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

IN THE MATTER OF APPLICATIONS 53989)
AND 53990 FILED TO APPROPRIATE THE)
UNDERGROUND WATERS OF THE DRY)
LAKE VALLEY HYDROGRAPHIC BASIN)
(181), LINCOLN COUNTY, NEVADA.)

RULING

#6166

GENERAL

I. DESCRIPTION OF APPLICATIONS

Application 53989 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 Dry Lake Valley Hydrographic Basin for municipal and domestic purposes within Clark, Lincoln, Nye and White Pine Counties as more specifically described and defined in Nevada Revised Statutes (NRS) 243.210-243.225 (Lincoln), 243.275-243.315 (Nye), 243.365-243.385 (White Pine), and 243.035-243.040 (Clark). The proposed point of diversion is described as being located within the SE1/4 SW1/4 of Section 30, T.2S., R.64E., M.D.B.&M, within Lincoln County.[1]

Application 53990 was filed on October 17, 1989, by the Las Vegas Valley Water District to appropriate 10 cfs of underground water from the Dry Lake 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 8, T.2S., R.65E., M.D.B.&M, within Lincoln County.[2]

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.[3] The Applications were originally

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[1] Exhibit No. SE_044.
[2] Exhibit No. SE_045.
[3] File Nos. 53989, 53990, official records in the Office of the State Engineer.

filed by the LVVWD and are now held by the Southern Nevada Water Authority ("SNWA" or "Applicant").[4]

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.[5]

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.[6] The State Engineer scheduled a hearing on the Spring Valley applications to begin on September 11, 2006.[7] A hearing on the Dry Lake Valley Applications was not scheduled at that time.

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.[8] 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.[9]

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.[10] 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

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[4] *Ibid.*
[5] *In re Applications 53987-53992 & 54003-54030*, State Engineer Intermediate Order & Hearing Notice, p. 1 (March 8, 2006).
[6] *Id.* at 7.
[7] *Id.* at 11.
[8] *In re Applications 53987-53992 & 54003-54030*, Protestants' Petition for Declaratory Order (July 6, 2006).
[9] *In re Applications 54003-54021*, State Engineer Intermediate Order No. 3, p. 2 (July 27, 2006).
[10] *Great Basin Water Network v. Taylor*, No. CV 0608119, Petition for Judicial Review (7th Judicial Dist. Ct. Nev. Aug. 22, 2006).

and re-open the protest period did not violate due process and denied the petition for judicial review.[11] Some Protestants appealed the District Court's order to the Supreme Court of Nevada.

On October 4, 2007, the State Engineer scheduled a hearing for the applications in Cave, Dry Lake, and Delamar Valleys.[12] On January 7, 2008, 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 Cave, Dry Lake, and Delamar Valleys applications in exchange for, among other things, implementation of monitoring, management, and mitigation plans.[13] The Moapa Band of Paiute Indians also entered into a stipulation with the Applicant to withdraw its protests.[14]

The State Engineer held hearings on the Cave, Dry Lake, and Delamar Valleys applications from February 4, 2008 to February 15, 2008. On July 9, 2008, the State Engineer issued Ruling 5875, approving in part Applications 53987, 53988, 53991, and 53992 and approving in full Applications 53989 and 53990 subject to monitoring and mitigation requirements.[15]

Some Protestants petitioned for judicial review of State Engineer's Ruling 5875 to the Seventh Judicial District Court of the State of Nevada. The District Court vacated the State Engineer's ruling and remanded the matter to the State Engineer for further proceedings on October 15, 2009.[16] The State Engineer and the Applicant appealed the decision to the Supreme Court of the State of Nevada.

On review of the District Court's decision regarding the re-notice and re-opening of the protest period, 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

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[11] *Great Basin Water Network v. Taylor*, No. CV 0608119, Order, pp. 9-12 (7th Judicial Dist. Ct. Nev. May 30, 2007).
[12] *In re Applications 53987-53992*, State Engineerr Intermediate Order No. 1 & Hearing Notice, p. 15 (Oct. 4, 2007).
[13] Exhibit No. SE_080.
[14] Exhibit No. SE_079.
[15] State Engineer's Ruling No. 5875, pp. 39-40, dated July 9, 2008, official records in the Office of the State Engineer.
[16] *Carter-Griffin Inc. v. Taylor*, No. CV 0830008, Order (7th Judicial Dist. Ct. Nev. Oct. 15, 2009).

Applications.[17] 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.[18]

On June 17, 2010, the Supreme Court granted, in part, the Applicant's and State Engineer's request for re-hearing.[19] 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.[20] The Supreme Court concluded that "the proper and most equitable remedy is that the State Engineer must re-notice the applications and reopen the protest period" and remanded the matter to the District Court with instructions to remand it to the State Engineer for further proceedings.[21] The Supreme Court noted that its decision on the notice and protest issue rendered the appeal of Ruling 5875 moot because the State Engineer must re-decide the Cave, Dry Lake, and Delamar Valleys applications. The Supreme Court therefore dismissed the appeal of the District Court's order vacating Ruling 5875.[22]

On remand, Applications 53989 and 53990 were sent for publication in the Lincoln County Record on January 26, 2011, and last published on February 24, 2011. On March 26, 2011, the protest period ended and the Applications 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.[23] 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.[24] The State Engineer further ordered that Protestants wishing to put on a case-in-chief notify the State Engineer by April 29, 2011.[25] The State Engineer ordered that an initial evidentiary exchange take place no later than July 1, 2011,

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[17] *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).
[18] *Id.*at 672, *Ibid.*
[19] *Great Basin Water Network v. Taylor*, 126 Nev. Adv. Op. 20, 234 P.3d 912, 913 (2010).
[20] *Id.*at 913-14.
[21] *Id.* at 920.
[22] *Southern Nevada Water Authority v. Carter-Griffin Inc.*, No. 54986, slip op. (Nev. Sept. 13, 2010).
[23] Exhibit No. SE_001, pp. 1, 3.
[24] Exhibit No. SE_001, p. 1.
[25] Exhibit No. SE_001, p. 3.

and that a second, rebuttal evidentiary exchange take place no later than August 26, 2011.[26] 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.[27]

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.[28] 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.[29] The State Engineer allowed the parties to file written opening statements by September 19, 2011.[30] The State Engineer allowed the parties to file written closing briefs by December 23, 2011, and to file proposed rulings by January 27, 2012.[31] The State Engineer also set the hearing schedule and format for exhibits.

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

III. LIST OF PROTESTANTS

Applications 53989 and 53990 were originally published in 1990, and many protests were filed. The Applications were published again in 2011 and a second round of protests and amended protests were filed. The Applications were protested by the following persons as identified below:

In 1990, Application 53989 was protested by: U.S. Bureau of Land Management; Anthony Wells; Frank C. Hulse; Yvonne Stackhouse; Renee Vincent; Richard Vincent; Steve T. Sendlein; John M. Wadsworth; Candy Haley; City of Caliente; Wilford L. Cantrell; Lillian E. Edwards; James I. Lee; County of White Pine and City of Ely; Moapa Band of Paiute Indians; U.S. Fish and Wildlife Service; County of Nye; Frank Delmue; William G. Schoenberg; Mary

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[26] Exhibit No. SE_001, p. 4.
[27] Exhibit No. SE_001, p. 5.
[28] Exhibit No. SE_100, p. 3.
[29] Exhibit No. SE_100, p. 5.
[30] Exhibit No. SE_100, p. 6.
[31] Exhibit No. SE_100, p. 7.

Smith; U.S. National Park Service; James R. Prince; Unincorporated Town of Pahrump[32]; and the Lincoln County Board of County Commissioners.[33]

In 2011, Application 53989 was protested by: Col. James R. Byrne; Great Basin Water Network, et al.; Defenders of Wildlife; Confederated Tribes of the Goshute Reservation; County of White Pine and City of Ely (Amended Protest); Ely Shoshone Tribe; Duckwater Shoshone Tribe; Mark Wadsworth; Central Nevada Regional Water Authority; County of Inyo, California; Elko Band Council; Donna Lytle; Kena Glockener; Kenneth Lytle; Farrel W. Lytle; Jason Lloyd; Preston Irrigation Co.; Patrick J. Gloeckner; L. Ryan Stever; Jim Cole; Pete T. Delmue; Nevada Department of Wildlife; Louis Benezet; and Toiyabe Chapter of the Sierra Club.[34]

In 1990, Application 53990 was protested by: Citizen's Alert; U.S. Bureau of Land Management; Reion Lee; Grace Wallis; Alex P. Coroneos and Steve T. Sendlein; Jack E. Cupples; Kathryn J. Miller; John M. Wadsworth; Richard J. Walters; Ruby Walters; County of Inyo, California; City of Caliente; Ely Shoshone Tribe; James I. Lee; Lund Irrigation and Water Co.; County of White Pine and City of Ely; Moapa Band of Paiute Indians; U.S. Fish and Wildlife Service; County of Nye; Frank Delmue; Karl and Gerry Hanning; Genevieve D. Logan; U.S. National Park Service; Unincorporated Town of Pahrump,[35] and the Lincoln County Board of County Commissioners.[36]

In 2011, Application 53990 was protested by: Col. James R. Byrne; Great Basin Water Network, et al.; Defenders of Wildlife; Confederated Tribes of the Goshute Reservation; County of White Pine and City of Ely (Amended Protest); Ely Shoshone Tribe; Duckwater Shoshone Tribe; Rob Mrowka; Mark Wadsworth; Central Nevada Regional Water Authority; County of Inyo, California (Amended Protest); Elko Band Council, Great Basin Business & Tourism Council; Terry P. and Debra J. Steadman; Donna Lytle; Kena Gloeckner; Kenneth Lytle; Manetta B. Lytle; Brad Lloyd; Mick Lloyd; Jason Lloyd; Roderick G. McKenzie; Patrick J. Gloeckner; D. Dane Bradfield; Jesse J. Howard; Pete T. Delmue; Nevada Department of Wildlife; Louis Benezet; and Toiyabe Chapter of the Sierra Club.[37]

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[32] Exhibit No. SE_050.
[33] File No. 53989, official records in the Office of the State Engineer.
[34] Exhibit No. SE_056.
[35] Exhibit No. SE_051.
[36] File No. 53990, official records in the Office of the State Engineer.
[37] Exhibit No. SE_057.

IV. WITHDRAWN PROTESTS

Of the above listed protests, several were later withdrawn for various reasons. As per 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.[38] As per the Stipulation for Withdrawal of Protests dated January 9, 2008, the protests by Moapa Band of Paiute Indians were withdrawn.[39] Pursuant to the Stipulation for Withdrawal of Protests dated January 7, 2008,[40] the protests by U.S. Fish and Wildlife Service, Bureau of Land Management, Bureau of Indian Affairs, and the National Park Service, were withdrawn on February 4, 2008.[41]

V. PARTICIPATING PROTESTANTS

The Protestants that indicated an intent to participate at the administrative hearing were: Nye County, Nevada; Confederated Tribes of the Goshute Reservation; Duckwater Shoshone Tribe and Ely Shoshone Tribe; Great Basin Water Network, et al. (GBWN); Defenders of Wildlife (with GBWN); Great Basin Business & Tourism Council (with GBWN); Inyo County, California (with GBWN); Kena Gloeckner (with GBWN); Patrick Gloeckner (with GBWN); Lund Irrigation & Water Co. (with GBWN); Pete T. Delmue (with GBWN); Preston Irrigation Co. (with GBWN); Roderick G. McKenzie (with GBWN); Terry and Debora Steadman (with GBWN); Toiyabe Chapter of the Sierra Club (with GBWN); White Pine County and the City of Ely (with GBWN).[42]

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. 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

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[38] File Nos. 53989 and 53990, official records in the Office of the State Engineer. *See*, agreement dated April 17, 2003, and recorded June 19, 200,3 under Document Number 120355, in the Official Records of the Lincoln County Recorder, Nevada.
[39] Exhibit No. SE_079.
[40] Exhibit No. SE_080.
[41] Exhibit No. SE_081.
[42] Exhibit Nos. SE_100, SE_050, SE_051, SE_056, SE_057.

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.

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

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

5. It is the public policy of the State of Nevada, per Governor Bob Miller's January 25, 1990, State of the State Address, to protect Nevada's environment, even at the expense of growth.

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

7. The Applications should be denied because Dry Lake Valley is an arid valley and drawdown of the water table will have irreversible effects on its fragile ecosystem. The negative

effects will occur to migratory birds and the plant and animal species inhabiting and dependent on water resources in the Dry Lake Valley, including some sensitive species and some species protected under the federal Endangered Species Act and related state statutes.

8. 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.

9. The approppropriation of the 864,000 acre-feet of water requested by the Applicant would make a Sahara Desert out of Nye, Lincoln, and White Pine Counties. The water is now being used and further pumping in large amounts would deplete the underground water, and dry up springs harming humans, livestock, and wildlife.

10. The desert needs the water to not become a wasteland and Mono Lake in California is a good example of the damage that would occur; our oxygen also comes from these plants.

11. The appropriation will turn the area into a situation similar to Owens Valley in California.

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

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

14. There is not sufficient unappropriated water available in the Dry Lake Valley Basin to provide the water being sought. Due to cyclical drought, and long-term climatic change, the water resource in this basin and all connecting basins is diminishing.

15. The granting or approval of the Applications would sanction water mining.

16. 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.

17. The appropriation in Dry Lake Valley, when added to the already approved appropriations and dedicated users in Pahranagat Valley, will exceed the annual recharge and safe yield of the basin.

18. There is not sufficient unappropriated water available in the Dry Lake Valley Basin to provide the water being sought. Due to cyclical drought, and long-term climatic change the water resource in this basin and all connecting basins is diminishing and that withdrawal in excess of perennial yield will cause a decline in the static water level beyond reasonable limits.

19. 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, and threaten springs, seeps and phreatophytes, which provide water and habitat that are critical to the survival of wildlife and grazing livestock in the basins of origin and surrounding valleys, including Patterson Valley and areas in Inyo County, California.

20. 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.

21. The Applications are like the dewatering processes of the mining industry; however, unlike mining, the 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.

22. While the Applications are located in Dry Lake Valley, 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.

23. 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.

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

25. The appropriation will deprive the users of water allotted to them in Dry Lake Valley.

26. Donna Lytle, Kena Gloeckner, and Kenneth Lytle state that they are permittees in the Dry Lake Valley and indicate that their ranching operation has two underground wells, five ponds, and over thirty miles of pipeline throughout the valley. They basically use two springs, Fairview and Simpson Springs, for all of their stock watering. They indicate that Dry Lake Valley makes up 42% of their year-long range, but without this vital winter range their entire cattle operation would be destroyed since they would no longer be able to sustain the cattle numbers that use their fall, spring, and summer allotments.

27. William Schoenberg states that his well is the only water available to him and, if the water level drops in his well, he will be finished.

28. Grace Wallis is concerned for the water rights she has to a hot springs which is her main source of income. She states that "the hot springs also heats homes in the winter time, many for senior citizens. The geologic study in 1980 when dyes were used at our location showed up later in Ash Springs." Although the Applications are in Dry Lake Valley, she asserts that taking away water from Delamar Valley will reduce water in her wells and that without further study, the granting of water rights will be detrimental to the water rights she already has.

29. 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.

30. 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.

31. 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.

32. Sufficient information about the deep water aquifers and the interaction between the various levels of aquifers does not presently exist to allow an intelligent judgment as to what effects the granting of the Applications may have on the several (five) springs that supply the Lund Irrigation Company systems.

33. 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 (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.

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

35. 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.

36. The Applicant has not shown a need for the water or the feasibility (technical and financial) of the water-importation project. Further, 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.

37. 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.

38. 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.

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

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

41. Clark County should solve their problems there and not steal the good things rural Nevada offers.

42. This environment and ecosystem is not a fair exchange for lakes, golf courses, and casino waste in the desert.

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

44. The 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.

45. 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.

46. 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.

47. 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.

48. 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.

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 also filed a motion in limine to exclude an expert report by Dr. Mayer identified as DDC Exhibit 501, expert reports by Dr. Krueger identified as DDC Exhibits 539 and 559, and an expert report by Dr. Scoppettone identified as DDC Exhibit 609. 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 Corporation of the Presiding Bishop of the Church of Jesus Christ of Latter-Day Saints ("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).[43] 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).[44] 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.[45]

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[43] Exhibit No. SE_090, p. 7.
[44] Exhibit No. SE_090, p. 10.
[45] Exhibit No. SE_090, p. 12.

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).[46]

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 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.

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[46] Exhibit No. SE_090, p. 13.

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 basin 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[47] 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

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

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 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.

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.[48] Beneficial use is the basis, the measure and the limit of the right to the use of water in the State of Nevada.[49]

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[48] *See,* NRS 533.030(1); NRS 533.035; NRS 533.045; NRS 533.060(1); NRS 533.070(1); NRS 533.370(3)(a).

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;[50] (3) John Entsminger, the Applicant's Senior Deputy General Manager, an expert in Colorado River water resources;[51] 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.[52] These witnesses have all been responsible for managing Southern Nevada's water-resource portfolio and each expressed an opinion that the Applicant would not be able to meet Southern Nevada's water needs without the water from the Applications.[53]

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.[54]

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.[55] 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.[56] Public advisory committees in Southern Nevada have determined that Southern Nevada needs this water and have recommended that the Applicant develop the project

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[49] NRS 533.035.
[50] Transcript, Vol.1 p. 174:7-8 (State Engineer).
[51] Transcript, Vol.1 p. 191:1-3 (State Engineer).
[52] Transcript, Vol.1 p. 186:22-24 (State Engineer).
[53] Transcript, Vol.2 p. 328:1-4 (Holmes); p. 345:14-18 (Brothers); p. 347:3-20 (Entsminger).
[54] Transcript, Vol.23 pp. 5127:22-5128:25 (Gleick).
[55] Exhibit No. SNWA_189, p. 2-1.
[56] Exhibit Nos. SNWA_223 through SNWA_229.

associated with the Applications.[57] The Applicant's board of directors has determined that the Applicant needs this water and has directed staff to pursue permitting of the Applications.[58]

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 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.[59] 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.[60]

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.[61] 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.[62]

Southern Nevada is almost entirely dependent on the Colorado River as it supplies 90% of Southern Nevada's water.[63] 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

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[57] Exhibit No. SNWA_209, Appendix 2; Exhibit No. SNWA_201; Transcript, Vol.1 pp. 225:11-228:6 (Brothers).
[58] Exhibit No. SNWA_211; Transcript, Vol.1 pp. 235:25-236:4 (Brothers).
[59] Transcript, Vol.2 p. 262:24-25 (Entsminger).
[60] Transcript, Vol.2 p. 264:6-8 (Entsminger).
[61] Exhibit No. SNWA_189, p. 8-2, Figure 8-1; Transcript, Vol.2 p. 264:11-13 (Entsminger).
[62] Exhibit No. SNWA_189, p. 8-2, Figure 8-1; Transcript, Vol.2 p. 264:14-16 (Entsminger).
[63] Exhibit No. SNWA_189, p. 7-1; Transcript, Vol.2 p. 260:20-22 (Entsminger).

any surplus that becomes available to Nevada.[64] 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.[65] 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.[66] 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.[67] The Applicant also relies heavily on the use of return-flow credits on the Colorado River, whereby the Applicant returns treated wastewater to Lake Mead in exchange for the right to divert a corresponding amount of Colorado River water. The use of return-flow credits allows the Applicant to extend its available water supplies by approximately 70%, which represents a significant portion of Southern Nevada's water resources.[68]

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.[69] The water-level elevation in Lake Mead dropped by roughly 130-140 feet.[70] 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.[71] As a point of reference, that reduction is equal to Nevada's Colorado River allocation for a period of 50 years.[72] 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.[73]

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[64] Exhibit No. SNWA_189, p. 3-1; Transcript, Vol.2 p. 261:13-16 (Entsminger).
[65] Exhibit No. SNWA_189, pp. 3-1, 3-4.
[66] Exhibit No. SNWA_189, p. 3-4.
[67] Exhibit No. SNWA_189, p. 3-5.
[68] Exhibit No. SNWA_189, p. 3-1; Transcript, Vol.2 p. 282:2-16 (Entsminger).
[69] Exhibit No. SNWA_232; Transcript, Vol.2 p. 266:20-23 (Entsminger).
[70] Exhibit No. SNWA_189, p. 7-1; Exhibit No. SNWA_232; Transcript, Vol.1 p. 194:25 (Holmes).
[71] Exhibit No. SNWA_189, p. 7-1; Exhibit No. SNWA_403; Transcript, Vol.1 p. 195:2-6 (Holmes).
[72] Transcript, Vol.1 p. 195:6-9 (Holmes).
[73] Transcript, Vol.2 pp. 266:23-267:5 (Entsminger).

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.[74] 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.[75] The amounts of those reductions are uncertain, but are anticipated to be significantly larger than those quantified in existing agreements.[76]

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.[77] 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.[78] 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.[79] 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.[80]

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,

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[74] Exhibit Nos. SNWA_189, p. 2-2; SNWA_203; SNWA_204; Transcript, Vol.2 pp. 269:9-272:11 (Entsminger).
[75] Exhibit No. SNWA_189, p. 6-3; Transcript, Vol.2 p. 269:21-23, p. 277:8-21 (Entsminger).
[76] Exhibit No. SNWA_189, p. 1-2; Transcript, Vol.2 p. 277:11-17 (Entsminger).
[77] Exhibit No. SNWA_189, p. 2-3; Transcript, Vol.2 p. 414:4-9 (Entsminger).
[78] Transcript, Vol.2 p. 303:10-12, p. 414:4-10 (Entsminger).
[79] Exhibit No. SNWA_189, p. 7-2.
[80] Exhibit No. SNWA_189, p. 8-4; Transcript, Vol.2 p. 269:6-9 (Entsminger).

occurred on the Colorado River system.[81] 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.[82] 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.[83] 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,[84] 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 effects on the availability of water supplies.[85] 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.[86] 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.[87] 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.[88] The Bureau of Reclamation uses the CRSS model to evaluate long-term policy and address long-

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81 Transcript, Vol.2 p. 268:10-12 (Entsminger).
82 Transcript, Vol.2 p. 268:1-8 (Entsminger), p. 333:12-19 (Brothers).
83 Exhibit No. SNWA_189, pp. 7-2 to 7-3. Figure 7-1; Transcript, Vol.2 p. 334:4-9 (Brothers).
84 Exhibit No. SNWA_189, p. 7-2, p. A-5, p. A-6, Figure A-2.
85 Exhibit No. SNWA_237, p. 25.
86 Exhibit No. SNWA_189, p. 7-2; Transcript, Vol. 2 p. 336:16-20 (Brothers).
87 Transcript, Vol.2 p. 336:16-20 (Brothers).
88 Exhibit No. SNWA_189, p. A-1; Transcript, Vol.2 p. 337:2-10 (Brothers).

term planning for the Colorado River system.[89] 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."[90] CRSS allows the Bureau of Reclamation to evaluate proposed operating policies over a broad range of possible future hydrologic conditions.[91] 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.[92] The CRSS model results show a 50% probability of shortage by 2035 with the probability of shortage reaching upwards of 60% by 2060.[93] 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.[94] That means that the CRSS model predicts on average that 30 years of shortage will occur during the Applicant's 50-year planning period.[95]

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.[96] 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

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[89] Exhibit No. SNWA_189, p. A-1.
[90] Exhibit No. SNWA_189, pp. A-1 to A-2.
[91] Exhibit No. SNWA_189, p. A-2.
[92] Exhibit No. SNWA_189, p. A-5, p. A-6, Figure A-2.
[93] Exhibit No. SNWA_189, p. A-6, Figure A-2; Transcript, Vol.2 p. 339:10-13 (Brothers).
[94] Exhibit No. SNWA_189, pp. A-5 to A-6.
[95] Exhibit No. SNWA_189, p. A-6, Table A-1; Transcript, Vol.2 p. 340:16-21 (Brothers).
[96] Exhibit No. SNWA_189, Appendix A.

uncertainty, the Applicant used a series of assumptions in its analysis.[97] 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).[98] 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.[99] 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.[100]

The Applicant's analysis graphically demonstrates the amount of water that the Applicant estimates could be available under shortage conditions on the Colorado River.[101] 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.[102] 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.[103] 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.

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[97] Exhibit No. SNWA_189, Appendix A, pp. A-3 to A-5.
[98] Exhibit No. SNWA_189, p. 8-4; Transcript, Vol.2 p. 343:14-20 (Brothers).
[99] Exhibit No. SNWA_189, p. 8-4.
[100] Exhibit No. SNWA_189, p. 8-4.
[101] Exhibit No. SNWA_189, p. 8-5, Figure 8-5.
[102] Exhibit No. SNWA_189, pp. A-10 to A-12.
[103] Transcript, Vol.2 p. 267:18-23 (Entsminger).

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.[104] 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 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.[105] 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.[106] 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.[107] The current Water Resource Plan was revised in 2009 and that version was adopted without revision in 2010 and 2011.[108] 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

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[104] Exhibit No. SNWA_209.
[105] Transcript, Vol. 2 pp. 307:19-308:5 (Holmes).
[106] Transcript, Vol. 2 p. 308:6-15 (Holmes).
[107] Transcript, Vol.2 p. 249:13-18 (Entsminger).
[108] Transcript, Vol.2 p. 250:1-16 (Entsminger).

projected demand-line.[109] 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.[110] 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.[111] Permanent supplies available to the Applicant include Nevada's allocation of Colorado River water, return-flow credits, conservation savings, Virgin/Muddy River Tributary Conservation ICS water, Coyote Spring Valley Imported ICS water, Las Vegas Valley groundwater, and other in-state groundwater.[112] Temporary supplies are one-time use resources that are not replenished and are used as a bridge until permanent supplies can be developed.[113] Temporary supplies available to the Applicant include Brock Reservoir System Efficiency ICS water, Arizona banked water, California banked water, and Southern Nevada banked water.[114] Because temporary supplies are one-time use resources, the Applicant must ensure that it has developed permanent supplies to satisfy demand after temporary supplies are exhausted. Additionally, because some temporary supplies are not available for use during declared shortages on the Colorado River, permanent supplies with no shortage-use restrictions are necessary to replace these restricted temporary supplies.

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

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[109] Exhibit No. SNWA_209, p. 43, Figure 28.
[110] Exhibit No. SNWA_189.
[111] Exhibit No. SNWA_189, p. 3-1; Transcript, Vol.2 p. 251:16-18 (Entsminger).
[112] Exhibit No. SNWA_189, pp. 3-1 to 3-3; Exhibit No. SNWA_209; Transcript, Vol.2 pp. 248-306 (Entsminger).
[113] Exhibit No. SNWA_189, p. 3-3; Transcript, Vol.2 p. 251:19-22 (Entsminger).
[114] Exhibit No. SNWA_189, pp. 3-3 to 3-5; Exhibit No. SNWA_209; Transcript, Vol.2 pp. 248-306 (Entsminger).

to receive 272,000 afa from the Colorado River,[115] as well as a total of 50,000 afa of Virgin/Muddy River Tributary Conservation ICS water.[116] The Applicant expects to develop some 9,000 afa of Coyote Spring Valley groundwater Imported ICS.[117] There are 46,340 afa available from Las Vegas Valley groundwater rights held by the City of North Las Vegas and LVVWD.[118] The Applicant expects to receive 40,000 afa from the Arizona water bank during the planning period.[119] Conservation savings are also considered a permanent water supply and conservation is built into the demand-line as further discussed below.[120] The Applicant expects to achieve conservation savings of more than 276,000 afa by 2035.[121] Finally, the Applicant expects to develop in-state groundwater, which includes 2,200 afa from Garnet and Hidden Valleys, 10,600 afa from the Three Lakes and Tikaboo Valleys, and the water requested in these Applications.[122] The Applicant expects that it will continue to use return-flow credits to extend available water supplies by roughly 70%.[123]

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.[124] 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

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[115] Exhibit No. SNWA_189, p. 3-1; Transcript, Vol.2 p. 261:13-16 (Entsminger).
[116] Exhibit No. SNWA_189, p. 3-1; Transcript, Vol.2 p. 293:6-23 (Entsminger).
[117] Exhibit No. SNWA_189, p. 3-1; Transcript, Vol.2 p. 294:14-17 (Entsminger).
[118] Exhibit No. SNWA_189, p. 3-2; Transcript, Vol.2 p. 255:5-17 (Entsminger).
[119] Exhibit No. SNWA_189, p. 3-4; Exhibit No. SNWA_209, p. 26.
[120] Exhibit No. SNWA_189, p. 3-3; Transcript, Vol.2 pp. 254:22-255:4 (Entsminger).
[121] Exhibit No. SNWA_189, p. 6-1, Figure 6-1; Exhibit No. SNWA_209, p. 39, Figure 24.
[122] Exhibit No. SNWA_189, p. 3-2.
[123] Exhibit No. SNWA_189, p. 3-1; Transcript, Vol.2 pp. 289:3-290:5 (Entsminger).
[124] Exhibit No. SNWA_189, p. 4-9, Figure 4-9; Exhibit No. SNWA_209, p. 43, Figure 28.

water provider may not have developed sufficient supplies to meet actual demand, which could result in catastrophic consequences for the community.[125] 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.[126] 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 States.[127] CBER has monitored the Clark County economy for more than 25 years and has prepared population forecasts annually since the 1990s.[128] The Applicant has used CBER forecasts for every Water Resource Plan that it has adopted since 1996.[129] 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.[130] 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.[131] 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

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[125] Transcript, Vol.2 p. 312:8-23 (Holmes).
[126] Transcript, Vol.2 p. 312:8-11 (Holmes).
[127] Exhibit No. SNWA_189, p. 5-1; Transcript, Vol.2 p. 311:12-13 (Holmes).
[128] Exhibit No. SNWA_189, p. 5-1; Transcript, Vol.2 pp. 310:24-311:22 (Holmes).
[129] Exhibit No. SNWA_189, p. 5-1.
[130] Exhibit No. SNWA_189, p. 5-2.
[131] Exhibit No. SNWA_189, p. 5-2; Transcript, Vol.2 p. 312:14-23 (Holmes).

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.[132]

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.[133] Southwestern states are expected to continue to experience some of the fastest population growth in the country over the next 30 to 40 years.[134] Water managers focus on long-term population forecasts for water planning purposes.[135] 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.[136] One report states "future demand projections have typically been based on assumptions of future population and housing expansions that may not materialize and are well above rates for the past few years."[137] 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. <u>Individual Water Use Estimates</u>

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.[138]

The Applicant uses GPCD to measure and compare its water use over time.[139] There is currently no standard measuring system for comparing water use between communities.[140]

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[132] Exhibit No. SNWA_189, p. 5-2; Transcript, Vol.2 p. 313:1-13 (Holmes).
[133] Exhibit No. SNWA_189, pp. 5-4 to 5-5.
[134] Exhibit No. SNWA_189, p. 5-5; Transcript, Vol.2 p. 318:11-18 (Holmes).
[135] Transcript, Vol.2 p. 317:3-8 (Holmes).
[136] Transcript, Vol.23 p. 5098:17-20 (Gleick).
[137] Exhibit No. GBWN_069, p. 5.
[138] Exhibit No. SNWA_189, p. 5-1; Transcript, Vol.2 p. 309:10-15 (Holmes).
[139] Exhibit No. SNWA_189, p. 5-1.

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.[141] 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.[142] Despite those limitations, GPCD is an effective tool for an individual community to use as a yardstick against its own water use.[143]

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 decreased from 344 to 240 due largely to intensive conservation efforts.[144] In 2009, the Applicant set a conservation goal of 199 GPCD by 2035.[145] The Applicant believes that conservation goal is challenging but also realistic.[146] The demand forecast in the Applicant's Water Resource Plan incorporates the conservation goal established in 2009 to achieve 199 GPCD by 2035.[147]

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.[148] 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

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[140] Transcript, Vol.1 pp. 107:16-109:16 (Mulroy); Transcript, Vol.2 p. 321:8-21 (Holmes).
[141] Exhibit Nos. SNWA_189, p. 5-1; SNWA_15, p. 66; SNWA_397, p. 8; Transcript, Vol.2 pp. 321:24-323:6 (Holmes).
[142] Transcript, Vol.2 p. 322:10-13 (Holmes); Transcript, Vol.23, pp. 5204:15-5205:9 (Gleick).
[143] Exhibit No. SNWA_189, p. 5-1.
[144] Exhibit No. SNWA_189, p. 5-2.
[145] Exhibit No. SNWA_189, 5-2; Exhibit No. SNWA_004, p. 8-1; Transcript, Vol.2 p. 320:12-21 (Holmes).
[146] Transcript, Vol.2 p. 320:12-21 (Holmes).
[147] Exhibit No. SNWA_209, p. 39.
[148] Transcript, Vol.23 p. 5100:16-20, p. 5124:22-25 (Gleick).

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.[149] Additional conservation savings will be necessary to achieve the goal of 199 GPCD by 2035.[150] 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.[151] 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. There will be shortfalls between water supply and demand in the water-resource portfolio for Southern Nevada.[152] 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.[153] The Applicant anticipates that it could manage its use of temporary supplies in order to avoid shortfalls until 2028.[154] 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.[155]

By the end of the 50-year planning period, customer demand is projected to require the diversion of 897,087 afa.[156] Without any additional water resources, projected demand would

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[149] Exhibit No. SNWA_189, p. 5-2.
[150] Exhibit No. SNWA_189, p. 5-2.
[151] Transcript, Vol.4 p. 896:4-7 (Bennett).
[152] 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).
[153] Exhibit No. SNWA_189, p. 6-2, Figure 6-2; Exhibit No. SNWA_209, p. 43; Transcript, Vol.2 p. 326:13-18 (Holmes).
[154] Exhibit No. SNWA_189, p. 6-4, Figure 6-3; Transcript, Vol.2 p. 327:14-18 (Holmes).
[155] Transcript, Vol.2 p. 327:8-13 (Holmes).
[156] Exhibit No. SNWA_189, p. 6-4, Table 6-1.

exceed available supplies by approximately 275,000 afa.[157] Under shortage conditions, shortfalls are projected to be greater and to occur sooner.[158] 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.[159] 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.[160] 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.[161] Water from the Applications could be used to fill these supply gaps.

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.[162] 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.[163] 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

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[157] Exhibit No. SNWA_189, p. 6-4, Figure 6-3 and Table 6-1.
[158] Exhibit No. SNWA_189, p. 8-5, Figure 8-5, p. 6-5 and pp. A-10 to A-12.
[159] Exhibit No. SNWA_189, Appendix A, Table A-2.
[160] Exhibit No. SNWA_189, Appendix A, Table A-3.
[161] Exhibit No. SNWA_189, Appendix A, Table A-4.
[162] Transcript, Vol.23 p. 5124:18-21 (Gleick).
[163] NRS 533.370(1)(c).

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.[164] 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.[165] 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.[166] 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.[167] The Applicant has developed monitoring, management and mitigation plans for eventual pumping as described below. 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.[168] 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.

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[164] Exhibit No. SNWA_209, Appendix 2; Exhibit No. SNWA_201; Transcript, Vol.1 pp. 225:11-228:5 (Brothers).
[165] Exhibit Nos. SNWA_223 through SNWA_229.
[166] Exhibit No. SNWA_211; Transcript, Vol.1 pp. 235:24-236:4 (Brothers).
[167] Exhibit No. SNWA_190; Exhibit No. SNWA_190; SNWA_191; Transcript, Vol.1 pp. 204:16-205:13 (Holmes).
[168] Transcript, Vol.1 p. 238:14-18 (Brothers).

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.[169] 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.

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.[170] 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.[171] 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.[172] The State Engineer finds that construction of the Project has a feasible conceptual plan of development.

2. Estimated Construction Costs

The Applicant's engineering department has developed a cost estimate based on the conceptual plan of development for the Project.[173] The engineering department prepared this cost estimate using the same methods it has used to develop cost estimates for other capital construction projects.[174] The engineering department uses a cost estimating guide that contains cost curves, or reasonable cost estimates, for various project components.[175] The guide is based

[169] Exhibit No. SNWA_195; Transcript, Vol.1 pp. 216:10-217:13 (Holmes).
[170] Exhibit No. SNWA_190; Transcript, Vol.1 pp. 201:16-204:15 (Holmes).
[171] Transcript, Vol.1 p. 201:6-14 (Holmes).
[172] Transcript, Vol.1 p. 204:5-12 (Holmes).
[173] Exhibit No. SNWA_195; Transcript, Vol.1 p. 211:18-25 (Holmes).
[174] Exhibit No. SNWA_195; Transcript, Vol.1 p. 214:18-22 (Holmes).
[175] Exhibit No. SNWA_194; Exhibit No. SNWA_195; Transcript, Vol.1 pp. 208:9-209:15 (Holmes).

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.[176] The guide was prepared in accordance with industry standards, including those set by the Association for Advancement of Cost Engineering ("AACE").[177] The engineering department has used this guide to generate cost estimates for projects since 2006, including projects in its 2011 Major Construction and Capital Plan.[178] The engineering department used this same cost estimating guide to develop the cost estimate for the Project.[179]

The Applicant's engineering department estimates that the capital costs for the Project will be approximately $3.224 billion.[180] Including contingency (15%) and inflation (4%), the engineering department estimates that the cost to construct the Project would be approximately $6.45 billion.[181] 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.[182] The engineering department also developed cash-flow projections to allow financial experts to evaluate potential funding requirements for the Project.[183]

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.[184] 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.[185] 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

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[176] Exhibit No. SNWA_195, pp. 2-3; Transcript, Vol.1 p. 209:8-15 (Holmes).
[177] Exhibit Nos. SNWA_195, p. 2; SNWA_233; SNWA_234; Transcript, Vol.1 p. 210:3-15 (Holmes).
[178] Exhibit No. SNWA_195, p. 2; Transcript, Vol.1 pp. 207:25-208:19 (Holmes).
[179] Transcript, Vol.1 pp. 215:25-216:6 (Holmes).
[180] Exhibit No. SNWA_195, p. 4, Table 1; Transcript, Vol.1 p. 213:13-21 (Holmes).
[181] Exhibit No. SNWA_195, p. 5, p. 7; Transcript, Vol.1 p. 214:4-6 (Holmes).
[182] Exhibit No. SNWA_195, pp. 3-5.
[183] Exhibit No. SNWA_195, p. 5, p. 7, Table 2.
[184] Exhibit No. SNWA_195, p. 2.
[185] Exhibit No. SNWA_189, p. 2.

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.[186]

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

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

The Applicant provided the cost estimate, construction schedule and cash-flow projections to John Bonow and Guy Hobbs.[187] Mr. Bonow and Mr. Hobbs prepared an expert report that analyzed the Applicant's ability to issue bonds to finance the estimated cost of the Project.[188] 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.[189] 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.[190]

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.[191] 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.[192]

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.[193] 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.

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[186] Transcript, Vol.1 pp. 215:25-216:6 (Holmes).
[187] Exhibit No. SNWA_383; Transcript, Vol.13 p. 214:11-17 (Holmes).
[188] Exhibit No. SNWA_383.
[189] Transcript, Vol.13 p. 2836:1-25 (Bonow); p. 2840:11-23 (Hobbs).
[190] Transcript, Vol.13 pp. 2837:5-2838:3 (Bonow); pp. 2841:17-2842:11 (Hobbs).
[191] Transcript, Vol.13 pp. 2842:22-2843:19 (Hobbs).
[192] Transcript, Vol.13 p. 2846:1-5 (Hobbs).
[193] Exhibit No. SNWA_383, Section I.

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.[194]

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.[195] The Applicant's current plan of finance is to fund 10% of initial construction costs through its commercial paper program and to then issue tax-exempt bonds every two years through the LVVWD with level debt service over 30 years.[196] 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.[197] 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.[198] The Applicant has never failed to make full and timely payment on its debt obligations.[199] Based on this review, Mr. Bonow and Mr. Hobbs concluded that the Applicant currently accesses the capital markets on agreeable terms.[200]

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

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194 Transcript, Vol.13 p. 2844:11-15 (Bonow), p. 2854:18-20 (Hobbs).
195 Exhibit No. SNWA_383, Section II.
196 Exhibit No. SNWA_383, p. 22.
197 Transcript, Vol.13 pp. 2847:23-2848:17 (Bonow).
198 Exhibit No. SNWA_383, p. 22; Transcript, Vol.13 p. 2853:11-19, p. 2860:10-15 (Hobbs).
199 Transcript, Vol.13 p 2858:3-6 (Hobbs).
200 Transcript, Vol.13 p. 2860:12-15 (Hobbs).

timely payment.[201] 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.[202]

Mr. Bonow and Mr. Hobbs created a funding plan to analyze the Applicant's ability to finance its funding needs for all ongoing and planned projects, including the Project. The funding plan assumes that the Applicant would access the capital markets under the Applicant's typical plan of finance because that is the most cost-effective approach at this time.[203] 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.[204]

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.[205]

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.[206] When the Applicant last accessed the capital markets in 2011, it achieved an interest rate of 4.06%.[207] 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.[208]

With regard to projected growth and development, the funding plan assumes almost non-existent population increases.[209] This assumption affects the amount of commodity charge revenues and connection charge revenues that are projected to be available under the funding

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201 Transcript, Vol.13 pp. 2856:7-2858:2 (Hobbs).
202 Transcript, Vol.13 p. 2845:3-6 (Bonow).
203 Transcript, Vol.13 pp. 2865:7-2866:11 (Hobbs).
204 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).
205 Transcript, Vol.13 p. 2846:12-24 (Bonow, Hobbs).
206 Exhibit No. SNWA_383, Appendix F; Transcript, Vol.13 p. 2868:14-16 (Hobbs).
207 Transcript, Vol.13 p. 2869:10-11 (Hobbs).
208 Transcript, Vol.13 p. 2869:16-19 (Hobbs).
209 Exhibit No. SNWA_383, Appendix C.

plan.[210] 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.[211] 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.[212] If moderate growth were to occur, it would increase the amount of revenues available to pay debt service on the bonds from sources other than the commodity charge.

In addition, with regard to available revenues, the funding plan also assumes that only revenues from its commodity charge and reliability charge[213] would be used to pay debt service even though revenues from other charges could be available.[214] 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.[215] 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.[216] 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.[217] 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.[218]

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.[219] The vast majority of bonds

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[210] 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.
[211] Transcript, Vol.13 p. 2879:10-19 (Bonow).
[212] Transcript, Vol.13 p. 2872:15-24 (Hobbs).
[213] 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.
[214] Exhibit No. SNWA_383, p. 29.
[215] Exhibit No. SNWA_383, p. 33; Transcript, Vol.13 p. 2851:14-21, pp. 2871:23-2872:14 (Hobbs).
[216] Transcript, Vol.13 p. 2861:10-13 (Hobbs).
[217] Transcript, Vol.13 pp. 2880:18-2882:7 (Hobbs).
[218] Transcript, Vol.13 p. 2896:21-23 (Hobbs).
[219] Transcript, Vol.13 pp. 2869:25-2870:10 (Hobbs).

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.[220] 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.[221]

With regard to the projected debt coverage ratio, the funding plan does not reflect the fact that the commodity charge rate could decrease as bonds are retired and debt service levels decline. The Applicant is required to maintain a minimum debt coverage ratio of 1.00x, meaning pledged revenues must at least be equal to debt service requirements on outstanding bonds.[222] However, the funding plan reflects coverage ratios that exceed that requirement.[223] That means that over time, the commodity charge rate levels could decrease since those inflated debt coverage ratios would not be required.[224]

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.[225] 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.[226]

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.[227] 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

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[220] Transcript, Vol.13 p. 2870:2-4 (Hobbs).
[221] Transcript, Vol.13 p. 2870:4-10 (Hobbs).
[222] Exhibit No. SNWA_383, p. 15.
[223] Exhibit No. SNWA_383, p. 35.
[224] Transcript, Vol.13 pp. 2877:15-2878:2 (Hobbs).
[225] Exhibit No. SNWA_383, p. 34; Transcript, Vol.13 p. 2870:16-23 (Hobbs).
[226] Transcript, Vol.13 pp. 2870:19-2871:4 (Hobbs).
[227] Exhibit No. SNWA_383, pp. 30, 33, 34-35.

maintain the required minimum 1.00x debt coverage ratio.[228] 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.[229] 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 thousand gallons of water, the resulting average monthly residential water bill in Southern Nevada would be $90.62 by the year 2026.[230]

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.[231] 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.[232] 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.[233] Ms. Leurig is the Senior Manager, Insurance Program at CERES, which is a non-profit research and advocacy group. [234,235] She is the author of a report titled *The Ripple Effect: Water Risk in the Municipal Bond Market*.[236] Ms. Leurig has experience in engaging with insurers on investment and asset management opportunities related

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[228] Transcript, Vol.13 pp. 2863:13-2865:4 (Hobbs).
[229] Exhibit No. SNWA_383, p. 35.
[230] Exhibit No. SNWA_383, p. 36.
[231] Exhibit No. SNWA_383, p. 38; Exhibit No. SNWA_384; Transcript, Vol.13 pp. 2882:22-2885:18 (Bonow).
[232] Transcript, Vol.13 p. 2887:11-15 (Bonow).
[233] Transcript, Vol.22 p. 4831:1-3 (State Engineer).
[234] Exhibit No. GBWN_125.
[235] Transcript, Vol.22 p. 4868:19-21 (Leurig).
[236] Exhibit No. GBWN_116.

to climate change, including energy-efficiency financing, renewable energy, investments and adaptation investments, including water infrastructure.[237] She has experience with issues relating to municipal bonds, but has never advised a municipality on how to access the capital markets.[238] She is not an expert regarding the Applicant's financial condition or the process the Applicant uses to finance its capital construction projects,[239] 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 finance the Project.[240] Lastly, she did not analyze the Applicant's rate levels, ability to raise rates, or how those rates compare to other municipalities.[241]

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.[242]

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.[243] 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.[244]

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[237] Exhibit No. GBWN_125.
[238] Transcript, Vol.22 p. 4864:9-20 (Leurig).
[239] Transcript, Vol.22 p. 4865:10-21 (Leurig).
[240] Transcript, Vol.22 p. 4866:9-23 (Leurig).
[241] Transcript, Vol.22 p. 4867:2-14 (Leurig).
[242] Transcript, Vol.1 pp. 93:17-95:7 (Mulroy).
[243] Transcript, Vol.13 p. 2889:6-13 (Hobbs).
[244] Transcript, Vol.22 p. 4891:1-13 (Leurig).

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.[245] The State Engineer finds that this evidence outweighs the testimony and evidence presented by Ms. Leurig.

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

A. General

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

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[245] Transcript, Vol.13 p. 2846:12-17, p. 2896:13-16 (Bonow).

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 directly observed, 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.

In determining the amount of water available for appropriation, NRS 533.370(2) requires that there be unappropriated water at the proposed source of supply and that the proposed use not conflict with existing water rights. To address the issue of unappropriated water, during the 1950s to the 1970s, the U.S. Geological Survey ("USGS"), in conjunction with the Nevada Division of Water Resources, prepared the first analyses to determine the amount of water that could be appropriated in the various hydrographic basins in Nevada. These analyses were issued in USGS Reconnaissance Reports and Bulletins that addressed this question relative to various hydrographic basins throughout Nevada. The State Engineer has historically managed the appropriation of groundwater on a hydrographic basin-wide scale. However, it is also well known that regional groundwater flow systems hydrologically connect many of these basins and make management on the hydrographic basin-scale more complex, and often dependent on prior management/appropriation decisions.

B. <u>Flow System Considerations</u>

Where basins are hydrologically closed, that is, with only minor water inflow or outflow across the basin boundary, groundwater management was relatively straightforward by basing the quantity available for appropriation solely on the perennial yield of the individual hydrographic basin. The perennial yield of such a hydrographic basin was usually equal to the evapotranspiration ("ET") of the basin. In this case, the State Engineer held a hearing on water right applications in four different hydrographic basins: Spring Valley, Cave Valley, Dry Lake Valley and Delamar Valley. None of the basins subject to the SNWA pipeline hearing is completely hydrologically closed, although Spring Valley is nearly closed and is treated as such. In Cave Valley, Dry Lake Valley and Delamar Valley the basins are not hydraulically closed, and an important consideration is interbasin flow. The State Engineer must determine from which basin the groundwater should be counted as available for appropriation. Thus, the analysis of water available for appropriation in Cave, Dry Lake and Delamar Valleys considers these interbasin subsurface flows and is a reflection of the best science available, evidence and testimony, and the professional judgment of the State Engineer.

Cave, Dry Lake and Delamar Valleys, as well as ten other hydrographic basins, are all part of what is known as the White River Flow System ("WRFS"). In the WRFS, groundwater is discharged primarily in three known locations: White River Valley, Pahranagat Valley, and the Muddy River Springs Area. Every basin within the WRFS has an identified perennial yield based on either groundwater discharge from ET or subsurface groundwater discharge. Each of the basins in the WRFS has a scientifically determined water budget. The Protestants suggest the State Engineer employ a "one-river" analysis to manage the basins on the flow-system scale rather than the hydrographic basin scale. Under this analysis, the State Engineer would consider groundwater flows from up-gradient basins to down-gradient basins where the groundwater ultimately discharges at regional springs. They assert that if the water is used in these up-gradient basins, it may not be available in sufficient quantity for the down-gradient users who hold senior water rights; therefore, approval of the applications could impact their senior water rights, albeit hundreds of years into the future. However, comparing a groundwater flow system to a river is flawed by ignoring the time frames and geological uncertainties involved. Up-stream use of a river will affect down-stream supply in days to weeks. In this groundwater flow system, up-gradient use will not, if at all, measurably affect down-gradient supply for hundreds of years. Historically, State Engineers have not managed Nevada's water resources in the above described manner, and in following Nevada water law, have found that there was groundwater available for appropriation in each basin, and the amount available is related to the annual supply of the basin, i.e., the perennial yield.

Nevada is a very large state with extremely complex geology and hydrology. Every basin is unique, and science and professional judgment must be applied in appropriating its resources. The State Engineer is encouraged to use the best available science, and one such scientific tool is the groundwater flow model. NRS 533.024(1)(c). A thoroughly-detailed groundwater flow model submitted for the Environmental Impact Statement ("EIS") process in this matter and for the hearing on these Applications shows that after 200 years of pumping, the regional warm springs in the White River Valley, Pahranagat Valley, and the Muddy River Springs Area are virtually unaffected. The State Engineer finds that if no measurable impacts to existing rights occur within hundreds of years, then the statutory requirement of not conflicting with existing rights is satisfied.

The statutory requirement that provides the State Engineer shall reject an application if the use of the water conflicts with existing rights must be analyzed in reference to other statutes which provide for reasonable impacts and for mitigation. For example, the groundwater law provides in NRS 534.110(5) that the right of an appropriator must allow for a reasonable lowering of the static water level at the appropriator's point of diversion. While the new appropriator may lower the static water level, which in turn may lower the water level in another appropriator's well, as long as it is reasonable, the law allows for this impact. The water law also provides for mitigation as a cure. *See*, NRS 533.024(1)(b) which provides that the policy of this State is to recognize the importance of domestic wells as appurtenances to private homes, to create a protectable interest in such well, and to protect their supply of water from unreasonable adverse effects which are caused by municipal, quasi-municipal or industrial uses which cannot reasonably be mitigated.

The Legislature and the State Engineer recognize 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)), but also the importance of maintaining natural resources for wildlife, including wetlands and fisheries. NRS 533.023. The State Engineer is given the task of balancing all of these competing interests in a state with very little water. The State Engineer must make determinations as to whether any impacts to existing water rights are of a magnitude that requires the denial of a new application for appropriation or whether impacts can be detected by monitoring and effectively managed to minimize impacts or mitigated, if necessary, to prevent a conflict with existing water rights.

C. Perennial Yield Dry Lake Valley

To provide background and context for the determination of perennial yield in Dry Lake Valley, the Applicant initially conducted a comprehensive literature review of prior investigations.[246] The Applicant's witness, Mr. Andrew Burns[247], testified that he reviewed 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.[248]

To estimate recharge in Dry Lake Valley, the Applicant used a groundwater balance approach similar to the approach applied in the well-known Maxey-Eakin method. The Maxey-Eakin method was employed by the USGS in the Reconnaissance Series Reports in basins across Nevada, and those reports have been relied upon by the State Engineer in managing groundwater in Nevada for decades. The Applicant's witness, Ms. Warda Drici,[249] testified that the differences between the Maxey-Eakin method used in the Reconnaissance Series Reports and the groundwater balance approach used in this analysis involve the quantity and quality of available data, which is greater now, and the advancements in computer power and spatial analysis techniques, which are now computer-based as opposed to trial-and-error based.[250] Calculating recharge based on precipitation data requires a determination of the ratio of recharge to precipitation, which is referred to as recharge efficiency.[251] In this case, the goal of such an analysis is to develop recharge efficiencies for every one-inch precipitation interval in the WRFS. Here, the Applicant used the Excel Solver, which is designed to solve complex optimization problems using numerical methods, to develop the recharge efficiencies.[252] The objective function used in the Excel Solver was derived from the groundwater balance equation

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[246] Transcript, Vol.3 pp. 588:11-592:22 (Burns).
[247] Mr. Burns is a hydrologist for Southern Nevada Water Authority. Exhibit No. SNWA_256. He was qualified by as an expert in surface water and groundwater hydrology. Transcript, Vol.3 p. 576:11–14 (Burns).
[248] Transcript, Vol.3 pp. 588:11-592:22 (Burns).
[249] Ms. Drici is a hydrologist with the Southern Nevada Water Authority. Exhibit No. SNWA_257. She was qualified as an expert in groundwater hydrology and modeling. Transcript, Vol.3 p. 579:14-17 (Drici).
[250] Transcript, Vol.6 pp. 1348:16-1349:9 (Drici).
[251] Exhibit No. SNWA_258, p. F-6.
[252] Exhibit No. SNWA_258, p. F-7.

relating the groundwater budget components of the WRFS.[253] The Applicant distributed the recharge by applying the recharge efficiencies to the best available and current map of average annual precipitation. This is the same approach used in the Reconnaissance Series Reports. This approach is necessary since basin-wide precipitation recharge cannot be measured in the field.

The approach was applied to the entire WRFS. There are a total of 13 hydrographic basins within the WRFS.[254] Because many of the basins within the WRFS do not contain measureable amounts of groundwater ET, independent analyses of the groundwater budgets for these basins is not feasible. To address this problem, a groundwater budget is developed for the entire flow system. Each basin in the flow system can then be examined individually to calculate its groundwater recharge.

1. Groundwater ET

Groundwater ET is important because it can be more accurately measured than groundwater recharge or subsurface flow.[255] Groundwater may discharge to the atmosphere 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"). The Applicant estimated the total volume of average annual groundwater ET in the WRFS to be 105,800 afa, half of which occurs in the White River Valley.[256] The estimate of groundwater ET for White River Valley was obtained from new field investigations conducted between 2006 and 2010. The groundwater ET estimates for all other basins of the WRFS were obtained from the Applicant's conceptual model report for the BLM's Draft Environmental Impact Statement.[257]

The Draft Environmental Impact Statement ("DEIS") estimated groundwater ET by: delineating and classifying potential areas of groundwater ET; compiling, evaluating, and selecting published ET rates for each area; adjusting ET rates to local potential ET conditions; applying the ET rates to each area; determining precipitation for each area; and finally removing precipitation from total ET to arrive at groundwater ET.[258] The DEIS provides groundwater ET

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[253] Exhibit No. SNWA_258, p. F-15.
[254] Exhibit No. SNWA_274, p. 252.
[255] Exhibit No. GBWN_103, p. 17; Transcript, Vol.17 p. 3794:6-9 (Myers); Transcript, Vol.24 p. 5413:9–16 (Bredehoeft).
[256] Exhibit No. SNWA_258, p. F-15.
[257] Exhibit No. SNWA_258, p. F-15.
[258] Exhibit No. SNWA_088, p. 7-5.

values as follows for valleys in the WRFS: 1,700 afa for Garden Valley; 400 afa for Jakes Valley; 3,000 afa for Long Valley; 1,300 afa for Cave Valley; 28,500 afa for Pahranagat Valley; and 6,000 afa for Muddy River Springs Area.[259] The Protestants did not take issue with these estimates of groundwater ET. Specifically, Dr. Myers considered the estimate of 1,300 afa of groundwater ET in Cave Valley and the estimate of 28,500 afa in Pahranagat Valley to be reasonable.[260]

To estimate groundwater ET in White River Valley, the Applicant relied on five years of direct ET measurements using state-of-the-art Eddy Covariance Towers in 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 precipitation in White River Valley based on Parameter-elevation Regressions on Independent Slopes Model ("PRISM").

The Applicant completed the following steps to estimate ET in White River Valley: (1) delineate groundwater ET extent boundaries and land-cover classes; (2) 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; (3) acquire and process satellite imagery to derive distributions of normalized difference vegetation indices ("NDVI"); (4) develop an empirical relationship between annual total ET measurements and NDVI values for corresponding ET measurement sites; (5) apply the empirical relationship to NDVI distributions to estimate the distribution of annual total ET rates within the groundwater discharge area; (6) subtract the distributions of annual precipitation rates from the annual total ET rates to arrive at distributions of annual groundwater ET rates; and (7) calculate the annual average basin-wide groundwater ET for the five-year period of ET data collection.[261] Dr. Myers generally agreed with this approach.[262]

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[259] Exhibit No. SNWA_088, p. 7-17.
[260] Exhibit No. GBWN_103, p. 19.
[261] Exhibit No. SNWA_258, p. D-1.
[262] Exhibit No. GBWN_103, p. 17.

