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Methodology and Process Required To Establish Quantitative Threshold Values for Mitigation to Protect Existing Water Rights and Unreasonable Impacts to the Environment

Prepared for
the Confederated Tribes of the Goshute Reservation

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ES. EXECUTIVE SUMMARY

The Nevada State Engineer (NSE) issued rulings 6164, 6165, 6166, and 6167 concerning the grant of water rights to Southern Nevada Water Authority (SNWA) in Spring Valley, Cave Valley, Dry Lake Valley, and Delamar Valley. Subsequently, the Seventh Judicial District Court of the State of Nevada considered an appeal from petitioners (Case No. CV1204049), which included the Confederated Tribes of the Goshute Reservation (CTGR). The Court remanded the ruling to the NSE for: (1) inclusion of Millard and Juab counties in the mitigation plan; (2) recalculation of water available from each basin; (3) additional hydrological study of Delamar, Dry Lake, and Cave Valley; and (4) to establish standards for mitigation in the event of a conflict with existing water rights or unreasonable effects to the environment or the public interest. This report describes the standards essential to establishing an objective methodology for constructing a comprehensive Monitoring, Management, and Mitigation plan (MMM Plan) that protects the public interests.

Rulings 6164-6167 adopted a MMM proposal that consisted of monitoring, management, and mitigation requirements as a condition of the SNWA appropriations. The Court rejected the ruling based on the lack of objective standards as to when mitigation must occur, and found that the NSE must define standards to provide for mitigation of unreasonable effects from pumping of water in Spring Valley, Cave Valley, Dry Lake Valley, and Delamar Valley.

The NSE had concluded that it was premature to set quantitative standards or triggers for mitigation actions for several reasons, including the predictive uncertainty of regional level groundwater modeling and incomplete baseline data collection. The Court, on review, found that if the SNWA were to gather and present sufficient environmental baseline data to provide a platform for sound, informed decision making the setting of standards and triggers would not be premature. The Court found the existing MMM plan insufficient for additional reasons: it failed to define unreasonable environmental impacts, and lacked a plan to oversee the environmental soundness of the project. The Court held that, by approving SNWA's water rights applications without demanding that information or performing that evaluation, "impliedly, the Engineer has ceded the monitoring responsibilities to SNWA."

Our review of Rulings 6164-67 and the supporting exhibits finds that SNWA's MMM proposal fails to provide an objective framework and methodology required to set triggers, thresholds, and action items required to protect the public's interests. Nor do we believe that the baseline study required in Rulings 6164-67, subject to approval by the NSE, is adequate to protect the interests of the public. While we agree that water withdrawals should not be authorized without first performing the appropriate level of impact analysis, we also believe that

a framework for developing hydrologic tools and scientific analyses that support groundwater withdrawals must be developed before SNWA's water rights applications or the Groundwater Development Project (GWD Project) can be reasonably evaluated and considered for approval. As explained in this report, these hydrologic tools and analyses may be developed through a robust Comprehensive Baseline Study that sets quantitative limits before the applications or any groundwater withdrawals are approved.

SNWA's existing proposal identifies monitoring wells, springs, streams, and other hydrologic parameters that require monitoring. Additionally, it addresses topics such as groundwater modeling, aquifer characteristics, data collection, database management, reporting, and possible mitigation measures. The primary component that is missing from the existing MMM proposal is an adaptive management plan that ties the various components together so that informed decision-making can proceed based on an objective and quantitative analysis. This process includes developing a representative stakeholders' group so that constraints can be identified for the goals and objective of the project. Based on these constraints, quantitative threshold values for triggers such as groundwater level and spring flow may be determined such that action items to prevent unplanned impacts can be implemented.

The NSE ruling states that the uncertainty of the regional groundwater model prevents the project proponent from identifying meaningful threshold values that can be determined prior to project operations. While the reasonableness of the regional groundwater model's predictive accuracy is a matter of debate, we find that a programmatic process of analysis may be implemented to reduce uncertainty of project impact analysis. A "tiered" approach that includes a Comprehensive Baseline Study, describing refined hydrologic tools and extended baseline data, followed by project performance reporting, would allow the NSE to assess impacts with a higher degree of certainty.

Any appropriation by the NSE should be contingent upon impact analysis from basin-specific hydrologic models[1] using baseline hydrological and biological data that captures the natural variability of the physical system. The appropriate amount of data used for calibrating basin-specific groundwater models is based on a period that includes extended wet and dry hydrologic cycles. Given a model calibration period that includes the natural range of hydrologic variability, impact analyses from a staged GWD Project could then be performed. The impact analysis would be based on comprehensive baseline data and the first stage of pumping. Impacts from subsequent phases (stages) of development would then be assessed

[1] Basin specific groundwater model requirements are described in Section 3.1.

under a tiered approach that calibrated the model to the physical responses from the current level of pumping to predict impacts from future increases in pumping.

The NSE's staged development decision-making process should involve basin stakeholders and the public at large in the development of a robust Comprehensive Baseline Study and subsequent Stage Performance Reports. In addition to the monitoring requirements and methodology currently outlined in SNWA's proposed approach to MMM issues, refined basin-specific groundwater models, hydrologic tools, and an adaptive management planning process should be submitted to the NSE in a Comprehensive Baseline Study prior to evaluating SNWA's water rights applications for possible approval. If that is completed, and the NSE finds that the study is adequate to support an effective MMM Plan, which would eliminate conflicts with existing rights, the public interest, and the environment, it may then be appropriate for the NSE to permit staged development of the GWD Project in a manner similar to Ruling 6164. Subsequent increases in groundwater pumping (stages) would require SNWA to develop and submit Stage Performance Reports at the end of each stage for review by the NSE and the public under the tiered approach. The Stage Performance Report would protect the public's interests by demonstrating how GWD Project performed with respect to specific goals and objectives of the MMM Plan to which stakeholders contributed.

The Comprehensive Baseline Study and subsequent Stage Performance Reports would allow the NSE to meet the requirement of the Court to establish standards for the avoidance or mitigation of a conflict with existing water rights or unreasonable effects to the environment or the public interest, and do so prior to withdrawals of groundwater. The Comprehensive Baseline Study establishes standards for mitigation through the development of triggers, thresholds, and action items based on physical, environmental, and legal constraints identified through adaptive management. The Stage Performance Reports would provide a review of how the public's interests were protected, what improvements in protective measures might be required, and which, if any, mitigation measures were implemented. Public involvement would occur almost continuously through the obligation on the SNWA to consult meaningfully with the Tribes, ranchers, and other members of the public affected by the GWD Project. Public involvement would continue through the transparency offered by the NSE's office providing a 90-day public comment period on each of the reports. The public's comments would then be available to the NSE prior to accepting the report from SNWA and deciding whether to allow the next stage of groundwater pumping to begin.

The success of establishing standards for mitigation relies on improved monitoring, numerical models, and adaptive management techniques. Improved monitoring occurs both with the active involvement of a watchful public in the affected basin, and with the installation of

early-warning monitoring wells in the vicinity of groundwater withdrawals. We propose each production well be associated with two monitoring wells to measure early time response so model recalibration can occur. The first monitoring well would be located so the effects of pumping would be measured within a 1-year period; while the second monitoring well would be located so as to measure pumping effects within a 5-year period. The basin-specific models could then be either rerun or recalibrated on 5-year periods to better predict long-term effects 10-, 25-, and 100-years into the future.

The process by which the observed data is used by the numerical models is addressed through the adaptive management process so that managers can make informed decisions based on objective criteria. The GWD Project represents an example of a project that would require adaptive management since it likely would continue in perpetuity. Adaptive management recognizes uncertainty that exists today, and allows managers and institutions to learn through data collection and improved understanding of the basin hydrology as it responds to pumping under variable hydrologic conditions over time.

1.0 BACKGROUND AND OVERVIEW

In order to provide recommendations to establish initial environmental indicator threshold levels, Stetson Engineers reviewed the available documents to understand the extent of existing planning that has been done regarding baseline data collection, monitoring plan development, adaptive management process framework, and mitigation planning. Although there are inherent uncertainties and limitations associated with results of a regional groundwater flow model that covers a broad region with complex hydrogeologic conditions, we generally concur that the groundwater model was a reasonable and appropriate tool to initiate a programmatic assessment that estimates probable regional-scale drawdown patterns and trends over time for this project. In order to assess the impact of the GWD Project on specific water rights and water related resources, basin-specific models that provide a higher degree of certainty will need to be developed. The existing MMM proposal acknowledges the inherent uncertainty of using a regional groundwater model for environmental impact analysis, but also suggests that the model will be refined to improve predictive capabilities as more data become available[2].

The existing MMM proposal adopted by the NSE in Ruling 6164 is described in various documents developed by SNWA in June of 2011. In addition to these documents, the Biological Monitoring Plan (BMP) for the Spring Valley Stipulation (SNWA Exhibit 365) establishes the Biological Working Group (BWG) that recommends hydrological monitoring associated with biological assets and features. Parties to the BWG include the Bureau of Indian Affairs (BIA), Bureau of Land Management (BLM), National Park Service (NPS), SNWA, and the United States Fish and Wildlife Service (FWS). Because the BWG is focused on meeting Federal requirements under the Stipulation for Withdrawal of Protests[3] (Stipulation), which does not include the NSE, we have chosen not to describe it in our report. Furthermore, the BMP is limited to Spring Valley, the northern portions of Hamlin Valley, and southern Snake Valley and does not address resources in the White River Flow System.

1.1 EXISTING HYDROLOGIC MMM PROPOSAL

The proposed MMM Plan for the Project was documented in (1) SNWA Hydrologic Management Program for Groundwater Development in Spring, Cave, Dry Lake, and Delamar Valleys, Nevada (SNWA, June 2011; Exhibit 147), Hydrologic Monitoring and Mitigation Plan for Delamar, Dry Lake, and Cave Valleys (SNWA, June 2011; and, Exhibit 148), Hydrologic Monitoring and Mitigation Plan for Spring Valley (Hydrographic Area 184) (SNWA, June 2011;

[2] SNWA Exhibit 147, page 2-15.
[3] Stipulation for Withdrawal of Protests, 2006

Exhibit 149). Generally, the MMM Plan outlines a framework for collecting data, developing hydrologic tools to assess and predict impacts, and provide mitigation efforts to offset unplanned impacts. The MMM Plan also discusses an adaptive management strategy to adjust monitoring and refine hydrologic tools to improve management decisions. Specifically, the MMM Plan states: "*The long-term basin Hydrologic Management Program strategy integrates understanding of the hydrologic system, monitoring and mitigation program, water development operations, and predictive tools in an adaptive manner.*"[4]

Although the MMM Plan describes specific components of adaptive management, it falls short in establishing quantitative thresholds that ensure that the public's interests are protected in the future. Furthermore, the MMM Plan fails to discuss key elements of the adaptive management process, which includes stakeholder involvement, quantification of goals and objectives, documenting hypothesis, and establishing future planning documents. The explicit identification of stakeholders' goals and objectives is a primary element that allows for the adaptive management process to be successful. Typically, stakeholders' goals and objectives can be expressed by triggers, thresholds, and action items so objective decisions, by both project and environmental managers, can be based on sound science.

The MMM Plan defines the stakeholders to include NSE, Technical Review Panel (TRP), and the Executive Committee (EC). The TRP is composed of technical experts from SNWA, U.S. Fish and Wildlife (USFWS), Bureau of Land Management (BLM), National Park Service (NPS), Bureau of Indian Affairs (BIA), and the NSE. The EC is composed of representatives from the signatory parties to the Stipulation. Lastly, at least in theory, the non-Federal water right holders and the public's interests are represented through the NSE. The goals outlined in the MMM Plan for the existing stakeholders are shown in Table 1.

[4] Exhibit 147, page 5-2

TABLE 1 SUMMARY OF EXISTING MMM PROPOSAL'S GOALS AND OBJECTIVES

	Goal and Objective[5]
1	Manage the development of groundwater by SNWA in the Spring Valley hydrographic area without causing injury to Federal water rights and/or unreasonable adverse effects to Federal resources in the area of interest;
2	Accurately characterize the groundwater hydraulic gradient from the Spring Valley hydrographic area to the Snake Valley hydrographic area via Hamlin Valley;
3	Avoid any effect on Federal resources located within the boundaries of the Great Basin National Park (GBNP) from groundwater withdrawal by SNWA in the Spring Valley hydrographic area;
4	Manage the development of groundwater by SNWA in Spring Valley hydrographic area in order to avoid unreasonable adverse effects to wetlands, wet meadow complexes, springs, streams, and riparian and phreatophytic communities (Water-Dependent Ecosystems) and to maintain biologic integrity and ecological health of the area of interest over the long term;
5	Avoid any effect to Water-Dependent Ecosystems within the boundaries of the GBNP; and
6	Avoid an unreasonable degradation of the scenic values of and visibility from the GBNP due to a potential increase in airborne particulates and loss of surface vegetation that may result from groundwater withdrawals by SNWA in Spring Valley.

The goals and objectives are typically revisited on an annual basis through the adaptive management process. For example, following the March 2012 Ruling 6164 decision, additional goals and objectives could be added to avoid impacts to non-Federal water rights to assure the project does not detrimentally impact senior water right holders or Tribal cultural resources. Based on the condition of existing water right holders (trigger), quantitative thresholds for impact to senior water right holders could then be established to determine when action needs to occur to mitigate negative impacts. Typically, stakeholder goals and objectives are quantitatively defined in a MMM Plan so effective adaptive management would occur in the future.

Constraints are developed from the goals and objectives for the Project. Although the constraints are not specifically identified in the existing MMM proposal, Table 2 describes a

[5] Exhibit 147, page 2-2

summary of the limited constraints that can be ascertained from the existing goals and objectives. Tribal and other interests should be added to existing project constraints.

TABLE 2 SUMMARY OF EXISTING PROJECT CONSTRAINTS

Constraint	Description
Hydrological	Protection of surface and groundwater hydrology and aquifer conditions.
Water Quality	Protection of water quality in surface and groundwater system.
Water Rights	Protection and use of Federal water rights.
Operations	Promotion of efficient, effective, and economical system operations.
Ecological	Protection of riparian, wetland, and aquatic habitat.

The existing MMM Proposal also fails to address non-Federal goals and objectives specific to Delamar, Dry Lake, and Cave Valleys, instead stating: "*The common goals stated in the Stipulation are to manage the development of groundwater by SNWA in the Hydrographic Basins without causing injury to Federal Water Rights and/or unreasonable adverse effects to Federal Resources and Special Status Species within the Area of Interest as a result of groundwater withdrawals by SNWA in the Hydrographic Basins*"[6]. Although the MMM Plan indicates that non-Federal water rights shall be monitored, the lack of goals and objectives to protect those rights prevents the development of quantitative measures required to determine when impacts occur.

The existing MMM Proposal fails to provide a process of how stakeholders' goals are identified and met through control and oversight. While the MMM proposal states, "*The Hydrologic Management Program provides the structure and content for effective hydrologic monitoring with a clear process for project input, review, and control by stakeholders through the NSE, TRP, and EC*"[7], it fails to establish the actual process of stakeholder control. Instead, the

[6] Exhibit 147, page 5.
[7] Exhibit 147, page 5-2.

MMM Plan indicates that an annual monitoring report will be provided to the NSE for review; but without knowing if goals or objectives are being met, the monitoring plan only identifies what has happened, not what will happen in the future. Reporting on how quantitative triggers and thresholds are being met each year will allow for a process by which stakeholders can determine whether goals and objectives are being met, so that action can be taken. It is not clear whether the annual report will be made publicly available, but it appears that the monitoring data is publicly available. If the full report is not made publicly available, the public and stakeholders that are not party to the TRP or the EC are left to conduct analysis without the benefit of the information that the TRP and the EC were privy to. Members of the public with critical interests are excluded from meaningful participation in this process.

The existing MMM Proposal allows for the adaptive management of monitoring and development of hydrologic tools, but it fails to provide adequate oversight and accountability essential to objective decisions to be made in the future. While the existing hydrologic model may not provide the appropriate tool for quantitatively establishing accurate thresholds at this time, a process exists whereby numerical threshold values are determined before pumping is initiated. The Final EIS and Record of Decision (ROD), issued after Ruling 6164, introduces ideas that are used here to create a framework for further developing goals and objectives, as well as identifying appropriate triggers and thresholds.

1.2 TIERED NEPA ANALYSIS

The Department of the Interior (DOI) and the Bureau of Land Management (BLM) issued SNWA a Right of Way (ROW) to construct, operate, and maintain the groundwater from the subject basins as described in the Final Environmental Impact Statement (EIS) (BLM, August 2012). Although groundwater pumping facilities are discussed in the National Environmental Policy Act (NEPA) documentation, such groundwater facilities tied to the pipeline will require future compliance with NEPA. Actual groundwater development is contingent upon the BLM's future approval of ROWs for associated facilities such as wells, collector pipelines, ancillary power and access roads. The BLM is using a "tiered" approach to implement the NEPA for the Groundwater Development Project (GWD or Project). Tiering allows for a combined assessment of site-specific actions and broader programs and issues in an initial (Tier 1) analysis, allowing for more comprehensive environmental review of the effects of additional site-specific facilities in subsequent or "tiered" NEPA analyses.

The Tier 1 Final EIS includes an analysis supporting the decision making for the ROW-related impacts of the GWD Project primary conveyance facilities and a programmatic analysis

of future groundwater development, including a conceptual analysis of ROWs for groundwater production wells and associated groundwater-related pumping. Future NEPA analysis for the groundwater development areas will provide opportunities for additional, more-specific analysis of groundwater withdrawal options. No ROW decisions on groundwater development facilities were made as part of Tier 1 analysis. Specific pumping proposals will be addressed by future NEPA documents.

There are mitigation and monitoring requirements associated with the Tier 1 ROW. Other monitoring and mitigation requirements associated with, and in anticipation of, future ROW requests for groundwater development facilities also are included, but on a conceptual basis, given the programmatic nature of the analysis for future facilities at this time. This dual approach to the environmental impact analysis and development of monitoring and mitigation requirements was necessary to comply with NEPA's requirement for analysis as early in the planning process as possible. After the SNWA identifies specific details of the groundwater development components analyzed programmatically in the Final EIS, it will submit additional ROW applications to the BLM. Based upon these applications, the BLM will address these future site-specific components in subsequent tiered NEPA documents.

We agree that the groundwater model used for the programmatic Tier 1 analysis is not sufficient for the granting of approval for groundwater development. Similarly, the NSE should not grant an application for water withdrawals until basin level analysis is complete and ROWs have been granted. At that point, as part of the review of the application, it would be appropriate for the NSE to consider the Comprehensive Baseline Study, basin specific modeling that is predictive of basin level impacts, and detailed monitoring plans that establish quantitative triggers for mitigation and early warning. The NSE should clearly specify the necessary components of the Comprehensive Baseline Study, and require that meaningful consultation have taken place with non-Federal stakeholders (existing water right holders and Tribal concerns regarding culturally sensitive locations).

Given the extended duration of proposed build-out and the fact that the project extends in perpetuity, the NSE should require a baseline document that preserves the entire record of the environmental baseline in one location for future entities charged with oversight. Similarly, the Hydrologic and Biologic Monitoring Plans should be continually updated during the baseline period, and should be considered for approval along with the Comprehensive Baseline Study, but not before. The Comprehensive Baseline Study, including updated monitoring plans, should be posted on a publicly available website. Meaningful consultation would be indicated by including culturally sensitive sites in the monitoring plan and involving the Tribes in establishing triggers and mitigation actions. Upon approval of the Comprehensive Baseline Study, the basin

level models, and the final monitoring plans, the NSE would grant the application and implement a staged development decision making process designed to involve stakeholders and the public at the following critical decision points:

- Review of annual reports detailing the findings of the approved Hydrologic and Biological Monitoring Plans. The annual report should be publicly available along with a public comment period prior to the NSE consideration and potential approval of the report.
- Review of a Consolidated Stage Performance Report[8] which must be approved prior to proceeding between Stage 1 and 2 and between Stage 2 and 3. These reports should be posted on a publicly available website and have public involvement in the decision-making process.

As discussed in the EIS, the hydrologic model used for the Tier 1 EIS and baseline assessments for all resources is to be updated, revised, or incorporated into subsequent tiered analyses to address site-specific groundwater development components. These subsequent analyses must conform to the NEPA including appropriate public involvement. If the model was not sufficient to grant ROW for groundwater development facilities, it is clear that the consideration of the application by the NSE should be postponed until the Applicant is prepared to specifically discuss basin level impacts and analysis. In particular, the regional model does not offer the level of accuracy required to predict absolute values at specific points in time. Their tiered approach to assessing environmental impacts is an acceptable method, and should be considered for adoption by the NSE.

However, as is recognized in the Final EIS, local-scale groundwater flow models must be developed and designed to simulate effects of pumping within each specific basin in order to refine environmental indicator threshold levels that would be protective of existing water rights and unreasonable environmental impacts prior to commencement of pumping operations. As baseline data at monitoring locations identified in the areas of risk provide additional clarity regarding natural variability, the early warning thresholds will be modified. Considering the applications prior to the completion of a comprehensive baseline study would be premature.

The adaptive management process was developed as a management tool between SNWA and the federal regulatory oversight agencies. While the NSE is a member of the TRP, the management process falls short in stakeholder engagement and transparency once the NEPA and permitting process is complete. Given the size and scope of the project, and the uncertainty and continued development of the monitoring plans and environmental indicator threshold levels, the

[8] Recommended Consolidated Stage Performance Report discussed in Chapter 2.

NSE's decision making process associated with the future staged development plan should be tiered and involve the public that the NSE is charged with protecting in the adaptive management process.

2.0 ADDITIONAL MONITORING REQUIREMENTS

Additional monitoring data is required to develop baseline studies and basin-specific groundwater models so that potential impacts from GWD Project withdrawals can be estimated with a reasonable amount of certainty. The additional monitoring requirements include early-time groundwater monitoring requirements, hydrologic monitoring at cultural sites, and hydrologic monitoring for water rights and environmental impacts. The data gathered from these sites should be included in baseline and future staged development reports to assess whether impacts due to GWD Project pumping will occur, and if so, whether they are reasonable. The monitoring requirements discussed below can help to provide triggers and quantitative threshold values so the NSE can objectively determine when mitigation would be required.

2.1 EARLY-TIME MONITORING REQUIREMENTS

Early-time groundwater level monitoring wells are needed to show if the expected propagation of groundwater drawdown behavior in the subsurface is within expectations. The existing Spring Valley monitoring network of 37 monitoring wells and 16 springs is insufficient to provide this early-time statistic to adaptively manage the resources to meet the goals and objectives of the stakeholders.

As production wells are put on line and become utilized for the GWD Project, there will be a cone of depression that spreads outward from the pumping zone over time from the new pumping locations. To provide an early time indication of the drawdown propagation, each production well requires a minimum of two monitoring wells (either existing or new) to record a one-foot response to pumping at approximately year 1 and year 5 after production well start-up.

For example, based on a simplified analytical equation (Theis, 1935[9]; example curve shown in Attachment A), monitoring wells would need to be placed approximately 0.8 and 1.8 miles from a production well pumping at an average of 800 gallons per minute (gpm) in order to observe a one-foot drawdown in groundwater levels at one and five years, respectively. This example assumes an aquifer transmissivity of 75,000 feet^2/day and storage coefficient of 0.0075 (unitless).

Each new production well requires a minimum of two monitoring wells to describe the cone of depression response associated with it. Where there is a pumping center of more than one production well, there should be twice as many monitoring wells as production wells to observe the collective cone of depression response from aquifer withdrawals. Site specific

[9] Theis, C.V. 1935. The relation between the lowering of the piezometric surface and the rate and duration of discharge of a well using ground-water storage. Transactions, American Geophysical Union, Vol. 16, pp, 519-524.

aquifer test data from each new production well should be used to estimate the best placement and spacing of the two new early-time monitoring wells. The new monitoring wells should be associated with existing baseline monitoring wells so hydrologic variability can be accounted for when estimating project related impacts. Continuous dataloggers should be placed in the monitoring wells to record the aquifer responses at these distances.

The groundwater level data from these early-time monitoring wells should be evaluated to determine if the aquifer responses are within the predicted drawdown. If the response exceeds predicted drawdown, the adaptive management would trigger changes to pumping locations or amounts to bring the drawdown within acceptable values.

2.2 CULTURAL RESOURCES IN SPRING, SNAKE, AND STEPTOE VALLEYS

While the NSE found that the monitoring points in northern Spring Valley will detect any spread of drawdown in the direction of the CTGR reservation[10], Ruling 6164 does not address potential impacts to the "cultural landscape" throughout Steptoe, Spring, and Snake Valleys. As described by Lahren[11], "cultural landscapes give us a sense of place" and "reveal our relationship with the land over time"[12]. Given the insufficiently predictive nature of the regional model and its inability to identify impacts on a local scale, neither SNWA, the NSE, nor the CTGR have the ability to determine now whether or not project related impacts will occur at these sites in the future. Given the substantial amount of culturally significant sites in Steptoe, Spring and Snake Valleys, the NSE should recognize the need for baseline monitoring at these sites in order to protect these public interests. By incorporating culturally significant sites into a project related monitoring plan, the NSE will assure these interests of the public are protected in the future.

The CTGR described 16 villages, three Festival sites, and 12 pine nut gathering locations (Sites) in Spring Valley[13] that relate to the abundance of water in the valley (Figure 1, Attachment B). These sites represent cultural and natural resources to the CTGR and the people of Nevada. For example, Basonip Village (Village 12) was clearly identified as being located along Bastian Creek, which feeds Spring Creek and the Swamp Cedar Natural Area (Swamp Cedar North). The Basonip Village is also associated with Bastian Springs and Layton Spring,

[10] Ruling 6164, Page 116.
[11] CTGR Exhibit 5, Page 42
[12] Also, see CTGR Exhibit 5, *"They* [cultural landscapes] *provide scenic, economic, ecological, social, recreational, and educational opportunities which help individuals, communities and nations understand themselves (Birnbaum, 1994,* NPS, Preservation Brief 36, 1994*)".*
[13] CTGR Exhibit 5, page 42.

which together with Bastian Creek, "played a key role in the human occupation and use of Spring Valley and the Swamp Cedar Natural Area"[14].

Basonip Village is a historical site that links other villages and festival sites throughout Spring Valley. Lahren[15] found that Basonip Village was a Festival Site that linked together the different families of Spring Valley together for communal activities, pine nut gathering, and communal hunts. Basonip Village also provided a link to another Festival Site between Villages 8 and 10 (see Figure 1), as well as a Festival Site in Steptoe Valley. In summary, Lehren stated that of the 11 Festival Sites located in Ruby, Butte, Steptoe, Antelope, Spring, Deep Creek, and Snake Valleys, 10 (91%) were connected to the Festival Sites in Spring Valley.

Because 16 villages, 3 Festival Sites, and 12 pine nut gathering locations throughout Spring Valley have been previously identified by the CTGR[16], the responsibility of determining the project's impact on these locations falls on the Applicant. The process of assessing potential impacts should include baseline data collection, basin-scale groundwater modeling, and determination of natural variability so meaningful consultation with the CTGR could occur. Both hydrological and biological baseline monitoring of the sites will then establish a basis to identify how the GWD Project may impact these sites and what types of mitigation would be appropriate. Until consultation with the CTGR occurs at the end of this process, at which time the Applicant would be required to demonstrate whether impacts will occur, the NSE should not grant permission for any level of groundwater development

Ruling 6164 found that SNWA's effects analysis predicted "possible impacts to four valley floor areas" Swamp Cedar North, Unnamed #5 Spring, Four Wheel Drive Spring, and South Milick Spring"[17], which are in close proximity to some of the CTGR cultural sites. The ruling found that groundwater drawdown and reduced spring flow at these sites has the potential to further degrade existing habitat and cause the redistribution of mobile species[18]. Due to these effects, the Biological Monitoring Plan[19] addresses the need to monitor the two swamp cedar sites in Spring Valley. The ruling further recognized that there are possibilities for mitigation, but failed to identify quantitative measures to determine when mitigation should be taken. The proposed process of baseline studies followed by consultation with the CTGR, will result in quantitative measures at cultural sites that can be used to establish if mitigation is appropriate, and if so, when it would be triggered.

[14] CTGR Exhibit 5, page 9.
[15] CTGR Exhibit 5, page 9.
[16] Other sites exist in Steptoe and Snake Valleys as described in CTGR Exhibit 5.
[17] Ruling 6164, page 186.
[18] Ibid.
[19] SNWA Exhibit 365.

2.3 WHITE RIVER FLOW SYSTEM BASINS

Regional springs that support longstanding existing water rights and important sensitive wildlife habitat areas critical to protected species in the White River Flow System (WRFS) should be monitored and addressed in the Comprehensive Baseline Study. The springs are presented as they are geographically grouped together within the WRFS.

White River Valley: Butterfield, Flag, Hot Creek, and Upper or Lower Sunnyside Creek Springs (Figure 2).

In White River Valley, the group of springs that supply much of the water for the State of Nevada's Kirch Wildlife Management Area, which contains refugia for four protected endemic fish species, and agricultural water rights in the Valley south of Shingle Pass.

Northern Pahranagat Valley: Hiko, Ash, and Crystal Springs (Figure 3).

These springs lie in a north-south row towards the northern end of Pahranagat Valley, and they serve as the primary source of supply for the Pahranagat National Wildlife Refuge, the State of Nevada's Key-Pittman Wildlife Management Area, and most of the agricultural water rights in the valley.

Southern Pahranagat Valley: Maynard, Hoyt, and Lone Tree Springs (Figure 3).

These springs should be indicative of regional groundwater flow that plays a significant role in establishing the water table and supporting habitat in the southern portion of the Pahranagat NWR and water rights in that portion of the valley. They also are an indicator of the regional flow that is making it down to the lower portion of the WRFS, including Coyote Spring and Moapa Valleys.

Moapa Valley: Muddy River Springs (Figure 4).

The Muddy River Springs are the supply for the Moapa Valley NWR, for the only refugia for the endangered Moapa dace, and for all of the water rights established by the Muddy River Decree in 1920.

3.0 RECOMMENDED PROCESS TO DEVELOP QUANTITATIVE MEASURES

The NSE can meet the Court's requirement to establish quantitative measures to protect the public's interest by requiring that a MMM Plan be developed based on an appropriate baseline period and refined hydrologic tools. The MMM Plan should require SNWA to develop basin-specific models in order to establish quantitative threshold values prior to groundwater withdrawal. The analysis, hypothesis, and calculations of the threshold values will be described in a Comprehensive Baseline Study report so initial conditions are documented. Following acceptance of the Comprehensive Baseline Study by the NSE and initiation of Stage 1 pumping, installation of early-time monitoring wells will provide data required to further calibrate the basin-specific models to local stresses so long-term impact may be better estimated. The recommended MMM Plan required to develop quantitative measures is discussed in greater detail below.

3.1 DEVELOP BASIN SPECIFIC GROUNDWATER FLOW MODEL USED TO ADAPTIVELY MANAGE WITHIN BASIN THRESHOLDS

It is essential to develop basin-specific groundwater models that can be used to establish threshold values for each trigger prior to Stage 1 pumping. Historical and baseline data must be incorporated into a computer groundwater flow model[20] that can provide '*predictive results*[21]' for establishing threshold values. A minimum of 10 years of hydrologic data is required to calibrate the basin-specific model so it may distinguish between impacts caused by hydrologic variability and those that are project-related. Baseline model simulations should then be performed to quantify threshold values throughout the staged plan of the groundwater development project at 10-, 25-, and 100-year periods to compare with the impact analysis completed for the FEIS, ROD, and subsequent Tiered NEPA analyses.

Following Stage 1 commencement, model simulations should be performed annually using actual production and monitoring data to assess whether thresholds will be exceeded in the future. Model prediction is expected to improve as new data is incorporated throughout this process. The new data will show the measured results from varying hydrologic conditions, seasonal changes, and the aquifer/evapotranspiration responses to the phased pumping project.

Model recalibration should occur at a time interval using '*reliable transient-state data*' that results in an '*effective calibration of a groundwater flow model*'. The time interval between

[20] Ruling #6164, page 217; *6) The Applicant shall update a computer groundwater flow model approved by the State Engineer once before groundwater development begins and at a minimum of every eight years thereafter, and provide predictive results for 10-year, 25-year and 100-year periods;*
[21] Ibid.

model calibrations will vary based on results of actual versus simulated model results, but should occur at least every five to eight years based on available data and TRP recommendations.

A predictive model that is actively updated as new data becomes available is required to adaptively manage a groundwater basin within the listed constraints of the predicted project impacts[22]. Each basin-specific model should be constructed to consider the stress period (time increments) and spatial distribution required to incorporate the triggers and thresholds needed to manage annual operational decisions regarding pumping locations and volumes. The basin's resilience to pumping stresses is currently not known, nor is it fully defined. Early-time impact analysis needs to be established so that changes in pumping can be managed appropriately to assure additional impacts are not sustained.

Predictive hydrologic assessments from basin-specific models should be developed after the location of production wells and early-time monitoring wells are known. The results from these assessments can then be used to establish threshold values for initiating mitigation measures. Another benefit of the model is its ability to simulate changes to groundwater in storage, potential for land subsidence, and capture of evapotranspiration over time. These values can also be used in good stewardship of the water resources.

3.2 COMPREHENSIVE BASELINE STUDY

The Comprehensive Baseline Study is the basis for establishing quantitative measures for the goals and objectives of the stakeholders; as well as the adaptive management process and its ability to meet operational requirements. The Comprehensive Baseline Study must include the current MMM proposal, additional monitoring requirements, a description of basin-specific models and hydrologic tools, a description of the AMP, as described in detail below, and the biological and hydrologic baseline studies previously identified by the NSE in Ruling 6164-6167. Based on this submittal, the NSE would then be able to review the impacts to water rights and the environment, and specify when mitigation measures will be initiated, so that he can make an informed decision regarding the award of appropriative rights.

Prior to SNWA exporting any groundwater resources, the Comprehensive Baseline Study should be evaluated and approved by the NSE. It is anticipated that each basin may be in different stages of development, so the baseline and staging requirements should apply to specific basins. The following items should be part of a publicly available Comprehensive Baseline Study.

[22] FEIS, 2012. Appendix F3.3.14 Predicted Drawdown at Existing Groundwater Rights.

3.2.1 ADAPTIVE MANAGEMENT PLAN

The AMP for the GWD project should be described in the Comprehensive Baseline Study to document how decisions have been made and how they will continue to be made in the future to successfully meet the goals and objectives of the stakeholders to protect public interests. SNWA currently relies on personnel, watershed management tools, and data to perform adaptive management of the basin resources throughout each delivery year. The hydrologic models are used to predict groundwater levels, spring flow, and streamflow rates established by project goals, and is the basis for many of the management decisions. Data produced by the tools and models used to meet AMP goals would define thresholds and establish annual groundwater withdrawals. These data must be related to ecosystem-level environmental sampling and survey data for approval by the NSE before project pumping may be initiated. The predicted impacts associated with future operations identified in the EIS, BO, and subsequent Tiered analyses should also be quantitatively described in the Comprehensive Baseline Study.

The Comprehensive Baseline Study must describe the following AMP related subjects so the NSE may make an informed decision as to whether the public's interests are being met.

Adaptive Management Approach

The Comprehensive Baseline Study must describe concepts such as water resources reliability, resilience, and sustainability with meaningful input from the stakeholders. The approach should have flexibility through adaptive management practices to utilize monitoring data to refine the Program in an iterative process.[23] The management and data review process should describe input from stakeholders to show that the plan may be refined or modified based upon scientifically sound data and current conditions.[24] The Comprehensive Baseline Study should clearly define these concepts and how stakeholder involvement will be relied upon to assess data, improve hydrologic tools, and manage future operations.

Adaptive Management Cycle

Implementation of adaptive management can be described in terms of two phases: a set-up phase in which its key components are developed, and an iterative phase in which the components are linked together in a sequential decision process. The steps in these two phases

[23] SNWA Exhibit 147; page 4-6
[24] Ibid.

should be presented first in general terms, followed by discussion of how the adaptive management process works using specific examples.

SNWA proposed development of the monitoring objectives are currently based on the understanding of regional and basin-scale hydrologic systems[25]. The use of the monitoring objectives, and how they are used to make management decisions in an iterative cycle, should be described in the Comprehensive Baseline Study. For example, the Comprehensive Baseline Study should document how specific monitoring plan results, predictive tools, and water development operations plans are integrated to provide for optimal operations while minimizing and managing potential impacts.

As knowledge of system response grows during the baseline period, triggers, thresholds and action items will be modified to incorporate an evolving understanding of complex hydrologic and riparian ecosystem interactions. Comparison of empirical data with the simulated results fosters the learning process of the AMP, so that tools and models may be refined, resulting in improved simulations and better management of the basin. A description of how SNWA's understanding of the complex interactions of the basin has changed over time should be included in the Comprehensive Baseline Study.

List of Management Constraints

The Comprehensive Baseline Study should address management constraints which typically include, but are not limited to: physical, environmental, and legal considerations. Physical constraints address the surface water, groundwater, and aquifer conditions. Environmental constraints address the protection of endangered species, riparian, and wetland habitats consistent identified in the EIS and BO. Legal constraints address the use of project water rights, impact to other water rights holders, and adherence to the NSE rulings. All management constraints should be included in the Comprehensive Baseline Study for approval by the NSE.

Identify Triggers and Thresholds

Various system triggers and thresholds are used during evaluation of the monitoring data, and they serve as references for required action. Triggers are measurable or modeled responses in the physical system to the basin operations and other environmental stresses. Triggers that are included in the AMP are based on hydrologic parameters that may be indirectly related to changes in the environmental system. Thresholds are specific values that denote when a trigger

[25] Ibid.

has reached a state when some management action must be undertaken to mitigate the triggering condition. Thresholds may vary from year-to-year depending on the hydrologic conditions that prevail. Each of the triggers and thresholds shall be documented in the Comprehensive Baseline Study.

List of Action Items

Upon meeting or exceeding a threshold for a trigger, SNWA must execute an action item to mitigate impacts that do not meet AMP goals. For example, the measured decline of groundwater levels below a specified depth will dictate the use of alternative well(s) to meet delivery schedules. While project action items have been previously identified in the existing MMM proposal (Table 3), additional action items identified during the baseline investigation period may likely be developed. The Comprehensive Baseline Study should include a comprehensive list of the action items (mitigation measures) that will be implemented for each of the triggers and thresholds established based on project constraints.

TABLE 3 EXITING MMM PLAN ACTION ITEMS

Action Item	Description	Related Trigger
Redistribution of Groundwater Pumping	Shift pumping to other areas to reduce impacts.	Groundwater Level, non-project groundwater production, riparian vegetation
Provide Alternative Water Supply	Provide groundwater or surface water supply to existing water right holders.	Groundwater levels, spring flow, and surface water flow.
Augment water supply for Federal and non-Federal water rights and resources	Increase rainfall infiltration and enhanced recharge strategies.	Ecological, riparian vegetation
Reduction or cessation in groundwater withdrawal	Suspend or reduce groundwater production.	Groundwater level, spring flow, and surface water flow, riparian vegetation, other ecological
Other Measures	TBD	TBD

Note: Initial Threshold Values will be determined in Comprehensive Baseline Study

3.2.2 UPDATED HYDROLOGIC AND BIOLOGICAL MONITORING PLANS

Monitoring locations, environmental indicator thresholds, and mitigation actions that are protective of existing water right holders and state environmental resources shall be identified in the Hydrologic and Biologic Monitoring Plans (Plans) prior to commencement of Project pumping. The updated Plans shall include the operational monitoring and mitigation measures developed for the Final EIS as approved by the courts and additional requirements that may be specified in successive NEPA tiers and Construction, Operation, Maintenance, Monitoring, Management, and Mitigation Plans (COM Plans). As the NEPA documents and COM Plans mature, so do the cumulative effects analysis associated with the granting of specific Rights of Way for groundwater development facilities. A comprehensive Water Resources Monitoring Plan (WRMP) is a condition of BLM approving the ROW for the pipeline and is described in the EIS Mitigation and Monitoring Measures (GW-WR-3a), and should be incorporated into the Comprehensive Baseline Study approved by the NSE.

The monitoring requirements must identify an early warning system that is designed to distinguish among the effects of project pumping, natural variations, and other non-project related groundwater pumping activities. The Plans should also address hydrological and biological resources that exist in the WRFS described in Section 2.3. The anticipated thresholds associated with early-time monitoring wells[26] shall be identified and described in the final Comprehensive Baseline Study.

3.2.3 BASELINE DATA AND ANALYSIS

For a project that will take 38 years to build out and that will last in perpetuity, the full record of baseline monitoring and analysis should be publicly available for the future generations that are charged with regulatory oversight of the project. The Comprehensive Baseline Study should encompass the entire monitoring period prior to SNWA exporting groundwater from any groundwater basin. While newer monitoring points will have less data, all data should be included in the Comprehensive Baseline Study. The study and the data should be available through a publicly accessible website. The design and maintenance of the website would be the responsibility of SNWA.

[26] See section 2.1 regarding early-time monitoring wells.

3.2.4 BASIN-SPECIFIC GROUNDWATER MODELS.

In addition to the regional groundwater flow model used for the granting of water rights and programmatic environmental review, basin-specific groundwater flow models[27] designed to simulate the effects of pumping within each specific basin will be completed prior to Stage 1 Development and included in the Comprehensive Baseline Study. These updated models are a condition of BLM approving the ROW for the pipeline and are described in the EIS Mitigation and Monitoring Measures (GW-WR-3b). The regional groundwater flow model and basin specific groundwater models will be maintained for the life of the project, as required by the EIS. The NSE should participate in the BLM established TRP in order to have input on model performance reviews and refinements so that the public's interest is represented.

3.2.5 MODEL ANALYSES

The basin-specific groundwater model should be used to prepare a predictive analysis of the effects of Stage 1 Development, along with model runs that simulate full buildout and eventual equilibrium. Model analysis should provide predicted drawdown over time at key monitoring locations. The early-time analysis can be compared with on-going annual measurements to determine if a management action, or change in well field operation, needs to occur. The up-to-date basin-specific model will be the best predictive tool available for making sure that the project stays within the long-term thresholds and objectives developed for the project. Model results and analysis should be available through a publicly accessible website. The design and maintenance of the website would be the responsibility of the Applicant.

It is expected that simulated predictions will be improved as the model is updated with measured data showing groundwater level and spring flow responses to the staged pumping stresses, and annual changes in evaporation and recharge. By using the full range of the model's predictions, long-term impacts can be adaptively managed in current time

3.3 ANNUAL REPORTS

SNWA has prepared and submitted Spring Valley Hydrologic Monitoring, Management, and Mitigation Plan Status and Data Reports[28] (Data Reports) to the NSE since calendar year

[27] See section 3.1 regarding Basin-Specific Groundwater Model.
[28] 2016 Spring Valley Hydrologic Monitoring, Management, and Mitigation Plan Status and Data Report, SNWA, Water Resources Division, March 2017.

2008 based on their existing MMM proposal. While these reports address current year annual activities, planned future activities, and data summations, additional information should be presented to the NSE for assessment of project operations in the form of an Annual Report. While we support the structure of the existing Data Reports during the baseline data collection period, additional information is required so that pre-project conditions may be better documented. Subsequently, if appropriations are awarded to the applicant, post-start up Annual Reports should contain additional data that document management decisions and mitigation measures throughout the life of the project.

A description of the regional and basin-specific groundwater model, changes and updates to the model, and use of the model for analysis should be discussed in each of the Annual Reports. The evolution of the hydrologic tools is based on data collected over time and how that data is used to improve SNWA's understanding of the physical system. The Annual Reports should document how each year's activities are used, or not used, to improve the tools used to manage the basin.

During pre- and post-project start-up operations, the Annual Report should include a summary of findings from the biological monitoring plans. While the biological monitoring plan documents the detailed information about environmental conditions, and changes to those conditions, the Annual report should include a status of the plan and a summary of its findings.

Effects analysis that compare predicted impacts to observed impacts during post-project start-up should be included in the Annual Report to the NSE. This section of the report will document the difference between observed and predicted responses in early-warning monitoring wells and discuss what actions, if any, are required for correction. This section can also describe mitigation actions that were taken to avoid unanticipated or unreasonable impacts based on the effect analysis.

Changes to the Adaptive Management Plan documented in the Comprehensive Baseline Study should be addressed in the Annual Report during the post-project start-up phase. As new data become available and responses to the physical system occurs, changes to triggers and threshold values will likely occur, likely through the TRP. Because adaptive management is a process of observing, testing, and learning over time, future management actions and operating criteria will likely occur. The Annual Report to the NSE should document a summary of changes in management activities, thresholds, triggers, and action items that take place over time.

3.4 INTER-STAGE APPROVAL PROCESS

The NSE should condition movement from Stage 1 to Stage 2 or Stage 2 to Stage 3 on the submission and approval of a Consolidated Stage Performance Report. The uncertainty in the modeling and adaptive nature of the project and monitoring plans rightfully lend to both tiered environmental analysis and staged water development. The Applicant should be required to prepare a stage report that describes planned versus actual pumping, the effectiveness of the model as a predictive tool, the observed conditions as compared to the baseline, and a vegetation type analysis as compared to the baseline in order to analyze the effects of groundwater drawdown on vegetation community type conversion. The report should include updated groundwater models and predictive analysis of the next level of development through buildout and eventual basin equilibrium.

3.4.1 COMPREHENSIVE BASELINE STUDY UPDATE

Background monitoring commenced in 2007, collecting data to form a baseline study documented in SNWA's Data Reports. The Comprehensive Baseline Study will have included a conceptual model of Spring Valley hydrology that was incorporated into the Basin-Specific Model development. The Stage Performance Report should be based on an updated Comprehensive Baseline Study, including changes to the conceptual model from data collected during the current phase of pumping.

3.4.2 BASIN-SPECIFIC MODEL CALIBRATION

A description of changes to the Basin-Specific Models based on data collected to date should be included in the Stage Performance Report. The Basin-Specific Model should be calibrated to baseline data and data collected during the current phase of pumping. An effect analysis may then be prepared based on projecting future pumping during staged development and future build-out. Proposed changes to previously reported thresholds and triggers resulting from the updated effects analysis should then be discussed in the Stage Performance Report.

3.5 REVIEW OF STUDIES AND REPORTS

The NSE should insist upon public availability of the proposed Comprehensive Baseline Study, Annual Reports, and Stage Performance Repots to supplement his review and approval process. In the absence of stakeholder and public involvement, the NSE, who does not possess the staff to properly oversee a project of this magnitude, would rely solely on reports prepared by SNWA for parties that may have conflicting interests with the existing non-Federal water right holders and the State of Nevada. The proposed study and reports should be available on a

publicly accessible website. The design and maintenance of the website would be the responsibility of the Applicant.

We recommend that the CTGR request a review period of at least 90 days for each of the Comprehensive Baseline Study, Annual Reports, and Stage Performance Reports prior to the NSE granting approval of appropriate rights or approval for subsequent stages of the GWD Project. As previously recommended in Section 2.2, which identifies cultural monitoring requirements for CTGR, the Comprehensive Baseline Study should reflect results from consultation with the Tribe, thus allowing for timely review of the study.

4.0 CONCLUSIONS AND RECOMMENDATIONS

The Court faulted the current Monitoring, Management, and Mitigation Plan due to lack of objective standards that could be implemented to protect environmental and water resources of the State of Nevada. The BLM took a different approach than the NSE during their impact analysis performed under NEPA. Though imperfect and insufficient in significant respects, it does suggest an approach to addressing the substantial uncertainties in the impacts of groundwater withdrawal. The NSE can follow a similar approach of adopting a programmatic assessment that estimates probable regional-scale drawdown patterns and trends over time based on basin-specific models and comprehensive baseline data.

Given the stated uncertainty of the predictive modeling at this phase of the GWD Project, the NSE should refrain from allowing withdrawals to occur until a more robust process of assessing the impacts is available. