Spring, Cave, Dry Lake, and Delamar Valleys Effects Rebuttal Report in Response to Myers (2011b, c, and d) and Bredehoeft (2011)

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Pertaining to:
Groundwater Applications 54003 through 54021 in
Spring Valley
and
Groundwater Applications 53987 through 53992 in
Cave, Dry Lake, and Delamar Valleys

August 2011

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1.0 INTRODUCTION

There were five hydrology related technical reports submitted on behalf of Great Basin Water Network and other protestants for the hearings on the Southern Nevada Water Authority's (SNWA) groundwater applications in Spring, Cave, Dry Lake, and Delamar valleys. These reports include:

- Myers, T., 2011a, Hydrogeology of Spring Valley and Surrounding Areas, Part A: Conceptual Flow Model.
- Myers, T., 2011b, Hydrogeology of Spring Valley and Surrounding Areas, Part B: Groundwater Model of Snake and Spring Valleys and Surrounding Areas.
- Myers, T., 2011c, Hydrogeology of Spring Valley and Surrounding Areas, Part C: Impacts of Pumping Underground Water Right Applications #54003 through 54021.
- Myers, T., 2011d, Hydrogeology of Cave, Dry Lake, and Delamar Valleys: Impacts of Pumping Underground Water Right Applications #53987 through 53092.
- Bredehoeft, J., 2011, Report on the Hydrogeolgy [sic] of Proposed Southern Nevada Water Authority Groundwater Development.

The purpose of this report is to discuss the use or interpretation of groundwater flow model results presented in Myers (2011b, c, and d) as well as in Bredehoeft (2011). Additional discussions of these reports are presented for Myers (2011a) in Burns et al. (2011a), Myers (2011b) in D'Agnese (2011a), Myers (2011d) in Burns et al. (2011b), and Bredehoeft (2011) in Prieur (2011a). This report has been broken down into specific sections as follows:

- Section 1.0 contains this introduction.
- Section 2.0 contains a discussion on the Spring Valley hydrogeology reports (Myers, 2011b and c).
- Section 3.0 contains a discussion on the Cave, Dry Lake, and Delamar valleys hydrogeology reports (Myers, 2011d).
- Section 4.0 contains a discussion on the Bredehoeft (2011) report.
- Section 5.0 provides a summary of this document.
- Section 6.0 provides a list of references cited in this report.

2.0 MYERS SPRING VALLEY HYDROGEOLOGY REPORTS

The Conceptual Model (Part A) and Groundwater Model (Part B) has been reviewed by Burns et al. (2011a) and D'Agnese (2011a). The focus of this section will be on a review of the conclusions found within the Impacts Report (Part C).

2.1 Perennial Yield and Water Balance

Pumping Will Not Exceed Perennial Yield

Many of the conclusions in Myers (2011c) stem from the assumption that the SNWA will be permitted groundwater rights in excess of the Nevada State Engineer's (NSE) determination of perennial yield. This assumption and the conclusions that result from it are incorrect. At the time of the preparation of this report, the NSE listed the perennial yield for Spring Valley as 80,000 acre-feet per year (afy) (NDWR, 2011a). Burns and Drici (2011) presents an analysis of the data, for the consideration of the NSE, that demonstrates the perennial yield for Spring Valley should be increased to 94,800 afy. Stanka (2011) presents an analysis of the existing rights for Spring Valley and by simple math (Perennial Yield minus Existing Rights) Burns and Drici (2011) calculate the unappropriated groundwater resources that would be available for appropriation under these applications. By performing this analysis the unappropriated water resources could be granted to SNWA without exceeding the perennial yield.

Perennial Yield versus Equilibrium and Time to Full Capture

Myers (2011c, p. 3) provides a definition of perennial yield in his report, however he incorrectly assumes it to mean: "A corollary is that the aquifer system must come to equilibrium within a reasonable time or the amount being pumped exceeds the perennial yield for that pumping regime."

This reinterpretation of the definition is completely inaccurate as the definition of perennial yield is unrelated to a system reaching equilibrium within specific time frames.

If the goal of water managers was to obtain a new equilibrium in the shortest time possible, then one way to achieve this goal would be to dramatically increase pumpage that would result in a quick new equilibrium (Alley et al., 1999, p. 72). This could be accomplished by pumping at levels drastically above the perennial yield until such time as the system was near equilibrium and then reducing the pumping back to perennial yield levels. While this would most certainly achieve the Myers (2011c) definition of obtaining equilibrium in the shortest possible time, it would likely have significant environmental impacts of the type SNWA is trying to avoid.