The Applicant delineated groundwater ET discharge areas in White River Valley using satellite imagery and previous mapping. The Applicant then classified land-cover classes within the groundwater ET discharge area using NDVI values. The Applicant also verified the classifications in the field.[263] Dr. Myers notes that phreatophytic areas vary in areal extent and plant density over time.[264] However, he did not question the accuracy of the Applicant's areal extents at the time they were made.[265]

The Applicant estimated ET for wetland/meadow, phreatophytic/medium vegetation, and bare soil/low vegetation land-cover classes in the groundwater ET discharge area in White River Valley using an empirical relationship developed in cooperation with the Desert Research Institute. The empirical relationship is expressed by a linear 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.[266]

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.[267] NDVI is the most commonly

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[263] Exhibit No. SNWA_258, pp. D-3 to D-5.
[264] Exhibit No. GBWN_103, pp. 17–18.
[265] Transcript, Vol.17 pp. 3794:18-3795:2 (Myers).
[266] Transcript, Vol.3 pp. 656:16–657:9 (Fenstermaker).
[267] Exhibit No. SNWA_312, pp. 2-1 to 2-7; Transcript, Vol.4 pp. 806:24–808:5 (Fenstermaker).

used vegetation index.[268] 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.[269] By relating a growing-season average NDVI value with an annual ET value, Dr. Fenstermaker accounts for all the variation in ET that occurs during the year. By using a footprint average rather than the single pixel average where the tower is located, Dr. Fenstermaker accounts for the fact that the ET measurements include contributions of ET from areas beyond the measurement site. By using a weighted average, Dr. Fenstermaker accounts for the fact that certain areas within the footprint contribute more to the ET measurement than others. The State Engineer finds this approach to be scientifically sound.

Dr. Fenstermaker used Eddy Covariance tower measurements of ET. The Eddy Covariance method is the most direct and defensible way to measure fluxes of heat, water vapor and gas concentrations and momentum between the atmosphere and biosphere.[270] Mr. Burns described the Eddy Covariance method as state of the art.[271] The Eddy Covariance towers use sophisticated sensors to measure the components of ET.[272] The sensors were installed and calibrated according to manufacturer recommendations.[273] 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.[274] Dr. Fenstermaker testified that she was unaware of any other published study that used this many Eddy Covariance Towers.[275] 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.[276] The site selection was independently evaluated and approved by Dr. Travis

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[268] Transcript, Vol.3 p. 685:7-9 (Fenstermaker).
[269] Transcript, Vol.3 pp. 695:24-696:1 (Fenstermaker).
[270] Exhibit No. SNWA_312, p. 3-1.
[271] Transcript, Vol.3 p. 670:10-13 (Burns).
[272] Exhibit No. SNWA_312, p. 3-2.
[273] Exhibit No. SNWA_312, p. 3-3; Transcript, Vol.4 pp. 796:12–797:4 (Fenstermaker).
[274] Exhibit No. SNWA_312, pp. 3-1, 3-3.
[275] Transcript, Vol.4 p. 759:4–10 (Fenstermaker).
[276] Exhibit No. SNWA_312, p. 3-3.

Huxman of the University of Arizona.[277] Dr. Huxman has extensive experience in locating ET measurement sites in complex ecosystems.[278]

The ET measurement sites did not include agriculture or open water.[279] 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 from 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 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.[280] The tower in White River Valley had measurements for all five years.[281] Mr. Burns testified that the ET data collected was excellent.[282] Dr. Myers did not question the Applicant's measurement of ET rates.[283]

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.[284] The replacement

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[277] Transcript, Vol.3 p. 674:22–675:16 (Fenstermaker).
[278] Transcript, Vol.3 pp. 674:25-675:12 (Fenstermaker).
[279] Exhibit No. SNWA_312, pp. 3-4 to 3-5.
[280] Exhibit No. SNWA_312, pp. 3-3, 3-10.
[281] Exhibit No. SNWA_312, p. 3-10.
[282] Transcript, Vol.3 p. 683:8-11 (Burns).
[283] Transcript, Vol.17 p. 3794:18-19 (Myers).
[284] Exhibit No. SNWA_312, p. 4-3.

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.[285] Finally, Dr. Fenstermaker averaged the scenes for each year to obtain average growing-season NDVI images.[286]

Dr. Fenstermaker and her colleagues then calculated the footprint-weighted growing season average NDVI values for each Eddy Covariance Tower. This approach was selected to account for the fact that the towers measure ET from an area surrounding the tower that is larger than the area directly below the towers. Using an equation of Hsieh, et al. (2000), footprints were delineated based on wind speed and direction. The number of times each pixel contributed to a measurement was then used to compute a weighted-average NDVI value for each tower.[287] 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.[288] 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.[289] 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.[290] When evaluated against the seven reserved points, the analysis revealed no clear bias to over-estimate or under-estimate.[291] 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.

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[285] Transcript, Vol.4 p. 770:4-5 (Fenstermaker).
[286] Exhibit No. SNWA_312, pp. 4-4 to 4-5.
[287] Exhibit No. SNWA_312, pp. 4-5 to 4-7.
[288] Exhibit No. SNWA_312, p. 5-1.
[289] Exhibit No. SNWA_312, p. 5-4.
[290] Transcript, Vol.4 p. 726:2–5 (Fenstermaker).
[291] Exhibit No. SNWA_312, p. 5-7; Transcript, Vol.4 p. 730:8–19 (Burns).

The Applicant applied the regression equation to growing-season average NDVI grids after the removal of areas of agriculture and open water to obtain a total annual ET distribution for the remaining land-cover classes in the groundwater discharge area for each year in the period of record.[292] The Applicant queried the initial ET distribution grid to identify grid-cell values exceeding the average annual reference ET in White River Valley of 4.5 feet as measured by the Eddy Covariance stations. For those grid cells, the Applicant used the average annual reference ET value.[293]

As noted, the Applicant's goal was to develop an estimate of groundwater ET for White River 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 White River Valley by assigning the ET rates derived from the empirical relationship for the natural vegetation surrounding the agricultural areas. For areas of open-water, the Applicant assigned a consumptive-use rate of 4.90 feet per year based on Huntington and Allen (2010, Appendix 14, p. 246).[294] The Applicant estimated an average total ET of 64,900 afa in White River Valley for the period of record 2006 to 2010. The yearly total ET estimates, in acre-feet, were: 59,400 in 2006; 77,100 in 2007; 89,700 in 2008; 70,900 in 2009; and 27,600 in 2010.[295] 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.[296] Protestants' witness Dr. Myers testified that the Applicant's total-ET estimates are probably as accurate as they can be.[297] The State Engineer finds that the Applicant provided a scientifically sound estimate of total ET in White River Valley.

To estimate groundwater ET, precipitation has to be subtracted from the total ET estimates. The Applicant used the 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.[298] PRISM is a model that estimates how much precipitation falls on specific areas throughout the

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[292] Exhibit No. SNWA_258, p. D-16.
[293] Exhibit No. SNWA_258, pp. D-16 to D-17.
[294] Exhibit No. SNWA_258, p. D-17.
[295] Exhibit No. SNWA_258, p. D-18.
[296] Transcript, Vol.4 pp. 731:8–17; 731:25-732:7 (Fenstermaker).
[297] Transcript, Vol.20 p. 4442:3-7 (Myers).
[298] Exhibit No. SNWA_258, pp. 5-5, D-6 to D-15.

United States.[299] 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 2000. The 4-km grid is available on an annual basis, including for the period of record of the Applicant's ET measurements.[300] Ms. Drici testified that PRISM provided the best available method to estimate the precipitation distribution over the areas of interest.[301] 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.[302]

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. The Applicant determined that the PRISM grids under-estimated precipitation on the valley floor in White River Valley for all years in the period of record except for 2007 by comparing the grids to precipitation data collected in the valley. The Applicant corrected for this under-estimation by adding the average difference between the observed precipitation and the PRISM precipitation to the PRISM grid.[303] Protestants did not present any evidence challenging this adjustment to the PRISM estimates. The Applicant's final estimates for precipitation on the valley floor in the White River Valley discharge area in afa were: 123,300 in 2006; 76,300 in 2007; 79,400 in 2008; 108,800 in 2009; and 167,100 in 2010.[304] This five-year period represents a range of hydrologic conditions.[305] Given the evidence submitted regarding the accuracy assessment of PRISM and the adjustments applied by the Applicant based on determined underestimates in the ET discharge area of White River Valley, the State Engineer finds that the Applicant's method of developing estimates of precipitation distribution for White River Valley is scientifically sound.

The Applicant's final estimate of average annual groundwater ET in the groundwater discharge area of White River Valley is 64,900 acre-feet for the period of record from 2006 to 2010. The yearly groundwater ET estimates in acre-feet were: 59,400 in 2006; 77,100 in 2007;

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[299] Exhibit No. SNWA_258, p. B-2.
[300] Transcript, Vol.3 p. 608:10-13 (Drici).
[301] Transcript, Vol.3 p. 606:1–16 (Drici).
[302] Transcript, Vol.21 pp. 4649:18-4651:1 (Myers).
[303] Exhibit No. SNWA_258, pp. D-6 to D-15.
[304] Exhibit No. SNWA_258, p. D-14.
[305] Transcript, Vol.4 pp. 739:2–9, 810:19–25 (Burns).

89,700 in 2008; 70,900 in 2009; and 27,600 in 2010.[306] In cases where the local precipitation exceeded the local ET, a value of zero was assigned rather than assigning negative groundwater ET.[307]

The Applicant's estimate of groundwater ET is within the range of prior estimates. Welch et al. (2008), which is a USGS study published in 2007 as part of the BARCASS, estimated 76,700 afa, Maxey and Eakin (1949, p 42) estimated 34,000 afa, and Nevada Department of Conservation and Natural Resources (1971) estimated 37,000 afa.[308] Dr. Myers states that the Welch, et al. estimate is the most accurate of the prior estimates, which is higher than the Applicant's estimate.[309]

The State Engineer finds the Applicant's estimate of 64,900 afa of groundwater ET in White River Valley is reasonable, is supported by the available data, and is within the range of other recent estimates. The Protestants do not challenge this estimate and no better estimate of groundwater ET was offered into evidence.

2. WRFS External Interbasin Flow

Interbasin flow is another component of a groundwater budget analysis. Interbasin flow into and out of the flow system along with system groundwater ET are applied to the groundwater balance equation to derive an estimate of total recharge for the system. The Applicant evaluated interbasin flow into and out of the WRFS using available geologic, hydrologic, and geochemical evidence. The Applicant's witness, Dr. Peter Rowley, who the State Engineer qualified 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)[310] identified the boundaries between the Project basins and adjoining basins where interbasin flow is either likely or permissible based on the geology of each area. Dr. Rowley focused much of his testimony on five boundaries, which are where there were disputes about the likelihood of interbasin flow. These areas include: the borders of Butte and Jakes Valleys; Pahranagat and Southern Tikaboo Valleys; Coyote Spring and Hidden

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[306] Exhibit No. SNWA_258, p. D-18.
[307] Transcript, Vol.6 p. 1331:6-8 (Burns).
[308] Exhibit No. GBWN_004, p. 26.
[309] Exhibit No. GBWN_004, p. 26.
[310] Transcript, Vol.5 p. 976:23-25 (Rowley).

Valleys; the Lower Meadow Valley Wash and the Muddy River Springs Area ("MRSA"); and the MRSA and California Wash.[311]

The Applicant used the best available geologic information and analysis to support its interbasin flow analysis, however, it is of some concern that there is still very little direct hydrogeologic information on the specific sites, and there are no actual measurements of flow.

a. Mapping

The Applicant based its geologic interpretations on 1:250,000 scale mapping.[312] 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.[313] Previous geologic mapping included many other 1:250,000 and 1:100,000 scale maps that cover only portions of the Project basins.[314] The Applicant's 1:250,000 scale mapping includes previous work and provides greater detail by showing the location of more faults,[315] confining units and aquifers.[316] The Applicant's 1:250,000 scale mapping is more valuable than larger scale maps for identifying features impacting interbasin flow.

b. Geophysical Data

In addition to using more detailed mapping, the Applicant worked with the USGS to collect and analyze gravity and audiomagnetotelluric ("AMT") data to help identify and interpret the subsurface geology.[317] AMT is a geophysical technique that uses the earth's natural electromagnetic fields as an energy source to determine the electrical resistivity structure of the subsurface.[318] AMT studies can indicate buried faults by mapping differences in resistivity or conductivity of the buried rock formations.[319] Gravity studies are an additional state-of-the-art geophysical approach that use gravity readings across a broad area to measure the density of the mass of the underlying rock.[320] Gravity maps characterize buried faults by indicating areas

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[311] Exhibit No. SNWA_258, p. E-6.
[312] Transcript, Vol.5, p. 1099:1-3 (Rowley).
[313] Exhibit No. SNWA_058, p. 3-4; Transcript, Vol.5 p. 983:8-10 (Rowley); Transcript, Vol.6 p. 1255:6-18 (Rowley); Transcript, Vol.16 pp. 3644:23–3645:1-10 (Hurlow).
[314] Transcript, Vol.5 p. 982:15-22 (Rowley).
[315] Transcript, Vol.5 pp. 985:4-11 (Rowley) (referencing Exhibit No. SNWA_61).
[316] Transcript, Vol.5 pp. 986:23-25; 987:1-4 (Rowley).
[317] Transcript, Vol.5 pp. 989:1-15, 990:10-23 (Rowley).
[318] Transcript, Vol.5 pp. 1093:23-1094:1 (Rowley).
[319] Transcript, Vol.5 p. 1095:11-16 (Rowley).
[320] Transcript, Vol.5 p. 990:6-9(Rowley); Transcript, Vol.5 pp. 995:24-996:1 (Rowley).

where there are changes in density.[321] The Applicant also used this technology to calculate the depth to basement rock in the Project basins.[322] Knowing the depth to basement rock allows the Applicant to determine the thickness of the basin-fill aquifers.

c. **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.[323] The Applicant believes most regional flow occurs via fracture flow.[324] The Project basins are characterized by basin-range topography and contain primarily north-south trending normal faults aligned with the basins and ranges.[325]

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.[326] 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.[327] Despite the general rule, the experts in this case recognized there are no absolutes in nature.[328] There is extensive peer-reviewed scientific literature that explains the fracture-flow approach and the role of faults as barriers and/or conduits to groundwater flow, and both Protestant experts recognized the validity of the analytical method.[329]

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.

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[321] Transcript, Vol.5 p. 998:10-13. (Rowley).
[322] Transcript, Vol.5 pp. 997:13 - 998:9 (Rowley).
[323] Transcript, Vol.5 p. 1112:3-10 (Rowley).
[324] Exhibit No. SNWA_058, p. 2-5.
[325] Transcript, Vol.5 pp. 1107:12-13, 1112:7-10 (Rowley).
[326] Transcript, Vol.5 pp. 1111:22 -1113:18 (Rowley).
[327] Transcript, Vol.5 p. 1112:20-25 (Rowley).
[328] Transcript, Vol.5 p. 1132:21-23 (Rowley).
[329] Transcript, Vol.16 p. 3643:8-20 (Hurlow); Transcript, Vol.20 pp. 4448:22 – 4449:7 (Myers).

d. 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.[330] The Applicant started its analysis with Dr. Rowley's development of a geologic framework and conceptual model based on fracture flow.[331] Mr. Burns then applied hydrologic information, including groundwater elevations data, hydraulic gradients, and aquifer properties to Dr. Rowley's framework.[332] 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.[333] 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.[334] 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.[335]

BARCASS produced a map depicting boundaries where interbasin groundwater flow may exist and referred to each potential area as "not permitted, permitted, and possible by subsurface geology."[336]

Where the hydrologic data was available, the Applicant applied Darcy's Law to calculate interbasin flow.[337] 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 moves through the aquifer. The saturated thickness of the aquifer through which flow occurs is expressed as "b" in feet. The estimated saturated thickness is primarily dependent on the geologic formation in the

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[330] Exhibit No. SNWA_058, p. 4-34, Figure 4-9.
[331] Transcript, Vol.5 p. 1134:7-23 (Rowley).
[332] Transcript, Vol.5 p. 1136:10-13 (Rowley).
[333] Transcript, Vol.5 p. 1134:7-23 (Rowley).
[334] Exhibit No. SNWA_058, p. 2-10, Figure 2-5; Transcript, Vol.5 p 1115:20-24 (Rowley).
[335] Transcript, Vol.5 pp. 1135:25-1136:6 (Rowley).
[336] Exhibit No. SNWA_068, p. 34.
[337] Exhibit No. SNWA_258, pp. E-1, E-8.

flow section area. The permeability of these formations control the depth at which groundwater can move through the aquifer. "I" is the horizontal hydraulic gradient, expressed in feet per feet, which is the slope of the water table. "W" is the width of the flow section also expressed in feet.[338] None of the parties disputed that Darcy's Law is an appropriate method for calculating groundwater flow. However, the values used in the Darcy analyses are not known, having not been measured directly, and may have significant variability.

(1) <u>Butte Valley to Jakes Valley</u>

Mr. Burns testified that the saturated and fractured carbonate rock formation in the graben that extends from the Butte Mountains in the west toward the Egan Range in the east could support groundwater flow.[339] Dr. James Thomas, who is the Interim Director of the Division of Hydrologic Science at the Desert Research Institute, is a recognized expert in geochemistry. He stated that stable isotopic data supports groundwater flow from southern Butte Valley to Jakes Valley in the WRFS as well as to the regional warm springs in northern White River Valley.[340] Using available hydrologic data, the Applicant applied a Darcy analysis. The Applicant calculated a 0.003487 ft/ft hydraulic gradient for the flow section between a carbonate well in Butte Valley, 178B-7, and the only representative well in Jakes Valley located near the flow section, 174-10.[341] The Applicant applied a mean hydraulic conductivity value derived from numerous aquifer tests performed in wells completed in carbonate rocks throughout the Basin and Range region of Nevada and from studies conducted at the Nevada Test site and for the Death Valley Regional Flow System ("DVRFS") model.[342] For the purpose of assessing the saturated depth of the aquifer, the 45,000 foot wide flow section was divided into two parts. For the northern part of the flow section, which was approximately 30,000 feet wide, the Applicant estimated the saturated thickness of the aquifer contributing to interbasin flow was 500 feet deep due to the greater thickness of lesser permeable volcanic and clastic rocks near the ground surface.[343] The southern section, which was approximately 15,000 feet wide, had a larger estimated saturated thickness, 1,500 feet, due to a thinning of the surficial lesser permeable

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338 Exhibit No. SNWA_258, p. E-1. The term (365/43560) is a unit conversion from ft^3 per day to afa.
339 Transcript, Vol.6 pp. 1402:20-1403:8 (Burns); Exhibit No. SNWA_258, p. E-7.
340 Exhibit No. SNWA_079, p. 1.
341 Exhibit No. SNWA_258, pp. E-5 to E-8.
342 Exhibit No. SNWA_258, p. E-8.
343 Exhibit No. SNWA_258, p. E-5.

rock.[344] Applying these values to Darcy's Law resulted in an estimated inflow of 6,700 afa from Butte Valley to Jakes Valley.[345]

Dr. Myers also considered this boundary flow for his analysis. It appears that Dr. Myers adopted the inflow estimate of 16,000 acre-feet for this flow section boundary reported by BARCASS.[346] Dr. Myers argued that a greater amount of flow was possible because the Applicant's geologic analysis showed that the thickness of the carbonate rock aquifer could be much greater given the depth of the carbonate rocks.[347] The BARCASS interbasin flow estimate was based upon on an imbalance in the groundwater budget for southern Butte Valley. BARCASS estimated that southern Butte Valley received 35,000 afa of recharge and discharged 12,000 afa, leaving 23,000 afa to discharge from the basin as interbasin flow.[348] The USGS recently published an updated groundwater budget for southern Butte Valley in GBCAAS.[349] The GBCAAS estimated that southern Butte Valley received 21,000 afa of recharge and discharged 12,000 afa, leaving 9,000 afa to discharge from the basin as interbasin flow. The reduction in the groundwater budget components reduced the potential for interbasin flow by 14,000 afa, or 61%.[350] Based on this evidence, the State Engineer adopts the Applicant's 6,700 afa estimate of interbasin flow from Butte Valley to Jakes Valley. Even though there is a general lack of site-specific data, their calculation for interbasin flow uses reasonable ranges for hydraulic properties and flow width. The State Engineer agrees that the estimate in BARCASS is probably an over-estimate resulting from excess groundwater recharge. The Applicant's estimate is in reasonable agreement with the recent GBCAAS estimate.

(2) <u>Pahranagat Valley and Tikaboo Valley</u>

The next external flow boundary of the WFRS that the Applicant analyzed is between the Pahranagat Valley and Tikaboo Valley South.[351] In this area, the Pahranagat Sheer Zone is an area where there are many significant faults, including the Maynard Lake fault, that makes flow

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[344] Exhibit No. SNWA_258, p. E-5.
[345] Exhibit No. SNWA_258, p. E-8.
[346] Transcript, Vol.17 pp. 3807:13-3808:5 (Myers).
[347] Transcript, Vol.17 pp. 3807:13-3808:5 (Myers).
[348] Exhibit No. SNWA_068, pp. 44-45.
[349] Exhibit No. MILL_038.
[350] Exhibit Nos. MILL_033, p. 4; MILL_034, p. 4.
[351] Exhibit No. SNWA_058, p. 4-43, Figure 4-11.

possible from Pahranagat Valley to Tikaboo Valley.[352] Dr. Thomas stated that isotopic data also suggests that flow from Pahranagat Valley (in the WRFS) to Tikaboo Valley South (in the DVRFS) is possible.[353] Due to a lack of hydrologic data in this area, the Applicant based its estimate of external boundary flow on prior investigations. For this flow section, Kirk and Campana (1988), in a published Desert Research Institute ("DRI") study, estimated 4,400 afa, 4,400 afa, and 3,700 afa of outflow from Pahranagat Valley to Tikaboo Valley South for three different flow scenarios. Winograd and Thordarson (1975) estimated 6,000 afa of outflow in this area. Dr. Thomas, in a USGS report published in 1996, estimated 7,000 afa of outflow occurs at this area.[354] The Applicant used the average of these estimates, 5,100 afa, as its estimated outflow for this analysis.[355] Dr. Frank D'Agnese, an expert in groundwater modeling whose background includes extensive experience in the DVRFS, testified that based on his experience, flow from Pahranagat Valley to the DVRFS was reasonable.[356]

Dr. Myers suggested that groundwater may actually flow in the opposite direction from the DVRFS to the WRFS, based on the DVRFS Conceptual Model Report. Based on this report, Dr. Myers estimated that a net 6,500 afa enters the WRFS from the DVRFS.[357]

The evidence regarding interbasin flow for this flow section is conflicting. The Applicant reviewed three different studies that all concluded that there is outflow to Tikaboo Valley South within a limited range of 3,700 afa to 7,000 afa.[358] Dr. Myers cited the recent USGS DVRFS study.[359] That study estimated interbasin flow between valleys of the WRFS and the DVRFS, and found a net 6,500 afa entering the WRFS from the DVRFS.[360] However, a close examination of the DVRFS boundary shows that the depicted flow system's eastern boundary is coincident with the hydrographic basin boundaries north of the Pahranagat Shear Zone, but south of the Pahranagat Shear Zone the DVRFS boundary is coincident with the Gass Peak thrust fault, which lies within Coyote Spring Valley and Las Vegas Valley. Most of the DVRFS estimated flow from DVRFS to WRFS occurs across the Sheep Range in Coyote Spring Valley, and it is

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[352] Transcript, Vol.5 pp.1194:17-1197:4 (Rowley).
[353] Exhibit No. SNWA_079, p. 3.
[354] Exhibit No. SNWA_258, p. E-9; Transcript, Vol.6 p. 1409:7-9 (Burns).
[355] Exhibit No. SNWA_258, p. E-9;Transcript, Vol.6 p. 1409:5-9 (Burns).
[356] Transcript, Vol.9 pp. 2025:12-2026:6 (D'Agnese).
[357] Exhibit No. GBWN_103, p. 13.
[358] Exhibit Nos. SNWA_285; SNWA_301; SNWA_304.
[359] Exhibit No. SNWA_299.
[360] Exhibit No. GBWN_103, p. 13.

not possible to discern how much of that flow originated in the Coyote Spring Valley part of the range. However, it is clear from Figure C-9 of that report that approximately 800 afa (one million cubic meters per year) is estimated as inflow to Pahranagat Valley from Tikaboo Valley.[361]

The Applicant did not compute their own estimate for groundwater flow from Pahranagat Valley to Tikaboo South Valley, but instead chose to use previously published data. They chose not use the most recent publication as cited by Dr. Myers. The State Engineer finds that the Applicant, choosing to use older existing data, erred by ignoring the most recent USGS published estimate. The State Engineer finds interbasin flow from Pahranagat Valley to Tikaboo Valley South, for the purposes of the Applicants' recharge solver,[362] is the average of the six estimates cited above, and will use that estimate of 4,100 afa for use in their Excel recharge solver.

(3) <u>Coyote Spring Valley to Hidden Valley</u>

Further south, the Applicant calculated interbasin flow of 8,600 afa from Coyote Spring Valley to Hidden Valley using available hydrologic data and Darcy's Law.[363] Dr. Thomas' memorandum states that the most likely source of groundwater in Hidden Valley and Garnet Valley is groundwater from the carbonate aquifer underlying Coyote Spring Valley and Upper Moapa Valley (a.k.a. Muddy River Springs Area). His opinion is based on isotopic values of groundwater samples extracted from carbonate wells in Garnet Valley that are significantly more negative than the local recharge, but match well with the groundwater from the carbonate-rock aquifer underlying Coyote Spring Valley and Upper Moapa Valley.[364] However, his memorandum does not address potential flow paths where such flow is likely to occur.

The Applicant's geologic analysis identified the Meadow Valley Mountain Range on the west side of the valley as carbonate,[365] as well as a fractured carbonate rock formation estimated to be 30,000 feet long and potentially supporting groundwater flow between the valleys.[366] They suggest the range-front fault that defines the west side of the Arrow Canyon Range is likely the

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[361] Exhibit No. SNWA_299, p. 119.
[362] Exhibit No. SNWA_452.
[363] Exhibit No. SNWA_258, p. E-11.
[364] Exhibit No. SNWA_079, p. 2.
[365] Transcript, Vol.6 p.1223:11-13 (Rowley).
[366] Exhibit No. SNWA_258, p. E-10.

main conduit for the flow into Hidden Valley.[367] Scheirer and Andreason of the USGS confirmed the existence of this major fault in a gravity study published in 2011.[368] The Applicant calculated a relatively flat hydraulic gradient, 0.00016 ft/ft, between monitor wells CSVM-2 and GV-1, which would initially suggest little or no flow in this section.[369] However, the Applicant estimated a relatively high transmissivity, 213,035 square feet per day, using a geometric mean transmissivity value derived from the aquifer tests performed on test wells located in the vicinity of the flow section. They suggest the relatively small hydraulic gradient is likely an artifact of the large transmissivities of the highly fractured carbonate rocks, and that such large transmissivities would support flow in spite of the small hydraulic gradient.[370] Dr. Myers noted that there are no direct measurements of transmissivity across the width of the suggested flow corridor.[371]

Referencing the small hydraulic gradient, Dr. Myers suggested that flow in this area is much closer to zero. He also questioned the Applicant's transmissivity value, testifying that the Applicant selected wells that were "high producers."[372] Dr. Myers suggested that a groundwater divide potentially exists in this area, which would limit or prevent outflow.[373] Questions related to a potential groundwater divide between Coyote Spring Valley and Hidden Valley were also brought up by State Engineer's staff in questions to the Applicant's expert regarding a gradient from CSVM-2 to the MX wells. The Applicant's witness testified that an apparent gradient exists from the Coyote Spring Valley - Hidden Valley boundary in both northerly and southerly directions, and that a groundwater divide may exist there.[374] Given this evidence, the State Engineer agrees with the Protestant that the hydrographic boundary between Coyote Spring Valley and Hidden Valley appears to be a groundwater divide, and flow through this area in a southerly direction is unlikely. The State Engineer finds that the Applicant's interbasin flow estimate between Coyote Spring Valley and Hidden Valley is not reasonable, and is not supported by the hydraulic gradients in the region. The State Engineer also finds that evidence

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[367] Transcript, Vol.6 p.1222:3-5 (Rowley).
[368] Transcript, Vol.6 pp.1220:21-1221:7 (Rowley).
[369] Exhibit No. SNWA_258, pp. E-9, E-11.
[370] Exhibit No. SNWA_258, p. E-11.
[371] Transcript, Vol.17 p. 3810 (Myers).
[372] Exhibit No. GBWN_103, p. 13; Exhibit No. GBWN_271, Slide 37; Transcript, Vol.17 p. 3811:4-21 (Myers).
[373] Exhibit No. GBWN_103, p. 13; Exhibit No. GBWN_271, Slide 37; Transcript, Vol.17 p. 3811:4-21 (Myers).
[374] Transcript, Vol. 6, pp. 1415-1416; Vol. 7, p.1599.

better supports a finding of no interbasin flow from Coyote Spring Valley to Hidden Valley through the shared hydrographic boundary. The State Engineer will use this revised estimate of no interbasin flow at this location in the Applicant's Excel recharge solver.[375]

(4) Muddy River Springs Area to California Wash

The final WRFS system boundary that the Applicant analyzed for interbasin flow is the very southern portion of the Muddy River Springs Area ("MRSA"), around the source of the Muddy River.[376] Both the Applicant and the Protestant, GBWN, found that the MRSA accommodates inflow from the northern part of the MRSA, Lower Meadow Valley Wash, and outflow to the south to the California Wash.[377] Dr. Thomas testified that isotopic data shows the Muddy River springs discharge is a mixture of water from Pahranagat, Delamar, Coyote Spring, and Kane Springs Valleys, and probably also Lower Meadow Valley Wash.[378] The only dispute between the parties is the net amount of interbasin flow in this area. From prior investigations, the Applicant estimated that 8,000 afa flows into the WRFS from the Lower Meadow Valley Wash at the MRSA.[379] The estimate is within the range of prior investigations, which ranged from 4,500 afa (Kirk and Campana, 1988) to 13,000 afa (Prudic, et al., 1995). GBWN did not dispute this estimate.

Dr. Myers instead suggested that the inflow to the WRFS at the MRSA is equal to the outflow from the MRSA to California Wash.[380] However, Dr. Myers did not present any evidence to support this statement. On the other hand, the Applicant analyzed the potential outflow to the California Wash with available geologic and hydrologic data. Dr. Rowley identified a 16,500 foot section that could accommodate interbasin flow from the MRSA to the California Wash.[381]

The Applicant calculated the hydraulic gradient across the flow section to be 0.00652 ft/ft, using average measurements from 13 wells in the MRSA and four wells in the California Wash.[382] The top 2,000 feet of this flow section consists of basin-fill material comprised of

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[375] Exhibit No. SNWA_452.
[376] Exhibit No. SNWA_258, p. E-6.
[377] Exhibit No. SNWA_258, p. E-6; Exhibit No. GBWN_103, p. 13.
[378] Exhibit No. SNWA_079, pp. 1–2.
[379] Exhibit No. SNWA_258, p. E-8.
[380] Exhibit No. GBWN_103, p. 13.
[381] Exhibit No. SNWA_258, pp. E-13-14.
[382] Exhibit No. SNWA_258, p. E-12.

Tertiary Horse Spring and Muddy Creek formation, and the Applicant assumed that all subsurface flow out of the MRSA occurs in this section. The Applicant calculated the transmissivity of the basin-fill material, 11,000 ft^2 per day, using the geometric mean transmissivities derived from aquifer tests performed in basin-fill wells located in the Lower Meadow Valley Wash and Virgin River Valley.[383] The Applicant applied this data using Darcy's Law and calculated 9,900 afa of interbasin outflow for this boundary. In addition, the Applicant also determined that 33,700 afa flows out of the MRSA to California Wash as Muddy River streamflow, and that the source of the streamflow is the groundwater discharge from regional springs located in the MRSA. This brings the total outflow from the WRFS at the MRSA to 43,600 afa.[384]

Based on the evidence in the record, the difference between the inflow to and outflow from the MRSA is quantifiable and can be adopted by the State Engineer. The Applicant's estimated inflow to the MRSA was based on a prior investigation, was within the range of previously reported estimates, and was not disputed by any of the Protestants. The Applicant used a site-specific analysis to determine outflow from the MRSA, which carries more weight than Dr. Myers' simple assumption that inflow and outflow estimates were equivalent to each other. Accordingly, the State Engineer finds that the Applicant's estimate of 9,900 afa of interbasin flow to California Wash is sound.

(5) Steptoe Valley

Dr. Myers suggests there is inflow to the WRFS from Steptoe Valley.[385] Dr. Myers also testified that the isotopic data presented by Dr. Thomas supports flow from Cave and southern Steptoe Valleys to White River Valley.[386] Dr. Thomas, however, testified that he did not conclude that groundwater flows from southern Steptoe Valley to White River Valley.[387]

Also, Dr. Myers appears to adopt this inflow estimate from BARCASS.[388] However, Dr. Myers failed to adopt the total BARCASS inflow to the WRFS, mistakenly leaving out 8,000 afa that flows from Steptoe Valley directly into White River Valley.[389] Dr. Myers admitted that this

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383 Exhibit No. SNWA_258, p. E-14.
384 *See* Exhibit No. SNWA_258, p. G-5.
385 Transcript, Vol.17 p. 3801:5-13 (Myers).
386 Exhibit No. GBWN_103, p. 22.
387 Transcript, Vol.5 p. 1045:12–14 (Thomas).
388 Exhibit No. SNWA_068, pp. 5, 44-45; Transcript, Vol.17 p. 3801:5-13 (Myers).
389 Transcript, Vol.19 p. 4536:3-21 (Myers).

was an error in his analysis[390], which calls his interbasin flow estimates into question and undermines his groundwater balance for the flow system.[391] The BARCASS estimate for interbasin flow was based on an imbalance in the groundwater budget for Steptoe Valley. In BARCASS, the groundwater budget for Steptoe Valley had an unprecedented amount of recharge, 154,000 afa, and only 101,000 afa of discharge, leaving 53,000 afa of an imbalance. The BARCASS authors then routed the water from this imbalance to adjacent basins as interbasin flow.[392] 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 and southern Spring Valleys. The latter two flow paths from central and southern Steptoe Valley have not been identified in previous investigations." The Applicant's geologic expert, Dr. Rowley, testified that the geologic framework shows both westerly flow paths from Steptoe Valley are unlikely flow paths because the Egan Range in this area is bounded by faults perpendicular to the proposed flow path.

In arguing that there is flow into Jakes Valley from Steptoe Valley, Dr. Myers also claims that this area supports westerly flow because the mines in the area have required "significant dewatering over the years."[393] Dr. Myers cites a report from Leggette, Brashears, and Graham (1959)[394] that details "how the water levels in an early shaft would fill as the shaft encountered highly fractured rock zones."[395] The report, however, does not claim that this water originates from interbasin flow. Instead on the very next page, the report states that "[t]he limestones that produce water in the Deep Ruth Mine crop out extensively at the land surface, where they are readily recharged whenever moderately heavy precipitation occurs."[396] Therefore, this localized groundwater occurs as a result of a local precipitation recharge area perched above an impermeable layer of weathered monzonite and the beds of shale, not as a result of interbasin flow. [397]

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[390] Transcript, Vol.19 p. 4536:11-21 (Myers).
[391] Transcript, Vol. 17, p. 3801:6-14 (Myers); Exhibit Nos. SNWA_068, pp. 5, 44-45; GBWN_004, p. 34.
[392] Exhibit No. SNWA_068, p. 44, Table 5; 45, Table 6.
[393] Exhibit No. GBWN_ 103, p. 9.
[394] Exhibit No. GBWN_ 108.
[395] Exhibit No. GBWN_ 108, p. 1033.
[396] Exhibit No. GBWN_ 108, p. 1034.
[397] Transcript, Vol.6 p. 1245:11-16 (Rowley).

The BARCASS analysis that resulted in this suggested flow path was subsequently updated by the USGS in GBCAAS.[398] 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 the Basin and Range Carbonate Aquifer System [BARCAS] study."[399] Using this information, GBCAAS recalculated the groundwater budget components for Steptoe Valley.[400] 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.[401] The new groundwater budget for Steptoe Valley leaves a recharge deficit of 24,000 afa. The report is clear in that estimates of recharge and discharge are considered very uncertain, and imbalances between recharge and discharge in a basin could be due to this error or possibly to interbasin flow.[402]-

3. Recharge

The Applicant calculated total recharge for the White River Flow System using the groundwater balance method. Once estimates of groundwater ET and system inflow and outflow values were made, the groundwater balance equation was simply used to compute total recharge for the WRFS. The State Engineer, as discussed above, revised estimates for outflow from Pahranagat Valley and Coyote Spring Valley. After adding up all groundwater discharge from the WRFS (105,800 afa of groundwater ET and 47,700 afa of external boundary outflow) and subtracting external boundary inflow (14,700 afa), recharge in the WRFS totals 138,800 afa.[403] In order to estimate how much recharge occurs in individual basins within the WRFS, this quantity of recharge was mathematically distributed within the basins of the WRFS. The first step in this recharge distribution was to estimate the amount of precipitation that occurs in recharge areas in the WRFS. The second step was to calculate recharge efficiencies to estimate the amount of preciptation that actually becomes recharge.

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398 Exhibit No. SNWA_065; Exhibit No. MILL_38.
399 Exhibit No. MILL_038, p. 1.
400 Exhibit No. MILL_033, p. 4; Exhibit No. MILL_034, p. 4.
401 Exhibit Nos. MILL_033, p. 4; MILL_034, p. 4; SNWA_068, pp. 44 to 45.
402 Exhibit No. MILL_041, pp. 45-46.
403 *See* Exhibit No. SNWA_452.

4. **Precipitation Distribution in WRFS**

The Applicant selected the most accurate data available to map the spatial distribution of precipitation in the WRFS, which is the PRISM 800-meter grid representing the normal period 1971-2000. The PRISM precipitation grid was derived using the PRISM computer program developed to model spatial distributions of climatic variables including precipitation. The program uses precipitation station data and topographical data and takes into account orographic effects. The PRISM precipitation grid represents an annual average for a 30-year period (1971 to 2000) and is based on station data collected during that period of time. Dr. Myers conceded that PRISM is "as of right now…the best tool that we can use."[404] Using this distribution, the Applicant generated contour lines representing average annual precipitation throughout the WRFS recharge area that are spaced at one-inch precipitation intervals.[405]

The Applicant completed an analysis to determine the accuracy of the PRISM precipitation distribution. The Applicant's witness Ms. Drici testified that the PRISM grid precipitation estimates were analyzed against precipitation-station data. Ms. Drici concluded that the precipitation estimates of the PRISM precipitation grid matched well with the actual normal precipitation station measurements.[406] PRISM also matched well with precipitation data from non-normal stations with more than 20 years of non-zero data.[407] For precipitation stations located within the recharge areas of the WRFS, the PRISM precipitation estimate was within the range of uncertainty of the period of record mean of each precipitation station.[408] From a statistical standpoint, this information indicates that PRISM and the long-term mean are the same.[409] Ms. Drici also concluded that PRISM provided the most current and accurate estimates of precipitation distribution for the Project basins.[410] The State Engineer agrees and finds that the Applicant's use of the PRISM precipitation distribution grid in the recharge analysis was proper.

Taking into account all of the factors that control precipitation, including elevation, PRISM estimated 569,600 acre-feet annually of precipitation in Dry Lake Valley, which was

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[404] Transcript, Vol.21 p. 4650:12-15 (Myers).
[405] Exhibit No. SNWA_258, p. F-12.
[406] Transcript, Vol.3 p. 615:10-16 (Drici); Exhibit No. SNWA_258, p. B-14.
[407] Transcript, Vol.3 pp. 616:18-617:7 (Drici); Exhibit No. SNWA_258, p. B-15.
[408] Transcript, Vol.3 p. 619:8-16 (Drici).
[409] Transcript, Vol.3 p. 619:20-22 (Drici).
[410] Transcript, Vol.3 p. 629:11-17 (Drici).

202,250 acre-feet annually more than the Applicant calculated by digitizing the Hardman Map.[411] The Applicant reported that prior estimates of precipitation in Dry Lake Valley were 571,000 acre-feet annually (SNWA, 2009a); 340,000 acre-feet annually (Scott, et al., 1971); 455,000 acre-feet annually (LVVWD, 2001).[412] PRISM's total annual precipitation estimate for Dry Lake Valley is within the range of these previous estimates.

5. Recharge Distribution

To develop recharge efficiencies, the Applicant used the 800-meter PRISM precipitation distribution and the Excel Solver, which is designed to solve optimization problems using numerical methods. In this case, the Excel Solver was used to find the optimal value for recharge efficiencies for each one-inch precipitation interval in the WRFS. In doing so, the Applicant expressed the recharge efficiencies as a function of precipitation coupled with an objective function derived from the groundwater balance equation relating groundwater ET to the other groundwater budget components of the WRFS.[413] The recharge efficiency is expressed as a mathematical equation representing the ratio of recharge to precipitation, in which recharge is a function of precipitation as a power function.[414] In the initial development of this relationship, in order to keep the calculated recharge efficiency values reasonable, the Applicant placed constraints (limits or ranges) on the power function coefficients. For example, limits were placed to ensure recharge efficiencies increase with increased precipitation.[415] To ensure the Excel Solver calculated representative recharge efficiencies for the WRFS, the Applicant set a maximum recharge efficiency value of 49% for the WRFS based on prior studies.[416] Areas where recharge was not expected to occur were also excluded from the Excel Solver analysis. Recharge efficiencies with values of zero were applied to: (1) areas on the valley floor; (2) areas of groundwater ET discharge; and (3) areas that received less than 8 inches of precipitation annually.[417] Notably, none of the Protestants disputed these constraints. With these constraints in place, the Excel Solver yielded optimal solutions for recharge efficiencies for each one-inch

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[411] Exhibit No. SNWA_258, p. 3-13.
[412] Exhibit No. SNWA_258, p. 3-7.
[413] Exhibit No. SNWA_258, p. F-15.
[414] Exhibit No. SNWA_258, p. F-6.
[415] Exhibit No. SNWA_258, p. F-18.
[416] Exhibit No. SNWA_258, p. F-19.
[417] Exhibit No. SNWA_258, p. F-8.

precipitation interval.[418] Having reviewed the method by which the Applicant utilized the Excel Solver, the State Engineer finds that the Applicant's use of the Excel Solver, and the State Engineer's revision as described above, in this case is fundamentally sound.

The Applicant's recharge efficiencies were then applied to the spatial distribution of precipitation for Dry Lake Valley.[419] Recharge volumes were calculated for each one-inch precipitation interval by multiplying the precipitation rate for the interval (not including areas of no recharge), by the surface area within the valley for the corresponding interval, and by the recharge efficiency.[420] The Applicant calculated total recharge by summing the recharge volumes for each precipitation interval in Dry Lake Valley, which equaled 16,200 afa.[421] After adjusting for lesser White River Flow System outflow at Pahranagat and Coyote Spring Valleys and re-running the Excel Solver, the State Engineer estimated recharge in Dry Lake Valley to be 15,000 afa. The Applicant reported the following recharge estimates from prior investigations: 16,208 afa (SNWA, 2009a); 5,000 afa (Reconnaissance Series and Scott, et al. 1971); 7,500 afa (Kirk and Campana, 1988); 13,000 afa (LVVWD, 2001); 9,159 afa, 28,559 afa, 20,187 afa, 8,947 afa, and 50,389 afa (Epstein, 2004); 10,627 afa and 11,298 afa (Flint, et al. 2004); and 5,000 afa (Brothers, et al., 1996).[422] The GBCAAS report estimated 8,900 afa of total recharge. [423] The State Engineer finds that the new recharge estimate of 15,000 is within the range of prior estimates, and is appropriate for use in the determination of perennial yield for Dry Lake Valley.

Dr. Myers appears[424] to urge the State Engineer to adopt the recharge estimate in the Reconnaissance Series report for Dry Lake Valley.[425] As mentioned above, there are improvements in the modern precipitation data over the data that were available at the time of the Reconnaissance Series investigations. In addition, there have been dramatic advancements in the computing power and spatial-analysis techniques, which now lead to more accurate estimates of recharge as opposed to the method applied in the Reconnaissance Series estimates.[426] Because

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[418] Exhibit No. SNWA_258, pp. F-22, F-24 to F-25.
[419] Exhibit No. SNWA_258, p. 6-17.
[420] Transcript, Vol.6 p. 1365:3-7 (Drici).
[421] Exhibit No, SNWA_258, p. 6-17.
[422] Exhibit No. SNWA_258, p. 6-18.
[423] Exhibit No. Mill_033, Table A 4-1.
[424] The State Engineer notes that Dr. Myers' reports and testimony do not explicitly state his groundwater budget components for Cave, Dry Lake, or Delamar Valleys.
[425] Transcript, Vol.20 p. 4577:2-10 (Myers).
[426] Transcript, Vol.6 p. 1349:4-9 (Drici).

of these scientific advancements, the State Engineer finds that the Reconnaissance Series report does not contain the most current and accurate estimate for recharge in Dry Lake Valley.

With respect to the Applicant's analysis, Dr. Myers questioned whether the Applicant could accurately calculate recharge for individual basins using the PRISM 800-meter precipitation distribution. The Applicant's analysis acknowledged that PRISM generally over-estimates precipitation, but that nearly all the PRISM estimates fall within plus or minus 10% of the station values.[427] However, using the Applicant's method, over-estimating precipitation does not yield more recharge. As the Applicant pointed out, the total recharge for the WRFS was determined using the groundwater balance equation and was constrained or limited by estimates of groundwater ET and interbasin flow.[428] Therefore, any over-estimation of precipitation does not yield a greater value for recharge in the WRFS as a whole.

Dr. Myers also expressed concern that PRISM inaccurately distributed precipitation in the WRFS. Specifically, Dr. Myers questioned whether PRISM simulated greater precipitation in a 12 to 15 inch precipitation band that extended from southern Cave Valley down through eastern Dry Lake and Delamar Valleys, which according to Dr. Myers, would cause the Excel Solver analysis to distribute more recharge to these areas.[429] However, the Applicant presented evidence of a precipitation station, Station 26, which had greater than 20 years of measurable precipitation data and was located in this particular band of precipitation. The average annual precipitation for Station 26 was greater than the PRISM simulated precipitation for that station location.[430] Therefore, in this particular precipitation band, PRISM does not over-estimate precipitation. Dr. Myers did not submit any evidence to refute this fact.

Dr. Myers also argued that the system-wide approach used by the Applicant to calculate recharge efficiencies was improper. Dr. Myers testified that the Excel Solver analysis distributed recharge without any concern for locations of potential discharge, referring to the analysis as a "Black Box."[431] However, Dr. Myers did not provide any examples of basins in the Applicant's Excel Solver analysis where the distributed recharge was insufficient to balance discharge from

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[427] Exhibit No. SNWA_258, p. B-15.
[428] Transcript, Vol.6 p. 1359:4-10; 20-23 (Drici).
[429] Transcript, Vol.17 p. 3822:17-22 (Myers).
[430] Exhibit No. SNWA_258, pp. B-8, Table B-1, Map ID 26; B-10, Figure B-2, Map ID 26; Transcript, Vol.21 pp. 4594:20-4595:4 (Myers).
[431] Transcript, Vol.17 pp. 3794:4-5; 3852:3-7 (Myers).

the basin. In fact, upon questioning from the Applicant's counsel, Dr. Myers conceded that the Applicant's analysis yields enough recharge in the northern part of the WRFS to satisfy discharge in the White River Valley.[432] Further, the "Black Box" approach is ultimately the same approach that was used by Maxey-Eakin, which Dr. Myers implicitly adopted by selecting the Reconnaissance Report Series recharge estimates for the WRFS project basins.[433] When Maxey and Eakin developed the recharge efficiencies that were ultimately used throughout Nevada to calculate recharge, they considered the WRFS as one unit, just as the Applicant does. Accordingly, the State Engineer finds Dr. Myers' criticisms of the Applicant's Solver analysis unpersuasive.

The State Engineer finds that the Applicant properly applied the groundwater balance method by calculating recharge efficiencies using the PRISM precipitation distribution grid and updating estimates of groundwater ET.[434] The State Engineer further finds that the Applicant's analysis is a fundamentally sound method for estimating recharge in Dry Lake Valley.

6. Dry Lake Valley Groundwater ET

The parties do not dispute that there is little or no measurable groundwater ET in Dry Lake Valley.

7. Dry Lake Valley Inflow

Dr. Thomas testified that up to 2,000 afa of groundwater may flow into Dry Lake Valley from northeast Pahroc Valley, or possibly directly from Cave Valley, based on isotopic data.[435] Dr. Myers admits that the isotopic data suggests that a small amount flow is possible from southern Cave Valley or northern Pahroc Valley into Dry Lake Valley.[436]

According to Dr. Thomas, two wells in Dry Lake Valley were recently drilled with imported drilling fluid. These wells were drilled as groundwater-level monitor wells by the Applicant. Dr. Thomas did not rely on the isotopic signatures of the water sampled from these wells to determine the source of groundwater in Dry Lake Valley because he concluded that the wells were underdeveloped and that the sample results were likely affected by residual drilling

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[432] Transcript, Vol.21 p. 4652:18-21 (Myers).
[433] Transcript, Vol.20 pp. 4429:19-4430:8 (Myers).
[434] Exhibit No. SNWA_294; Exhibit No. SNWA_448.
[435] Transcript, Vol.5 pp. 1023:14–21, 1035:9–1037:14 (Thomas); Exhibit No. SNWA_077, p. iii.
[436] Transcript, Vol.17 p. 3835:10–24 (Myers).

fluids present in the samples.[437] The isotopic signatures of the groundwater sampled from other fully developed wells in the valley suggest local recharge as the source of groundwater in the valley. Dr. Rowley evaluated the geology of the basin, and based on that evaluation he identified boundaries in which interbasin flow is likely or permissible. His testimony supported Dr. Thomas' conclusion that interbasin flow is only entering Dry Lake Valley from Pahroc Valley, and the amount from that location is limited.

Dr. Myers also points out that the measurements for the SNWA wells in Dry Lake were taken a year apart and show almost the same values. The last measurement reported was taken in 2006. Dr. Myers questions why more measurements were not taken.[438] Though Dr. Myers raises valid points, there are wells within Dry Lake Valley that have been fully developed and whose samples would therefore be more reliable. Samples from these wells indicate groundwater in the valley is derived from local recharge, and that the Applicant's monitor wells are likely discharging a mixture of drilling fluid and groundwater and that isotopic results from these wells should not be included in the analysis. The State Engineer finds that the groundwater in Dry Lake Valley is largely local recharge with potentially a small amount of inflow from Pahroc Valley or Cave Valley. The State Engineer also finds that any such inflow is highly uncertain, and will not be considered in determining the perennial yield of the Dry Lake Valley Hydrographic Basin.

8. <u>Dry Lake Valley Outflow</u>

Since there is no groundwater ET in the basin,[439] groundwater is discharged from the valley as interbasin outflow. The magnitude and direction of this flow is disputed by the parties. The Applicant's geologic and hydrologic evidence shows that Dry Lake and Delamar Valleys are separated by a low alluvial divide, but are geologically and hydrologically connected. All of the significant structures occurring in the basin are associated with north-south trending normal faults that formed the basins and ranges except only one east-west structure that intersects the Dry Lake Valley and the adjacent basin of Pahranagat Valley. This fault is located between the North Pahroc and South Pahroc Ranges, an east-west zone of faulted rocks that runs along the

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437 Transcript, Vol.5 pp. 1033:21–1034:15 (Thomas).
438 Transcript, Vol.17 pp. 3836:22–3837:9 (Myers).
439 Exhibit Nos. SNWA_258, p. 5-1, GBWN_004, p. 25.

boundary of Dry Lake Valley and Delamar Valley.[440] The Applicant's witness opined that transverse zones are very deep-seated features that do not have any effect on groundwater flow.[441] Gravity anomalies in Dry Lake and Delamar Valleys and their basin boundary show expression of the Timpahute transverse zone east and west of the basin boundary but not at the boundary.[442] A buried north-trending bedrock ridge between the North Pahroc and South Pahroc ranges is depicted in gravity maps even though it is crossed at right angles by the Timpahute transverse zone.[443] Detailed geologic mapping [444]and gravity surveys[445] have identified parts of the east-trending Timpahute transverse zone in the bedrock on both (western and eastern) sides of the valley where Dry Lake Valley passes into Delamar Valley.[446] East-trending faults may be traced to the west as far west as Pahroc Summit Pass, between the North and South Pahroc Ranges where US 93 crosses into Six Mile Flat and north of which a SNWA monitoring well was sited. The Timpahute transverse zone, however, has not been identified in the Six Mile Flat area and at the approximate location of a SNWA monitor well.[447] A series of large, north-trending normal faults define the range fronts on either side of Dry Lake and Delamar Valleys, essentially connecting the two basins by these structures. These faults are oriented parallel to the potentiometric gradient and are likely conduits to southward groundwater flow and barriers to westward flow.[448]

The geologic analysis indicates that the primary flow paths for groundwater between the valleys is through the basin fill and the north-south trending range front faults of the North Pahroc and Burnt Spring Ranges. This conclusion is supported by the Applicant's hydrologic evidence, which demonstrated that the prevailing hydraulic gradient in the carbonate rock and basin-fill material in Dry Lake and Delamar Valleys is to the south toward Coyote Spring Valley and the Pahranagat Shear Zone.[449]

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[440] Exhibit No. SNWA_058, p. 4-51; Transcript, Vol.5 pp. 1188:12-15, 1189:7-11 (Rowley).
[441] Transcript, Vol. 5 p. 1190:2-10 (Rowley).
[442] Exhibit No. SNWA_058, pp. 5-15, 6-9.
[443] Exhibit No. SNWA_058, p. 5-18 (Fig. 5-12).
[444] Exhibit No. SNWA_058, pp. 4-52 to 4-53.
[445] Exhibit No. SNWA_058, pp. 5-13 to 5-18.
[446] Exhibit No. SNWA_058, p. 6-9.
[447] Exhibit No. SNWA_058, pp. 6-9 to 6-10 (referencing Plates 4 and 8).
[448] Exhibit No. SNWA_058, p. 6-9 to 6-10.
[449] Exhibit No. SNWA_258, Plate 2, Carbonate Wells Map ID's 181-6 and 181-25; and Basin Fill Wells 181-7, 181-3, 181-1, 181-19, 181-20, 181-21, 182-4, and 182-3.

Dr. Thomas stated that isotopic data suggests that groundwater flows from Dry Lake Valley south into Delamar Valley.[450] He stated that the isotopic data shows that little if any groundwater from Dry Lake Valley supplies the warm springs in Pahranagat Valley.[451] Dr. Thomas and Dr. Myers agree that the isotopic data do not support groundwater flows from Dry Lake Valley to the warm springs in Pahranagat Valley.[452] However, Dr. Thomas recognized that in his analyses, the measured isotopic value of the Pahranagat Valley warm springs did not match his modeled results, and for groundwater from Dry Lake Valley to flow to the Warm Springs would make the model more wrong.[453]

Dr. Myers maintains that all of the recharged groundwater in Dry Lake and Delamar Valley flows to Pahranagat Valley. His report supports the potential for flow in carbonate aquifers from from Dry Lake Valley to Pahranagat, but believes most of the flow occurs along the Pahranagat Shear Zone into southern Pahranagat Valley.[454] While the groundwater elevations in Pahranagat Valley are lower than the groundwater elevations in Dry Lake Valley,[455] the geologic and geochemical evidence does not support this suggested flow path. The State Engineer finds the Applicant's arguments pursuasive, but the potential for a minor amount of flow westward into Pahranagat Valley along structures associated with the Timpahute transverse zone cannot be ruled out. Detailed monitoring of groundwater along this zone will determine whether such flow occurs and if there is a change in flow due to pumping in Dry Lake Valley. The State Engineer finds that most of the groundwater in Dry Lake Valley discharges via interbasin outflow to Delamar Valley, rather than to adjacent valleys to the east or west.

9. <u>Perennial Yield for Dry Lake Valley Conclusion</u>

It is accepted by the State Engineer that outflow from Dry Lake Valley occurs via the subsurface primarily to Delamar Valley, which has few existing groundwater rights and whose perennial yield will not rely on inflow from Dry Lake Valley. Inflow to Dry Lake Valley is minimal, and will not be part of the perennial yield of Dry Lake Valley. However, because the down-gradient basin is not developed, and also because no impacts to any existing rights are

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[450] Exhibit No. SNWA_077, p. iii.
[451] Exhibit No. SNWA_077, p. iii.
[452] Transcript, Vol.5 p. 1041:2–9 (Thomas); Transcript, Vol. 20 pp. 4555:24-4556:4 (Myers).
[453] Transcript, Vol.5 pp. 1089 - 1090 (Thomas).
[454] Exhibit No. GBWN_004, p. 34.
[455] Exhibit No. SNWA_258, Plate 2.

likely for hundreds of years, the perennial yield will be equal to the local groundwater recharge from precipitation. **The State Engineer finds that the perennial yield for Dry Lake Valley is equal to the State Engineer's estimated recharge of 15,000 acre-feet.**

D. Time to Reach Equilibrium

The Protestants suggest that the perennial yield of a basin is further limited to the amount of groundwater discharge that the proposed pumping will actually capture in a reasonable amount of time.[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.

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.[457] Committed groundwater rights are the portion of groundwater rights that actually deplete water from the groundwater reservoir. The Applicant undertook a complete and comprehensive evaluation of committed groundwater rights in Dry Lake Valley. The Applicant's evaluation was presented through exhibits and the testimony of expert water rights surveyor, Michael Stanka. The State Engineer also conducted an inventory of existing rights in Dry Lake Valley persuant to NRS 533.364.[458] The results of these inventories are nearly identical, with the State Engineer identifying 807 afa of committed groundwater and the Applicant's witness identifying 807.78 afa.[459] The State Engineer finds that there are 807 afa of consumptively used groundwater rights in the basin which will be deducted from the amount available for appropriation.

A. 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

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[456] Exhibit No. GBWN_003, p. 3; Transcript, Vol.24 pp. 5369:16–5370:8 (Bredehoeft).
[457] NRS 533.370(2); NRS 534.110(3).
[458] Exhibit No. SNWA_460 (Dry Lake Valley Inventory).
[459] Exhibit No. SNWA_097.

with the State Engineer.[460] 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.[461] 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 water right applications in order of their date of filing so that senior applications would be acted on first. In that context, only senior water rights would be considered to be committed groundwater rights. For that purpose, Mr. Stanka's analysis distinguished between water rights with a priority date before and after October 17, 1989 (the priority date of the Applications). However, these are special circumstances because junior groundwater irrigation rights were approved in Dry Lake Valley after Ruling 5875 was issued. These junior groundwater irrigation rights were issued subject to existing rights, which would include the Applications, if permitted. Although Ruling 5875 was vacated, but these junior rights remained in existence. The State Engineer will treat these junior groundwater irrigation rights as committed groundwater rights.

The State Engineer finds that there are a total of 807 afa of committed groundwater rights in Dry Lake Valley, including water rights that are both junior and senior to the Applications.

V. IMPACTS TO EXISTING RIGHTS

When considering new applications to appropriate water, the Nevada State Engineer must deny the applications if development of the new applications will conflict with existing water rights or with protectable interests in existing domestic wells.[462] To address this requirement, the Applicant prepared an expert report describing a three part analysis.[463] First, a qualitative analysis was performed, which assessed potential conflicts based on water right ownership, geographical location, and priority date.[464] 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.[465] Third, a qualitative site-specific analysis of

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[460] 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").
[461] NRS 533.425; NRS 533.430.
[462] NRS 533.370(2).
[463] Exhibit No. SNWA_337, pp. 1-1, 3.
[464] Transcript, Vol.11 p. 2541:1-3 (Watrus).
[465] Transcript, Vol.11 p. 2541:3-4 (Watrus).

each of the areas of concern identified in the model was performed to assess the potential for conflicts.[466]. Additionally, the Applicant prepared a management plan for Delmar, Dry Lake and Cave Valleys ("DDC Valleys") 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 Delamar, Dry Lake, and Cave Valleys (the "Management Plan") part of the permit terms for the Applications.[467]

A. DDC Management Program

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. The management program in this case is designed to promote sustainable development of the resource while protecting existing rights. The data collected from the plan will allow the State Engineer to make real time assessments of the spread of drawdown within the basin as well as make predictions, using data collected under the monitoring plan, as to the location and magnitude of drawdown in the future under different pumping regimes. The State Engineer finds an effective management program that includes monitoring activities, management tools and mitigation options is critical to the determination that the Applications will not conflict with existing water rights or with protectable interests in existing domestic wells.

The Applicant's primary witness regarding the hydrologic aspects of the Management Plan for Delamar, Dry Lake, and Cave Valleys was Mr. James Prieur. Mr. Prieur is an expert in hydrogeology and, more specifically, hydrologic monitoring and management.[468] The record reflects that Mr. Prieur has extensive professional experience in this field. Mr. Prieur is currently a senior hydrologist for the Applicant.[469] Mr. Prieur developed and implemented the Applicant's hydrologic monitoring program for the DDC Valleys.[470] He is responsible for the monitoring

[466] Transcript, Vol.11 p. 2541:3-6 (Watrus).
[467] Exhibit No. SNWA_148, p.1; Transcript, Vol.8 p. 1795:16-22 (Prieur).
[468] Mr. Prieur was qualified as an expert in hydrogeology, which covered hydrologic monitoring and management. Transcript, Vol.8 p. 1788:22-23 (Prieur).
[469] Transcript, Vol.8 p. 1778:14-16 (Prieur).
[470] Transcript, Vol.8 p. 1781:8-10 (Prieur).

program that includes hydrologic monitoring, permit compliance, and reporting, as well as the aquifer testing program in the DDC Valleys.[471]

Prior to development of the monitoring and management plan in DDC, the Applicant had a history of supporting its Applications through data collection. The record reflects that the Applicant has been collecting data related to groundwater hydrology in the DDC Valleys since it filed the Applications.[472] The monitoring plan was initially completed as a component of the Stipulation between the Applicant and the Bureau of Indian Affairs, National Parks Service, 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.[473] The monitoring plan was finalized to comply with permit terms for the Applications after the Applications were approved in Ruling 5875.

The State Engineer is not a party to the Stipulation with the Federal Agencies. While the Stipulation is binding on the Applicant and the Federal Agencies, it is not binding on the State Engineer. However, the Stipulation is important to the consideration of the Applications for a number of reasons. First, the Stipulation formed the process for the initial development of the DDC Management Plan. Second, the Stipulation addresses how 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 and biologic elements of the monitoring, management and mitigation program.[474] The monitoring area includes the Project basins as well as adjacent basins. Mr. Prieur testified that the area of interest for monitoring efforts is Cave Valley, Dry Lake Valley, Delamar Valley, the southern portion of White River Valley and Pahranagat Valley.[475]

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[471] Transcript, Vol.8 pp. 1779:20-1780:12 (Prieur).
[472] Transcript, Vol.9 pp. 2080:25-2081:2 (Prieur).
[473] Transcript, Vol.9 p. 2081:3-7 (Prieur); Exhibit No. SE_080.
[474] Transcript, Vol.9 p. 2081:11-16 (Prieur).
[475] Transcript, Vol.9 p. 2081:20-23 (Prieur).

The parties agreed upon mutual goals to guide the development of these monitoring plans. The common hydrologic goals of the parties are to manage the development of groundwater by SNWA without (1) causing any injury to federal water rights and (2) any unreasonable adverse effects to federal resources and special status species within the area of interest.[476]

The Stipulation established a Technical Review Panel ("TRP") for the hydrologic plan, a Biological Resource Team ("BRT") for the biological plan, and an Executive Committee to oversee implementation and execution of the agreement.[477] The TRP and BRT 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.[478]

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 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.[479] The Applicant's representatives regularly meet with the TRP and the BRT to discuss ways to best utilize each group's data and to discuss any additional hydrologic data that may be needed under the plan.[480]

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.[481] 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.[482]

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[476] Transcript, Vol.9 pp. 2082:25-2083:6 (Prieur); Exhibit No. SNWA_080, p. 4, § H.
[477] Transcript, Vol.8 p. 1800:6-10 (Prieur); Transcript, Vol.9 pp. 2081:8-10, 2083:7-10 (Prieur).
[478] Transcript, Vol.8 p. 1802:6-10 (Prieur).
[479] Transcript, Vol.8 p. 1837:12-17 (Prieur).
[480] Transcript, Vol.8 p. 1837:18-21 (Prieur).
[481] Transcript, Vol.8 pp. 1802:17-1803:8 (Prieur).
[482] Exhibit No. SE_080.

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 Tribe's interpretation of language in the Stipulation. The State Engineer finds that the Stipulation is relevant to the consideration of the Applications for the reasons stated above. Whether proper consultation occurred with the Tribes before the Stipulation was executed is a matter between the Tribes and the Federal Agencies and does not require resolution in order to consider the Applications. Whether admission of the Stipulation at these hearings was contrary to terms of the Stipulation is an issue between the parties to that agreement, not the State Engineer, and does not require resolution in order to consider these 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 5875. That plan was approved by the State Engineer on December 22, 2009.[483] The Applicant submitted an updated monitoring and mitigation plan ("Management Plant") for this hearing and requested that the State Engineer include compliance with the Management Plan as part of the permit terms.[484] The proposed Management Plan includes all of the elements from the previous plan, 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.[485]

Data collection is a key component of the monitoring plan. Mr. Prieur testified that the purpose of data collection at this time is to provide a baseline characterization of the hydrologic system, including seasonal as well as climatological events, which will be used as background information to assess changes to the system once groundwater production commences.[486] 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.[487]

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483 Transcript, Vol.8 p. 2332:6-20 (Prieur); Exhibit No. SNWA_152.
484 Exhibit No. SNWA_148.
485 Transcript, Vol.11 pp. 2332:23-2333:8 (Prieur).
486 Transcript, Vol.8 p. 1840:17-23 (Prieur).
487 Transcript, Vol.8 p. 1841:1-6 (Prieur).

The Applicant has established a monitoring network of wells and springs as part of the monitoring plan. Mr. Prieur testified that the Applicant spent well over $10,000,000 to develop the monitoring, test, and exploratory well network.[488] Mr. Prieur testified that the well network provides spatial distribution across the valleys in different hydrologic and geologic settings.[489] The object of the hydrologic monitoring plan was to assess the hydrologic interrelationship between the DDC Valleys and adjacent basins, primarily White River Valley, Pahranagat Valley, and Northern Coyote Spring Valley.[490]

In addition to the monitoring well network, the plan also calls for a test well network. Test wells will provide geologic data and hydrologic aquifer property data.[491] Similar to the monitoring wells, these wells collect water-level elevation information that is plotted on a hydrograph.[492] 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.[493] 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.[494]

The major area of concern is the relationship between Dry Lake and Delamar Valleys and Pahranagat and Coyote Spring Valleys. Here, the Applicant has installed one carbonate well at Pahroc summit, 209M-1, located between Dry Lake Valley and Pahranagat Valley. The Applicant is also monitoring two existing basin-fill wells to the east of Hiko Springs in Six Mile Flat and has committed to constructing a carbonate well between the basin-fill wells and Hiko Springs.[495] In southern Delamar Valley, the Applicant has constructed two monitoring wells in volcanic material, and has committed to construct additional monitoring wells further south between Delamar Valley and Pahranagat Valley.[496] Mr. Prieur specifically identified monitoring well 209M-1 as a potential indicator of any flow from Dry Lake and Delamar Valleys to Pahranagat Valley.[497] The Applicant will compare the water elevation in this well, located at

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488 Transcript, Vol.8 p. 1845:18-221:1-6 (Prieur).
489 Transcript, Vol.11 p. 2334:1-5 (Prieur).
490 Transcript, Vol.11 p. 2336:3-7 (Prieur).
491 Transcript, Vol.9 p. 2072:4-12 (Prieur).
492 Transcript, Vol.9 p. 2073:18-22 (Prieur).
493 Transcript, Vol.9 pp. 2073:22-2074:8 (Prieur).
494 Transcript, Vol.9 pp. 2075:19-2076:4 (Prieur).
495 Transcript, Vol.11 p. 2337:7-12 (Prieur).
496 Transcript, Vol.11 p. 2343:13-20 (Prieur).
497 Transcript, Vol.11 pp. 2342:20-2343:20 (Prieur).

Pahroc Summit, with the water elevation in the new carbonate well on the eastside of the Hiko Range and the other basin-fill wells in the area to assess the prevailing hydraulic gradient.[498] In addition, water chemistry samples from this well will also be compared against samples from the other wells to determine the sources of water in this area.[499] The well completion and testing report for irrigation well PW-1 located in Dry Lake Valley, which is not part of the monitoring network, will provide additional data on water-level elevation, water chemistry, transmissivity, and aquifer storage for this analysis.[500] The State Engineer finds that these continued monitoring efforts will provide an informed understanding of the hydrologic system in this area and further confirm the State Engineer's finding that there is no hydrologic connection (1) between Dry Lake and Pahranagat Valleys, and (2) between Delamar and Pahranagat Valleys except in the area of southern Delamar Valley near the Pahranagat Shear Zone.

Due to the significant depth to water ("DTW") in the DDC Valleys, the spring monitoring network consists of eight springs that are either located in the mountain block or are sourced by local water.[501] These springs are monitored biannually, even at Cave Spring which is monitored in the fall when it is historically dry and again in the spring when it is flowing.[502] The remaining eight springs are located in White River Valley or Pahranagat Valley. The springs were selected by the TRP after meeting with water right owners in these valleys. Hiko Springs is equipped with a continuous flow meter and an 18-inch discharge line installed by the Applicant.[503] At the Flag Springs Complex, a flume and continuous gaging station were installed with assistance from the Nevada Department of Wildlife.[504] The Applicant also worked with the State Engineer's office to obtain permission to install a flume at Hardy Springs, which is associated with Sunnyside Ranch.[505] In addition, there is continuous monitoring of discharge and diversions at Hot Creek and Crystal and Ash Springs by the USGS.[506]

The Monitoring Plan includes other hydrologic elements that provide a comprehensive view of the hydrologic system. For example, there is a requirement in the plan to establish a

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498 Transcript, Vol.11 p. 2343:13-20 (Prieur).
499 Transcript, Vol.11 p. 2343:18-20 (Prieur).
500 Transcript, Vol.11 p. 2344:2-17 (Prieur).
501 Transcript, Vol.11 p. 2346:4-8 (Prieur).
502 Transcript, Vol.11 p. 2347:12-24 (Prieur).
503 Transcript, Vol.11 p. 2346:21-22 (Prieur).
504 Transcript, Vol.11 pp. 2346:25-2347:3 (Prieur).
505 Transcript, Vol.11 p. 2347:4-7 (Prieur).
506 Transcript, Vol.11 p. 2348:15-20 (Prieur).

precipitation measurement network. There is also a requirement to collect two rounds of water chemistry data from 10 sites at six month intervals, prior to groundwater production and every five years thereafter. These additional data collection efforts will provide a well-rounded view of the hydrologic system.

The data collection process is subject to quality assessment and quality control procedures. The Applicant implemented a quality control process for collection of field data. The Applicant has standard procedures for site monitoring; instrumentation preparation, calibration and maintenance; and data recording and collection.[507] The Applicant also has standard procedures for database entry and management. The collected data is brought to the office and entered into the database.[508] 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.[509] The hourly continuous data is processed using Aquarius software and then it is placed into the database.[510] Any erroneous data must go through an audit process in order for it to be removed from the database.[511]

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.[512] These reports have been submitted to the State Engineer for 2008, 2009, 2010, and 2011 and are available to the public.[513] Electronic data is 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 signals at long distances or if detected, it may be too late to effectively react to it. He provided a simple hypothetical model of a groundwater system to support his conclusions[514] and testified

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[507] Transcript, Vol.9 pp. 2066:11-2067:13 (Prieur).
[508] Transcript, Vol.9 p. 2067:14-23 (Prieur).
[509] Transcript, Vol.9 pp. 2067:24-2068:12 (Prieur).
[510] Transcript, Vol.9 p. 2068:13-14 (Prieur).
[511] Transcript, Vol.9 pp. 2068:25-2069:2 (Prieur).
[512] Transcript, Vol.11 p. 2349:8-10 (Prieur).
[513] Transcript, Vol.11 p. 2349:8-21 (Prieur); Exhibit Nos. SNWA_165 through 168.
[514] Exhibit No. GBWN_109, p. 9; *see, e.g.*, GBWN_011.

that, based on his hypothetical example, impacts due to pumping may not be detected for up to 75 years.[515] Dr. Bredehoeft testified that his hypothetical model differs from the conditions found in the project basins, and that these differences would affect the results in some instances.[516] Mr. Prieur testified that Dr. Bredehoeft's example does not reflect the reality of Cave, Dry Lake, and Delamar Valleys because of differences in pumping locations and rates, aquifer properties, and interbasin flow and the lack of an extensive monitoring network.[517] Dr. Bredehoeft's hypothetical model is in general agreement with the Applicant's groundwater flow model predictive simulations, which show regional spring flows in White River and Pahranagat Valleys decrease by 1% to 17% after 200 years of pumping of the full application amounts.[518]

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.[519] With a network of monitoring wells, deviations among different wells at different locations can be compared to determine the likely source of the effect.[520] 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.[521] One could then determine the level of impact at the monitoring site that would lead to a certain impact at the site of interest and cease or reduce pumping once that impact is seen at the monitoring well to prevent the impact from reaching the site of interest.[522] More monitoring wells closer to the pumping would allow for even earlier detection.[523]

Dr. Bredehoeft highlights some difficulties in monitoring, but these difficulties can be overcome. Because the monitoring program will be utilized in conjunction with a continually revised groundwater modeling program, there will be adequate warning of the progesssion of effects of groundwater pumping. The State Engineer finds that the Applicant's monitor well network is scientifically sound, particularly because of the spatial distribution across the DDC Valleys and the WRFS. Information from these wells will provide the State Engineer with

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[515] Transcript, Vol.24 pp. 5400:17–5401:7 (Bredehoeft).
[516] Transcript, Vol.24 p. 5450:12–20 (Bredehoeft).
[517] Transcript, Vol.11 p. 2369:1-20 (Prieur).
[518] Exhibit No. SNWA_091, p. 4-14.
[519] Exhibit No. GBWN_011.
[520] Exhibit No. SNWA_428, pp. 17–18.
[521] Transcript, Vol.24 p. 5458:1–7 (Bredehoeft).
[522] Transcript, Vol.24 pp. 5479:19–5480:15 (Bredehoeft).
[523] Transcript, Vol.11 pp. 2375:17–2376:11 (Prieur).

knowledge of the characteristics of groundwater flow in this area for the purpose of diagnosing and addressing potential impacts to existing rights. The Applicant has provided significant hydrologic data regarding the DDC Valleys and the WRFS for four years. Finally, the State Engineer finds that the Applicant has provided persuasive scientific evidence that the monitoring efforts and data collection in the DDC Valleys and the WRFS will provide scientifically sound baseline information from which changes to the system and potential impacts can be diagnosed, assessed, and addressed. In summary, the State Engineer finds that the Applicant's monitoring plan will be effective.

2. Management Tools

The Management Plan requires the data collection efforts from the monitoring plan to be coordinated with the development and refinement of a groundwater model for the purpose of managing the water resource in the DDC Valleys.[524] The State Engineer will use the groundwater model to assess where additional data is needed, to identify potential areas of impact, to review the appropriate location of new wells, and to optimize pumping at current well sites without causing impacts.[525] 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 State Engineer acknowledges that two models were received into evidence at the hearing. Though the models are poor tools to make local predictions at present, they can be improved. The Applicant's model will be improved in the future as more data is collected.[526] 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.[527] Dr. Myers admitted that once data from large-scale stresses are available, the Applicant's model could be calibrated to allow experts to make local-scale predictions on impacts from pumping.[528] Dr. Bredehoeft also stated that models can be improved through an iterative process of

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[524] Transcript, Vol.9 pp. 2063:24-2064:1 (Prieur).
[525] Transcript, Vol.9 p. 2063:17-23 (Prieur).
[526] Exhibit No. SNWA_087, pp. 1, 20.
[527] Transcript, Vol.20 pp. 4473:21-4474:4 (Myers); Exhibit No. SNWA_428, p. 10.
[528] Transcript, Vol.21 pp. 4598:14–4599:11 (Myers).

monitoring.[529] As the model continues to improve, it will be used as a management tool by the Applicant to monitor and manage its pumping in order to prevent impacts to existing rights and environmentally sensitive areas.

The State Engineer finds that the Applicant will be required to improve and use its model as a management tool. The State Engineer further finds that stressing the aquifer will improve the predictive capabilities of the model. The State Engineer requires that the model be updated and run every 5 years, or as required by the State Engineer, to incorporate collected data and run predictive drawdown simulations for the purpose of assessing any emerging potential conflicts with existing rights.

Protestants GBWN assert that the absence of quantitative standards, or triggers, in the Applicant's Management Plan will limit its effectiveness. However, GBWN's expert witness, Dr. Robert Harrington, acknowledged that the Applicant has neither the ability nor the need to set quantitative standards at the present time and at this stage in the development process.[530] Dr. Harrington, a Protestant witness, is the Director of the Inyo County Water Department and has experience with implementation of monitoring and management plans for the Owens Valley project.[531] In order to set quantitative standards, well locations and other variables, such as pumping timing and duration, must be known. Stress placed on the system through pumping also helps determine these standards because it shows how the aquifer responds to pumping. Additionally, the natural variability in the system must be documented to determine if 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.[532] The same situation is not present in Dry Lake Valley. Because well locations and pumping amounts have not been determined, and no large-scale pumping has occurred in Dry Lake Valley, it would be premature to complete a pumping management program.[533] Therefore, it is not currently possible to set quantitative standards or triggers for mitigation actions.

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[529] Exhibit No. GBWN_009, p. 7.
[530] Transcript, Vol.23 pp. 5291:20-5292:14 (Harrington).
[531] Transcript, Vol.23 p. 5278:3-5 (Harrington).
[532] Transcript, Vol.23 p. 5294:15-21 (Harrington).
[533] Transcript, Vol.23 p. 5307:17-24 (Harrington).

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.[534] 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.[535] The proper time to address pumping management concerns, including quantitative standards or triggers for mitigation, is when pumping determinations are made for each well.[536] Dr. Harrington stated that inclusion of quantitative standards in a plan for well operations would satisfactorily address any concerns he had regarding such standards.[537]

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. <u>Mitigation Requirements</u>

In the event mitigation is needed, Mr. Prieur testified that there is clear language in the Management Plan that outlines the mitigation process.[538] 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.[539] 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.[540] Mr. Prieur testified that there is a wide range of mitigation alternatives.[541] Dr. Harrington also agreed that determining whether mitigation is needed in the first place and then determining what type of mitigation to implement is done on a site-by-site basis.[542] Possible mitigation alternatives could include modifying the pumping regime, changing the location of pumping, drilling new wells, and lowering pumps A wide range of environmental mitigation alternatives also are available, and are discussed in the "Environmental Soundness" section below.

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[534] Transcript, Vol.23 p. 5292:9-14 (Harrington).
[535] Transcript, Vol.23 pp. 5286:19 - 5287:8 (Harrington).
[536] Transcript, Vol.23 p. 5308:15-17 (Harrington).
[537] Transcript, Vol.23 p. 5308:11-15 (Harrington).
[538] Transcript, Vol.9 p. 2078:10-19 (Prieur).
[539] 534.110(6).
[540] Transcript, Vol.9 p. 2078:19-23 (Prieur); Transcript, Vol.23 pp. 5301:3-5302:15 (Harrington).
[541] Transcript, Vol.9 p. 2078:19-23 (Prieur).
[542] Transcript, Vol.23 p. 5302:8-15 (Harrington).

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.

Dr. Bredehoeft testified for GBWN and said that mitigation measures will be ineffective. Dr. Bredehoeft asserted that recovery may take a long time at locations a great distance from pumping wells. However, these impacts will be the least in magnitude. Recovery will be quicker and more effective near the wells[543] where drawdowns are expected to be greatest.

He testified that reducing or ceasing pumping is a technically feasible way to mitigate impacts of pumping and that stopping pumping would allow the basin to recover.[544] He notes, however, that it may not achieve full recovery and that recovery may take a long time.[545] Dr. Bredehoeft also testified that the Endangered Species Act may effectively force the reduction or cessation of pumping.[546] In addition, the federal stipulations may require the Applicant to reduce pumping.[547] 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.

The State Engineer finds that the Applicant has presented a comprehensive monitoring, management and mitigation plan. The State Engineer finds that mitigation measures listed in the Management Plan will be effective, and the State Engineer has authority to order any mitigation activities that may be necessary to avoid conflicts with existing rights.[548] Accordingly, in addition to other permits terms that will be required, the State Engineer will make the DDC Management Plan a part 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

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543 Exhibit No. SNWA_428, p. 9; Transcript, Vol.11 pp. 2379:16-23 (Prieur).
544 Transcript, Vol.24 pp. 5464:22–5465:4 (Bredehoeft).
545 Transcript, Vol.24 p. 5378:1–17, 5402:9–13 (Bredehoeft).
546 Transcript, Vol.24 p. 5465:13–23 (Bredehoeft).
547 Transcript, Vol.11 pp. 2384:11–2385:3 (Prieur).
548 *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).

existing water rights and environmental areas of interest located in the DDC Valleys. The Applicant's expert, Mr. James Watrus,[549] conducted a conflicts analysis by first identifying the Application points of diversion, existing rights and environmental areas of interest within the DDC Valleys and adjacent basins.[550] The existing rights were queried from the Nevada Division of Water Resources database in September 2010 and updated in April 2011.[551] Federal claims of water rights and resources were included in this analysis.[552] 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.[553] Mr. Watrus testified that he analyzed all of the identified water rights and environmental areas of interest in his conflicts analysis.[554]

With this information, Mr. Watrus followed three steps in his analysis. First, he conducted a qualitative analysis, which assessed potential conflicts based on water right ownership, geographical location, and priority date.[555] 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.[556] 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.[557]

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 were excluded from further analysis. 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.[558] Since mountain block springs are likely perched and fed from a different water source than the Applications, there can be no

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[549] 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. 2537:13-2538:16 (Watrus).
[550] Transcript, Vol.11 pp. 2540:24-2541:2 (Watrus).
[551] Transcript, Vol.11 p. 2551:16-18 (Watrus); Exhibit No. SNWA 337, Appendix A.
[552] Transcript, Vol.11 p. 2551:8-13 (Watrus).
[553] Transcript, Vol.11 p. 2551:1-7 (Watrus); Exhibit No. SNWA_337, pp. 3-6 to 3-7.
[554] Transcript, Vol.11 pp. 2552:11-2555:3 (Watrus).
[555] Transcript, Vol.11 p. 2541:1-3 (Watrus).
[556] Transcript, Vol.11 p. 2541:3-5 (Watrus).
[557] Transcript, Vol.11 p. 2541:5-6 (Watrus).
[558] Transcript, Vol.11 p. 2574:13-16 (Watrus).

impact on these springs. None of the Protestants disputed this step of the analysis. After the first qualitative analysis was complete, there were 17 water rights in Dry Lake Valley that were part of the conflicts analysis.[559]

2. Quantitative Analysis with Groundwater Model

The Applicant next used a groundwater model to evaluate the development of the Applications. Numerical groundwater models are computer models that are used to approximately simulate groundwater systems. They can be used to test concepts about groundwater flow or to make predictions regarding the effects of future stresses on the groundwater system. Two numerical groundwater models were submitted for this hearing to simulate pumping in the DDC Valleys: the Applicant's model, originally designed for the BLM's Draft Environmental Impact Statement ("DEIS") and Dr. Myers' DDC model. Both of the models contain significant uncertainties when used to predict the effects of the proposed pumping, but the State Engineer finds that the Applicant's model is the most reliable.

a. BLM DEIS Model

The Applicant's numerical model was originally developed for the U.S. Bureau of Land Management ("BLM") in order to comply with the National Environmental Policy Act ("NEPA") and the Endangered Species Act ("ESA"). The Applicant submitted a right-of-way request to the BLM for the construction of the proposed Project.[560] The Applicant provides assistance as needed to the 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.[561] As part of the DEIS process, the BLM determined that a groundwater model was needed.[562]

Ms. Luptowitz is the Environmental Resources Division Manager for the Applicant.[563] 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.[564] The site-specific locations of the wells are not yet known for DEIS

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[559] Exhibit No. SNWA_337, p. 6-11.
[560] Exhibit No. SNWA_089, p. 1-1.
[561] Transcript, Vol.9 pp. 1881:4–1882:1 (Luptowitz).
[562] Transcript, Vol.9 p. 1882:7–9 (Luptowitz).
[563] Exhibit No. SNWA_362.
[564] Transcript, Vol.9 pp. 1882:24–1883:11 (Luptowitz).

purposes so the BLM uses the model to identify regional patterns and compare alternatives.[565] The BLM will conduct more specific analysis when site-specific right-of-way applications are made for wells.[566] Under NEPA, the BLM can grant the right-of-way even if the model simulates impacts to existing rights and environmental resources.[567] For the purposes of the current DEIS, the model does not need to predict absolute or specific values at specific locations.[568]

The DEIS model was developed through a collaborative process involving many experts and significant effort. The DEIS model was developed by Earth Knowledge, Inc., the Applicant, and the BLM's Hydrology Technical Group. The Hydrology Technical Group consisted of representatives from the BLM and consulting experts.[569] A representative from the State Engineer's office also attended technical meetings on model development.[570] The model was reviewed by the cooperating agencies for the NEPA process.[571] The Applicant prepared the groundwater model under the direction of the BLM Hydrology Technical Group. The BLM is ultimately responsible for the groundwater model.[572]

The Hydrology Technical Group collaborated on the model development from November 2006 to November of 2009, including an 18-month period of intense collaboration.[573] 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.[574] Dr. Poeter has been involved in hydrogeologic and groundwater research for 30 years and is considered an international authority in groundwater modeling.[575] Dr. Halford is an experienced groundwater modeler who has developed and published numerous models in many parts of the country.[576] In addition, representatives from the State Engineer's office

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[565] Transcript, Vol.9 p. 1883:12–18 (Luptowitz).
[566] Transcript, Vol.9 pp. 1883:19–1885:3 (Luptowitz).
[567] Transcript, Vol.9 pp. 1887:16–1888:2 (Luptowitz).
[568] Transcript, Vol.9 p. 1887:10–13 (Luptowitz).
[569] Exhibit No. SNWA_087, p. 5; Transcript, Vol.9 pp. 1895:18–1896:18 (D'Agnese).
[570] Exhibit No. SNWA_087, p. 6.
[571] Exhibit No. SNWA_087, p. 2.
[572] Transcript, Vol.9 p. 1882:10–20 (Luptowitz); Transcript, Vol.9 p. 1899:9–11 (D'Agnese).
[573] Exhibit No. SNWA_087, p. 5; Transcript, Vol.9 pp. 1898:2–1899:4 (D'Agnese).
[574] Transcript, Vol.9 p. 1896:10-18 (D'Agnese).
[575] Transcript, Vol.9 p. 1897:9-14 (D'Agnese).
[576] Transcript, Vol.9 pp. 1897:21–1898:1 (D'Agnese).

participated as observers.[577] Earth Knowledge, Inc., itself spent approximately 15,000 person-hours on the project.[578] Dr. D'Agnese, President of Earth Knowledge and an expert in groundwater modeling,[579] 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.[580] He opined that the level of time and collaboration significantly benefited the model.[581]

The model was developed using the MODFLOW-2000 modeling code with some customizations.[582] The development of the model was completed according to Hill and Tiedeman's 14 Guidelines for effective model calibration.[583] Dr. D'Agnese testified that Hill and Tiedeman's 14 Guidelines are accepted as authoritative in the field of groundwater modeling.[584] 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 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.[585] 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.[586] Dr. Myers notes that the per-basin recharge in the Applicant's numerical model is different than that in the Applicant's conceptual model.[587] The Applicant argues the model is designed to closely match observations in the system and to have parameters that are in the

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[577] Transcript, Vol.9 p. 1896:15-18 (D'Agnese).
[578] Transcript, Vol.9 p. 1900:5–8 (D'Agnese).
[579] Exhibit No. SNWA_086. He was qualified as an expert in groundwater modeling. Transcript, Vol.9 p. 1895:11–12 (D'Agnese). 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).
[580] Transcript, Vol.9 p. 1899:12–23 (D'Agnese).
[581] Transcript, Vol.9 pp. 1899:24–1900:2 (D'Agnese).
[582] Exhibit No. SNWA_087, pp. 4–5.
[583] Exhibit No. SNWA_087, pp. 4, 15–20.
[584] Transcript, Vol.9 p. 1913:13–21 (D'Agnese).
[585] Exhibit No. SNWA_090, pp. 3-1 to 3-3.
[586] Exhibit No. GBWN_103, p. 27; Exhibit No. GBWN_104, p. 15.
[587] Exhibit No. GBWN_104, p. 10.

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 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.[588] 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.[589]

The model covers 20,688 square miles, including Spring, Cave, Dry Lake, and Delamar Valleys.[590] Though there are other regional models of similar size in the United States, they typically have much more available data.[591] The model grid cells are each one kilometer by one kilometer.[592] The Applicant's model has 474 rows, 202 columns, and 11 layers with a total of 589,391 active cells.[593] Dr. D'Agnese testified that the data resolution for the area did not justify using smaller grid-cell sizes.[594] 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.[595]

The complexity and large size of the region modeled and the sparseness of available data result in uncertainties in the Applicant's model simulations.[596] Furthermore, the lack of good historical data on anthropological uses of groundwater provides further uncertainty to the model simulations.[597] Because of the model's regional scale, local-scale features are not accurately

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[588] Exhibit No. SNWA_087, p. 1; Transcript, Vol.9 p. 1909:18–25 (D'Agnese).
[589] Exhibit No. SNWA_087, p. 2; Transcript, Vol.9 pp. 1908:12–1909:17 (D'Agnese).
[590] Exhibit No. SNWA_089, pp. 1-2, 4-2; Transcript, Vol.9 p. 1902:20–21 (D'Agnese).
[591] *See,* Transcript, Vol.9 pp. 1903:1–1906:6 (D'Agnese).
[592] Exhibit No. SNWA_087, p. 11; Exhibit No. SNWA_089, p. 4-1; Transcript, Vol.9 p. 1907:2–4 (D'Agnese).
[593] Exhibit No. SNWA_089, pp. 3-4, 4-2.
[594] Exhibit No. SNWA_087, p. 11; Transcript, Vol.9 pp. 1907:5–1908:11 (D'Agnese).
[595] Transcript, Vol.9 pp. 1906:20–1907:1, 2026:5–2027:19 (D'Agnese).
[596] Exhibit No. SNWA_087, p. 9.
[597] Exhibit No. SNWA_087, p. 12.

simulated. All layers in the Applicant's model are simulated as confined.[598] Dr. Myers states that the use of a confined top layer biases the Applicant's model to under-predict drawdowns.[599] 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.[600] The use of a confining layer was directed and approved by the many groundwater modeling experts on the BLM's Hydrology Technical Group. Dr. D'Agnese testified that it is a common practice among modelers to simulate the top layer as confined due to model convergence issues. He did not believe the use of a confined layer for the top layer made the model inappropriate to use for this hearing.[601] 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 effect on model results.[602]

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.[603] 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.[604]

(2) Model Construction

Dr. Myers asserts that the Applicant's model has a bias towards negative residuals in Dry Lake and Pahroc Valleys and positive residuals to the east in Patterson, Lake, and Cave Valleys due to difficulty in modeling a geologic fault along the boundary. Dr. Myers suggests that this may be due to over-simulation of recharge in the east of Dry Lake Valley, similar to that seen in PRISM, which prevents the model from simulating a high drop in head from Patterson to Dry Lake using Horizontal Flow Barriers ("HFBs").[605] Dr. D'Agnese admitted that the Applicant's model does not represent the gradient from Patterson to Dry Lake Valley as steep enough.[606]

Dr. Myers also alleges that the Applicant's use of a specific storage value of 0.015 for lower layers indicates a bias in the model. Dr. Myers states that this value is more typical of

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[598] Exhibit No. SNWA_089, p. 4-2.
[599] Transcript, Vol.18 pp. 4091:2-5, 4094:4-7 (Myers).
[600] Exhibit No. SNWA_089, pp. 4-2, 4-4.
[601] Transcript, Vol.9 pp. 1918:17–1919:16 (D'Agnese).
[602] Transcript, Vol.18 pp. 4108:2–4109:18 (Myers).
[603] Exhibit No. GBWN_104, pp. 14–15.
[604] Exhibit No. GBWN_104, p. 15.
[605] Exhibit No. GBWN_104, pp. 2–3; Transcript, Vol.18 pp. 4080:6–4082:15 (Myers).
[606] Transcript, Vol.9 p. 1990:2–15 (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.[607] Dr. D'Agnese testified that the storage parameters were selected based on analysis of literature and aquifer test result with the concurrence of the Hydrology Technical Group.[608]

Dr. Myers criticizes the Applicant's use of Constant Head Boundaries to allow discharge to flow out of the modeled area from Pahranagat Valley to Tikaboo Valley. He asserts that this was done to make up for the over-estimation of recharge in the White River Flow system, especially in Dry Lake and Delamar Valleys.[609] Dr. D'Agnese responds that many other conceptual models have flow from Pahranagat Valley to Tikaboo Valley in the Death Valley Flow System. He notes that the decision to have flow from Pahranagat Valley to Tikaboo Valley was made through collaboration with the Hydrology Technical Group.[610] Dr. D'Agnese testified that based on his experience the amount of simulated flow from Pahranagat Valley to the DVRFS was reasonable.[611]

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.[612] 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.[613] The Applicant used both manual trial-and-error and automated-regression methods to calibrate the model.[614] 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.[615] The Applicant weighted observations so that more reliable measurements were given more

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[607] Exhibit No. GBWN_104, p. 9; Transcript, Vol.18 pp. 4084:23–4085:11 (Myers).
[608] Transcript, Vol.9 pp. 1923:22–1924:14 (D'Agnese).
[609] Exhibit No. GBWN_104, p. 14.
[610] Transcript, Vol.9 pp. 1927:18–1928:17 (D'Agnese).
[611] Transcript, Vol.9 pp. 2025:10–2026:11 (D'Agnese).
[612] Transcript, Vol.9 pp. 1914:17–1915:2 (D'Agnese).
[613] Exhibit No. SNWA_087, p. 3.
[614] Exhibit No. SNWA_087, p. 6.
[615] Exhibit No. SNWA_087, p. 17.

weight during calibration.[616] Only a subset of the regional and intermediate springs in the model was used for calibration targets.[617] 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 one can have little confidence in the precision of spring flow predictions for such springs that were not included in the calibration process.[618]

Dr. D'Agnese testified that the model simulates the regional intermediate spring flows that were used as calibration targets quite well over time.[619] He also states that, though the model does not accurately simulate individual ET locations, it simulates aggregate ET well.[620] 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.[621] Drawdown maps were prepared based on the difference in model results between the two scenarios.[622] In addition, changes in spring flow volumes were analyzed.[623] Mr. Watrus used the baseline pumping scenario to set the initial conditions of the water table.[624] He then used the full volume scenario to simulate the water elevations under pumping stresses.[625] 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.[626] The baseline water-level elevations and spring flows were subtracted from the pumping water elevations and spring flows to determine drawdown of the aquifer and changes in spring flow resulting from simulated pumping of the Applications.[627]

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[616] Exhibit No. SNWA_087, p. 7.
[617] Transcript, Vol.9 pp. 1910:1–1911:1 (D'Agnese).
[618] Exhibit No. SNWA_407, p. 5.
[619] Transcript, Vol.9 p. 1915:16–24 (D'Agnese).
[620] Exhibit No. SNWA_087, p. 14.
[621] Transcript, Vol.11 pp. 2574:20-2575:4 (Watrus).
[622] Transcript, Vol.11 p. 2575:1-4 (Watrus).
[623] Transcript, Vol.11 p. 2575:3-4 (Watrus).
[624] Transcript, Vol.11 p. 2555:14-15 (Watrus).
[625] Transcript, Vol.11 p. 2555:14-19 (Watrus).
[626] Exhibit No. SNWA_337, p. 4-3; Transcript, Vol.11 p. 2557:1-9 (Watrus).
[627] Transcript, Vol.11 p. 2555:13-25 (Watrus).

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.[628] 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 it provides enough lead time to meet that demand.[629] 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.[630] 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 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. Further, the State Engineer will require model updates every 5 years following the start of groundwater production and longer simulation periods may be required if it appears to the State Engineer that because the model was updated with actual pumping data, predictions for longer simulation periods become more certain.

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 concern. 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.[631]

Second, as stated above, the model is a regional model whose site-specific predictions are uncertain. The model cannot currently represent the complex geologic stratification in the DDC Valleys and the White River Flow System.[632] The model represents uniform drawdown in an

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[628] Transcript, Vol.11 p. 2559:13-18 (Watrus).
[629] Transcript, Vol.2 pp. 307:22-308:5 (Holmes).
[630] Transcript, Vol.2 p. 308:6-13 (Holmes).
[631] Transcript, Vol.11 pp. 2558:6-2559:1 (Watrus).
[632] Transcript, Vol.11 p. 2585:3-12 (Watrus).

area that has potentially numerous confined units which would influence drawdown.[633] 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.[634]

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.[635] Mr. Watrus did not consider the model results sufficiently accurate to predict specific drawdowns and specific spring discharges.[636] 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.[637] Ms. Luptowitz testified that the difference in threshold values depends on the purpose of the model simulation results. She testified that the DEIS thresholds were selected to compare the potential range of effects between the different alternatives.[638] 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.[639] The DEIS is meant to disclose a regional comparison of alternatives without having site-specific pumping locations.[640] The BLM may grant the right-of-way even if some impacts are shown. The DEIS was not

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[633] Transcript, Vol.11 p. 2585:13-22 (Watrus).
[634] Transcript, Vol.11 pp. 2566:5-9; 2567:24-2568:13 (Watrus).
[635] Transcript, Vol.11 p. 2575:5-17 (Watrus).
[636] Transcript, Vol.11 p. 2575:5-17 (Watrus).
[637] Transcript, Vol.9 p. 1890:4-7 (Luptowitz).
[638] Transcript, Vol.9 p. 1890:4-7 (Luptowitz).
[639] Transcript, Vol.9 p. 1890:20-23 (Luptowitz).
[640] Exhibit No. SNWA_337, p. 6-2; Transcript, Vol.9 p. 1889:19-24 (Luptowitz).

intended to determine if there would be unreasonable effects to existing rights under Nevada law.[641]

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 that 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 exact numeric amounts of drawdown. However, because the model is unable to represent local-scale geologic and hydrogeologic features that control whether or not a drawdown will actually occur in reality, these exact numeric drawdown predictions are unreliable. Even if the model simulates, for example, a 45-foot drawdown at a specific water right location, because of the limitations and uncertainties in the model predictions, the State Engineer finds the model predictions at that level of specificity are not credible. The State Engineer recognizes that there is conflicting evidence between what the model predicts and what the hydrogeologic understanding of the area shows.

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

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

There were a total of 17 water rights analyzed with the model in Dry Lake Valley.[642] None of these water rights were located in an area where the model simulated greater than 50 feet of drawdown or a reduction in spring discharge greater than 15%.[643] 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. There were a total

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[641] Exhibit No. SNWA_408, p. 3.3-93.
[642] Exhibit No. SNWA_337, p. 6-11.
[643] Exhibit No. SNWA_337, p. 6-11.

of 36 environmental areas of interest within the model domain that were quantitatively analyzed. None of the 36 locations were simulated to be impacted by pumping in Dry Lake Valley.

4. Myers' DDC Model

a. Model Construction

Dr. Myers used the Regional Aquifer System Analysis ("RASA") groundwater model developed by the USGS to analyze impacts of the Applicant's proposed pumping in the DDC Valleys.[644] The RASA model was developed by Prudic, et al. in 1995 as a conceptual model to improve understanding of the region. Schaefer and Harrill later used the RASA model to run simulations of the effects of pumping.[645] Dr. D'Agnese testified that the RASA model was never intended to predict water-level declines or reductions in spring flow due to pumping.[646] Dr. Myers agrees that the RASA model was not designed to make local-scale drawdown predictions.[647]

The original RASA model had two layers, 61 rows, and 60 columns. Each cell was 5 miles by 7.5 miles, or 37.5 square miles for a total area of approximately 137,000 square miles. Both layers were simulated as confined.[648] Dr. Myers refined the model by telescoping the grid-cell sizes so that smaller cells were used in the model in the area of the pumping in the DDC Valleys. Dr. Myers, however, did not change any of the property parameters other than the simulation of the proposed pumping wells at issue in this hearing.[649]

The RASA model contains many limitations and shortcomings. The RASA model does not include geologic faults, which may lead to inaccurate predictions because propagation of effects are not constrained by geologic structures in the model. Dr. Myers specifically suggested that this could result in inaccuracy in the simulation of the effects of pumping in Cave Valley to regional springs in White River Valley.[650]

Prudic, et al. calibrated the RASA model to steady state. Though Schaefer and Harrill used the model for transient simulations, the model was never fully calibrated to transient

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[644] Exhibit No. GBWN_004, p. 42.
[645] Exhibit No. GBWN_004, p. 42.
[646] Transcript, Vol.9 pp. 1952:17–24, 1955:13–16 (D'Agnese).
[647] Transcript, Vol.20 p. 4497:8–14 (Myers).
[648] Exhibit No. GBWN_242, p. 63.
[649] Exhibit No. GBWN_242, p. 72; Transcript, Vol.9 pp. 1955:17–1956:2 (D'Agnese); Transcript, Vol.20 p. 4499:21–24 (Myers).
[650] Transcript, Vol.21 p. 4676:3–15 (Myers).

conditions. Calibration refers to the process of trying to match simulated values in the model to actual observed field values. Instead, Schaefer and Harrill assigned storage-parameter values based on then-existing literature.[651] Schaefer and Harrill admit that the storage values were not well known and may cause the results of the model to vary significantly.[652] Schaefer and Harrill state that the "adequacy of the model in simulating the effects of the proposed pumping will remain untested until actual pumping stresses have been in place long enough to cause measurable effects within the system."[653] Dr. D'Agnese states that the storage values used by Schaefer and Harrill were rather conservative, causing simulated drawdown to be larger and ET to be captured more quickly.[654]

The RASA model is a regional model. Prudic, et al. state that the model is "not suited to predict accurate water-level declines that would result from pumping ground water in the province," and that "the model is not suited to predict the accurate rate of change in natural discharge caused by pumping because the model has not been calibrated to any transient simulations."[655] Schafer and Harrill state that the RASA model is "adequate to develop first approximations of probable regional-scale effects, but is not adequate to support detailed predictions."[656] The State Engineer agrees with these limitations and accordingly will place little weight on predictions of specific drawdowns or spring flow declines presented from the RASA model.

Prudic, et al. note that the RASA model is only suitable to infer "broad concepts and large-scale features" due to its coarse resolution.[657] The original authors used a target range of 250 feet to calibrate the model.[658] Though Dr. Myers telescoped the model grid, he did this after the coarse model was calibrated to set model parameters. Dr. Myers did not update any of the model parameters. Dr. D'Agnese points out, and Dr. Myers agrees, that the telescoping of the

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[651] Exhibit No. SNWA_405, pp. 1, 6; Transcript, Vol.9 p. 1955:9–12 (D'Agnese); Transcript, Vol.20 p. 4500:15–24 (Myers).
[652] Exhibit No. SNWA_406, p. 36.
[653] Exhibit No. SNWA_406, p. 42.
[654] Exhibit No. SNWA_405, p. 7.
[655] Exhibit No. SNWA_297, p. D93.
[656] Exhibit No. SNWA_406, p. 2.
[657] Exhibit No. SNWA_297, p. D15.
[658] Exhibit No. SNWA_297, p. D32.

model does little to improve the accuracy of its predictions, though it does result in a smoother representation of drawdown near the wells.[659]

Prudic, et al. also note that there is uncertainty in the RASA model due to uncertainties in the distribution of recharge and the lack of knowledge regarding water levels in much of the region at that time.[660] Prudic, et al. state that the errors in estimates of recharge could be in excess of 100%, which affect the tramissivities and vertical leakances, and that transmissivity estimates may be off by a factor of five.[661] In addition, many of the spring discharge rates in the RASA model were off from the target values by 10% or more.[662]

Dr. D'Agnese also notes that the RASA model assumes steady-state conditions though many areas in the model region were likely undergoing transient conditions.[663] According to Dr. D'Agnese, Dr. Myers did not resolve the limitations of the RASA model or fix any of the uncertainties described by Prudic, et al. and Schaffer and Harrill.[664] Dr. Myers agrees that the limitations of the RASA model mentioned by the authors exist and remain in his version of the model.[665] Dr. Myers notes that Halford and Plume of the USGS recently used the RASA model to simulate effects of pumping in Snake Valley.[666] Halford and Plume, however, unlike Dr. Myers, used observations within the valleys of interest and up-to-date parameter estimation techniques to update the model parameters.[667] Dr. Myers made no adjustments to the RASA model that would change the limitations of the model that were documented by the authors of the RASA model.

The State Engineer finds that there is no reason to use the RASA model instead of the Applicant's model to make predictions of impacts due to pumping in Cave, Dry Lake, and Delamar Valleys. The RASA model was never intended to be used to make such predictions. It is very coarse and has many limitations, which its original authors and Dr. Myers acknowledge. Indeed, according to Dr. Bredehoeft, one of the Protestant's experts, most observers think that

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[659] Exhibit No. SNWA_405, p. 3; Transcript, Vol.9 p. 1956:3–12 (D'Agnese); Transcript, Vol.20 pp. 4501:15–4502:19 (Myers).
[660] Exhibit No. SNWA_297, p. D38.
[661] Exhibit No. SNWA_297, pp. D38–D39.
[662] Exhibit No. SNWA_405, pp. 4–5.
[663] Exhibit No. SNWA_405, p. 4; Transcript, Vol.9 p. 1959:7–24 (D'Agnese).
[664] Transcript, Vol.9 p. 1960:20–23 (D'Agnese).
[665] Transcript, Vol.19 p. 4250:5–8 (Myers); Transcript, Vol.20 p. 4501:12–14 (Myers).
[666] Exhibit No. GBWN_004, p. 43.
[667] Exhibit No. GBWN_002, p. 2; GBWN_004, p. 43; Transcript, Vol.20 pp. 4505:9–4507:15 (Myers).

the RASA model was too simplistic and coarse to yield a good estimate of the local impacts.[668] Dr. Bredehoeft appears to place very little confidence in the RASA model due to its lack of a good underlying conceptual model.[669] However, Dr. Myers states that it is appropriate to consider estimates using the RASA model as long as the low precision of those estimates is understood.[670] On the other hand, Dr. D'Agnese opines that the RASA model was never intended to be and should never be used for predictions.[671]

Dr. Myers testified that the RASA model is better than nothing.[672] In this case, the alternative is not nothing, but the Applicant's model. Dr. Myers testified that he would not solely rely on the RASA model, but still suggested that it should be one of the tools considered.[673] In the end, however, Dr. Myers stated that he did not disagree with the Applicant's model, but simply wanted to provide an alternative tool to the State Engineer[674] and that the RASA model is not as accurate as the Applicant's model.[675]

The State Engineer finds that the best scientific tool he has to evaluate potential impacts due to pumping in the DDC Valleys is the Applicant's model. The RASA model may still be considered in comparison, but it carries very little weight due to the high level of uncertainty of its predictions. The State Engineer finds that when the Applicant's model and the RASA model provide conflicting simulations, he rejects the RASA projections and relies on the Applicant's model instead.

b. <u>Model Predictions</u>

Dr. Myers used the RASA model to simulate pumping for 2,000 years in Cave, Dry Lake, and Delamar Valleys.[676] Simulations indicated some wells had extreme simulated drawdown at the initial locations due to the presence of simulated low-transmissivity zones, so Dr. Myers adjusted their locations to adjacent higher-transmissivity zones.[677] Dr. Myers states that any

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668 Exhibit No. GBWN_137, p. 3.
669 Transcript, Vol.24 pp. 5394:15–17, 5396:19–21, 5420:2–5 (Bredehoeft).
670 Exhibit No. GBWN_004, p. 43.
671 Exhibit No. SNWA_405, p. 7; Transcript, Vol.9 pp. 1960:24–1961:7 (D'Agnese).
672 Transcript, Vol.20 p. 4497:18–20 (Myers).
673 Transcript, Vol.20 p. 4499:10–12 (Myers).
674 Transcript, Vol.21 p. 4672:3–5 (Myers).
675 Transcript, Vol.21 p. 4642:22–23 (Myers).
676 Exhibit No. GBWN_004, p. 49. Dr. Myers admitted that his water budget accounting is a way to determine whether there is water available in the system rather than an effects analysis that would evaluate potential drawdowns and other impacts. Transcript, Vol.20 p. 4522:10–14 (Myers).
677 Exhibit No. GBWN_004, p. 43.

impacts due to pumping in the DDC Valleys will mostly occur in down-gradient basins because there are few discharge areas in the DDC Valleys.[678]

Dr. Myers 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. They argue that little is gained by examining pumping simulations of greater than 75 years. Dr. Myers' RASA model is already extremely coarse and uncertain. Simulations beyond 75 years become more uncertain.[679] The Applicant's conflicts analysis utilized a 75-year simulation combined with a qualitative analysis to analyze impacts to specific existing rights. Dr. Myers did not conduct an analysis of effects on specific existing rights at all. Thus, Dr. Myers' simulated impacts for pumping periods of more than 75 years will be given little weight.

Dr. Myers' RASA model simulates impacts to Pahranagat Valley Springs from the Applicant's pumping in the DDC Valleys. The Pahranagat Valley Springs flow is reduced by about 2 cfs from an initial rate of about 32 cfs within 20 years. After 2,000 years, the spring flow decreases by about one third, but still flows at about 20 cfs.[680] Dr. Myers' RASA model simulates a reduction in flow of about 15% at Panaca Springs after 2,000 years of simulated pumping.[681] The model simulates essentially no impacts to Mormon Springs or the warm springs in Northern White River Valley after 2,000 years.[682] The State Engineer finds, however, that these predictions cannot be considered reliable given the uncertainties in the RASA model.

The State Engineer finds that pumping under the application amounts granted will not conflict with existing rights, will not unreasonably lower the static water table, and will not interfere with protectable interests in existing domestic wells.

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

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[678] Exhibit No. GBWN_004, p. 42.
[679] Transcript, Vol.20 pp. 4471:16–4472:22, 4489:3–4489:16 (Myers).
[680] Exhibit No. GBWN_004, pp. 51, 56.
[681] Exhibit No. GBWN_004, pp. 51–52.
[682] Exhibit No. GBWN_004, pp. 51–52.

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. 5825, which is the first ruling issued on these applications the State Engineer specifically adopted and incorporated the public interest analysis found in State Engineer's Ruling No. 5726 where 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) (currently 533.370(4)), 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. <u>Analysis of Judicial Interpretations</u>

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.**[683] The State Engineer found in the Honey Lake case while it was in the public interest

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

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 on the grounds that NRS 459.910 is not a Nevada water law statute, either substantive or procedural.[684]

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.

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

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 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 533.530(1) (currently 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.[685] 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 manner decided in this ruling. The State Engineer finds the conditions and limitation of this ruling will 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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[685] 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,[686] 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.[687] This process, known as the Section 106 process, affords tribes an opportunity to participate in the federal environmental review processes associated with the Project.[688] 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.[689] The Tribes presented testimony during both the public comment session and through direct examination by their attorney.[690] The Tribes presented expert testimony by two expert witnesses,[691] and they cross-examined the Applicant's witnesses.[692]

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.[693] 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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[686] Exhibit No. SNWA_408, pp. 29-75.
[687] Transcript, Vol.12 p. 2773:8-12 (Luptowitz).
[688] Transcript, Vol.12 p. 2774:2-6 (Luptowitz).
[689] Transcript, Vol.25 p. 5749:1-4 (Naranjo).
[690] Transcript, Vol.25 pp. 5749:7-5752:11 (Naranjo).
[691] Transcript, Vol.25 pp. 5749:19-5750:1 (Naranjo).
[692] *E.g.*, Transcript, Vol.1 pp. 144:10-151:11 (Mulroy); Transcript, Vol. 25 p. 5751:19-23 (Naranjo).
[693] 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." 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 "Interbasin Transfer Criteria-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 staged development is not being utilized in Dry Lake Valley.

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 Dry

Lake 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 dry Lake 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 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 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.[694] 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.[695]

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.[696] There are simply no additional groundwater resources available in the Las Vegas Valley to meet Southern Nevada's water needs.

The Applicant cannot expect to receive additional Colorado River water. First, it is not realistic for Southern Nevada to expect to receive an increased allocation from the other Colorado River basin states. The Colorado River basin states are highly protective of their

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[694] Exhibit No. SNWA_189, p. 6-2, Figure 6-2; Exhibit No. SNWA_209, p. 43, Figure 28.
[695] Exhibit No. SNWA_189, p. 6-4, Figure 6-3, p. 6-5, Figure 6-4.
[696] Exhibit No. SNWA_189, p. 3-2.

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.[697] The basin states are prepared to litigate in front of the U.S. Supreme Court to protect their water rights if necessary.[698] 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.[699] 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.[700] 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.[701] 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.[702] 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.[703]

Southern Nevada cannot expect that the federal government or other states will solve its water supply issues. The other basin states are facing their own water supply issues and have expressed a reluctance to help Nevada unless Nevada helps itself by developing permanent in-state supplies.[704] 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.

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[697] Transcript, Vol.2 pp. 264:24-266:1 (Entsminger).
[698] Transcript, Vol.2 pp. 265:23-266:1 (Entsminger).
[699] Transcript, Vol.2 p. 265:10-13 (Entsminger).
[700] Transcript, Vol.2 p. 266:5-12 (Entsminger).
[701] Transcript, Vol.2 pp. 297:9-298:23 (Entsminger).
[702] Transcript, Vol.2 p. 299:2-7 (Entsminger).
[703] Exhibit No. SNWA_189, p. 3-3.
[704] Transcript, Vol.1 p. 137:15-23 (Mulroy); Vol.2 pp. 234:23-235:11, p. 361:7-23 (Brothers).

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."[705] The State Engineer determines that a plan for conservation of water is advisable for the Las Vegas Valley Hydrographic Basin, which is the basin into which the evidence indicates 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.[706] 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.[707] 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.[708]

The Applicant has had a Conservation Plan in effect since 1999,[709] has submitted a conservation plan to the State Engineer for approval at five-year intervals since 1999[710] with the last Conservation Plan approved by the State Engineer on April 22, 2009.[711] 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"[712] and approved the Applicant's Conservation Plan on May 14, 2009.[713]

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[705] NRS 533.370(3)(b).
[706] Transcript, Vol.4 p. 823:16-19.
[707] Transcript, Vol.23 p. 5091:10-12.
[708] Transcript, Vol.23 p. 5145:21-25 (Gleick).
[709] Exhibit No. SNWA_004, p. 1-1; Transcript, Vol.4 p. 825:3-5 (Bennett).
[710] 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).
[711] Exhibit No. SNWA_006.
[712] Reclamation Reform Act, § 210(a) & (b) and 43 C.F.R. § 427.1.
[713] Exhibit No. SNWA_007.

The Applicant's Conservation Plan employs a four-part strategy to ensure active, community-wide participation in conservation.[714] The four interwoven strategies are regulation, pricing, incentives and education.[715] 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.[716] In addition, Protestant's witness failed to update his analysis of SNWA member agencies' rate structures in his initial expert report[717] and his rebuttal report[718] to reflect two subsequent rate adjustments that enhanced the conservation effect of SNWA member agencies' rate structures.[719] 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.[720] 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.[721] They restrict the use of water for ornamental water features and man-made lakes,[722] limit the size and scale of swimming pools,[723] and require resort hotels to submit water efficiency plans describing their current or projected uses of water and their water efficiency plans.[724] Customer water use is also limited through mandatory landscape watering groups,[725] and prohibited water waste. Violators who allow water to run down the street or flow off the customer's property can be sanctioned.[726] Enforcement of water waste restrictions is aggressive; the Las Vegas Valley Water District assesses fees in excess of $5,000 per violation to chronic

[714] Exhibit No. SNWA_004, p. 2-1; Transcript, Vol.4 pp. 831:22-832:9 (Bennett).
[715] Exhibit No. SNWA_004, p. 2-1; Transcript, Vol.4 p. 832:1-2 (Bennett).
[716] Transcript, Vol.23 p. 5199:17-22 (Gleick).
[717] Exhibit No. GBWN_069.
[718] Exhibit No. GBWN_118.
[719] Transcript, Vol.23 pp. 5176:14 - 5177:2 (Gleick).
[720] Exhibit No. SNWA_004, p. 3-1; Exhibit No. SNWA_012; Exhibit No. SNWA_013.
[721] Transcript, Vol.4 pp. 841:6-842:5 (Bennett).
[722] Transcript, Vol.4 p. 845:14-15 (Bennett).
[723] Transcript, Vol.4 p. 845:16-17 (Bennett).
[724] Transcript, Vol.4 p. 845:18-24 (Bennett).
[725] Transcript, Vol.4 p. 842:14-24 (Bennett).
[726] Transcript, Vol.4 p. 843:4-8 (Bennett).

violators,[727] 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.[728]

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.[729] 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.[730] 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.[731] Member agencies have committed to reviewing and adjusting rates frequently to ensure the conservation effect is sustained.[732]

The Applicant has created substantial, long-term water savings by providing financial incentives and products to customers.[733] 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.[734] It is the largest incentive program in the nation, paying customers an average of $16 million per year for turfgrass conversion.[735] 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.[736]

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

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[727] Exhibit No. SNWA_004, pp. 3-4; Transcript, Vol.4 p. 857:1-22 (Bennett).
[728] Transcript, Vol.4 p. 863:2-5 (Transcript).
[729] Exhibit No. SNWA_004, p. 4-1; Transcript, Vol.4 p. 864:10-12 (Bennett).
[730] *See,* NRS 540.011.
[731] Transcript, Vol.4 pp. 865:10-867:1 (Bennett).
[732] Exhibit No. SNWA_395, p. 7.
[733] Exhibit No. SNWA_004, p. 5-1.
[734] Exhibit No. SNWA_004, p. 5-1; Transcript, Vol.4 pp. 872:19-873:18 (Bennett).
[735] Transcript, Vol.4 p. 869:20-21, p. 870:16-22 (Bennett).
[736] Transcript, Vol.4 p. 833:10-13 (Bennett).

wastewater, nearly 100% of which is directly or indirectly reused.[737] 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,[738] 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.[739] 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.[740]

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.[741] Public/private partnerships, including the Water Upon Request and Water Smart Homes programs, help promote the conservation message.[742] Awards that encourage community conservation include the Water Hero Award and the annual SNWA Landscape Awards, now in its fourteenth year.[743] 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.[744] The Applicant has set and achieved conservation goals

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[737] Exhibit No. SNWA_004, p. ES-1; Exhibit No. SNWA_402; Transcript, Vol.2 pp. 283:21-284:22 (Entsminger).
[738] Transcript, Vol.23 pp. 5207:18-5208:7 (Gleick).
[739] Transcript, Vol.4 p. 834:6-20 (Bennett).
[740] Exhibit No. SNWA_004, pp. 5-3 to 5-4; Exhibit No. SNWA_399.
[741] Exhibit No. SNWA_004, p. 6-1; Transcript, Vol.4 pp. 887:18-888:22 (Bennett).
[742] Exhibit No. SNWA_004, pp. 7-1 to 7-2; Transcript, Vol.4 pp. 889:21-891:11 (Bennett).
[743] Exhibit No. SNWA_395, p. 9; Transcript, Vol.4 p. 891:15-23 (Bennett).
[744] Transcript, Vol.1 p. 69:24-25 (Mulroy).

resulting in a dramatic reduction in per capita water use.[745] In 1990, the Applicant service area's gallons-per-capita-per-day ("GPCD") use was 347,[746] which was reduced to 274 GPCD by 2004.[747] The Applicant established a goal of 199 GPCD by 2035.[748] 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.[749] 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%.[750] Those savings outpace the seven Colorado River basin states as a whole, where from 1975 to 2005 per capita water use declined by 21%.[751]

One of the major conclusions of Dr. Gleick's rebuttal report was that per capita water use is declining, but more can be done.[752] 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.[753] Dr. Gleick opined there's nothing inherently special or different about the Las Vegas Valley that justifies this higher per capita use.[754] 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.[755]

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 measure of population that takes into account a high influx of daily visitors that normally are not included in population for GPCD calculations.[756] Mr. Bennett testified that if the Applicant accounted for functional population, the Applicant's GPCD would be reduced by as much as 40

[745] Exhibit No. GBWN_118, p. 3.
[746] Transcript, Vol.4 p. 894:4-7 (Bennett).
[747] Transcript, Vol.4 p. 894:8-14 (Bennett).
[748] Transcript, Vol.4 pp. 894:15-22-895:20 (Bennett).
[749] Exhibit No. SNWA_209, p. 39; Transcript, Vol.4 p. 895:21-25 (Bennett).
[750] Exhibit No. SNWA_397, p. 25.
[751] Exhibit No. SNWA_397, p. 3.
[752] Transcript, Vol.23 p. 5099:1-3 (Gleick).
[753] Exhibit No. GBWN_118, pp. 5-6; Transcript, Vol.23 p. 5099: 3-12, p. 5102:7-15 (Gleick).
[754] Transcript, Vol.23 p. 5099:13-15 (Gleick).
[755] Exhibit No. GBWN_072, p. 18; Transcript, Vol.23 p. 5141:7-13 (Gleick).
[756] Exhibit No. SNWA_014, pp. 8-14; Exhibit No. SNWA_397, p. 8.

GPCD.[757] Dr. Gleick indicated that he had failed to account for either functional population or climatic differences in his analysis.[758] 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;[759] 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.[760]

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.[761] 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,[762] but still argues that the Applicant could do even more.[763]

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 conservation effort in the nation.[764] 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

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[757] Transcript, Vol.4 p. 904:6-8 (Bennett).
[758] Transcript, Vol.23 pp. 5142:24-5143:2, p. 4134:4-6 (Gleick).
[759] Transcript, Vol.23 p. 5203: 7-11 (Gleick).
[760] Transcript, Vol.23 p. 5145:12-22 (Gleick).
[761] Transcript, Vol.4 p. 912:14-23 (Bennett).
[762] Transcript, Vol.23 p. 5200:3 (Gleick).
[763] Transcript, Vol.23 p. 5203:21 (Gleick).
[764] NRS 533.370(3)(c).

conservation efforts. Based on the evidence in the record, the State Engineer finds the Applicant has demonstrated that a conservation plan has been adopted and is being effectively carried out.

C. <u>Environmental Soundness</u>

The State Engineer must consider whether the approval of the Applications is environmentally sound as it relates to Dry Lake Valley – the basin from which the water is exported.[765] 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. There is a balancing act in the appropriations of these waters - a balancing act that provides the State Engineer discretion in applying Nevada's water law.

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.[766] 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 the Dry Lake, Delamar and CaveValleys ("DDC Valleys") 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

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[765] NRS 533.370(3)(c).
[766] Transcript, Vol.8 p. 1776:15-24 (Marshall).

the State Engineer as an expert in the areas of ecology and range science.[767] Dr. McLendon testified about the effect of change in depth to water ("DTW") on individual plants and plant communities, plant succession and blowing dust from playas and dry lake beds.

GBWN presented expert testimony on this subject from three witnesses, Dr. James Deacon, Dr. Duncan Patten and Dr. Robert Harrington. Other Protestants provided lay testimony about the feared impact on the environmental resources of the DDC Valleys and adjacent basins. Dr. Deacon was qualified by the State Engineer as an expert in the area of desert aquatic ecology.[768] 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.[769] 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.

1. <u>Environmental Baseline</u>

The Applicant has performed significant work toward establishing the environmental baseline in the basins from which water is to be exported, and in adjacent basins, as well.[770] The Applicant has studied a broad array of biotic communities within the DDC Valleys and adjacent basins. Areas of focus included: aquatic ecosystems;[771] amphibians;[772] birds;[773] mammals, including bats and small mammals;[774] reptiles;[775] fish, including the Pahrump poolfish and Moapa dace;[776] invertebrates, including terrestrial and aquatic invertebrates;[777] and vegetation, including endangered, threatened and sensitive plant species, cactus and yucca, weeds and

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767 Transcript, Vol.7 p. 1611:23-25 (McLendon).
768 Transcript, Vol.19 p. 4140:17-23 (Deacon).
769 Transcript, Vol.18 p. 3938:20-21 (Patten).
770 Exhibit No. SNWA_363, pp. 4-1 to 4-43; Transcript, Vol.12 pp. 2681:17–2691:2, pp. 2723:3–2724:20 (Marshall).
771 Exhibit No. SNWA_363, pp. 4-2 to 4-5; Exhibit No. SNWA_422; Exhibit No. SNWA_374; Transcript, Vol.12 pp. 2691:5–2697:13 (Marshall).
772 Exhibit No. SNWA_363, pp. 4-5 to 4-8; Transcript, Vol.12 pp. 2697:14 – 2698:5 (Marshall).
773 Exhibit No. SNWA_363, pp. 4-8 to 4-17; Transcript, Vol.12 pp. 2698:6–2706:10 (Marshall).
774 Exhibit No. SNWA_363, pp. 4-17 to 4-21; Transcript, Vol.12 pp. 2706:11–2713:12 (Marshall).
775 Exhibit No. SNWA_363, pp. 4-22 to 4-24; Transcript, Vol.12 pp. 2713:13–2714:11 (Marshall).
776 Exhibit No. SNWA_363, pp. 4-25 to 4-26; Transcript, Vol.12 pp. 2714:12–2717:2 (Marshall).
777 Exhibit No. SNWA_363, pp. 4-25, 4-27 and 4-27 to 4-28; Transcript, Vol.1 p. 2717:3-25 (Marshall).

phreatophytic vegetation.[778] The Applicant also assessed environmental areas of interest throughout the DDC Valleys and adjacent basins,[779] 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.[780] 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.[781] The State Engineer finds that the Applicant's effort and investment in gathering baseline information has been unprecedented and greatly expands knowledge of the region's biota.[782]

GBWN argued in their written closing that the baseline data was inadequate in kind and quality,[783] 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.[784] Dr. Patten similarly testified he had no criticism of Dr. McLendon's work.[785]

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.

2. Permitting

The baseline information collected by the Applicant informs federal, state and local resource managers[786] who have permitting authority over the Project.[787] Federal and state laws, including the National Environmental Policy Act ("NEPA"), the ESA, the Clean Water Act

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778 Exhibit No. SNWA_363, pp. 4-27, and 4-29 to 4-36; Transcript, Vol.12 pp. 2718:1–2722:23 (Marshall).
779 Transcript, Vol.12 pp. 2740:1-2741:3, 2742:19-25, 2744:10-24 (Marshall).
780 Exhibit No. SNWA_363, p. 2-1.
781 Transcript, Vol.12 p. 2752:2-4 (Marshall).
782 Transcript, Vol.12 p. 2723:6-16 (Marshall).
783 GBWN Closing Brief at 24.
784 Transcript, Vol.18 pp. 4028:4-4029:11 (Patten).
785 Transcript, Vol.18 pp. 4174:18-4177:23 (Deacon).
786 Transcript, Vol.12 p. 2723:20-24 (Marshall).
787 Transcript, Vol.12 pp. 2752:21-2753:1 (Luptowitz).

("CWA"), and Nevada water law, require environmental protection through comprehensive permitting and regulatory processes.[788] These permitting processes impose strict environmental controls on the Project that ensure it will be environmentally sound.[789] Protestants' witness Rebecca Mills, former superintendent at Great Basin National Park, conceded it is the mission of federal agencies to zealously enforce the environmental protections with which they are charged.[790]

NEPA requires a full consideration of environmental impacts resulting from the project.[791] 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.[792] With respect to the Project, the Applicant has prepared more than 300 Applicant Committed Measures aimed at minimizing and mitigating Project impacts.[793]

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.[794] The Applicant agreed to inclusion of even non-listed species for the Project ESA consultation, resulting in an even greater breadth of coverage.[795]

Protestants' expert Dr. James Deacon raised concerns regarding the extinction of species due to water development, but those concerns arise in the context of historical water development practices that preceded the ESA.[796] 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.[797]

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[788] Exhibit No. SNWA_363, p. 5-3, Table 5-2: Potentially Required Federal and State Permits and Reviews.
[789] 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).
[790] 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).
[791] 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).
[792] Transcript, Vol.12 pp. 2764:23-2765:11 (Luptowitz).
[793] Transcript, Vol.12 pp. 2765:16-24 (Luptowitz).
[794] Transcript, Vol.12 pp. 2755:21-2756:1, 2756:22-2757:2 (Luptowitz).
[795] Transcript, Vol.12 p. 2758:8-16 (Marshall).
[796] Transcript, Vol.12 pp. 2823:22 - 2824:3 (Marshall).
[797] Transcript, Vol.12 pp. 2823:22-2824:7 (Marshall).

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.[798] Protestants also expressed doubts about a future State Engineer's resolve to halt groundwater withdrawals if adverse environmental impacts occurred.[799]

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 andfederal 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 January 7, 2008, 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. 53987-53992 in Delamar, Dry Lake, and Cave Valley Hydrographic Basins.[800]

The Goals of the DDC Stipulation included:

• To manage the development of groundwater by SNWA in DDC without causing injury to Federal Water Rights and/or unreasonable adverse effects to Federal

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[798] GBWN, et al., Closing Statement at 21.
[799] GBWN, et al., Closing Statement at 26.
[800] Exhibit No. SE Ex._080. The Tribes argue the Stipulation is not properly in evidence because it bars discussion of the Stipulation without the presence of federal representatives.. SNWA explained that the Stipulation provides it "may be used in any future proceeding to interpret and/or enforce its terms." Exhibit No. SE_080, p. 10; SNWA Closing Statement at 17-18. In any event, because the State Engineer's ruling relies on the incorporation of the BMP, rather than the Stipulation, arguments about the admissibility of the Stipulation are not relevant to the State Engineer's environmental soundness determination.

> Resources and Special Status Species within the Area of Interest as a result of groundwater withdrawals by SNWA in DDC; and,
>
> • Taking actions that protect and recover those Special Status Species that are currently listed pursuant to the Endangered Species Act and avoid listing of currently non-listed Special Status Species.

The Stipulation created a Biological Resources Team ("BRT"), which includes representatives from the Applicant, 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.[801] These representatives are biologists who provide scientific and technical expertise.[802] The Nevada Department of Wildlife, and the Nevada State Engineer have also participated in BRT meetings developing and implementing the Biological Monitoring Plan ("BMP").[803] The role of the BRT is to develop and implement a "BMP".[804] The BMP requires the development of conceptual models and the identification of indicators and ecological attributes to be monitored throughout the DDC Valleys and adjacent basins that will allow for the thorough assessment of the health and integrity of the full range of groundwater-influenced resources in the DDC Valleys and adjacent basins.[805] Development of the monitoring plan involves significant interaction between the BRT and the hydrologic Technical Review Panel ("TRP"). This interaction is integral to enhancing the technical understanding of monitoring processes and results under the BMP.[806] 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.[807] The BMP provides for significant interaction between the BRT and the hydrologic TRP, an approach that is integral to enhancing technical understanding of monitoring processes and results under the BMP.[808]

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[801] Exhibit No. SNWA_366, p. ix (DDC Biological Monitoring Plan).
[802] Transcript, Vol.8 p. 1809:10-19 (Marshall); Transcript, Vol.9 p. 2083:7-9 (Prieur).
[803] Transcript, Vol.9 p. 2084:12-21 (Marshall).
[804] Exhibit No. SE_080, Exhibit A.
[805] Exhibit No. SNWA_366, pp. 2-1 to 2-4.
[806] Transcript, Vol.8 p. 1813:8-12 (Marshall).
[807] *See,* Exhibit No. SNWA_366.
[808] Transcript, Vol.8 p. 1813:8-12 (Marshall).

The BMP provides for monitoring potential impacts to both the DDC Valleys and adjacent basins.[809] The BMP establishes an Area of Interest that includes all or parts of five hydrographic basins ("HB"): the three basins in which the Applicant has applied for groundwater rights (Cave, Dry Lake, and Delamar Valleys HBs) and two down-gradient basins (Pahranagat Valley HB and the southern portion of White River Valley HB that is south of Hardy Springs).[810] Southern White River Valley and Pahranagat Valley HBs are included in the Area of Interest because of the potential for interbasin groundwater.[811] Pahroc Valley HB, which lies between the Cave Valley and Pahranagat Valley HBs, is excluded from the Area of Interest because no surface water features are present.[812] Notably, 97.9% of this Area of Interest is federally held land; only 1.5% is privately owned.[813] Protestants' expert, Dr. James Deacon, agreed the monitoring sites identified by the BMP will produce a good body of information.[814]

The BMP was approved by representatives from the Applicant, the U.S. Bureau of Indian Affairs, the U.S. Bureau of Land Management, the U.S. National Park Service, and the U.S. Fish and Wildlife Service in January 2011.[815] In addition, it has been made available to the State Engineer as SNWA Exhibit No. 366.[816] 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 DDC BMP into the terms of the approved permits.

Based on the evidence in the record, the State Engineer finds the monitoring and reporting aspects of the BMP comprehensively address the groundwater-influenced environmental resources of the DDC Valleys 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 the DDC Valleys 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 the Project will ensure proper monitoring and

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[809] Exhibit No. SNWA_366, pp. 1-8 to 1-9, Transcript, Vol.9 p. 2087:17-21 (Marshall).
[810] Exhibit No. SNWA_366, p. 1-8.
[811] Exhibit No. SNWA_366, p. 1-8.
[812] Exhibit No. SNWA_366, p. 1-8.
[813] Exhibit No. SNWA_366, p. 1-10.
[814] Transcript, Vol.19 p. 4181:22-24 (Deacon).
[815] Transcript, Vol.9 p. 2089:23-25 (Marshall).
[816] Transcript, Vol.11 pp. 2523:17-2524:1 (Marshall).

oversight of the Project and its environmental soundness as it relates to groundwater-influenced environmental resources.

4. <u>Adaptive Management</u>

The BMP provides flexibility for future modifications to the monitoring plan based on new information and technologies and future management considerations.[817] 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.[818] 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.[819] 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.[820]

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 function of systems and managing those systems.[821] Dr. Patten further conceded that monitoring programs can achieve ecological sustainability of spring areas through appropriate water management.[822] Protestants' witness Dr. Robert Harrington, Director of the Inyo County Water Department, acknowledged that this adaptive management process is one he employs in the Owens Valley,[823] and that adaptive management has had success there.[824]

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

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[817] Exhibit No. SNWA_366, p. 2-1.
[818] *See* Exhibit No. SNWA_366, p. 1-2.
[819] Exhibit No. SNWA_461, p. 17; Transcripts, Vol.18 pp. 4024: 20-4025:24 (Patten).
[820] Transcript, Vol.8 p. 1815:10-16 (Marshall).
[821] Transcripts, Vol.18 pp. 4023:10-4025:20 (Patten).
[822] Transcripts, Vol.18 pp. 4027:10-4028:1 (Patten); Exhibit No. GBWN_59, p. 12.
[823] Transcript, Vol.23 p. 5271:2-14 (Harrington).
[824] Transcript, Vol.23 pp. 5208:23-5209:13 (Harrington).

Project such as this one. The State Engineer finds that adaptive management is the best way to ensure water development occurs in a manner that is environmentally sound.

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.[825] The process includes the identification of conservation targets and their key ecological attributes and indicators and the development of adequate baseline data.[826] This data will provide valuable information to the State Engineer, informing his continuing jurisdiction over pumping pursuant to the Applications.

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.[827] However, under the BMP, the BRT is working to develop suitable conservation targets and parameters that in concert with hydrologic monitoring will provide early warning of impacts to the ecosystem.[828] Factors such as natural variation in the environmental resources must be understood before any standards or triggers are set.

Selecting specific standards before a full baseline is developed would be premature.[829] It would not lead to sound scientific decisions.[830] Indeed, Protestants' expert Cliff Landers stated, "[y]ou really have to have baseline data in order to be able to make intelligent decisions."[831] Dr. 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.[832]

Based on the evidence in the record, 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

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[825] Exhibit No. SNWA_366, pp. 4-1 and 7-5.
[826] Transcript, Vol.8 p. 1815:4-16 (Marshall).
[827] Transcript, Vol.23 p. 5276:6-17 (Harrington).
[828] Transcript, Vol.8 p. 1836:3-15 (Marshall).
[829] Transcript, Vol.14 p. 3211:7-15 (Marshall); Transcript, Vol.12 p. 2683:16-21 (Marshall).
[830] Transcript Vol.12 p. 2686:2-9 (Marshall).
[831] Transcript, Vol.28 p. 6289:10-11 (Landers).
[832] Transcript, Vol.23 pp. 5286:22-5287:5 (Harrington).

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 the Applicant and the Federal agencies lacks adequate enforcement mechanisms.[833] However, as Mr. Marshall identified, the Applicant is bound by any decision made by the State Engineer.[834] 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.[835] The State Engineer always retains the authority to monitor water rights and any impact to them[836] and the dispute resoulution process in the Stipulation has no impact on that authority.

Although Dr. Deacon has criticized the Stipulation based on his belief that final or controversial decisions would be made by management personnel rather than scientists, Mr. Marshall testified that decision-makers act on the basis of the recommendations made by the scientifically trained staff that comprise the technical committees, such as the biologists who develop and implement the BMP.[837] Protestants' witness, former Great Basin National Park superintendent Rebecca Mills, acknowledged that federal agency management takes seriously and follows the recommendations of scientific personnel.[838]

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

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[833] *See* Transcript, Vol.11 p. 2495:1-10 (Question by Paul Hejmanowski).
[834] Transcript, Vol.11 p. 2496:13-14 (Marshall).
[835] Transcript, Vol.11 p. 2499:7-22 (State Engineer King).
[836] Transcript, Vol.11 p. 2499:16-22 (State Engineer King).
[837] Transcript, Vol.12 pp. 2822:25-2823:17 (Marshall).
[838] Transcript, Vol.22 p. 4953:13-23 (Mills).

7. Environmental Effects Analysis

The Applicant identified those environmental areas of interest in the DDC Valleys and adjacent basins that could be sensitive to groundwater withdrawal.[839] 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.[840] 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.[841] 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.[842] 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.[843] This criteria was a 50-foot or greater drawdown in depth to groundwater or a 15% reduction in spring flow.[844] 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 does not form the basis for biological evaluations.[845] The Applicant used the 50-foot, 15% criteria for an initial evaluation of the appropriateness of the monitoring network established by the BRT.[846] 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 BRT to determine the actual environmental effects and the mitigation required.[847]

This measured approach to assessing impacts contrasts sharply with the impacts analysis provided by Protestants' expert, Dr. James Deacon.[848] 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

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[839] Transcript, Vol.12 pp. 2738:8–2739:23, 2742:4–2743:3; 2743:17-2744:9 (Marshall) (Cave Valley); Vol.12 pp. 2747:15–2749:4 (Marshall) (White River Valley); Transcript, Vol.12 pp. 2749:11–2751:21 (Marshall) (Pahranagat Valley).
[840] Transcript, Vol.12 p. 2796:11-17 (Marshall).
[841] Transcript, Vol.12 pp. 2796:21-2797:1 (Marshall).
[842] Transcript, Vol.12 p. 2797:2-4 (Marshall).
[843] Transcript, Vol.12 p. 2797:7-8 (Marshall).
[844] Transcript, Vol.12 p. 2797: 12-14 (Marshall).
[845] Transcript, Vol.12 pp. 2797:25 - 2799:15 (Marshall).
[846] Transcript, Vol.12 p. 2798:18-23 (Marshall).
[847] Transcript, Vol.12 p. 2799: 9- 19 (Marshall).
[848] *See* Exhibit No. GBWN_014.

springs would die.[849] 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.[850] 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.[851] 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).[852] 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.[853] As a result, Dr. Deacon testified that groundwater models only permit a generalized understanding and therefore require testing through a monitoring plan.[854] Dr. Deacon also relied on Dr. Bredehoeft's application of the time to capture theory.[855] He acknowledged the models upon which he relied so extensively for site-specific analysis provide predictions that, applied even more generally, are uncertain at best.[856] His report does not take into consideration the realities of federal and state environmental compliance and the authority that the State Engineer holds.[857] 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 no impacts to Dry Lake Valley environmental areas of interest.[858] 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, and the BMP applies to ensure there would be adequate monitoring, management, and mitigation.[859] Similarly, the effects analysis predicted no impacts to the Pahranagat Valley environmental areas

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[849] *See* Exhibit No. GBWN_014, pp. 2-3; Exhibit No. GBWN_138, pp. 5-8; Exhibit No. GBWN_248, pp. 4, 6-7; Transcript, Vol.12 p. 2821:14-21 (Marshall).
[850] Transcript, Vol.20 p. 4468:22-25 (Myers).
[851] Transcript, Vol.19 p. 4162:10-13 and p. 4190:2-12 (Deacon).
[852] Transcript, Vol.19 p. 4184:12-22 (Deacon).
[853] Transcript, Vol.19 p. 4185:11-18 (Deacon).
[854] Transcript, Vol.19 p. 4186:1-8 (Deacon).
[855] Transcript, Vol.19 p. 4189:6-15 (Deacon).
[856] Transcript, Vol.19 pp. 4185:17-4186:4 (Deacon).
[857] Exhibit No. GBWN_014, p. 4.
[858] Transcript, Vol.12 p. 2805:15-18 (Marshall).
[859] Transcript, Vol.12 p. 2806:4-7 (Marshall).

of interest.[860] However, although no sites met or exceeded the 50 foot, 15% criteria, monitoring is in place to provide early warning of any unanticipated effects,[861] and the BMP applies to ensure there would be adequate monitoring, management, and mitigation.

All parties agree that depth to water in Dry Lake Valley is so great that vegetation resources in those valleys are not connected to the groundwater. Therefore, the State Engineer finds that development of groundwater will not impact vegetation resources in Dry Lake Valley.

