54	-1.39	10.06	10.31	-0.25	--	--	--
SV7	--	--	--	4.26	5.72	-0.86	3.19	4.65	-1.46	7.61	10.38	-2.77	--	--	--
SPV-1	7.07	8.35	-1.28	--	--	--	--	--	--	--	--	--	--	--	--
SPV-2	7.89	8.09	-0.20	--	--	--	--	--	--	--	--	--	--	--	--
SPV-3	6.60	8.30	-1.70	--	--	--	--	--	--	--	--	--	--	--	--
Average	--	--	**-1.00**	--	--	**-0.19**	--	--	**-0.98**	--	--	**-1.78**	--	--	**-0.95**

Unmodified PRISM precipitation for the groundwater discharge area for the period 2006 to 2010 averages 107,660 acre-feet.[316] After adjusting PRISM to site precipitation measurements, but ignoring documented undercatch by tipping buckets, precipitation for 2006 to 2010 in the same area averaged 87,260 acre-feet.[317] Had the Applicant multiplied those station-years where only tipping bucket data are available by the correction factor of 1.23, then adjusting PRISM to match station averages, they would have calculated an additional 7,700 acre-feet of precipitation annually, as shown in Table 3.

[316] Exhibit No. SNWA_258, p. D-14.
[317] Exhibit No. SNWA_258, p. D-14.

Table 3. Difference in precipitation, after adjustment to tipping bucket measured data

	2006	2007	2008	2009	2010	**Average (rounded)**
Average PRISM overestimation at gage locations, as reported by applicant(inches) [a]	1.36	1.34	1.45	2.77	0.95	
Average PRISM overestimation at gage locations with tipping bucket adjustment factor of 1.23 (inches) [b]	1.00	0.19	0.98	1.78	0.95	
Difference	0.36	1.15	0.47	0.99	0.00	
Main groundwater discharge area, excluding playa (acres) [c]	156,092	156,092	156,092	156,092	156,092	
Volume of precipitation resulting from tipping bucket adjustment (AF)	4,635	14,972	6,176	12,853	0	**7,700**

[a] Exhibit SNWA 258, Table D-4

[b] Table 2

[c] Main discharge area is reported as 169,425 acres. The estimated playa area is 13,000 acres, based on Applicant's findings of 1200 AF and 0.09 feet of groundwater ET.

Because groundwater ET is calculated as the difference of total ET and precipitation, any error in precipitation estimates will result in an equal but opposite error in groundwater ET estimation. Dr. Myers appears to agree that PRISM over-estimates precipitation in Spring Valley and does not suggest that the Applicant was wrong to adjust the PRISM results to remove the over-estimation bias, but did not comment on the issue of tipping bucket undercatch.[318] Given the evidence submitted regarding the accuracy assessment of PRISM and the adjustments applied by the Applicant based on determined over-estimates in the Main groundwater discharge area of Spring Valley, the State Engineer finds that the Applicant's method of developing estimates of precipitation distribution for Spring Valley erred by not considering their own documented undercatch by tipping buckets. The State Engineer finds that the method employed to adjust the PRISM-modeled precipitation to actual measurements is generally sound, but by ignoring undercatch by tipping buckets, under-estimated average annual precipitation, and consequently over-estimated average annual groundwater ET for the five-year period by approximately 7,700 acre-feet.

[318] Exhibit No. GBWN_103, pp. 15–18.

After subtracting the precipitation distribution from the total ET distribution in the Main groundwater discharge area in Spring Valley, the Applicant assigned an annual groundwater-ET rate of 0.09 feet to the playa areas based on Deverel, et al. (2005, p. 14).[319]

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.[320]

The Applicant's yearly estimates of groundwater ET do not equal the difference between their total ET and precipitation estimates due to their handling of locations where precipitation exceeded groundwater ET. In cases where the local precipitation exceeded the local ET, a value of zero was assigned rather than assigning negative groundwater ET.[321] 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% 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% 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.[322] He argues 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.[323] The State Engineer does not agree with Mr. Burns' conclusion in this case, because in their calculations, the Applicant assigned a value of zero to their groundwater-ET calculation where precipitation exceed total ET, thus they already discounted the excess precipitation. Had they not discounted excess precipitation, Mr. Burns would have been correct. As computed by the Applicant, their

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[319] Exhibit No. SNWA_258, pp. 5-8.
[320] Exhibit No. SNWA_258, pp. 5-8.
[321] Transcript, Vol.6 p. 1331:6-8 (Burns).
[322] Transcript, Vol.4 p. 740:6–17, p. 811:3–12 (Burns).
[323] Exhibit No. SNWA_258, pp. 5-9 to 5-10.

groundwater ET estimate for 2010 would be accurate, but 10,000 acre-feet of excess precipitation is available for phreatophyte use in the following year(s). Because the study ended in 2010, there is no accounting for this water. Another issue of possible concern is that 2010 was an exceptionally wet year. The five-year period was just below the long-term average; if 2010 had average precipitation, it would have been a dry period. Failing to account for the excess precipitation in the wettest year is problematic, and supports the Protestants' claim that a five-year period is not representative of long-term average conditions.

Dr. Myers disagrees with Mr. Burns' conclusion, and argues that precipitation in excess of ET would be stored in the ground and consumed by ET the following year. Thus, though groundwater ET may be under-estimated for wet years, it would be similarly over-estimated the year following the wet period as precipitation reaching the groundwater system during the prior year would be discharged through ET.[324] Dr. Myers may be correct. Over the long run, the groundwater ET would be under-estimated in wet years and over-estimated for the following years due to holdover moisture. In the long term, these over-estimates and under-estimates would effectively cancel each other out. However, the Applicant's method does not allow for carryover precipitation.[325] The excess precipitation is removed from the mass balance equation, and subsequent years' groundwater ET is based solely on total ET and precipitation for the given year.

Dr. Myers suggests that this holdover effect occurs from 2005, a wet year, to 2006 and from 2010 to 2011.[326] It may also occur from 2009 to 2010. Mr. Burns argues the holdover from 2010 may be irrelevant in this case, because 2010 was the final year in the Applicant's period of record, so whatever over-estimation of groundwater ET that might result in 2011 is not included in the Applicant's average.[327] Dr. Myers did not quantify the effect of this possible holdover. The State Engineer agrees with Dr. Myers that precipitation that exceeds ET would infiltrate, be stored in either the unsaturated soils or in the aquifer, and be used by the plants in following years. Mr. Burns was asked by State Engineer staff why his groundwater ET estimate from Table 5.3 did not equal the difference between his total ET from Table 5.2 and his

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[324] Exhibit No. GBWN_103, p. 18.
[325] Transcript, Vol. 4 pp. 812-814 (Burns).
[326] Transcript, Vol.20 pp. 4438:16–4439:10 (Myers).
[327] Transcript, Vol.4 p. 741:10-25 (Burns).

precipitation in Table D-5.[328] His response was that differences were due to their discounting of excess precipitation.[329] The provided data indicates that 1,200 acre-feet of the difference is accounted for in the playa groundwater ET estimate. Therefore, excess precipitation was 1,200 acre-feet in 2006, 100 acre-feet in 2007, 3,900 acre-feet in 2009, and 10,000 acre-feet in 2010, as shown in Table 4.[330]

Table 4. Excess precipitation

	2006	2007	2008	2009	2010	Average
ET volume for main groundwater discharge area [a]	184,900	162,900	153,500	186,600	184,700	174,500
Adjusted-PRISM Precip Volume for main groundwater discharge area [b]	82,900	64,500	50,000	99,700	139,200	87,260
Difference between Total ET and Precipitation, plus 1,200 AF for playa ET	103,200	99,600	104,700	88,100	46,700	88,460
Applicant's groundwater ET estimate [c]	104,400	99,700	104,700	92,000	56,700	91,500
Excess Precipitation	1,200	100	0	3,900	10,000	3,040

a. Exhibit No. SNWA_258, Table 5-2

b. Exhibit No. SNWA_258, Table D-5

c. Exhibit SNWA 258, Table 5-3

The State Engineer finds that the Applicant's groundwater-ET estimation method does not under-estimate groundwater ET in wet years because they discount precipitation in excess of ET; however, their method does over-estimate groundwater ET in dry years when carry-over soil moisture from prior-year precipitation is available. The State Engineer finds the Applicant's method is a mass balance approach to determine groundwater ET, and by ignoring a portion of the water budget their groundwater ET estimation method is flawed. The State Engineer also finds that the annual average groundwater-ET over-estimation error attributable to this cause is approximately 3,000 acre-feet.

[328] Exhibit No. SNWA_258.
[329] Transcript, Vol. 4 pp. 812-814.
[330] Exhibit No. SNWA_258, p. 5-7, p. D-14.

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.[331] 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.[332] 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.[333] He admits, however, that it may be appropriate to adjust the precipitation component of the groundwater-ET estimate based on variance from the long-term average.[334]

Landsat imagery was not acquired for the small groundwater discharge area in Northern Spring Valley; therefore, separate analyses were applied to estimate groundwater ET for this area, which are as follows:[335] (1) compute annual groundwater-ET rates for land-cover 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.[336] 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.[337] The Applicant's final estimate of average annual groundwater-ET in the Northern groundwater

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[331] Exhibit No. GBWN_103, pp. 17–18.
[332] Exhibit No. GBWN_103, p. 18.
[333] Transcript, Vol.20 p. 4438:4-12, p. 4443:9-13 (Myers).
[334] Transcript, Vol.20 pp. 4442: 24–4443: 13 (Myers).
[335] Transcript, Vol. 4, p. 745:20–23 (Burns).
[336] Exhibit No. SNWA_258, p. D-17.
[337] Exhibit No. SNWA_258, p. D-17.

discharge area of Spring Valley is 3,300 acre-feet.[338] 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.

Rush and Kazmi provided a reconnaissance-level estimate of average annual groundwater ET of 70,000 acre-feet.[339] Nichols (2000) reported groundwater ET estimates of 101,770 acre-feet and 77,460 acre-feet for 1985 and 1989, respectively.[340] Nichols' average is about 90,000 afa. Welch, et al. (2007) estimated the average annual groundwater ET for Spring Valley to be approximately 75,600 acre-feet.[341] The State Engineer finds the Applicant over-estimated groundwater ET for the five-year period 2006 to 2010 by approximately 7,700 afa due to tipping bucket undercatch and 3,000 afa due to unaccounted excess precipitation. Therefore, the State Engineer subtracts 10,700 afa from the Applicant's estimated 94,800 afa of groundwater ET. The State Engineer finds that, after adjustments as described above, the Applicant's data supports an annual groundwater-ET estimate in Spring Valley of 84,100 acre-feet.

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 indicative of long-term mean hydrologic conditions.[342] 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.[343] 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.[344]

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[338] Exhibit No. SNWA_258, p. 5-9.
[339] Exhibit No. SNWA_298, pp. 22–23.
[340] Exhibit No. SNWA_292, p. C44.
[341] Exhibit No. GBWN_001, p. 21; Exhibit No. SNWA_068, p. 45.
[342] Transcript, Vol.4 p. 739:2–9, p. 810:19–24 (Burns).
[343] Exhibit No. SNWA_258, p. B-18
[344] Exhibit No. SNWA_258, p. B-19.

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% of the mean value for 2006; 77% of the mean value for 2007; 71% of the mean value for 2008; 110% of the mean value for 2009; and 120% of the mean value for 2010. For the Applicant's period of record, 2006-2010, the average precipitation was 10.43 inches per year or 96% of the long-term period of record mean value. Therefore, the 2006 to 2010 period is 4% dryer than the long-term period of record. 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 should be representative of the current long-term average.

Because plants generally use easily available water from precipitation first and groundwater second, they use more groundwater when there is less precipitation. This is apparent on a year-by-year basis as demonstrated by the Applicant's data, where the year with the highest precipitation (2010) had the lowest groundwater ET, and the year with the lowest precipitation (2008) had the highest groundwater ET.[345] Nevertheless, over an extended period of time, it is expected that lower precipitation would ultimately result in lesser recharge, and consequently, lesser groundwater ET. It is unclear whether groundwater ET over a five-year period, when precipitation was minimally less than the long-term average, would differ measurably from the long-term average. Therefore, the State Engineer finds no additional adjustments to the estimate of groundwater ET are warranted.

Dr. Myers asserts 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% because rainfall would find specific areas of the soil surface more receptive to seepage and become more effective (consumed by phreatophytes).[346] Dr. Myers also states that the Applicant fails to

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[345] Exhibit No. SNWA_258, pp. 5-8, D-14.
[346] Exhibit No. GBWN_103, p. 18.

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.[347]

In general, Dr. Myers agrees that spring discharge within the groundwater discharge area will be accounted for as part of the ET estimate.[348] Often the best measurement of total spring discharge is an estimate of ET.[349] 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.[350] 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).[351] Welch, et al. (2007) classified land cover into ET units based on vegetation and soil-moisture conditions.[352] The accuracy of the land classification in Nevada ranged from 18% to 100%. The overall accuracy of ET-unit delineation was 72%.[353] This is substantially less accurate than the Applicant's land classification accuracy of 88%.

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.[354] Three of the towers were in Spring Valley.[355] 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

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[347] Exhibit No. GBWN_103, pp. 18–19; Transcript, Vol.17 p. 3793:6-18 (Myers).
[348] Transcript, Vol.20 p. 4443:18-22 (Myers).
[349] Exhibit No. GBWN_009, p. 5; Transcript, Vol.24 p. 5413:17–20 (Bredehoeft).
[350] Transcript, Vol.4 p. 743: 9–744:22; p, 783:13–784:21 (Burns).
[351] Exhibit No. GBWN_001, p. 21; Exhibit No. SNWA_68, p. 45.
[352] Exhibit No. SNWA_068, p. 51, p. 56.
[353] Exhibit No. SNWA_320, pp. 17–18.
[354] Exhibit No. SNWA_068, p. 51, p. 56.
[355] Exhibit No. SNWA_321, p. 20.

based on satellite-imagery data.[356] 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.[357] A Desert Research Institute study found the coefficient of variation of total groundwater discharge to be 0.241, meaning BARCASS had a 24% error rate.[358] This 24% error was determined using the data BARCASS used to develop the ET estimate, not independent data.[359] The Applicant's predictive error of total ET in Spring Valley was stated to be 15%. Furthermore, the Applicant's error was based on an assessment using independent data while BARCASS did not use independent data.

The State Engineer finds that the Applicant's estimate of groundwater ET, adjusted to account for carryover precipitation and for tipping bucket undercatch, is the best estimate currently available. 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. The methods of measuring phreatophyte discharge have greatly improved in the past 50 years.[360] The Applicant has used state of the art Eddy Covariance Towers and satellite imagery in developing their estimate of groundwater ET in Spring Valley. The Applicant's estimate of precipitation was found to have error, but after adjusting for that error, it represents a scientifically sound estimate of precipitation in Spring Valley. Therefore, the State Engineer will use the adjusted estimate of 84,100 afa of groundwater ET for the purpose of determining perennial yield.

B. Interbasin Flow

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 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

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[356] Exhibit No. SNWA_068, p. 59.
[357] Exhibit No. SNWA_068, p. 61.
[358] Exhibit No. SNWA_322, p. 13.
[359] Transcript, Vol.4 pp. 768: 15–769:3 (Fenstermaker).
[360] Exhibit No. GBWN_009, p. 5.

as an expert in geology and hydrogeology (Dr. Rowley was qualified in hydrogeology only for the purpose of preparing maps and discussing geologic framework for hydrologists to make decisions),[361] 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. Myers and Dr. Hurlow, to support their conclusions about the region's geologic framework for their interbasin flow analysis. Dr. Myers primarily relied upon BARCASS for geologic information and interbasin flow calculations.[362] Dr. Hurlow is a senior scientist at the Utah Geological Survey ("UGS") and was qualified as an expert in hydrogeology.[363] Dr. Hurlow is in charge of research projects on hydrogeologic studies of groundwater basins, involving summarizing the geology and hydrogeology and subsurface structure of various groundwater basins and evaluating issues of groundwater flow and occurrence.[364] 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.[365] His opinion was that subsurface groundwater flow occurs from southern Spring Valley eastward into northern Hamlin Valley and southern Snake Valley,[366] but that only 10 to 25% of the groundwater resources present in southern Snake Valley comes from interbasin flow from southern Spring Valley.[367] 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.[368]

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[361] Transcript, Vol.5 p. 974:11-12, p. 976:23-25 (Rowley).
[362] Transcript, Vol.20 p. 4479:7-10 (Myers).
[363] Transcript, Vol.16 p. 3593:1-6 (Hurlow).
[364] Transcript, Vol.16 p. 3583: 18-23 (Hurlow).
[365] Transcript, Vol.16 p. 3582: 3-13 (Hurlow).
[366] Transcript, Vol.16 p. 3596: 3-5 (Hurlow).
[367] Transcript, Vol.16 pp. 3599-3600: 25-4 (Hurlow).
[368] Transcript, Vol.16 p. 3632: 9-11 (Hurlow).

1. Mapping

The Applicant based its geologic interpretations on 1:250,000 scale mapping.[369] 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.[370] Previous geologic mapping included many other 1:250,000 and 1:100,000 scale maps that cover only portions of the Project basins.[371] 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.[372] 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.[373]

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.[374] AMT is a geophysical technique that uses the earth's natural electromagnetic fields as an energy source to determine the electrical resistivity of the subsurface.[375] AMT studies can indicate buried faults by mapping differences in resistivity of the buried rock formations.[376] Gravity studies are an additional geophysical approach that uses gravity readings across a broad area to measure the density of the mass of the underlying rock.[377] Gravity maps characterize buried faults by indicating areas where there are changes in density.[378] The Applicant also used this technology to calculate the depth to basement rock in the Project basins.[379] Knowing the depth to basement rock allows the Applicant to determine the thickness of the basin-fill aquifers.

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[369] Transcript, Vol.5 p. 1099:1-3 (Rowley).
[370] 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).
[371] Transcript, Vol.5 p. 982:15-22 (Rowley).
[372] Transcript, Vol.5, p. 985:4-12 (Rowley) (referencing Exhibit No. SNWA_061).
[373] Transcript, Vol.5, pp. 986:23-987:25; p. 987:1-4 (Rowley).
[374] Transcript, Vol.5, p. 989:1-15, p. 990:10-23 (Rowley).
[375] Transcript, Vol.5 pp.1093:23-1094:1 (Rowley).
[376] Transcript, Vol.5 p. 1095:15-16 (Rowley).
[377] Transcript, Vol.5 pp. 995:24-996:4; Transcript, Vol.5 p. 990:6-9 (Rowley).
[378] Transcript, Vol.5 p. 998:10-13 (Rowley).
[379] 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. Hydrogeologists use both fracture-flow and porous-media flow concepts to explain groundwater flow in basin-range topography.[380] Regional flow through mountain ranges occurs via fracture flow. The Project basins are characterized by basin-range topography and contain primarily north-south trending normal faults aligned with the basins and ranges.[381]

The Applicant's 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.[382] 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.[383] Despite this general rule, the experts in this case recognized there are no absolutes in nature.[384] There is extensive peer-reviewed scientific literature that explains the fracture-flow approach and the role of faults as barriers and/or conduits,[385] and both Protestant experts recognized the validity of the analytical method.[386]

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.

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.[387] The Applicant

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[380] Transcript, Vol.5, p. 1112: 3-6 (Rowley); Exhibit No. SNWA_058, pp. 2-4 to 2-5.
[381] Transcript, Vol.5 p. 1107: 12-13, p. 1112:7-10 (Rowley).
[382] Transcript, Vol.5 pp. 1111:22-1113:18 (Rowley).
[383] Transcript, Vol.5 p. 1112: 13-25 (Rowley).
[384] Transcript, Vol.5 p. 1132:22-24 (Rowley).
[385] Exhibit No. SNWA_058, p. 2-9; Exhibit No. SNWA_063, pp. 1025-1028.
[386] Transcript, Vol.16 p. 3643:8-20 (Hurlow); Transcript, Vol.20 pp. 4448:22-4449:7 (Myers).
[387] Exhibit No. SNWA_058, p. 4-34, Figure 4-9.

started its analysis with Dr. Rowley's development of a geologic framework and conceptual model based on fracture flow.[388] Mr. Burns then applied hydrologic information, including groundwater-elevations data, hydraulic gradients, and aquifer properties to Dr. Rowley's framework.[389] The Applicant argues that 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.[390] Conversely, they assert that 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.[391] 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.[392]

BARCASS also produced a map depicting boundaries where interbasin groundwater flow may exist and referred to each potential flow area as "not permitted, permitted, and possible by subsurface geology."[393]

In considering the Applicant's expert testimony and exhibits, the State Engineer generally agrees with their analyses. However, there is a component of interbasin flow that they appear to have ignored. Their analyses do not address interbasin flow that would occur as a result of a water table divide occurring somewhere other than directly below a hydrographic basin boundary. Basin boundaries usually occur at topographic divides, and any place where the water table divide was not below the topographic divide would be a location of interbasin flow. It is generally assumed that such occurrences are minor and would offset each other, so that this type of interbasin flow at a basin scale is negligible. However, as can be seen on the Applicant's groundwater contour map, significant exceptions are possible.[394] The Applicant's witnesses correctly point out that flow is subject to local controls, such as the location, orientation and

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[388] Transcript, Vol.5 p. 1134:7-23 (Rowley).
[389] Transcript, Vol.5 p. 1136:7-17 (Rowley).
[390] Transcript, Vol.5 p. 1134:7-23 (Rowley).
[391] Exhibit No. SNWA_058, p. 2-10, Figure 2.5.; Transcript, Vol.5 p. 1115: 20-24 (Rowley).
[392] Transcript, Vol.5 p. 1136:1-6 (Rowley).
[393] Exhibit No. SNWA_068, p. 34.
[394] Exhibit No. SNWA_089, Plate 3.

hydraulic properties of faults, and the hydraulic properties of the rocks, which would include anisotropy. Anisotropic regions of a mountain block, where bedding dips primarily in one direction, therefore, would be likely locations for such interbasin flow.

a. Spring Valley to Hamlin Valley

A 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).[395]

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 of east-dipping Devonian carbonate rock defined on either side by two north-trending basin-range range-front and subsidiary faults.[396] The Applicant mapped fault structures to the north and south ends of the Limestone Hills that likely support interbasin outflow to northern Hamlin Valley.[397] In between these areas, they believe 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.[398] Darcy's Law is expressed as $Q = (K \times b) \times I \times W$. 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, and is the rate at which water is capable of moving 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, they argue groundwater flow is restricted to the upper 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 below 2,000 feet. "I" is the horizontal hydraulic gradient, expressed in feet per feet, which is the slope of the water table.

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[395] Exhibit No. SNWA_258, p. 7-8
[396] Exhibit No. SNWA_258, p. 7-5, § 7.1.3.; Transcript, Vol.5 p. 1157:14-21 (Rowley).
[397] Exhibit No. SNWA_258, p. 7-5, § 7.1.3.
[398] Exhibit No. SNWA_258, pp. E-1 to E-2.

"W" is the width of the flow section also expressed in feet.[399] 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.[400] Analysis of the aquifer-test data yielded estimates of hydraulic conductivity ranging from 7.6 to 8.0 feet per day.[401] 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.[402] 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.[403] Applying these values to the Darcy equation, the Applicant calculated 3,600 acre-feet of outflow for the northern flow section and 800 acre-feet of outflow for the southern flow section.[404] The Applicant's total outflow estimate was 4,400 acre-feet, which is within the range of previously reported estimates. In reviewing this analysis, the State Engineer disagrees with the Applicant limiting the depth of the flow section to 2,000 feet. They argue that 2,000 feet is the probable limit for flow through saturated alluvium, but their measured section is in fractured carbonate rock. The evidence presented indicates that flow through carbonate rock is not limited by that depth, so their use of a 2,000-foot thickness for flow through the Limestone Hills is probably too low.[405] Had the Applicant used a thicker section, their calculated flow would be proportionately greater.

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[399] 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.
[400] Exhibit No. SNWA_258, p. 7-7, § 7.1.3.
[401] Exhibit No. SNWA_258, p. 7-7, § 7.1.3.
[402] Exhibit No. SNWA_258, p. 7-7, § 7.1.3.
[403] Exhibit No. SNWA_258, p. 7-7, § 7.1.3.
[404] Exhibit No. SNWA_258, p. 7-7, § 7.1.3.
[405] Exhibit No. SNWA_087, p. C-28.

Protestant Millard County's witness, Dr. Hugh Hurlow,[406] 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.[407] 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.[408] 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.[409]

Both Dr. Hurlow and the Applicant use a Darcy flux calculation to estimate flow through the Limestone Hills, which would move groundwater from Spring Valley into Hamlin Valley and then to Snake Valley. The section shown by the Applicant where flow is likely or permissible is approximately 15 miles in length.[410] The information used by both parties to support their interbasin flow calculations is sparse, and estimates of flow using limited data will have significant uncertainty.

Dr. Myers, on the other hand, appears[411] 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 154,000 acre-feet of recharge annually, and only discharged 101,000 acre-feet through ET, leaving 53,000 acre-feet to discharge from the basin as subsurface interbasin flow.[412] 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 Valley. The latter two flow paths from central and southern Steptoe

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[406] Dr. Hurlow is a senior scientist at the Utah Geologic Survey. Dr. Hurlow was qualified as an expert in hydrogeology. Transcript, Vol.16 p. 3593:5-6.
[407] Exhibit No. MILL_011, pp. 4 and 5.
[408] Exhibit No. MILL_011, p. 15.
[409] Exhibit No. MILL_011, pp. 14 and 17.
[410] Exhibit No. SNWA_058, p. 4-73.
[411] 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. 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).
[412] Exhibit No. SNWA_068, p. 44, Table 5; p. 45, Table 6.

Valley have not been identified in previous investigations."[413] 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 was 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.[414] 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."[415] Using this information, GBCAAS recalculated the groundwater-budget components for Steptoe Valley.[416] 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.[417] The new groundwater budget for Steptoe Valley leaves a recharge deficit of 24,000 afa.

Outflow to Hamlin Valley is generated by precipitation recharge in the southern sub-basin of Spring Valley and inflow from Lake and Steptoe Valleys. The Applicant argues there is no inflow from those valleys due to the hydrogeologic conditions, including faults and high mountain peaks. However, their model incorporated those hydrogeologic properties and, in their modeling results, show that the groundwater divide between Spring and Steptoe Valleys is shifted westward, so that it is no longer located directly beneath the topographic basin boundary, and 4,400 afa is simulated to flow from Steptoe to Spring Valley.[418] Thus groundwater recharge in the southeastern part of Steptoe Valley is modeled to flow to Spring and/or Lake Valleys; this is by definition interbasin flow. The Applicant's model also estimates 7,600 afa of interbasin flow from Spring to Hamlin Valley.[419] The Applicant's expert witnesses argue that the groundwater-flow model should not be used to determine interbasin flow, but the State Engineer finds that such estimates are at least as reliable as Darcy flux calculations in this area given the paucity of available head and hydraulic property data. The State Engineer finds the Applicant's

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[413] Exhibit No. SNWA_068, p. 5.
[414] Exhibit No. SNWA_065; Exhibit No. MILL_038.
[415] Exhibit No. MILL_038, p. 1.
[416] Exhibit No. MILL_033, p. 4; Exhibit No. MILL_034, p. 4.
[417] Exhibit Nos. MILL_033, p. 4; MILL_034, p. 4; SNWA_058, p. 44, Table 5; p. 45, Table 6.
[418] Exhibit No. SNWA_089, Plate 3.
[419] Exhibit No. SNWA_089, Plate 3.

and Dr. Hurlow's estimate of interbasin flow are similar, and accepts the range of interbasin flow through the Limestone Hills is between 4,000 and 12,000 afa.

b. 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).[420] Dr. Myers adopted this estimate from BARCASS and suggested that this interbasin flow estimate is now accepted.[421] 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 southwest boundary of Spring and Lake Valleys.[422] 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."[423] The Applicant's witness, Dr. Rowley found that this caldera complex is likely a barrier to flow.[424]

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."[425] 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.[426] The State Engineer finds that the groundwater flow is likely minimal or negligible across the Fortification Range due to the

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[420] Transcript, Vol.19 pp. 4297: 24-4298:78 (Myers).
[421] Transcript, Vol.19 p. 4297:720-23 (Myers); Exhibit No. GBWN_001, p. 12.
[422] Exhibit No. SNWA_258, Plate 1.
[423] Exhibit No. GBWN_001, p. 23.
[424] Transcript, Vol.5 p. 1156:10-14 (Rowley); SNWA_058, p. 4-63.
[425] Exhibit No. GBWN_001, p. 23.
[426] Exhibit No. SNWA_058, p. 4-60.

