United States Department of the Interior

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Memorandum

To: Project Manager, Nevada Groundwater Projects Office, Bureau of Land Management, Reno, Nevada

From: Deputy State Supervisor, Nevada Fish and Wildlife Office, Reno, Nevada

Subject: U.S. Fish and Wildlife Service Comments on the Draft Environmental Impact Statement (dated June 2011) for the Clark, Lincoln, and White Pine Counties Groundwater Development Project

The following U.S. Fish and Wildlife Service (Service) comments pertain to the *Clark, Lincoln, and White Pine Counties Groundwater Development Project Draft Environmental Impact Statement* (DEIS, dated June 2011). We have focused our review of the DEIS on key issues related to the proposed development of up to 176,655 acre-feet per year (afy) of groundwater from Spring, Snake, Cave, Dry Lake, and Delamar valleys. These key issues are summarized below, with the attachment providing corroborating information and additional technical comments. As a cooperating agency, we have brought many of these concerns to the Bureau of Land Management's (BLM) attention through our review of administrative versions of the DEIS.

While we have focused the majority of our comments on issues related to groundwater withdrawal, we acknowledge the potential for adverse effects to terrestrial resources from construction and operation of the Clark, Lincoln, and White Pine Counties Groundwater Development Project (GWD Project). We anticipate working with BLM on these issues during section 7 consultation, which will include considerations for the federally-listed desert tortoise and several technical assistance species (e.g., greater sage-grouse). Additionally, we anticipate meeting with the Southern Nevada Water Authority (SNWA) and BLM in the near future to discuss migratory bird and bald and golden eagle issues. These meetings may result in recommendations to add measures (or modify existing applicant committed measures) in order to avoid, minimize, or mitigate adverse effects to these species.

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Magnitude of the Proposed Groundwater Development

The magnitude of the proposed groundwater withdrawal is large compared to the rate of recharge in the project basins (rate of natural replenishment). Consequently, the GWD Project is likely to result in widespread and substantial declines in groundwater levels within the project basins and significant declines in groundwater levels in some adjacent basins, accompanied by impacts to springs, stream baseflows, wetlands and groundwater-dependent vegetation where the latter are present.

In particular, project pumping under the Proposed Action represents approximately 115 percent of the annual rate of recharge (natural replenishment) to aquifers in Cave, Dry Lake, and Delamar Valleys, at least 98 percent of the annual rate of recharge to aquifers in Spring Valley, and 140 percent of the unallocated groundwater recognized by the draft Utah-Nevada interstate agreement in the Nevada portion of Snake Valley (45 percent or more of the annual rate of groundwater recharge to the valley as a whole), a total of 158 million gallons per day for municipal water supply in perpetuity. Project pumping under Alternative A represents approximately 60 percent of annual recharge to Cave, Dry Lake, and Delamar Valleys, at least 65 percent of annual recharge to Spring Valley, and 100 percent of the unallocated groundwater recognized by the draft Utah-Nevada interstate agreement in the Nevada portion of Snake Valley (30 percent or more of annual recharge to the valley as a whole), a total of 102 million gallons per day in perpetuity.

In total, pumping under the Proposed Action represents at least 75 percent of annual recharge to the aquifers of the project basins. Pumping under Alternative A, although less, represents at least 50 percent of annual recharge to these semi-arid basins. Because the rate of groundwater pumping (under either scenario) is large compared to the rate of natural replenishment, the project is likely to result in widespread, significant declines in groundwater levels and the capture of springs, streams, and evapotranspiration (natural forms of discharge) within and beyond the project basins over time. Springs, streams, and wetlands are likely to be among the first resources impacted, followed by groundwater-dependent flora and fauna. The DEIS should disclose the magnitude of the proposed pumping in relation to the water budgets of the project basins as a basis for providing a general description of the scope of the impacts which are likely to result from the project, in addition to presenting detailed predictions of drawdown and impacts to individual springs, streams, and other resources which, due to their specificity, are less certain.

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Model Uncertainties and Limitations

In an effort to quantify the potential effects of the proposed pumping, a groundwater flow model has been constructed and calibrated and simulations have been performed to estimate drawdown

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and changes in spring and stream discharge. Many of the uncertainties associated with the model and model predictions are unavoidable given the sparsity of geologic and hydrologic information. However, a great deal of complexity has been built into the model which is unsupported by available hydrologic observations, compounding uncertainties associated with the model and model predictions. Some of these complexities (e.g., complex variations in the assignment of aquifer parameters within major hydrogeologic units) are physically tenable, but greatly exceed the information content of available calibration (hydrologic) data. Other structural complexities appear to be largely based on assumptions about the hydrologic character of geologic structures, notably the incorporation of a large number of regional faults and collections of subsidiary faults as 'horizontal flow barriers' which extend over great distances and to great depths. Still other elements of the model structure (the truncation of the model domain at the Snake Valley boundary) appear to have no physical basis, but significantly affect predictions of drawdown and the capacity of the model to predict the effects of project pumping in areas which may be affected. To a large degree, the model reflects a particular concept of the groundwater flow system and the model predictions are a manifestation of that concept. Collectively, these complexities and assumptions produce uncertainties in the model predictions which have not been adequately evaluated or disclosed in the DEIS, or by reference in the model reports.

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Disclosure of Model Uncertainties

Section 3.3.2.8 of the DEIS (*Central Carbonate-Rock Province (CCRP) Model Construction, Calibration, Uncertainty, and Limitations*) includes a general description of the model construction and calibration process and the challenges of model calibration. This same section provides a limited, largely generic discussion of uncertainties associated with the development of the conceptual and numerical models as a result of data limitations, the need to generalize and simplify, and the numerical discretization. It does not, however, include a description of the potential effects of specific model uncertainties on the model predictions. In view of the importance of the flow model predictions to subsequent impact analyses, Section 3.3.2.8 (and complementary sections of the model reports) should be expanded to include a more complete and specific description of uncertainties associated with the structure, boundary conditions, and calibration of the CCRP model and their potential effects on the model predictions, including uncertainties arising in connection with the following: 1) the sparsity and information content of the calibration data; 2) overparameterization (the total number of parameters comprising the model, whether assigned or calibrated); 3) the incorporation of numerous "horizontal flow barriers;" 4) the specification of constant head conditions on the lateral model boundaries; 5) the plausibility of model-calibrated transmissivities of up to 970,000 ft^2/day; 6) poor reproduction of spring discharges; 7) the capacity of the model to reproduce heads in the carbonate aquifer which

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match the elevations of carbonate springs; 8) weak calibration of spring "conductances;" and 9) assumed rates of depth decay of hydraulic conductivity within regional modeling units (RMUs).

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Moreover, drawdown predictions produced using the calibrated model are believed to approximate the minimum areal extent and magnitude of drawdown that will result from project pumping (SNWA, 2010), and yet were used for the impact analyses. Calibrated model conductivities are deemed to be low if anything, while the specific yield assigned to upper valley fill is deemed to represent the highest plausible value(s), i.e., the model represents a minimum diffusivity interpretation of the flow system which yields estimates of the minimum extent of drawdown rather than a best estimate. In an effort to characterize the effects of uncertainties in the calibrated RMU parameters, a bounding simulation has been performed for Alternative A pumping. Whereas the bounding value used for the specific yield of upper valley fill is reasonable (10 percent), the bounding values used for RMU conductivities were a mere 1.5-fold increase over the calibrated values – a fraction of an order of magnitude increase in the value of an aquifer parameter that typically varies orders of magnitude in any particular lithology at the simulated scale. Increases in RMU conductivities above the tested values produced large residuals (reduced the model fit compared to the calibrated model). Is this because the calibrated model is a near perfect representation of the flow system? Or is it because the simulation of groundwater flow is so constrained by the incorporation of 50 plus 'horizontal flow barriers' that a more robust range of RMU aquifer parameters cannot be tested? The description of model uncertainties in both the DEIS and simulation model report (SNWA, 2010) should be expanded to explain this result.

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Disclosure of Model Limitations

Section 3.3.2.8 of the DEIS (*CCRP Model Construction, Calibration, Uncertainty, and Limitations*) includes a general description of the limitations of the model, with a somewhat more detailed discussion provided by reference in the numerical model report (SNWA, 2009). However, the discussion of model limitations should be expanded to disclose that: 1) predicted drawdowns presented and utilized in the DEIS represent the response of a system which is dissected by numerous barriers to lateral groundwater flow (as is evident in 1-foot contours of the predicted drawdowns); 2) actual drawdown due to project pumping may differ significantly from the predicted drawdowns to the extent that some, if not many, of the 50 plus faults (and collections of faults) incorporated in the model as 'horizontal flow barriers' are, in fact, not barriers to groundwater flow; 3) the model is a poor predictor of spring and stream discharge, consequently a poor predictor of pumping-induced changes in spring and stream discharge (i.e., due to the sparsity and information content of spring and stream discharge calibration data, considerable uncertainties concerning mechanisms which give rise to individual spring flows,

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and the weak calibration of spring and stream conductances); 4) the truncation of the model domain at the Snake Valley boundary and specification of constant head conditions on this and other portions of the eastern boundary of the model have compromised predictions of drawdown in Snake Valley and Fish Springs Flat to an unknown degree; 5) due to the truncation of the model domain at the Snake Valley boundary, the model cannot simulate the propagation of project-induced drawdown into basins east of Snake Valley (basins which have been omitted from the model such as Pine, Wah Wah, and Tule Valleys); 6) the truncation of the model domain at the Snake Valley boundary precludes the estimation of cumulative drawdown due to project pumping in Snake Valley and foreseeable future pumping in adjacent Utah basins (e.g., Pine and Wah Wah Valleys); and 7) predictions of drawdown are only indicative of future groundwater level declines to the extent that pumping by other entities does not increase beyond the currently projected levels and no changes in climatic conditions occur over the period of the GWD Project (i.e., in perpetuity).

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Notably, the DEIS (Section 3.3.2.8) states that CCRP model predictions "provide valuable insight as to the general, long-term drawdown patterns and relative trends likely to occur from the various pumping scenarios, but do not have the level of accuracy required to predict absolute values at specific points in time, especially decades to centuries into the future." This section of the DEIS additionally refers the reader to the numerical model report (SNWA, 2009) for a more complete description of the uncertainties and limitations of the CCRP model wherein the model is described as "a reasonable tool for estimating probable regional-scale drawdown patterns and trends over time" (page 8-2). If the predictive capacity of the model is indeed limited to regional-scale assessments and providing insight into general, long-term drawdown patterns and relative trends (as stated), it is not suitable for assessing impacts to site-specific water resources such as springs, perennial stream reaches, wetlands, and flowing artesian wells at particular locations, or the biological resources that depend on them. The text of the DEIS and model report should be modified to reflect that the CCRP model (in its present state) lacks the capacity to predict site-specific impacts to water resources (such as those found on Pahranagat National Wildlife Refuge (NWR) and Fish Springs NWR), but has been used nonetheless as a basis for the impact analyses since currently the best tool available. Specifically, the limitations of the model are not limited to predicting impacts at specific points in time (with accuracy), but also include predicting impacts at specific locations (e.g., specific springs, streams, and wetlands). The text should be modified to reflect that model predictions of drawdown and changes in spring/stream discharge at specific locations are highly uncertain due to the limitations of the flow model, and consequently the analysis of impacts to groundwater-dependent aquatic species is highly uncertain.

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Full Disclosure of Potential Impacts to Water Resources

The potential impacts of the GWD Project have not been fully evaluated or disclosed with respect to the following: 1) the impact analyses are based on drawdown predictions produced using the calibrated CCRP model, which yields minimum estimates of the areal extent and magnitude of project-induced drawdown according to the simulation model report (SNWA, 2010); 2) simulated project pumping has been distributed to "minimize pumping effects" in the impact simulations in unspecified ways (Simulation Model Report, November 2009), consequently represents a best case; 3) although not disclosed in either the DEIS or model reports, the vast majority of project pumping has in fact been simulated in upper valley fill which has storage coefficients that are many orders of magnitude higher than that of the regional carbonate aquifer, minimizing estimates of project-induced groundwater level declines; 4) the preponderance of production targets identified to date by the project proponent through exploratory drilling and testing are comprised of carbonate units and the damage zones of range-bounding faults, yet project pumping has been simulated almost exclusively in higher storativity upper valley fill; 5) the impact analyses are based on the areal extent of model-simulated drawdown in amounts equal to or greater than 10-feet, despite the potential for substantial impacts to springs, streams, wetlands, and water-dependent biological resources as a result of lesser amounts of drawdown; 6) simulated declines in the elevation of the water table (located primarily in valley fill and other surficial units) have been used to estimate potential impacts to carbonate springs, rather than predicted changes in hydraulic head in carbonate units which are deemed to be the source of the springs; 7) project pumping is expected to continue in perpetuity, but the impact analyses are based on simulations of project-induced drawdown at 200 years after full build-out (FBO); 8) the impact analyses are based on simulated drawdown at 200 years after FBO, even though the effects of project pumping are expected to take hundreds to thousands of years to fully develop; and 9) reasonably foreseeable, future groundwater development has been narrowly defined for the purposes of the cumulative impact simulations, as discussed further below.

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Sufficiency of the Cumulative Effects Analysis

We find the cumulative effects analysis for the DEIS to be too limited, both in timeframe and geographic scope. The DEIS describes the cumulative effects analysis for Tier 1 project facilities as including "the combined effects of the project facilities, past and present actions, and the reasonably foreseeable projects *within the time frame required to complete this EIS process* (expected to be 2012)" (emphasis added). As it pertains to groundwater development, the DEIS describes reasonably foreseeable projects as those that were known at the time the modeling effort was initiated in 2006 (Section 2.9, page 2-90). This does not appear to reflect guidance in BLM's National Environmental Policy Act (NEPA) Handbook (H-1790-1), in which section

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6.8.3.3 recommends basing the timeframe of the cumulative effects analysis on the duration of the direct and indirect effects of the proposed action and alternatives. Given that construction and operation of the GWD Project and resulting effects (both direct and indirect) on resources will be long-term, it does not seem reasonable to be overly prescriptive and limiting in the cumulative effects analysis. On the other hand, carrying the cumulative effects analysis out far into the future, as would happen if BLM considered the full duration of indirect effects, would require an unreasonable amount of speculation about future activities. Some compromise must be found in order to ensure that BLM decision makers have complete information for evaluating the consequences of approving this project. Additionally, being less restrictive with the criteria for determining Reasonably Foreseeable Future Actions (RFFA) could increase the longevity of the Tier 1 analysis and the value for subsequent tiering, as described in BLM's NEPA Handbook.

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The BLM outlines its criteria for determining which actions to consider as Reasonably Foreseeable Future Actions (RFFA) in Section 2.9.1.2 (*Reasonably Foreseeable Future Actions*, page 2-93) of the DEIS. These include evidence of continued development activity within the past year for projects on private land; and for projects with an approved Environmental Assessment (EA) or EIS, there must be evidence of continued development activity within a year of receiving a Record of Decision and Right-of-Way grant. This one-year timeframe seems overly restrictive given the long-term nature of the GWD Project. Some actions not included in the Tier 1 cumulative effects analysis have shown considerable recent commitment of resources by the project applicant in order to meet environmental compliance requirements, even if there has been no activity within the last year. For example, the Coyote Springs Investment (CSI) development in Coyote Spring Valley (Clark and Lincoln Counties) is not included in the analysis despite considerable past activity and resources devoted to development of a Multi-Species Habitat Conservation Plan and completion of other environmental compliance documents. The exclusion of this project from the cumulative effects analysis also seems incongruous given the identification of CSI groundwater rights in Coyote Spring Valley as a reasonably foreseeable, future groundwater use (Table 2.9-4, page 2-101). The decision concerning LS Power's White Pine Power Project is similarly confusing: the groundwater development associated with this project is analyzed as "reasonably foreseeable" (with a note that it is assumed the project will start in 2020), but the project itself is described as "on hold" and not included in the GWD Project Tier 1 cumulative effects analysis (page 2-99).

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Other NEPA analyses of a regional and programmatic nature appear to utilize broader criteria for determining RFFA, such as the December 2010 Solar Energy Development Draft Programmatic EIS (Solar PEIS) prepared by BLM and the Department of Energy. The Solar PEIS recognized

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that the cumulative effects analysis could appropriately include activities that would occur during the timeframe used for the general analysis in the PEIS, although it was also recognized that little to no information on projects was available past five to ten years. In cases where project specifics are unknown and analyses are done conceptually, assumptions can be made (and described in the text) regarding the overall potential for future development in the cumulative effects analysis area, as was done in the Solar PEIS. Also, we note that the two documents are inconsistent in the way they classify projects as RFFA. For example, the BrightSource Coyote Springs Solar project is described as a RFFA in the Solar PEIS, but it is not included as a RFFA in the GWD Project DEIS.

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Additionally, the GWD Project DEIS should better explain why there are relatively few reasonably foreseeable, future groundwater uses in the hydrologic Region of Study. Again, it appears that BLM is defining RFFA too narrowly considering the GWD Project timeline and how long it will take pumping impacts to reach full effect. It does not seem reasonable to assume that, over the lifetime of the GWD Project, there will be no additional groundwater extractions from basins within the Region of Study that have unallocated water (e.g., White River Valley, Utah side of Snake Valley). Also, based on the information presented in Table 2.9-5 of the DEIS (*Estimated Cumulative Total Groundwater Consumptive Use by Hydrologic Basin*), it appears that development of some of the existing permitted groundwater rights were not considered by BLM to be RFFA. In our opinion, it seems reasonable to assume that currently undeveloped but permitted groundwater rights *will* be put to use in the future and, therefore, the potential consumptive use portion of these groundwater rights should be considered RFFA.

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Lastly, the geographic scope of the cumulative effects analysis does not encompass the area in which project effects will occur. Truncation of the model domain at the Snake Valley boundary limits BLM's ability to analyze cumulative effects resulting from future groundwater uses in Snake Valley and adjacent basins on resources of concern in Utah, including at Fish Springs NWR.

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Potential for Impacts to Groundwater-dependent Ecosystems and Associated Fauna

Many endemic and rare species (including federally listed species and others that are candidates for listing under the Endangered Species Act) within the Region of Study inhabit ecosystems that are greatly influenced by or depend wholly on groundwater availability for their persistence. Small changes or fluctuations in groundwater levels (i.e., less than 10 feet) could affect spring discharge (Mayer and Congdon 2008); the extent of aquatic systems (Patten et al. 2008); and composition, cover, and structure of wetland, meadow, riparian and phreatophytic shrubland

C14 cont'd vegetation communities (Stromberg et al. 1996, Castelli et al. 2000, Elmore et al. 2003, Patten et al. 2008). However, predicting and interpreting ecosystem response is complex (e.g., plant species will respond differently) and can be confounded by numerous factors (Naumburg et al. 2005). Changes in the magnitude, frequency, timing, and duration of spring or stream annual and low flows could substantially affect water temperature, chemistry, and other physical habitat components. This in turn could affect aquatic communities by: 1) altering habitat needed by fauna during particular life stages (e.g., breeding, spawning, foraging, and over-wintering habitat for fish or frogs); 2) modifying overall assemblage structure and complexity; and 3) potentially rendering systems less resilient (Kennen and Riskin 2010).

C15 While BLM acknowledges in the DEIS that groundwater-dependent ecosystems are sensitive to groundwater drawdown of less than ten feet, BLM has chosen to base its impact analysis primarily on the areal extent of model-simulated drawdown in amounts equal to or greater than ten feet. This is based on several lines of reasoning, including the unavoidable uncertainty associated with the CCRP model predictions and the fact that changes in groundwater levels of less than ten feet can be difficult to distinguish from seasonal and annual fluctuations in groundwater levels. However, the full extent of potential impacts from project pumping is not disclosed by utilizing this approach. We agree that the regional model has limited utility for predicting site-specific impacts and that there is a high degree of uncertainty associated with the model predictions in terms of location, timing, and amount of drawdown. Nonetheless, actual impacts could be higher or lower than what is currently predicted at any particular location, including at sites outside the 10-foot drawdown contour. Additionally, it should be possible to distinguish seasonal and other climatic variations in groundwater levels and spring flows from pumping-induced changes by monitoring spatial and temporal trends (i.e., through a robust monitoring program), though this will depend in part on the amount and rate of pumping-induced change and the amount of natural variation in each system. Because groundwater-dependent ecosystems are sensitive to small changes in groundwater levels, the prediction of which is subject to numerous uncertainties (as outlined above), it would behoove BLM to consider the potential for impacts more broadly by considering the potential for impacts beyond the model-predicted 10-ft drawdown contour. For example, the fact that the CCRP model predicts substantial flow reductions at Flag Springs, which falls outside the 10-foot drawdown contour, by 200 years after FBO supports utilizing something other than the 10-ft drawdown contour for delineating the area of potential impact.

C16 In view of the above, we find that the DEIS conveys an unwarranted level of certainty concerning the potential for effects to aquatic fauna that occur outside the ten-foot drawdown contour. For example, based on CCRP model predictions, BLM concludes that pumping under

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all alternatives would "not affect" federally-listed fish in Pahranagat Valley (Hiko White River springfish, White River springfish, and Pahranagat roundtail chub) and the Muddy River Springs Area (Moapa dace; page 3.7-44), and would pose only "slight risk" to aquatic habitats in Pine Valley, Tule Valley, Wah Wah Valley, and Fish Springs Flat (page 3.7-46). Similarly, BLM concludes in Section 3.14.2 of the DEIS (*Special Designations and Lands with Wilderness Characteristics, Environmental Consequences*) that pumping under all alternatives would not compromise Pahranagat NWR (Fish Springs NWR is notably absent from the discussion of environmental consequences to special designations; we request that this be remedied).

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We request that BLM present its effects conclusions within the context of model uncertainties and limitations. We note that the DEIS presents a limited discussion in this regard in support of the "slight risk" predictions to aquatic resources in Utah basins adjacent to Snake Valley, but fails to explain that the "no effect" conclusion to Pahranagat Valley aquatic resources is also subject to considerable uncertainty. Additionally, we noticed that there is no mention in Section 3.7.2.9 (*Aquatic Biological Resources- Environmental Consequences: Other Special Status Fish Species, Invertebrates, and Utah Pumping Effects*) of the potential for adverse impacts to two Utah aquatic species of concern that occur in northern Snake Valley: the sub-globose snake pyrg (a species that has been petitioned for listing under the Endangered Species Act) and least chub (a candidate for listing) (see page 3.7-44 through 3.7-46 and other relevant pages for other alternatives). The CCRP model predicts a small amount of flow reduction at Foote Reservoir Spring, which is in the general area occupied by least chub and sub-globose snake pyrg.

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Ecological Uncertainties

In addition to the uncertainties associated with the CCRP model and the other hydrologic analyses, ecological responses to groundwater drawdown and diminished flow are equally uncertain. For example, we do not know how endemic fish and aquatic invertebrates in these particular spring systems will respond to incremental decreases in flow (and the rate of this response), and if there will be ecological thresholds where a small change in flow leads to a large system response (which could result in loss of viable fish populations). Empirically based flow-ecology response models are needed to provide insight into those aspects of flow needed to maintain the integrity of groundwater-dependent ecosystems and viable populations of aquatic fauna within the Region of Study (Kennen and Riskin 2010). We request that BLM require the collection of empirical data which will support the development of quantitative relationships between flow variables and ecological response variables, and that this be done prior to future tiered NEPA so as to better inform these analyses. In other words, we request that BLM include monitoring recommendation GW-MN-AB-3 as a condition of the Right-of-Way permit. Such studies, including selection of the Principal Investigators, should be administered by an oversight

C19 cont'd group such as the Biological Work Group and Executive Committee established by the Department of Interior-SNWA Stipulations.

C20 *Potential for Impairment of Public Trust Resources*

We continue to be concerned about the large predicted impacts to biological resources in Spring Valley as a consequence of the proposed groundwater development. Because project pumping represents a substantial proportion of annual recharge to aquifers in Spring Valley under all alternatives, we anticipate extensive and sizeable impacts to groundwater-dependent ecosystems and associated fauna in this valley, including northern leopard frog, springsnails, greater sage-grouse, relict dace, and potentially Pahrump poolfish, depending on the effectiveness of proposed mitigation measures (see discussion below).

C21 We are also greatly concerned about the potential for substantial and potentially irretrievable impacts to Big Springs and nearby smaller springs in southern Snake Valley as a consequence of proposed groundwater pumping. The Big Springs Creek/Lake Creek system is unique in that it harbors an assemblage of five native Bonneville Basin fish and two springsnail species, both of which have been petitioned for listing under the Endangered Species Act. One of these two springsnail species, the longitudinal gland pyrg, is only known from the Big Springs system (including Stateline Springs) and two smaller springs that are relatively close by. Cessation of flow in these springs would result in complete loss of all known longitudinal gland pyrg populations, and it is possible that significant or complete losses would occur with decreased flow (i.e., something short of flow termination), especially if sustained over the long-term.

C22 Current CCRP model predictions show Big Springs ceasing to flow by 30 years after full build-out under both the Proposed Action and Alternative A scenarios, and within 75 years after full build-out under most of the other alternatives (note: we assume that under these scenarios, nearby smaller springs will go dry even sooner). Even if pumping does not occur in Snake Valley (e.g., Alternative E), the CCRP model still indicates potential for substantial impacts to the Big Springs Creek system and nearby springs due to Spring Valley pumping (78% reduction in flow at Big Springs by 200 years after full build-out). Potential impacts could be even greater when past, present, and RFFA are considered, as demonstrated in the cumulative effects analysis. C23 Reductions of this magnitude will likely imperil the longitudinal gland pyrg, which is a consequence of project implementation that we find unacceptable. Therefore, we request that BLM require specific protection measures for those springs that harbor longitudinal gland pyrg in order to ensure persistence of this species, with implementation of these measures linked to specific monitoring thresholds. These measures should apply to all of the alternatives considered in the DEIS and should be included as a condition of the Right-of-Way permit. We would like to

C23 cont'd work with BLM and SNWA to establish the protection measures as part of the informal section 7 consultation process.

C24 We are also concerned about potential impacts to aquatic systems in northern Snake Valley, Tule Valley, and at Fish Springs NWR. These areas contain populations of the least chub, Columbia spotted frog, northern leopard frog, and the sub-globose snake pyrg. Additionally, we are concerned about potential impacts to aquatic systems in Pahranagat Valley, including valley-floor springs and wetland and riparian areas on Pahranagat NWR. Impacts to these areas are predicted to be minimal at most at 200 years after FBO. However, we believe that impacts to northern Snake Valley, adjacent valleys in Utah (including Fish Springs Flat), and Pahranagat Valley may exceed current predictions in view of uncertainties concerning the underlying flow model and units of completion of the simulated production wells versus actual future wells.

C25 Additionally, the impact analyses have so far been limited to a time corresponding to FBO plus 200 years, which falls short of the time required for the full effects of project pumping to develop (i.e., the time required for the groundwater system to reach a new state of equilibrium). Consequently, we believe that maximum drawdown associated with project pumping, both in terms of magnitude and areal extent, could exceed current predictions for FBO plus 200 years. Therefore, the DEIS should present a thorough discussion of groundwater-dependent resources in these areas, the potential for effects to these resources, and how effects will be avoided.

C26 ***Effectiveness of Proposed Plans for Monitoring, Management, and Mitigation***

The following comments pertain to the various monitoring, management and mitigation (3M) plans that are included as either applicant committed measures or proposed BLM mitigation measures in the DEIS.

C27 *Monitoring, Management, and Mitigation Plans under Stipulated Agreements*

To date, implementation of the Spring Valley Stipulation and the Delamar, Dry Lake, and Cave Valley Stipulation (Stipulations) has primarily involved development of monitoring plans, which while needed, are not in and of themselves protective of federal trust resources. Additionally, while the Stipulations establish a framework and process for working together to achieve common goals, they do not provide specific assurances regarding unacceptable level(s) of impact and management responses, including mitigation. Therefore, BLM should not rely on them unduly at the Tier 1 NEPA stage as a means of mitigating adverse impacts. "Unreasonable Adverse Effect," which is to be avoided per the Stipulations, has yet to be defined and how specifically this goal will be achieved has not been specified to date. For example, when or if any specific mitigation action would be implemented, and the "triggers" that would lead to implementation of these actions, is uncertain and/or not specified. Additionally, the potential

C27 cont'd effectiveness of proposed mitigation actions (e.g., redistribution of pumping, curtailment or cessation of pumping, etc.) to avoid or reduce impacts to listed and technical assistance species should be thoroughly examined in order to minimize the possibility of mitigation failure. The results of this analysis should be disclosed (along with any anticipated residual impacts) in the DEIS. Lastly, the management and mitigation portions of the Stipulation 3M plans need to be sufficiently developed (i.e., detailed) by the time future tiered NEPA analyses are done for this project, in order to more accurately assess their effectiveness at avoiding, minimizing, and mitigating project impacts. This will help BLM to determine what additional mitigation measures, if any, are needed and should therefore be included as terms and conditions in future Records of Decision for this project.

C28 *Snake Valley Monitoring, Management, and Mitigation Plan*

The development of a 3M Plan for Snake Valley (similar to that developed for Spring Valley) has been proposed as a means of mitigating the impacts of project pumping in Snake Valley, and draft guidance for developing this plan is provided in Appendix B of the DEIS. We recommend and support inclusion of this measure as a term and condition for BLM's issuance of the Right of Way permit. We also appreciate BLM including other Department of Interior agencies and the States of Nevada and Utah in the management (oversight) committee and the technical working group responsible for developing the Snake Valley 3M Plan. It is crucial that the Snake Valley 3M Plan is developed and finalized through a multi-party process that includes the relevant resource agencies with state and federal trust responsibilities. While BLM would have authority over the Snake Valley 3M Plan, we envision that BLM will foster an atmosphere of consensus building amongst the various parties, as has been done for the Spring Valley and DDC Stipulations. Success of the Snake Valley 3M Plan (and the overall adaptive monitoring and management approach) will require participation from these multiple stakeholders, as well as a commitment of funding over the long-term, and we are committed to participating in this process.

C29 Given the amount of time between finalization of the Tier 1 EIS and SNWA's proposed development of groundwater in Snake Valley, it seems reasonable to develop the Snake Valley 3M Plan in stages as described in Appendix B. However, we request that a comprehensive 3M Plan be developed and approved by the oversight management group *prior* to initiation of tiered NEPA analyses in Snake Valley and well in advance of pumping so as to allow for sufficient collection of baseline data. We also recommend that prior to publication of the Final EIS and ROD for this first tier of the project, BLM work with all parties (including Department of Interior agencies, Nevada Department of Wildlife, and Utah Division of Wildlife Resources) to develop an outline of required components of a Snake Valley 3M Plan that is inclusive of all

C29 cont'd party needs. The agencies need an opportunity outside of the NEPA process to interact with BLM and SNWA about the content of the draft 3M Plan.

C30 The initial Snake Valley 3M Plan, which is to be developed by the technical working group within one year of the Tier 1 EIS Record of Decision, should also include the following elements:

- Identification of specific and quantifiable goals and objectives for management of biological resources of concern;
- Identification of the minimum number of years of baseline monitoring that will be conducted;
- Identification of existing biological monitoring sites to include in the Snake Valley 3M Plan and additional sites to be monitored under the plan;
- Identification of the "initial" biological and hydrologic monitoring area (which can change over time, if necessary, based on observed or model-predicted impacts);
- Identification of studies that will be implemented (and timeline for implementation) to investigate spring flow-ecological response relationships;
- Commitment by SNWA to maintain UGS or USGS hydrologic monitoring at specific sites, if such monitoring were to lapse in the future; and
- Commitment by SNWA to update the CCRP groundwater flow model to include basins adjacent to Snake Valley that contribute flow to regional springs in Fish Springs Flat, or to use another regional model(s) approved by the technical working group that includes these basins.

C31 That being said, we still have serious concerns regarding the Snake Valley segment of this proposed project, and the ability of a 3M Plan to satisfy all of those concerns. For example, it should be noted in the DEIS that monitoring cannot provide "early warning" of the propagation of impacts in cases where resources of concern are located close to production wells, as is the case with Big Springs Creek/Lake Creek and nearby springs occupied by longitudinal gland pyrg. Even where early warning is possible, meaningful mitigation options must be available. The rate of pumping proposed in Snake Valley for all alternatives except D and E represent a significant proportion of the basin water budget (e.g., a large fraction of annual groundwater recharge). Under such circumstances, the development of unacceptable levels of drawdown cannot be effectively mitigated by rotating pumping from one well to another. Significant reductions in pumping, or the cessation of pumping, are the only effective mitigations under such conditions. BLM's own model predictions indicate that a substantial period of time (decades to 100 years or more) would be required for the groundwater system of southern Snake Valley to

C31 cont'd recover substantially following years of project pumping in Snake Valley at rates proposed under Alternative A, reducing the efficacy of the proposed mitigation measures – up to and including the cessation of project pumping.

C32 Therefore, as mentioned previously, specific and binding measures are needed up-front (i.e., before issuance of the ROW permit for Spring and Snake Valley laterals) to ensure persistence of the longitudinal gland pyrg, which is only known from southern Snake Valley and is likely to be severely impacted by project pumping.

C33 *Adaptive Management Plan*

An Adaptive Management (AM) approach is necessary for a large project such as this that is fraught with uncertainties regarding location, timing, and amount of impacts and the effectiveness of mitigation actions. However, the AM plan outlined in the DEIS, as well as the Spring Valley and DDC Stipulation monitoring plans, are not specific enough at this point in time and cannot provide assurances that adverse effects to species of concern will be avoided or successfully mitigated. An effective AM Plan must do more than outline a process for working toward common goals. A key first step in the AM process is the identification of goals and objectives for the management of biological resources, and these need to be quantifiable and measurable instead of vague concepts (Ruhl and Fischman 2010). Criteria for measuring success and the triggers for initiating mitigation actions, including reinitiation of section 7 consultation, should be clearly articulated. While we recognize that defining these criteria and triggers is a very difficult task and will take time (and more data), and that the Biological Work Group for the Spring Valley Stipulation has initiated work on this front, we believe that BLM should require assurances up-front (at the Tier 1 stage) that the Proposed Action will not put at risk the continued existence of species. This is of high importance when it comes to managing SNWA's groundwater withdrawal to ensure the long-term viability of the longitudinal gland pyrg in Snake Valley and the White River spinedace, Flag pyrg, and Butterfield pyrg in White River Valley--species that have potential, based on our current understanding of project impacts, to be substantially impacted by this project throughout most, if not all, of their global range. Since many of the resources of management concern that are subject of the AM plan are Service trust responsibilities, the Service should be actively involved in this AM plan; therefore, we request a role in the annual review process for assessing project impacts, as reference in the AM plan.

C34 ***BLM Selection of a Preferred Alternative***

While BLM has not identified a preferred alternative in the DEIS, it does identify Alternative A as a reasonable groundwater development scenario to help focus the public's review of the various alternatives. Additionally, BLM has requested public input regarding the Snake Valley

C34 cont'd

portion of the proposed project due to the high level of controversy and concern expressed by numerous cooperating agencies, including the Service.

As explained above, we are concerned about potential impacts to aquatic species in Snake Valley and adjacent basins in Utah as a consequence of additional groundwater development in Snake Valley. Since any production wells installed for the GWD Project in Snake Valley would be constrained to the Nevada side of the basin and to the southern part of the valley, we conclude that impacts to southern Snake Valley aquatic systems (e.g., Big Springs) are unavoidable under any alternative that includes Snake Valley pumping. Because of these concerns, we request that BLM select Alternative E, which does not include the Snake Valley lateral pipeline, as its preferred alternative. Based on BLM's model predictions, Alternative E will result in less extensive and/or less severe impacts to groundwater-dependent ecosystems and associated fauna in Snake Valley and adjacent basins of the Great Salt Lake Desert Groundwater Flow System than Alternative A and the other alternatives. Unlike the main pipeline, the Snake Valley lateral is not authorized under the Lincoln County Conservation Recreation and Development Act (LCCRDA), nor has a final interstate agreement on the management of groundwater resources in Snake Valley been reached, as required by LCCRDA. Additionally, water rights hearings on SNWA's Snake Valley applications have not been set, nor will they likely occur any time soon. These factors, considered together, give credence to Alternative E as a potential preferred alternative.

C35

We also recommend that BLM consider selecting one or more of the pipeline alignment options (Alignment Options 1-4). Most of these alignment options appear to reduce impacts to biotic resources by locating stretches of the power line or pipeline in or near areas that have been previously disturbed, or by tying into other proposed transmission projects. It appears that Alignment Option 1 (Humboldt-Toiyabe Power Line Alignment) and Alignment Option 3 (Muleshoe Substation and Power Line Alignment) would have reduced construction acreage impacts to numerous special status species, and Alignment Option 3 would result in fewer impacts to perennial water sources. Alignment Option 4 (North Delamar Valley Pipeline Alignment) also appears to reduce construction impacts to numerous special status species, but would result in slight increases in habitat impacts to others (e.g., pygmy rabbit). Alignment Option 2 (North Lake Valley Pipeline and Power Line Alignment) would create additional impacts to northern leopard frog, Lake Valley pyrg, and greater sage-grouse by potentially affecting an additional lek and more brood rearing habitat, rendering it (at least upon initial review) to be less preferable to other alignment alternatives.

C36 ***Additional Considerations***

Given the high level of concern regarding the potential for impacts to aquatic resources in Utah, including at Fish Springs National Wildlife Refuge, we request that BLM include in the groundwater flow model those Hydrographic Basins to the east of Snake Valley that may be hydraulically connected and contribute subsurface flow to the Fish Springs Flat area (e.g., Pine Valley, Wah Wah Valley, Tule Valley, etc.). We also request that BLM include the *entirety* of the Fish Springs Flat area within the model domain so as to capture not only the major spring discharge areas on the refuge in a physically meaningful way, but also the wetlands that are dependent on this discharge. If these additional basins are not included in the model for the Tier 1 EIS analysis, then at a minimum, BLM should require SNWA to expand the model domain in this area prior to tiered analyses for Spring Valley and Snake Valley groundwater withdrawal.

C37 We also request that BLM not issue a Notice to Proceed for any particular segment of the pipeline, such as the laterals into Cave Valley, Spring Valley, or Snake Valley, until such time as SNWA secures the groundwater rights in these valleys and any pending litigation regarding these rights is resolved. In particular, we wish to avoid a situation where the pipeline is constructed in a valley prior to SNWA securing water rights in that valley.

If you have any questions regarding this correspondence or require additional information, please contact myself or Jill Ralston, Deputy Field Supervisor at (775) 861-6300.

Jill A. Ralston

Attachment

cc:

Project Leader, Fish Springs National Wildlife Refuge, U.S. Fish and Wildlife Service, Ibapah, Utah
Project Leader, Desert National Wildlife Refuge Complex, U.S. Fish and Wildlife Service, Las Vegas, Nevada (attn: Laurie Simons)
Regional Director, U.S. Fish and Wildlife Service Region 1, Portland, Oregon, attn: Tim Mayer
Regional Director, U.S. Fish and Wildlife Service Region 6, Denver, Colorado, attn: Meg Estep
Regional Director, U.S. Fish and Wildlife Service Region 8, Sacramento, California
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General Hydrology Comments	
C38 3.3.2.9 to 3.3.2.14	**Magnitude of the Proposed Groundwater Development.** The magnitude of the proposed groundwater development is large compared to the rate of recharge in the project basins (rate of natural replenishment). Consequently, the project is likely to result in widespread and substantial declines in groundwater levels within the project basins and significant declines in groundwater levels in some adjacent basins, accompanied by impacts to springs, stream baseflows, wetlands and groundwater-dependent vegetation where the latter are present. In particular, project pumping under the Proposed Action represents approximately 115 percent of the annual rate of recharge (natural replenishment) to aquifers in Cave, Dry Lake, and Delamar Valleys, at least 98 percent of the annual rate of recharge to aquifers in Spring Valley, and 140 percent of the unallocated groundwater recognized by the draft Utah-Nevada interstate agreement in the Nevada portion of Snake Valley (45 percent or more of the annual rate of groundwater recharge to the valley as a whole), a total of 158 million gallons per day for municipal water supply in perpetuity. Project pumping under Alternative A represents approximately 60 percent of annual recharge to Cave, Dry Lake, and Delamar Valleys, at least 65 percent of annual recharge to Spring Valley, and 100 percent of the unallocated groundwater recognized by the draft Utah-Nevada interstate agreement in the Nevada portion of Snake Valley (30 percent or more of annual recharge to the valley as a whole), a total of 102 million gallons per day in perpetuity. In total, pumping under the Proposed Action represents at least 75 percent of annual recharge to the aquifers of the project basins. Pumping under Alternative A, although less, represents at least 50 percent of annual recharge to these semi-arid basins. Because the rate of groundwater pumping (under either scenario) is large compared to the rate of natural replenishment, the project is likely to result in widespread, significant declines in groundwater levels and the capture of springs, streams, and evapotranspiration (natural forms of discharge) within and beyond the project basins over time. Since springs, streams, and wetlands occupy the top of the hydrologic system, they are likely to be among the first resources impacted, followed by groundwater-dependent biological resources and vegetation. The EIS (ES 2.13 and the introductory text of Sections 3.3.2.9 to 3.3.2.14) should disclose the magnitude of the proposed pumping in relation to the water budgets of the project basins as a basis for providing a general description of the scope of the impacts which are likely to result from the project, in addition to presenting detailed predictions of drawdown and impacts to individual springs, streams, and other resources which, due to their specificity, are less certain.
C39 3.3.2.8, Numerical Model Reports SNWA 2009b, SNWA 2010a & 2010b, and the Simulation Model Report (dated Nov 2009)	**Uncertainties and Limitations Associated with the CCRP flow model and predictions.** In an effort to quantify the potential effects of the proposed pumping, a groundwater flow model has been constructed and calibrated and simulations have been performed to estimate drawdown and changes in spring and stream discharge. Many of the uncertainties associated with the model and model predictions are unavoidable given the sparsity of geologic and hydrologic information. However, a great deal of complexity has been built into the model which is unsupported by available hydrologic observations, compounding uncertainties associated with the model and model predictions. Some of these complexities (e.g., complex variations in the assignment of aquifer parameters within major hydrogeologic units) are physically tenable, but greatly exceed the information content of available calibration (hydrologic) data. Other structural complexities appear to be largely based on assumptions about the hydrologic character of geologic structures, notably the incorporation of a large number of regional faults and collections of subsidiary faults as 'horizontal flow barriers' which extend over great distances and to great depths. Still other elements of the model structure (the truncation of the model domain at the Snake Valley boundary) appear to have no physical basis, but significantly affect predictions of drawdown and the capacity of the model to predict the effects of project pumping in areas which may be affected. To a large degree, the model reflects a particular concept of the groundwater flow system and the model predictions are a manifestation of that concept. Collectively, these complexities and assumptions produce uncertainties in the model predictions which have not been adequately evaluated or disclosed in the DEIS (Section 3.3.2.8), or by reference in the model reports (SNWA 2009b, the Simulation Model Report dated November 2009, and SNWA 2010a & 2010b).

C40	3.3.2.8, Numerical Model Reports SNWA 2009b, SNWA 2010a & 2010b, and the Simulation Model Report (dated Nov 2009)	**Disclosure of Model Uncertainties.** Section 3.3.2.8 of the DEIS (CCRP Model Construction, Calibration, Uncertainty, and Limitations) includes a general description of the model construction and calibration process and the challenges of model calibration. This same section provides a limited, largely generic discussion of uncertainties associated with the development of the conceptual and numerical models as a result of data limitations, the need to generalize and simplify, and the numerical discretization, but includes no description of the potential effects of specific model uncertainties on the model predictions. In view of the importance of the flow model predictions to subsequent impact analyses, Section 3.3.2.8 (and complementary sections of the model reports) should be expanded to include a more complete and specific description of uncertainties associated with the structure, boundary conditions, and calibration of the CCRP model and their potential effects on the model predictions, including uncertainties arising in connection with the following: 1) the sparsity and information content of the calibration data; 2) overparameterization (the total number of parameters comprising the model, whether assigned or calibrated); 3) the incorporation of numerous 'horizontal flow barriers'; 4) the specification of constant head conditions on the lateral model boundaries; 5) the plausibility of model-calibrated transmissivities of up to 970,000 ft2/day; 6) poor reproduction of spring discharges; 7) the capacity of the model to reproduce heads in the carbonate aquifer which match the elevations of carbonate springs; 8) weak calibration of spring 'conductances'; and 9) assumed rates of depth decay of hydraulic conductivity within regional modeling units (RMUs). Moreover, drawdown predictions produced using the calibrated model are believed to approximate the minimum areal extent and magnitude of drawdown that will result from project pumping (SNWA, 2010b), and yet were used for the impact analyses. Calibrated model conductivities are deemed to be low if anything, while the specific yield assigned to upper valley fill is deemed to represent the highest plausible value(s), i.e., the model represents a minimum diffusivity interpretation of the flow system which yields estimates of the minimum extent of drawdown rather than a best estimate. In an effort to characterize the effects of uncertainties in the calibrated RMU parameters, a bounding simulation has been performed for Alternative A pumping. Whereas the bounding value used for the specific yield of upper valley fill is reasonable (10 percent), the bounding values used for RMU conductivities were a mere 1.5-fold increase over the calibrated values – a fraction of an order of magnitude increase in the value of an aquifer parameter that typically varies orders of magnitude in any particular lithology at the simulated scale. Increases in RMU conductivities above the tested values produced large residuals (reduced the model fit compared to the calibrated model). Is this because the calibrated model is a near perfect representation of the flow system? Or is it because the simulation of groundwater flow is so constrained by the incorporation of 50 plus 'horizontal flow barriers' that a more robust range of RMU aquifer parameters cannot be tested? The description of model uncertainties in both the DEIS and simulation model report (SNWA, 2010b) should be expanded to explain this result.