The discussion of equilibrium is inappropriate for additional reasons. As with the modeling performed in Watrus and Drici (2011), the scenarios presented in Myers (2011c) assume that once pumping begins, it continues nonstop throughout the simulation time period without intervention from SNWA, Federal agencies, or the NSE. Watrus and Drici (2011) conclude that this is not realistic, for their 75-year post full build-out period of analysis. As such, it is purely an academic exercise to perform this analysis for the 10,200-year period in Myers (2011c). The simulation of nonstop pumping does not take into account SNWA management decisions, system maintenance, major repairs, facility replacement, or a potential lack of need for the water in certain years. It also does not take into account management decisions made between SNWA and the federal agencies as part of the stipulated agreements, or actions taken by the NSE.

In other words, SNWA's goal is not as simplistic as that of Myers (2011c), to achieve a new equilibrium in a short period of time. But rather, SNWA intends to manage the groundwater withdrawals to avoid and minimize potential unwanted effects while maintaining a sustainable resource.

Water Balance

Myers (2011c) also attempts to link perennial yield with the ability to capture the discharge when he states: "A corollary to this discussion is that perennial yield may be limited by the ability to place wells to actually capture the discharge" (Myers, 2011c, p. 3) and "SNWA would not be able to capture sufficient discharge to match its proposed pumpage at their proposed points of diversion" (Myers, 2011c, p. 5).

As was the case with equilibrium, this reinterpretation of the definition of perennial yield is inaccurate. There is no statutory or other, requirement for a water right applicant to show that they can capture the discharge of a basin with their proposed points of diversion. Groundwater development projects capture transitional storage, not just discharge. The assumption that groundwater pumping captures discharge is a necessary result of the process used to calculate perennial yield. It is an accounting assumption, not a real world pumping requirement. Water-rights are typically permitted where the applicant owns land without regard as to whether or not natural discharge can be captured on that specific piece of property. As described in NDWR (2011b), "Groundwater is managed by the State Engineer on a Basin scale, and can be developed anywhere in the Basin..." and "Since groundwater is managed at a basin scale, it is available anywhere in the basin, but with certain practical considerations for local factors, such as depth to water, the productivity of the aquifer and possible conflicts with existing rights." (NDWR, 2011b, p.1-3)

2.2 Effects

Use of One-foot Contours

Myers (2011c, p.7) argues for the use of displaying the one-foot drawdown contour for the assessment of phreatic springs. However, Myers (2011a, b, and c) makes no attempt to classify the source of water or heads driving the springs within the model domain. Therefore, the display of the one-foot drawdown contour which has a great deal of uncertainty about it, especially over the significant model simulation periods, is of no value to the analysis of spring discharges.

Model Does Not Converge

Myers (2011c) describes the problems encountered with model convergence as: "The simulation at long time periods has slight convergence problems due to instability in the MODFLOW rewetting routine. During simulation of the larger time steps in stress period three during recovery simulation, a few cells oscillated between wet and dry conditions. The oscillation occurs because the water level in those cells has recovered to within a small fraction of a foot of rewetting. Oscillation does not occur during more rapid recovery. The MODFLOW-2000 output files show (1) that the model almost converges (it is not diverging), the residual values are less than 5 whereas the criteria was set to 1, and (2) that the failure to converge for a few steps does not cause a water balance error."

Failure to converge can be a significant issue and while Myers (2011c) discusses the likely problem, it does not appear that attempts were made to resolve the issue. Additionally, Myers (2011c) provides no discussion as to what influence, if any, the problem may have on the model predictions. This type of discussion would have helped decision-makers have a more informed understanding of the applicability/usefullness of the model results.