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.[427] The hydraulic conductivities in these faults are usually higher along the fault rather than across the fault.[428] Therefore, the preferential flow path for the water would be along these faults rather than across the faults, and would probably prevent 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. His groundwater model does not simulate this magnitude of interbasin flow from Steptoe Valley to Spring Valley, but rather 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.[429]

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.[430] 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.[431] 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.[432] 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, in combination with hydrogeologic features between Steptoe and Lake Valleys and southern Spring Valley, likely prevent significant inflow from Lake Valley through the Fortification Range into southern

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[427] Exhibit No. SNWA_426, p. 8.
[428] Exhibit No. SNWA_058, p. 2-7, p. 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.
[429] Exhibit No. GBWN_002, p. 38.
[430] Exhibit No. SNWA_258, p. 8-3.
[431] Exhibit No. SNWA_258, p. 8-3.
[432] Exhibit No. SNWA_258, p. 8-2.

Spring Valley. As discussed in the previous section, the Applicant's groundwater flow model simulates 4,400 afa of flow from Steptoe to Spring Valley.[433] The State Engineer finds that the best evidence indicates that inflow from Steptoe and Lake Valleys to southern Spring Valley is not significant, and that the flow model estimate of 4,400 afa is probably at the upper limit of likely flow.

c. 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).[434] 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.[435] In the middle, carbonate rocks are separated by Chainman Shale confining units.[436] 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.[437] These geologic features have low permeability. The State Engineer finds that the presence of these low-permeability geologic formations limits interbasin flow in this area.

While groundwater flow through the younger sediments along an inferred northwest-southeast trending fault is permissible, available water-level data does not support the likelihood of such flow. The basin-fill wells in this area of Spring Valley (Map ID's184-197, 184-200, 184-195, and 184-186) show a prevailing gradient to the south toward the Main groundwater-discharge area.[438] Any outflow through this flow section likely originates in Tippett Valley where water levels in wells completed in the basin fill (Map ID's 185-2, 185-4, 185-3, and 185-1) indicate a hydraulic gradient to the south and east. Along this hydraulic gradient, groundwater

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[433] Exhibit No. SNWA_089, Plate 3.
[434] Exhibit No. SNWA_258, p. 7-5, § 7.1.2.
[435] Exhibit No. SNWA_258, p 7-3, § 7.1.2.
[436] Exhibit No. SNWA_258, p. 7-3, § 7.1.2.
[437] Transcript, Vol.5 p. 1150:6-25 (Rowley); SNWA_058, p. 5-9; Fig. 5-6.
[438] Exhibit No. SNWA_258, Plate 1.

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.

Dr. Myers' groundwater model simulated zero interbasin flow through this boundary, and he conceded that interbasin flow is closer to zero at this location.[439] Therefore, the State Engineer finds that the hydrologic and geologic data all support the conclusion that there is not substantial outflow from northern Spring Valley to northern Snake Valley.

d. Spring Valley to Tippett Valley

The Applicant has identified two permissible flow boundaries between Spring Valley and Tippett Valley on the west and east side of the Red Hills.[440] 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,[441] that would limit or prevent outflow.[442] 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.[443]

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 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.[444] 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.[445] Dr. Myers also conceded that the southern well was misplotted.[446] Dr. Myers further conceded

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[439] Transcript, Vol.20 p. 4423:18-22; p., 4424:19-25 (Myers).
[440] Exhibit No. SNWA_258, p. 7-1.
[441] Exhibit No. SNWA_058, p. 4-67.
[442] Exhibit No. SNWA_258, p. E-3.
[443] Exhibit No. SNWA_258, Plate 1.
[444] Exhibit No. GBWN_001, p. 7.
[445] Exhibit No. SNWA_426, p. 3.
[446] Transcript, Vol.20 p. 4409:12-17 (Myers).

that there were additional wells in this area that were not included in his analysis.[447] 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.[448] 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.[449] Using this approach, the Applicant estimated 99,200 acre-feet of recharge for Spring Valley.[450] Using the same groundwater balance approach as the Applicant, but correcting for the adjusted groundwater ET by the State Engineer, would result in an estimated annual recharge of 88,500 acre-feet. 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 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 (Mizel, et al., 2007).[451] In addition, GBCAAS estimated that Spring Valley receives 110,000 acre-feet of recharge.[452] 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.[453] This approach is inconsistent with his recharge analysis for other basins during the hearing. For Cave, Dry Lake, and Delamar Valleys, Dr. Myers testified that the Reconnaissance Report Series recharge estimates were the best estimates for these basins, but

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[447] Transcript, Vol.20 p. 4411:18-24 (Myers).
[448] Transcript, Vol.20 pp. 4409:25–4410:2; pp. 4411:25–4412:6 (Myers).
[449] Exhibit No. SNWA_258, p. 6-10.
[450] Exhibit No. SNWA_258, p. 6-10.
[451] Exhibit No. SNWA_258, p. 6-12, Table 6-2.
[452] Exhibit No. MILL_033, p. 5.
[453] Transcript, Vol.20 p. 4432:8-9 (Myers).

that the BARCASS estimates in other basins were appropriate.[454] 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.[455]

Groundwater recharge in Spring Valley is not directly measured. It can be estimated by the groundwater balance of the basin. As discussed above in the groundwater ET section, groundwater ET is estimated to be 84,100 afa. Inflow from Steptoe Valley is highly uncertain, and probably is between zero and 4,400 afa. Outflow to Hamlin Valley is believed to be 4,000 to 12,000 afa. Therefore, groundwater recharge in the basin reasonably ranges from 84,000 to 96,000 afa.

D. Perennial Yield

In hydrographic basins that have relatively little subsurface interbasin flow, such as Spring Valley, the State Engineer has consistently determined the perennial yield to be equal to the basin's groundwater ET, rather than estimates of recharge or interbasin flow. Because groundwater ET is a measured value with relatively high confidence, the State Engineer finds that the perennial yield in Spring Valley will be based on the groundwater-ET estimate, rounded to the nearest thousand. Basin boundary flows are not a component of the perennial yield of Spring Valley. Any outflow to Snake Valley and/or Hamlin Valley is reserved for those basins. **The State Engineer finds the perennial yield of the Spring Valley Hydrographic Basin is 84,000 acre-feet.**

E. 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.[456] The State Engineer finds that there is no provision in Nevada water law that addresses time to capture, and no State Engineer has required that ET be captured within a specified period of time. It will often take a long time to reach near-equilibrium in large basins and flow systems, and this is no reason to deny water right applications. The estimated time a pumping project takes to reach a new equilibrium does not affect the perennial yield of a basin.

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[454] Exhibit No. GBWN_004, p. 35, Table 6; Transcript, Vol.20 pp. 4576:23–4577:45 (Myers).
[455] Exhibit No. SNWA_068, p. 44.
[456] Exhibit No. GBWN_003, p. 3; Transcript, Vol.24 pp. 5369:16–5370:8 (Bredehoeft).

F. ET Capture

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.[457] 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. The State Engineer finds that the Applicant is not required to prove capture of ET as a prerequisite to approval of the Applications.

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.[458] The State Engineer prepared an inventory of all water rights in Spring Valley pursuant to NRS 533.364 ("Spring Valley Inventory").[459] The Applicant also undertook an evaluation of committed groundwater rights in Spring Valley ("Stanka Report").[460] The results presented in the Stanka Report are similar to the results presented in the Spring Valley Inventory, and the differences will be discussed in the appropriate subsection below.

Both the Spring Valley Inventory and the Stanka Report identified every groundwater right in Spring Valley and then made adjustments for the total combined duty, the supplemental nature and the consumptive use of the water rights. This is added to the amount of groundwater

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[457] *See,* Exhibit No. GBWN_009, p. 3; Exhibit No. GBWN_013, p. 342; Transcript, Vol.24 p. 5371:3-5 (Bredehoeft).
[458] NRS 533.370(2); NRS 534.110(3).
[459] Exhibit No. SNWA_460.
[460] Exhibit No. SNWA_097.

that is estimated to be consumed for domestic uses and the amount of valley-floor spring discharge estimated to be consumptively used.[461]

Both the Spring Valley Inventory and the Stanka Report follow a similar analysis. A review of the records of the Office of the State Engineer was conducted to identify every active water right in the basin, those being permits, certificates, decreed rights, claims of vested rights and claims of implied federal water rights identified as public water reserves.[462] Pending applications are not included, because unless or until they are permitted, they are not a commitment on the basin.[463] In the case of the Spring Valley Inventory, claims of vested right not accepted due to deficiencies requiring correction by the claimant are not included as a commitment on the basin (see subsection F below).[464]

When groundwater from a specific well, or point of diversion, is used as the sole source of water for a specific place of use, it is commonly referred to as a "stand-alone" right. When a water right is used in combination with surface water or with groundwater from another water right, the right is considered "supplemental," meaning the groundwater right supplements, or is supplemented by, water from another source used on the same place of use.[465]

A. Non-Irrigation Groundwater Rights

For groundwater rights with a manner of use other than irrigation ("non-irrigation groundwater rights"), the permit or certificate may identify a total combined duty associated with that permit or certificate the purpose of which is to indicate water rights that are supplemental to another water right(s). The total combined duty may limit the total duty of a group of supplemental water rights. The Stanka Report identified a total combined duty of 1,901.25 afa of non-irrigation groundwater rights in Spring Valley.[466] This value agrees within 1 afa of the Spring Valley Inventory, which gave a value of 1,901 afa.[467] The State Engineer finds that 1,901 afa of non-irrigation groundwater rights are consumptively used and are not available for appropriation.

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[461] Exhibit No. SNWA_097, p. 1-7; Exhibit No. 460 SNWA_460 (Spring Valley Inventory).
[462] Exhibit No. SNWA_097, Section 5.2, pp. 5-4 to 5-10; Transcript, Vol.2 p. 425:21-23 (Stanka); Exhibit No. SNWA_460 (Spring Valley Inventory), pp. 1-2.
[463] Exhibit No. SNWA_097, p. 5-4; Transcript, Vol.2 p. 430:5-18 (Stanka); Exhibit No. 460 SNWA_460 (Spring Valley Inventory), pp. 1-2.
[464] Exhibit No. SNWA_460 (Spring Valley Inventory), p. 1.
[465] *Id.* at 3.
[466] Exhibit No. SNWA_097, Section 5.2, pp. 5-4 to 5-10; p. 5-6, Table 5-3; p. 5-19, Table 5-10.
[467] Exhibit No. SNWA_460 (Spring Valley Inventory), p. A-3.

B. Groundwater Irrigation Rights

For groundwater rights with a manner of use of irrigation ("groundwater irrigation rights"), the permit or certificate may identify a total combined duty term associated with that permit or certificate the purpose of which is to indicate water rights that are supplemental to another water right(s). The total combined duty may limit the total duty of a group of supplemental water rights; however, in some cases the water right is not explicit and an analysis of the place of use must be performed to identify supplemental water rights.

Both the Stanka Report and the Spring Valley Inventory considered the supplemental nature of groundwater irrigation rights. The Stanka Report identified a total combined duty of 19,772.473 afa of groundwater irrigation rights.[468] This value agrees within 10 afa of the Spring Valley Inventory, which gives a value of 19,780 afa.[469]

Within these groundwater irrigation rights, some are supplemental to surface water rights and some are not ("stand-alone"). Both the Stanka Report and the Spring Valley Inventory identify those water rights that are at least partially supplemental to surface water rights, but they are not entirely in agreement.

The Stanka Report presented that a total of 9,950.45 afa of groundwater irrigation rights are supplemental to surface water irrigation rights, and thus, a total of 9,822.023 afa of groundwater irrigation rights are not supplemental to surface water irrigation rights.[470]

While the general method utilized by Mr. Stanka is sound, there are discrepancies between his report and the Spring Valley Inventory that must be addressed. The Spring Valley Inventory reported that 8,823 afa of groundwater irrigation rights are supplemental to surface water irrigation rights.[471]

In reviewing both the Stanka Report and the Spring Valley Inventory, the State Engineer agrees with Mr. Stanka's determination regarding the supplemental group of groundwater rights comprised of Permits 20817, 26228, 26229, 26546, 26952, 26953, 34727 and 78107. Additionally, the State Engineer agrees with Mr. Stanka's determination regarding the supplemental group of groundwater rights comprised of Permits 18525, 25679, 25680 and 30319.

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[468] Exhibit No. SNWA_097, p. 5-6, Table 5-3; p. 5-19, Table 5-9; Transcript, Vol.2 p. 450:7-12 (Stanka).
[469] Exhibit No. SNWA_460 (Spring Valley Inventory), p. A-3.
[470] Exhibit No. SNWA_097, p. 5-24, Table 5-12; Transcript, Vol.2 p. 471:1-4 (Stanka).
[471] Exhibit No. SNWA_460 (Spring Valley Inventory), p. A-3.

However, the State Engineer disagrees with Mr. Stanka's determination of some of the supplemental groundwater values. First, in the case of Permit 71840, the duty and acreage that is supplemental cannot exceed the total value of the permit. Mr. Stanka also treated the entire amount of Permit 39817 as non-supplemental to Claim of Vested Right V01213, but from the description of claim it is possible for 40 acres to be supplemental; this is the best estimate until Claim of Vested Right V01213 is adjudicated and Permit 39817 is certificated.

Based on the place of use descriptions and place of use maps, the most acreage that could overlap between Permit 39818 and Claim of Vested Right V01214 is 440 acres, so the 540 acres from the Stanka Report is too high; this is the best estimate until Claim of Vested Right V01214 is adjudicated and Permit 39818 is certificated. As for Permit 27378, Certificate 8357, it is clear from examining the certificate and proof of beneficial use map that there is only 2.20 acres stand-alone. It cannot be determined from the scale of the map in the Stanka Report where the additional 0.75 acres of stand-alone portion was thought to exist. For the supplemental groundwater group of water rights comprised of Permits 63532, 63533, 71525, 71526, 71603 and 74274, the original base right for Permits 71525, 71526, 71603 and 74274 is Permit 18827. Looking at the supplemental nature of this base right, 416.69 acres were determined to be supplemental to surface water. These water rights are limited to a duty rate of 2.43 afa per acre due to the total combined duty term. The results of the Stanka Report assumed 4 afa per acre. Otherwise, Stanka Report and the Spring Valley Inventory are in agreement.

Resolving these discrepancies, the State Engineer finds that the best value for the groundwater-irrigation rights that are supplemental to surface water irrigation rights is 9,186 afa and, thus, the State Engineer finds that the value for the groundwater irrigation rights that are not supplemental to surface water irrigation rights is 10,595 afa.

C. Consumptive Use of Groundwater Irrigation Rights

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.[472] Both the Stanka Report and the Spring Valley Inventory reduced the amount of water committed in the basin to the consumptive use portion.

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[472] Transcript, Vol.3 pp. 508:22-509:9 (Stanka).

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.[473] It is estimated that in Spring Valley the net irrigation water requirement (NIWR) for alfalfa and highly managed pasture grass crops is 3 afa per acre.[474] The Stanka Report 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.[475] For the Spring Valley Inventory, the NIWR was multiplied by the number of acres of groundwater irrigation water rights to determine the consumptive use portion of the groundwater irrigation water rights if the duty rate of the water right exceeded 3 afa per acre. If the duty rate was less than 3 afa per acre, then the permitted or certificated duty rate was used (e.g., Permits 71525, 71526, 71603 and 74274 have an effective duty rate of 2.43 afa per acre).[476]

When accounting for the discrepancies between the Stanka Report and Spring Valley Inventory as discussed in subsection B above, the State Engineer finds that 8,304 afa of stand-alone groundwater irrigation rights are consumptively used and are not available for appropriation.

D. <u>Groundwater Irrigation Rights Supplemental to Surface Water Rights</u>

The State Engineer also finds that the consumptive use amount of groundwater irrigation rights that are supplemental to surface water rights is 7,710 afa. However, when a groundwater right is issued as supplemental to a surface water source, it is expected that the groundwater permit will not be utilized until the surface water becomes unavailable, and then only to make up the difference between the surface water available and the right allowed. Thus, it is expected that a supplemental groundwater right will not be used to its full allocation.[477]

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

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[473] Exhibit No. SNWA_097, p. 5-31; Transcript, Vol.3 pp. 509:14-510:20 (Stanka).
[474] Exhibit No. SNWA_460 (Spring Valley Inventory), p. 2; Huntington, J. L., Allen, R. G., 2010, *Evapotranspiration and Net Irrigation Water Requirements for Nevada*. State of Nevada, Department of Conservation and Natural Resources, Division of Water Resources.
[475] Exhibit No. SNWA_097, p. 5-31, Table 5-16; Transcript, Vol.3 pp. 510:21-511:12 (Stanka).
[476] Exhibit No. SNWA_460 (Spring Valley Inventory), p. B-7; File No. 74274, official records in the Office of the State Engineer.
[477] Exhibit No. SNWA_460 (Spring Valley Inventory), p. 3.

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 available for Spring Valley.[478] Therefore, it becomes necessary to estimate this value. The Stanka Report describes two types of analyses, one of which is similar to the analysis that formed the basis of the Spring Valley Inventory estimate.

The first approach presented in the Stanka Report analyzed the amount of groundwater that would be needed to supplement flows on Cleve Creek, which is a surface water source in Spring Valley for which there are more than 40 years of stream gage information available.[479] The Stanka Report takes the position that 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.[480] The Stanka Report 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.[481] This approach resulted in an estimate that 39.1% of all supplemental groundwater irrigation rights would be used to supplement surface water irrigation rights in Spring Valley during an average irrigation season.[482]

The second approach presented in the Stanka Report was an analysis of data regarding supplemental groundwater usage for a surrogate surface water source that is not located in Spring Valley, but does have some associated supplemental groundwater-use data. That data is then normalized for application to surface water sources in Spring Valley.[483] Daggett Creek, which is located in Carson Valley on the west side of the state, was selected because: (1) Daggett Creek surface use has 40 years of stream gage data and supplemental groundwater use has ten years of data; (2) surface water is directly related to snow pack runoff; and (3) groundwater rights are fully supplemental to surface water.[484] The Nevada Division of Water Resources has previously determined that the percentage of the total duty of supplemental groundwater used on Daggett

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[478] Transcript, Vol.3 p. 483 (Stanka).
[479] Exhibit No. SNWA_097, Section 5.6.1, pp. 5-26 to 5-27; Transcript, Vol.3 pp. 484-495 (Stanka); Exhibit No. SNWA_097, p. 5-26; Transcript, Vol.3 p. 485:6-8 (Stanka).
[480] Transcript, Vol.3 p. 489:11-21 (Stanka).
[481] Exhibit No. SNWA_097, p. 5-27, Figure 5-8 and Table 5-14.
[482] Exhibit No. SNWA_097, p. 5-27, Table 5-14; Transcript, Vol.3 p. 494:17-21 (Stanka).
[483] Exhibit No. SNWA_097, Section 5.6.2, pp. 5-28 to 5-30; Transcript, Vol.3 pp. 495-504 (Stanka).
[484] Exhibit No. SNWA_097, pp. 5-28 to 5-29; Transcript, Vol.3 pp. 496:23-497:1; p. 499:8-10 (Stanka).

Creek ranges from 9.3% to 26.7% annually with an average of 18.0% annually.[485] 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.[486] This approach resulted in an estimate that 27.4% of all supplemental groundwater irrigation rights in Spring Valley would be used to supplement surface water irrigation rights during an average irrigation season.[487] This is similar to the approach used by the State Engineer for the Spring Valley Inventory; however, instead of using the average value of 18.1%, the State Engineer used the more conservative upper value of 26.7%. This approach was described in State Engineer's Ruling 5726. This resulted in an estimated use of about 50%.

Mr. Stanka chose the 39.1% result from the Cleve Creek approach for his analysis because it was the more conservative value.[488] However, many streams in Spring Valley have insufficient data to develop a profile for comparison with Cleve Creek or Daggett Creek. For those streams where there is at least some seasonal or annual data,[489] the same analysis described above can be performed comparing Daggett Creek supplemental use to these creeks as a check for reasonableness. For those creeks on the western side of the valley, like Cleve Creek, that also have underground supplemental rights, a range of values from 13% to 68%, with an average 48.4%, is calculated.[490] For those creeks on the eastern side of the valley that also have underground supplemental rights, a range of values from 25% to 68%, with an average 49.9%, is calculated. For those creeks that do not have underground supplemental rights, a range of values from 34% to 66%, with an average 51.9%, is calculated. An average of all creeks for which such data is available, not including Cleve Creek, is 50.2%. An average of all creeks for which such data is available, including Cleve Creek, is 50.0%. Thus, the analysis of other creeks in the basin justifies the use of 50% of estimated underground supplemental water use, as this value appears to be more indicative of the entire basin.

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[485] Exhibit No. SNWA_097, p. 5-28; Transcript, Vol.3 pp.497:19-498:6 (Stanka).
[486] Exhibit No. SNWA_097, p. 5-30, Eq. 5-1; Transcript, Vol.3 pp. 499:24-500:19 (Stanka).
[487] Exhibit No. SNWA_097, p. 5-30; Transcript, Vol.3 p. 504:7-11 (Stanka).
[488] Exhibit No. SNWA_097, p. 5-30; Transcript, Vol.3 pp. 504:12-505:15 (Stanka).
[489] Exhibit No. SNWA_460 (Spring Valley Inventory), Appendix C.
[490] Exhibit No. SNWA_460 (Spring Valley Inventory), Appendix C;

Multiplying 7,710 afa by 50% results in a value of 3,855 afa. The State Engineer finds that, after adjustment for estimated annual use, 3,855 afa of groundwater irrigation rights that are supplemental to surface water rights are consumptively used and are not available for appropriation.

E. Consumptive Use from Domestic Wells

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.[491] 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.

The Stanka Report presented an estimate of the amount of water that is consumptively used by domestic wells in Spring Valley by estimating the acre-foot amount of water consumptively used per well and multiplying that value by the estimated number of wells in Spring Valley. The estimate of the acre-foot amount of water consumptively used per well was estimated by multiplying the estimated number of people per well by the estimated per capita water use and then from that product subtracting the estimated amount of water returned to the groundwater system through secondary recharge via septic systems.[492]

The Stanka Report estimated that the 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 well casing diameter of 5 to 9 inches, which is within the diameter range for a domestic well casing.[493] The Stanka Report identified 50 well logs meeting this criterion, but perusing the well logs revealed that many of these were drilled specifically for other uses, which include commercial, industrial, mining, monitoring, stock-watering and testing purposes. Based on a review of the Well-Driller Log Database for new and replacement wells and also accounting for plugged wells, 20 domestic wells were identified within the Spring Valley Hydrographic Basin.[494] This is the value used in the Spring Valley Inventory.[495]

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[491] NRS 534.180.
[492] Exhibit No. SNWA_097, Section 5.8, pp. 5-34 to 5-35.
[493] Exhibit No. SNWA_097, p. 5-34; Transcript, Vol.3 p. 517:6-16 (Stanka).
[494] Well-Driller Log Database accessed February 1, 2012, official records in the Office of the State Engineer.
[495] Exhibit No. SNWA_460 (Spring Valley Inventory).

Mr. Stanka reviewed the mean number of people per household in six Nevada counties as identified by the State Demographer and assumed that the estimated number of people per well in Spring Valley was equal to the highest mean number identified.[496] As a result of this analysis, Mr. Stanka estimated that 28.5 afa is being pumped from domestic wells in Spring Valley.[497] Mr. Stanka estimated that 40% of groundwater pumped from domestic wells in Spring Valley is returned to the groundwater system through secondary recharge, and that 60%, or 17.1 afa, is consumptively used.[498]

The data and analysis in the Stanka Report is for primarily suburban locations, while Spring Valley is primarily rural in nature. The more appropriate value for estimating water use from domestic wells is 1 afa per well. Multiplying 20 domestic wells by 1 afa per well results in an estimate of 20 afa, which is the value used in the Spring Valley Inventory.[499]

The State Engineer finds that 20 afa is committed in the basin for domestic wells.

F. Spring Rights in Discharge Area

Mr. Stanka also prepared an analysis to quantify the total amount of committed spring water rights in the discharge area of Spring Valley.[500] 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.[501] 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.[502] 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.[503]

However, Claims of Vested Rights V09665 - V09672 have not been properly filed in the Office of the State Engineer, and are not entitled to protection from impairment as specified in NRS 533.085. The estimated consumptive use of these claims of 1,276.6 afa[504] shall be

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[496] Exhibit No. SNWA_097, p. 5-34; Exhibit No. SNWA_098; Transcript, Vol.3 pp. 517:17-23-518:4 (Stanka).
[497] Exhibit No. SNWA_097, p. 5-34.
[498] Exhibit No. SNWA_097, p. 5-34; p. 5-35, Eq. 5-2; Transcript, Vol.3 pp. 521:3-523:6 (Stanka).
[499] Exhibit No. SNWA_460 (Spring Valley Inventory).
[500] Exhibit No. SNWA_423; Transcript, Vol.3 pp. 532-540 (Stanka).
[501] Exhibit No. SNWA_460.
[502] Transcript, Vol.3 p. 534:2-8, pp. 534:25-535:10 (Stanka).
[503] Exhibit No. SNWA_423, p. 13, Table 8; Transcript, Vol.3 p. 534:19-24 (Stanka).
[504] Exhibit No. SNWA_423, p. 13, Table 7.

deducted from the above amount of 6,069.78. The State Engineer finds that there are 4,793 afa of consumptively used committed spring rights in the discharge area of Spring Valley.

Dr. Myers estimated there are a total of 122,695 afa of certificated, permitted, reserved and vested water rights associated with springs in Spring Valley.[505] However, Dr. Myers did 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.[506] 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. Results

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. He did not estimate the amount of groundwater used from domestic wells.[507] Therefore, the State Engineer finds that Dr. Myers' estimates cannot be relied upon to determine the amount of committed groundwater rights in Spring Valley.

The CPB presented 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.[508] 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.[509]

The State Engineer finds the Spring Valley Inventory, as adjusted by the above findings, is the most reasonable estimate of the groundwater rights in Spring Valley.

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[505] Exhibit No. GBWN_001, p. 41; Transcript, Vol.3 p. 533:16-17 (Stanka).
[506] Exhibit No. GBWN_001, p. 41; Transcript, Vol.17 pp. 3877:18-3878:15 (Myers); Transcript, Vol.3 pp. 535:17-536:6 (Stanka).
[507] 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).
[508] Transcript, Vol.23 p. 6149:11-18.
[509] Exhibit No. CPB_011, p. 9; Transcript, Vol.27 p. 6207:9-22, p. 6208:5-20, p. 6210:19-21 (Scott).

The findings of this section are summarized in the table below:

Table 5. Summary of committed water rights that will be deducted from the perennial yield of Spring Valley.

Commitment Values to the Nearest 1 afa			
Type of Commitment	**Spring Valley Inventory**	**Stanka Report**	**Finding**
Non-Irrigation	1,901	1,901	1,901
Stand-alone Irrigation	8,551	7,711	8,304
Supplemental Irrigation	3,731	3,140	3,855
Domestic Well	20	17	20
Commitment Subtotal	**14,203**	**12,769**	**14,080**
Spring Discharge	NA	6,090	4,793
Total Commitment	**14,203**	**18,858**	**18,873**

H. Applicability to Junior Rights

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.[510] 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 beneficially used pursuant to the permit terms, the State Engineer will issue a certificate with the same priority date as the underlying permit and application.[511] Relative to each other, a water right with a priority date earlier in time to another water right is senior to the junior right.

Under normal circumstances, the State Engineer would act on new appropriations for water 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).[512] 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, if permitted. Although Ruling 5726 was

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[510] 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").
[511] NRS 533.425; NRS 533.430.
[512] Transcript, Vol.2 pp. 426:12-427:2 (Stanka).

vacated, these junior rights remain in existence. The State Engineer will treat these junior groundwater irrigation rights as committed groundwater rights since they were approved as part of the 8,000 afa reserve allowed to the basin for future development under Ruling 5726.

Based on the evidence in the record, and on the State Engineer's water right files, the State Engineer finds that 14,080 afa of groundwater rights are committed and consumptively used in Spring Valley and 4,793 afa of spring water rights are committed and consumptively used from valley floor springs, which also utilize groundwater. Therefore, the State Engineer finds that 18,873 afa of the 84,000 acre-foot perennial yield of the basin is already allocated.

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.[513] To address this requirement, the Applicant prepared an expert report describing a three part analysis. [514] First, a qualitative analysis was performed, which assessed potential conflicts based on water right ownership, geographical location, and priority date.[515] 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.[516] 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.[517] 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 Plan for Spring Valley part of the permit terms for the Applications.[518]

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[513] NRS 533.370(2).
[514] Exhibit No. SNWA_337, pp. 1-1, 3.
[515] Transcript, Vol. 11, pp. 2540:21-2541:8 (Watrus).
[516] Transcript, Vol. 11, pp. 2540:21-2541:8 (Watrus).
[517] Transcript, Vol. 11, pp. 2540:21-2541:8 (Watrus).
[518] Exhibit No. SNWA_149, p.1; Transcript, Vol.8 p. 1795:18-21 (Prieur).

A. Spring Valley Monitoring, Management and Mitigation Plan

The Project proposed by the Applicant is of a size and scope that requires a comprehensive monitoring, management and mitigation 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. A Hydrologic Monitoring and Mitigation Plan was previously approved by the State Engineer in 2009, and a 2011 revision of that plan has been submitted into evidence.[519] The revised Monitoring and Mitigation Plan ("Management Plan") presented 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 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 record reflects that the Applicant has been collecting data related to groundwater hydrology in Spring Valley since it filed the Applications.[520] Mr. Prieur testified that systematic data collection started in 2007 with project development and the implementation of a monitoring plan for Spring Valley.[521] The monitoring plan was initially completed as a component of the Stipulation between the Applicant and the U.S. Bureau of Indian Affairs, U.S. National Park Service, U.S. Bureau of Land Management, and U.S. Fish and Wildlife Service ("Federal Agencies") that resulted in the withdrawal of the Federal Agencies' protests against the Applications.[522] 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

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[519] Exhibit No. SNWA_149.
[520] Transcript, Vol.8 p. 1797:20-21 (Prieur).
[521] Exhibit No. SNWA_151; Transcript, Vol.8 p. 1797:20-24 (Prieur).
[522] Exhibit No. SE_041; Transcript, Vol.8 p. 1798:5-11 (Prieur).

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 claims to 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.

By its terms, the Stipulation, and its exhibits, 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.[523] Exhibit B provided the same technical structure and management elements for the biologic portion of the plan.[524] 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.[525]

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.[526] 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.[527]

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

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[523] Transcript, Vol.8 p. 1799:14-22 (Prieur).
[524] Exhibit No. SE_041.
[525] Transcript, Vol.8 pp. 1803:19-1804:6 (Prieur).
[526] Transcript, Vol.8 p. 1800:8-12 (Prieur).
[527] 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.[528] 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.[529]

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.[530] 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.[531]

This process was questioned by the CPB as not requiring any type of resolution and not protecting existing rights.[532] 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.[533] 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.[534] The Stipulation in no way limits the State Engineer's obligations or authority to protect CPB water rights. For instance, in addition to making the 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

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[528] Transcript, Vol.8 p. 1837:13-19 (Prieur).
[529] Transcript, Vol.8 p. 1837:20-25 (Prieur).
[530] Transcript, Vol.8 pp. 1802:19-1803:10 (Prieur).
[531] Exhibit No. SE_041, Exhibit A, p. 14, II(2).
[532] Transcript, Vol.29 pp. 6438:11-6439:14 (Hejmanowski).
[533] Exhibit No. SE_041; Transcript, Vol.11 p. 2500:3-9 (State Engineer).
[534] Transcript, Vol.11 pp. 2498:22-2499:15 (State Engineer).

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. Monitoring Requirements

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.[535] The Applicant submitted an updated Management Plan for this hearing and requested that the State Engineer include compliance with the Management Plan as part of the permit terms.[536] The proposed Management Plan includes all of the elements from the previous plan, includes management strategies and objectives, and was updated to include survey information and construction information obtained since the plan was approved. Additionally, the Management Plan addresses non-federal water rights.[537]

Data collection is a key component of the Management 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.[538] 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.[539] The Management 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.

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[535] Exhibit No. SNWA_153; Transcript, Vol.8 p. 1839:8-22 (Prieur).
[536] Exhibit No. SNWA_149.
[537] Transcript, Vol.8 p. 1839:8-22 (Prieur).
[538] Transcript, Vol.8 pp. 1840:25-1841:6 (Prieur).
[539] Transcript, Vol.8 p. 1841:9-14 (Prieur).

The Management 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.[540] Importantly, the majority of the wells are clustered in the area of the proposed points of diversion.[541] Fourteen of these wells are equipped for continuous monitoring, which allows the Applicant to assess hourly water-level variations in these wells.[542] In addition, once production starts, water elevations in the proposed production wells will be continuously monitored.[543]

Information on water-level variation assists in assessing the horizontal and vertical hydraulic gradients (i.e., direction of groundwater flow) in the basin.[544] 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.[545] The goal of the monitoring network is to provide a three-dimensional understanding of the groundwater flow in the basin.[546] 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.[547]

In addition to the monitoring-well network, the Management Plan also calls for a test-well network. Test wells will provide geologic data and hydrologic aquifer property data.[548] Similar to the monitoring wells, these wells collect water-level elevation information that is plotted on a hydrograph.[549] 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.[550] 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.[551]

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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[540] Transcript, Vol.8 p. 1843:17-19 (Prieur).
[541] Exhibit No. SNWA_147, p. 2-5.
[542] Exhibit No. SNWA_147, pp. 2-5 and 2-6; Transcript, Vol.8 p. 1846:17-19 (Prieur).
[543] Exhibit No. SNWA_147, p. 2-7.
[544] Transcript, Vol.9 pp. 2029:23-2030:5 (Prieur).
[545] Transcript, Vol.9 p. 2030:2-6 (Prieur).
[546] Transcript, Vol.9 p. 2029:19-22 (Prieur).
[547] Transcript, Vol.8 pp. 1845:24-1846:5 (Prieur).
[548] Transcript, Vol.9 p. 2072:3-7 (Prieur).
[549] Transcript, Vol.9 p. 2073:13-17 (Prieur).
[550] Transcript, Vol.9 pp. 2073:15-2074:9 (Prieur).
[551] Transcript, Vol.9 p. 2075:16-(20 (Prieur).

proposed points of diversion.[552] The spring-monitoring sites were selected in consensus with the TRP, BWG, and the State Engineer's office.[553] The criteria used to select the springs included the spatial distribution, the biologic importance, the hydrogeologic setting, and the areas of concern.[554]

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.[555] This information will be 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.[556] 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.[557] As required by the State Engineer, the Management Plan already includes additional monitoring to protect existing non-federal water rights.[558] 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, at two different sites. The State Engineer also required two flumes to measure spring discharge and a shallow piezometer.[559] The State Engineer also required regular spring discharge monitoring at Turnley Springs, which is a privately owned water source.[560] 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.[561] Also, throughout the development of the water rights, the State Engineer has the option and authority to add additional monitoring.

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[552] Exhibit No. SNWA_147, p. 2-8.
[553] Transcript, Vol.8 p. 1864:13-15 (Prieur).
[554] Transcript, Vol.9 p. 2059:13-17 (Prieur).
[555] Transcript, Vol.8 pp. 1866:23-1867:6 (Prieur).
[556] Transcript, Vol.8 pp. 1866:24-1868:22 (Prieur).
[557] Transcript, Vol.9 p. 2060:1-16 (Prieur).
[558] Transcript, Vol.8 pp. 1838:6-1839:7 (Prieur).
[559] Transcript, Vol.8 p. 1838:14-24 (Prieur).
[560] Transcript, Vol.8 pp. 1838:21-1839:1 (Prieur).
[561] Transcript, Vol.8 pp. 1838:25-1839:3 (Prieur).

The Management Plan includes other hydrologic elements that provide a comprehensive view of the hydrologic system. For example, there is a requirement 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.[562] 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 collection and recording.[563] The Applicant also has standard procedures for database entry and management. The collected data is brought to the office and entered into the database.[564] 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.[565] The hourly continuous data is processed using Aquarius software and then it is placed into the database.[566] Any erroneous data must go through an audit process in order for it to be removed from the database.[567]

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.[568] These reports have been submitted to the State Engineer for 2008, 2009, 2010, and 2011 and are available to the public.[569] Electronic data are also provided to the State Engineer on a quarterly basis.

Dr. Bredehoeft, a witness for GBWN, provided general opinions that monitoring will not be effective. He implied in his written report that monitoring may not effectively detect pumping

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[562] Transcript, Vol.9 p. 2062:7-23 (Prieur).
[563] Transcript, Vol.9 pp. 2066:6-2067:11 (Prieur).
[564] Transcript, Vol.9 p. 2067:11-15 (Prieur).
[565] Transcript, Vol.9 pp. 2067:19-2068:2 (Prieur).
[566] Transcript, Vol.9 p. 2068:8-11 (Prieur).
[567] Transcript, Vol.9 pp. 2068:25-2069:2 (Prieur).
[568] Transcript, Vol.9 pp. 2068:25-2069:17 (Prieur).
[569] Exhibit Nos. SNWA_154 through SNWA_157; Transcript, Vol.9 pp. 2068:25-2069:2 (Prieur).

signals at long distances or, if detected, it may be too late to effectively react to it.[570] He provided a simple model of a groundwater system to support his conclusions[571] and testified that, based on his hypothetical example, impacts due to pumping may not be detected for up to 75 years.[572] 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 model differs from the conditions found in Spring Valley and that these differences would affect the results in some instances.[573] Mr. Prieur testified that Dr. Bredehoeft's example does not accurately reflect conditions in Spring Valley because Spring Valley has more dispersed recharge, more dispersed springs, more dispersed wells, and an extensive network of monitoring wells.[574]

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.[575] With a network of monitoring wells, deviations among different wells at different locations can be compared to determine the likely source of the effect.[576] 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, the Applicant's witness testified early detection of drawdown at the monitoring well allows the water manager to halt pumping and prevent significant impacts to the spring.[577] 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.[578] In rebuttal to Dr. Bredehoeft's example, Mr. Prieur testified that more monitoring wells closer to the pumping would allow for even earlier detection.[579]

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 because of the spatial distribution across Spring Valley, the dense distribution of

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[570] Transcript, Vol.24 pp. 5400:17-5401:7, pp. 5409:8–5409:12, p. 5455:20-24, pp. 5495:16-5496:6 (Bredehoeft).
[571] Exhibit No. GBWN_109, p. 9; *see, e.g.*, GBWN_011.
[572] Transcript, Vol.24 pp. 5400:17–5401:7 (Bredehoeft).
[573] Transcript, Vol.24 pp. 5450:1–5455:5 (Bredehoeft).
[574] Transcript, Vol.11 pp. 2367:15–2368:24 (Prieur).
[575] Exhibit No. GBWN_011.
[576] Exhibit No. SNWA_428, pp. 17–18.
[577] Exhibit No. SNWA_428, p. 19; Transcript, Vol.11 pp. 2372:6–2375:20 (Prieur).
[578] Transcript, Vol.24 p. 5458:2–8 (Bredehoeft).
[579] Transcript, Vol.11 pp. 2375:21–2376:9 (Prieur).

monitoring wells near the points of diversion, and because the plan is flexible, allowing for changes as needed. 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, but additional monitoring sites will be required as necessary during Project development. 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, if necessary, mitigated. In summary, the State Engineer finds that the Applicant's Management Plan will be effective.

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 CPB representatives.[580] 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.[581] These wells were completed as one deep well and one shallow well for the purpose of evaluating the vertical hydraulic gradient at this location.[582] 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.[583]

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.[584] The location of these monitoring wells is coincident with the point of diversion for Application 54017.[585]

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[580] Transcript, Vol.8 pp. 1848:17-1849:4 (Prieur).
[581] Exhibit No. SNWA_149, p. 32; Transcript, Vol.8 pp. 1850:23-1851:4 (Prieur).
[582] Transcript, Vol.8 p. 1851:15-22 (Prieur).
[583] Transcript, Vol.8 pp. 1851:23-1852:3 (Prieur).
[584] Exhibit No. SNWA_149, p. 32; Transcript, Vol.8 p. 1857:17-19 (Prieur).
[585] Transcript, Vol.8 pp. 1857:25-1858:2 (Prieur).

The monitoring plan also includes 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.[586] In addition, the plan required maintenance of a continuous gaging station at Cleve Creek.[587] The purpose of continuous monitoring at Cleve Creek is to establish variations in stream discharge over time with varying precipitation.[588]

The spring and stream monitoring efforts associated with Cleveland Ranch cost the Applicant approximately $200,000. Mr. Prieur opined 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.[589] The State Engineer finds that the current monitoring program is adequate in the Cleveland Ranch area to assess impacts from water development under the Applications that are being granted in this ruling.

b. Turnley Spring

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.[590] Turnley Spring is located in the mountain block on Sacramento Pass.[591] 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.[592] The Applicant has collected spring discharge data at Turnley Spring since 2008.[593] 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.

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[586] Transcript, Vol.8 p. 1867:20-24 (Prieur).
[587] Transcript, Vol.8 p. 1868:2-5 (Prieur).
[588] Transcript, Vol.8 p. 1868:15-25 (Prieur).
[589] Transcript, Vol.8 pp.1869:21-1870:1 (Prieur).
[590] Transcript, Vol.9 p. 2032:5-17 (Prieur).
[591] Exhibit No. SNWA_149, p. 31; Transcript, Vol.9 p. 2032:9-10 (2011Prieur).
[592] Transcript, Vol.9 pp. 2032:18-2033:2 (Prieur).
[593] Exhibit No. SNWA_147, p. 2-7.

c. Shoshone Ponds

The Management Plan requires monitoring wells in the area of Shoshone Ponds, which is an area of critical environmental concern.[594] Shoshone Ponds exists due to free-flowing artesian wells that were drilled between 1935 and 1971. These wells are the sole source of water for the Ponds.[595] A monitoring location in the Ponds area was selected in consensus with the TRP and the State Engineer's office.[596] It is located approximately one mile to the southeast of the Shoshone Ponds area.[597] 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.[598] 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.[599]

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.[600] Dr. Myers, however, suggested that there may be an alternative flow path along the mountain front.[601] 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.[602] 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.[603] 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.[604] Mr. Prieur testified that the geologic conditions in this area are similar to Cleveland Ranch, where there are interbedded sands and clays near Shoshone Ponds and coarser sand and gravel material up the alluvial fan to the east where the monitoring wells are

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[594] Exhibit No. SNWA_147, pp. 2-4, 2-5; Transcript, Vol.9 p. 2037:2-4 (Prieur).
[595] Transcript, Vol.9 p. 2035:1-4 (Prieur).
[596] Transcript, Vol.9 p. 2040:18-20 (Prieur).
[597] Transcript, Vol.9 p. 2035:2-3 (Prieur).
[598] Transcript, Vol.9 pp. 2036:23-2037:3 (Prieur).
[599] Transcript, Vol.9 p. 2035:13-19 (Prieur).
[600] Transcript, Vol.9 p. 2037:5-7 (Prieur).
[601] Transcript, Vol.9 p. 2040:7-9 (Prieur).
[602] Transcript, Vol.9 p. 2037:7-10 (Prieur).
[603] Transcript, Vol.9 pp. 2035:6-2036:18 (Prieur).
[604] Transcript, Vol.9pp. 2039:3-2040:4 (Prieur).

located.[605] Ultimately, Mr. Prieur concluded that the location of the monitoring wells will provide for effective monitoring of any spread of drawdown toward Shoshone Ponds.[606] 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. Interbasin Monitoring Zone

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 ("Zone").[607] 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. The Management 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.[608] In addition, four additional basin-fill wells in the Zone were selected as part of the monitoring well network.[609]

Part of the hydraulic gradient analysis requires a geologic investigation. The Applicant has already drilled one monitor and one test well in the 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 test wells in the Zone.[610]

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.[611] 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

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[605] Transcript, Vol.9 p. 2036:2-12 (Prieur).
[606] Transcript, Vol.9 p. 2041:7-12 (Prieur).
[607] Exhibit No. SNWA_149, p. 15; Transcript, Vol.9 pp. 2041:24-2042:8 (Prieur).
[608] Transcript, Vol.9 p. 2042:21-23 (Prieur).
[609] Transcript, Vol.9 p. 2042:23-25 (Prieur).
[610] Transcript, Vol.9 p. 2044:8-10 (Prieur).
[611] Transcript, Vol.9 p. 2050:6-2051:1 (Prieur).

site. The cost to develop the new Zone monitor wells will be approximately $1.3 to $1.4 million.[612]

There are two "near zone monitoring wells" included in the Plan.[613] These wells will be sited between the nearest carbonate-production well and the nearest basin-fill 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.[614]

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.[615] These wells have provided new information about the potential interbasin flow in this area.

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.[616] 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 it.[617] 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 Applicant shall 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

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[612] Transcript, Vol.9 p. 2051:4-6 (Prieur).
[613] Exhibit No. SNWA_149, p. 17; Transcript, Vol.9 p. 2052:6-8 (Prieur).
[614] Transcript, Vol.9 pp. 2052:25-2053:9 (Prieur).
[615] Transcript, Vol.9 p. 2053: 12-20 (Prieur).
[616] Exhibit No. MILL_011, pp. 8-9.
[617] Exhibit No. MILL_011, pp. 9, 13.

Snake Valley would necessarily be detected by the monitoring sites that are located in the flow path between the valleys.

e. Big Springs

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.[618] 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.[619] When Mr. Prieur referred to southern Snake Valley, it is accepted that he was actually referring to northern Hamlin Valley, a Nevada Hydrographic Area that is located within the larger Snake Valley, Nevada and Utah. 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. Tribal Resources

The Management Plan also includes monitoring designed to protect the water resources of the Confederated Tribes of the Goshute Reservation ("CTGR"), whose reservation 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 U.S. 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.[620] 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.

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[618] Exhibit No. SNWA_147.
[619] Transcript, Vol.9 p. 2058:12-19 (Prieur).
[620] Transcript, Vol.11 p. 2479:11-14 (Prieur).

2. Management Tools

The Management Plan requires the data collection efforts be coordinated with the development and refinement of a groundwater model for the purpose of managing the water resource in Spring Valley.[621] 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 to prevent impacts.[622] 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.

The Applicant's model will be improved in the future as more data is collected.[623] 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.[624] Dr. Myers testified that once data from large-scale stresses are available, models can be calibrated to allow experts to make local-scale predictions on impacts from pumping.[625] As the model continues to improve, it will be used as a management tool by the State Engineer to monitor and manage the Applicant's 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 be used to prevent impacts currently predicted by the models in this hearing. The State Engineer will use the Applicant's model for monitoring and management purposes in the development of the Applications. The State Engineer requires that the model be included in the Management Plan and updated for the purpose of assessing any emerging potential conflicts with existing rights.

Protestants GBWN and CPB assert that the absence of quantitative standards or triggers in the Applicant's Plan will limit its effectiveness. 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

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[621] Transcript, Vol.9 p. 2064:2-8 (Prieur).
[622] Transcript, Vol.9 p. 2064:1-9 (Prieur).
[623] Exhibit No. SNWA_087, p. 1, p. 20.
[624] Exhibit No. SNWA_428, p. 10; Transcript, Vol.20 pp. 4473:22–4474:15 (Myers).
[625] Transcript, Vol.21 pp. 4598:13–4599:10 (Myers).

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.[626] The same situation is not present in Spring Valley. 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 thresholds.[627] 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.[628] The proper place to address pumping management concerns is in an operation plan for pumping management.[629]

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.[630] 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. Mr. Prieur and Dr. Harrington both agreed that the need for mitigation actions should be assessed on a case-by-case, or a site-by-site basis.[631] Mr. Prieur testified that there is a wide range of mitigation alternatives.[632] Possible mitigation alternatives could include cessation of pumping, modifying the pumping regime, changing the location of pumping, drilling new wells, lowering a pump, or providing alternative sources of water.[633] A wide range of environmental mitigation alternatives also are available, and are discussed in the "Environmental Soundness" section below.

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[626] Transcript, Vol.23 p. 5294:15-21 (Harrington).
[627] Transcript, Vol.23 p. 5292:10-15 (Haringtон).
[628] Transcript, Vol.23 pp. 5286:18 - 5287:7 (Harrington).
[629] Transcript, Vol.23 p. 5308:11-17 (Harrington).
[630] Transcript, Vol.9 p. 2078:8-14 (Prieur).
[631] Transcript, Vol. 9 p. 2078:19-23 (Prieur); Transcript, Vol. 23 pp. 5301:3-5302:15 (Harrington).
[632] Transcript, Vol.9 p. 2078:19-23 (Prieur).
[633] Transcript, Vol.9 p. 2079:2-11 (Prieur).

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.[634] 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.[635]

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. He testified that reducing or ceasing pumping is a technically feasible way to mitigate impacts of pumping,[636] and that stopping pumping would allow the basin to recover, but notes, however, that it may not achieve full recovery and that recovery may take a long time.[637] Dr. Bredehoeft also testified that the Endangered Species Act may effectively force the reduction or cessation of pumping.[638] In addition, the federal stipulations may require the Applicant to reduce pumping.[639] 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.[640]

The State Engineer finds that the Applicant has presented a comprehensive monitoring, management and mitigation plan. 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 mitigation options, together with the required Management Plan and staged

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[634] Transcript, Vol.11 p. 2397:2-8 (Entsminger).
[635] Transcript, Vol.11 pp. 2397:18-2398:9 (Entsminger).
[636] Transcript, Vol.24 pp. 5464:22–5465:4 (Bredehoeft).
[637] Transcript, Vol.24 p. 5378:1–17, p. 5402:9–13 (Bredehoeft).
[638] Transcript, Vol.24 p. 5465:13–23 (Bredehoeft).
[639] Transcript, Vol.11 p. 2384:8–25 (Prieur).
[640] Transcript, Vol.11 pp. 2385:1-2389:12 (Prieur).

development, will ensure the development of the Applications in a sustainable manner that will avoid conflicts with existing rights. 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.[641] The State Engineer finds that Nevada Revised Statutes grant him authority to amend the Management Plan as necessary. Accordingly, the State Engineer will make the Spring Valley Management Plan a requirement of the permit terms for the Applications.

B. Analysis for Conflicts with Existing Rights

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,[642] conducted a conflicts analysis by first identifying the Application points of diversion, existing rights and environmental areas of interest within Spring Valley.[643] The existing rights were queried from the Nevada Division of Water Resources database in September 2010 and updated in April 2011.[644] Federal claims of water rights and resources were included in this analysis.[645] 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.[646] Mr. Watrus testified that he analyzed all of the identified water rights and environmental areas of interest in his conflicts analysis.[647] With this information, Mr. Watrus followed three steps in his analysis. First, he conducted a

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[641] *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) (where pumping exceeds recharge, State Engineer may restrict pumping based on priority rights); and NRS 534.110(5) (unreasonable adverse effects to domestic wells may be mitigated or pumping limited).
[642] Mr. Watrus is a senior hydrologist with the Southern Nevada Water Authority and was qualified as an expert in groundwater hydrology. Transcript, Vol.11 pp. 2537: 3-2538:6.
[643] Transcript, Vol.11 pp. 2540:24-2541:2 (Watrus).
[644] Exhibit No. SNWA_337, Appendix A; Transcript, Vol.11 p. 2551:7-9 (Watrus).
[645] Transcript, Vol.11 p. 2551:1-4 (Watrus).
[646] Exhibit No. SNWA_337, pp. 3-6, 3-7; Transcript, Vol.11 p. 2551:1-7 (Watrus).
[647] Transcript, Vol.11 pp. 2552:11-2555:3 (Watrus).

qualitative analysis, which assessed potential conflicts based on water right ownership, geographical location, and priority date.[648] 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.[649] 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.[650]

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 are junior in priority to the Applications and those that are owned by the Applicant were excluded from further analysis.[651] 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.[652] Since mountain block springs are likely perched and fed from a different water source than that sought under 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.[653] After the first qualitative analysis was complete, there were 114 water rights in Spring Valley that were subject to further conflicts analysis.

2. Quantitative Analysis with Groundwater Model

The Applicant next used the Applicant's 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 simulate pumping in Spring Valley: the Applicant's model, originally designed for the BLM's

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[648] Transcript, Vol.11 pp. 2540:23-2541:3 (Watrus).
[649] Transcript, Vol.11 p. 2541:2-5 (Watrus).
[650] Transcript, Vol.11 p. 2541:5-8 (Watrus).
[651] Transcript, Vol.11 p. 2574:2-8 (Watrus).
[652] Transcript, Vol.11 p. 2572:5-7 (Watrus).
[653] Transcript, Vol.27 p. 6068:8-14 (Mayo).

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; however, the fact that the two models, different as they are, provide similar results gives the State Engineer confidence in the overall models' results.

a. BLM DEIS Model

The Applicant's numerical model was originally developed for the 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.[654] The Applicant provides assistance as needed to BLM as the BLM complies with the NEPA by preparing a DEIS that considers the environmental consequences of the BLM's decision and provides an opportunity for public involvement.[655] As part of the DEIS process, the BLM determined that a groundwater model was needed.[656]

Ms. Luptowitz is the Environmental Resources Division Manager for the Applicant.[657] 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.[658] 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.[659] The BLM will conduct more specific analysis when site-specific right-of-way applications are made for wells.[660] Under the NEPA, the BLM can grant the right-of-way even if the model simulates impacts to existing rights and environmental resources.[661] For the purposes of the current DEIS, the model does not need to predict absolute or specific values at specific locations.[662]

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

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[654] Exhibit No. SNWA_089, p. 1-1.
[655] Transcript, Vol.9 pp. 1881:4–1882:1 (Luptowitz).
[656] Transcript, Vol.9 p. 1882:7–9 (Luptowitz).
[657] Exhibit No. SNWA_362.
[658] Transcript, Vol.9 pp. 1882:24–1883:11 (Luptowitz).
[659] Transcript, Vol.9 p. 1883:12–18 (Luptowitz).
[660] Transcript, Vol.9 pp. 1883:19–1885: 3 (Luptowitz).
[661] Transcript, Vol.9 pp. 1887:16–1888:2 (Luptowitz).
[662] Transcript, Vol.9 p. 1887:10–13 (Luptowitz).

representatives from the BLM and consulting experts.[663] A representative from the State Engineer's office also attended technical meetings on model development.[664] The model was reviewed by the cooperating agencies for the NEPA process.[665] The Applicant prepared the groundwater model under the direction of the BLM Hydrology Technical Group. The BLM is ultimately responsible for the groundwater model.[666]

The Hydrology Technical Group collaborated on the model development from November 2006 to November of 2009, including an 18-month period of intense collaboration.[667] The Hydrology Technical Group consisted of local, regional, and national representatives from the BLM as well as Dr. Eileen Poeter from the Colorado School of Mines and Dr. Keith Halford from the USGS.[668] Dr. Poeter has been involved in hydrogeologic and groundwater research for 30 years and is considered an international authority in groundwater modeling.[669] Dr. Halford is an experienced groundwater modeler who has developed and published numerous models in many parts of the country.[670] In addition, representatives from the State Engineer's office participated as observers.[671] Earth Knowledge, Inc., itself spent approximately 15,000 person-hours on the project.[672] Dr. D'Agnese, President of Earth Knowledge and an expert in groundwater modeling, [673] 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.[674] He opined that the level of time and collaboration significantly benefited the model.[675]

The model was developed using the MODFLOW-2000 modeling code with some customizations.[676] The development of the model was completed according to Hill and

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[663] Exhibit No. SNWA_087, p. 5; Transcript, Vol.9 pp. 1895:18–1896:18 (D'Agnese).
[664] Exhibit No. SNWA_087, p. 6.
[665] Exhibit No. SNWA_087, p. 2.
[666] Transcript, Vol.9 pp. 1882:10–20 (Luptowitz), 1899:9–11 (D'Agnese).
[667] Exhibit No. SNWA_087, p. 5; Transcript, Vol.9 pp. 1898:2–1899:4 (D'Agnese).
[668] Transcript, Vol.9 p. 1896:10-18 (D'Agnese).
[669] Transcript, Vol.9 p. 1897:9-14 (D'Agnese).
[670] Transcript, Vol.9 pp. 1897:21–1898:1 (D'Agnese).
[671] Transcript, Vol.9 p. 1896:15-18 (D'Agnese).
[672] Transcript, Vol.9 p. 1900:5–8 (D'Agnese).
[673] 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).
[674] Transcript, Vol.9 p. 1899:12–19 (D'Agnese).
[675] Transcript, Vol.9 pp. 1899:24–1900:2 (D'Agnese).
[676] Exhibit No. SNWA_087, pp. 4–5.