C41	3.3.2.8, Numerical Model Reports SNWA 2009b, SNWA 2010a & 2010b, and the Simulation Model Report (dated Nov 2009)	**Disclosure of Model Limitations.** Section 3.3.2.8 of the DEIS (CCRP Model Construction, Calibration, Uncertainty, and Limitations) includes a general description of the limitations of the model, with a somewhat more detailed discussion provided by reference in the numerical model report (SNWA, 2009b). However, the discussion of model limitations should be expanded to disclose that: 1) predicted drawdowns presented and utilized in the DEIS represent the response of a system which is dissected by numerous barriers to lateral groundwater flow (as is evident in 1-foot contours of the predicted drawdowns); 2) actual drawdown due to project pumping may differ significantly from the predicted drawdowns to the extent that some, if not many, of the 50 plus faults (and collections of faults) incorporated in the model as 'horizontal flow barriers' are, in fact, not barriers to groundwater flow; 3) the model is a poor predictor of spring and stream discharge, consequently a poor predictor of pumping-induced changes in spring and stream discharge (i.e., due to the sparsity and information content of spring and stream discharge calibration data, considerable uncertainties concerning mechanisms which give rise to individual spring flows, and the weak calibration of spring and stream conductances); 4) the truncation of the model domain at the Snake Valley boundary and specification of constant head conditions on this and other portions of the eastern boundary of the model have compromised predictions of drawdown in Snake Valley to an unknown degree; 5) due to the truncation of the model domain at the Snake Valley boundary, the model cannot simulate the propagation of project-induced drawdown into basins east of Snake Valley (basins which have been omitted from the model such as Pine, Wah Wah, and Tule Valleys); 6) the truncation of the model domain at the Snake Valley boundary precludes the estimation of cumulative drawdown due to project pumping in Snake Valley and foreseeable future pumping in adjacent Utah basins (e.g., Pine and Wah Wah Valleys); and 7) predictions of drawdown are only indicative of future groundwater level declines to the extent that pumping by other entities does not increase beyond the currently projected levels and no changes in climatic conditions occur over the period of the project (i.e., in perpetuity). Notably, the DEIS (Section 3.3.2.8) states that CCRP model predictions 'provide valuable insight as to the general, long-term drawdown patterns and relative trends likely to occur from the various pumping scenarios, but do not have the level of accuracy required to predict absolute values at specific points in time, especially decades to centuries into the future'. This section of the DEIS additionally refers the reader to the numerical model report (SNWA, 2009b) for a more complete description of the uncertainties and limitations of the CCRP model wherein the model is described as 'a reasonable tool for estimating probable regional-scale drawdown patterns and trends over time' (page 8-2). If the predictive capacity of the model is indeed limited to regional-scale assessments and providing insight into general, long-term drawdown patterns and relative trends (as stated), it is not suitable for assessing impacts to site-specific water resources such as springs, perennial stream reaches, wetlands, and flowing artesian wells at particular locations, or the biological resources that depend on them. The text of the DEIS and model report should be modified to reflect that the CCRP model (in its present state) lacks the capacity to predict site specific impacts to water resources, but has been used nonetheless as a basis for the impact analyses since currently the best tool available. Specifically, the limitations of the model are not limited to predicting impacts at specific points in time (with accuracy), but also include predicting impacts at specific locations (e.g., specific springs, streams, and wetlands). The text should be modified to reflect that model predictions of drawdown and changes in spring / stream discharge at specific locations are highly uncertain due to the limitations of the flow model, and consequently the analysis of impacts to groundwater-dependent aquatic species is highly uncertain.
C42	3.3.2.9 to 3.3.2.14, the Simulation Model Report dated Nov 2009, and SNWA 2009b	**Full Disclosure of Potential Impacts to Water Resources.** The potential impacts of project pumping have not been fully evaluated or disclosed with respect to the following: 1) the impact analyses are based on drawdown predictions produced using the calibrated CCRP model, which yields minimum estimates of the areal extent and magnitude of project-induced drawdown according to the simulation model report (SNWA, 2010b); 2) simulated project pumping has been distributed to "minimize pumping effects" in the impact simulations in unspecified ways (Simulation Model Report, November 2009), consequently represents a best case; 3) although not disclosed in either the DEIS or model reports, the vast majority of project pumping has in fact been simulated in upper valley fill which has storage coefficients that are many orders of magnitude higher than that of the regional carbonate aquifer, minimizing estimates of project-induced groundwater level declines; 4) the preponderance of production targets identified to date by the project proponent through exploratory drilling and testing are comprised of carbonate units and the damage zones of range-bounding faults, yet project pumping has been simulated almost exclusively in higher storativity upper valley fill; 5) the impact analyses are based on the areal extent of model-simulated drawdown in amounts equal to or greater than 10-feet, despite the potential for substantial impacts to springs, streams, wetlands, and water-dependent biological resources as a result of lesser amounts of drawdown; 6) simulated declines in the elevation of the water table (located primarily in valley fill and other surficial units) have been used to estimate potential impacts to carbonate springs, rather than predicted changes in hydraulic head in carbonate units which are deemed to be the source of the springs; 7) project pumping is expected to continue in perpetuity, but the impact analyses are based on simulations of project-induced drawdown at 200 years after full build-out (FBO); 8) the impact analyses are based on simulated drawdown at 200 years after FBO, even though the effects of project pumping are expected to take hundreds to thousands of years to fully develop; and 9) reasonably, foreseeable future groundwater development has been narrowly defined for the purposes of the cumulative impact simulations.

C43	3.3.2.8 to 3.3.2.14, Numerical Model Reports SNWA 2009b, SNWA 2010a & 2010b, and the Simulation Model Report (dated Nov 2009)	**Use of the 10-ft simulated drawdown criterion.** Uncertainties concerning the structure of the CCRP model (e.g., the incorporation of numerous horizontal flow barriers unsupported by hydrologic field observations) give rise to uncertainties in the predicted drawdowns that vary significantly from one location to another and are unrelated to the magnitude of the predicted drawdown. For example, the error in predicted drawdown (both absolute and relative) may be greater at a location where 40-ft of drawdown is predicted upgradient of an hypothesized horizontal flow barrier than at a location where 1-ft of drawdown is predicted some distance downgradient of the same hypothesized barrier. Since predicted drawdowns of all magnitudes are subject to uncertainty which varies significantly with location and is not a simple function of the magnitude of the predicted drawdown (due to the incorporation of flow barriers), predicted drawdowns which are less than 10-ft but equal to or greater than 1-ft are generally no more discountable (unlikely) than those which are equal to or greater than 10-ft. Moreover, a long-term decline in head of less than 10-ft in a source aquifer could result in a decrease in discharge at any number of springs within the potentially affected area which would be significant for a species. Because the effects of drawdown in amounts less than 10-ft but equal to or greater than 1-ft are generally neither discountable (unlikely) or insignificant, the analysis of impacts to biological resources should consider predictions of drawdown in amounts equal to or greater than 1-ft, in combination with other relevant information -- including qualitative assessments of potential impacts to the water resource in question and factors contributing to the uncertainty of the predicted drawdown (whatever the magnitude) at the location under consideration.
C44	3.3.2.9 and Simulation Model Report dated Nov 2009	**Simulated distributed pumping for the Proposed Action and Alternatives A, C, D, and E represent best case scenarios with respect to impacts to individual springs and streams and fails to reflect information which is currently available about the prospective locations of production wellfields based on exploratory drilling/testing completed to date by the Project Proponent.** According to the Simulations Report (Section 3.2, p 3-2 to 3-11) and DEIS (Section 3.3.2.9), project pumping was distributed to 'minimize pumping effects' in the impact and cumulative impact simulations performed for the Proposed Action and Alternatives A, C, D, and E. The justification provided is that "This distribution reflects the adaptive management strategies that SNWA plans to use in managing the resource by redistributing pumping to minimize effects" (Simulations Report, p 3-4). However, it is clear that this is not the only criterion SNWA will use to site future production wells. Otherwise, for example, there would be no need for the targeted (and costly) exploration program initiated by SNWA in 2005. Since the production wellfields will not be sited with the sole goal of minimizing pumping effects (including impacts to springs, streams, wetlands, and local supply wells), but will also be influenced by the capacity to produce significant volumes of water at a reasonable cost, this represents a best case scenario even in the absence of information about prospective production targets. Moreover, information which is currently available about the locations of prospective production targets was not utilized in determining the distribution of simulated production wells for the distributed pumping scenarios, nor is it reflected in the locations of the simulated production wells. Specifically, significant exploratory drilling/testing has been completed by the project proponent in Spring Valley (8 exploratory well sites, 14 exploratory/test wells, 2006 to 2008), including the identification of at least three major production targets: the alluvial fan near Swallow Springs, damaged zone of the range-bounding fault on the west side of the valley opposite Sacramento Pass, and Ely Limestone in the southcentral valley floor. Exploratory drilling and testing is less advanced in Cave, Dry Lake, and Delamar Valleys: 6 test/monitoring wells were drilled in 2005, two in each basin. Yet information gleaned from exploratory drilling and testing, including the identification of several promising production targets, is not reflected in the distribution of simulated pumping for the distributed pumping scenarios. Rather, simulated production wells appear to be widely dispersed within the project basins in a way that minimizes predicted drawdown at any one location (as stated). The distribution of simulated project pumping for the distributed pumping scenarios should be a fair representation of what is known today about the potential or likely locations of future production wellfields, whatever percentage of total exploration the current exploration drilling/testing program might represent. Since the distribution of simulated project pumping for the distributed pumping scenarios is based solely on the minimization of pumping impacts, the results of the impact and cumulative impact analyses for the Proposed Action and Alternatives A, C, D, and E represent hypothetical best case scenarios with respect to the effects of pumping and fail to assess impacts to individual springs, streams, wetlands and their associated biological resources to the degree possible as part of this programmatic EIS.
C45	3.3.2.9 and Simulation Model Report dated Nov 2009	**Actual versus simulated units of completion of SNWA production wells.** The EIS should disclose that the results of the impact and cumulative impact analyses may differ significantly from actual impacts depending on the actual versus simulated units of completion and depths of completion of future SNWA production wells. Further, the EIS should disclose whether the depths and units of completion of simulated SNWA production wells, like their areal distribution, have been selected to 'minimize pumping effects' in the impact analyses (Simulations Report, p 3-2 to 3-11) and consequently represent a best case scenario with respect to predicted impacts to water resources and water-dependent resources. For example, wells completed in upper valley fill would result in less simulated drawdown than wells completed in carbonate rocks (or lower valley fill) since the storativity of upper valley fill is much greater than that of the other units in both the model and real world. Moreover, cells representing upper valley fill are underlain and bound laterally by cells representing low permeability 'upper aquitard' at a great many locations in the model (based on a careful inspection of the model cross-sections). To the degree that the completion of future SNWA production wells in upper valley fill has been over-represented in the impact simulations, the lateral extent of drawdown, or magnitude, or both have been underestimated.

C46	3.3.2.9 and Simulation Model Report dated Nov 2009	**Failure to disclose the completion of simulated SNWA production wells (with ramifications for the impact analyses).** The DEIS and Simulations Report (including the DVD) fail to disclose the units of completion of simulated SNWA production wells in either the distributed pumping or POD-related impact simulations. Since the storativity of upper valley fill is much greater than that of other units (in both the model and real world) and cells representing upper valley fill are underlain and bound laterally by cells representing 'upper aquitard' at a great many locations in the model, the impact simulations underestimate the lateral extent of drawdown or magnitude (or both) to the extent that future SNWA production wells have been over-represented as completed in upper valley fill. In contrast, simulated pumping from the carbonate aquifer or portions of fault damaged zones that are in hydraulic connection with the carbonate aquifer would result in greater drawdown (due to the limited storativity of carbonate rocks) and extend over greater distances (propagate through the lower carbonate aquifer unimpeded by units of 'upper aquitard'). Because the production targets identified to date by the project proponent include both the lower carbonate aquifer and the damaged zone of range bounding faults (as well as upper valley fill), and the results of the drawdown simulations are significantly effected by the choice of pumped unit, the units of completion of the simulated production wells should be disclosed. The criteria used to select the units of completion should also be disclosed, accompanied by a description of the potential effects on predictions of drawdown due to project pumping.
C47	Sections 3.3.2.8 & 3.3.2.9, SNWA 2009b, 2010a, and 2010b, and Simulation Model Report dated Nov 2009	**Numerous 'horizontal flow barriers' (HFBs) have been incorporated in the flow model which reflect a particular hypothesis (concept) concerning the hydraulic properties of faults and their degree of influence over the groundwater flow system.** Specifically, the incorporation of over 50 'groups' of HFBs in the flow model appears to be largely based on a hypothesis that the hydraulic character of faults can be inferred from their geologic character (in view of the sparsity of calibration data). The model construction further assumes that faults, and even discontinuous collections of faults of various sizes, comprise significant hydraulic barriers (and/or conduits for flow) over many tens of miles and to great depths (including the full depth of the flow model, 10,000 ft bgs). Additionally, it has been assumed in constructing the model that many faults (or collections of faults) are comprise of both a low permeability core which impedes flow across the fault(s) and a damaged zone of enhance permeability that acts as a high-conductivity conduit for flow parallel to the fault(s), again over great distances and to depths of up to 10,000 ft bgs (at many locations in the study area). That the incorporation of HFBs has had a significant impact on the computed 'branch conductances' is evident in 1-ft contours of the predicted drawdowns. To a large degree, the model reflects a particular concept of the groundwater flow system and the model predictions are a manifestation of that concept. Predicted drawdowns presented and utilized in the DEIS represent the response of a system which is dissected by numerous barriers to lateral groundwater flow. To the extent that some, if not many, of the 50 plus faults (and collections of faults) incorporated in the model as 'horizontal flow barriers' are, in fact, not barriers to groundwater flow, actual drawdown due to project pumping may differ significantly from predicted drawdowns. The latter should be disclosed in the discussion of model uncertainties (Section 2.2.3.8) and a discussion of model uncertainties in the Executive Summary (as an addition to section ES .2).
C48	3.3.2.8 & 3.3.2.9, SNWA 2009b, 2010a, and 2010b, and Simulation Model Report dated Nov 2009	**The incorporation of over 50 HFB's has likely had a significant effect on the calibration of RMU parameters (with ramifications for the results of the impact analyses).** The effects of the incorporation of the HFBs on the calibration of RMU (regional modeling unit) parameters, and consequently the impact simulations, are likely substantial, but have not been assessed or disclosed in the model reports or DEIS.

C49	3.3.2.8, SNWA 2009b & 2010a	**The model appears to be greatly overparameterized (with ramifications for the model calibration and impact analyses).** It's not clear from the Numerical Model Report, DVD, or DEIS how many parameters were optimized as part of the model calibration. A spreadsheet provided on the Numerical Model Report DVD lists over 2000 HUF package parameters (representing RMU properties) and 58 HFB parameters, in addition to drain, stream, and constant head package parameters, with no indication of how many or which parameters were model calibrated (versus assigned). A second spreadsheet lists 'non-derived' parameters (not clearly defined) that were apparently optimized using UCODE -- these number 242, also a very large number. The Numerical Model Report acknowledges that only a 'small number of parameters can be estimated' of the 'large number of parameters in the model' (p 6-45). To that end, they suggest that the optimization focused on the calibration of a set of 10 aggregate parameters 'that combined nearly all the model parameters' (e.g., 'all carbonate horizontal K parameters, all HFB parameters, all UVF horizontal K parameters, all UVF specific storage parameters - see Table 6.6), which were then used to 'raise or lower values for the entire group' during the calibration process. However, it is clear from the numerical model cross-sections that a great many different values of, for example, horizontal conductivity have been assigned to cells representing the lower carbonate RMU. At best, the relative magnitude of these values were determined prior to optimizing the aggregate 'horizontal K parameter for carbonate rocks', so that the optimization of the aggregate parameter was significantly influenced by the assignment of relative values (in addition to the minimization of residuals). At worst, the relative values themselves were optimized during some form of model calibration (not clear from the model report), in which case the calibration was even more overparameterized. In either case, the optimization is not likely to represent an optimal solution to the parameter estimation problem and no doubt reflects a large number of assigned values and (or) assigned relative values. Given the complexity of the model and likelihood of overparameterization (based on the shear number of assigned and calibrated parameters, both of which contribute to uncertainty), the optimization was likely significantly less than optimal and the results of the impact simulations should be viewed as a manifestation of a particular concept of the flow system. A clear distinction should be made between assigned and model calibrated parameters in the Numerical Model Report (and DVD). The number and nature of the model calibrated parameters should be clearly described, along with the potential consequences of overparameterization for the model predictions.
C50	3.3.2.9 to 3.3.2.14, the Simulation Model Report dated Nov 2009, and SNWA 2009b	**Impact Analyses Based on Simulations of Pumping to a Maximum of 200 years after Full Build-out.** A range of uncertainties affect the CCRP model predictions over all timeframes. Some model uncertainties have a cumulative effect over time (those related to the assignment or calibration of aquifer parameters and boundary conditions). Others do not. In particular, uncertainties related to potential conceptual errors in the structure of this complex (and over parameterized) model vary significantly from one location to another, affecting model predictions over all timeframes, and may or may not produce smaller errors in predicted drawdowns at earlier times. For example, the error in predicted drawdown may be as large, or larger, at a particular location at 200 years after full build-out (FBO) than at later times (in both absolute and relative terms) due to the incorporation of one or more hypothesized horizontal flow barriers and their locations relative to simulated production wells. Since predicted drawdowns are subject to errors which vary as much in space as time and model predictions indicate significant downward trends in groundwater levels and spring discharge at numerous locations as of 200 years after FBO (signaling the potential for greater impacts at later times), the effects analysis presented in the EIS should, at a minimum, disclose information which allows the reader to evaluate predicted drawdowns at 200 years after FBO in the context of the potential full effects of project pumping (i.e., the proportion of total drawdown represented by predictions of drawdown at 200 years after FBO at selected representative locations). As a practical matter, the most reliable drawdown predictions may be produced by a steady state model simulation which represents the response of the system over thousands of years (i.e., the full impacts of the project) since the latter would be independent of weakly calibrated storage coefficients and minimally affected by the incorporation of numerous horizontal flow barriers that may or may not exist.
C51	3.3.2.8 & 3.3.2.9	**The model cannot evaluate impacts to springs which have been omitted from the model.** Additionally, some springs have been included in the model, but omitted from the impact analyses based on *a priori assumptions* concerning 'the likely source of water' for the spring. Specifically, some springs have been omitted from the impact analyses based on assumptions concerning the degree of hydraulic connection with the regional or a basin-scale flow system, i.e., its "susceptibility to groundwater development drawdown impacts". Significant examples include Roland Springs, Great Basin National Park.

C52	Section 3.3.2.9	**Underestimation of 'at risk' springs based on the 10-ft simulated drawdown criterion.** The DEIS states that a minimum of 10-ft of simulated drawdown was used as a criterion in identifying 'at risk' springs. Since the discharge of many, if not all, springs in the study area would be affected by less than 10-ft of pumping-induced drawdown (e.g., 9, 5, or even 1 ft), 'at risk' springs are underestimated. For example, the rating curve for Pederson Spring in the Muddy River Springs Area suggests that a 0.5 ft reduction in spring stage (head at the spring orifice) would result in an 80 percent reduction in spring discharge and that a 1 ft reduction in stage would cause the spring to stop flowing altogether. Rating curves are not readily available for Flag Springs 1, 2, and 3. However a reduction in head of 1 to 9 ft at the orifice of Flag Spring #2 would likely result in a significant reduction in discharge of this ~2.5 cfs spring. A reduction in head of several feet would also presumably have more than a measurable effect on the discharge of larger springs such as Crystal, Ash, and Hiko Springs in Pahranagat Valley. As such, the minimum 10-ft simulated drawdown criterion is too high to reasonablely, much less conservatively, identify springs which may be susceptible to drawdown impacts as a result of project pumping. Moreover, simulated declines in the elevation of the water table (located primarily in valley fill and other surficial units) have been used to estimate potential impacts to carbonate springs, rather than predicted changes in head in carbonate units deemed to be the source of the springs. The identification of 'at risk' springs should be revised using predictions of drawdown in carbonate units deemed to be the source of the springs, respectively (specifically at the depth of the assumed source). Additionally, the 'at risk' status of springs should not be based on their location in the valley floor versus valley margin, since the latter may be equally or more connected to pumped units (i.e., depend on the location of pumping). The evaluation should be based on the magnitude of predicted drawdown at the depth of each spring source (simulated or assumed) and a rating curve for the spring (or a spring of similar size and source). For example, springs could be considered to be at moderate risk if the projected reduction in discharge is 10 to 25%, high risk if the projected reduction in discharge is closer to 50%, and very high risk if the projected reduction in discharge is ≥ 90% based on the magnitude of simulated drawdown at the depth of the assumed spring source. Whereas this would require full use of the available drawdown predictions (including predictions of drawdown which are greater than zero, but less than 10-ft), it would yield a more physically tenable and defensible result than the current treatment.
C53	3.3.2.8 & 3.3.2.9, SNWA 2009b, 2010a, and 2010b, and Simulation Model Report dated Nov 2009	**The model is weakly calibrated (at best) to spring and stream baseflow observations, thus a poor predictor of impacts to springs and perennial streams.** The Numerical Model Report indicates that spring discharge and stream baseflow measurements were utilized as calibration data. However, the model was subsequently described by the modeling team in a cooperative agency conference call as uncalibrated to spring and stream discharge data. The Numerical Model Report (SNWA 2009b & 2010a) and EIS should accurately reflect whether spring and stream discharge data were effectively used to constrain the model calibration. To the extent that the model has not been effectively calibrated to reproduce observed spring/stream flows, or only weakly so, the model is generally a poor predictor of the impacts of project pumping on springs and perennial streams.
C54	3.3.2.8 & 3.3.2.9, SNWA 2009b, 2010a, and 2010b, and Simulation Model Report dated Nov 2009	**Reproduction of physical processes controlling spring discharge is poor (with ramifications for the impact analyses).** Because the model was weakly calibrated to spring discharge and stream baseflow observations, at best, physical processes controlling spring discharge and stream baseflows are poorly reproduced by the model. Additionally, some train-and-error calibration of 'drain' and 'stream segment' locations, elevations, and conductances (used to simulate springs) was apparently undertaken in an effort to reproduced documented spring discharges and known water quality parameters such as temperature and age. But the structure of the model (configuration of RMUs), aquifer parameters for RMUs, and distributed recharge were apparently not calibrated to any meaningful degree as part of this effort. As such, physical processes controlling the location and rate of discharge of specific springs are generally poorly reproduced by the model as indicated by the failure of the calibrated model to reproduce observed discharges at many of the modeled springs, as well as the numerous springs which have been removed from the model in the last year due to the difficulty of reproducing their flows. Moreover, the annual mean discharge of several large springs (Hiko, Crystal, Ash and the hypothetical aggregate spring representing the Muddy River Springs) are approximated by the calibrated model, but it is not clear from the documentation whether this was achieved through manipulation of stream package parameters alone (e.g., streambed elevations and conductances) or indicative of the reproduction of salient physical processes controlling the occurrence and discharge of these springs. If the former, then the model is likely a poor predictor of impacts to Hiko, Crystal, Ash, and the Muddy River Springs, even though the annual mean discharges of these springs are reproduced by the calibrated model. To improve the reproduction of physical processes controlling spring discharge and the capacity of the model to predict pumping impacts to springs, consider using standard model calibration and the superposition approach iteratively to calibrate the model. Specifically, it might be possible to use standard model calibration runs to elucidate physical processes which control the occurrence and discharge of individual springs (this would include optimizing the structure of the model, RMU parameters, and distributed recharge in addition to drain and/or stream package parameters), followed by superposition runs to constrain the calibration of RMU aquifer parameters (apart from the effects of errors in modeled spring discharges, ET, and areally distributed recharge). The benefits of this approach would be analogous to iterating between steady and transient model calibration runs to ensure that model-calibrated storativities (which can only be optimized during transient calibration and are influenced by model-calibrated conductivities/transmissivities) are effectively constrained by conductivities/transmissivities which are also calibrated to steady data.

C55	3.3.2.9		**Descriptions of predicted impacts to springs and streams.** Because the text of the resource chapters is lengthy and will likely not be read in their entirety by the public, sections describing impacts to specific water resources, for example *Impacts to Springs and Streams*, should reiterate that predicted impacts are based on model simulations which are subject to uncertainties described in Section 3.3.2.8. Consider modifying the opening text of such sections to something like: "Estimates of the potential risk to springs based on model simulations of drawdown due to the Proposed Action are presented in Figures X, Y, and Z for times corresponding to full build out, 75 years after and 200 years after full build out, respectively. This and other model simulations preformed for the EIS are subject to uncertainties described in Section 3.3.2.8. The model used to perform the simulation is described in Section X." Additionally, Table 3.3.2-6 (and similar tables) describe potential impacts to springs in terms such as 'X number of 'inventoried springs' are located in areas where impacts to flow could occur, Y number of 'other springs' are located in areas where impacts to flow could occur'. This fails to convey the number of springs impacted in any one valley (essentially the distribution and magnitude of the impacts). Absolute numbers of impacted springs do little to provide the reader with an understanding of the extent of the predicted impacts within a basin or region, unless the reader knows the total number of springs in the area (or more specifically the total number of springs in hydraulic connection with the regional or a basin-fill aquifer). Also, the meaning of 'inventoried spring' (e.g., in Table 3.3.2-6) is unclear unless the reader has located the definition earlier in Water Resources sub-chapter. 'Inventoried' could mean inventoried for this project/EIS. A footnote should be added to tables referencing 'inventoried springs' with the definition. Also, sections describing impacts to springs (and stream baseflows) should include text which describes the predicted impacts in 'plain English', basin by basin, and a description of the relative magnitude of those impacts instead of relying on tables or figures, e.g., 25% of all springs in Spring Valley which are supplied by the regional or basin-scale aquifer are predicted to be at risk at full build out, 50% after an additional 75 years of project pumping, and 75% at full build out plus 200 years of pumping, etc.. This summary text should be reiterated in the Executive Summary.
	Specific Comments		
	Section		
C56	3.3.2.8 (and by reference to Numerical Model Reports SNWA 2009b & 2010a)		**The application of different methods to assign ET to different portions of the model domain undermines confidence in the model calibration and model predictions.** A combination of methods was used to assign groundwater ET (ETgw) to various portions of the model domain, some changed mid-stream during the analysis (Conceptual Model Report, Sections 7.1.8.1 and F.1.1.3). Uncertainties in the distribution of assigned ETgw, in turn, create a cascade of potential effects which have not been adequately disclosed in the model reports or DEIS. Specifically, uncertainties in the distribution of assign ETgw have the potential to significantly effect the optimization of recharge efficiencies, optimization of outflows at the lateral model boundary, initial and final estimates of distributed recharge, model-calibrated conductivities (transmissivities), model-calibrated diffusivities and storage coefficients, and finally model predictions about the location, magnitude, and timing of drawdown due to project pumping. Whereas an attempt has been made to characterize uncertainties in the distribution of assigned ETgw, the stochastic treatment provided is based on poor quality mean values and variances, so of little practical significance. Moreover, the effects of these uncertainties on the model calibration and drawdown predictions have not been assessed.

C57	3.3.2.8 (and by reference to Numerical Model Reports SNWA 2009b & 2010a)		**Method used to estimate predevelopment boundary fluxes and the initial distribution of recharge with ramifications for the final distribution of recharge, model calibration, and results of the impact analyses.** Predevelopment boundary fluxes were optimized across ~15 segments of the lateral model boundary, in conjunction with recharge efficiencies, using the groundwater balance method and a spreadsheet optimization routine, one flow system at a time. The reason for performing the optimization one flow system at a time is not provided in the model reports -- flow systems represented by the model extend over 100 miles from north to south over a variety of geologic terrains and climatic conditions. Whereas the optimization of recharge efficiencies must be constrained by estimates of discharge (using the modified Maxey-Eakin method), it was equally possible to constrain the optimization over subsets of the model domain where the geology of high-altitude recharge areas and climate are similar. By performing the optimization one flow system at a time, different recharge efficiencies have been estimated for each flow system, with significant differences from one flow system to another which may or may not represent actual differences in recharge processes. Rather, differences in the estimated recharge efficiencies may be due to differences in the quality of ETgw estimates for any particular area (see previous comment), the validity of conditions prescribed on the lateral model boundary, internal interbasin flow constraints imposed on the optimization for each flow system, and the degree to which the solution for each flow system represents an optimal solution to this inherently nonidentifiable problem. A reason should be provided in the Numerical Model Report for optimizing recharge efficiencies one flow system at a time. Future updates of the model should include an optimization of recharge efficiencies over areas of similar geology and climate to see what bias the flow system-by-flow system approach may have introduced to the initial assignment of distributed recharge, which influenced the calibration of aquifer parameters and consequently the results of the impact simulations. An effort has been made to characterize uncertainties in the optimized recharge efficiencies. However, the stochastic treatment provided is based on poor quality mean values and variances, so of little practical significance. Moreover, the effects of these uncertainties on the model calibration and drawdown predictions have not been assessed.
C58	3.3.2.8 (and by reference to Numerical Model Reports SNWA 2009b & 2010a)		**Calibration of areally distributed recharge.** The Numerical Model Report indicates that the percentage of total groundwater recharge which occurs as 'runoff recharge' was model calibrated prior to redistribution along 'runoff pathways' (Numerical Model Report, p 4-71). However, "large simulated hydraulic head residuals in recharge areas" were interpreted as being due to 'perched conditions' (measurements from wells completed in 'perched' units). The extent to which head residuals in recharge areas were discounted should be clarified to avoid the impression that the distribution of recharge was not effectively model calibrated. Additionally, the effects of uncertainties in the distribution of groundwater recharge on the remainder of the model calibration and drawdown predictions has not been assessed or adequately disclosed in the model report(s) or DEIS.

C59	3.3.2.8 (and by reference to Numerical Model Reports SNWA 2009b & 2010a)		**The calibration datasets are sparse (with ramifications for the calibration of the model and results of the impact simulations).** The steady calibration dataset (which represents pre-development conditions) is limited to 57 pre-1945 groundwater level measurements, no stream discharge observations, and a large number of 'regional' and 'intermediate' spring discharge measurements which, however, were collected over a range of years, including recent years (post-2000, Numerical Model Report, Section B.4.1). The transient calibration dataset (which represents 1945 - 2004 conditions) is comprised of numerous groundwater level data, several hundred of which were collected at locations 'near' pumping. However, few of the available groundwater level records show a response to pumping and are comprised of more than a few measurements, and most are likely from shallow wells completed in upper valley fill. Additionally, groundwater level data exhibiting climate-induced fluctuations where included in the transient calibration dataset even though boundary conditions imposed during the transient calibration were themselves steady (not intended to account for climatic fluctuations). Moreover, Section B.4.2.1 indicates that the model was calibrated to reproduce zero change in discharge from 1945 - 2004 at 11 major springs: Big Springs and Gandy Warm Springs in Snake V; Preston Big Spring and Hot Creek Spring in White River Valley; Ash Springs and Crystal Springs in Pahranagat V; Muddy Springs, Pederson Spring, and Pederson East Spring in the Muddy River Springs Area; and Rogers Spring and Blue Point Spring in the Black Mountain Area. That is, discharge at these springs was assumed to be steady (unchanged) throughout the historical development period (1945 - 2004), despite the advent of irrigation pumping in the 1940's. To the extent that some of these springs may have experienced pumping-induced declines from 1945 to 2004 which were unaccounted for during the transient calibration, spring 'drain' or 'stream' (package) conductances may have been underestimated, resulting in an underestimation of impacts to spring discharge in the pumping simulations. The reason given for imposing 'zero change in discharge' conditions at these springs was that available continuous spring discharge records for these sites, none longer than 11 years (of the 69 year transient calibration period) and most 1 to 4 years in length, showed no obvious declines. Transient streamflow calibration data were limited to the Muddy River, the end of Lake Creek, and end of Pahranagat Wash. The transient calibration did not include transient spring discharge observations. Given the limited quantity and quality of the calibration datasets, the model is weakly calibrated, at best. This, in turn, gives rise to significant uncertainties in the impact simulations which have not been adequately assessed or disclosed.
C60	3.3.2.8 (and by reference to Numerical Model Reports SNWA 2009b & 2010a)		**Weak calibration of specific yield and specific storage values (with ramifications for the results of the impact analyses).** Specific yield and specific storage values for the major aquifer units (RMUs) are weakly calibrated, at best, due to the limited information content of available transient calibration data (necessary to calibrate specific storage and specific yield values). Groundwater level data utilized in the transient calibration represent numerous locations. However, very few of these records are of any length and only a subset of those reflect a transient response to pumping (as opposed to climatic fluctuations). Additionally, few transient calibration data are available for lithologies other than upper valley fill (i.e., carbonate rocks). Model calibrated specific yield and specific storage values, in turn, have a significant effect on the magnitude, areal extent, and timing of predicted drawdowns. This limitation should be disclosed in the EIS (Section 2.2.3.8) and numerical model reports.
C61	3.3.2.8 & 3.3.2.9 (and by reference to Model Reports SNWA 2009b, 2010a, and 2010b, and the Simulation Model Report dated Nov 2009)		**Calibration data are too sparse to model-calibrate the conductivity (conductance) of the incorporated HFB's (with ramifications for the results of the impact simulations).** The Numerical Model Report indicates that the hydraulic conductivity of most of the 50 HFBs incorporated in the model were model-calibrated (Numerical Model Report, Table 5-3). Specifically, they were described as "tested during model calibration" (p 5-10). This despite an earlier statement that "Practically no data are available to accurately identify the role of the faults present in the model domain" (p 3-4). The density and distribution of calibration data (shown in Figures 2-1 and 2-2 of the addendum to the Numerical Model Report) are clearly insufficient to model calibrate the conductivity (conductance) of any of the HFBs at any particular location. Even more clear, the calibration data are not sufficient to model calibrate conductivities (conductances) for high and low permeability HFB components over the hypothesized distances and depths. Additionally, only the final values of HFB conductances provided in Table 5-3, making it difficult to assess the extent to which the initial assignment of conductances were in fact modified during the calibration process. Conductances associated with the various HFBs, including their subcomponents, appear to be largely assigned, rather than model calibrated, and reflect a particular hypothesis (concept) concerning the hydraulic properties of faults, and even collections of faults, based on their characteristics as geologic structures. As such, the impact analyses are a manifestation of a particular hypothesis concerning the hydraulic character of a large number of individual faults within the project area. In contrast, the hydraulic character of faults is widely understood within the hydrologic community to vary from fault to fault, with location along any given fault, and with depth in individual fault zones (as acknowledged in the DEIS (Section 3.3.1.5). Uncertainties arising from the assignment of conductances to these discrete model structures has not been adequately assessed or disclosed in the model reports or DEIS.

C62	3.3.2.8 & 3.3.2.9 (and by reference to Model Reports SNWA 2009b, 2010a, and 2010b, and the Simulation Model Report dated Nov 2009)		**Inadequacy of the uncertainty analyses.** Kh values equal to 1.5x the calibrated Kh values and an Sy for upper valley fill (UVF) of 0.10 was used to approximate the maximum extent of drawdown due to Alternative A pumping. This was compared to drawdown simulated using the calibrated model (which was considered to yield the minimum extent of drawdown) in an effort to assess the effects of parameter uncertainty on the spatial extent of the drawdown predictions. Whereas 0.10 is a reasonable lower bound for the Sy of UVF, the range of values tested for Kh do not reflect the plausible range of values for the conductivity of the major RMUs at the scale of the model simulations. The rationale provided for testing an upper bound of 1.5x was that the test values should represent 'the uncertainty on the mean values', rather than 'the range of spatial variability', for major RMUs (Simulations Report, p 5-2). Whereas it would be inappropriate (excessive) to test a range of variability corresponding to a very small scale (e.g., sub-packer test), it's 100% appropriate to test a range of variability corresponding to the scale of the model simulations (conservatively the scale of the model cells), which can be approximated by a constant rate pumping test. Appendix C of the Conceptual Model Report (Table C-1) summarizes Kh's compiled from field tests conducted over a range of scales, including constant rate pumping tests. Whereas the maximum estimate of Kh recorded for fractured carbonate rocks at the scale of a constant rate pumping test may be anomalously high (e.g., ~10-2 m/s which is 3 orders of magnitude greater than the mean of 10-5 m/s), it would be conservative to test 5x the calibrated values in order to simulate a half an order of magnitude increase in Kh overall in the UC/LC RMU. Likewise, the maximum estimate of Kh compiled for UVF at the scale of a constant rate pumping test may be anomalously high (e.g., ~10-2 m/s which is 2 orders of magnitude greater than the mean of 10-4 m/s), but it would be conservative to test 5x the calibrated values in order to simulate a half an order of magnitude increase in Kh overall in the UVF RMU. The current uncertainty analyses likely greatly underestimate the range of potential drawdown due to pumping by utilizing 1.5x the calibrated Kh values for the RMUs. This notwithstanding, increases in RMU conductivities above the tested values produced large residuals (reduced the model fit compared to the calibrated model). This result suggests that the model is overconstrained by the incorporation of 50 plus 'horizontal flow barriers', with significant ramifications for predicted drawdowns, and should be addressed in the discussion of model uncertainties (Section 3.3.2.8 and model reports SNWA 2009b, SNWA 2010a, and SNWA 2010b).
C63	3.3.2.9 to 3.3.2.14		**Clarification of drawdown figures and plates.** Section 4.2.1 of the Simulations Report (p 4-5) states that drawdown maps (in the Simulations Report) show the 'simulated effects of pumping on the water table'. This also presumably applies to 'drawdown figures' provided in the DEIS. However, the latter are ambiguously labeled 'predicted changes in groundwater levels'. Drawdown maps which depict predicted changes in the elevation of the water table should be clearly labeled as such. The Simulations Report and EIS should also include contour maps of predicted drawdown in the regional carbonate aquifer (e.g., vertically averaged drawdown in the active portion of the regional flow system) to facilitate the evaluation of impacts to springs supplied by the carbonate aquifer and more completely convey the propagation of regional impacts.
C64	3.3.2.9 to 3.3.2.14		Depiction of predicted drawdown as it relates to the usability of the impact simulations. Simulated drawdown is currently depicted to a minimum of 10-ft in the Simulations Report and DEIS. However, many, if not all, springs in the study area would be substantially impacted by less than 10-ft of pumping-induced drawdown (e.g., 9, 5, or even 1 ft) -- see previous comment titled 'at risk' springs. Consequently, lesser levels of drawdown are relevant to the evaluation of impacts to springs, as well as perennial streams and wetlands. Yet it is impossible to extrapolate from the 10-ft drawdown contours provided in the DEIS to lesser, but environmentally relevant, levels of drawdown with the mind's eye due to the complexity of the hydrogeologic system and generally logarithmic decrease of drawdown with distance. Consequently, simulated drawdowns should be depicted to a minimum of 1 ft, with an additional contour at 5-ft, accompanied by an adequate disclosure of the uncertainties. The reviewer acknowledges the 'relative error' argument, but submits that errors associated with large predicted drawdowns can also be significantly in error in a model (problem) of this complexity (e.g., a prediction of 5-ft of drawdown may be 20-ft in error due to the inclusion of a particular HFB).
C65	3.3.2.8 (and by reference Model Reports SNWA 2009b & 2010a)		**Disclosure of the volume of springs omitted from the model (with potential ramifications for the impact simulations).** A significant number of springs have been omitted from the flow model. To the extent that the volume of springs omitted is significant compared to total discharge in the model domain (ET + spring discharge), or compared to total discharge in individual basins comprising the model domain, the pumping simulations likely overestimate the capture of ET and interbasin flows (which are adequately represented in the model) and systematically underestimate the capture of discharge from springs (which are under-represented in the model), even at springs which have been included in the model. The Numerical Model Report and DEIS should include a description of the volume of springs omitted from the model (due to difficulties in reproducing their flows) and their collective magnitude relative to the water budget for all basins comprising the model domain, individual basins within the model domain, and flow systems represented by the model, so that any such bias is disclosed and can be assessed.

C66	3.3.2.9 (and by reference Simulation Model Reports dated Nov 2009 and SNWA 2010b)		**The impact analyses likely overestimate the capture of ET and underestimate the capture of spring discharge in areas where modeled springs are located in 'low-relief' ET areas (e.g., valley floors).** The majority of springs represented in the model have been incorporated as MODFLOW 'drains'. ET has also been simulated in the model using 'drains'. 'Drain' elevations assigned to springs in 'low-relief' areas (presumably valley floors) are lower than 'drain' elevations assigned to ET in the same areas. Specifically, spring 'drains' everywhere are assigned an elevation equal to the minimum elevation within the cell of the spring (based on a 30-m DEM), minus 10 m; while ET 'drains' in 'low relief' areas are assigned an elevation equal to the average elevation within the cell (based on a 30-m DEM), minus 5 m. Consequently, the model tends to overestimate the capture of ET and underestimate the capture of spring discharge in these important areas as the elevation of the water table (or head) drops in response to simulated pumping.
C67	3.3.2.9 (and by reference to Numerical Model Report SNWA 2009b)		**Predictions of impacts to Hiko Spring.** Hiko Spring appears to discharge from a fault which is exposed in outcrop above the spring outlet (carbonate rocks of the Lower Carbonate Aquifer). However, this fault has been simulated in the model as a 'horizontal flow barrier' (HFB), 25 miles in length, and the spring is simulated as discharging ~0.6 miles (or one model cell) to the west. As a result, Hiko Spring is sheltered from the propagation of drawdown in pumping simulations by this, as well as three other north-trending HFBs which have been incorporated in the model between the spring and Delamar and Dry Lake Valleys. Specifically, four HFBs have been incorporated in the model between the simulated location of Hiko Spring and simulated locations of SNWA production wells in Delamar and Dry Lake Valleys: the first at the actual location of Hiko Spring; a second ~6 miles east of the first (which is 30 miles in length and coincides with a discontinuous collection of faults ranging in size from regional to minor); a third ~6 miles east of the second (which is 35 miles in length and coincides with a regional-scale normal fault inferred at the boundary between Pahranagat and Delamar Valleys and north into Pahroc Valley); and a fourth ~7 miles east of the third (which is 50 miles in length and coincides with a range-bounding fault inferred on the west side of Dry Lake Valley, then a strike-slip fault extending NNW into northern Pahroc Valley). At 200 years after FBO, simulated drawdown for Alternative A (proposed project pumping at previously approved rates) is significantly reduced across this series of hypothesized flow barriers (i.e., reduced by roughly 20, 10, 5, and finally 1 ft across each hypothesized structure from east to west), so that the predicted drawdown at Hiko Spring after more than 200 years of project pumping is < 1 ft [based on simulated drawdown contours provided by SNWA to a minimum of 1-ft]. However, available calibration data (groundwater level measurements) are not sufficient to confirm the presence of these structures as 'horizontal flow barriers' (see the distribution of calibration data, Figures 2-1 and 2-2 of the Addendum to the Numerical Model Report), nor are they sufficient to model-calibrate conductivities (conductances) for any of the four structures, at any location, or confirm the proposed uniformity of hydraulic properties over distances of 25 to 50 miles. To the extent that one or more of these faults (or collections of faults) are not significant barriers to groundwater flow, or the actual faults possess hydraulic properties which differ from those assigned in the flow model, or the faults do not constitute continuous barriers to groundwater flow over the proposed distances, drawdown at Hiko Spring due to project pumping could be significantly greater than that predicted by the model. The effects of these HFBs on predictions of impacts to Hiko Spring have not been assessed or adequately disclosed in the DEIS. Hiko Spring is an important source of water for Pahranagat National Wildlife Refuge.
C68	3.3.2.9 (and by reference to the Numerical Model Report SNWA 2009b)		**Predictions of impacts to Crystal Springs.** Crystal Springs has similarly been simulated as discharging ~0.6 miles (or one model cell) west of its actual location, and west of the four HFBs described above (see comment concerning Hiko Spring). Simulated drawdown for Alternative A (proposed project pumping at previously approved rates) is significantly reduced across this series of hypothesized flow barriers, so that the predicted drawdown at Crystal Springs after more than 200 years of project pumping is < 1 ft [simulated drawdown contours provided by SNWA to a minimum of 1-ft]. However, available calibration data (groundwater level measurements) are not sufficient to confirm the presence of these structures as 'horizontal flow barriers' (see the distribution of calibration data, Figures 2-1 and 2-2 of the Addendum to the Numerical Model Report), nor are they sufficient to model-calibrate conductivities (conductances) for any of the four structures, at any location, or confirm the proposed uniformity of hydraulic properties over distances of 25 to 50 miles. To the extent that one or more of these faults (or collections of faults) are not significant barriers to groundwater flow, or the actual faults possess hydraulic properties which differ from those assigned in the flow model, or the faults do not constitute continuous barriers to groundwater flow over the proposed distances, drawdown at Crystal Springs due to project pumping could be significantly greater than predicted by the model. The effects of these HFBs on predictions of impacts to Crystal Springs have not been assessed or adequately disclosed in the DEIS. Crystal Springs is an important source of water for Pahranagat National Wildlife Refuge.

C69	3.3.2.9 (and by reference to the Numerical Model Report SNWA 2009b)		**Predictions of impacts to Brownie and Ash Springs.** Like Hiko and Crystal Springs, Brownie and Ash Springs are located west of the four HFBs described above. Simulated drawdown for Alternative A (proposed project pumping at previously approved rates) is significantly reduced across this series of hypothesized flow barriers, so that the predicted drawdown at Brownie and Ash Springs after more than 200 years of project pumping is < 1 ft [simulated drawdown contours provided by SNWA to a minimum of 1-ft]. However, available calibration data (groundwater level measurements) are not sufficient to confirm the presence of these structures as 'horizontal flow barriers' (see the distribution of calibration data, Figures 2-1 and 2-2 of the Addendum to the Numerical Model Report), nor are they sufficient to model-calibrate conductivities (or conductances) for any of the four structures, at any location, or confirm the proposed uniformity of hydraulic properties over distances of 25 to 50 miles. To the extent that one or more of these faults (or collections of faults) are not significant barriers to groundwater flow, or the actual faults possess hydraulic properties which differ from those assigned in the flow model, or the faults do not constitute continuous barriers to groundwater flow over the proposed distances, drawdown at Brownie and Ash Springs due to project pumping could be significantly greater than predicted by the model. The effects of these HFBs on predictions of impacts to Brownie and Ash Springs have not been assessed or adequately disclosed in the DEIS. Ash Springs is an important source of water for Pahranagat National Wildlife Refuge.
C70	3.3.2.9 (and by reference to Section 4.4.4.2.2 of Numerical Model Report SNWA 2009b)		**Predictions of impacts to Pahranagat National Wildlife Refuge.** The model construction reflects the assumption (articulated in the Conceptual Model Report, page 7-48) that wetlands in Pahranagat Wash (Pahranagat National Wildlife Refuge) are maintained by discharge from Hiko, Crystal, and Ash Springs which are located north of the refuge; more specifically that wetland phreatophyte communities within the Wash are 'supported by a shallow alluvial aquifer which is recharged by the regional springs' (Hiko, Crystal, and Ash Springs) [Numerical Model Report, pages 4-53 to 4-58]. Moreover, the model construction reflects the assumption (described on p 4-57 of the Numerical Model Report) that the shallow alluvial aquifer underlying Pahranagat Wash from Ash Springs to the Pahranagat Shear Zone is 'perched or semi-perched'. Specifically, low permeability layers (~10^{-8} m/s conductivity) have been incorporated in the model beneath the area of the refuge (the full length of the Wash and width of the riparian zone) which are not explicitly disclosed in the text but clearly evident in the numerical model cross-sections. This despite a lack of data supporting the presence of perched or semi-perched conditions in the vicinity of the refuge (Numerical Model Report, p 5-21, "no data are available to support it"). The effect of these low permeability layers is to preclude any significant drawdown of the water table in the vicinity of the refuge in response to the propagation of drawdown from Delamar Valley in the pumping simulations. Significant changes in the elevation of the water table can only be simulated at the refuge to the extent that changes in the discharge of Hiko, Crystal, and Ash Springs (assumed to be the sole sources of water to the refuge) are predicted by the model. This, in turn, is unlikely given the incorporation of the four HFBs discussed above (see comments for Hiko, Crystal, and Ash Springs). As a consequence, the current impact analyses predict that drawdown will propagate southwest through the Pahranagat Shear Zone due to pumping at SNWA production wells in Delamar Valley (and Dry Lake and southern Cave Valleys), but the elevation of the water table will be little changed in the immediate area of the refuge (specifically ≤ 1-ft in the southern half of the refuge at full 200 years after FBO in Alternative A). The Numerical Model Report should disclose the incorporation of low permeability layers and the lack of data confirming the existence of perched or semi-perched conditions in the area of the refuge, as well as uncertainties associated with the incorporation of the flow barriers. It seems likely that the current impact analyses significantly underestimate the potential impacts of project pumping in Cave, Dry Lake, and Delamar Valleys on the refuge.
C71	3.3.2.9 (and by reference to Numerical Model Report SNWA 2009b)		**Predictions of impacts to northern Cave Valley and adjacent portions of the White River Valley.** The model construction includes an HFB which effectively limits the propagation of drawdown into northern Cave Valley to the cross-sectional area of a few model cells based on an inspection of the numerical model cross-sections and simulated drawdowns for Alternative A [provided by SNWA to a minimum of 1-ft]. This, in turn, greatly limits the propagation of drawdown to Flag and Butterfield Springs through Shingle Pass in the impact simulations. To the degree that this HFB does not exist, or the lateral extent or properties of the fault differ from those hypothesized in the model, the propagation of drawdown into northern Cave Valley and adjacent portions of the White River Valley, including the areas of Flag and Butterfield Springs, may be underestimated.
C72	3.3.2.9 and by reference to the Simulation Model Reports)		**Predictions of impacts to Gandy Warm Springs and Leland Springs in northern Snake Valley.** Simulated drawdown in potentially significant amounts may propagate to the area of Gandy Warm Springs in pumping simulations prepared for Alternative A and (or) the Proposed Action. However, this cannot be determined from the drawdown figures provided in Plates 1 and 2 of the Simulations Report or the DEIS which depict drawdown to a minimum of 10-ft.

C73	3.3.2.9 and by reference to the Simulation Model Reports)		**Propagation of simulated drawdown within Snake Valley.** The propagation of simulated drawdown from west to east across Snake Valley appears to be impeded by low permeability 'upper aquitard', which is appropriately incorporated in the model at the approximate location of the Confusion Range Synclinorium. However, this would only occur to the extent that simulated SNWA production wells are limited to upper valley fill. If production wells (actual or simulated) are completed in the lower carbonate aquifer (near the base of the Snake Range) or in the damaged zone of the range bounding fault (at a location which is in hydraulic connection with the lower carbonate aquifer), drawdown would propagate unimpeded beneath this fold of 'upper aquitard' to the west and drawdown at the boundary between Snake Valley and Pine, Wah Wah, and Tule Valleys would be significantly greater than that currently predicted. The Simulations Model Report and DEIS should disclose whether the latter result is due to the completion of simulated SNWA production wells in upper valley fill.
C74	3.3.2.9 and by reference to the Simulation Model Reports)		**Evaluation of impacts to Fish Springs (with ramifications for the evaluation of impacts and cumulative impacts).** The model domain was extended in 2008 or 2009 to include the portion of Fish Springs Flat that comprises Fish Springs National Wildlife Refuge (NWR). However, Fish Springs has not been included in the model (or impact simulations) in a meaningful way. The model domain was extended by two cells to include the immediate area of the springs and refuge. However, Pine Valley, Wah Wah Valley, Tule Valley, the eastern portion of the Sevier Desert, and remainder of Fish Springs Flat, which are believed to contribute to discharge at Fish Springs in combination with Snake Valley [Harrill and Prudic, 1998; Prudic et al., 1995; and Prudic et al., 1993; Gates, 1987; Carlton, 1985; Gates and Kruer, 1981; and Bolke and Sumsion, 1978], have been omitted from the model. Consequently, the model cannot simulate discharge from Fish Springs in any meaningful way. Additionally, a constant head condition has been assigned to the two cells which represent Fish Springs (two boundary cells), precluding any change in groundwater level or spring discharge at the refuge during the impact or cumulative impact simulations. Whereas drawdown failed to propagate into northern Snake Valley in the current pumping simulations and predicted reductions in underflow from Snake to Pine, Wah Wah, and Tule Valleys are minimal, this may be due to the completion of simulated SNWA production wells in upper valley fill (see previous comment concerning the propagation of simulated drawdown within Snake Valley). To the extent that SNWA production in upper valley fill has been over-represented (more occurs from the lower carbonate aquifer than simulated), drawdown may propagate further north and east in Snake Valley than currently predicted. Underflow from Snake to Pine, Wah Wah, and Tule Valleys could be significantly reduced or even reversed and drawdown could propagate into Pine, Wah Wah, and Tule Valleys. This, in turn, would result in impacts to Fish Springs that cannot be simulated by the current model.
C75	3.3.2.9 (and by reference to Numerical Model Report SNWA 2009b)		**Evaluation of cumulative impacts due to SNWA pumping in Snake Valley.** Since Pine, Wah Wah, and Tule Valleys have been left out of the model, it follows that the model cannot be used to evaluate the cumulative impacts of SNWA pumping in Snake Valley and reasonably foreseeable municipal pumping in Pine, Wah Wah, and Tule Valleys (e.g., Beaver and Central Iron Counties).
C76	3.3.2.9 (and by reference to Numerical Model Report SNWA 2009b)		**Lateral Model Boundary (East Side of Snake Valley).** The northeastern portion of the lateral model boundary is located on the eastern boundary of Snake Valley in the middle of the Great Salt Lake Desert Groundwater Flow System. Whereas BARCASS and numerous other studies suggest that groundwater flow is possible across this boundary (e.g., through the Confusion Range), a no-flow condition has been assigned to the majority of the boundary, with constant head conditions assigned to segments of the boundary between Snake Valley and Pine, Wah Wah, and Tule Valleys, respectively. The effect of the no-flow conditions is conservative with respect to predictions of drawdown in Snake Valley due to SNWA pumping. However, the assignment of constant head conditions is not. Even in the absence of the propagation of drawdown to the constant head boundary segments, reductions in simulated underflow to Pine ,Wah Wah, and Tule Valleys result in the underestimation of drawdown in Snake Valley. Current model simulations predict only a small reduction in underflow to Pine, Wah Wah, and Tule Valleys as a result of SNWA pumping in Snake Valley (~1100 afy in Alternative A at 200 years after FBO). However, the reduction in underflow could be significantly greater than predicted (the direction of flow even reversed), if SNWA production in upper valley fill has been over-represented in the pumping simulations (see previous comments). In this case, the effect of placing the model boundary at this location becomes even more unclear -- the model boundary should be moved east to include the whole of the Great Salt Lake Desert Groundwater Flow System in order to minimize uncertainties concerning drawdown predictions in Snake Valley and facilitate the evaluation of cumulative effects.

C77	3.3.2.9 (and by reference to Numerical Model Report SNWA 2009b)		**Description of Transient Calibration Data (with ramifications for the model calibration and results of the impact analyses).** The documentation should include a table, either hardcopy or electronic, that describes what aquifer unit(s) groundwater level calibration data represent (the completion units and depths of wells). This is currently only provided in the form of Figure 4-40 of the 2009 Numerical Model Report, which makes no distinction between steady (< 1945) and transient (1945 - 2004) groundwater level calibration locations. This information is also not provided in the Baseline Report or on the Numerical Model Report DVD.
C78	3.3.2.9 (and by reference to Numerical Model Report SNWA 2009b)		**Weighting of residuals during the model calibration (with ramifications for the calibrated model and results of the impact analyses).** Weights applied to residuals during the calibration of the model appear to be largely appropriate. The weights applied were the square root of the inverse of the 'variance' of calibration observations. The 'variance' of an observation was generally defined as the sum of the error in the location of the observation (within the model domain?), error in the elevation of the land surface at the location of the observation (within the model domain?), and variability of raw data used to compute the observation (e.g., the variability of groundwater level measurements used to obtain target annual average groundwater levels). These weights were applied uniformly to residuals, except for a 10x increase in the weights applied to key spring and stream flow observations which was implemented part way through the calibration process in an effort to elevate the influence of spring and stream flow observations on the outcome. If a similar increase in weights had been applied to transient groundwater level data (data showing a response to pumping, well qualifier flag '4'), the transient calibration of the model would have been improved. The latter were the most valuable groundwater level data available for the transient calibration.

	Chapter	Section	Global Comment
C79	General	General	We believe that the risk of impacting Federal resources on Paharanagat NWR is likely greater than disclosed in the DEIS due to CCRP model uncertainties and limitations, which are described in detail in the cover letter that accompanies these comments. On Pahranagat NWR, the resources at risk are the surface waters that are derived from Ash and Crystal Springs. Pahranagat NWR was established for the conservation of migratory birds, and the wetlands, riparian areas, and open waters on the refuge support numerous migratory bird species and their habitats, including the endangered southwestern willow flycatcher. The Service is also reintroducing the Pahranagat roundtail chub to waters on Pahranagat NWR, and northern leopard frog and White River specked dace already occur on the refuge.
C80	General	General	The water resources study area of the DEIS (and the CCRP model domain) should include those Hydrographic Basins east of Snake Valley in Utah (Pine, Wah Wah, and Tule Valleys, at a minimum) that are potentially interconnected and contribute flow to Fish Springs Flat. In addition, the entirety of Fish Springs Flat should be included in the water resources study area (not just the spring heads) so as to include the downstream habitats that are fed by discharge from the regional springs. This is needed in order to provide a thorough anlaysis of environmental effects, including indirect and cumulative effects. Under the Proposed Action, the 10-foot drawdown contour abuts directly against the Snake Valley-Pine Valley boundary by 75 years after FBO. At 200 years after FBO, the 20 to 50-foot drawdown contour abuts directly against this boundary and the 50-100 foot drawdown contour is directly adjacent to this boundary. This boundary issue occurs for all DEIS alternatives (except Alternative E), where the 10-foot drawdown contour apparently transcends the study boundary into Pine Valley. The DEIS acknowledges this cross-boundary issue, but does not provide a reasonable explanation as to why the water resources study area was truncated at the Snake Valley boundary when: 1) the entirety of other flow systems (e.g, the White River Groundwater Flow System) were included in the water resources study area and 2) the biological resources study area did include these potentially interconnected basins of the Great Salt Lake Desert Flow System.

C81	General	General	As explained in our cover letter, we are concerned that BLM's use of the 10-foot drawdown contour to delineate potentially affected areas may be underestimating the aerial extent of potential impacts, given model uncertainties and limitations and the sensitivity of groundwater-dependent ecosystems to small (i.e., <10 feet) changes in depth-to-water. For example, after over 50 years of management and monitoring at Fish Springs NWR, it is well understood that a reduction in water flows (such as those caused by only a one inch drop in spring heads) would result in substantial effects to water quality, quantity and regimen resulting in cascading impacts to wetland function and plant and animal resources across the refuge. Based on measured annual spring flows in 2010, if water levels of refuge springs were reduced by only one foot, there would be a conservatively estimated change in total average annual measured flow from 30.46 cfs to 0.13 cfs. This is a 99.57% reduction in spring flow. If spring water levels were reduced by one inch, there would be conservatively estimated reduction to 25.28 cfs, or a 17.01% reduction in spring flow. In regard to water quality alone, reduced flows would magnify the concentration gradient of salts across the refuge (as it relates to managed water delivery within the impoundment system with evapotranspiration loss), causing substantial changes to plant composition, animal abundance and diversity. For example, only the slightest increase in salinity in the refuge's already-brackish waters can result in substantial loss in aquatic invertebrate diversity since those waters are already near the limits of the tolerances of those species. In addition, changes to water temperatures may result from up-gradient removal of heated deep-carbonate aquifer water or cooler basin-fill aquifer water. These changes in water temperature could alter current biological habitat at the refuge. The refuge's thermal discharges maintain large areas of open-water habitats for wintering migratory birds and other resident and sensitive wildlife on the refuge.
C82	ES Ch3 and Ch 4	3.5 and 4.0	Based on the text in ES 3.5 and ES 4, it appears that BLM management direction (established in management documents) was applied to the evaluation and mitigation of project construction and maintenance effects. It does not appear that it was applied to pumping effects, which are widespread in Nevada and Utah. Management direction relative to the effect of groundwater pumping on BLM lands and resources should be referenced and consulted in Chapter 4. Because project pumping effects will be realized in Utah BLM Districts, we recommend that the BLM reference relevant Utah BLM Resource Management Plans (e.g. House Range RMP, Warm Springs RMP and the Cedar District RMP) for management direction. The Cedar City District RMP is currently undergoing revision, however the Cedar City District has released its draft "Analysis of the Management Situation" (dated August 2011) which describes current management direction and management opportunities derived from considering the current conditions and trends. For example, under Management Opportunities, Fish and Wildlife Habitat, two goals are to "Maintain all good condition habitat areas" and "Prohibit management actions that would dewater sources". A final version of the document will be released soon (pers. comm. , Becky Bonebrake, BLM Cedar City Field Office, 9/23/2011). The final version should be referenced and consulted for management direction relative to the effect of groundwater pumping on BLM lands and resources in the Cedar City District.

C83	General	General	The Cedar City District RMP is currently undergoing revision, however the Cedar City District has released its draft "Analysis of the Management Situation" (dated August 2011) which describes current management direction and management opportunities derived from considering current resource conditions and trends. The Area Profile section of the draft and/or final "Analysis of the Management Situation" (August 2011) for the BLM Cedar City District should be referenced for baseline and "Affected Environment" presentations in the SNWA GWD Project NEPA document. It should also be referenced for the trends it presents specific to individual resources. This information should be used in BLM's evaluation of cumulative effects for resources in Utah.
C84	Chapter 3	General	Spring Valley pumping could result in impacts to Hamlin and Snake Valleys (in Utah), as the model-predicted 10-foot contours touch into Utah for Alternative E and spread farther into Utah under Alternative D. The Spring Valley stipulation only minimally addresses these potential effects with limited hydrology and biological resource monitoring & mitigation in Utah. If BLM selects a "no snake valley" alternative as its preferred alternative, and it is determined that Utah resources not currently covered by the Spring Valley Stipulation could be affected by Spring Valley pumping, then BLM should require additional monitoring and mitigation to cover these Utah resources. This could take the form of a Snake Valley (and adjacent valleys) 3M Plan or the Spring Valley stipulation monitoring could be expanded to encompass these Utah resources.
C85	Chapter 3.6	3.6.2.8	Relative to groundwater pumping effects, the impact analysis for many terrestrial species depends on methodology decisions made in the water resources or vegetation sections of the document. For example, under the water resources and vegetation analyses, ET zones were derived and depicted on maps for the valleys where the model predicts a 10 foot+ drawdown. To determine impacts to terrestrial species from groundwater pumping, the BLM appears to say that where a species may use these ET zones, there may be impacts. This analysis is limited for species such as greater sage-grouse in Hamlin Valley, Utah. There is crucial brooding habitat and a number of leks in Hamlin Valley, Utah, but the analysis of pumping to the species is limited because there is only a small sliver of an ET zone presented for Hamlin Valley (Nevada). Clearly there are water resources that support the mesic vegetation necessary for brooding greater sage-grouse in Hamlin Valley, Utah. We recommend that the BLM look closely at those water sources and vegetation and provide an analysis of potential effects (under the proposed action and all alternatives) to those water sources, vegetation and ultimately, greater sage-grouse as a result of groundwater pumping.
C86	Chapter 3.3	3.3.1, 3.3.2 and 3.3.3	BLM should reference and review the new USGS groundwater study titled "Conceptual model of the Great Basin carbonate and alluvial aquifer system." The document can be found at: http://pubs.usgs.gov/sir/2010/5193/.

	Page	Section	Paragraph	Comment
				Chapter 2 Description of Proposed Action and Alternatives
C87	2-6	2.2.2	1	**Groundwater Development for No Action**: Based on the text in this paragraph, it appears that the No Action alternative was defined and modeled according to the amount of water currently pumped from agricultural, municipal, and industrial/power wells. There are two associated comments: 1) According to Figure 3.3.1-22, there are a number of other types of existing water rights including commercial, stockwatering and "other" within the basins. For Snake Valley for example, these water rights make up 183 of the total 256 according to Table 3.3.1-19. On an AFY basis, it is unclear what these rights represent. If the amount of water represented is insignificant and therefore not included, then it should be disclosed in the text of the document. If the amount of water is significant, it should be included in the No Action alternative definition and modeling. 2) Figure 2.2-1 indicates that there are no existing industrial, municipal or irrigation groundwater rights within Hamlin Valley. Table 3.3.1-19 indicates that there are. These water rights should be included in the No-Action alternative modeling or a rationale should be given for excluding them.
C88	2-43	2.5.3.1, Part C		**Applicant Committed Environmental Protection Measures, Regional Water-Related Effects:** Of the Applicant Committed Measures for the Proposed Action and Alternative A, there are few meaningful measures that apply to Utah resources and that address effects from groundwater withdrawal due to pumping in Spring Valley or due to pumping in Snake Valley on Utah resources. The SNWA Adaptive Management Plan focuses primarily on stipulated agreements for valleys in Nevada, of which the Spring Valley Stipulation only minimally addresses resource monitoring and mitigation in Hamlin and Snake Valleys, Utah. There are a number of other basins in Utah that lie within the Spring Valley Stipulation Area of Interest, but where no monitoring is proposed. For effects due to pumping in Snake Valley, there is no stipulated agreement. Snake Valley pumping may cause flow reduction in a number of basins in Utah including Snake Valley, Hamlin Valley, Pine Valley, Wah Wah Valley or Fish Springs Flat. We recommend that SNWA expand its Applicant Committed Measures to address potentially affected resources in Utah beyond the few that will be monitored as part of the Spring Valley Stipulation.

	3.0 Introductory Material			
C89	3-12	3.0.4	3	Between the ADEIS and this DEIS, the following language was removed: "The cumulative impact analysis also was discussed in relation to any regulatory, biological, socioeconomic, or physical thresholds," and these thresholds were uniformly not applied to the resources under consideration in the DEIS. Thresholds such as those above, are strongly recommended in guidance documents such as the CEQ handbook "Considering Cumulative Effects Under the National Environmental Policy Act" (1997) and an EPA Advisory Memorandum titled "Consideration of Cumulative Impacts in EPA Review of NEPA Documents" (1999). Thresholds are critical in presenting meaningful impact analyses to the public who has little knowledge about current status and trends of natural resources. Absent the identification of trends in various species and their habitats, there is no context for evaluating the impacts disclosed in the DEIS. We recommend revisiting the cumulative effects analyses and applying appropriate thresholds that put impacts into context for more effective and meaningful decision-making.
	3.1 Air and Atmospheric Values			
C90	3.1-50 thru 3.1-55	3.1.3.2	General	The analysis of climate change effects is not very useful in that there is no substantive conclusions that reflect best professional judgement of the additive effect of climate change to project specific effects, or cumulative level project effects. It is highly likely that for some wildlife species for example, climate change will increase the vulnerability of a species to other stressors (or vice versa, that groundwater withdrawal for municipal or other needs could render species and ecosystems less resilient to impacts from climate change). Therefore, it is reasonable to suggest that the intensity of impacts and the extent of impact to sensitive wildlife species will multiply beyond that identified in the document at the project specific level and the cumulative effects level. The BLM could also reasonably disclose that effects articulated in the project specific and cumulative effects analyses for certain resources are under-represented.
C91	3.1-53	3.1.3.2	4	The literature sources referenced in the *Wildlife* section are useful, but BLM could provide much more context to the reader by summarizing whether the changes already documented are positive or negative for various wildlife guilds. That context would also establish a more meaningful interpretation of project specific and cumulative effects analyses.

	3.3 Water Resources			
C92	3.3-7	3.3.1.4	General	It appears that much of the descriptive language and rationale for naming a spring regional, intermediate, or local has been eliminated from the document since the last ADEIS. The reader cannot, therefore, determine whether a spring of interest (i.e. Gandy Warm Spring or Foote Reservoir Spring) is a regional spring. This is important for extrapolating whether a model-predicted reduction in flow at Foote Reservoir Spring is indicative of potential flow reductions at nearby springs, such as Gandy Warm Spring. The potential risk to a species such as least chub, which has a limited distribution, multiplies if all of the springs it occupies in the vicinity of Foote Reservoir Spring are likely to experience reductions in flow over time. The reader is unable to make these kind of comments if the local versus regional nature of all springs within the Region of Study is not consistently presented. It is also critical to articulate how BLM determined if a spring is regional versus local, regardless of where it falls relative to the 10-foot drawdown contour.
C93	3.3-11	3.3.1.4	Table 3.3.1-2	Table 3.3.1-2 of the DEIS lists Fish Springs Flat as having only "North Springs" with discharge of 200 gpm or greater. First, "North Springs" is not a term that is consistently used in other areas of the DEIS (or by the USFWS) that identify named springs on Fish Springs NWR/Fish Springs Flat. This term should be clarified or changed. Second, all measured springs located within the Fish Springs NWR exceed 200 gpm flow so all springs should be listed in the table. These measured springs include North Spring and the South Springs Complex. All measured springs in the South Springs Complex individually exceed 200 gpm flow, including; House Spring, Thomas Spring, Middle Spring, Lost Spring, South Spring, and Percy Spring. Deadman Spring and Crater Spring have not been measured and Walter Spring is currently not being measured, although some or all three of these springs exceed 200 gpm flow. All of these springs exceeding 200 gpm should be listed.

C94	3.3-11	3.3.1.4	1	It should be clarified that the stated USFWS estimate of 28.69 cfs is total *measured* average annual flow and does not represent total actual spring flow. Not all spring discharge has been measured through annual monitoring by refuge staff at any point during the history of the refuge. For 2010 annual monitoring, the total measured average annual flow was 30.46 cfs. This measured flow did not include spring discharge from Deadman Spring, Walter Spring, Crater Spring, or unnamed lesser seeps. At only a few selected times has there been an effort completed by hydrologists to measure total spring discharge from all springs. Total spring discharge was measured at 43.88 cfs in 1961 and 39.79 cfs in 1968 (the latter measurement appears to have possibly left out a spring/s). There was another effort completed in 1991 (34.5 cfs) that clearly did not include all springs. Resolution of varying discharge values may be done partially by reviewing and including the 2009 value posited by the Utah Division of Water Rights and included in the Draft Utah/Nevada Snake Valley Agreement. A value of 20,000 acre-feet per year is asserted as passing through Snake Valley and discharging at the refuge (http://www.waterrights.utah.gov/snakeValleyAgreement/snakeValley.asp). In addition to this 20,000 acre-feet per year, the Utah Geological Survey and the U.S. Geological Survey have asserted in various publications more ground-water is received from the Deep and Fish Springs Ranges as well as the Sevier Desert. Thus, total production from Fish Springs exceeds the 21,000 acre-feet per year reported in the 2004 USFWS Comprehensive Conservation Plan.
C95	3.3-87	3.3.2.8	1	If BLM is not going to use the model to predict areas where there may be <10-foot of drawdown, then there needs to be an alternative method for identification, disclosure, and analysis. The deficiency of the model to evaluate these areas does not preclude the requirement to analyze these areas and disclose effects.
C96	3.3-87	3.3.2.8	2	There is an implication here that BLM has identified which springs arise from the regional groundwater flow system. If this is the case, BLM needs to disclose which springs meet this criteria and include rationale for that determination. If the DEIS contains such a disclosure, it was not clear where to find this information.
C97	3.3-89	3.3.2.8	Table 3.3.2-3	As described in Table 3.3.2-3, Valley Margin Areas support water sources that are local and intermediate and, therefore, are moderately susceptible to pumping from the regional flow system. The table does not provide for a situation where pumping occurs from valley margin areas. What are the local impacts as a result of this situation? It appears relevant because under section 3.3.2.9 Proposed Action, the first paragraph discloses that groundwater development areas will be located in portions of valley floor and valley margin areas within each basin. Therefore, it appears that some of the springs in valley margin areas may be at high risk of impact from the GWD Project pumping.

C98	3.3-92	3.3.2.8	6	Because BLM has limited its effects analysis (outside of the 10' drawdown contour) to modeled springs that show >5% reduction in flow, the BLM appears to conclude that a reduction in flow <5% equates to no impact. We disagree with this logic as it does not result in full disclosure of potential project impacts. For example, the document fails to account for reductions in flow in habitat critical for least chub, a candidate species for listing under the ESA. Where the groundwater model predicts <5% reduction in flow in Foote Reservoir Springs, the document concludes no impact to sensitive species that depend on that system (i.e., northern leopard frog and least chub). To the contrary, USFWS found that any further reduction in water levels beyond that which exist today will be detrimental to the least chub (FWS, 2010). Yet, this impact is not disclosed.
C99	3.3-98, 3.3-124	3.3.2.9, 3.3.2.10	3, 2	Where the document presents impacts to water levels from groundwater pumping, it consistently makes an inaccurate statement that "Drawdown does not occur at this time period in Snake Valley because pumping is not projected to begin in Snake Valley until the final stage of the development". This sentence makes an errant and dangerous conclusion that pumping in Spring Valley will not cause drawdown in Snake Valley (at any point in the future). A more accurate statement would be: "Drawdown does not occur at this time period in Snake Valley because pumping effects from Spring Valley have not yet propagated to Snake Valley according to the groundwater model." We recommend that BLM correct its statement where it may be errant, and consider how an inaccurate conclusion may have influenced the analysis of project effects to all resources. This comment is relevant to pumping effects analyses for the proposed action, Alternative A, D and E.
C100	3.3-110	3.3.2.9	1 thru 6	**Utah Surface Water Resources:** This section (and others in Chapter 3.3) describes the effect of pumping under the Proposed Action to water resources in Pine Valley. Specifically, drawdown under the Proposed Action at FBO +75 and FBO+200 could propagate into Pine Valley. The model predicts some number <17 feet for drawdown at FBO + 75 years and some number <51 feet at FBO + 200 years. Because depths to groundwater are deep in Pine Valley and because many investigated springs are intermittent, the DEIS concludes no impact to water resources in Pine Valley. Groundwater depths and surface water status in other valleys such as Wah Wah or Tule are not presented. Water resource conditions in adjacent basins within the Great Salt Lake Desert Flow System may be vulnerable to drawdown propagating through and beyond Pine Valley. We recommend that the BLM provide an analysis of Tule and Wah Wah Valleys similar to the analysis it provided for Pine Valley.

C101	3.3-110	3.3.2.9	1 thru 6	**Utah Surface Water Resources:** This section fails to describe impacts of pumping under the proposed action (and other Alternatives) to water resources in Hamlin Valley, Utah. There are a number of terrestrial and aquatic species that rely on surface water resources in the Utah portion of Hamlin Valley that will experience drawdown. This comment applies to Alternatives A - D in addition to the proposed action.
C102	3.3-117	3.3.2.9	7	**GW-WR-3:Monitoring and Modeling, Effectiveness:** The effectiveness of the Stipulated Agreement monitoring plans, and BLM's annual review of monitoring and modeling results, in providing "early warning" of undesirable impacts is unknown at this point in time. Time lags in biological response to hydrologic changes could be problematic and need to be taken into account when planning and implementing minimization and mitigation measures. Once an ecological change of concern is documented, the cause for this change is determined, and mitigation (such as redistribution or cessation of pumping) is implemented, it may take many years before the system responds to the mitigation efforts (in fact, the adverse impact could get worse before there is any leveling out or rebounding of the system). Ultimately, there could be extensive spatial and temporal loss of water dependent resources, and the DEIS should be clear in disclosing this and addressing this through monitoring and mitigation requirements. Additionally, residual impacts should be disclosed and described as quantitatively as possible (though we understand that there is a lot of uncertainty in this regard). The analysis should be carried through from water resources to all other resources affected by drawdown. This comment applies to Alternatives A-E in addition to the proposed action.
C103	3.3-118	3.3.2.9	2	**GW-WR-4: Snake Valley 3M Plan:** The 3M Snake Valley Plan should be a Term and Condition of ROW authorization. Otherwise, there is no way to ensure adequate consideration of all resource agency needs and no way to ensure enforcement. This comment applies to the Spring Valley and DDC Stipulated Agreement 3M plans as well. This comment applies to Alternatives A-E in addition to the proposed action.
C104	3.3-121	3.3.2.9	3	If water is pumped from increasingly deeper depths to maintain the water supply at Shoshone Ponds, it seems possible that there could be changes in water quality and temperature at this location. The DEIS does not address how this could affect the Pahrump poofish and relict dace. We request that BLM include this discussion in the FEIS and require SNWA to maintain the water quality at this location appropriate for protection of relict dace and Pahrump poolfish (include this as an additional mitigation measure).

C105	3.3-129	3.3.2.10	4 and 5	**Utah Surface Water Resources:** This section describes impacts of pumping under Alternative A to water resources in Pine Valley. Specifically, pumping at FBO+200 could propagate drawdown into Pine Valley. The model predicts some number <31 feet at FBO + 200 years. Because depths to groundwater are deep in Pine Valley and because many investigated springs are intermittent, the DEIS concludes no impact to water resources in Pine Valley. Water resource conditions in adjacent basins within the Great Salt Lake Desert Flow System may be vulnerable to drawdown propagating through and beyond Pine Valley, yet these resources are not considered. This section should also describe the potential impact of pumping to water resources in Wah Wah Valley, eastern Snake Valley, and Tule Valley. This comment applies to Alternatives A-E in addition to the proposed action.
C106	3.3-110	3.3.2.10	4 and 5	**Utah Surface Water Resources:** This section fails to describe impacts of pumping under Alternative A to water resources in Hamlin Valley, Utah. Hamlin Valley in Utah supports greater sage-grouse brooding habitat and a number of leks. During early brood rearing, the species depends upon wetter areas that support grasses and forbs. During late brood rearing, the species depends upon mesic vegetation that supports succulent vegetation and insect abundance and diversity. In Hamlin Valley, this type of vegetation is dependent on a number of water sources including springs, seeps and artificial sources such as artesian wells. Recommend that BLM analyze water resources in Hamlin Valley closely and disclose findings, including pumping effects, in EIS. See comments under Vegetation and Terrestrial wildlife resources for additional information. This comment applies to Alternatives A-E in addition to the proposed action.

C107	3.3-131	3.3.2.10	6	**Monitoring and Mitigation Recommendations:** This paragraph references GW-WR-3 for monitoring/mitigation measures to address groundwater drawdown impacts under Alternative A. Under Alternative A, the model and resulting analysis predict impacts to water resources in Snake and Hamlin Valleys, Utah although the document does not differentiate Spring Valley pumping effects from Snake Valley pumping effects. GW-WR-3 cites the Spring Valley stipulation as a source for monitoring and mitigation measures for resources affected under Alternative A. The Spring Valley Stipulation and associated hydrological and biological monitoring plans do little to ensure monitoring and mitigation within Hamlin and Snake Valleys in Utah. Based on Figure 3.3.2-9 (Spring and Well Monitoring Sites, Spring Valley Stip), there are no hydrological monitoring devices in Snake or Hamlin Valleys, Utah. The only biological resources monitored under the Spring Valley Stipulation in Utah are restricted to Snake Valley and are limited to springs, wet meadow, and greasewood communities in the very southwestern corner of the valley. Given the size and complexity of the BMP under this Stip, monitoring of Utah resources is significantly under-represented. There is a need to provide monitoring and mitigation measures for Snake and Hamlin Valleys (Utah) drawdown effects that arise from Spring Valley pumping. This comment applies to Alternatives A-E in addition to the proposed action.
C108	3.3-131	3.3.2.10	6	**Monitoring and Mitigation Recommendations:** This paragraph references GW-WR-4 for monitoring/mitigation measures to address groundwater drawdown impacts under Alternative A. Under Alternative A, the model and resulting analysis predict impacts to water resources in Snake and Hamlin Valleys, Utah. GW-WR-4 cites the draft outline for a Snake Valley 3M plan as a source for monitoring and mitigation measures for resources affected under Alternative A. The effectiveness of the 3M Plan is questionable unless it is a Term and Condition of the ROW authorization, and unless the resource agencies have an opportunity to discuss the draft outline in Appendix B with BLM and SNWA. Recommend creating a final "outline" of the 3M Plan (Appendix B) with input from all relevant parties before finalization of the EIS and ROD. This comment applies to Alternatives A-E in addition to the proposed action.
C109	3.3-186	3.3.2.16	Table 3.3.2-22	There is little meaning in presenting a comparison of alternatives where the No Action assumes the "continuation of existing activities" but the project alternatives are presented as isolated actions. The impacts represented under the project alternatives are inaccurate unless all other existing activity stops, which is not realistic. The project alternatives cannot realistically be compared to the No Action alternative unless the "continuation of existing activities" is incorporated into the projected effects for each project alternative. It is disingenuous to ask the public to compare the alternatives based on unrealistic scenarios.

	3.5 Vegetation			
C110	3.5-10	3.5.1.4	Figure 3.5-3	It appears that Hamlin Valley (except for ROW and GWD Areas) and Deep Creek Valley were omitted from the Region of Study vegetation analysis without disclosure of a reason. The public and natural resource agencies need to understand what vegetation types exist across these valleys in order to meaningfully comment on the analysis of impacts due to groundwater pumping within the Natural Resources Region of Study. Under a number of the alternatives, Hamlin Valley in particular will experience drawdown that extends into Iron County, Utah where there is crucial brooding habitat, four active greater sage-grouse leks and 2 historical leks. During early brood rearing, the species depends upon wetter areas that support grasses and forbs. During late brood rearing, the species depends upon mesic vegetation that supports succulent vegetation and insect abundance and diversity. We recommend that BLM disclose whether sage-grouse brood rearing habitats in Hamlin Valley will be affected by potential drawdown, and the rationale for its decision. Some potential sources of information that BLM may want to consult include the spring and seep mapping efforts conducted by the state of Utah and BLM for Hamlin Valley as part of the Utah Partners for Conservation & Development Watershed Restoration Initiative. In addition, BLM Cedar City District has published a draft Hamlin Valley EA #DOI-BLM-UT-C010-2010-0022-EA to analyze the effects of improving access to existing Hamlin Valley water sources for greater sage-grouse. This document should provide background information on sources of water and vegetation types.
C111	3.5-24 - 3.5-25	3.5.2.2	Vegetation Community Surface Disturbance & Restoration	We recommend obtaining native, local seed from the appropriate NRCS Plant Materials Center instead of using a commercial vendor. The selection of appropriate seed material for rehabilitation or restoration should ideally come from an environment that closely matches the target environment to be seeded (Lesica and Allendorf, 1999; Hufford and Mazer, 2003; Rice and Emery, 2003; McKay et al., 2005). However, decisions about which species to use for restoration are often limited by non-ecological factors such as seed availability and cost (Richards et al., 1998; Pyke and McArthur, 2002; Thompson et al., 2006). Species used in Great Basin restoration projects are native cultivars or introduced grass species like crested wheatgrass (Agropyron cristatum (L.) Gaertn). Native cultivars are limited in number, represent a fraction of the natural genetic diversity of a species, and have narrowly defined, uniform traits due to their selective breeding history (Burton and Burton, 2002). One option managers could try is collecting seeds from species in desirable communities within the watershed and using them for restoration in the degraded communities. This comment applies to Alternatives A-E in addition to the Proposed Action.

C112	3.5-24 - 3.5-25	3.5.2.2	Vegetation Community Surface Disturbance & Restoration	The Service does not support planting of monocultures of crested wheatgrass as means to restore sage-grouse habitat. Studies have demonstrated that the establishment of native species into crested wheatgrass stands is difficult (Cox and Anderson 2004; Fansler and Mangold 2010). Attempts to reintroduce native species into crested wheatgrass stands suggest crested wheatgrass plants and propagules need to be destroyed or damaged through mechanical and/or chemical treatments, deliberate introduction of native species is required, and native species used need to be accessed for their performance (Bakker et al. 1997; Cox & Anderson 2004; Fansler and Mangold 2010). Overall, subsequent treatments of crested wheatgrass monocultures may be more costly than initially using a diverse mixture of native seeds for habitat restoration, especially if habitat diversity for wildlife species is the goal. This comment applies to Alternatives A-E in addition to the Proposed Action.
C113	3.5-24 - 3.5-25	3.5.2.2	Vegetation Community Surface Disturbance & Restoration	The Restoration Plan must include details regarding restoration methods, monitoring methods, and success criteria. We recommend *Monitoring Post-Fire Vegetation Rehabilitation Projects: A Common Approach for Non-Forested Ecosystems* (Wirth and Pyke 2007) as a reference for monitoring program design and sampling approaches. This comment applies to Alternatives A-E in addition to the Proposed Action.
C114	3.5-28	3.5.2.2	Cacti and Yucca, Special Status Plants	For the few *Sclerocactus blainei* individuals that cannot be avoided and must be salvaged, we recommend that BLM contact folks with experience transplanting other rare *Sclerocactus* species and/or researchers such as Eric Rechel and others who are studying and comparing different transplantation techniques for *Sclerocactus* species in Colorado with the goal of maximizing transplantation success. Transplantation effectiveness monitoring should be incorporated for cacti, including *S. blainei*. Another potential option is to bring the salvaged *S. Blainei* individuals into captive propagation (e.g., at the Springs Preserve in Las Vegas). This comment applies to Alternatives A-E in addition to the Proposed Action.
C115	3.5-28	3.5.2.2	Cacti and Yucca, Special Status Plants	We recommend reviewing the University of Arizona Cooperative Extension publication titled How to Transplant a Cactus, supplied to BLM with the Service's comments on the draft BA. This comment applies to Alternatives A-E in addition to the Proposed Action.

C116	3.5-40	3.5.2.8	8	It appears that this section assumes no drawdown effects to areas outside of ET zones. For Hamlin Valley, over 95% of the valley looks to be outside of a mapped ET zone (Figure 3.5-6). The rationale for excluding the majority of Hamlin Valley from an analysis of pumping effects to vegetation must be presented, especially because much of Hamlin Valley falls within the 10-foot drawdown contour under the various alternatives.
C117	3.5-67	3.5.3	General Cumulative Impacts	To provide an opportunity for meaningful comment, It is critical to discuss cumulative effects in the context of existing conditions and biological thresholds. For example, what extent of each basin is already infested by cheatgrass (existing conditions)? At what point does cheatgrass becomes impossible to manage or reverse i.e. 50% coverage in a given area? (threshold). Based on vegetation succession patterns, BLM could determine how much more area may be infested by cheatgrass as a result of project implementation. It could further disclose how many marginal cheatgrass communities will tip over to a majority of cheatgrass and therefore be unmanageable/irreversible. This comment applies to Alternatives A-E in addition to the proposed action.
	3.6 Terrestrial Wildlife			
C118	3.6-14	3.6.1.2	Figure 3.6-7	Greater sage-grouse leks in Hamlin, Pine, and Deep Creek Valleys, Utah are not represented on Figure 3.6-7 or considered in the document. For more information on the Hamlin Valley population, please contact Rhett Boswell at UDWR: 435-865-6112 or Nikki Frey at Southern Utah University (435)586-1924. The document should be revised to present baseline information for these valleys and the potential for these water sources (and species such as sage-grouse that rely on these water sources and mesic vegetation) to be affected by groundwater drawdown. In Hamlin Valley, a number of water sources exist that support vegetation used by greater sage-grouse during nesting and brood-rearing. These water sources include springs, seeps and artesian wells. Information about the water sources can be found at the Utah Partners for Conservation and Development Watershed Resource Initiative website as well as in the Hamlin Valley EA #DOI-BLM-UT-C010-2010-0022-EA.

C119	3.6-17	3.6.1.2	1	Please note that while we have not yet requested an Avian Protection Plan, discussions with SNWA on migratory bird and eagle protection measures have been delayed and, thus, our determination of what specifically is needed to protect these species from anticipated project impacts has been delayed. We anticipate that these discussions will occur in the very near future, so that recommendations can be incorporated into the FEIS and the Record of Decision. Regardless, we recommend providing a more complete assessment of impacts to eagles in the DEIS (e.g., "There would be an X probability of collisions and electrocutions to wintering and breeding eagles because..."). Also, please explain how adaptive management would address changing conditions in regard to eagle presence or use of the project area. This comment applies to Alternatives A-E in addition to the Proposed Action.
C120	3.6-22 +	3.6.1.4	General	At some point in this section, we recommend referencing the following three documents and the management direction they provide regarding Migratory Bird Habitat: Executive Order 13186, IM 2008-050 MBTA, and the BLM MOU with USFWS regarding migratory birds. There are measures included in each that specify management direction relative to 1) the analysis of direct and indirect impacts to nesting habitat, fragmentation of habitat, and reduction in habitat patch size (IM 2008-050 MBTA); 2) identification of the amount of affected habitat and relative abundance of the habitats over the landscape (IM 2008-050 MBTA); and 3) bird habitat protection and conservation (BLM/FWS MOU).
C121	3.6-22 +	3.6.1.4	General	There is little meaningful analysis or presentation of groundwater pumping impacts to migratory bird habitat. The analysis appears to be limited to the percentage of total ET areas subject to drawdown and what types of birds exist in the habitats affected by drawdown. Recommend the following: 1) Identify the acreage of each habitat type that will be lost under each groundwater pumping scenario; 2) Summarize that information in the main text of the document; 3) Evaluate habitat loss in light of the relative abundance of those habitat types over the landscape, as well as the trends for those habitat types. The Utah Wildlife Action Plan identifies abundance, levels of threat, and trends for 10 key habitat types in Utah. Where these habitat types overlap with the Region of Study, they should be referenced to establish a context for evaluating impacts (i.e. existing conditions). This analysis is supported by management direction in the following documents: Executive Order 13186, IM 2008-050 MBTA, and the BLM MOU with USFWS regarding Migratory Birds. This comment applies to Alternatives A-E in addition to the proposed action.

C122	3.6-44	3.6.2.2	ACM A.5.47	Even if eggs have not been laid, if evidence of nesting (i.e., mated pairs, territorial defense, carrying nesting material, transporting food) is observed, a protective buffer (refer to Service 2007) should be delineated around the entire area. This area should be avoided to prevent destruction or disturbance to nests until they are no longer active. This comment applies to Alternatives A-E in addition to the Proposed Action.
C123	3.6-45	3.6.2.2	ACM A.5.44	The FWS has conservation responsibilities and management authority for migratory birds. Therefore, please coordinate closely with the Service on any actions that may affect the burrowing owl or any other migratory bird. ACM A.5.44, referred to here, states that SNWA would coordinate with the BLM and NDOW on relocation of burrowing owls. Relocation of burrowing owls would require a special purpose permit issued through our Regional Migatory Bird Office in Sacramento. This comment applies to Alternatives A-E in addition to the Proposed Action.
C124	3.6-59 thru 3.6-86	3.6.2.8		There is no comparison of alternatives for terrestrial wildlife under Groundwater Pumping. The document should present an analysis that demonstrates how the various groundwater pumping scenarios compare relative to impacts to terrestrial species. Without this analysis, the reader cannot provide meaningful comment to the DEIS. This comment applies to Alternatives A-E in addition to the proposed action.
C125	3.6-77	3.6.2.9	3+	**GW-WL-8**: "The Snake Valley 3M Plan will include management and mitigation measures that could be used to address impacts identified during monitoring relevant to terrestrial wildlife species". This sentence implies that monitoring of terrestrial wildlife (e.g., greater sage-grouse or migratory birds) responses to groundwater pumping will be implemented. However, it does not appear that there is a monitoring provision for these species, therefore it would be impossible to say at what point and to what extent terrestrial wildlife has been impacted. We recommend adding a provision to Appendix B, Snake Valley 3M Plan, that articulates a monitoring, management and mitigation requirement for terrestrial species that may not be considered "groundwater dependent" but yet rely on vegetation (at some point of the year) that is subject to groundwater drawdown effects. Based on language in the Spring and DDC Valley Stipulation Agreements and associated documents, DOI will likely be pressed by SNWA to prove that it is pumping that has decreased habitat for a terrestrial (or aquatic) species. The potential for this situation to occur, and the potential difficulties of showing cause and effect, should be addressed in the DEIS. This comment applies to Alternatives A-E in addition to the proposed action.

C126	3.6-77	3.6.2.9	1 thru 6	The monitoring and mitigation recommendations provided on this page do not address the loss of migratory bird habitat due to groundwater pumping. The Snake Valley 3M Plan does not appear to include provisions to monitor or mitigate for the effects of migratory bird habitat loss. One cannot assume that monitoring of northern leopard frog habitat, for example, translates into monitoring for migratory bird habitat. The same rationale applies to mitigation. It is unsupported to imply that mitigation for lost frog habitat will translate into effective mitigation for lost migratory bird habitat. This section of the document should identify specific measures that will be implemented to ensure protection and conservation of migratory bird habitat. The identification of such measures is supported by management direction in the following documents: Executive Order 13186, IM 2008-050 MBTA, and the BLM MOU with USFWS regarding Migratory Birds. This comment applies to Alternatives A-E in addition to the proposed action.
C127	3.6-89	3.6.3.5		For cumulative impacts related to pipeline disturbance, we ask BLM quantify the existing disturbance (acres of previous fires, exsisting roads, site-type ROWs, linear ROWs) of areas that would intersect the area of pipeline construction. Then, analyze impact to terrestrial species based on the combined acreage. This comment applies to Alternatives A-E in addition to the Proposed Action.
	3.7 Aquatic Biological Resources			
C128	3.7-16	3.7.1.4	Table 3.7-3	The table should be updated to reflect the following: Least chub is a Tier I species in the Utah Comprehensive Wildlife Conservation Strategy, Utah Wildlife Action Plan (UDWR, 2005). Northern leopard frog is a Tier III species. Columbia spotted frog is a Tier I species.
C129	3.7-18	3.7.1.4	5	**Least chub:** The DEIS should disclose that in its 12-month finding for least chub, the USFWS found that current levels of water pumping represent a significant threat to least chub, contributing to the need to the list the species under the ESA. It additionally finds that any further reduction in water levels beyond that which exist today will be detrimental to the species.
C130	3.7-18	3.7.1.4	5	**Least chub:** The DEIS should be clear that Bishop Springs Complex includes Foote Reservoir Springs, a spring existing outside the 10-foot contour but where reduced flows are predicted.
C131	3.7-19	3.7.1.4	2	**Amphibians, Northern leopard frog**: The DEIS should be clear that Bishop Springs Complex includes Foote Reservoir Springs, a spring existing outside the 10-foot contour but where reduced flows are predicted.

C132	3.7-19	3.7.1.4	2	**Amphibians, Northern leopard frog:** According to the 2007 Bio-West report prepared for SNWA (Ecological Evaluation of Selected Aquatic Ecosystems in the Biological Resources Study Area), surveyors found northern leopard frog in the following springs not represented in this paragraph: Leland Harris and Twin Springs, Snake Valley, Utah. Bio-West cited Utah Division of Wildlife Resources to support these findings.
C133	3.7-21	3.7.2	Rights of Way, Issues	A big issue with rights-of-way would be the potential threat of spreading or encouraging the spread of invasive aquatic species. Spread could occur both unintentionally through mud on vehicle tires (for example) or by the purposeful spread of sport fish, released pets, bait bucket releases, etc. Improved access by the public to aquatic ecosystems will increased this threat significantly. Habitat alterations will also greatly increase this threat. Invasive species are one of the major threats to native aquatic biodiversity, in addition to habitat loss and destruction.
C134	3.7-24	3.7.2.2	Mitigation Measures	Suggest adding an invasive species monitoring, avoidance, and eradication measure throughout the project footprint and activities. Public spread of exotics is a significant concern to native biodiversity. An effective strategy to respond aggressively and decisively to any incursions of exotic species is necessary to avoid allowing invasive fauna to become locally entrenched in aquatic ecosystems. There are many invasive species, but a short list includes mosquitofish, shortfin mollies, tilapia, carp, bass, sunfish, red-rimmed melania snails, bullfrogs, and crayfish (of any type). To date, Spring Valley aquatic systems appear to be free of many of the aquatic invasive vertebrates and invertebrates that plague other systems in the Region of Study, such as red-rimmed melania snails and bullfrogs. Keeping invasive species out of these systems should be a high priority. This comment applies to Alternatives A-E in addition to the Proposed Action.
C135	3.7-44	3.7.2.9	2	This paragraph relies on information gleaned from Appendix F3.7, Table F3.7-13A to summarize potential effects to special status fish species. The referenced table inaccurately presents "no data" as it pertains to Percent Change in Flow at Bishop Springs Area. Foote Reservoir Springs is part of the Bishop Springs Area. The model predicts a 2% reduction in flow at Foote Springs under the proposed action at FBO + 200 years and a 1% reduction in flow at Foote Springs under Alternative A, FBO + 200 years. This percent change in flow should be reflected in Table F3.7-13A and further analyzed for impacts to least chub in Section 3.7 as the species is sensitive to even minor changes in groundwater levels. This comment applies to Alternatives A-E in addition to the proposed action.

C136	3.7-44	3.7.2.9	2	Given the acknowledged limitations of the CCRP model, it is inaccurate and unsupported to say that least chub will not be affected by groundwater pumping and subsequent groundwater drawdown. To the contrary, the sensitivity of the species to even minor (<1') changes in groundwater levels (as documented in the 2010 12-month finding for the species) in addition to the regional connectivity of springs where least chub exists indicates a potential for effect. SNWA is a party to the least chub conservation agreement which calls for maintaining the hydrological features of the springs that support least chub. These factors all present a compelling case to acknowledge and develop measures to avoid ANY effect to the springs that support least chub. This comment applies to Alternatives A-E in addition to the proposed action.
C137	3.7-45	3.7.2.9	1	This paragraph relies on information gleaned from Appendix F3.7, Table F3.7-13B to summarize potential effects to amphibians. The referenced table neglects to include two northern leopard frog occupied habitats: Gandy Salt Marsh and Bishop Spring/Foote Reservoir Springs. These habitat locales should be included in the table. Percent flow change data should also be presented for Bishop Spring/Foote Reservoir Springs. The model predicts a 2% reduction in flow at Foote Springs under the proposed action at FBO + 200 years and a 1% reduction in flow at Foote Springs under Alternative A, FBO + 200 years. This percent change in flow should be reflected in Table F3.7-13B and further analyzed for impacts to northern leopard frog in Section 3.7.
C138	3.7-46	3.7.2.9	4	**Compliance with Management Objectives:** A fifth species (least chub) should be included in this section. SNWA is a signatory to the least chub conservation agreement. The model predicts a 2% reduction in flow at Foote Springs (habitat for least chub) under the proposed action at FBO + 200 years and a 1% reduction in flow at Foote Springs under Alternative A, FBO + 200 years. The Proposed action and Alternative A pumping scenarios conflict with management objectives for this species. Given the acknowledged limitations of the CCRP model, it is inaccurate and unsupported to say that least chub will not be affected by groundwater pumping and subsequent groundwater drawdown. To the contrary, the sensitivity of the species to even minor (<1') changes in groundwater levels (as documented in the 2010 12-month finding for the species) in addition to the regional connectivity of springs where least chub exists indicates potential for effect. SNWA is a party to the least chub conservation agreement which calls for maintaining the hydrological features of the springs that support least chub. These factors all present a compelling case to acknowledge and develop measures to avoid ANY effect to the springs that support least chub. This comment applies to Alternatives A-E in addition to the proposed action.

C139	3.7-90	3.7.3.5	4	Very little meaningful information is provided to describe cumulative effects to aquatic species as a result of groundwater pumping. Context and thresholds are critical in presenting meaningful impact analyses to the public who has little knowledge about current status and trends of natural resources. Absent the identification of trends in various species and their habitats, there is no context for evaluating the impacts disclosed in the DEIS. For the longitudinal gland pyrg, for example, model predictions for the Proposed Action and Alternative A indicate complete loss of habitat for the species. The cumulative effects section should reiterate that if project specific pumping will eliminate the full range of habitat, then cumulative effects will most certainly do the same. A threshold for this species would be easy to establish: 100% elimination of the species' natural habitat is unacceptable. This section should determine whether this threshold will be met under a cumulative effects scenario. This comment applies to Alternatives A-E in addition to the proposed action.
	3.14 Special Designations			
C140	3.14-18	3.14.2.8	General	In the case of Gandy Salt Marsh ACEC in Millard County, Snake Valley, Utah, the BLM did not comprehensively consider the impact of groundwater pumping. It could use two criteria to determine effects: 1) overlap of groundwater drawdown contours and 2) presence of a specifically modeled water source where a reduction in flow is predicted. While the 10-foot groundwater drawdown contour does not overlap with Gandy ACEC, there is reason to believe that the individual springs contributing to the salt marsh may be impacted. Modeling of Foote Reservoir Spring, part of the Bishop Springs Complex approximately 4 miles away from the Gandy ACEC, revealed a 1-3% reduction in flow depending on the alternative, timeframe and project specific vs. cumulative scenario. Given that Foote Reservoir Spring and Gandy Salt Marsh are regional level springs that exist within the valley floor, it is reasonable to assume a similar level of impact between the two water bodies. The BLM should disclose potential effects to Gandy Salt Marsh in the document or its rationale in determining no effect. Should an effect be disclosed, BLM should identify potential conflicts with ACEC management direction, how it will avoid an adverse effect, and the effectiveness of such measures. This comment applies to Alternatives A-E in addition to the proposed action.
	3.20 Monitoring and Mitigation Summary			
C141	3.20	3.20-1	1	This paragraph should describe to the reader that the measures are only in summary form; i.e., Section 3.20 should not be used now or in the future without referencing more detailed information about the mitigation measures. Either in this paragraph or under the individual measures, BLM should provide a reference for the reader where he can find more detailed information.

C142	3.20	3.20-9	Table 3.20-2	GW-WR-3, as it is presented here, does not specify what kind of monitoring will be reflected in the annual monitoring reports. In case this section of the EIS is ever used as a stand-alone document, the language that describes GW-WR-3 should be more explicit OR include a reference where the reader can find more detailed information.
C143	3.20	3.20-9	Table 3.20-2	To provide a good summary to the reader, it would be useful to add the following information to GW-WR-4: 1) The 3M Plan, as it exists in the DEIS, is only an outline of what should be included in the Plan; 2) The purpose of the 3M Plan for Snake Valley should include "where" the three purposes apply. For example, "where" will it protect water dependent resources on public lands? In Snake Valley only? In a not yet described "area of interest"? 3) When will SNWA, in conjunction with DOI agencies and the States, develop a long term 3M Plan for Snake Valley? 4) Whether the Snake Valley 3M Plan is specific to Snake Valley pumping OR whether it also covers pumping from other valleys (e.g., Spring Valley); and 5) Who will approve the plan, enforce it and how?
C144	3.20	3.20-10	Table 3.20-2	The first bullet under GW-WR-6 should be revised to remove "general" in the description of water quality. In some cases where wildlife species are concerned, a specific water quality may be critical to provide habitat.
C145	3.20	3.20-10	Table 3.20-2	GW-VEG-3: See comments for GW-WR-4.
C146	3.20	3.20-11	Table 3.20-2	GW-WL-8: "The Snake Valley 3M Plan will include management and mitigation measures that could be used to address impacts identified during monitoring relevant to terrestrial wildlife species" implies that monitoring for terrestrial wildlife responses to groundwater pumping will be implemented. It does not appear that there is a plan for such monitoring; therefore, it would be impossible to say at what point and to what extent terrestrial wildlife has been impacted. The resource agencies will also likely be asked by SNWA to prove that it is pumping that has decreased habitat for a terrestrial species. The potential for this situation to occur should be analyzed and addressed somewhere in the NEPA document.
C147	3.20	3.20-12	Table 3.20-2	GW-AB-3: The summary information here should articulate "whom" will be responsible for identifying specific mitigation measures and "when" they will be identified.

	Appendices			
C148		App. B	General Comment	The document is only an outline, developed by BLM and SNWA, of what should be included in a final 3M Snake Valley Plan. It is currently divided between "required" components and those that fall under the term "guidance". We are concerned that Resource Agency input will not be considered at this critical point in time. We recommend that prior to publication of the Final EIS and ROD, BLM work with all parties (including DOI Agencies, NDOW, UDWR) to develop an outline of required components of a 3M Plan that is inclusive of all party needs. The Agencies need an opportunity outside of the NEPA process to interact with the BLM and SNWA about the content of the draft Plan.
C149	B-1	App. B	General	Recommend renaming the document: "Draft Outline - Monitoring, Mitigation and Management Plan for Snake Valley, Utah-Nevada."
C150	B-1	App. B	General	We fully support the detail with which the main text of the 3M Plan is written and believe it is critical to include as required components of the 3M Plan (as opposed to "guidance").
C151	B-1	App. B	General	The USFWS fully supports a multi-party effort for development of the 3M Plan and is committed to meaningful involvement in the process. We also fully support adoption of the 3M Plan as a Term and Condition of issuance of the ROW and believe that is the best way to ensure that monitoring and mitigation occurs in Snake Valley and the rest of the Great Salt Lake Desert Flow System (including Hamlin Valley).
C152	B-1	App. B	General	It is critical that a 3M Snake Valley Plan be developed through a multi-party process that includes the relevant resource agencies with state and federal trust responsibilities (i.e. Utah DWR, NDOW, US Fish and Wildlife Service Reno and Utah Offices, NPS). We recommend including the USFWS Refuge System if they wish to be involved.
C153	B-1	App. B	2	Recommend identifying the geographic area (Great Salt Lake Desert Flow System, including Fish Springs Flat, Hamlin Valley, Tule Valley, Pine Valley, and Wah Wah Valley)to which the 3M Plan will apply within the purpose of the document. It is critical information that should be immediately available to the reader.
C154	B-1	App. B	2	Recommend that the third purpose of the 3M Plan be revised as follows: "Provides a process for *identifying* and mitigating impacts."
C155	B-1	App. B	4	Recommend that BLM change the last sentence in this paragraph to the following: "The 3M Plan will include, *but is not limited to* :"
C156	B-2	App. B	5	The final sentence of this paragraph reads "Final approval of the Snake Valley 3M Plan (or any interim Plans) rests with the BLM". This sentence is important and should be moved to the beginning of the document.

C157	B-2	App. B	6	The first sentence of Paragraph 6 should be revised to read: "SNWA would be responsible for the development and implementation of management actions associated with the 3M Plan including all monitoring activities *prior to (i.e. baseline) and* during the life of the project.
C158	B-2	App. B	6	SNWA should provide results and analysis of monitoring not only to BLM, but to the technical group and management committee.
C159	B-3	App. B	1	It is critical that the 3M Snake Valley Plan outline a geographic area to which it will apply. We fully support the text on page B-3, under "Monitoring Area" that articulates its application to the Great Salt Lake Desert Flows system, and hydrographic basins adjacent to Snake Valley including Fish Springs Flat, Tule Valley, Pine Valley, and Wah Wah Valley. We recommend, however, that the Plan articulate the geographic area to which Management and Mitigation applies. The geographic areas for Management and Mitigation should be the same as those for Monitoring.
C160	B-4	App. B-1	General	We are concerned with the language used to describe Appendix B Supplement 1. We recommend that the BLM call the supplement something other than "Guidance," as many of the provisions will be critical to a meaningful Snake Valley 3M Plan. If the 3M Plan is written to truly reflect measures in the Stipulations, then the majority of the "guidance" should be required elements.
C161	B-4	App. B-1	General	Members of the Technical Working Group should be more specifically defined according to roles.
C162	B-4	App. B-1	General	Recommend adding a paragraph that emphasizes: 1) the link between hydrology and biology and 2) the importance of coordination/collaboration in the development of hydrological and biological plans. For example, in order to correlate changes in habitat or species populations to changes in hydrology, it is critical to monitor hydrology at times and locations compatible with collection of biological data. Therefore, hydrologists and biologists must consult with one another when developing hydrology and biology monitoring networks to ensure individual data collection is informative to each group.
C163	B-4	App. B-1	3	It may not be prudent for the 3M Plan to rely on the existing groundwater monitoring networks established by the USGS and by the UGS as it is not clear how long into the future they will be funded and operated. Specifically, an intention by UGS to maintain and operate its network for at least the next 50 years does nothing to assure the reader that the network will be maintained and operated post-pumping in Snake Valley. This section of Appendix B Supplement 1 could reference the uncertainty of these networks and articulate a way to address it so that the reader is assured the networks will be available and functioning once pumping starts in Spring and Snake Valleys, and into the future.

C164	B-5	App. B-1	2	Under Biological Provisions, the document should be clear that monitoring, management and mitigation can apply to terrestrial species such as migratory birds or greater sage-grouse, for example, whose brooding habitat may be affected by groundwater pumping. Recommend adding a provision to Appendix B, Snake Valley 3M Plan, that articulates that monitoring, management and mitigation can apply to aquatic and terrestrial species that rely on groundwater-dependent vegetation (at some point of the year). It is critical to tie changes in groundwater dependent vegetation and other habitat components to changes in the vigor and viability of species of concern, which should be identified through the technical working group process. The technical working group will be responsible for determining the resources of concern that need to be included in the monitoring, management, and mitigation program, including terrestrial and aquatic species.
C165	A2 - A3	App. E	A.1.1	The Service would appreciate reviewing sections of the POD, Mitigation Plan, Integrated Weed Management Plan, and Restoration Plan that pertain to Service trust resources, including migratory birds and species to be considered for the section 7 consultation (federally listed species and technical assistance species).
C166	A-3	App. E	A.1.2	Is one Compliance Inspector Contractor enough for a project of this size?
C167	A-6	App. E	A.1.15	It may be necessary and advisable to inspect tortoise exclusion fencing after it is installed on a more frequent basis, to ensure that a tortoise has not been trapped within the fenced area.
C168	A-11	App. E	A.1.58	Temporary erosion and sediment controls will need to be inspected following large precipitation events.
C169	A-13	App. E	A.1.69	The Service would appreciate reviewing the restoration plan for sage-grouse habitat, or the habitat of any other listed or technical assistance species. We would like the opportunity to provide input on restoration and monitoring methods, as well as success criteria.
C170	A-13	App. E	A.1.70	The Restoration Plan must include details regarding restoration methods, monitoring methods, and success criteria. We find it difficult to evaluate the restoration conservation measures without this information, and we cannot assume successful restoration will occur with the information we have been provided in the Applicant Committed Measures. We recommend *Monitoring Post-Fire Vegetation Rehabilitation Projects: A Common Approach for Non-Forested Ecosystems* (Wirth and Pyke 2007) as a reference for monitoring program design and sampling approaches.

C171	A-13 - A-14	App. E	A.1.71	Cacti and yucca are protected under Nevada Revised Statutes (NRS) 527.060 to 527.110 and Nevada Administrative Code chapter 527. Removal or possession requires a permit and tags from the Nevada State Forester Firewarden, Nevada Division of Forestry. Also, we recommend reviewing the attached University of Arizona Cooperative Extension publication titled *How to Transplant a Cactus* .
C172	A-15	App. E	A.1.79	We recommend obtaining native, local seed from the appropriate NRCS Plant Materials Center instead of using a commercial vendor. The selection of appropriate seed material for rehabilitation or restoration should ideally come from an environment that closely matches the target environment to be seeded (Lesica and Allendorf, 1999; Hufford and Mazer, 2003; Rice and Emery, 2003; McKay et al., 2005). However, decisions about which species to use for restoration are often limited by non-ecological factors such as seed availability and cost (Richards et al., 1998; Pyke and McArthur, 2002; Thompson et al., 2006). Species used in Great Basin restoration projects are native cultivars or introduced grass species like crested wheatgrass (Agropyron cristatum (L.) Gaertn). Native cultivars are limited in number, represent a fraction of the natural genetic diversity of a species, and have narrowly defined, uniform traits due to their selective breeding history (Burton and Burton, 2002). One option managers could try is collecting seeds from species in desirable communities within the watershed and using them for restoration in the degraded communities.
C173	A-15	App. E	A.1.79	The Service does not support planting of monocultures of crested wheatgrass as means to restore sage-grouse habitat. Studies have demonstrated that the establishment of native species into crested wheatgrass stands is difficult (Cox and Anderson 2004; Fansler and Mangold 2010). Attempts to reintroduce native species into crested wheatgrass stands suggest crested wheatgrass plants and propagules need to be destroyed or damaged through mechanical and/or chemical treatments, deliberate introduction of native species is required, and native species used need to be accessed for their performance (Bakker et al. 1997; Cox & Anderson 2004; Fansler and Mangold 2010). Overall, subsequent treatments of crested wheatgrass monocultures may be more costly than initially using a diverse mixture of native seeds for habitat restoration, especially if habitat diversity for wildlife species is the goal.
C-174	A-17	App. E	A.2.10	Seven years seems like a short time-frame for assessing restoration success in the Mojave and Great Basin deserts.

C175	A-20 - A-21	App. E	A.5.9 & A.5.15	For the few *Sclerocactus blainei* individuals that cannot be avoided and must be salvaged, we recommend that BLM contact folks with experience transplanting other rare *Sclerocactus* species and/or researchers such as Eric Rechel and others who are studying and comparing different transplantation techniques for *Sclerocactus* species in Colorado with the goal of maximizing transplantation success. Transplantation effectiveness monitoring should be incorporated for cacti, including *S. blainei* . Another potential option is to bring the salvaged *S. Blainei* individuals into captive propagation (e.g., at the Springs Preserve in Las Vegas).
C176	A-21	App. E	A.5.19	ACM A.1.14 (p. B-4) states that temporary tortoise-exclusion fencing ***will be used*** within desert tortoise habitat, while ACM A.5.19 states that there will be areas within desert tortoise habitat not enclosed by tortoise exclusion fencing. Please clarify. Also, it is not clear what is meant by "timing of the survey will be determined at the project-level consultation." We thought that all desert tortoise impacts were associated with the main pipeline, and that the tortoise would not be impacted by future activities being considered programmatically herein. Is this incorrect?
C177	A-23	App. E	A.5.29	Please clarify what is meant by "where appropriate" as it relates to this measure.
C178	A-24	App. E	A.5.34	Blasting may have site specific and unknown effects on desert tortoise. We recommend adding: "If blasting is necessary, SNWA shall notify BLM 48 hours prior to any blasting. Field meetings will be held to review the blasting process and its implementation prior to blasting. Effects of blasting on desert tortoise and their burrows shall be reported to the USFWS."
C179	A-25	App. E	A.5.44	The FWS has conservation responsibilities and management authority for migratory birds. Therefore, please coordinate closely with the Service on any actions that may affect the burrowing owl. This measure states that SNWA would coordinate with the BLM and NDOW. Relocation of burrowing owls would require a special purpose permit issued through our FWS Regional Migatory Bird Office in Sacramento.
C180	A-26	App. E	A.5.47	Even if eggs have not been laid, if evidence of nesting (i.e., mated pairs, territorial defense, carrying nesting material, transporting food) is observed, a protective buffer (refer to Service 2007) should be delineated around the entire area. This area should be avoided to prevent destruction or disturbance to nests until they are no longer active.

C181	A-26	App. E	A.5.49	The pipeline and new roads have been sited to be 0.25 miles or more from active sage-grouse leks. Why was this buffer distance chosen, and why does BLM consider this to be sufficient? Other pipelines have had more stringent conservation measures (e.g., 0.6 mile buffer, where practicable, for the Ruby Pipeline). It would be worth exploring whether there are some leks that are considerably larger and/or of higher relative importance for maintaining populations in the affected valleys, and then applying more stringent conservation measures (e.g., larger buffers) to avoid disruption of sage-grouse activity at these leks.
C182	A-26	App. E	A.5.50 & A.5.51	It is not clear what is meant by "restrict" permitted activities. We recommend that SNWA ***avoid*** construction activities from March 1 through May 15 within 2 miles of an active sage-grouse lek. "Restrict" could mean "reduce" or "limit" as opposed to ceasing an activity. Also, it is not clear what "where appropriate" means as it relates to these measures.
C183	A-27	App. E	A.5.55	These activities should also be coordinated with the Service.
C184	A-27	App. E	A.5.56	It sounds like SNWA is considering a 1:1 mitigation ratio for sagebrush habitat disturbed by this project. However, a certain percentage of any revegetation effort will not be successful, so SNWA should consider restoring more habitat than was destroyed by the project. The mitigation measure may be partly dependent on quality of the sagebrush habitat that will be destroyed or altered by the project, which has not been discussed (but should be) in the BA.
C185	A-36	App. E	B.5.1	Similar to the comment above (ACM A.5.49), please explain why a 0.25-mile buffer distance from active leks was chosen, as other pipelines have had more stringent conservation measures (e.g., 0.6 mile buffer). Again, it would be worth exploring whether there are some leks that are considerably larger and/or of higher relative importance for maintaining populations in the affected valleys, and then applying more stringent conservation measures (e.g., larger buffers) to avoid disruption of sage-grouse activity at these leks.
C186	A-46	App. E	General	This document was prepared "to address inherent uncertainties in predicting potential effects of SNWA's groundwater withdrawals on groundwater-dependent systems, other water right holders, and other resources." Yet, it appears that the AMP only applies to valleys where pumping will occur. There will likely be groundwater pumping effects in basins where withdrawal is not occurring. These valleys (e.g. Hamlin Valley) should be specifically addressed. In addition, the AMP should specify that it applies to Snake Valley even if pumping does not occur there.

C187	A-48	App. E	1		There is a general lack of information about how SNWA will address the last objective on this page to "Avoid, minimize or mitigate degradation of visibility and air quality due to potential increases in airborne particulates and loss of surface vegetation". The AMP should be revised to incorporate needs for data collection, monitoring, establishment of indicators and thresholds, reporting, and Plan implementation specific to air quality.
C188	A-48	App. E	1		The 1st, 2nd, 4th and 6th bullet statements (objectives) on this page should be revised to remove "or" and replace it with "and/or". Avoidance and minimization should be pursued prior to, or in conjunction with, mitigation.
C189	A-48	App. E	1		SNWA should clearly state whether its Environmental Goals and Objectives apply to groundwater-dependent ecosystems and biological communities on private land, regardless of a connection to a federal trust resource.
C190	A-50	App. E	1		The AMP references future monitoring plans and the development of environmental indicators for Snake Valley. It is unclear whether these components of the AMP apply only if pumping occurs in Snake Valley. If no pumping occurs in Snake Valley, model predictions still show effects to Snake Valley resources from pumping in Spring Valley. Language in the AMP should be revised to make it clear that monitoring plans for Snake Valley will be developed regardless of pumping in Snake Valley (in order to monitor effects from pumping in other valleys). If the Spring Valley Stipulation monitoring will be expanded to include additional areas in Snake Valley (or adjacent basins), if observations or model-predicted impacts show this is needed, then this mechanism should be identified.
C191	A-52	App. E	3		The AMP in general is "Stipulation-centric", meaning that resources not covered in the Stipulations are not addressed. For example, Under Plan Implementation, Prior to Groundwater Withdrawal, SNWA states the following: "The baseline data will be collected for the specified minimum time periods and annual reports submitted, as required under future water rights rulings and the Spring Valley and DDC Stipulations". Each section of the AMP should be reviewed and revised to ensure that resources not covered by the Stipulations are addressed. Those resources would include: 1) air quality, and 2) groundwater-dependent ecosystems in valleys not covered by the Stipulations (yet affected by pumping), and with no direct connection to a federal trust resource.
C192	A-52	App. E	6		This paragraph is confusing in that it appears to create dual roles for BLM and potentially conflicting management decisions. Where resources are covered by the Stipulated Agreements, the process outlined here results in two separate analyses, one conducted by BLM alone and one conducted by the Stipulation Executive Committees. This possible scenario should be considered and addressed.

C192	A-56	App. E	C.2.14	We ask that habitat enhancement projects, to mitigate for effects to Yuma clapper rail, southwestern willow flycatcher, and yellow-billed cuckoo from groundwater withdrawal, be conducted as close to the area of impact as possible. We also ask that SNWA conduct habitat enhancement projects in occupied and suitable habitat for these species (e.g., offsite enhancement projects for Yuma clapper rail should be constructed in the Virgin and Muddy Rivers; yellow-billed cuckoo projects should be conducted near Warm Springs or Pahranagat Valley) . We request more specificity of the types of habitat enhancment projects SNWA would undertake. Finally, we request that SNWA coordinate closely with BLM and FWS when selecting these habitat enhancment projects.
C-193	F3.6-107	F3.6	Figure F3.6-1(	Figure does not demonstrate that there are a number of active and historical leks in Hamlin, Deep Creek and Pine Valleys, Utah. These leks and grouse brooding habitat were subsequently not analyzed for pumping effects under the various alternatives. The habitat and leks indicate there is vegetation other than "upland" species. The source of water for this vegetation should be identified and disclosed in the document and an analysis of drawdown should be conducted specific to grouse brooding habitat.
C194	F3.7-31	App. F3.7	Entire table	Recovery plans with management objectives also exist for the Muddy River aquatic ecosystem (Moapa dace), Big Spring spinedace, and Pahranagat Valley aquatic ecosystem (Pahranagat roundtail chub).
C195	F3.7-38 to 49 (and other rel. pages)	App. F3.7	Entire table	This table is not clear as there is no indication what "N" means (which populates most of the table cells) and footnotes are often not defined (e.g. footnote "2" in table 13A). Explanation (if any) requiring reference back to Volumes 1A or 1B creates a lot of work and is difficult to follow. Tables (appendices) should stand on their own.
C196	F3.7-50-97 (and other rel. pages)	App. F3.7	tables	Although "total stream miles" and other absolute measures may be valuable for some species and habitats, it is misleading (minimizes disclosure) for many springs and spring endemics because the entire ecosystem and/or species may exist only within a very small area. It would be clearer to provide a relative measure like "percent of entire spring ecosystem" or "percent of range of species X" when disclosing impacts of water withdrawal in these areas. This comment applies to many other parts of the analyses as well. As an example, for the Muddy River entry on page F3.7-97, the entry may be correct in that approximately 6.2 miles of the ecosystem is impacted, but it would be helpful to make clear (and misleading to omit) that this 6.2 miles represents 100% of the Moapa dace's entire global distribution.
C197	F3.7-98-101	App. F3.7	tables	It is difficult to understand what the values in the tables mean. Please make this clearer, perhaps provide an explanation at the beginning.

United States Department of the Interior

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November 4, 2011
File No. BLM 0711

Memorandum

To: Project Manager, Nevada Groundwater Projects Office, Bureau of Land Management, Reno, Nevada

From: State Supervisor, Nevada Fish and Wildlife Office, Reno, Nevada

Subject: Supplemental U.S. Fish and Wildlife Service Comments on the Draft Environmental Impact Statement (dated June 2011) for the Clark, Lincoln, and White Pine Counties Groundwater Development Project

This memorandum transmits additional U.S. Fish and Wildlife Service (Service) comments on the Bureau of Land Management's June 2011 Draft Environmental Impact Statement for the *Clark, Lincoln, and White Pine Counties Groundwater Development Project* (see attachment). These comments are meant to supplement the comments we submitted on October 11, 2011. As a cooperating agency, the Service appreciate the opportunity to provide BLM with supplemental comments on the DEIS for this project.

If you have any questions regarding this correspondence or require additional information, please contact myself or Jill Ralston, Deputy State Supervisor at (775) 861-6300.

(for: Edward D. Koch

Attachment

cc:

Project Leader, Fish Springs National Wildlife Refuge, U.S. Fish and Wildlife Service, Ibapah, Utah

Project Leader, Desert National Wildlife Refuge Complex, U.S. Fish and Wildlife Service, Las Vegas, Nevada (attn: Laurie Simons)
Regional Director, U.S. Fish and Wildlife Service Region 1, Portland, Oregon, attn: Tim Mayer
Regional Director, U.S. Fish and Wildlife Service Region 6, Denver, Colorado, attn: Meg Estep
Regional Director, U.S. Fish and Wildlife Service Region 8, Sacramento, California
Field Supervisor, Utah Ecological Services Office, U.S. Fish and Wildlife Service, West Valley City, Utah, attn: Amy Defreese
Assistant Field Supervisor, Nevada Fish and Wildlife Office, U.S. Fish and Wildlife Service, Las Vegas, Nevada, attn: Brian Novosak

	Page	Section	Paragraph	Comment
C199	General Comment			**Identification of the Environmentally Preferred Alternative.** The Service recommends that a combination of Alternatives E and C be identified as the environmentally preferred alternative. Specifically, the Service recommends identification of the following alternative as the scenario that would minimize impacts to water-dependent biotic resources while fulfilling the aim of providing a supplemental source of water for the project proponent: no project pumping in Snake Valley (for reasons outlined in our March 23, 2011 and October 11, 2011 letters); pumping by the project proponent in Spring Valley not limited to the LCRDA corridor, i.e., not concentrated in southern Spring Valley (also for reasons outlined in our March 23, 2011 letter); and pumping of groundwater as a whole limited to periods when municipal demand cannot be meet by the project proponent with available Lake Mead water, except for minimum flows required to maintain the pipeline and other project facilities in a ready condition.
C200	3.3-191	3.3.3.4	1	As described in our October 11, 2011 cover letter, we are concerned that the cumulative effects analysis is limited in a number of ways, including geographically due to truncation of the Water Resources Region of Study at the Snake Valley boundary. Therefore, it appears that past and present consumptive groundwater use is not considered for many basins within the Great Salt Lake Desert flow system (Table 2.9-3), including but not limited to Pine, Wah Wah, Hamlin, and Tule valleys. Given that pumping in these basins could cumulatively affect groundwater levels and flow within the Great Salt Lake Desert Flow System, it seems reasonable to include and consider them. If no pumping currently exists in these basins, that conclusion (and how it was reached) should be presented in the document. Second, Table 2.9-4, Estimated Reasonably Foreseeable Future Groundwater Developments Included in the Cumulative Analysis, does not appear to address and consider Hamlin, Pine, Wah Wah, and Tule valleys. If there are no groundwater development projects that meets BLM's criteria for inclusion in these basins, that conclusion and supporting rationale should be presented in the document.
C201	3.5-1	3.5.1.1	4	To provide more comprehensive vegetation community characterizations, the BLM could draw information from the relevant Districts in Utah (Fillmore and Cedar City).
C202	3.5-1	3.5.1.1	6	It should be noted that in Service comments to the draft Natural Resources Baseline report (dated January 25, 2008), the Service voiced particular concern that Utah resources were not adequately addressed. We recommended a thorough review of all available information before finalization of the report. As described in the following comments, inadequate consideration of Utah resources remains a significant concern.

C203	3.5-2	3.5.1.1	1	The description of the Region of Study for vegetation is unclear. It appears that the Region of Study for vegetation resources is the same as the Natural Resources Region of Study, yet this is not specifically stated. It is also confusing because the analysis of pumping effects to groundwater-dependent vegetation seems to be constrained to an area that is considerably smaller than the Natural Resources Region of Study.
C204	3.5-2	3.5.1.1	1	Without a hydrological model to support effects analyses in Pine, Wah Wah, and Tule valleys, it is unclear how one can analyze project effects to vegetation in these valleys. Yet, these valleys are included in the Natural Resources Region of Study. This inconsistency should be better explained and addressed in this paragraph, specifically regarding the consequences of two different regions of study (Water Resources vs. Natural Resources). There are a number of reasons to believe there may be project effects to groundwater resources in these valleys: 1) The 10' contours for the Proposed Action and cumulative effects at 200 years after FBO are truncated at the boundaries between Hamlin Valley and Pine Valley, and Snake Valley and Pine Valley. As a result, the reader is left to guess how many more valleys could be affected by drawdown; 2) The effects analysis is incomplete in that drawdown is only considered where it is 10' or greater (or where a spring was specifically modeled); 3) From Table 3.3.2-6 of the Water Resources section, a 10% reduction in flow from Snake Valley to Pine, Wah Wah and Tule valleys is predicted at FBO + 200 years; and, 4) No springs or ET areas in Pine, Wah Wah or Tule valleys were included in the model, so one cannot conclude there will be no effects to these basins from pumping without additional explanation.
C205	3.5-3	3.5.1.2	Figure 3.5-1	This Figure should depict the entire Natural Resouces Region of Study. As it stands, the Figure does not depict vegetation land cover for Deep Creek Valley, northern Snake Valley or Fish Springs Flat.

C206	3.5-10	3.5.1.4	Figure 3.5-3 and 3.5-4	It is unclear why no springs of biological interest are mapped and inventoried in Deep Creek, Tule, Pine, and Wah Wah Valleys because all of these valleys lie within the Natural Resources Region of Study. The document should address this discrepancy and provide information that explains how springs in these valleys were considered. There are a number of reasons to believe there may be project effects to groundwater resources in these valleys: 1) The 10' contours for the Proposed Action and cumulative effects at 200 years after FBO are truncated at the boundaries between Hamlin Valley and Pine Valley, and Snake Valley and Pine Valley. As a result, the reader is left to guess how many more valleys could be affected by drawdown; 2) The effects analysis is incomplete in that drawdown is only considered where it is 10' or greater (or where a spring was specifically modeled); 3) From Table 3.3.2-6 of the Water Resources section, a 10% reduction in flow from Snake Valley to Pine, Wah Wah and Tule valleys is predicted at FBO + 200 years; and, 4) No springs or ET areas in PIne, Wah Wah or Tule valleys were included in the model, so one cannot conclude there will be no effects to these basins from pumping without additional explanation.
C207	3.5-12	3.5.1.4	Table 3.5-5	This table neglects to include vegetation characteristics for spring systems in Hamlin Valley, Pine or Wah Wah Valleys, yet all are within the Natural Resources Region of Study and presumably contain spring systems with vegetation. We recommend that BLM identify spring systems in these valleys and the vegetation they support.
C208	3.5-16	3.5.1.4	3	There is an unexplained disconnect between the boundaries of the Natural Resources Region of Study and the valleys actually mapped for phreatophytic vegetation. Because Figure 3.5-3 relies on corresponding ET data from the Water Resources section, a number of valleys were left out of the analysis. These valleys are Pine, Wah Wah, Tule, and Deep Creek. We recommend that BLM map phreatophytic vegetation in these valleys as there is reason to believe groundwater resources will be affected in these areas.
C209	3.5-16	3.5.1.4	3	There is an inaccurate and confusing sentence in this paragraph: "The same ET areas are illustrated by individual basin in Section 3.3, Water Resources." This is incorrect as the only basins mapped for ET areas in Section 3.3, Water Resources, are Spring, Snake Valleys, Dry, Delamar and Cave Valleys. Therefore, it is unclear what information was used to establish the presence and extent of phreatophytic vegetation in Hamlin Valley.

C210	3.5-16	3.5.1.4	4	The information provided in this paragraph may be inaccurate and misleading in 1) its reference of the 2007 BIO-WEST reports; and 2) the representation of BIO-WEST's work. While the DEIS reports that "BIO-WEST conducted habitat surveys for this species in spring-fed meadows in *several project and adjacent hydrologic basins,* " the surveys did not cover a representative portion of those valleys in the Natural Resources Region of Study. SNWA only contracted with BIO-WEST to review 32 springs in Spring and Snake Valleys for Ute ladies'-tresses; only one of those springs occurs in Utah (Clay Springs). No surveys were conducted in Hamlin Valley, Pine Valley, Tule Valley, Wah Wah Valley, or Deep Creek Valley for the species, and only one spring was visited in Snake Valley, Utah.
C211	3.5-16	3.5.1.4	4	This paragraph does not accurately represent the status of *Spiranthes diluvialis* across the Natural Resources Region of Study, specifically within Utah valleys. There is very little information that can be drawn from the 2007 BIO-WEST *Spiranthes* report because, as the author states, it is "...impossible to eliminate the possibility of the species for these springs after peak flowering or during a single visit." BIO-WEST visited Clay Springs in Utah to conduct surveys only once. USFWS must assume that if habitat exists and surveys for the plant have not been conducted according to protocol, then there is potential for the species to exist at the site. This paragraph should be revised to reflect this information.
C212	3.5-16	3.5.1.4	4	The population of *Spiranthes diluvialis* referenced in this paragraph for northern Snake Valley, Utah (Callao) is presumed extant.
C213	3.5-16	3.5.1.4	4	It is unclear if any special status species, other than *Spiranthes* , were considered for groundwater pumping effects. At a minimum, the BLM-Nevada Sensitive Species List and BLM-Utah 2011 Interim Sensitive Plant Species List should be referenced. We recommend that BLM review those lists for species that may be affected by groundwater drawdown and include them in this section (if not already).
C214	3.5-39	3.5.2.8	1	It would benefit the document and subsequent vegetation analysis to provide a reference for the following assumption: an index drawdown contour of 10 feet is a reasonable estimate of the point at which long-term changes in plant community vigor and composition would begin to appear. Of the references provided, BLM should specifically state which support(s) this assumption.

C215	3.5-40	3.5.2.8	8	**Methodology for Analysis,** *Groundwater Pumping* : We recommend that BLM analyze effects to wetland/meadow and basin shrubland within the Utah basins included in the Natural Resources Region of Study (if BLM believes there will be no effects to phreatophytic vegetation in these areas, document these reasons). We further recommend that BLM include a Methodology for Analysis for groundwater pumping effects to plant communities in basins outside the hydrologic Region of Study, but within the Natural Resources Region of Study.
C216	3.5-44 through 3.5-66	3.5.2.9 through 3.5.2.15	Figures 3.5-6 through 3.5-12	We recommend further separating the yellow layer in these Figures to distinguish between phreatophytic vegetation communities outside of the Project 10' drawdown and those more than 50' above groundwater. It is unclear, for example, whether the phreatophytic vegetation in mid- and northern Snake Valley (Utah) and White River Valley (Nevada) is more than 50' above groundwater or outside the 10' drawdown contour.
C217	3.5-44 through 3.5-66	3.5.2.9 through 3.5.2.15	Figures 3.5-6 through 3.5-12	The various chapters of the document are inconsistent in the assessment of groundwater pumping effects to springs in mid and northern Snake Valley. In these Figures, the Gandy system, the Bishop Springs complex, the Fish Springs complex and Callao springs are all presented as "Impacts likely." Yet, these spring systems and the aquatic flora and fauna they support are not addressed as such in the water resources and aquatic resources sections.
C218	3.5-44 through 3.5-66	3.5.2.9 through 3.5.2.15	Figures 3.5-6 through 3.5-12	These figures illustrate three categories of springs (Valley floor - Impacts Likely, Valley Margin - Impacts Possible and Other Springs). Springs that fall under the first category, Valley floor - Impacts Likely, include many in mid and northern Snake Valley. Some of these springs include the Gandy system, Bishop Springs complex, Callao and those at Fish Springs National Refuge. It stands to reason that if these valley floor and valley margin springs are likely to experience impacts from groundwater pumping, then the phreatophytic vegetation will be affected as well. If not, then the BLM should provide an explanation.
C219	3.5-45 through 3.5-66	3.5.2.9 through 3.5.2.15	Page 3.5-45, paragraph 2	Absent *Spiranthes diluvialis* surveys (according to Service protocol) in areas of suitable habitat, the Service cannot assume that the species does not occur at the site. We are not aware of such surveys in the Utah portion of the Natural Resources Region of Study, other than the one survey conducted in 2007 at Clay Springs. The text in this paragraph should reflect this conclusion and disclose how BLM will address pumping effects to this species.

C220	3.5-67	3.5.3.2	4	The study area for groundwater pumping is defined here and is referenced as "the boundary for the groundwater model simulations (Figure 3.0-2)." First, it is not clear why the cumulative effects study area (which we assume is also the region of study) is smaller than the region of study referenced in the beginning of the Vegetation Resources chapter. It should be the same, if not larger. Second, there may be a typo here as Figure 3.0-2 depicts a process, not a map.
C221	3.5-67 through 3.5-89	3.5.3	All	One purpose of a cumulative effects analysis is to put project effects into context for the public. We recommend that BLM provide additional information to: 1) identify existing conditions and trends in the persistence and sustainability of vegetation resources; and 2) identify thresholds for the assessment of resource degradation. For example, how much succession has already occurred across varying scales (Great Basin region, Nevada, Utah, by valley)? How much wetland acreage has already been lost? How much loss is acceptable on public lands? Significant information is available that documents the status of sensitive habitat in Utah. The Utah Division of Wildlife Resources described the ten most at risk habitat types found in Utah and ranked each by the degree of threat it faces due to various stressors. Ultimately, the BLM must determine and disclose if the resource will be degraded to unacceptable levels given the existing condition of the resource and additive/interactive effects. The public should be given enough information to form an opinion about an acceptable level of resource degradation and provide meaningful comment.
C222	3.5-72	3.5.3.5	1	BLM does not provide enough information to conclude that a loss of 3,065 acres of basin shrubland habitat is a "relatively low level." What percentage of total basin shrubland habitat in Hamlin Valley does that number represent? In the Great Salt Lake desert flow system? What flora and fauna depend on that habitat? This type of information is critical to draw a meaningful conclusion about the loss of basin shrubland in Hamlin Valley under the Proposed Action, Cumulative Effects. This comment applies to all project alternatives in addition to the proposed action.
C223	3.5-74	3.5.3.5	2	For Snake Valley, BLM predicts effects (gradual loss) to 49,068 acres of basin shrubland and 1,927 acres of wetland/meadow. What percentage of total basin shrubland habitat in Snake Valley (and the Great Salt Lake Desert Flow System) does that number represent? What flora and fauna depend on that habitat? This type of information is critical to draw a meaningful conclusion about the loss of basin shrubland in Snake Valley under the Proposed Action, Cumulative Effects. This comment applies to all project alternatives in addition to the proposed action.