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

In both the DDC Valleys and adjacent basins, the Applicant indicated it 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.[862] The Applicant's approach is first avoidance, then minimization, then mitigation of impacts, avoiding as many conflicts as possible as the Project is developed.[863]

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 and the native fishes of the White River and Pahranagat Valleys.[864]

The State Engineer finds that no unreasonable adverse impacts are anticipated in Dry Lake Valley. The State Engineer finds that in the event unexpected impacts occur, the Applicant has the ability to identify impacts of the proposed project through its environmental monitoring plan.

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[860] Transcript, Vol.12 pp. 2810:21-2811:4 (Marshall).
[861] Transcript, Vol.12 p. 2811:5-7 (Marshall).
[862] Exhibit No. GBWN_059, p.12; Transcripts, Vol.18 pp. 4027:10-4028:1 (Patten); Transcript, Vol.23 pp. 5308:23-5309:13 (Harrington); Transcripts, Vol.28 p. 6297:19-22 (Landers).
[863] Transcript, Vol.12 pp. 2799:23-2800:1 (Marshall).
[864] 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).

The Applicant has demonstrated its commitment to environmental protection and informed, scientifically sound decision-making.[865] The State Engineer finds that by requiring the collection of biological baseline data in concert with hydrologic data and a significant monitoring, management and mitigation plan through the incorporation of the BMP as conditions to development of the Applications, there are sufficient safeguards in place to ensure that the interbasin transfer of water from Dry Lake Valley will be environmentally sound. The State Engineer finds that any impacts to hydrologically related resources in the DDC Valleys and adjacent basins will be reasonable, and the basins will remain environmentally viable. Therefore, the State Engineer finds that pumping pursuant to the Applications is environmentally sound.

D. <u>Future Growth and Development in the Basin of Origin</u>

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 Dry Lake 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 Dry Lake 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 Dry Lake 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

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

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 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.[866] 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."[867] In determining the likelihood of future growth and development in Dry Lake 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 Dry Lake Valley, also referred to as the basin of origin.[868] Specifically, 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.[869] The Applicant submitted evidence regarding commercial, industrial, and alternative energy development within Dry Lake Valley.[870] The Applicant offered evidence related to possible residential development within Dry Lake Valley.[871] The Applicant also submitted evidence related to possible economic development and growth issues related to mining, manufacturing,

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[866] NRS 570.370(3)(d).
[867] NRS 570.370(3)(d).
[868] Exhibit No. SNWA_241.
[869] Exhibit No. SNWA_103, 104, 105 and 241; Transcript, Vol.13 pp. 2947-3053 (Carter and Peseau). *See also*, Transcript, Vol.15 pp. 3357-3361 (Holmes).
[870] Exhibit No. SNWA_241. *See also*, Exhibit Nos. SNWA_113 through SNWA_142; Transcript, Vol.14 pp. 3273-3331, Vol.15 pp. 3321-3390 (Holmes); Transcript, Vol.13 pp. 3053-3083, Vol.14 pp. 3084-3144 (Candelaria and Linvill).
[871] Exhibit No. SNWA_241; Transcript, Vol.14 pp. 3273-3331 and Vol.15 pp. 3321- 3390 (Holmes).

tourism, hunting and general population growth.[872] The Applicant also presented evidence and foundational testimony from Mr. Dylan Frehner regarding Lincoln County and the Lincoln County Water District's intentions in Dry Lake Valley.[873] The evidence submitted by the Applicant provided the State Engineer with a comprehensive evaluation of economic development and growth issues for Dry Lake Valley and included an analysis of all current and proposed categories of development known to be relevant to the basin.

1. <u>Future Economic Activity in Dry Lake Valley</u>

The Applicant undertook a comprehensive review of the historic and existing economic activity in Dry Lake 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 Dry Lake Valley in the foreseeable future that would require additional water resources to be reserved for the basin.

In determining the likelihood of future economic growth and development in Dry Lake 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 Dry Lake Valley.[874] Mr. Holmes testified that the most fundamental factors which would lead to economic growth within Dry Lake 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.[875]

In applying those factors to Dry Lake Valley, Mr. Holmes testified that the presently non-existent population in Dry Lake Valley is unlikely to show an upward trend.[876] 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 Dry Lake Valley remained

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[872] Exhibit No. SNWA_241; Transcript, Vol.14 pp. 3273-3331 and Vol.15 pp. 3321- 3390 (Holmes).
[873] Exhibit No. SNWA_347 and 346; Transcript, Vol.14 pp. 3146, 3153-3156 (Frehner).
[874] Exhibit No. SNWA_241 pp. 1-1 to 1-2; Transcript, Vol.14 pp. 3285-3299 (Holmes).
[875] Exhibit No. SNWA_241 p. 2-1; Transcript, Vol.14 pp. 3285-3299 (Holmes).
[876] Exhibit No. SNWA_241, pp. 2-6 to 2-11; Transcript, Vol.14 pp. 3305-3308 and Vol.15 pp. 3321-3332 (Holmes).

virtually unchanged with an estimated population of three persons during this period of extreme growth within the state.[877] Because the population in Dry Lake Valley did not increase even in this time of fast growth for the state as a whole, Mr. Holmes concluded that it is unlikely Dry Lake Valley would experience an increase in population in the future. The Protestant witness Dr. Kilkenny not only conceded that the population statistics utilized by Mr. Holmes were correct, but she deferred to his numbers when presenting rebuttal testimony.[878] Thus, based on the extremely low population of Dry Lake Valley, Mr. Holmes concluded that there is little to no labor force for future business expansion within Dry Lake Valley.[879]

Additionally, the Applicant provided evidence that Dry Lake Valley is extremely isolated and is located well over 100 miles from the nearest metropolitan city.[880] The extreme isolation of Dry Lake 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.[881] Mr. Holmes further testified that given the high expenses associated with developing the infrastructure and services needed to support economic growth within Dry Lake Valley, it is unlikely that there will be any public or private investment to develop such infrastructure as Dry Lake Valley will not generate significant return on the investment.[882] The Applicant additionally provided evidence that over 99% of Dry Lake Valley is owned by the federal government.[883] As such, the Applicant concluded that there is little opportunity to privately develop land for future business or residential use.[884]

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 Dry Lake Valley in the foreseeable future. For example, Mr. Holmes testified that water consumption for tourism and recreation within the basin will be minimal as the basin has stagnant hunting and fishing

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[877] Exhibit No. SNWA_241, pp. 2-6 to 2-11; Transcript, Vol.14 pp. 3305-3308 and Vol.15 pp. 3321-3332 (Holmes).
[878] Transcript, Vol.22 p. 5028 (Kilkenny).
[879] Transcript, Vol.15 pp. 3332:8-12, 333:1-7 (Holmes).
[880] Exhibit No. SNWA_241, p. 2-4
[881] Transcript, Vol.14 pp. 3294-3305 and Vol.15 pp. 3345-3350 (Holmes).
[882] Transcript, Vol.15 pp. 3347-3349 (Holmes).
[883] Exhibit No. SNWA_241, p. 3-3.
[884] Exhibit No. SNWA_241, p. 3-3.

numbers.[885] Additionally, there is a lack of mining operations despite the current high demand for metals.[886] As such, based on all these factors, Mr. Holmes concluded that it is highly unlikely that Dry Lake Valley will sustain any economic growth requiring significant water resources in the foreseeable future.[887]

The Protestants provided evidence and testimony from Dr. Kilkenny to rebut Mr. Holmes' evaluation of the likelihood of future growth and development within Dry Lake Valley. Dr. Kilkenny argued that the Applicant failed to consider the Central Place Theory Model and Rank-Size rule to predict future urban areas in Nevada.[888] 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.[889] 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.[890] Finally, Dr. Kilkenny testified that the threat of these Applications has affected growth during their pendency.[891]

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.[892] 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.[893] 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 county containing Dry Lake Valley.[894] In contrast, Dr. Kilkenny admitted to speculation, utilized

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[885] Exhibit No. SNWA_241_, pp. 3-10 to-3-11; Transcript, Vol. 15 pp. 3379-3381 (Holmes).
[886] Exhibit No. SNWA_241, pp. 3-8 to 3-11; Transcript, Vol.15 pp. 3373-3374 (Holmes).
[887] Exhibit No. SNWA_241, pp. 5-1 to 5-2; Transcript, Vol.14 pp. 3380-3381 (Holmes).
[888] Exhibit No. GBWN_114, pp. 12 to 13.
[889] Exhibit No. GBWN_114, p. 4.
[890] Exhibit No. GBWN_114, pp. 4 to 6.
[891] Transcript, Vol.22 pp. 4988-4989, 5022-5023 (Kilkenny).
[892] Transcript, Vol.15 pp. 3349-3355 (Holmes); Vol.13 pp. 3009-3013 (Peseau and Carter).
[893] Transcript, Vol.15 pp. 3352-3354 (Holmes).
[894] Exhibit No. SNWA 241, p. 1-1; Transcript, Vol.14 pp. 3285-3291 and Vol.15 pp. 3435-3438 (Holmes).

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.[895] 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.[896] Additionally, Dr. Kilkenny's testimony regarding the lack of growth within the basins due to the mere threat of the Applications is highly speculative.[897] The State Engineer must make rulings based upon the evidence submitted and not on the public beliefs offered by Dr. Kilkenny. The State Engineer finds that Dr. Kilkenny did not provide any opinion regarding the likelihood of future growth and development within Dry Lake Valley, nor did she 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 has presented testimony and evidence as to Lincoln County's Master Plan to show that Lincoln County does not have any plans for development within Dry Lake Valley which would require any water resources.[898] Instead, development in Lincoln County is targeted towards the Toquop Area near Mesquite, as well as Coyote Springs.[899] This evidence and testimony is consistent with the 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 Dry Lake Valley.[900] 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 Dry Lake Valley.[901] The Resolutions further state that the Lincoln County Master Plan does not anticipate any proposed development or municipal use of water within Dry Lake Valley.[902] The Protestants have not presented any contradicting evidence or testimony to refute the lack of any current development plans in Dry Lake Valley.

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[895] Transcript, Vol.22 pp. 5039, 4999-5002, 5039-5040, 5043-5058 (Kilkenny).
[896] Exhibit No. GBWN_066, p. 1; Transcript Vol.22 pp. 5008-5009, 5023-5024 (Kilkenny).
[897] Transcript, Vol.22 pp. 4988-4989 (Kilkenny).
[898] Transcript, Vol.15 pp. 3331-3332 (Holmes).
[899] Transcript, Vol.15 pp. 3331-3332 (Holmes).
[900] Exhibit No. SNWA_353; Transcript, Vol.14 pp. 3151-3153 (Frehner).
[901] Exhibit No. SNWA_346; Exhibit No. SNWA_347.
[902] Exhibit No. SNWA_ 346; Exhibit No. SNWA_347.

2. Renewable Energy Development in Dry Lake Valley

The Applicant offered the expert testimony of Dr. Carl Linvill and Mr. John Candelaria to address the possible future water needs of Dry Lake Valley related to future alternative energy development.[903] In reaching their conclusions, Dr. Linvill and Mr. Candelaria reviewed and relied upon numerous sources, which have been submitted as exhibits.[904] 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.[905] 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.[906] They referenced the Renewable Energy Transmission Initiative in California which brings together persons from varying interests to evaluate renewable energy and transmission in California.[907] 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.[908]

The evidence submitted by the Applicant demonstrates to a reasonable certainty that the quality of renewable energy resources available in Dry Lake 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.[909] Mr. Candelaria testified that solar energy is currently the most costly renewable energy to develop.[910] Based on

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[903] Exhibit No. SNWA_113; Transcript, Vols.13 and 14 pp. 3053-3144 (Candelaria and Linvill).
[904] Exhibit Nos. SNWA_114 through 142.
[905] Transcript, Vol.13 pp. 3075:10-3076:20 (Candelaria and Linvill).
[906] Transcript, Vol.13 pp. 3076:21-3077:10 (Candelaria and Linvill).
[907] Transcript, Vol.13 pp. 3077:11-3079:22 (Candelaria and Linvill).
[908] Transcript, Vol.13 pp. 3079–3082 (Candelaria and Linvill).
[909] Transcript, Vol.14 pp. 3098:17-3101:13 (Candelaria and Linvill).
[910] Transcript, Vol.14 p. 3099:7-9 (Candelaria and Linvill).

the high cost to develop solar energy and the general preference in developing geothermal over solar and wind energy, the experts' report at Figure 1-3 demonstrates that Nevada produces over 10,000 GWh of highly competitive geothermal energy, and these resources make up the bulk of Nevada's renewable energy portfolio standard.[911]

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.[912] Dr. Linvill and Mr. Candelaria explained that even this higher quality Delamar Valley resource is not competitive and will not likely be developed.[913] 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").[914] PV bypasses the turbine process and requires little to no water.[915] 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.[916] Furthermore, the evidence demonstrates that PV costs are rapidly declining, making the technology more competitive than concentrated solar.[917] The State Engineer finds the Applicant provided substantial evidence that the quality of the solar resource in Dry Lake 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.[918] 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 Dry Lake Valley.

The State Engineer notes that there was no evidence presented by any Protestant demonstrating current or even future alternative energy development plans in Dry Lake Valley which would require additional water resources. Based upon the evidence received, the State

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[911] Exhibit No. SNWA_113, Figures 1-3 and 4-2.
[912] Exhibit No. SNWA_113, p. 1-5; Transcript, Vol.14 pp. 3103:12-19 (Candelaria and Linvill).
[913] Exhibit No. SNWA_113 pp.1-5 to 1-8; Transcript, Vol.14 pp. 3103-3105 (Candelaria and Linvill).
[914] Exhibit No. SNWA_113, p. 1-10; Transcript, Vol.14 pp. 3090:20-3092:9 (Candelaria and Linvill).
[915] Exhibit No. SNWA_113, Transcript, Vol.14 pp. 3090-3094 (Candelaria and Linvill).
[916] Exhibit No. SNWA_113, p. 1-10; Transcript Vol.14 pp. 3090:17-3094:22 (Candelaria and Linvill).
[917] Exhibit No. SNWA_113, p. 1-9; Transcript, Vol.14 pp. 3094-3099 (Candelaria and Linvill).
[918] Exhibit No. SNWA_113 p. 7-1 to 7-5; Transcript, Vol.14 pp. 3138-3141 (Candelaria and Linvill).

Engineer finds that it is improbable that future development will occur that would require additional water resources and that no water should be reserved for future renewable energy development within Dry Lake Valley.

3. Agricultural Development in Dry Lake 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.[919] Dr. Dennis Peseau and George Carter explained that they researched and reviewed data and literature which they believed would be particularly relevant to predict agriculture operations in this area of Nevada and memorialized their research in their report.[920] 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.[921] Additionally, Dr. Peseau and Mr. Carter visited Dry Lake Valley and reviewed satellite maps to determine terrain and existing infrastructure and current operations within Dry Lake Valley.[922]

The Applicant submitted uncontroverted evidence that there is no reasonable expectation that Dry Lake Valley will experience expansion of its agricultural economy in the future.[923] This opinion was primarily based upon the observation of the very limited current activity, the small irregular shapes of the existing private parcels, and the slope of the few parcels.[924]

The Applicant has utilized the most relevant factors to determine that it is highly unlikely that there will be future agricultural growth and development in Dry Lake Valley. In addition to the factors discussed above, the conclusion advanced by the Applicant is based upon the fact that new investment in agricultural projects within Dry Lake Valley will not result in positive economic returns and therefore it is unlikely that new money will be invested in such a venture. Dr. Peseau and Mr. Carter base this opinion in large measure upon studies published by the University of Nevada, Reno.[925] These documents were each based upon practices and materials

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[919] Transcript, Vol.13, pp. 2947-3053 (Carter and Peseau).
[920] Exhibit No. SNWA_103, pp. 26-28; Transcript, Vol.13 pp. 2959-2961, 2965-2967 (Carter and Peseau).
[921] Exhibit No. SNWA_103, pp. 26-28; Transcript, Vol.13 pp. 2959:14-2960:15 (Carter and Peseau).
[922] Transcript, Vol.13 pp. 2966:4-2968:1 (Carter and Peseau).
[923] Exhibit No. SNWA_103; Transcript, Vol.13 pp. 3018-3021:1, 3050:24-3052:24 (Carter and Peseau).
[924] Exhibit No. SNWA_103, p. 23; Transcript, Vol.13 pp.3018- 3019 (Carter and Peseau).
[925] Exhibit No. SNWA_104; Exhibit No. SNWA_105; Transcript, Vol.13 pp. 2964-2965 (Carter and Peseau).

considered typical of a well-managed farm and ranch in the region, as determined by a producer panel.[926] 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.[927] Based upon the evidence submitted such an operation would face even greater challenges in Dry Lake Valley.[928]

Dr. Peseau also provided testimony regarding his review of external factors that might be relevant to agricultural growth in Dry Lake Valley.[929] 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.[930] The State Engineer also received testimony that limitations on grazing allotments will negatively impact the demand for alfalfa as a supplemental winter feed.[931] This opinion was consistent with the Protestant testimony that grazing allotments have been reduced in recent years.[932]

No Protestant submitted any credible evidence indicating the likelihood of expansion of agriculture within Dry Lake Valley which would require additional water resources. Based upon the evidence submitted, the State Engineer finds that no reservation of water is necessary for future agricultural development purposes in Dry Lake Valley.

Protestant witnesses testified that they believed approving the Applications will harm and/or "dry up" the existing vegetation on their ranching operations.[933] However, none of these Protestant witnesses provided testimony or evidence regarding future expansion of their existing operations or future economic or agriculture development plans which would require significant water resources.[934] Accordingly, the State Engineer finds that the Protestant witnesses have not presented evidence that approving the Applications will unduly limit growth and development on their ranching operations or within the basin, and that the Applicant has presented evidence to

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[926] Exhibit No. SNWA_104; Exhibit No. SNWA_105; Transcript, Vol.13 pp. 2964:12-2966:3, 2990:7-2991:3, 3005:6-20 (Carter and Peseau).
[927] Exhibit No. SNWA_103; Transcript, Vol.13 pp. 2987-2999 (Carter and Peseau).
[928] Exhibit No. SNWA_103, p. 23; Transcript, Vol.13 pp. 3018-3020 (Carter and Peseau).
[929] Transcript, Vol.13 pp. 2983:10-2985:19 (Carter and Peseau).
[930] Exhibit No. SNWA_103, pp.12-13; Transcript, Vol.13 pp. 2999:8-3002:1 (Carter and Peseau).
[931] Transcript, Vol.13 pp. 2984:11-2985:11 (Carter and Peseau).
[932] Transcript, Vol.24 pp. 5507:12-15 (Gloeckner).
[933] Transcript, Vol.24 pp. 5503:11-5516:7 (Gloeckner); Vol.24 pp. 5541-5551 (Roundtree).
[934] Transcript, Vol.24 pp. 5503:11-5516:7 (Gloeckner); Vol.24 pp. 5541-5551 (Roundtree).

show that approving the Applications will not unduly limit growth and development with Dry Lake Valley.

As with crop-based agriculture, the uncontroverted evidence demonstrates that the cow/calf market in Dry Lake Valley is unlikely to grow in the foreseeable future. Mr. Carter provided testimony and USDA trends for cow/calf grazing.[935] 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.[936] 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 Dry Lake 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.[937]

Lastly, Dr. Peseau and Mr. Carter submitted their analysis of the economics of a new joint alfalfa and cow/calf operation.[938] 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.[939]

The evidence and conclusions of Dr. Peseau and Mr. Carter was 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.[940] 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

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[935] Transcript, Vol.13 pp. 3002:15- 3009:5 (Carter and Peseau).
[936] Exhibit No. SNWA_104; Transcript, Vol.13 pp. 3004-3005 (Carter and Peseau).
[937] Transcript, Vol.13 pp. 3037-3038 (Carter and Peseau).
[938] Exhibit No. SNWA_103; Transcript, Vol.13 pp. 3013:13-3016:24 (Carter and Peseau).
[939] Exhibit No. SNWA_103; Transcript, Vol.13 pp. 3013:13-3016:24 (Carter and Peseau).
[940] Transcript, Vol.22 pp. 4988-4989 (Kilkenny).

in the basins of origin.[941] 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.[942] 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.[943] 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.[944]

The Applicant has presented substantial uncontroverted evidence supported by expert testimony that it is highly improbable that there will be any additional investment in new agricultural endeavors in Dry Lake 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 the basin.[945] The State Engineer finds that it is unlikely there will be any new agricultural development in Dry Lake Valley and therefore the granting of these Applications will not unduly limit such development.

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.[946] Rather, she indicates her effort was an attempt to update information which had been previously compiled by others.[947] Notably, Dr. Kilkenny did not provide any opinion regarding the likelihood of future growth and development within Dry Lake 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

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941 Transcript, Vol.13 pp. 3047-3048 (Carter and Peseau).
942 Transcript, Vol.22 pp. 4991-4992 (Kilkenny).
943 Transcript, Vol.22 p. 4991:21-22 (Kilkenny).
944 Exhibit Nos. GBWN_066, GBWN_068, GBWN_114; Transcript, Vol.22 p. 4971-5080 (Kilkenny); Vol.28 pp. 6226-6260 (Cooper and Sanders).
945 Transcript, Vol.13 pp. 3021-3022 (Carter and Peseau).
946 Transcript, Vol.22 pp. 5020:18-5021:7 (Kilkenny).
947 Transcript, Vol.22 pp. 5020:18-5021:7 (Kilkenny).

development of the basin.[948] Dr. Kilkenny explained that she did not attempt to quantify the economic activity within Dry Lake Valley, instead she presented county-wide information for White Pine and Lincoln Counties.[949] Dr. Kilkenny testified that when she authored her report she did not understand the geographic extent of Dry Lake Valley.[950] Dr. Kilkenny's testimony revealed numerous errors and misstatements in her report, and her report and testimony has been given little weight by the State Engineer.

Little evidence of even speculative future growth was submitted by any Protestant and no Protestant identified a specific quantity of water that should be reserved for protection of future growth and development in Dry Lake Valley. Instead, the Protestants focused upon the current and past uses of water in Dry Lake Valley, rather than arguing the need for water to support future growth. The Protestants' evidence of the need to protect established water rights in Dry Lake Valley is understood, appreciated and acknowledged by the State Engineer. However, the protection of those senior rights is provided for under Nevada law and the issue of impacts to existing rights is addressed fully in this ruling.

Since no Protestant submitted evidence in support of a specific quantity of water that should be reserved Dry Lake Valley, the only evidence in the record of a specific quantity that should be reserved for future growth and development was offered by the Applicant. Based on the historic use of water in the basin and the evidence submitted, the Applicant asserts there is no reasonable expectation for growth and development in Dry Lake Valley in the foreseeable future and, therefore, there are no foreseeable additional water needs in the basin; therefore, the reservation of 50 afa is appropriate. A reservation of 50 afa is consistent with the testimony of Mr. Holmes. Mr. Holmes presented at Table 4-1 of his expert report the non-agricultural water rights that have been granted in Dry Lake Valley for the past 50 years, demonstrating that only 10 afa have been approved during that time frame.[951] While Mr. Holmes concluded no water is required to be reserved, based on the historic use of water in the basin he also testified that 50 afa would be more than enough water for any unforeseen future uses in Dry Lake Valley.[952] Accordingly, the State Engineer has elected to reserve 50 afa of water for unforeseeable future

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[948] Transcript, Vol.22 pp. 4988-4989, 5022-5023 (Kilkenny).
[949] Transcript, Vol.22 pp. 5033-5035, 5038 (Kilkenny).
[950] Transcript, Vol.22 pp. 5024-5026 (Kilkenny).
[951] Exhibit No. SNWA_241, pp. 4-1, 4-2.
[952] Exhibit No. SNWA_241, pp. 4-1, 4-2.

growth in Dry Lake Valley. The State Engineer finds approving the Applications will not unduly limit future growth and development in Dry Lake 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.[953] 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.[954] Both resolutions identified and confirmed Lincoln County's lack of current plans for growth and development in Dry Lake Valley, which resides in Lincoln County.[955] In that regard, evidence indicated that Lincoln County does not anticipate development for municipal use of water within Dry Lake Valley.[956] Rather, this evidence indicated Lincoln County's intention to put the water to beneficial use elsewhere within Lincoln County, specifically within Coyote Spring Valley.[957]

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.[958] Through the testimony of Mr. Frehner and the evidence submitted, Lincoln County has indicated that it does not anticipate projects or development in Dry Lake 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.[959]

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[953] Exhibit No. SNWA_352.; Transcript, Vol.14 pp. 3149:18-3157:7 (Frehner).
[954] Exhibit No. SNWA_346; Exhibit No. SNWA_347; Transcript, Vol.14 pp. 3153:4-3157:7 (Frehner).
[955] Exhibit No. SNWA_346, Exhibit No. SNWA_347; Transcript, Vol.14 pp. 3153:4-3157:7 (Frehner).
[956] Transcript, Vol. 14, pp. 3153:4-3157:7 (Frehner).
[957] Transcript, Vol. 14, pp. 3153:4-3157:7 (Frehner).
[958] Exhibit No. SNWA_352; Transcript, Vol.14 pp. 3152:14-3153:2 (Frehner).
[959] 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.[960] 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.[961] Further, Coyote Springs Development was the only anticipated use for the water.[962]

The Nevada Supreme Court in the case of *Bacher v. Office of the State Engineer*,[963] reversed the District Court's affirmance of the State Engineer's approval of an interbasin roundwater 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).

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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[960] Exhibit No. SNWA_347.
[961] Transcript Vol.14 pp. 3168-70 (Frehner).
[962] Transcript Vol.14 pp. 3171-72 (Frehner).
[963] *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.[964]

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.

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[964] Exhibit No. SE_044.

B. Access to Federal Land

Some of the Protestants alleged that the Applicant has not demonstrated the ability to access land containing the points of diversion or a right-of-way from the BLM for the Project. Testimony was provided that the Lincoln County Lands Act identified a utility corridor for this and other utilities and that the Act required issuance of a right-of-way for the Project within the area designated by the Act.[965] 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.[966] 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.[967] 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. 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 and dismisses this protest claim.

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

D. Las Vegas is Big Enough

Protestants argue that Las Vegas is large enough and further growth is not in the best interest of Las Vegas Valley, that Clark County should only grow within the limits of its local resources, and 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. 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 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.

F. 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.

G. 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.

H. Impacts to Indian Springs, Nellis Air Force Base, Lake Mead and Lake 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.

I. 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 no evidence was submitted that the groundwater resources in Dry Lake Valley are diminishing due to climate change or drought and dismisses this protest claim.

X. UNAPPROPRIATED WATER

The State Engineer finds the perennial yield of Dry Lake Valley is 15,000 afa, based on the State Engineer's revision of the Applicant's estimated annual recharge for the basin. The amount of committed groundwater is 807 afa and 50 afa is reserved for unforeseen future growth and development in the basin. Accordingly, the State Engineer finds that there is 14,143 afa available for appropriation in Dry Lake Valley.

CONCLUSIONS OF LAW

I. JURISDICTION

The State Engineer has jurisdiction over the parties and the subject matter of this action and determination.[968]

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[968] NRS Chapters 533 and 534.

II. STATUTORY DUTY TO DENY

The State Engineer is prohibited by law from granting an application to appropriate the public waters where:[969]

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 Dry Lake Valley, there is no substantial evidence the proposed use will conflict with existing rights, that existing rights are sufficiently protected by the Applicant's monitoring, management, and mitigation plan, there is no substantial evidence that the proposed use will conflict with protectable interests in existing domestic wells, or that the use will threaten to prove detrimental to the public interest. Therefore, there is no reason to reject the Applications under NRS 533.370(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 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 Dry Lake 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 50 afa in the basin of origin, that the export of water will not unduly limit the future

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[969] NRS 533.370(2).

growth and development of Dry Lake Valley. Therefore, there is no reason to reject the Applications under NRS 533.370(3).

RULING

The protests to Applications 53989 and 53990 are hereby overruled and the Applications are hereby granted in the following amounts and subject to the following conditions:

1. Applications 53989 and 53990 are hereby granted for a total of 11,584 afa;
2. The State Engineer has reviewed and approves the Hydrologic Monitoring and Mitigation Plan for Delamar, Dry Lake and Cave Valleys that was prepared by the Applicant. The Applications are granted conditioned upon the Applicant's compliance with that Plan, and any amendments to that Plan that the State Engineer requires at a later date pursuant to his authority under Nevada law;
3. The State Engineer has reviewed and approves the Biological Monitoring Plan for Delamar, Dry Lake and Cave Valleys that was prepared by the Applicant. The Applications are granted conditioned upon the Applicant's compliance with that Plan, and any amendments to that Plan that the State Engineer requires at a later date pursuant to his authority under Nevada law;
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 Dry Lake 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 every five 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 fees.

Respectfully submitted,

P.E.

JASON KING, P.E.
State Engineer

Dated this 22nd day of

March, 2012.