Tiedeman's 14 Guidelines for effective model calibration.[677] Dr. D'Agnese testified that Hill and Tiedeman's 14 Guidelines are accepted as authoritative in the field of groundwater modeling.[678] The State Engineer finds that following Hill and Tiedeman's 14 Guidelines enhances the reliability of a groundwater model.

For purposes of the hearing on the Applications, the Applicant used a model that differed slightly from the model used by the 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.[679] 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.[680] Dr. Myers notes that the per-basin recharge in the Applicant's numerical model is different than that in the Applicant's conceptual model.[681] The Applicant argues 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) Scope of BLM DEIS Model

In light of the model's purpose - to support analysis under the 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 local features that are not connected to the regional features.[682] 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 flow system boundaries. Dr. D'Agnese testified that predictions in cells where wells are located should not be relied on.[683]

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[677] Exhibit No. SNWA_087, p. 4, p. 15.
[678] Transcript, Vol.9 p. 1913:13–21 (D'Agnese).
[679] Exhibit No. SNWA_090, pp. 3-1 to 3-3.
[680] Exhibit No. GBWN_103, p. 27; Exhibit No. GBWN_104, p. 15.
[681] Exhibit No. GBWN_104, p. 10.
[682] Exhibit No. SNWA_087, p. 1; Transcript, Vol.9 p. 1909:18–25 (D'Agnese).
[683] Exhibit No. SNWA_087, p. 2; Transcript, Vol.9 p. 1908:12-1909:17 (D'Agnese).

The model covers 20,688 square miles, including Spring, Cave, Dry Lake, and Delamar Valleys.[684] Though there are other regional models of similar size in the United States, they typically have much more available data.[685] The model grid-cells are each one kilometer by one kilometer.[686] The Applicant's model has 474 rows, 202 columns, and 11 layers with a total of 589,391 active cells.[687] Dr. D'Agnese testified that the data resolution for the area did not justify using smaller grid-cell sizes.[688] 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.[689]

The complexity and large size of the region modeled and the sparseness of available data result in uncertainties in the Applicant's model simulations.[690] Furthermore, the lack of good historical data on anthropological uses of groundwater provides further uncertainty to the model simulations.[691] 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 to make drawdown predictions at Cleveland Ranch or spring-flow predictions for the Gandy Warm Springs and McGill Springs.[692]

All layers in the Applicant's model are simulated as confined.[693] Dr. Myers states that the use of a confined top layer biases the Applicant's model to under-predict drawdowns.[694] 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.[695] 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

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[684] Exhibit No. SNWA_089, pp. 1-2, p. 4-2; Transcript, Vol.9 p. 1902:20–21 (D'Agnese).
[685] *See* Transcript, Vol.9 p. 1903:1–1906:6 (D'Agnese).
[686] Exhibit No. SNWA_087, p. 11; Exhibit No. 089, p. 4-1; Transcript, Vol.9 p. 1907:2–4 (D'Agnese).
[687] Exhibit No. SNWA_089, pp. 3-4, 4-2.
[688] Exhibit No. SNWA_087, p. 11; Transcript, Vol.9 pp. 1907:5–1908:11 (D'Agnese).
[689] Transcript, Vol.9 pp. 1906:20–1907:1, pp. 2026:9–2027:15 (D'Agnese).
[690] Exhibit No. SNWA_087, p. 9.
[691] Exhibit No. SNWA_087, p. 12.
[692] Transcript, Vol.9 p. 1911:2–15, p. 1915:7–9 (D'Agnese).
[693] Exhibit No. SNWA_089, p. 4-2.
[694] Transcript, Vol.18 pp. 4090:25–4091:3, p. 4094:2–10 (Myers).
[695] Exhibit No. SNWA_089, p. 4-2, p. 4-4.

of a confined layer for the top layer made the model inappropriate to use for this hearing.[696] 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.[697]

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.[698] Dr. Myers also states that the Applicant's model structure is far too complex for the quantity and quality of hydrologic data used to calibrate it.[699]

(2) Model Construction

The Applicant used Horizontal Flow Barriers ("HFB") to represent geologic faults when they were considered to be barriers to groundwater flow.[700] 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.[701] 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.[702] Dr. D'Agnese, when questioned about this issue, explained that the model was completed prior to the completion of Rowley, et al. (2011) and so could not have relied on it. Dr. D'Agnese's response to this question is perplexing; if he did not rely on Rowley, et al. (2011),[703] then what is the purpose of Rowley's work? Dr. D'Agnese **did** rely on previous work of Rowley, including his contributions to the conceptual model, where those structures between Steptoe and Spring Valleys are clearly documented.[704] His response to this question seems disingenuous. He later stated that the HFB is not meant to be a complete barrier to groundwater flow; it is only meant to impede flow.[705]

Dr. Myers also argues 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

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[696] Transcript, Vol.9 pp. 1918:17–1919:16 (D'Agnese).
[697] Transcript, Vol.18 pp. 4107:25–4109:16 (Myers).
[698] Exhibit No. GBWN_104, pp. 14–15.
[699] Exhibit No. GBWN_104, p. 15.
[700] Exhibit No. SNWA_089, p. 4-16.
[701] Exhibit No. GBWN_104, pp. 4–8, p. 15; Transcript, Vol.18 p. 4092:15–22 (Myers).
[702] Exhibit No. GBWN_104, p. 9; Transcript, Vol.18 pp. 4085:17–4086:19 (Myers).
[703] Transcript, Vol.9 pp. 1922:9–1923:12 (D'Agnese); Exhibit No. SNWA_058.
[704] Exhibit No. SNWA_087, Plate 2.
[705] Transcript, Vol.9 pp. 1922:9–1923:12 (D'Agnese).

plastic clay and that the fill should typically have a lower specific storage value. This results in the model releasing more water from storage per foot of drawdown.[706] 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.[707]

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.[708] 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.[709] The Applicant used both manual trial-and-error and automated-regression methods to calibrate the model.[710] 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 observations, and 144 spring or stream flow observations to constrain the model calibration.[711] The Applicant weighted observations so that more reliable measurements were given more weight during calibration.[712] Only a subset of the regional and intermediate springs in the model was used for calibration targets.[713] The Applicant argues 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, and that one can have little confidence in the precision of spring flow predictions for such springs that were not included in the calibration process.[714]

Dr. D'Agnese testified that the model simulates the regional intermediate spring flows that were used as calibration targets quite well over time.[715] He also states that, though the

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[706] Exhibit No. GBWN_104, p. 9; Transcript, Vol.18 pp. 4084:21–4085:9 (Myers).
[707] Transcript, Vol.9 pp. 1923:22–1924:14 (D'Agnese).
[708] Transcript, Vol.9 pp. 1914:17–1915:2 (D'Agnese).
[709] Exhibit No. SNWA_087, p. 3.
[710] Exhibit No. SNWA_087, p. 6.
[711] Exhibit No. SNWA_087, p. 17.
[712] Exhibit No. SNWA_087, p. 7.
[713] Transcript, Vol.9 pp. 1910:1–1911:1 (D'Agnese).
[714] Exhibit No. 407, p. 5.
[715] Transcript, Vol.9 p. 1915:16–24 (D'Agnese).

model does not accurately simulate individual ET locations, it simulates aggregate ET well.[716] Dr. Myers asserts that the Applicant's model has a bias toward positive un-weighted 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.[717] 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

Two model simulations were submitted by the Applicant, one using a baseline scenario and one that simulated pumping the full volume of the Applications.[718] Drawdown maps were prepared based on the difference in model results between the two scenarios.[719] In addition, changes in spring flow volumes were analyzed.[720] Mr. Watrus used the baseline pumping scenario to set the initial conditions of the water table.[721] He then used the full volume scenario to simulate the water elevations under pumping stresses.[722] 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.[723] The baseline water-level elevations and spring flows were subtracted from the pumping elevations and spring flows to determine drawdown of the aquifer and changes in spring flow resulting from simulated pumping of the Applications.[724]

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.[725] 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.[726] Dr. Myers testified that the original version used by the

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[716] Exhibit No. SNWA_087, p. 14.
[717] Exhibit No. GBWN_104, p. 3; Transcript, Vol.18 p. 4082:14–23 (Myers).
[718] Transcript, Vol.11 p. 2574:13-15 (Watrus).
[719] Transcript, Vol.11 pp. 2574:23-2575:4 (Watrus).
[720] Transcript, Vol.11 p. 2575:3-4 (Watrus).
[721] Transcript, Vol.11 p. 2555:5-10 (Watrus).
[722] Transcript, Vol.11 pp. 2555:17-2556:15 (Watrus); Exhibit No. SNWA_337, p. 4-3 and p. 4-4.
[723] Transcript, Vol.11 p. 2557:1-9 (Watrus).
[724] Transcript, Vol.11 p. 2555:11-15 (Watrus).
[725] Exhibit No. SNWA_090, pp. 3-1 to 3-3.
[726] Transcript, Vol.11 p. 2550:12-13 (Watrus).

Applicant during this hearing is likely a more accurate representation of the hydrogeology of Big Springs.[727]

Dr. Myers suggested that the conflicts analysis should have used the pumping scenarios identified in the DEIS.[728] The DEIS alternative pumping scenarios mainly simulate distributed pumping throughout Spring Valley.[729] 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.[730] 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.[731] 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.[732] 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.[733] On the other hand, Dr. Myers and Dr. Jones ran model simulations to 200 years beyond full build-out.[734] 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 adequate for this

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[727] Transcript, Vol.18 p. 4087:8–12 (Myers).
[728] Transcript, Vol.19 pp. 4219:15-4222"10 (Myers).
[729] Transcript, Vol.11 pp. 2562:19-2563:2 (Watrus).
[730] Transcript, Vol.11 pp. 2562:19-2563:2 (Watrus).
[731] Transcript, Vol.11 p. 2559:3-9 (Watrus).
[732] Transcript, Vol.2 pp. 307:24-308:7 (Holmes).
[733] Transcript, Vol.2 p. 308:10-15 (Holmes).
[734] Exhibit No. GBWN_003, p.5; Transcript, Vol.27 p. 6009:13-18 (Jones).

conflicts analysis given the practical considerations provided by the Applicant and the substantial amount of uncertainty for longer prediction periods.

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.[735] For the simulation, the Applicant moved the Application point of diversion into alluvial material.[736] The geology in the actual location of the point of diversion is alluvial material, which, according to Mr. Watrus, is suitable for production.[737] Dr. Myers confronted a similar problem at more than one point of diversion in his simulations and used a similar technique to resolve the problem.[738] 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. He argues that the Project would be developed in a manner that responded to impacts before the drawdowns that are predicted in the model would occur.[739]

Second, Mr. Watrus testified that the volume of precipitation recharge that is simulated in the model is 82,600 afa as opposed to their estimate of 99,200 afa.[740] 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.[741] 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

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[735] Exhibit No. SNWA_337, p. 4-5; Transcript, Vol.11 p. 2560:18-2561:16 (Watrus).
[736] Exhibit No. SNWA_337, p. 4-5; Transcript, Vol.11 p. 2561:7-23 (Watrus).
[737] Exhibit No. SNWA_337, p. 4-5; Transcript, Vol.11 p. 2561:17-2562:8 (Watrus).
[738] Exhibit No. GBWN_003, p. 6.
[739] Transcript, Vol.11 pp. 2558:6-2559:6; p. 2558:13-16 (Watrus).
[740] Transcript, Vol.11 p. 2566:4-7 (Watrus).
[741] Transcript, Vol.11 p. 2566:10-12 (Watrus).

whole simply because the simulation includes pumping greater than perennial yield.[742] A simulation that includes more recharge, and pumping at the rate than is ultimately approved by the State Engineer for these Applications, would predict less drawdowns and decreases in spring flows.

Third, as stated above, the model is a regional model whose site-specific predictions are highly uncertain. The model cannot currently represent the complex geologic stratification on the valley floor in Spring Valley.[743] The model represents uniform drawdown in an area that has potentially numerous confined units, which would influence drawdown.[744] 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.[745]

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.[746] Mr. Watrus did not consider the model results sufficiently accurate to predict specific drawdowns and specific spring discharges.[747] 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%.

For the DEIS analysis, different threshold values were used. In particular, the DEIS used a drawdown threshold of 10 feet and a 5% change in spring discharge for the purpose of comparing the potential impacts from the different pumping scenarios.[748] 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

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[742] Transcript, Vol.11 p. 2566:10-24 (Watrus).
[743] Transcript, Vol.11 p. 2585:2-12 (Watrus).
[744] Transcript, Vol.11 p. 2585:2-19 (Watrus).
[745] Transcript, Vol.11 pp. 2565:17- 2566:9;2567:25-2569-7 (Watrus).
[746] Transcript, Vol.11 p. 2575:3-7 (Watrus).
[747] Transcript, Vol.11 pp. 2574:23-2575:2 (Watrus).
[748] Transcript, Vol.9 p. 1890:4-7 (Luptowitz).

effects between the different alternatives.[749] 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.[750] The DEIS is meant to disclose a regional comparison of alternatives without having site-specific pumping locations.[751] 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 water law.[752]

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.[753] Dr. Jones further testified that the screening criteria should be used in conjunction with the actual drawdown numbers.[754]

The State Engineer finds that predictions of the models become increasingly uncertain over extended periods of time. 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. 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%. 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.[755] However, because the model does not accurately represent local-scale geologic and hydrogeologic features that influence drawdown, numeric drawdown predictions are not precise.

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

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[749] Transcript, Vol.9 p. 1890:4-7 (Luptowitz).
[750] Transcript, Vol.9 p. 1890:20-23 (Luptowitz).
[751] Exhibit No. SNWA_337, p. 6-2; Transcript, Vol.9 pp. 1889:7–1890:7 (Luptowitz).
[752] Exhibit No. SNWA_408, p. 3.3-93.
[753] Transcript, Vol.27 p. 6001:22-24 (Jones).
[754] Transcript, Vol.27 p. 6001:24-25 (Jones).
[755] Transcript, Vol.27 p. 6002:7-11 (Jones).

3. Site-Specific Qualitative Analysis of Impacts to Existing Rights and Environmental Areas of Interest

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%.[756] 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.

a. Groundwater Rights

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. Nevada Revised Statute 534.110 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 drawdown at an existing water right, such a drawdown will not prevent the State Engineer from granting a permit for the new appropriation provided that drawdown is not unreasonable.

Permits 29371 (Certificate 10328) and 29567 (Certificate 10329) share a well, which corresponds to Well Driller's Log 10816 that is available in the State Engineer's records.[757] 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.[758] The saturated depth of this well is 174 feet. The State Engineer finds that this well

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[756] Exhibit No. SNWA_337, p. 6-4.
[757] Exhibit No. SNWA_337, p. 6-6.
[758] Exhibit No. SNWA_341; Transcript, Vol.11 pp. 2581:17-2582:6 (Watrus).

can accommodate a reasonable lowering of the water table at this location without causing a conflict to these existing rights. Permit 31239 (Certificate 10334) corresponds with Well Driller's Log 17124.[759] For this well, the completion depth is 535 feet and the static water level is 231 feet.[760] Again, the State Engineer finds that the saturated depth of this well, 304 feet, can accommodate a reasonable lowering of 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, Permits 7446 (Certificate 1515), 8075 (Certificate 1366), and 8077 (Certificate 1368), are located on the valley floor.[761] The water rights are small volume stock-water rights.[762] There is no well driller's log for these wells, and the Applicant determined that the wells were completed at shallow depths.[763] 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.[764]

Other than CPB rights, which are discussed below, the final underground right, Permit 45496 (Certificate 11965), is located at the interface of the valley floor and the alluvial fan.[765] The water right is a stock-water right with an annual duty of 86.24 acre-feet.[766] The well for this water right is completed to a depth of 495 feet and has a static water level of 407 feet below ground surface.[767] 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.[768] 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

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[759] Exhibit No. SNWA_341; Transcript, Vol.11 p. 2583:3-4 (Watrus).
[760] Exhibit No. SNWA_341; Transcript, Vol.11 pp. 2583:18-2584:1 (Watrus).
[761] Transcript, Vol.11 pp. 2583:25-2584:2 (Watrus).
[762] Transcript, Vol.11 p. 2586:1-6 (Watrus).
[763] Transcript, Vol.11 p. 2584:7-11 (Watrus).
[764] Transcript, Vol.11 p. 2586:1-6 (Watrus).
[765] Exhibit No. SNWA_337, p. 6-6; Transcript, Vol.11 p. 2586:3-6 (Watrus).
[766] Exhibit No. SNWA_337, p. 6-6; Transcript, Vol.11 p. 2586:11-13 (Watrus).
[767] Exhibit No. SNWA_337, p. 6-6; Transcript, Vol.11 p. 2586:6-8 (Watrus).
[768] Exhibit No. SNWA_337, p. 6-8.

conflicts during this time and will require mitigation if unreasonable drawdown is likely to occur.

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. Spring Rights

The next group of water rights is spring rights. The model simulated greater than 50 feet of drawdown at claimed and unadjudicated Federal reserved rights associated with Unnamed Spring, Four Wheel Drive Spring, and Spring Creek Spring.[769] The Applicant entered into stipulations with the Federal Agencies and the U.S. Forest Service regarding these claimed reserved rights.[770] The State Engineer finds that any conflicts with Federal claims of reserved rights will be managed by the parties pursuant to those stipulations. However, regardless of the stipulations, if these claimed water rights are impacted by pumping pursuant to the Applications, the Applicant will also be required to address the impacts to the satisfaction of the State Engineer.

The model also simulated a reduction in spring flow greater than 15% at North and South Millick Springs, which are located on the valley floor.[771] There are CPB water rights on these springs. Also, Permits 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% at these springs, these springs were not included as calibration targets in the model and there is no certainty that this simulation is accurate.[772] The State Engineer notes that this drawdown may be exaggerated due to over-simulated pumping in the model and the lack of simulated geologic complexity on the valley floor. The State Engineer finds that there is a significant amount of monitoring occurring between these rights and the Application points of diversion, which will help detect the

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[769] The Federal Reserve Water Rights Claims 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. 2590:4-7 (Watrus).
[770] Exhibit No. SE_041; Exhibit No. SE_095.
[771] Exhibit No. SNWA_337, p.6-8.
[772] Transcript, Vol.11, pp. 2591:23-2592:3 (Watrus).

spread of drawdown toward these rights for the purpose of preventing impacts or implementing mitigation measures, if needed.

c. Stream Rights

The final group of water rights analyzed is stream rights. The model simulated greater than 50 feet of drawdown at Cleve Creek, Bastian Creek, and Willard Creek.[773] Cleve Creek and Bastian Creek will be discussed in the Cleveland Ranch section below. The model simulated drawdown in excess of 50 feet at Willard Creek.[774] There are two senior water rights associated with Willard Creek, Permit 983 (Certificate 171) and Permit 1052 (Certificate 244).[775] The depth to groundwater in the vicinity of these rights is 14 feet and 80 feet, respectively.[776] 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.[777] 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. Environmental Areas of Interest

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%.[778] All of these springs will be monitored in accordance with the Management Plan and the Stipulated Agreements between the Applicant and the Federal Agencies and the U.S. Forest Service. A more detailed analysis of these areas of interest is included in the "Environmental Soundness" section of this ruling.

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[773] Exhibit No. SNWA_337, p. 6-10.
[774] Exhibit No. SNWA_337, p. 6-10.
[775] Exhibit No. SNWA_337, p. 6-10.
[776] Transcript, Vol.11 pp. 2594:19--2595:11 (Watrus).
[777] *See* Transcript, Vol.27 p. 6085:3-15 (Mayo).
[778] Exhibit No. SNWA_337, p. 6-12.

e. Cleveland Ranch and the Corporation of the Presiding Bishop of the Church of Jesus Christ of Latter-Day Saints Water Rights

The CPB filed protests to Applications 54009 - 54018 and 54020 - 54021, which are located in the vicinity of the CPB-owned Cleveland and Rogers Ranches in northern Spring Valley, Nevada.[779] 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.[780] The general geographic locations of the CPB protested applications are shown on page 10 of CPB Exhibit 11.[781] In vacated Ruling 5726, the State Engineer denied Applications 54016, 54017, 54018 and 54021, which are located on the Cleve Creek alluvial fan.[782] 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.[783]

Drs. Norman Jones and Alan Mayo testified on behalf of CPB regarding potential impacts on the CPB water rights. Dr. Jones was qualified as an expert in groundwater modeling, and Dr. Mayo was qualified as an expert in hydrogeology. The witnesses authored a report on the impacts of the Applications on CPB water rights.[784] The report uses the Applicant's groundwater model for all simulations, and includes drawdown maps and tables. 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 - 54018 and 54021, which were previously denied; and (3) a scenario representing the development of the full application volume for all of the Applications except Applications 54009 - 54018 and 54020 - 54021 that were protested by CPB.[785] The pumping schedule was as provided by the Applicant: 35,000 afa of pumping from year 2028 to 2038, 64,544 afa from 2028 to 2042, and 91,222 afa from 2042 to 2242.

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[779] CPB Protests to Applications 54009-54018, and 54020-21 (filed March 28, 2011).
[780] CPB Protests to Applications 54009-54018, and 54020-21 (filed March 28, 2011).
[781] Exhibit No. CPB_011, p. 10.
[782] *See, vacated Ruling 5726,* p. 36.
[783] *See, vacated Ruling 5726,* p. 37.
[784] Exhibit No. CPB_011.
[785] Exhibit No. CPB_011, p. 22.

The use of the model for site specific analyses was criticized by the Applicant's experts as being beyond the ability of the model.[786] However, the model is recognized as providing potential drawdowns in the intermediate flow systems in the model area.[787] In describing what the model is not designed for, there is no mention of uses as provided by the CPB witnesses.[788] Furthermore, Dr. Mayo notes that the Applicant used the model in the same fashion, as documented in their conflicts analysis.[789] He agrees that site specific modeling results must be viewed with caution, but the collective results indicate substantial drawdown in areas of the Cleveland Ranch.[790]

South of the Cleve Creek alluvial fan, CPB has groundwater rights associated with Permits 18841, 18842, and 18843.[791] Groundwater Permits 18841 through 18843 were analyzed as part of the Applicant's conflicts analysis, where greater than 50 feet of drawdown is predicted after 50 years of pumping.[792] The wells corresponding to these water rights are listed as flowing under artesian pressure on the water right certificates.[793] The Applicant suggests the water bearing zones for these wells may be completely confined and insulated from the effects of pumping, i.e., drawdown would be much less that simulated.[794] The analyses of the CPB indicate a drawdown of approximately 160 feet after 200 years of pumping all wells, and approximately 80 feet of drawdown after 200 years of pumping all wells except the four on the Cleve Creek fan, what they call their "Minus4" scenario. The Minus4 scenario indicated approximately 40 to 50 feet of drawdown by the year 2117, 91 years after initiation of simulated pumping and 75 years after full pumping. The Protestant's expert testified that confining clay layers are unlikely to be laterally extensive to the extent that drawdown will not occur throughout the aquifer.[795] The State Engineer finds the Protestant's arguments and analyses more persuasive, and disagrees with the Applicant's witness that a local confining layer at a depth of less than 200 feet could prevent drawdown at this location for an extended period of Applicant's

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[786] Exhibit No. SNWA_337, pp. 5-1 to 5-6; Transcript, Vol.9 p. 1909:7-10 (D'Agnese).
[787] Exhibit No. SNWA_087, p. 2.
[788] Exhibit No. SNWA_087, p. 2.
[789] Transcript, Vol. 27, p. 6010; Exhibit No. SNWA_337.
[790] Transcript, Vol. 27, p. 6010 - 6011 (Mayo).
[791] Exhibit No. SNWA_337, Plate 1; Exhibit No. CPB_11, p. 5; V010073, V010074, V010075, V010076, V010077.
[792] Exhibit No. SNWA_337, pp. 6-5, 6-7.
[793] Exhibit No. SNWA_337, p. 6-5.
[794] Exhibit No. SNWA_337, p. 6-5.
[795] Transcript, Vol.27 pp. 6031 - 6032.

pumping. CPB and their expert witnesses and testimony have provided substantial evidence that Applications 54016, 54017, 54018 and 54021, on the Cleve Creek alluvial fan and up-gradient of numerous CPB water rights will impact those rights to the extent that mitigation is not possible or practical.

CPB recently filed vested claims for water rights on Unnamed Spring #7 and #8, South Bastian Spring, South Bastian Spring 2, and Layton Spring. Claimed Federal reserved water rights R05278, R05272 and R05269 are associated with or in the vicinity of Unnamed Springs in this area.[796] The claimed reserved rights are for 67.24, 67.24 and 3.59 acre-feet of spring discharge, respectively.[797] Pursuant to the Stipulation for Withdrawal of Protests between the Applicant and the Federal Agencies, a common goal of the Parties is "1) management of the development of groundwater by [the Applicant] in the Spring Valley HB without causing injury to Federal Water Rights..."[798] In accordance with the Stipulation, a monitoring plan was developed by the Applicant and approved by the State Engineer.[799] The Applicant's Plan incorporates all of the elements from the approved plan.[800] Under the approved plan, a piezometer was installed at Four Wheel Drive Spring, which is located a quarter mile from Unnamed Springs.[801] 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.[802] However, the State Engineer will treat the vested claims at face value, which could change upon adjudication. The State Engineer finds that the mandates of the required Management Plan will protect these rights. Finally, CPB has vested claims to water rights on South Bastian and Layton Springs. Both of these sites have been selected for monitoring.[803] 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.[804] 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

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[796] Exhibit No. SNWA_337, Plate 1.
[797] Exhibit No. SNWA_337, pp. 6-8.
[798] Exhibit No. SE_041, p. 3, G.
[799] Exhibit No. SNWA_153.
[800] Transcript, Vol.8 p. 1840:12-17 (Prieur).
[801] Exhibit No. SNWA_337, p. 6-9.
[802] Transcript, Vol.11 p. 2590:6-25 (Watrus).
[803] Exhibit No. SE_095, Exhibit A, p. 5.
[804] Transcript, Vol.11 pp. 2589:19-2590:25 (Watrus).

potential impacts to these water rights; the State Engineer has the authority to require additional monitoring and will exercise his authority as needed to protect these existing rights, and will require mitigation if warranted.

The next group of water rights is located north and east of the Cleve Creek alluvial fan.[805] The existing rights are located in an area where CPB experts predicted a drawdown of 10 to 20 feet after 75 years of continuous pumping from full build-out.[806] The CPB analyses of pumping scenarios show that spring claims V10086 and V10087 will be minimally affected by pumping of the full Applications after 75 to 200 years, but for the Minus4 scenario, impacts are negligible after 200 years.[807] Drawdown at the Fera well after 75 years of full pumping is approximately 30 feet using the Minus4 pumping scenario.[808] This amount of drawdown over 75 years is reasonable.

Recently filed claims of vested rights V010078 through V010085 are for springs at the toe of the alluvial fan and each claim enough water sufficient to water 2,120 cattle. Vested claims V02818 – V02828 claim a total combined duty of 9,600 afa for irrigation. These claims also are located at the edge of the Cleve Creek alluvial fan. They are within an area where the Applicant's model predicted greater than 50 feet of drawdown.[809] The CPB's Minus4 simulation indicates approximately 20 feet of drawdown after 75 years.[810] The Applicant submitted geologic data for monitoring wells SPR7030M and M2.[811] These wells are located at the base of the alluvial fan in the area of these vested claims.[812] The water levels in both wells are shown as artesian, indicating that the wells penetrate confining units.[813] Both wells show significant clay layers in the range of 10 to 30 feet and 40 to 60 feet below ground surface.[814] In addition, the deeper of the two wells, SPR 7030M2 has clay layers at 110 to 120 feet, 160 to 190 feet and 220

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[805] Recent vested claims in this area include V10086, V10087. 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.
[806] Exhibit No. CPB_011, p. 27.
[807] Exhibit No. CPB_011, p. 39.
[808] Exhibit No. CPB_011, p. 33.
[809] 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.
[810] Exhibit No. CPB_011, p. 33.
[811] Exhibit No. SNWA_179.
[812] Exhibit No. SNWA_149, p. 32.
[813] Exhibit No. SNWA_179, pp. 9, 18.
[814] Exhibit No. SNWA_179, pp. 9, 18.

to 230 feet.[815] Similar stratification is also shown in well log 111291 corresponding to CPB Permit 54024 on the Cleveland Ranch. 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.[816] The clay layers in wells SPR7030M and M2 do not exactly line up with the clay layers shown in well log 111291 indicating an absence of lateral continuity between these clay layers on the valley floor-alluvial fan interface. 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.[817] However, the Cleveland Well is also located in the vicinity of SPR7029M2.[818] 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.[819]

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 avoid impacts to existing rights that derive their source above the clay layers[820] 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.[821]

The CPB has argued that the monitoring and management program will not be effective at protecting existing rights.[822] The Applicant, through numerous arguments and testimony disputes this, insisting that all Applications can be developed without impacting existing rights. Their arguments detailing how confining layers at the toe of the Cleve Creek fan will prevent impacts are not believable. Accordingly, the State Engineer agrees in part with the CPB's position that the monitoring and mitigation plan will be ineffective in protecting their water rights from pumping all 19 applications. The CPB and their expert witnesses and testimony have

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[815] Exhibit No. SNWA_179, p. 18.
[816] Exhibit No. SNWA_468.
[817] Exhibit No. SNWA_180, p. 18.
[818] Exhibit No. CPB_011, p. 5.
[819] Exhibit No. CPB_011, p. 15.
[820] Transcript, Vol.8 pp. 1854:10–1856:6 (Prieur).
[821] Transcript, Vol.27 p. 6032:1-23 (Mayo).
[822] Transcript, Vol.29 p. 6438:11-17 (Hejmanowski).

provided substantial evidence that Applications 54016, 54017, 54018 and 54021, on the Cleve Creek alluvial fan and up-gradient of numerous CPB water rights will impact those rights to the extent that mitigation is not possible or practical; therefore, these applications are denied.

The State Engineer finds because the remaining 15 applications will be developed in a staged manner, the Management Plan will detect effects before any impacts could occur, and management options will be utilized to prevent impacts. Nevertheless, if impacts do occur, the State Engineer has the authority to require mitigation. The State Engineer finds that the 15 applications not located on the Cleve Creek alluvial fan shall be developed in a staged manner, and with the monitoring in place and the management and mitigation options available, will not conflict with existing rights of the CPB.

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. After 200 years, Dr. Myers' model simulates essentially no impacts to Deep Creek Valley, Tippett Valley, or the EskDale Center.[823] The State Engineer finds that approval of the Applications will not conflict with EskDale's existing water rights in Snake Valley.

g. Tribal Protestants

Protestant Confederated Tribes of the Goshute Reservation protested that the Applications would conflict with water rights and/or claims on the Goshute reservation, which lies in Tippett and Deep Creek Valleys, Nevada and Snake Valley, Utah. 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.[824] The land of the Confederated Tribes of the Goshute Reservation is located in Deep Creek, Tippett, Pleasant, and Snake Valleys.[825] The Duckwater Shoshone Tribe's reservation is located in Duckwater Valley/Railroad Valley in Nye County,

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[823] Transcript, Vol.20 pp. 4415:19–4419:11, Vol.21 p. 4666:7–16 (Myers).
[824] *See,* Transcript, Vol.25 pp. 5793:19-5794:4 (Marques); Transcript, Vol.25 p. 5778:5-17 (Sanchez).
[825] Exhibit No. SE_060 (Confederated Tribes of the Goshute Reservation Protest to Application 54003, at 3).

Nevada.[826] 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.[827]

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. However, the State Engineer finds that in the absence of an adjudication 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.

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.[828] 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.[829] No evidence was presented showing drawdown near the City of Ely or Railroad Valley.[830] Therefore, no evidence was presented to support the Tribal Protestants' allegation of impacts to their claimed reserved water rights.

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.[831] 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.

The Tribal Protestants assert many arguments against the Applications under the broad category of threats to the public interest citing to other "existing rights." They argue that the

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[826] Exhibit No. SE_060 (Duckwater Shoshone Tribe Protest to Application 54003, pp. 1–2).
[827] Exhibit No. SE_060 (Ely Shoshone Tribe Protest to Application 54003, p. 3).
[828] Transcript, Vol.26 pp. 5957:8-5958:7 (Myers).
[829] Exhibit No. CTGR_014, p. 3.
[830] *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); 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).
[831] Closing Argument of the Confederated Tribes of the Goshute Reservation, p. 3.

proposed pumping will negatively affect their hunting, gathering, and cultural traditions in Spring Valley, will cause harmful impacts to Native American ritual worship and sacred sites, prehistoric Native American village or dwelling sites, graves or burial sites, and scenes of historic massacres of Tribal ancestry. They assert that the use of water under the Applications would violate federal and state laws that protect cultural, religious and historic resources, including but not limited to: The National Historic Preservation Act, American Indian Religious Freedom Act of 1978, Religious Freedom Restoration Act, Native American Graves Protection and Repatriation Act of 1990, Executive Order 13007, and the Treaty of 1863 in Ruby Valley. They also argue that the Applications should be denied because the use of the water would violate the federal government's trust responsibility to affected Indian tribes, that 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. Finally, their protests assert that the use of the water would unduly injure the Indian Tribes' sovereignty and ability to regulate their territory.

The Tribal Protestants argue the State Engineer should protect claimed treaty rights, i.e., aboriginal hunting and gathering rights and ceremonial use and historic value of natural resources as part of the public interest analysis.[832] Though the Tribal Protestants' current reservation lands are not located in Spring Valley,[833] 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.[834]

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.

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[832] *See, e.g.*, Transcript, Vol.1 48:13-20 (Echohawk) (discussing the importance of elk hunting to the Tribes).
[833] *See*, Duckwater/Ely Joint Closing Statement, p. 4 (Dec. 23, 2011).
[834] *See*, Exhibit No. CTGR_001; Exhibit No. CTGR_005.

4. Myers' Spring and Snake Valley Model

Dr. Myers developed a groundwater model of the Spring and Snake Valleys to predict future conditions in the valleys due to pumping.[835] Dr. Myers developed his model using the MODFLOW-2000 modeling code with additional packages.[836]

There was considerable discussion and evidence presented by all parties regarding the construction, errors, capabilities and accuracy of both the Applicant's and Dr. Myers' models. After considering the models, the evidence and the testimony, 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 better data and techniques, was developed through a more rigorous collaborative process with the BLM and recognized modeling experts, and is accompanied by more 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. 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 addition, the State Engineer is encouraged that the two models, constructed by opposing parties and with opposing perspectives, are similar in many areas, at least when viewed at the regional level.[837] Thus, the State Engineer will use both models' Spring Valley pumping simulations for the purpose of this ruling, but the Applicant's model will be given more weight.

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.[838] 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.[839] 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

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[835] Exhibit No. GBWN_002, p. 1.
[836] Exhibit No. GBWN_002, p. 2.
[837] Transcript, Vol.18 pp. 4111:23–4112:12, Vol.19 p. 4260:147-12, Vol.21 pp. 4668:13–4669:5 (Myers).
[838] *See,* Transcript, Vol.17 p. 3882:19–21; Vol.21 p. 4639:7–15 (Myers).
[839] Exhibit No. GBWN_002, p. 1, p. 42; Transcript, Vol.20 p. 4479:8–12 (Myers).

designed for detailed, local-scale predictions.[840] 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.[841] Furthermore, he testified that the models fail to account for management decisions to reduce or move pumping over the life of the project. Instead, they simulate full pumping of all the Applications 24 hours a day, 365 days a year.[842]

The State Engineer agrees the reliability of model predictions decreases the further out into the future they are made, especially when the period of future simulations exceeds the period of available pumping data.[843] A general rule of thumb is that one can use a model to make 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 predict ten years into the future.[844] This is known as history matching. Dr. Bredehoeft testified that predictions that go out a thousand years are beyond the possibility of history matching.[845] Long-term model projections are subject to the greatest error.[846]

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.[847] The State Engineer agrees that 75 years is a reasonable simulation period, but not due to expected lifetime of the equipment and infrastructure, which can be replaced, rather it is an appropriate length of time given the existing data.

Dr. Myers admits that predictions become more uncertain for periods beyond 75 years and that the predictions are less certain for a 200-year period than for a 75-year period.[848] 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

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[840] Transcript, Vol.20 p. 4418:12–21, p. 4459:12–18 (Myers).
[841] Transcript, Vol.9 p. 1975:1–19 (D'Agnese).
[842] *See,* Transcript, Vol.18 pp. 4105:15–4106:3, Vol.20 p. 4391:3–12, p. 4476:12–24 (Myers).
[843] 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.
[844] *See,* Transcript, Vol.24 p. 5422:21-25 (Bredehoeft).
[845] Transcript, Vol.24 p. 5423:20–23 (Bredehoeft).
[846] Transcript, Vol.24 pp. 5423:24–5424:1 (Bredehoeft).
[847] Exhibit No. SNWA_337, p. 4-4.
[848] Transcript, Vol.17 p. 3780:3–5, Vol.20 pp. 4488:25–4489:3 (Myers).

available to examine trends far into the future.[849] 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 spring flow of less than 15% should not be considered.[850] Dr. Myers suggests that the State Engineer examine drawdowns of one foot. However, he admits that such predictions are imprecise.[851] Dr. Myers notes that even a 12-foot drawdown may result in springs going dry.[852] He states that even though drawdowns of less than ten feet, or even 20 feet, are within the scope of seasonable variability, they should be considered as superimposed on the existing seasonal variability.[853] However, he also admitted that it may be proper not to consider drawdowns of less than ten feet.[854]

The State Engineer finds Dr. Myers' model is useful for approximating the effects of pumping at a basin scale for periods up to 100 years, but that longer time periods are less certain.

Dr. Myers presents his results relative to the simulated steady state of his model. Dr. Myers presented drawdown contours, spring flow hydrographs, and aggregate change in discharge and storage data. He did not, however, analyze 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.[855] Dr. Myers simulated recharge and discharge in Spring Valley such that the Applicant's proposed pumping exceeds recharge by 27% and discharge by 20%.[856]

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.[857] 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.[858]

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[849] Transcript, Vol.18 p. 4107:12–16; Vol.20 pp. 4418:22–4419:2 (Myers).
[850] Exhibit No. SNWA_337, p. 6-1.
[851] Transcript, Vol.18 p. 4107:12–16, Vol.20 pp. 4418:22–4419:2 (Myers).
[852] Transcript, Vol.19 p. 4237:11-21 (Myers).
[853] Transcript, Vol.21 p. 4634:5–8 (Myers).
[854] Transcript, Vol.20 pp. 4477:2–4478:8 (Myers).
[855] Transcript, Vol.21 pp. 4596:4–4597:15 (Myers).
[856] Exhibit No. GBWN_003, p. 4.
[857] Transcript, Vol.18 pp. 4111:23–4112:12, Vol.19 p. 4260:9–14 (Myers).
[858] Exhibit No. GBWN_003, p. 8.

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 uncertainty.[859] Dr. Myers admits that there is imprecision in 1-foot drawdowns, as well as all drawdown contours.[860] He admits that anything within ten feet is within seasonable variability and measurement accuracy.[861] 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.[862] The State Engineer agrees that a drawdown of just a few feet could dry up a spring; however, he also understands that the available models do not have that level of accuracy.

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. The Applicant argues little is gained by examining pumping simulations of greater than 75 years and simulations beyond 75 years become more uncertain. 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.[863] Even looking at Dr. Myers' 10-foot drawdown, simulated impacts are contained within Spring Valley and the western edge of Hamlin Valley.[864]

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.[865] After 200 years, Dr. Myers' model simulates essentially no impacts to Deep Creek Valley, Tippett Valley, or the EskDale Center.[866] 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

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[859] Exhibit No. SNWA_407, p. 3.
[860] Transcript, Vol.18 p. 4107:11–16 (Myers).
[861] Transcript, Vol.20 pp. 4477:2–4478:8 (Myers).
[862] Exhibit No. GBWN_003, p. 7; Transcript, Vol.19 p. 4237:11-21 (Myers).
[863] Exhibit No. GBWN_003, p. 8.
[864] Exhibit No. GBWN_003, p. 10.
[865] Transcript, Vol.18 p. 4119:5–10 (Myers).
[866] Transcript, Vol.20 pp. 4415:19–4419:11, Vol.21 p. 4666:7–16 (Myers).

continue to flow in Dr. Myers' simulation.[867] Simulated flow at South Spring Valley Springs has reduced to about 2,000 afa from about 15,000 afa after 200 years.[868] This impact is likely exaggerated due to Dr. Myers' use of a low-conductivity groundwater divide in Spring Valley.[869]

Dr. Myers' model simulates flow at Big Springs decreasing from about 1,500 afa to about 1,100 afa after 200 years.[870] However, Dr. Myers' simulated flow at Big Springs is not accurate. Recent observed flow at Big Springs has ranged from about 9.5 to 10.5 cubic feet per second,[871] 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.[872] 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.[873] Dr. Myers' simulated reduction in flow is about 25% after 200 years.[874] The impact to Big Springs may be 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.[875] Dr. Myers' model predictions for flow reductions as a percentage of initial flow for Big Springs are consistent with those of the Applicant's model, and add confidence that the models have similar results in this area.

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.[876] After 10,200 years of pumping, Dr. Myers' model is close to a new equilibrium. It simulates 1,310 afa being pumped from storage, or about 1.4% of the pumping amount. 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.[877]

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[867] Exhibit No. GBWN_003, p. 15.
[868] Exhibit No. GBWN_003, p. 23.
[869] *See,* Transcript, Vol.20 pp. 4343:24–4344:11 (Myers).
[870] Exhibit No. GBWN_003, p. 24; Transcript, Vol.20 pp. 4384:24–4385:8 (Myers).
[871] Transcript, Vol.20 pp. 4376:16–4379:21 (Myers).
[872] Exhibit No. GBWN_002, p. 38.
[873] Exhibit No. GBWN_002, p. 38; Transcript, Vol.20 pp. 4380:18–4382:19 (Myers).
[874] Transcript, Vol.20 pp. 4387:9–4389:17 (Myers).
[875] Exhibit No. SNWA_407, p. 6.
[876] Exhibit No. GBWN_003, pp. 25–26.
[877] Transcript, Vol.26 pp. 5957:7–5958:6 (Myers).

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.[878] Reducing the pumping rates decreases the drawdown extent of the 5-foot contour in north 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.[879] The lower pumping rates approach equilibrium faster and remove less water from storage.[880] The lower rates reduce simulated discharge at springs more slowly.[881]

In addition, Dr. Myers provided many simulations of pumping at alternative points of diversion.[882] 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 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.[883] 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.[884] 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.[885] Recovery then occurs slowly

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[878] Exhibit No. GBWN_003, p. 7.
[879] Exhibit No. GBWN_003, pp. 16–19.
[880] Exhibit No. GBWN_003, p. 20.
[881] Exhibit No. GBWN_003, pp. 21–22.
[882] *See,* Exhibit No. GBWN_105; Exhibit No. CTGR_014.
[883] Exhibit No. GBWN_003, pp. 11–14.
[884] Exhibit No. GBWN_003, p. 15.
[885] Exhibit No. GBWN_003, p. 14.

in his model, with the rate still being less than 85% of the steady state rate 600 years after pumping ceases.[886]

In sum, Dr. Myers' simulations do not alter the State Engineer's analysis of impacts. The impacts simulated by Dr. Myers are uncertain given the amount of simulated drawdown or reduction in flow spread over hundreds or thousands of years. The State Engineer finds Dr. Myers' model is useful for analyzing effects of pumping, but that predictions of effects after hundreds of years will carry little weight. After considering both the Applicant's and Dr. Myers' models, the State Engineer finds that the Applicant's model is more comprehensive, better documented and peer reviewed, and will carry more weight in impacts analyses.

5. Addressing Uncertainty

In order to ensure that existing rights are not impacted, additional information is necessary.[887] Staged development, in conjunction with an updated and more comprehensive Management Plan 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 a staged development plan for the Applications granted in this ruling.

Water rights shall be developed in a staged progression, with a minimum of eight years for each stage. Pumping at any time may be adjusted by the State Engineer based on observed or predicted effects from prior stage pumping. The State Engineer finds that staged development of the resource under the applications granted 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.

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[886] Exhibit No. GBWN_003, p. 24.
[887] NRS 533.3705.

VI. PUBLIC INTEREST

Nevada Revised Statute 533.370 provides that the State Engineer must reject an application if the proposed use "threatens to prove detrimental to the public interest." There is no specific statutory definition of the public interest considerations and not all the same considerations are applicable to all the various types of applications that come before the State Engineer. The criterion must be addressed on a case-by-case basis.

In State Engineer's Ruling No. 5726, which is the first ruling issued on these applications in Spring Valley, the State Engineer reviewed the case law and the history of how State Engineers have interpreted this statutory provision. In this ruling, the State Engineer further refines that analysis for the applications under consideration here and provides specific criteria that will be considered in this case under this statutory provision. The State Engineer notes that other statutory criteria, such as the provisions of NRS 533.370(3), which addresses interbasin transfers of groundwater, also address what the State Engineer considers to be public interest issues. For example, whether the proposed action is environmentally sound as it relates to the basin from which the water is exported. However, in the State Engineer's analysis in this section of the ruling, the focus will be the public interest criteria that are not found within specific provisions of the law that must be, and are, considered elsewhere in this ruling.

A. Analysis of Judicial Interpretations

Only one Nevada Supreme Court case addresses this statutory criterion. In what is commonly known as the Honey Lake case, the State Engineer issued a ruling on pending water right applications, and on appeal the district court concluded that the State Engineer had not specifically determined whether the applications were detrimental to the public interest and remanded the matter to the State Engineer to further consider that statutory criterion. Upon remand, the State Engineer identified 13 policy considerations contained in Nevada water statutes to help define the public interest in that case. The State Engineer further found that the Nevada Legislature has provided substantial guidance as to what it determines to be in the public interest and indicated that, in his review of Nevada water law, an additional 13 other principles (for a total of 26) should also serve as guidelines in the determination of what constitutes "the public interest" within the meaning of NRS 533.370. On further appeal, the Nevada Supreme Court specifically addressed whether the State Engineer had properly defined the meaning of the "public interest" and found that he had done so **in**

that case.[888] The State Engineer found in the Honey Lake case while it was in the public interest to facilitate the augmentation of the water supplies of the Reno-Sparks and North Valleys areas because of their declining water tables, it could only be done **so long as the other public interest values were not compromised or could be mitigated.** The State Engineer notes that Nevada's water law has not remained static since the 1996 Nevada Supreme Court decision; therefore, he must analyze this criterion in light of the water law as of 2012.

On appeal in the Honey Lake case, the Appellants contended that the State Engineer's failure to include economic considerations, such as whether the proposal was economically feasible or an analysis of alternatives, in the public interest guidelines was a dereliction of duty. The Appellants referenced the statutes of other states to indicate the types of issues they believed should be encompassed in the analysis of whether the use of the water as proposed would threaten to prove detrimental to the public interest. However, the Nevada Supreme Court held that it could find no indication that Nevada's Legislature intended the State Engineer determine public policy in Nevada by incorporating another state's statutes and vesting the State Engineer with the authority to re-evaluate the political and economic decisions made by local government. The Court held that the Nevada Legislature, presumably aware of the broad definition of the public interest enacted by other states (particularly Alaska and Nebraska), demonstrated through its silence that Nevada's water law statutes should remain as they have been and found that the State Engineer had properly defined the public interest in that case.

Only two other courts have specifically considered the meaning of Nevada's public interest criterion. The first case addressed State Engineer's Ruling No. 4848, pursuant to which the State Engineer was considering water right applications for the use of water at a nuclear waste storage facility. In the ruling, the State Engineer found that the Nevada Legislature had determined the public interest through its determination of policy in the enactment of NRS 459.910, which provides that it is unlawful for any person or governmental entity to store high-level radioactive waste in Nevada. The State Engineer held pursuant to that statutory provision that the Nevada Legislature had already determined that the use of water applied for threatened to prove detrimental to the public interest and denied the applications. The Federal District Court for the District of Nevada overturned the State Engineer's decision focusing its reasoning

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[888] *Pyramid Lake Paiute Tribe of Indians v. Washoe County*, 112 Nev. 743, 918 P.2d 697 (1996).

on the grounds that NRS 459.910 is not a Nevada water law statute, either substantive or procedural.[889]

The second opinion addressing the criterion was from the Ninth Circuit Court of Appeals in *United States* v. *Alpine Land & Reservoir Co. (County of Churchill* v. *Ricci),* 341 F.3d 1172 (9th Cir. 2003). In that case, the United States Fish and Wildlife Service (Service) had filed eight applications to transfer 2,855 acre-feet of water from irrigation use to the Stillwater National Wildlife Refuge to maintain wetland habitat. The transfers were in furtherance of a water-right acquisition program that instructed the Service to acquire 75,000 acre-feet of water to fulfill the congressional directive set forth in Section 206(a) of Public Law 101-618,104 Stat. 3289. Churchill County and the City of Fallon had protested the applications on the grounds that the State Engineer should study the cumulative effect on the public interest of the entire acquisition program and not just the eight applications that were currently before him for decision. The Ninth Circuit Court of Appeals held that the State Engineer has broad discretion under Nevada law to determine whether the use of water as proposed under an application will threaten to prove detrimental to the public interest. The Court noted that the Nevada Legislature has not provided an explicit definition of what constitutes a threat to the public interest under NRS 533.370, but held that the State Engineer's authority is limited to considerations identified in Nevada's water policy statutes.

In the Honey Lake decision, the State Engineer identified the following thirteen policy considerations contained in Nevada water statutes (NRS Chapters 532, 533, 534 and 540) to help define the criterion, those being:

1. The water of all sources above or beneath the ground belongs to the public. NRS 533.025.

2. Subject to existing rights, all such water may be appropriated for beneficial use as provided in this chapter and not otherwise. NRS 533.030(1).

3. The beneficial use of water is declared a public use. NRS 533.050.

4. The Legislature has determined that it is the policy of the State of Nevada to continue to recognize the critical nature of the State's limited water resources. It is acknowledged that many of the State's surface water resources are committed to existing uses, under existing water rights, and that in many areas of the State the available groundwater supplies have been appropriated for current uses. It is the policy

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[889] *See, United States* v. *Nevada,* CV-S-00-268-RLH (LRL) (D. Nev. 2003).

of the State of Nevada to recognize and provide for the protection of existing water rights. It is also the policy of the State to encourage efficient and non-wasteful use of the State's limited supplies of water resources. NRS 540.011(1).

5. The Legislature further recognizes the relationship between the critical nature of the State's limited water resources and the increasing demands placed on these resources as the population of the State continues to grow. NRS 540.011(2).

6. The Legislature recognizes the use of water for wildlife including the establishment and maintenance of wetlands and fisheries. NRS 533.023.

7. Springs on which wildlife customarily subsist must be protected. NRS 533.367.

8. The Legislature encourages the use of effluent where such use is not contrary to public health, safety or welfare. NRS 533.024.

9. Water for recreational purposes from either underground or surface sources is declared to be a beneficial use. NRS 533.030(2).

10. Livestock watering is declared to be a beneficial use. NRS 533.490(1).

11. Springs and streams on which livestock subsist must be protected. NRS 533.495.

12. The law addresses not allowing the waste of water and allowing rotation among users. NRS 533.075 and NRS 533.463.

13. The law prohibits the pollution and contamination of underground water and directs the State Engineer to promulgate rules to prevent such. NRS 534.020(2).

Additionally, the State Engineer found that the Nevada Legislature had also provided substantial guidance as to what it determines to be in the public interest and, that in his review of Nevada water law, the additional following principles should also serve as guidelines in the determination of what constitutes "the public interest" within the meaning of NRS 533.370.

1. An appropriation must be for a beneficial use. NRS 533.030(1).

2. The applicant must demonstrate the amount, source and purpose of the appropriation. NRS 533.335.

3. If the appropriation is for a municipal supply, the applicant must demonstrate the approximate number of persons to be served and the approximate future requirements. NRS 533.340(3).

4. The right to divert ceases when the necessity for the use of water does not exist. NRS 533.045.

5. The applicant must demonstrate the magnitude of the use of water, such as the number of acres irrigated, the use to which generated hydroelectric power will be applied, or the number of animals to be watered. NRS 533.340.

6. In considering extensions of time to apply water to beneficial use, the State Engineer must determine the number of parcels and commercial or residential units which are contained or planned in the area to be developed, economic conditions which affect the availability of the developer to complete application of the water to beneficial use, and the period contemplated for completion in a development project approved by local governments or in a planned unit development. NRS 533.380(4).

7. For large appropriations, the State Engineer must consider whether the applicant has the financial capability to develop the water and place it to beneficial use. NRS 533.375.

8. The State Engineer may cooperate with federal authorities in monitoring the development and use of the water resources of the State. NRS 532.170(1).

9. The State Engineer may cooperate with California authorities in monitoring the future needs and uses of water in the Lake Tahoe area and to study ways of developing water supplies so that the development of the area will not be impeded. NRS 532.180.

10. Rotation in use is authorized to bring about a more economical use of supplies. NRS 533.075.

11. The State Engineer may determine whether there is over pumping of groundwater and refuse to issue permits if there is no unappropriated water available. NRS 534.110(3).

12. The State Engineer may determine what is a reasonable lowering of the static water level in an area after taking into account the economics of pumping water for the general type of crops growing and the effect of water use on the general economy of the area in general. NRS 534.110(4).

13. Within an area that has been designated, the State Engineer may monitor and regulate water supply. NRS 534.110(6).

B. Standards Used in this Case for Analysis of Whether the Use of the Water Threatens to Prove Detrimental to the Public Interest

The State Engineer recognizes that many of the public interest criteria that are identified above are considerations addressed in other sections of this ruling and those will not be reconsidered here. After review of the current water law, along with those criteria identified above, additional public interest criteria were identified that will be analyzed in this case to determine whether the use of the water threatens to prove detrimental to the public interest. They are as follows:

1. The water of all sources above or beneath the ground belongs to the public. NRS 533.025.

2. Subject to existing rights, all such water may be appropriated for beneficial use as provided in Chapters 533 and 534 and not otherwise. NRS 533.030(1), 534.020(1).

3. The beneficial use of water is declared a public use. NRS 533.050.

4. The Legislature has determined that it is the policy of the State of Nevada to continue to recognize the critical nature of the State's limited water resources. It is acknowledged that many of the State's surface water resources are committed to existing uses, under existing water rights, and that in many areas of the State the available groundwater supplies have been appropriated for current uses. It is the policy of the State to recognize and provide for the protection of existing water rights. It is also the policy of the State to encourage efficient and non-wasteful use of the State's limited supplies of water resources. NRS 540.011(1).

5. The Legislature further recognizes the relationship between the critical nature of the State's limited water resources and the increasing demands placed on these resources as the population of the State continues to grow. NRS 540.011(2).

6. The Legislature further recognizes the important role of water resource planning and that such planning must be based upon identifying current and future needs for water. The Legislature determines that the purpose of the State's water resource planning is to assist the State, its local governments and its citizens in developing effective plans for the use of water. NRS 540.011(4).

7. The Legislature recognizes the use of water for wildlife including the establishment and maintenance of wetlands and fisheries. NRS 533.023.

8. Springs on which wildlife customarily subsist must be protected. NRS 533.367.

9. Springs and streams on which livestock subsist must be protected. NRS 533.495.

10. It is the policy of this State to recognize the importance of domestic wells as appurtenances to private homes, to create a protectable interest in such wells and to protect their supply of water from unreasonable adverse effects which are caused by municipal, quasi-municipal or industrial uses and which cannot reasonably be mitigated. NRS 533.024(1)(b).

11. It is the policy of this State to encourage the State Engineer to consider the best available science in rendering decisions concerning the available surface and underground sources of water in Nevada. NRS 533.024(1)(c).

12. It is the policy of the State to recognize and provide for the protection of existing water rights. NRS 540.011(1).

13. It is the policy of the State to encourage suppliers of water to establish prices for the use of water that maximize water conservation with due consideration to the essential service needs of customers and the economic burdens on businesses, public services and low-income households. NRS 540.011(1).

14. The State Engineer may cooperate with federal authorities in monitoring the development and use of the water resources of the State. NRS 533.165.

15. Upon approval of an application to appropriate water, the State Engineer may limit the initial use of water to a quantity that is less than the total amount approved for the application. The use of an additional amount of water that is not more than the total amount approved for the application 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 is available and may be appropriated in accordance with Chapters 533 and 534 of NRS. In making that determination, the State Engineer may establish a period during which additional studies may be conducted or additional evidence provided to support the application. NRS 533.3705.

C. Analysis of Public Interest Criteria in this Case

1. Water of All Sources Belongs to the Public and May Be Appropriated for Beneficial Use

Some Protestants assert that they feel it is their duty to protest any extraction and exportation of water from their county, while others feel that Clark County should grow within the limits of its natural resources or that Clark County should solve its problems there and not steal the good things Nevada offers. Others assert that the State of Nevada should consider public-policy issues concerning dispersal of population or that the proposed action is not an appropriate long-term use of Nevada's water. Some Protestants want the State Engineer to determine that Las Vegas' population is "big enough" and that further growth is not in the best interest of the Las Vegas community. Other Protestants indicate that the State Engineer has a responsibility to all the people of Nevada and must consider all the adverse effects the granting of these applications will have on all areas of the State. Some assert that the Applicant should pursue alternatives such as desalination and Colorado River management alternatives before the State Engineer should consider granting these applications. Others indicate that the Applicant has more feasible and cost-effective options.

The State Engineer finds that the water sought for appropriation belongs to the public, which includes all Nevada's citizens and the water does not belong to any one basin or county. The State Engineer finds that a policy behind Nevada water law is that, subject to existing rights, the water may be appropriated for beneficial use as provided in Nevada water law. The State Engineer finds use of water applied for under these Applications is for the beneficial public use of water. The State Engineer finds the Nevada Supreme Court has held that it is not the State Engineer's job to re-evaluate the political and economic decisions made by local government and there is nothing in

Nevada water law instructing the State Engineer to control or distribute population or perform an alternatives analysis. The State Engineer finds the water belongs to the people and the entities that provide water for Southern Nevada have as much right to apply for it as those who live in Northern Nevada. The State Engineer finds his job is to evaluate water right applications before him within the confines of the water law and water policy found in the Nevada Revised Statutes. The State Engineer finds the section of this ruling that addresses beneficial use and need further and more fully addresses this provision that the use of the water does not threaten to prove detrimental to the public interest.

2. Protection of Existing Rights, Limited Supply, Increasing Demands, Encourage Efficient Use

It is the policy of the State of Nevada to recognize and provide for the protection of existing water rights. It is also the policy of the State to encourage efficient and non-wasteful use of the State's limited supplies of water resources. The Legislature has recognized the relationship between the critical nature of the State's limited water resources and the increasing demands placed on these resources as the population of the State continues to grow. The State Engineer finds the Legislature has recognized that the population of the State has grown or will grow and directs the State Engineer to consider encouraging efficient and non-wasteful use of the water resources. These policies instruct the State Engineer in developing the State's water resources for all. The State Engineer finds this is what is being done in this ruling.

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 if the Applications are granted. The State Engineer finds there is nothing in Nevada water law that instructs the State Engineer to value one part of Nevada as greater than another part of Nevada and does not believe it should be the State Engineer's job to choose one part of the state over another. The State Engineer's consideration of public interest is limited by the considerations found in Nevada's water law and water policy statutes.

3. Important Role of Water Planning

The Legislature has recognized the important role of water resource planning and that such planning must be based upon identifying current and future needs for water. The Applicant presented testimony and evidence through Ms. Brothers, Mr. Enstminger and Mr. Holmes

regarding its water planning that identifies its current and future needs for water.[890] The section of this ruling that addresses Beneficial Use and the Need for the Water provides substantial evidence of SNWA's water resource planning and demonstrates that this portion of the public interest analysis has been met.

4. Protection of Springs for Wildlife and Livestock; Protection of Domestic Wells

The Legislature recognizes the use of water for wildlife, including the establishment and maintenance of wetlands and fisheries and the springs on which wildlife customarily subsist, must be protected. Springs and streams on which livestock subsist must be protected and it is the policy of this State to recognize the importance of domestic wells as appurtenances to private homes, to create a protectable interest in such wells and to protect their supply of water from unreasonable adverse effects which are caused by municipal, quasi-municipal or industrial uses and which cannot reasonably be mitigated.

The State Engineer finds the Nevada Legislature has established a public interest policy that emphasizes the protection of existing resources and water rights, but it also established a public interest policy that directs the State Engineer to recognize the relationship between the limited nature of the State's water resources, the increasing demands being placed on those resources as Nevada has grown and to encourage the efficient and non-wasteful use of those limited resources. The State Engineer finds it does not threaten to prove detrimental to the public interest to approve development of the Applications granted in the staged manner decided in this ruling and allowed for under NRS 533.3705. The State Engineer finds the staged development is to protect existing rights, springs and streams, which are sources upon which wildlife exists.

5. Government to Government Relations - Tribal Protestants

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

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[890] Exhibit No. SNWA_189; Exhibit No. SNWA_209.

not complied with the consultation process that protects those interests during the federal permitting process for the Project.

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,[891] 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.[892] This process, known as the Section 106 process, affords tribes an opportunity to participate in the federal environmental review processes associated with the Project.[893] 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.

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 water law. The Tribes participated in the process of consideration of the Applications by filing written protests.[894] The Tribes presented testimony during both the public comment session and through direct examination by their attorney.[895] The Tribes presented expert testimony by two expert witnesses,[896] and they cross-examined the Applicant's witnesses.[897]

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.[898] 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

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[891] Exhibit No. SNWA_408, pp. 29-75.
[892] Transcript, Vol.12 p. 2773:8-12 (Luptowitz).
[893] Transcript, Vol.12 p. 2774:2-6 (Luptowitz).
[894] Transcript, Vol.25 p. 5749:1-4 (Naranjo).
[895] Transcript, Vol.25 pp. 5749:7-5752:11 (Naranjo).
[896] Transcript, Vol.25 pp. 5749:19-5750:1 (Naranjo).
[897] *E.g.*, Transcript, Vol.1 pp. 144:10-151:11 (Mulroy); Transcript, Vol. 25 p. 5751:19-23 (Naranjo).
[898] Duckwater/Ely Joint Closing Statement pp. 7-9.

Applications and comply with Nevada water law. The parties to the Stipulations must address any violations among themselves. While both the Applicant and the Tribal Protestants offered 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 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 water law.

6. Best Available Science

The Legislature has established that it is the policy of this State to encourage the State Engineer to consider the best available science in rendering decisions concerning the available surface and underground sources of water in Nevada. The Applicant asserts that it has provided the most current, comprehensive, best science that any water right Applicant has ever provided. The State Engineer finds the Applicant provided a substantial amount of scientific work in this hearing and the State Engineer has fully analyzed that work in this ruling. However, the State Engineer finds that he does not agree that the most recent work can always be readily characterized as "the best available science" or that other work has "no value." The State Engineer finds as addressed in other sections of this ruling that the errors found in the Applicant's calculations regarding ET and precipitation indicate that at least a portion of the Applicant's work is not the "best science available." All who work in the sciences of geology, hydrology, and hydrogeology know that there is a great deal of uncertainty in the calculations being made and that no perfect numbers are ever going to be attained. The State Engineer finds that due to the uncertainties associated with many of the studies and evidence submitted during the hearing by all parties, it is prudent to consider and weigh the science provided by all parties, and then use the "best science available" submitted, regardless of who submitted it.

7. Water Pricing

The Legislature has established that it is the policy of the State to encourage suppliers of water to establish prices for the use of water that maximize water conservation with due consideration to the essential service needs of customers and the economic burdens on businesses,

public services and low-income households. The State Engineer finds this policy provision of Nevada's water law is adequately addressed in the section of this ruling on conservation.

8. Cooperating with Federal Agencies and Limiting Initial Quantity

The State Engineer may cooperate with federal authorities in monitoring the development and use of the water resources of the State. The State Engineer finds this policy provision of Nevada's water law supports the State Engineer's consideration of the existence of the Stipulations between the Applicant and the Federal agencies in his analysis of whether the use of the water threatens to prove detrimental to the public interest.

Upon approval of an application to appropriate water, the State Engineer may limit the initial use of water to a quantity that is less than the total amount approved for the application. NRS 533.3705. The use of an additional amount of water that is not more than the total amount approved for the application 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 is available and may be appropriated in accordance with Chapters 533 and 534 of NRS. In making that determination, the State Engineer may establish a period during which additional studies may be conducted or additional evidence provided to support the application. The State Engineer finds the Legislature indicated that it does not threaten to prove detrimental to the public interest to allow the staged development being utilized in Spring Valley; therefore, the use of the water does not threaten to prove detrimental to the public interest.

9. Public Interest Summary

The State Engineer finds the analysis of whether the use of water for a proposed project threatens to prove detrimental to the public interest must be addressed on a case-by-case basis. The State Engineer finds the statutory criterion, like beneficial use, is a dynamic concept changing over time, particularly as the Nevada Legislature provides more guidance as to the issues of importance.

The State Engineer finds in this case that the Applicant has applied for water that belongs to the public and the citizens of Southern Nevada are part of that public. The State Engineer has already found that the Applicant has demonstrated a need for the water and it does not threaten to prove detrimental to the public interest to allow the use of the water for reasonable and economic municipal uses in the service area of the members of the SNWA. The State Engineer finds it does not threaten to prove detrimental to the public interest to encourage Southern Nevada's

efficient and non-wasteful use of the State's limited supply of water. The State Engineer finds it does not threaten to prove detrimental to the public interest to cautiously use the water of Spring Valley for the population of Southern Nevada. The State Engineer finds it does not threaten to prove detrimental to the public interest for the SNWA to look to the water resources of Spring Valley in its water planning process.

The State Engineer finds the water law and policy of the State does not and should not require the State Engineer to include economic considerations of pitting one part of the State against another or to analyze alternatives to the Project. The State Engineer finds he has not been nor should he be vested with the authority to re-evaluate the political and economic decisions made by local government. The State Engineer finds the use of the water would threaten to prove detrimental to the public interest if it jeopardizes the sources of water for wildlife, livestock or domestic wells. The State Engineer finds that he has considered the "best available science," but does not accept that the newest science is always the best available science. The science used for the type of decision making being made here is built upon and includes the science that came before it, and what the evidence in this hearing shows is that uncertainty exists in the newest science, and any additional data and analysis cannot be obtained without pumping some amount of water in order to add to the knowledge base. The State Engineer finds that the science will never be perfect, will never be all-knowing and complete before decisions can be made, but that it does not threaten to prove detrimental to the public interest to move forward without perfect science.

The State Engineer finds the public interest policy set forth in NRS 533.3705 provides for staged development being allowed here; thus, the use of the water does not threaten to prove detrimental to the public interest. The State Engineer recognizes the critical nature between the limitations of the Applicant's current water resources and the increasing demands based on projected population growth. The State Engineer recognizes that existing rights must be protected, as well as a concern for the wildlife and maintenance of wetlands and fisheries; therefore, the State Engineer finds, as addressed in other sections of this ruling, it would not threaten to prove detrimental to the public interest to allow the resource to be developed in the manner set forth in this ruling. The State Engineer finds the springs and streams upon which water rights exist and wildlife depend on must be protected. The Applicant has demonstrated the approximate number of persons to be served and the approximate future requirements of water

supply. The Applicant has demonstrated the ability to finance the project and has demonstrated a capability to develop large water projects. The State Engineer finds the proposed use of the water, as outlined in the ruling section, does not threaten to prove detrimental to the public interest.

VII. INTERBASIN TRANSFER CRITERIA

Nevada Revised Statute 533.370(3) provides that in determining whether an application for an interbasin transfer of groundwater must be rejected, the State Engineer shall consider: (1) whether the applicant has justified the need to import the water from another basin; (2) 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; (3) whether the proposed action is environmentally sound as it relates to the basin from which the water is exported; (4) whether 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; and (5) any other factor the State Engineer determines to be relevant.

A. Justification of Need to Import Water

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 additional water resources 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.[899] 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.[900]

There are no other water supplies available in the Las Vegas Valley Hydrographic Basin. The Applicant has maximized local groundwater and surface water resources in the Las Vegas Valley. The Las Vegas Valley groundwater basin is fully appropriated.[901] There are simply no

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[899] Exhibit No. SNWA_189, p. 6-2, Figure 6-2; Exhibit No. SNWA_209, p. 43, Figure 28.
[900] Exhibit No. SNWA_189, p. 6-4, Figure 6-3, p. 6-5, Figure 6-4.
[901] Exhibit No. SNWA_189, p. 3-2.

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 other Colorado River basin states. 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.[902] The basin states are prepared to litigate in front of the U.S. Supreme Court to protect their water rights if necessary.[903] 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.[904] 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 is 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.[905] Third, system-augmentation projects are long-term projects between the basin states that are not expected to make additional water available on the Colorado River for decades.[906] 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.[907] 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.[908]

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-

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[902] Transcript, Vol.2 pp. 264:24-266:1 (Entsminger).
[903] Transcript, Vol.2 pp. 265:23-266:1 (Entsminger).
[904] Transcript, Vol.2 p. 265:10-13 (Entsminger).
[905] Transcript, Vol.2 p. 266:5-12 (Entsminger).
[906] Transcript, Vol.2 pp. 297:9-298:23 (Entsminger).
[907] Transcript, Vol.2 p. 299:2-7 (Entsminger).
[908] Exhibit No. SNWA_189, p. 3-3.

state supplies.[909] Southern Nevada has demonstrated a need for additional water resources for future growth and drought protection. The only way for Southern Nevada to become self-sufficient is to develop other, non-Colorado River water supplies. The State Engineer finds that the Applicant has justified its need to import water from another basin.

B. 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 demonstrated that such a plan has been adopted and is being effectively carried out."[910] The State Engineer determines that a plan for conservation of water is advisable for the Las Vegas Valley Hydrographic Basin, which is the main basin into which the evidence indicates most of the water is to be imported.

The Applicant presented expert testimony on this subject by Mr. Douglas Bennett, who is the Applicant's Conservation Manager and was qualified by the State Engineer as an expert in water conservation planning, municipal water conservation, and xeriscaping.[911] 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.[912] 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 indicated that he has never read the Applicant's 2009-2013 Conservation Plan.[913]

The Applicant has had a Conservation Plan in effect since 1999,[914] has submitted a conservation plan to the State Engineer for approval at five-year intervals since 1999[915] with the

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[909] Transcript, Vol.1 p. 137:15-23 (Mulroy); Vol.2 pp. 234:23-235:11, p. 361:7-23 (Brothers).
[910] NRS 533.370(3)(b).
[911] Transcript, Vol.4 p. 823:16-19.
[912] Transcript, Vol.23 p. 5091:10-12.
[913] Transcript, Vol.23 p. 5145:21-25 (Gleick).
[914] Exhibit No. SNWA_004, p. 1-1; Transcript, Vol.4 p. 825:3-5 (Bennett).
[915] 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).

last Conservation Plan approved by the State Engineer on April 22, 2009.[916] The Bureau of Reclamation also requires the Applicant to develop "appropriate water conservation measures," resulting from the "full consideration and incorporation of prudent and responsible water conservation measures"[917] and approved the Applicant's Conservation Plan on May 14, 2009.[918]

The Applicant's Conservation Plan employs a four-part strategy to ensure active, community-wide participation in conservation.[919] The four interwoven strategies are regulation, pricing, incentives and education.[920] Protestants asserted the Applicant's efforts with respect to these strategies could be more robust; however, Dr. Gleick testified 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.[921] In addition, Protestant's witness failed to update his analysis of SNWA member agencies' rate structures in his initial expert report[922] and his rebuttal report[923] to reflect two subsequent rate adjustments that enhanced the conservation effect of SNWA member agencies' rate structures.[924] The State Engineer finds Dr. Gleick's reports did not adequately consider the current status of the Applicant's conservation efforts, including its 2009-2013 Conservation Plan.

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.[925] These development codes restrict turfgrass in new developments to no more than 50% of the landscape area of residential backyards, and prohibit turfgrass altogether on residential front yards and commercial properties.[926] They restrict the use of water for ornamental water features and man-made lakes,[927] limit the size and scale of swimming pools,[928] and require resort hotels to submit water efficiency plans describing their current or projected uses of water and their water efficiency

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[916] Exhibit No. SNWA_006.
[917] Reclamation Reform Act, § 210(a) & (b) and 43 C.F.R. § 427.1.
[918] Exhibit No. SNWA_007.
[919] Exhibit No. SNWA_004, p. 2-1; Transcript, Vol.4 pp. 831:22-832:9 (Bennett).
[920] Exhibit No. SNWA_004, p. 2-1; Transcript, Vol.4 p. 832:1-2 (Bennett).
[921] Transcript, Vol.23 p. 5199:17-22 (Gleick).
[922] Exhibit No. GBWN_069.
[923] Exhibit No. GBWN_118.
[924] Transcript, Vol.23 pp. 5176:14 - 5177:2 (Gleick).
[925] Exhibit No. SNWA_004, p. 3-1; Exhibit No. SNWA_012; Exhibit No. SNWA_013.
[926] Transcript, Vol.4 pp. 841:6-842:5 (Bennett).
[927] Transcript, Vol.4 p. 845:14-15 (Bennett).
[928] Transcript, Vol.4 p. 845:16-17 (Bennett).

plans.[929] Customer water use is also limited through mandatory landscape watering groups,[930] and prohibited water waste. Violators who allow water to run down the street or flow off the customer's property can be sanctioned.[931] 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,[932] and golf courses that violate water waste restrictions by exceeding their water budgets can be fined up to 900% of their top tier water rate.[933]

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.[934] 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.[935] 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.[936] Member agencies have committed to reviewing and adjusting rates frequently to ensure the conservation effect is sustained.[937]

The Applicant has created substantial, long-term water savings by providing financial incentives and products to customers.[938] 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.[939] It is the largest incentive program in the nation, paying customers an average of $16 million per year for turfgrass conversion.[940]

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[929] Transcript, Vol.4 p. 845:18-24 (Bennett).
[930] Transcript, Vol.4 p. 842:14-24 (Bennett).
[931] Transcript, Vol.4 p. 843:4-8 (Bennett).
[932] Exhibit No. SNWA_004, pp. 3-4; Transcript, Vol.4 p. 857:1-22 (Bennett).
[933] Transcript, Vol.4 p. 863:2-5 (Transcript).
[934] Exhibit No. SNWA_004, p. 4-1; Transcript, Vol.4 p. 864:10-12 (Bennett).
[935] *See,* NRS 540.011.
[936] Transcript, Vol.4 pp. 865:10-867:1 (Bennett).
[937] Exhibit No. SNWA_395, p. 7.
[938] Exhibit No. SNWA_004, p. 5-1.
[939] Exhibit No. SNWA_004, p. 5-1; Transcript, Vol.4 pp. 872:19-873:18 (Bennett).
[940] Transcript, Vol.4 p. 869:20-21, p.870:16-22 (Bennett).

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.[941]

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% of which is directly or indirectly reused.[942] In response to a question from the State Engineer's staff concerning whether indoor conservation would actually allow the Applicant to serve more customers, Protestants' witness acknowledged that conservation of non-consumptive uses would allow the Applicant to serve new customers only if those new customers added no consumptive uses,[943] which is not plausible. 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 conservation as well.[944] 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.[945]

The Applicant's education programs ensure community-wide participation in conservation efforts throughout the Las Vegas Valley and the Applicant has worked to create a culture of conservation by developing a consistent message about the importance of indoor and outdoor conservation and offers public awards for innovative conservation programs. Its 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.[946] Public/private partnerships, including the Water Upon Request and Water Smart Homes programs, help promote the conservation message.[947] Awards that encourage community conservation include the Water Hero Award and the annual SNWA Landscape Awards, now in

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[941] Transcript, Vol.4 p. 833:10-13 (Bennett).
[942] Exhibit No. SNWA_004, p. ES-1; Exhibit No. SNWA_402; Transcript, Vol.2 pp. 283:21-284:22 (Entsminger).
[943] Transcript, Vol.23 pp. 5207:18-5208:7 (Gleick).
[944] Transcript, Vol.4 p. 834:6-20 (Bennett).
[945] Exhibit No. SNWA_004, pp. 5-3 to 5-4; Exhibit No. SNWA_399.
[946] Exhibit No. SNWA_004, p. 6-1; Transcript, Vol.4 pp. 887:18-888:22 (Bennett).
[947] Exhibit No. SNWA_004, pp. 7-1 to 7-2; Transcript, Vol.4 pp. 889:21-891:11 (Bennett).

its fourteenth year.[948] The Applicant has already implemented many of the programs suggested by the Protestants.

The Applicant's conservation planning has made a significant difference in the way southern Nevadans use water.[949] The Applicant has set and achieved conservation goals resulting in a dramatic reduction in per capita water use.[950] In 1990, the Applicant service area's gallons-per-capita-per-day ("GPCD") use was 347,[951] which was reduced to 274 GPCD by 2004.[952] The Applicant established a goal of 199 GPCD by 2035.[953] When compared to the 274 GPCD of 2004, the 199 GPCD goal will reduce annual demand by 276,000 acre-feet of water by the year 2035.[954] The Applicant has achieved a 31% reduction in per capita deliveries in Southern Nevada from 1990 to 2008 over a period when total population increased by almost 160%.[955] Those savings outpace the seven Colorado River basin states as a whole, where from 1975 to 2005 per capita water use declined by 21%.[956]

One of the major conclusions of Dr. Gleick's rebuttal report was that per capita water use is declining, but more can be done.[957] This conclusion was founded on a 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.[958] Dr. Gleick opined "there's nothing inherently special or different about the Las Vegas Valley that justifies this higher per capita use."[959] 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."[960]

The Applicant challenges the Protestants' use of cross-utility GPCD comparison and introduced evidence from authoritative sources, including publications by the American Water Works Association ("AWWA") and the Pacific Institute, which stated that cross-utility GPCD comparisons are inappropriate due to such differences as climate and functional population, the

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[948] Exhibit No. SNWA_395, p. 9; Transcript, Vol.4 p. 891:15-23 (Bennett).
[949] Transcript, Vol.1 p. 69:24-25 (Mulroy).
[950] Exhibit No. GBWN_118, p. 3.
[951] Transcript, Vol.4 p. 894:4-7 (Bennett).
[952] Transcript, Vol.4 p. 894:8-14 (Bennett).
[953] Transcript, Vol.4 p. 894:15-22, p. 895:20 (Bennett).
[954] Exhibit No. SNWA_209, p. 39; Transcript, Vol.4 p. 895:21-25 (Bennett).
[955] Exhibit No. SNWA_397, p. 25.
[956] Exhibit No. SNWA_397, p. 3.
[957] Transcript, Vol.23 p. 5099:1-3 (Gleick).
[958] Exhibit No. GBWN_118, pp. 5-6; Transcript, Vol.23 p. 5099: 3-12, p. 5102:7-15 (Gleick).
[959] Transcript, Vol.23 p. 5099:13-15 (Gleick).
[960] Exhibit No. GBWN_072, p. 18; Transcript, Vol.23 p. 5141:7-13 (Gleick).

measure of population that takes into account a high influx of daily visitors that normally are not included in population for GPCD calculations.[961] Mr. Bennett testified that if the Applicant accounted for functional population, the Applicant's GPCD would be reduced by as much as 40 GPCD.[962] Dr. Gleick indicated that he had failed to account for either functional population or climatic differences in his analysis.[963] 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. Dr. Gleick testified that this made the single-family account GPCD metric a relatively valuable one for comparing the effectiveness of different conservation programs;[964] however, 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, 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.[965]

The State Engineer finds that due to the inconsistencies 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%. This has resulted in a savings of more than 9.5 billion gallons a year.[966] Even Protestants' expert, after acknowledging that the Applicant has adopted most of the suggestions made in the Hidden Oasis report, admitted that pieces of the Applicant's Conservation Plan were effectively carried out,[967] but still argues that the Applicant could do even more.[968]

The State Engineer finds the statutory standard does not require the Applicant to develop and effectively implement the most severe Conservation Plan possible or to outpace every

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[961] Exhibit No. SNWA_014, pp. 8-14; Exhibit No. SNWA_397, p. 8.
[962] Transcript, Vol.4 p. 904:6-8 (Bennett).
[963] Transcript, Vol.23 pp. 5142:24-5143:2, p. 4134:4-6 (Gleick).
[964] Transcript, Vol.23 p. 5203: 7-11 (Gleick).
[965] Transcript, Vol.23 p. 5145:12-22 (Gleick).
[966] Transcript, Vol.4 p. 912:14-23 (Bennett).
[967] Transcript, Vol.23 p. 5200:3 (Gleick).
[968] Transcript, Vol.23 p. 5203:21 (Gleick).

conservation effort in the nation.[969] The State Engineer finds the Applicant provided substantial evidence that it has a Conservation Plan in place that is effectively implemented and has addressed, at least in part, every recommendation offered by Protestants to improve its conservation efforts. The State Engineer finds the Applicant has demonstrated that a conservation plan has been adopted and is being effectively carried out.

C. 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.[970] Nevada is the driest state in the nation, averaging approximately nine inches of precipitation each year. It has also been the fastest growing state in the nation for decades. The need for available water is undeniable and the water will only become more precious. It is imperative that the State Engineer maximize the beneficial use of all waters within the state, otherwise, it could unnecessarily stymie economic growth, eliminate recreational opportunities, hinder the use of water for environmental concerns, and be generally detrimental to the state as a whole. However, maximizing the beneficial use of the State's water resources shall not be done to the detriment of the other criteria found in Nevada water law.

In terms of the decision before the State Engineer here in Spring Valley, there is uncontroverted evidence that there is water available at the groundwater source. In other words, the amount of water appropriated by the State Engineer's office to date is less than estimates of perennial yield for the basin. However, in terms of interbasin transfers of groundwater, there is a dichotomy in how Nevada has appropriated its groundwater for more than 60 years and the fact that Nevada's water law requires interbasin transfers of ground water be found to be environmentally sound for the basin from which the water is exported. Nevada has formally and informally maintained that the amount of groundwater available to appropriate is equal to the amount of discharge available for capture – either through phreatophytic discharge, subsurface flows leaving the basin or a combination of the two. These opposing criteria raise the question *"[h]ow do we appropriate groundwater that targets the capture of wetland, meadow and other evapotranspiration but still be environmentally sound?"* Although the State Engineer carries a heavy burden of ensuring that any approval here is environmentally sound, it is also demanded

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[969] NRS 533.370(3)(c).
[970] NRS 533.370(3)(c).

that he be creative and flexible to maximize the beneficial use of the State's water. Nevada Revised Statute 533.3705(1) is an example of a statute that provides flexibility to the decision-making process that could otherwise stop water appropriations unnecessarily. Nevada Revised Statutes 533.3705(1) provides the State Engineer the authority and discretion to approve an application to appropriate water, but limit the initial use of water to a quantity that is less than the total amount approved for the application. This provision of the law provides for the submittal of additional evidence to demonstrate to the satisfaction of the State Engineer that any additional amount of water is available. The State Engineer interprets that statute to mean that while there is substantial evidence to approve an application, he is also able to approve it at a lower amount in order to measure and collect data that will either support increasing or decreasing the amount of the appropriation. The State Engineer finds this methodology is appropriate for this project and it is this staged development along with careful monitoring, management and mitigation, if needed, that he finds allows for the determination that the proposed action is environmentally sound as it relates to the basin from which the water is exported.

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, environmental compliance and environmental monitoring.[971] 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 U.S. 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.[972] Dr. McLendon testified about the effect of change in depth to water ("DTW") on

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[971] Transcript, Vol.8 p. 1776:15-24 (Marshall).
[972] Transcript, Vol.7 p. 1611:23-25 (McLendon).

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.[973] 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 the State Engineer as an expert in the area of plant ecology and hydroecology.[974] 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.[975] 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.[976] 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.

1. Environmental Baseline

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.[977] The Applicant has studied a broad array of biotic communities within Spring Valley and adjacent basins. Areas of focus included: aquatic ecosystems;[978] amphibians;[979] birds;[980] mammals,

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[973] Transcript, Vol.19 p. 4140:17-12 (Deacon).
[974] Transcript, Vol.18 p. 3938:20-21 (Patten).
[975] Transcript, Vol.28 pp. 6266:22-6267:1 (Landers).
[976] Transcript, Vol.28 6309:16-20 (Robinson).
[977] Exhibit No. SNWA_363, pp. 4-1 to 4-43; Transcript, Vol.12 pp. 2681:17–2691:2, pp. 2723:3–2724:20 (Marshall).
[978] Exhibit Nos. SNWA_363, pp. 4-2 to 4-5; SNWA_422; SNWA_374; Transcript, Vol.12 pp. 2691:5–2697:13 (Marshall).

including bats and small mammals;[981] reptiles;[982] fish, including the Pahrump poolfish and Moapa dace;[983] invertebrates, including terrestrial and aquatic invertebrates;[984] and vegetation, including endangered, threatened and sensitive plant species, cactus and yucca, weeds and phreatophytic vegetation.[985] The Applicant also assessed environmental areas of interest throughout Spring Valley and adjacent basins,[986] 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.[987] 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.[988]

GBWN argued in their written closing that the baseline data was inadequate in kind and quality,[989] 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.[990] Dr. Patten similarly testified he had no criticism of Dr. McLendon's work.[991]

The State Engineer finds that the Applicant gathered and presented substantial environmental resource baseline material and that the environmental resource baseline information provides a 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.

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[979] Exhibit No. SNWA_363 pp. 4-5 to 4-8; Transcript, Vol.12 pp. 2697:14–2698:5 (Marshall).
[980] Exhibit No. SNWA_363 pp. 4-8 to 4-17; Transcript, Vol.12 pp. 2698:6–2706:10 (Marshall).
[981] Exhibit No. SNWA_363, pp. 4-17 to- 4-21; Transcript, Vol.12 pp. 2706:11–2713:12 (Marshall).
[982] Exhibit No. SNWA_363, pp. 4-22 to 4-24; Transcript, Vol.12 pp. 2713:13–2714:11 (Marshall).
[983] Exhibit No. SNWA_363, pp. 4-25 to 4-26; Transcript, Vol.12 pp. 2714:12–2717:2 (Marshall).
[984] Exhibit No. SNWA_363, p. 4-25, pp. 4-27 to 4-28; Transcript, Vol.12 p. 2717:3-25 (Marshall).
[985] Exhibit No. SNWA_363, p. 4-27, pp. 4-29 to 4-36; Transcript, Vol.12 pp. 2718:1–2722:2 (Marshall).
[986] 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 pp. 2728:15–2738:7 (Spring Valley), pp. 2745:17–2747:15 (Snake Valley)(Marshall).
[987] Exhibit No. SNWA_363, p. 2-1.
[988] Transcript, Vol.12 p. 2752:2-4 (Marshall).
[989] GBWN Closing Statement, p. 24.
[990] Transcript, Vol.19 pp. 4174:18-4177:23 (Deacon).
[991] Transcript, Vol.18 pp. 4028:4-4029:11 (Patten).

2. Permitting

The baseline information collected by the Applicant was presented to federal, state and local resource managers[992] who have permitting authority over the Project.[993] 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.[994] These permitting processes impose strict environmental controls on the Project that ensure it will be environmentally sound.[995] Protestants' witness Rebecca Mills, former superintendent at Great Basin National Park, testified it is the mission of Federal agencies to zealously enforce the environmental protections with which they are charged.[996]

NEPA requires a full consideration of environmental impacts resulting from the Project.[997] 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 Decision for the Project and are then required under the terms of any right-of-way grant.[998] With respect to the Project, the Applicant has prepared more than 300 Applicant Committed Measures aimed at minimizing and mitigating Project impacts.[999]

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.[1000] The Applicant agreed to inclusion of even non-listed species for the Project ESA consultation, resulting in an even greater breadth of coverage.[1001]

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

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[992] Transcript, Vol.12 p. 2723:20-24 (Marshall).
[993] Transcript, Vol.12 pp. 2752:21-2753:1 (Luptowitz).
[994] Exhibit No. SNWA_363, p. 5-3, Table 5-2: Potentially Required Federal and State Permits and Reviews.
[995] 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).
[996] 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).
[997] 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).
[998] Transcript, Vol.12 pp. 2764:23-2765:11 (Luptowitz).
[999] Transcript, Vol.12 p. 2765:16-24 (Luptowitz).
[1000] Transcript, Vol.12 pp. 2755:21-2756:1, pp. 2756:22-2757:2 (Luptowitz).
[1001] Transcript, Vol.12 p. 2758:8-16 (Marshall).

development practices that preceded the ESA.[1002] 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.[1003]

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.[1004] Protestants also expressed doubts about a future State Engineer's resolve to halt groundwater withdrawals if adverse environmental impacts occurred.[1005]

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.

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.

3. Compliance with the Federal Stipulation

On September 8, 2006, SNWA and four Department of the Interior agencies, the U.S. Fish and Wildlife Service, U.S. Bureau of Indian Affairs, U.S. Bureau of Land Management, and U.S. National Park Service entered into a Stipulation for Withdrawal of Protests regarding Application Nos. 54003-54021 in Spring Valley.[1006]

[1002] Transcript, Vol.12 pp. 2823:22-2824:3 (Marshall).
[1003] Transcript, Vol.12 pp. 2823:22-2824:7 (Marshall).
[1004] GBWN Closing Statement, p. 21.
[1005] GBWN Closing Statement, p. 26.
[1006] 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 event, because the State Engineer's ruling relies on the incorporation of the BMP, rather than the Stipulation,

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 the SNWA, the U.S. Bureau of Indian Affairs, U.S. Bureau of Land Management, U.S. National Park Service, and U.S. Fish and Wildlife Service.[1007] These representatives are biologists who provide scientific and technical expertise.[1008] The Nevada Department of Wildlife, the Utah Division of Wildlife Resources and the Nevada State Engineer have also participated in BWG meetings developing and implementing the Biological Monitoring Plan ("BMP").[1009]

The role of the BWG is to develop and implement a BMP.[1010] The BMP requires the development of conceptual models and the identification of indicators and ecological attributes

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arguments about the admissibility of the Stipulation are not relevant to the State Engineer's environmental soundness determination.

[1007] Exhibit No. SNWA_365, p. 1-2; Transcript, Vol.8 p. 1809:11-15 (Marshall).

[1008] Transcript, Vol.8 p. 1809:10-19 (Marshall).

[1009] Exhibit No. 365, p. 1-2; Transcript, Vol.8 p. 1809:15-19 (Marshall).

[1010] *See,* Spring Valley Stipulation, Exhibits A & B; DDC Stipulation, Exhibit A.

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.[1011] In addition, the BMP contains a detailed monitoring plan which has been in use for two and one-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.[1012] 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.[1013]

The BMP provides for monitoring potential impacts to both Spring Valley and adjacent basins.[1014] The Spring Valley BMP establishes an Initial Biologic Monitoring Area ("IBMA") that encompasses the Spring Valley Hydrographic Basin, the northern portion of the Hamlin Valley Hydrographic Basin, and the Big Spring Creek sub-watershed in southern Snake Valley.[1015] The IBMA contains portions of Hamlin and Snake Valleys because of potential interbasin groundwater flow from Spring Valley.[1016] Notably, 95% of the land in the IBMA is federally held; only 4% is private land.[1017] Protestants' expert, Dr. James Deacon, agreed the monitoring sites identified by the BMP will produce a good body of information.[1018]

The State Engineer approved the Spring Valley BMP on January 23, 2009.[1019] 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,

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[1011] Exhibit No. SNWA_365, pp. 2-1 to 2-4.
[1012] Transcript, Vol. 8, p. 1813:8-12 (Marshall).
[1013] Exhibit No. SNWA_365 (Spring Valley BMP), § 8.4; Transcript Vol.8 p. 1810:12-15 (Marshall).
[1014] Exhibit No. SNWA_365, p. 1-6; Transcript, Vol.8 p. 1810:5-11 (Marshall).
[1015] Exhibit No. SNWA_365, p. 1-6.
[1016] Exhibit No. SNWA_365, p. 1-6.
[1017] Exhibit No. SNWA_365, p. 1-6.
[1018] Transcript, Vol.19 p. 4181:22-24 (Deacon).
[1019] Exhibit No. SNWA_367.

conceptual model formulation and determination of representative monitoring locations.[1020] 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.

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 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.

4. Adaptive Management

The BMP provides flexibility for future modifications to the monitoring plan based on new information and technologies and future management considerations.[1021] 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.[1022] 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.[1023] 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.[1024]

Protestants assert adaptive management plans are not learn-as-you-go plans, and criticize the Applicant's BMP on this ground. However, Dr. Patten testified that learning, and adapting to what scientists learn through monitoring, is an important part of understanding the ecological

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[1020] Exhibit Nos. SNWA_368; SNWA_369; SNWA_418.
[1021] Exhibit No. SNWA_365, p. 1-6.
[1022] *See* Exhibit No. SNWA_365, p. 3-3.
[1023] Exhibit No. SNWA_461, p. 17; Transcript, Vol.18 pp. 4024:20-4025:24 (Patten).
[1024] Transcript, Vol.8 p. 1815:10-16 (Marshall).

function of systems and managing those systems.[1025] Dr. Patten further testified that monitoring programs can achieve ecological sustainability of spring areas through appropriate water management.[1026] 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,[1027] and that adaptive management has had success there.[1028]

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 a critical component in ensuring water development occurs in a manner that is environmentally sound.

5. 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.[1029] The process includes the identification of conservation targets and their key ecological attributes and indicators and the development of adequate baseline data.[1030] The BWG agreed to collect at a minimum seven years of baseline data prior to groundwater development in Spring Valley.[1031] The BWG has already collected two years of data.[1032] The BWG is fully engaged in the process of data development.[1033]

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.[1034] 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.[1035] Factors such as natural variation in the environmental resources must be understood before any standards or triggers are set.

[1025] Transcript, Vol.18 pp. 4023:10-4025:20 (Patten).
[1026] Exhibit No. GBWN_059, p. 12; Transcript, Vol.18 pp. 4027:10-4028:1 (Patten).
[1027] Transcript, Vol.23 p. 5271:2-14 (Harrington).
[1028] Transcript, Vol.23 pp. 5208:23-5209:13 (Harrington).
[1029] Exhibit No. SNWA_365, pp. 8-4, 8-5.
[1030] Transcript, Vol.8 p. 1815:4-16 (Marshall).
[1031] Transcript, Vol.8 p. 1829:18-22 (Marshall).
[1032] Transcript, Vol.8 p. 1835:11 (Marshall).
[1033] Transcript, Vol.8 p. 1829:4-14 (Marshall).
[1034] Transcript, Vol.23 p. 5276: 6-17 (Harrington).
[1035] Transcript, Vol.8 p. 1836:3-15 (Marshall).

Selecting specific standards before a full baseline is developed would be premature.[1036] It would not lead to sound scientific decisions.[1037] Indeed, Protestants' expert Cliff Landers stated, "[Y]ou really have to have baseline data in order to be able to make intelligent decisions."[1038] 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.[1039]

The State Engineer finds that the BMP establishes a sound process for developing triggers and 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 thoroughly 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.

6. Enforcement and Dispute Resolution

Protestants argued the protections provided by the BMP are inadequate because the Stipulation between SNWA and the Federal agencies lacks adequate enforcement mechanisms.[1040] However, as Mr. Marshall identified, the Applicant is bound by any decision made by the State Engineer.[1041] 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.[1042] 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.[1043]

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.

[1036] Transcript, Vol.12 p. 2683:16-21, Vol.14 p. 3211:7-15 (Marshall).
[1037] Transcript, Vol.12 p. 2686: 2-9 (Marshall).
[1038] Transcript, Vol.28 p. 6289:10-11 (Landers).
[1039] Transcript, Vol.23 pp. 5286:22-5287:5 (Harrington).
[1040] *See,* Transcript, Vol.11 p. 2495:1-10 (Hejmanowski).
[1041] Transcript, Vol.11 p. 2496:13-14 (Marshall).
[1042] Transcript, Vol.11 p. 2499:7-22 (State Engineer King).
[1043] Transcript, Vol.11 p. 2499:16-22 (State Engineer King).

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 develop and implement the BMP.[1044] Protestants' witness, former Great Basin National Park superintendent Rebecca Mills, acknowledged that Federal agency management takes seriously and follows the recommendations of scientific personnel.[1045]

The State Engineer finds that he had been requested to take the Stipulation into consideration regarding the analysis of whether the proposed project is environmentally sound for the basin of export. The enforcement of the Stipulation is a matter between the parties to it, and while he is not relying on the Stipulation to make his environmental soundness determination, the Stipulated Agreement provides an additional level of assurance.

7. Environmental Effects Analysis

The Applicant identified those environmental areas of interest in Spring Valley and adjacent basins that could be sensitive to groundwater withdrawal.[1046] 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.[1047] 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.[1048] 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.[1049] If quantitative analysis was warranted, results from the Applicant's groundwater model were consulted, using criteria reflective of the limitations in using a regional model.[1050] This criteria was a 50-foot or greater drawdown in depth to groundwater or a 15% reduction in spring flow.[1051] This 50-foot, 15% criteria did not provide the definition of a reasonable or unreasonable impact, it does not set monitoring priorities or establish monitoring sites, and it

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[1044] Transcript, Vol.12 pp. 2822:25-2823:17 (Marshall).
[1045] Transcript, Vol.22 p. 4953:13-23 (Mills).
[1046] 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).
[1047] Transcript, Vol.12 p. 2796:11-17 (Marshall).
[1048] Transcript, Vol.12 pp. 2796:21-2797:1 (Marshall).
[1049] Transcript, Vol.12 p. 2797:2-4 (Marshall).
[1050] Transcript, Vol.12 p. 2797:7-8 (Marshall).
[1051] Transcript, Vol.12 p. 2797:12-14 (Marshall).

does not form the basis for biological evaluations.[1052] The Applicant used the 50-foot, 15% criteria for an initial evaluation of the appropriateness of the monitoring network established by the BWG.[1053] 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.[1054]

This measured approach to assessing impacts contrasts with the impacts analysis provided by Protestants' expert, Dr. James Deacon.[1055] 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.[1056] 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. However, even Dr. Myers did not assume that the Applicant's pumping would dry up mountain block springs.[1057] 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.[1058] Dr. Deacon testified 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)."[1059] 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.[1060] As a result, Dr. Deacon testified that groundwater models only permit a generalized understanding and therefore require testing through a monitoring plan.[1061] Dr. Deacon also relied on Dr. Bredehoeft's application of the time to capture theory.[1062] He acknowledged the models upon which he relied

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[1052] Transcript, Vol.12 pp. 2797:25-2799:15 (Marshall).
[1053] Transcript, Vol.12 p. 2798:18-23 (Marshall).
[1054] Transcript, Vol.12 p. 2799:9-19 (Marshall).
[1055] *See,* Exhibit No. GBWN_014.
[1056] *See,* Exhibit No. GBWN_014, pp. 2-3; Exhibit No. GBWN_138, pp. 5-8; Exhibit No. GBWN_248, p. 4, pp. 6-7; Transcript; Vol.12 p. 2820-21:14-21 (Marshall).
[1057] Transcript, Vol.20 p. 4468:22-25 (Myers).
[1058] Transcript, Vol.19 p. 4162:10-13, p. 4190:2-12 (Deacon).
[1059] Transcript, Vol.19 p. 4184:12-22 (Deacon).
[1060] Transcript, Vol.19 p. 4185:11-18 (Deacon).
[1061] Transcript, Vol.19 p. 4186:1-8 (Deacon).
[1062] Transcript, Vol.19 p. 4189:6-15 (Deacon).

so extensively for site-specific analysis provide predictions that, applied even more generally, are uncertain at best.[1063] His report does not take into consideration the realities of federal and state environmental compliance and the authority that the State Engineer holds.[1064] Based on the discussion above, the State Engineer finds Dr. Deacon's testimony does not compel the State Engineer to find the Project is not environmentally sound.

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.[1065] Special status species at some of these sites include northern leopard frog, birds, and bats.[1066] Big game uses some of these habitats from time to time.[1067] Groundwater drawdown and reduced spring flow at these sites has the potential to further degrade existing habitat and cause the redistribution of mobile species.[1068] 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.[1069] 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.[1070]

Sites where the 50-foot, 15% criteria indicated no impacts would occur also will be monitored.[1071] For instance, several types of monitoring data collection efforts occur at the Shoshone Ponds site, home to the Pahrump pool fish.[1072] These efforts include monitoring of Pahrump pool fish, relict dace, and leopard frog.[1073] A number of vegetative transects have been placed across the aquatic, wetland, and meadow habitats, as well.[1074]

[1063] Transcript, Vol.19 pp. 4185:17-4186:4 (Deacon).
[1064] Exhibit No. GBWN_014, p. 4.
[1065] Transcript, Vol.12 p. 2800:4-14 (Marshall).
[1066] Transcript, Vol.12 pp. 2800:22-2801:7 (Marshall).
[1067] Transcript, Vol.12 p. 2801:8-14 (Marshall).
[1068] Exhibit No. SNWA_363, p. 8-2; Transcript, Vol.12 pp. 2801:20-2803:1 (Marshall).
[1069] Exhibit No. SNWA_363, p. 8-2.
[1070] Transcript, Vol.12 p. 2803: 2-21 (Marshall).
[1071] Transcript, Vol.12 p. 2798:10-15 (Marshall).
[1072] Transcript, Vol.12 p. 2804:1-5 (Marshall).
[1073] Transcript, Vol.12 p. 2804:4-6 (Marshall).
[1074] Transcript, Vol.12 p. 2804:6-8 (Marshall).

The Applicant's adjacent basins analysis predicted no impacts to Snake, Hamlin, and Lake Valleys environmental areas of interest.[1075] However, even though no sites met or exceeded the 50-foot, 15% criteria, monitoring is in place to provide early warning of any unanticipated effects,[1076] and the BMP applies to ensure there would be adequate monitoring, management, and mitigation.

The State Engineer finds that the Applicant has adequately described the potential environmental effects of the Project in a manner that allows the State Engineer to make an informed environmental soundness determination.

8. 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.[1077] 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.[1078]

The Applicant's experts testified that there is no one-to-one relationship between DTW and plant function.[1079] 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.[1080] Anthropogenic factors, especially irrigation, impact the location and type of vegetation.[1081]

[1075] Transcript, Vol.12 pp. 2806:18-2807:2 (Snake Valley), pp. 2807:19-2808:2 (Hamlin Valley), pp. 2808:8-19 (Lake Valley) (Marshall).
[1076] Transcript Vol. 12, p. 2807:3-8 (Snake Valley); p. 2808:3-7 (Hamlin Valley) (Marshall).
[1077] Transcript, Vol.7 p. 1628:15-18 (McLendon).
[1078] Transcript, Vol.12 p. 2812:5-11 (Marshall).
[1079] Exhibit No. SNWA_039, p. 7; Exhibit No. SNWA_044, p. G24; Transcript, Vol.7 pp. 1633:25-1634:2 (McLendon).
[1080] Exhibit No. SNWA_039, p. 7; Exhibit No. SNWA_044, p. G24; Transcript, Vol.7 pp. 1628:21-1629:3 (McLendon).
[1081] Transcript, Vol.8 pp. 1648:24–1649:4 (McLendon).

Where change may occur, it would follow orderly succession patterns.[1082] Succession does not result in a denuded landscape; as one plant type is reduced, there is a shift to other plant types better adapted to the altered conditions.[1083] Changes in cover values do not equate to a lack of plant life; roots underground hold soil in place and collect moisture.[1084] Dr. McLendon testified that an increase in depth to water can result in healthy stable communities and does not inevitably result in not barren land.[1085]

The Applicant's experts indicate the aquatic and wetland communities would be most sensitive to change,[1086] but these are subject to monitoring, management and mitigation.[1087] 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.[1088]

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.[1089] The species has a wide range all over the western United States and is adapted to many different environmental conditions.[1090] While the rooting depth of swamp cedars in Spring Valley is unknown, Rocky Mountain junipers have a maximum rooting depth of 20 meters.[1091] 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.[1092] 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 locations.[1093] The valley floor populations occur in two clusters, one about in the center of

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[1082] Transcript, Vol.8 p. 1691:2-11 (McLendon).
[1083] Transcript, Vol.7 p. 1624:10-18 (McLendon).
[1084] Transcript, Vol.8 pp. 1672:19-1673:1 (McLendon).
[1085] Transcript, Vol.8 p. 1706:5-9 (McLendon).
[1086] Transcript, Vol.8 pp. 1710:23–1711:2 (McLendon).
[1087] Transcript, Vol.8 pp. 1713:19–1715:5 (McLendon).
[1088] Transcript, Vol.8 p. 1655:5-16, p. 1657: 8-25 (McLendon).
[1089] Transcript, Vol.8 p. 1677:3-4 (McLendon).
[1090] Transcript, Vol.8 p. 1677:17-19 (McLendon).
[1091] Transcript, Vol.8 p. 1681:5-9 (McLendon).
[1092] Transcript, Vol.8 p. 1677: 9-11 (McLendon).
[1093] Transcript, Vol.8 p. 1676: 7-12 (McLendon).

Spring Valley and the other around Shoshone Ponds.[1094] The Shoshone Ponds cluster is sustained in part by flow from artesian wells.[1095] The highest cover values for junipers are in the wetter lowland sites.[1096] In drier sites, the density and the cover values decrease.[1097] 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.[1098] 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.[1099]

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. The State Engineer finds that any increase in DTW that effects the swamp cedar will result in a decrease of density and cover, and the Applicant will be required to mitigate impacts to swamp cedars through regulating grazing and using the wells or surface water sources in the area to irrigate the trees or other methods approved by the State Engineer.

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. McLendon testified that cheatgrass would not result from a change in DTW.[1100] External factors (soil disturbance, heavy grazing) result in domination of a site by cheatgrass, but those factors can be controlled.[1101] Understanding how cheatgrass functions allows management of it.[1102] 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, [1103] 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

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[1094] Transcript, Vol.8 p. 1676:1-6 (McLendon).
[1095] Transcript, Vol.8 p. 1740:15-17 (McLendon).
[1096] Transcript, Vol.8 p. 1678:17-18 (McLendon).
[1097] Transcript, Vol.8 p. 1678:19-23 (McLendon).
[1098] Transcript, Vol.8 pp. 1678:15-1679:4 (McLendon).
[1099] Transcript, Vol.12 p. 2803:2-17 (Marshall).
[1100] Transcript, Vol.8 p. 1694:6-10 (McLendon).
[1101] Transcript, Vol.8 pp. 1694:14–1696:10 (McLendon).
[1102] Transcript, Vol.8 pp. 1696:19–1697:7 (McLendon).
[1103] Transcript, Vol.8 p. 1655:5-16, p. 1657:19-25 (McLendon).

the regional groundwater system, the general plant succession evidence presented by Dr. McLendon is persuasive.

Dr. McLendon's 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.[1104] Many wetlands in Spring Valley are supported by surface water diversions, and these wetlands would not be changed by declines in DTW.[1105] 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.[1106] Overall, this would lead to a greater presence of shrublands.[1107] In some instances, such as where greasewood shrublands are ultimately replaced by big sagebrush shrublands, ecological benefits in the form of increased vertebrate density may be realized.[1108]

In those areas where surface flows to aquatic habitats may be substantially diminished, a decline in species diversity can result.[1109] 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.[1110] 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.[1111] 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.[1112]

[1104] Transcript, Vol.8 pp. 1767:11-1768:5 (McLendon).
[1105] Transcripts, Vol.8 pp. 1767:20-1768:19 (McLendon).
[1106] Transcript, Vol.12 p. 2812:5-11 (Marshall).
[1107] Transcript, Vol.8 p. 1769:4-15 (McLendon).
[1108] Exhibit No. SNWA_363, p. 8-1.
[1109] Exhibit No. SNWA_363, p. 8-1.
[1110] Transcript, Vol.12 pp. 2801:20-2802:13 (Marshall).
[1111] Transcript, Vol.12 pp. 2802:20-2803:1 (Marshall).
[1112] Transcript, Vol.12 p. 2810:8-20 (Marshall).

Based on the evidence in the record, 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, as developed and described in this ruling, will be environmentally sound.

9. 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.[1113] The Applicant's approach is first avoidance, then minimization, then mitigation of impacts, avoiding as many conflicts as possible as the Project is developed.[1114]

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.[1115]

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.[1116] 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.[1117]

The Applicant purchased private landholdings totaling approximately 23,500 acres in Spring, Dry Lake, and Steptoe Valleys.[1118] These deeded properties encompass, in part, the

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[1113] 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).
[1114] Transcript, Vol.12 pp. 2799:20-2800:1 (Marshall).
[1115] 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).
[1116] Exhibit No. SNWA_363, p. 6-5; Transcript, Vol.12 pp. 2790:23–2791:3 (Marshall).
[1117] Exhibit No. SNWA_363, p. 6-5; Transcript, Vol.12 pp. 2789:22–2790:11 (Marshall).
[1118] Exhibit No. SNWA_363, p. 6-6.

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.[1119] Four of the ranch properties are base properties to federal grazing allotments that are managed by BLM or U.S. Forest Service.[1120] 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.[1121] The majority of these grazing allotments are in Spring Valley (>60%) and northern Dry Lake Valley (>30%).[1122] Approximately 40% (over 4,500 acres) of the wetland/meadow habitats in Spring Valley occur on the Applicant's deeded property and 40% (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.[1123] 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 down-stream channel of Unnamed #5 Spring; and Willow Spring.[1124]

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.[1125] 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.[1126] 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.[1127]

[1119] Exhibit No. SNWA_363, p. 6-6.
[1120] Exhibit No. SNWA_363, p. 6-6.
[1121] Exhibit No. SNWA_363, p. 6-6.
[1122] Exhibit No. SNWA_363, p. 6-6.
[1123] Exhibit No. SNWA_363, p. 6-6.
[1124] Exhibit No. SNWA_363, p. 6-6.
[1125] Exhibit No. SNWA_363, p. 6-6.
[1126] Exhibit No. SNWA_363, p. 6-5; Transcript, Vol.12 pp. 2789:22–2790:11 (Marshall).
[1127] Transcript, Vol.12 pp. 2791:8 – 2792:11 (Marshall).

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 adequately minimize the impacts, it has the resources in place to mitigate any unreasonable impact.

10. Air Quality

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 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. McLendon that there are many differences between Owens Valley and Spring Valley.[1128]

Based on hydrologists' potentiometric maps, Dr. McLendon concluded Spring Valley playas are predominantly dry playas.[1129] Protestant expert Mr. Clifford Landers acknowledged the data he reviewed on the Spring Valley playas was insufficient for site-specific evaluation.[1130] The data he reviewed was insufficient for making a definitive determination as to whether playas should be categorized as wet or dry playas.[1131]

Dr. McLendon testified that playas do not produce dust unless the surface is disturbed.[1132] And although there was some disagreement as to whether to divide playas into just wet and dry playas or three different categories,[1133] there was no disagreement that a change in depth to water may decrease, rather than increase, the propensity to blowing dust.[1134] The Applicant has demonstrated its commitment to environmental sustainability and informed, scientifically sound

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[1128] Transcript, Vol.8 p. 1697:13-17 (McLendon); Transcript, Vol.28 p. 6271:13-22 (Landers).
[1129] Transcript, Vol.8 p. 1700:18-21 (McLendon).
[1130] Transcript, Vol.28 pp. 6363:20-6364:12 (Landers).
[1131] Transcript, Vol.28 p. 6368:2-14 (Landers).
[1132] Exhibit No. SNWA_411; Transcript, Vol.8 p. 1701:3-5 (McLendon).
[1133] Transcript, Vol.28 p. 6377:5-9 (Landers).
[1134] Exhibit No. SNWA_411; Transcript, Vol.8 p. 1701:9-12 (McLendon); Transcript, Vol.28 pp. 6389:23-6390:1 (Landers).

decision-making.[1135] 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.

D. Future Growth and Development in the Basin of Origin

Pursuant to NRS 533.370(3)(d), 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(3)(d), 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 Protestants 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 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. The State Engineer considers evidence of growth that is reasonably foreseeable to occur given current and historic

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[1135] Transcript, Vol.12 p. 2724:9-20 (Marshall).

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.

The Applicant argues that the Nevada Legislature has not mandated that any water be reserved for the basin of origin.[1136] But rather, asserts that the statute only provides that 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."[1137] 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 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.[1138] 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.[1139] The Applicant submitted evidence regarding commercial, industrial, and alternative energy development within Spring Valley.[1140] The Applicant offered evidence related to possible residential development within Spring Valley.[1141] The Applicant also submitted evidence related to possible economic development and growth issues related to mining, manufacturing, tourism, hunting and general population growth.[1142] 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.[1143] The evidence submitted by the Applicant provided the State Engineer with a comprehensive evaluation of economic

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[1136] NRS 570.370(6)(d).
[1137] NRS 570.370(6)(d).
[1138] Exhibit No. SNWA_241.
[1139] 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).
[1140] 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).
[1141] Exhibit No. SNWA_241; Transcript, Vol.14 pp. 3273-3331, Vol.15 pp. 3321-3390 (Holmes).
[1142] Exhibit No. SNWA_241; Transcript, Vol.14 pp. 3273-3331, Vol.15 pp. 3321-3390 (Holmes).
[1143] Exhibit No. SNWA_346; Exhibit No. SNWA_347; Transcript, Vol.14 pp. 3146, 3153-3157 (Frehner).

County Water District's intentions in Spring Valley.[1143] 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.

1. **Future Economic Activity in Spring Valley**

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 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.[1144]

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.[1145] 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.[1146]

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.[1147] 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 unchanged - in fact it decreased in population - during this period of extreme growth within the state.[1148] Because the population in Spring Valley did not increase even in this time of fast

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[1143] Exhibit No. SNWA_346; Exhibit No. SNWA_347; Transcript, Vol.14 pp. 3146, 3153-3157 (Frehner).
[1144] Mr. Holmes was qualified as an expert in land use planning. *See*, Transcript Vol.14, pp. 3279:1-5 (Holmes).
[1145] Exhibit No. SNWA_241, pp. 1-1 -to1-2; Transcript, Vol.14 pp. 3285-3299 (Holmes).
[1146] Exhibit No. SNWA_241, p. 2-1; Transcript, Vol.14 pp. 3285-3299 (Holmes).
[1147] Exhibit No. SNWA_241, pp. 2-6 to 2-11; Transcript, Vol.14 pp. 3305-3308, Vol.15 pp. 3321-3332 (Holmes).
[1148] Exhibit No. SNWA_241, pp. 2-6 to 2-11; Transcript, Vol.14 pp. 3305-3308, Vol. 15 pp. 3321-3332 (Holmes).

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.[1149] The Protestants 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.[1150] 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.[1151]

Furthermore, Mr. Holmes testified that Spring Valley is extremely isolated and is located well over 250 miles from the nearest metropolitan city.[1152] 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.[1153] 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.[1154] 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 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.[1155] 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.[1156]

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.

[1149] Transcript, Vol.14 pp. 3305-3308; Vol.15 pp. 3321-3332 (Holmes); Exhibit No. SNWA_241, pp. 2-6 to 2-11.
[1150] Transcript, Vol.22 p. 5028 (Kilkenny).
[1151] Transcript, Vol.15 p 3332:8-12 (Holmes).
[1152] Exhibit No. SNWA_241, p. 2-4; Transcript, Vol.14 pp. 3301-3302 (Holmes).
[1153] Transcript, Vol.14 pp. 3294-3305(Holmes).
[1154] Transcript, Vol.15 pp. 3347-3349 (Holmes).
[1155] Exhibit No. SNWA_241, p. 3-8 to 3-11; Transcript, Vol.14 pp. 3375-3381 (Holmes).
[1156] Exhibit No. SNWA_241, pp. 5-1 to 5-2; Transcript, Vol.15 pp. 3380-3381 (Holmes).

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.[1157] 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.[1158] 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.[1159] Finally, Dr. Kilkenny testified that the threat of these Applications has affected growth during their pendency.[1160]

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.[1161] It is evident from Mr. Holmes' report and testimony that the Applicant does not 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.[1162] While NRS 533.370(3)(d) 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.[1163] 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.[1164] 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.[1165] Additionally, Dr. Kilkenny's testimony regarding the lack of growth

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[1157] Exhibit No. GBWN_114, pp. 12-13.
[1158] Exhibit No. GBWN_114, p. 54.
[1159] Exhibit No. GBWN_114, pp. 4-6.
[1160] Transcript, Vol.22 pp. 4988-4989, pp. 5022-5023 (Kilkenny).
[1161] Transcript, Vol.15 pp. 3349-3355 (Holmes), Vol.13 pp. 3009-3013 (Peseau and Carter).
[1162] Transcript, Vol.15 pp. 3352-3354 (Holmes).
[1163] Exhibit No. SNWA_241, p. 1-1; Transcript, Vol.14 pp. 3285-3291, Vol.15 pp. 3435-3438 (Holmes).
[1164] Transcript, Vol.22 pp. 4999-5002, pp. 5039-5040, pp. 5043-5058 (Kilkenny).
[1165] Exhibit No. GBWN_066, p. 1; Transcript, Vol.22 pp. 5008-5009, pp. 5023-5024 (Kilkenny).

within the basins due to the mere threat of the Applications is highly speculative.[1166] The State Engineer must make his decisions based upon the evidence submitted and not on the speculative assertions as to public beliefs offered by Dr Kilkenny.[1167] The State Engineer finds that Dr. Kilkenny did not provide substantial or credible 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.[1168] Instead, development in White Pine County is more targeted towards Steptoe Valley.[1169] 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.[1170] 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.[1171] The Protestants have not presented any contradicting evidence or testimony to refute the lack of any current development plans in Spring Valley. Testimony provided through White Pine County Commissioner Gary Perea discussed the development of the Pattern Energy wind project within Spring Valley,[1172] but this type of wind project would not utilize significant water in its operation.[1173] 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 Valley, Mr. Perea could not identify any specific quantity of water, but mentioned again the wind generation project and noted that there are numerous mining claims in the basin.[1174] 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.[1175]

[1166] Transcript, Vol.22 pp. 4988-4989 (Kilkenny).
[1167] Transcript, Vol.22 pp. 4988-4989 (Kilkenny).
[1168] Exhibit No. SNWA_252; Transcript, Vol. 15 pp. 3372-3373 (Holmes).
[1169] Transcript, Vol.15 pp. 3372-3373 (Holmes).
[1170] Exhibit No. SNWA_353; Transcript, Vol.14 pp. 3151-3153 (Frehner).
[1171] Exhibit No. SNWA 346; Exhibit No. SNWA_347.
[1172] Transcript, Vol.21 p. 4682:1-23 (Perea).
[1173] Transcript, Vol.14 p. 3090:9-16 (Candelaria and Linvill).
[1174] Transcript, Vol.21 pp. 4692:10-4693:6 (Perea).
[1175] Transcript, Vol.21 pp. 4693-4757 (Garza).

2. 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.[1176] In reaching their conclusions, Dr. Linvill and Mr. Candelaria reviewed and relied upon numerous sources, which have been submitted as exhibits.[1177] 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.[1178] 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.[1179] They referenced the Renewable Energy Transmission Initiative in California which brings together persons from varying interests to evaluate renewable energy and transmission in California.[1180] 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.[1181]

The evidence submitted by the Applicant demonstrates 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.[1182] Mr. Candelaria testified that solar energy is currently the most costly renewable energy to develop.[1183] Based on the high cost to develop

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[1176] Exhibit No. SNWA_113; Transcript, Vols. 13-14 pp. 3053-3144 (Candelaria and Linvill).
[1177] Exhibit Nos. SNWA_114 through 142.
[1178] Transcript, Vol.13 pp. 3075:10-3076:20 (Candelaria and Linvill).
[1179] Transcript, Vol.13 pp. 3076:21-3077:10 (Candelaria and Linvill).
[1180] Transcript, Vol.13 pp. 3077:11-3079:22 (Candelaria and Linvill).
[1181] Transcript, Vol.13 pp. 3079–3082 (Candelaria and Linvill).
[1182] Transcript, Vol.14 pp. 3098:17-3101:13 (Candelaria and Linvill).
[1183] Transcript, Vol.14 p. 3099:7-9 (Candelaria and Linvill).

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.[1184]

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 located in Delamar Valley.[1185] Dr. Linvill and Mr. Candelaria explained that even this higher quality Delamar Valley resource is not competitive and will not likely be developed.[1186] 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").[1187] PV bypasses the turbine process and requires little to no water.[1188] 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.[1189] Furthermore, the evidence demonstrates that PV costs are rapidly declining, making the technology more competitive than concentrated solar.[1190] The State Engineer finds the Applicant provided substantial evidence 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.[1191] 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.[1192] This resource and its development and water usage was also the subject of

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[1184] Exhibit No. SNWA_113, Figures 1-3 and 4-2.
[1185] Exhibit No. SNWA_113, p. 1-5; Transcript, Vol.14 p. 3103:12-19 (Candelaria and Linvill).
[1186] Exhibit No. SNWA_113 pp.1-5 to 1-8; Transcript Vol.14, pp. 3103-3105 (Candelaria and Linvill).
[1187] Exhibit No. SNWA_113, p.1-10; Transcript, Vol.14 pp. 3090:20-3092:9 (Candelaria and Linvill).
[1188] Transcript, Vol.14 pp. 3090-3094 (Candelaria and Linvill).
[1189] Exhibit No. SNWA_113, p.1-10; Transcript Vol.14 pp. 3090:17-3094:22 (Candelaria and Linvill).
[1190] Exhibit No. SNWA_113, p. 1-9; Transcript, Vol.14 pp. 3094-3099 (Candelaria and Linvill).
[1191] Exhibit No. SNWA_113, p. 7-1 to 7-5.
[1192] Transcript, Vol.14 p. 3090:9-16 (Candelaria and Linvill).

testimony from Protestant witnesses.[1193] Dr. Linvill explained that after construction, the operation of wind energy facilities requires little to no water.[1194] 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.[1195] 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 renewable energy development will occur that would require additional water resources.

3. 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.[1196] 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 research in their report.[1197] 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.[1198] 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.[1199]

The Applicant presented 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.[1200] Mr. Carter testified

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[1193] Transcript, Vol.27 pp. 6189:18-6191:6 (Scott and Drew).
[1194] Transcript, Vol.14 p. 3090:9-16 (Candelaria and Linvill).
[1195] Transcript, Vol.27 pp. 6189:18-6191:6 (Scott and Drew).
[1196] Transcript, Vol.13 pp. 2947-3053 (Carter and Peseau).
[1197] Exhibit No. SNWA_103, pp. 26-28; Transcript, Vol.13 pp. 2959-2961, pp. 2965-2967 (Carter and Peseau).
[1198] Exhibit No. SNWA_103, pp. 26-28; Transcript, Vol.13 pp. 2959:14-2960:15 (Carter and Peseau).
[1199] Transcript, Vol.13 pp. 2966:4- 2968:1 (Carter and Peseau).
[1200] Exhibit No. SNWA_103, pp.1-8; Transcript, Vol.13 pp. 2971-2974 (Carter and Peseau).

that a comparison of regional markets is important because the regional market affects market prices for a potential grower in Spring Valley.[1201]

The Applicant submitted evidence that the primary crop grown within Spring Valley is hay and, in particular, alfalfa.[1202] 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.[1203] The evidence indicates 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.

On direct examination, the relatively high current prices for alfalfa were discussed.[1204] 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.[1205] However, Mr. Carter testified that despite these high prices in alfalfa, White Pine County is not showing any increase in production.[1206]

The Applicant has utilized the most relevant factors to determine that it is 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.[1207] Dr. Peseau and Mr. Carter base this opinion in large measure upon studies published by the University of Nevada, Reno.[1208] 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.[1209] 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.[1210]

[1201] Transcript, Vol.13 pp. 2968:22-2970:5 (Carter and Peseau).
[1202] Exhibit No. SNWA_103, p. ES-1 to ES-2; Transcript, Vol.13 pp. 2967:15- 2968:5 (Carter and Peseau).
[1203] Exhibit No. SNWA_103, p. 6; Transcript, Vol.13 pp. 2978:7-16 (Carter and Peseau).
[1204] Transcript, Vol.13 pp. 2978:24-2982:5 (Carter and Peseau).
[1205] Transcript, Vol.13 pp. 2978:24-2982:5 (Carter and Peseau).
[1206] Transcript, Vol.13 pp. 2978:24–2982:5 (Carter and Peseau).
[1207] Exhibit No. SNWA_103; Transcript, Vol.13 pp. 2958:16- 2958:13 (Carter and Peseau).
[1208] Exhibit Nos. SNWA_104; SNWA_105; Transcript, Vol.13 pp. 2964:12-2966:3 (Carter and Peseau).
[1209] Exhibit Nos. SNWA_104; SNWA_105; Transcript, Vol.13 pp. 2964:12-2966:3 (Carter and Peseau).
[1210] Exhibit No. SNWA_103; Transcript, Vol.13 pp. 2987-2999 (Carter and Peseau).

Dr. Peseau also provided testimony regarding his review of external factors that might be relevant to agricultural growth in Spring Valley.[1211] He testified that the USDA prediction of contraction of the dairy market will likely negatively impact alfalfa demand and is not likely to drive growth in this basin.[1212] 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.[1213] This opinion was consistent with the Protestant testimony that grazing allotments have been reduced in recent years.[1214]

No Protestant submitted any credible evidence indicating the likelihood of expansion of agriculture within Spring Valley that 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.[1215] The State Engineer notes that Mr. Garza, although a county official, was not designated as an expert. 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.[1216] The testimony of Mr. Garza has been given little weight by the State Engineer because Mr. Garza's calculations showed what he speculated could be done in Spring Valley with a certain amount of water. Mr. Garza's calculations were a mathematical exercise and were unsupported by any evidence that the development he suggested was likely, even if these Applications were denied.[1217]

On cross-examination there was a suggestion by counsel for the CPB that the motivation to expand ranching operations for the CPB may be different from a for-profit operation; however, there was no evidence submitted by CPB or any protestant of any current plan or intent to expand operations.[1218] 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.

[1211] Transcript, Vol.13 pp. 2983:10-2985:19 (Carter and Peseau).
[1212] Exhibit No. SNWA_103, pp.12-13; Transcript, Vol.13 pp. 2999:8-3002:1 (Carter and Peseau).
[1213] Transcript, Vol.13 pp. 2984:11-2985:11 (Carter and Peseau).
[1214] Transcript, Vol.24 p. 5507:12-15 (Gloeckner).
[1215] Transcript, Vol.21 pp. 4705:24-4711:20 (Garza).
[1216] Exhibit No. SE_001.
[1217] Transcript, Vol.21 pp. 4705:24-4711:20 (Garza).
[1218] Transcript, Vol.13 pp. 3029:9-3031:12 (Carter and Peseau).

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.[1219] 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.[1220] The State Engineer finds that the Protestants witnesses have not presented evidence that approving the Applications will unduly limit growth and development of existing ranching operations within Spring Valley.

As with crop-based agriculture, the evidence demonstrates that the cow/calf market in Spring Valley is unlikely to grow in the foreseeable future. Mr. Carter provided testimony and USDA trends for cow/calf grazing.[1221] 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.[1222] 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.[1223]

Lastly, Dr. Peseau and Mr. Carter submitted their analysis of the economics of a new joint alfalfa and cow/calf operation.[1224] 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.[1225]

[1219] Transcript, Vol.24 pp. 5503:11-5516:7 (Gloeckner); Vol.24 pp. 5541-5551 (Rountree).
[1220] Transcript, Vol.24 pp. 5503:11-5516:7 (Gloeckner); Vol.24 pp. 5541-5551 (Rountree).
[1221] Transcript, Vol.13 pp. 3002:15-3009:5 (Carter and Peseau).
[1222] Exhibit No. SNWA_104.
[1223] Transcript Vol. 13 pp. 3037-3038 (Carter and Peseau).
[1224] Exhibit No. SNWA_103; Transcript, Vol.13 pp. 3013:13-3016:24 (Carter and Peseau).
[1225] Exhibit No. SNWA_103; Transcript, Vol.13 pp. 3013:13-3016:24 (Carter and Peseau).

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 been the effect.[1226] 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.[1227] 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.[1228] 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.[1229] Similarly, she offered no contrary opinion or rebuttal report regarding the economics of new crop-based agriculture in the basins. 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.[1230]

The Applicant presented substantial evidence supported by expert testimony that it is highly improbable that there will be any significant 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.[1231] The State Engineer finds that it is unlikely that there will be any significant new agricultural development in Spring Valley and therefore the granting of these Applications will not unduly limit such development.

4. 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 may remain

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[1226] Transcript, Vol.22 pp. 4988-4989 (Kilkenny).
[1227] Transcript, Vol.13 pp. 3047-3048 (Carter and Peseau).
[1228] Transcript, Vol.22 pp. 4991-4992 (Kilkenny).
[1229] Transcript, Vol.22 p. 4991:21-22 (Kilkenny).
[1230] 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).
[1231] Transcript, Vol.13 pp. 3021-3022 (Carter and Peseau).

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 may also be available 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. However, the State Engineer also finds that although there are existing rights in the basin that may be transferred to other uses to accommodate future activities, a significant amount of those rights are owned by the Applicant. The Applicant testified that under certain circumstances, use of their existing water rights in the basin may be used for mitigation of any impacts.[1232] The Applicant cannot use its existing water rights on the ranches it purchased in Spring Valley for both mitigation and future development; these two uses are contradictory. Although significant existing water rights are available within Spring Valley and will remain in the basin even after these Applications are granted, not all of the existing water rights may be available to support any unforeseen future use that is not known or contemplated at the time these Applications are considered.

4. 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.[1233] Rather, she indicates her effort was an attempt to update information which had been previously compiled by others.[1234] 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.[1235] Dr. Kilkenny explained that she did not attempt to quantify the economic activity within Spring Valley; instead, she presented county-wide information for

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[1232] Transcript, Vol.1 pp. 100:16-101:1 (Mulroy); Transcript, Vol.9 p. 2079:14-17 (Prieur); Transcript, Vol.11 pp. 2585"23-2586:6 (Watrus).
[1233] Transcript, Vol.22 pp. 5020:18-5021:7 (Kilkenny).
[1234] Transcript, Vol.22 pp. 5020:18-5021:7 (Kilkenny).
[1235] Transcript, Vol.22 pp. 4988-4989, 5023 (Kilkenny).

White Pine and Lincoln Counties.[1236] Dr. Kilkenny testified that when she authored her report she did not understand the geographic extent of Spring Valley.[1237] Dr. Kilkenny's testimony revealed errors and misstatements in her report and her report and testimony has been given little weight by the State Engineer.

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. No Protestant submitted evidence in support of a specific quantity of water that should be reserved in Spring Valley; however, many Protestant witnesses discussed growth in more general terms. The Applicant has suggested that a reservation of 300 afa is consistent with the testimony of its expert witness, Mr. Holmes. Based on the historic use of water in the basin, he asserts that 300 afa would be more than enough water for any unforeseen future uses in Spring Valley. However, the State Engineer must utilize his knowledge and judgment to evaluate the evidence and determine whether the Applicant's suggestion of 300 afa should be accepted and whether that amount is sufficient to satisfy the statutory requirement.

The State Engineer finds that he will reserve an amount of water based on the evidence and his professional knowledge and judgment. This evidence includes that cited above and official records on file in the Office of the State Engineer.[1238] The Applicant indicates it holds significant water rights in Spring Valley and implies that these water rights could be used for future growth and development; however, the Applicant states that its existing water rights may be used for mitigation purposes.[1239] Because the Applicant may use its existing water rights for mitigation purposes, those water rights would not be available for re-purposing to support future growth and development; therefore, the State Engineer finds that he must reserve more than the 300 afa suggested by the Applicant. Based upon the evidence in the record, including but not limited to that cited above, the State Engineer finds that approving the Applications, as limited in

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[1236] Transcript ,Vol.22 pp. 5033-5038 (Kilkenny).
[1237] Transcript, Vol.22 pp. 5024-5026 (Kilkenny).
[1238] NAC 533.300.
[1239] Transcript, Vol.1 pp. 100:16-101:1 (Mulroy), Transcript, Vol.9 p. 2079:14-17 (Prieur), Transcript, Vol.11 2585:23-2586:6 (Watrus).

this ruling and with the reservation of 4,000 afa of water, will not unduly limit future growth and development in Spring Valley.

VIII. 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 claim that there is 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.[1240] 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.[1241] Both resolutions identified and confirmed Lincoln County's lack of current plans for growth and development in that portion of Spring Valley which resides in Lincoln County.[1242] 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.[1243] Rather, this evidence indicated Lincoln County's intention to put the water to beneficial use elsewhere within Lincoln County, specifically within Coyote Spring Valley.[1244]

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.[1245] 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.[1246]

[1240] Exhibit No. SNWA_352.; Transcript, Vol.14 pp. 3149:18-3152:9 (Frehner).
[1241] Exhibit No. SNWA_346; Exhibit No. SNWA_347; Transcript, Vol.14 pp. 3153:4-3157:7 (Frehner).
[1242] Exhibit No. SNWA_346, Exhibit No. SNWA_347; Transcript, Vol.14 pp. 3153:4-3157:7 (Frehner).
[1243] Transcript, Vol. 14, pp. 3153:4-3157:7 (Frehner).
[1244] Transcript, Vol. 14, pp. 3153:4-3157:7 (Frehner).
[1245] Exhibit No. SNWA_352; Transcript, Vol.14 pp. 3152:14-3153:2 (Frehner).
[1246] Exhibit No. SNWA_346; Exhibit No. SNWA_347; Transcript, Vol.14 pp. 3152-3157 (Frehner).

The Applicant submitted a Lincoln County resolution dated June 20, 2011, in which Lincoln County expressed a preference for the use of any water acquired pursuant to the agreement.[1247] While the resolution clearly indicates intent by Lincoln County to use any water assigned to Lincoln County within the Coyote Springs-Lincoln County General Improvement District, the resolution provides that the water would be used for the Coyote Springs Development in Coyote Spring Valley. On cross examination, the Applicant's Lincoln County witness conceded that all development has come to a halt on that project and that the original project proponent no longer owns the development.[1248] Further, Coyote Springs Development was the only anticipated use for the water.[1249]

The Nevada Supreme Court in the case of *Bacher v. Office of the State Engineer*,[1250] reversed the district court's affirmance of the State Engineer's approval of an interbasin groundwater transfer because the evidence of the applicant's need was not based on specific facts, but speculation:

> When reaching his decision to grant Vidler Water's application, the State Engineer considered the proposed power plant second phase expansion, the mall expansion, the MGM Grand employee housing, an industrial park, and a theme park. Both the State Engineer's decision and the record suffer from a fundamental defect: neither specifies how much afa of water each project would require and how that quantity would be reduced by Primm South's unused water permits. Without this specificity, a reasonable mind could not accept as adequate the conclusion that Vidler Water had justified a need to import 415 afa of water from the Sandy Valley Basin. Because he failed to make the necessary calculations to determine Primm South's future water usage by project and the support of that usage by the imported water, the State Engineer's decision is not supported by substantial evidence. We therefore conclude the State Engineer abused his discretion in finding that Vidler Water had presented sufficient evidence to justify a need to import water under NRS 533.370(6)(a) (Currently, NRS 533.370(3)(a)).

The State Engineer finds these Applications were originally filed by the Las Vegas Valley Water District and are now held by the Southern Nevada Water Authority. The State Engineer finds there is no evidence in the record of a need for or a beneficial use of the water for anywhere other than Clark County, and there is no evidence in the record showing the Applicant has justified a need to import water into Coyote Spring Valley as part of the Coyote Springs-

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[1247] Exhibit No. SNWA_347.
[1248] Transcript Vol.14 pp. 3168-70 (Frehner).
[1249] Transcript Vol.14 pp. 3171-72 (Frehner).
[1250] *Bacher v. Office of the State Engineer*, 122 Nev. 1110, 1122-23, 146 P.3d 793, 801 (2006).

Lincoln County General Improvement District. The State Engineer finds based on the *Bacher* decision that insufficient evidence was provided to support a claimed use of any specific amount of water in Lincoln County. Accordingly, the State Engineer finds that the Applicant has not presented sufficient evidence that the place of use of the Applications will include Lincoln County.

IX. OTHER PROTEST GROUNDS

A. The Applications are in Proper Form

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.[1251]

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 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 and dismisses this protest claim.

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.

[1251] *See, e.g.*, Exhibit No. SE_003 (Spring).

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.[1252] 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.[1253] The State Engineer finds the evidence indicates the Applicant is pursuing the right-of-way in good faith and with reasonable diligence and dismisses this protest claim.

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. 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; however, the evidence shows that the Applicant has engaged in comprehensive long-range planning.[1254] 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, these protest claims are dismissed. The State Engineer finds that additional study is not needed to grant the Applications; however, additional studies associated with staged development pursuant to NRS 533.3705 will provide needed information for future development. 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 Management Plan.

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

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[1252] Exhibit No. SNWA_351.
[1253] Transcript, Vol.1 p. 217:16-25 (Holmes).
[1254] Exhibit No. SNWA_209; Transcript, Vol.2 pp. 248:20-250:2 (Entsminger).

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. 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 State Engineer finds the decisions as to growth control are the responsibility of other branches of government and dismisses this protest claim.

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 and dismisses this protest claim.

F. Denial of Prior Applications

Protestants argue that the Applications should be denied because the State Engineer 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 finds that several applications in the basin that were based on the Desert Land Entry Act and the Carey Act were denied for failure to establish a reasonable expectation to put the water to beneficial use based on lack of control of the point of diversion. The State Engineer finds that the Applicant is actively pursuing right-of-ways to the points of diversion and dismisses this protest claim.

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. The State Engineer finds the 2010 applications are irrelevant to the matter under consideration in this ruling and dismisses this protest claim.

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 and dismisses this protest claim.

I. Impacts to Indian Springs, Nellis Air Force Base, Lake Mead and Wildlife Areas

Protestants argue 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. The State Engineer finds that no evidence was presented of impacts to Indian Springs Valley Basin, Pahranagat and Moapa National Wildlife Refuges, Pahranagat and White River Valleys, Lake Mead National Recreation Area, Overton and Key Pittman and Wayne E. Kirsch Wildlife Management Areas, Railroad Valley wetlands areas, and Ash Meadows National Wildlife Refuge and Moapa Wildlife Refuge from the appropriation of water in Spring Valley and dismisses this protest claim.

J. Climate Change

Protestants allege that cyclical drought and long-term climatic change are causing a diminishment of water resources in this basin and all connecting basins. The State Engineer finds that no evidence was submitted that the groundwater resources in Spring Valley are diminishing due to climate change or drought and dismisses this protest claim.

X. UNAPPROPRIATED WATER

The estimated average annual groundwater ET in Spring Valley is 84,100 acre-feet. Using estimated groundwater ET as a basis, the State Engineer finds the perennial yield of Spring Valley is 84,000 acre feet. Existing water rights, as calculated in this ruling, equal 18,873

afa and an additional 4,000 afa is reserved for future growth and development, for a total of 22,873 afa of water committed to the basin. Subtracting 22,873 afa from the perennial yield of 84,000 afa, leaves 61,127 afa available for appropriation. The State Engineer finds that there is unappropriated water in the amount of 61,127 afa within the Spring Valley Hydrographic Basin available for appropriation pursuant to these applications.

CONCLUSIONS OF LAW

I. JURISDICTION

The State Engineer has jurisdiction over the parties and the subject matter of this action and determination.[1255]

II. STATUTORY DUTY TO DENY

The State Engineer is prohibited by law from granting an application to appropriate the public waters where:[1256]

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 and the staged development, 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(2).

III. GOOD FAITH, REASONABLE DILIGENCE, FINANCIAL ABILITY

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 actually to construct the work and apply the water to the intended beneficial use with reasonable

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[1255] NRS Chapters 533 and 534.
[1256] NRS 533.370(2).

diligence. Therefore, if all other statutory requirements are fulfilled, NRS 533.370(1) requires the Applications to be approved.

IV. NEED, CONSERVATION PLAN, ENVIRONMENTALLY SOUND, FUTURE GROWTH AND DEVELOPMENT BASIN OF ORIGIN

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 4,000 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(3).

RULING

The protests to Applications 54003-54021 are hereby overruled in part and upheld in part. Applications 54016, 54017, 54018 and 54021 are hereby denied on the grounds that the use of the water would conflict with existing rights. Applications 54003 to 54015, 54019 and 54020 are hereby granted in the following amounts and subject to the following conditions:

1. The amount of groundwater available for appropriation under the Applications is 61,127 afa, in staged development. The Stage development plan is as follows:

    a. Stage 1 Development: Pumping pursuant to the Applications shall be limited to 38,000 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 (32,300 afa – 38,000 afa) for a minimum of eight years. Data from those eight years of pumping and updated modeling results will be submitted to the State Engineer as part of the annual hydrologic monitoring report. The State Engineer will then make a determination as to whether the Applicant can proceed to Stage 2.

    b. Stage 2 Development: Pumping pursuant to the Applications shall be limited to a total of 50,000 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 Stage 2 development amount (42,500 afa - 50,000 afa) for a minimum of eight years. Data from those eight years of pumping and updated modeling results will be submitted to the State Engineer as part of the annual hydrologic monitoring report. The State Engineer will then make a determination as to whether the Applicant can proceed to Stage 3.

c. Stage 3 Development: The Applicant may pump the full amount granted, 61,127 afa. The annual hydrologic monitoring report will continue to be submitted and reviewed by the State Engineer;

2. The State Engineer has reviewed and approves the Hydrologic Monitoring and Mitigation Plan for Spring Valley 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 water law;

3. The State Engineer has reviewed and approves the Biological Monitoring Plan for Spring Valley 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 water law;

4. 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;

5. 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. 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;

6. The Applicant shall update a computer groundwater flow model approved by the State Engineer once before groundwater development begins and at a minimum of every eight years thereafter, and provide predictive results for 10-year, 25-year and 100-year periods;

7. The Applications are granted subject to existing rights; and

8. The Applicant shall pay the statutory permit fees.

Respectfully submitted,

JASON KING, P.E.
State Engineer

Dated this 22nd day of

March, 2012.