Points of Diversion versus Model Conceptualizations

Myers (2011c) describes the problems encountered with several of the SNWA application points of diversion as they were input into his model as: "However, the 10 cfs applications and application 54010 near Rattlesnake Knoll could not be pumped to their full amount without causing thousands of feet of drawdown. This was due to their location in bedrock with very low conductivity and indicates the SNWA applications as requested cannot actually withdraw the requested amount of water from those locations. I made small adjustments to their location to better accommodate the valley's conceptual model, just as SNWA would do when actually locating the wells if permitted (Myers, 2011c, p. 6). The problems with pumping the original applications demonstrate it is impossible to actually remove the requested water from some locations. Unless fractured, carbonate rock does not yield substantial amounts of water. The fill will yield the application amounts only if screened over very long lengths." (Myers, 2011c, p. 6)

Watrus and Drici (2011) had a similar issue with application number 54021. As explained in Watrus and Drici (2011, p. 4-4), the types of issues encountered in Myers (2011c) are not based on the physical reality of where the points of diversion are located but rather on the limitations associated with the construction of simplified models based upon coarse geologic information. This problem is even further amplified in Myers (2011c) as the geology used as the framework for model construction, as presented in Myers (2011a), is less sophisticated and contained substantially less detail than what was used by Watrus and Drici (2011). As a result, the statements in Myers (2011c) regarding the ability to remove the requested water are only applicable to his model simulations, not SNWA's ability to develop these application points of diversion in the real world. Myers (2011c) concedes this point when he says "I made small adjustments to their location to better accommodate the valley's conceptual model, just as SNWA would do when actually locating wells."

Spring Flows

Myers (2011c) makes the following statements regarding the simulation of springs within his model: "Some individual springs will be dried completely, and remain dry for tens of years after pumping ceases." (Myers, 2011c, p. 21)

Statements such as these should have been highly qualified as Myers (2011c, p. 7) admits that his model lacks precision. As described in D'Agnese (2011a), spring flows were not included during steady-state model calibration and the results of the steady-state simulation show the simulated values are in poor agreement with actual observations of real spring flows. If springs were not included in the steady state calibration, that means that the existing spring flow is not accurately represented as a starting point in the model. If the starting point for spring flow is not accurate, one can have little confidence in the precision of spring flow predictions many years into the future. As such, predictions based on springs that are not capable of being accurately represented, are not very meaningful and should be qualified as having significant uncertainties and described with far less certainty than what was presented in Myers (2011c).

Cleve Creek Springs Results

Myers' (2011c) conclusions regarding the simulation results for Cleve Creek Springs are erroneous. He states: "Cleve Creek Springs suffers a similar fate, going dry within 75 years for both full and two-thirds pumping (Figure 15). Recovery to a rate that is just beginning to discharge again takes up to 430 years (Figure 15)." (Myers, 2011c, p. 21)

The results presented for Cleve Creek Springs are in conflict with how these springs were conceptualized within Myers (2011a) and therefore represent a substantial error in model setup. According to Myers (2011a), these springs were conceptualized as follows: "The springs at the base of the fan discharge large flows which is likely percolation from Cleve Creek. The median flow, 5500 af/y, represents the percolation into the fan. This is secondary recharge of stream baseflow. Based on the stratified lithology in the area, flow in the fan may be partly perched, therefore it cannot be assumed that the water table approaches the ground surface." (Myers, 2011a, p. 39). This conceptualization is consistent with the description provided in Resource Concepts, Inc. (2011) of: "Infiltration of water from Cleveland Creek that occurs across the three miles of alluvial fan between the USGS Gauging Station and the Reservoir is believed to recharge many of the springs in the southern portion of the Cleveland Ranch, as they are directly down-gradient from this section of the creek....There are a multitude of springs located throughout the Cleveland Ranch. These springs are likely recharged by annual runoff from the Schell Creek Range via Cleveland, Indian, Freehill, and Stephens Creeks." (RCI, 2011, p. 11)

Therefore, according to Myers (2011a) and Resource Concepts, Inc. (2011), the Cleve Creek Springs are perched springs resulting from recharge of local stream flow. Myers (2011a) considers the springs to be perched and have no connection to the water table; so the simulations of these springs, if modeled properly, should show no impacts from pumping the proposed applications. As such, the model in Myers (2011b and c) has been improperly constructed in this region and his predictions regarding Cleve Creek Springs should be disregarded.

Big Springs Results

The description of the results for Big Springs are particularly misleading within Myers (2011c): "Big Springs is a major spring in Snake Valley, but pumping in Spring Valley clearly affects it (Figure 18). The effects continue to worsen up to 80 years after pumping ceases, a factor which demonstrates how the time to full capture can continue long after pumping ceases and demonstrates also the fallacy of monitoring plans (Bredehoeft and Durbin, 2009)." (Myers, 2011c, p. 24)

While the results from the Myers (2011c) model simulations may show 80-years of post-pumping spring flow declines, this is not what occurs at Big Springs within the original SNWA CCRP model simulations as used by Watrus and Drici (2011). While no specific recovery runs were made with the CCRP model for Watrus and Drici (2011), the run that was made has an additional ten years of post-pumping results included. These results indicate the spring begins to recover within a year of the cessation of pumping. The delayed response shown in Myers (2011c) likely results from the unsubstantiated highly transmissive zone, identified in D'Agnese (2011a), that runs from the west side of Spring Valley through Hamlin and up into Snake Valley. This hypothetical highly transmissive zone likely acts like a direct pipeline taking water from Spring Valley and using it as the source of water for Big Springs. According to this unsubstantiated model framework, in order for Big Springs to recover in the Myers (2011c) model simulations, the "pipeline" would have to fill before Big Springs would begin to simulate recovery. The lack of disclosure of this highly transmissive zone in the Myers (2011b) model report is shocking given the prominence and attention paid to Myers' (2011c) Big Springs results. Given the lack of scientific evidence to establish Myers' (2011b) "pipeline" from Spring Valley to Snake Valley, Myers' (2011c) predictions should be totally disregarded.

It is also unclear as to how the Myers (2011c) simulations demonstrate the fallacy of monitoring plans. There are no considerations for monitoring or management actions demonstrated within the Myers (2011c) simulations. The monitoring program described in Prieur (2011b) incorporates both monitoring locations as well as continued refinement of a groundwater model. Currently all model predictions of the Big Springs area contain significant uncertainties, but through time these uncertainties will be reduced and groundwater modeling will become an important tool that will aid in resource management decisions.

Model Limitations Section Missing

There are a number of important model limitations beginning simply with the available data, model conceptualization, and model construction that lead to uncertainty within the predictions made in Myers (2011c). While Myers (2011c) does not provide a specific limitations section within his report he has scattered a few limitations throughout the numerical model (Myers, 2011b) and predictions report (Myers, 2011c). These limitations include:

- The conceptual model contains significant uncertainties...The biggest uncertainty comes in the estimate of spring flow and groundwater ET (Myers, 2011b, p. 1).
- Parameters were set based upon subjective judgement where there are few observations (Myers, 2011b, p. 3).
- Spring data at Stateline Springs and the secondary recharge below several springs was estimated and modeled (Myers, 2011b, p. 4).
- Knowledge of the geology is less precise in deeper layers (Myers, 2011b, p. 4).
- Basinwide Groundwater ET estimates are not considered calibration targets in part because those estimates depend on the BARCAS recharge estimates (Myers, 2011b, p. 26).

- Spring and stream flow measurements are usually too infrequent to be certain of the amount of flow that is groundwater discharge and interbasin flows are broad estimates (Myers, 2011b, p. 29).

- There are many shallow wells at the edge of the valleys and the toe of the fans. During calibration they often were in dry cells, but right at the edge of saturation. This suggest the conceptual flow model at this point is not adequately defined due to the coarseness in the model (Myers, 2011b, p. 32).

- Data concerning existing stresses is sparse and subject to much interpretation because there are no direct measurements (Myers, 2011b, p. 42).

- Both recharge and groundwater ET rates are annual estimates although the amounts obviously vary over the year (Myers, 2011b, p. 42).

- Specific Yield and storage is an unknown and estimates vary by report (Myers, 2011b, p. 42-43).

- There are uncertainties in the recharge and discharge estimates so averages of the values were applied (Myers, 2011c, p. 4).

Given the significant limitations and uncertainties associated with the modeling, the results should be presented in the context of these uncertainties. As described in Section 4.0, Bredehoeft (2011) discusses how the predictions made by current models will improve with time, monitoring, and continued model refinements.

3.0 MYERS HYDROGEOLOGY OF CAVE, DRY LAKE, AND DELAMAR VALLEYS REPORT

Impact Analysis

The impact analysis performed for Myers (2011d) used the Regional Aquifer System Analysis (RASA) conceptual flow model originally prepared by the USGS and modified and documented in Myers (2007). The Myers (2011d) modeling efforts were reviewed by D'Agnese (2011b). The RASA conceptual flow model was also reviewed as part of the U.S. Bureau of Land Management's (BLM) selection of models for use in the Clark, Lincoln, and White Pine Counties Groundwater Development Project Environmental Impact Statement (BLM, 2011, p. 3.3-81). The RASA model was not selected for use in the EIS for the following reasons:

1. The broad regional nature of the model and its coarse discretization;

2. The highly generalized assumptions and simplifications used to construct the model;

3. The fact that the model was not calibrated to transient conditions; and

4. The lack of model set up to simulate the effects associated with existing pumping in the region.

The rapid response shown at major regional springs within Myers (2011d) are clearly the result of attempting to use a very generalized conceptual flow model in a predictive capacity. As described in Burns et al. (2011b), Cave Valley groundwater is not the source of water for Hot Creek and Moon River springs, and there are significant geographic, geologic, and hydrologic impediments that would need to be overcome in order for the effects of pumping SNWA's applications to propagate over such distances. It is important to stress again, that an adaptive management plan, as outlined in Prieur (2011b) and Watrus and Drici (2011), that consists of monitoring as well as iterative modeling updates will allow for significant early detection of effects that might occur in neighboring basins.

The remaining modeling conclusions represented in Myers (2011d) apply to the pumping of the perennial yield and simulate a minor (1 to 2.5 cubic feet per second) change in spring flows after 2,000 years of simulated pumping. Currently, the regional springs in Pahranagat Valley have substantially more natural variation than the 1 to 2.5 cfs described as being lost after 2,000 years. As described previously for Myers (2011c), the scenario presented in Myers (2011d) assumes that once pumping begins, it continues nonstop throughout the simulation time period without intervention from SNWA, the federal agencies, or the NSE. Watrus and Drici (2011) conclude that this is not realistic for their 75-year post full build-out period of analysis. As such, it is purely an academic exercise to perform this analysis for the 2,000-year period in Myers (2011d). The simulation of nonstop pumping does not take into account SNWA management decisions, system maintenance, major repairs, facility replacement, or a potential lack of need for the water in certain years. It also does not take into account management decisions made between SNWA and the federal agencies as part of the stipulated agreements, or actions taken by the NSE.

4.0 BREDEHOEFT (2011) MISREPRESENTATIONS

Bredehoeft (2011) provides a description of groundwater model development including the uncertainties that are associated with just some of the various data inputs required to build a model of this area. He also explains that "The models are known to be non-unique. Future projections have varying degrees of uncertainty." (Bredehoeft, 2011, p. 6). The uncertainties and model limitations associated with the CCRP model are well documented within BLM (2011), SNWA (2009), SNWA (2010), and Watrus and Drici (2011). However, Bredehoeft (2011) ignores these uncertainties and portrays the current model predictions in the following manner: "The conclusion from all the models is that there will be significant hydrologic impacts imposed on the system over a wide area as a result of the SNWA's proposed development—the Draft EIS (BLM, 2011) makes this point explicitly for not only Cave, Dry Lake, and Delamar Valleys, but Spring and Snake Valleys as well," and "The current analyses leave little doubt that there will be significant harmful impacts associated with SNWA's proposed development—large drawdowns will be created over very large areas; streams, springs, and phreatophytes will be eliminated, and wells will go dry, in the areas of drawdown—existing water rights will be damaged, if not totally destroyed." (Bredehoeft, 2011, p. 10)

The conclusions reached in Bredehoeft (2011) are substantial misrepresentations of the models prepared to date and are in direct disagreement with his own descriptions of the current state of hydrologic data and modeling uncertainties. These misrepresentations are specifically problematic with regards to the conclusions made about BLM (2011). BLM (2011) DOES NOT conclusively identify significant harmful impacts associated with SNWA's proposed development. The additional rebuttal to the misrepresentations presented in Bredehoeft (2011) include:

- **BLM (2011) <u>does not</u> contain drawdown maps showing large drawdowns over very large areas.** If closely inspected, large drawdowns are concentrated next to simulated SNWA well locations and are simulated to manifest over decades to hundreds of years.

- **BLM (2011) <u>does not</u> conclude that springs and streams will be eliminated.** In fact, it only concludes what portions of streams fall within the area encompassed by the 10-foot drawdown contour. BLM (2011, p. 3.3-88) clearly states, "This drawdown impact evaluation for springs and streams is limited to a prediction of areas of risk with the recognition that actual impacts to individual springs and streams distributed over this broad region cannot be determined precisely prior to pumping."

- **BLM (2011) <u>does not</u> conclude that phreatophytes will be eliminated.** BLM (2011, p.3.5-43) specifically discusses that changes in phreatophytes are dependent on many factors and describes this as "The specific vegetation community responses cannot be predicted on a site-specific basis. The rate of change in plant community composition also would be highly variable, depending on groundwater drawdown rates and local water elevation recovery, as well as the influence of precipitation and overland and runoff in channels."

- **BLM (2011) <u>does not</u> conclude that wells will go dry.** BLM (2011, p. 3.3-86) makes it clear that the model is not to be used for site specific impacts when BLM states "Although the model results provide valuable insight as to the general, long-term drawdown patterns and relative trends likely to occur from the various pumping scenarios, the model does not have the level of accuracy required to predict absolute values at specific points in time (especially decades or centuries into the future)." BLM (2011, p. 3.3-111) further explains: "For the purposes of this evaluation, it is assumed that wells located within the areas affected by drawdown of 10 feet or greater could experience impacts. Specific impacts to individual wells would depend on the: (1) well completion, including pump setting, depth, yield, predevelopment static and pumping groundwater levels; (2) interconnection between the aquifer in which the well is completed in and the aquifer targeted by the GWD Project; and (3) the magnitude and timing of the drawdown that occurs at the specific location." The level of detail and analysis required to determine the impacts at specific wells was not, nor could it have been, performed as part of the analysis in BLM (2011).

- **BLM (2011) <u>does not</u> conclude existing water rights will be damaged, if not totally destroyed**. BLM (2011, p. 3.3-93) specifically states "This impact evaluation is not intended to determine reasonable (or unreasonable) effects to water rights allowable under state law such as the Nevada Revised Statutes (NRS 534.110{4}) that allows for a reasonable lowering of the static water level at the points of diversion for existing water rights provided that the existing water rights can be satisfied." This statement in combination with the statements above regarding the limitations of impact analysis at springs, streams, and wells makes it clear that there is no evidence of water rights being damaged or destroyed within BLM (2011).

Despite these unconditional misrepresentations, Bredehoeft (2011), in contradictory fashion, concedes that the iterative nature of monitoring response data in concert with model updates can improve the current state of model predictions. Bredehoeft states "The models can be improved as the observations are made more coherent with the model results. Monitoring now becomes an iterative process between observations and model improvements—projections can be improved as the monitoring provides new system response data." (Bredehoeft, 2011, p. 7)

5.0 SUMMARY

This report has presented a response to the effects portion of Myers (2011c) for Spring Valley, Myers (2011d) for Cave, Dry Lake, and Delamar valleys, and the misrepresentation of model results found in Bredehoeft (2011).

Myers (2011c) contains several conclusions regarding perennial yield, equilibrium, and capture that are invalid or inappropriate to the permitting of these applications. Burns and Drici (2011) calculate the unappropriated groundwater resources that would be available for appropriation under these applications. By performing this analysis, the unappropriated water resources could be granted to SNWA without exceeding the perennial yield. Myers (2011c) also contains an effects analysis based upon work performed in Myers (2011a and b). Burns et al. (2011a) performed a review of Myers (2011a) and found the conceptual model described in that report to be unsubstantiated and unreliable while D'Agnese (2011a) found the model to be over-constrained and built upon a highly-subjective hydrogelogic framework. These problems continued in Myers (2011c) with the predictive model being driven by model construction errors and subjective interpretations. Additionally, spring flows were not used as calibration targets during model construction and are not accurately represented in the model. If the starting point for spring flow is not accurate, one can have little confidence in the precision of spring flow predictions many years into the future. As such, predictions based on springs that are not capable of being accurately represented, are not very meaningful and should have been described as such in Myers (2011c).

Myers (2011d) uses a very generalized conceptual flow model to make effects predictions for Cave, Dry Lake, and Delamar valleys. This model was reviewed in D'Agnese (2011b) and the earlier foundational RASA model was reviewed as part of BLM (2011). These reviews conclude that the RASA-based model used by Myers (2011d) is not an appropriate tool for effects analysis. This is effectively demonstrated in regards to the rapid response shown in Myers' (2011d) simulated predictions at major springs located at considerable distances away from the SNWA applications. As described in Burns et al. (2011b), there are significant geographic, geologic, and hydrologic impediments that would need to be overcome in order for the effects of pumping SNWA's applications to propagate over such distances. As with Myers (2011c), the Myers (2011d) model also runs predictions out for several thousands of years, which given the uncertainties in these models, is totally inappropriate.

Bredehoeft (2011) contains numerous misrepresentations of model results, specifically those presented in BLM (2011), while at the same time admitting that there are great uncertainties and limitations with current models that will be improved through iterative data collection and modeling.

6.0 References

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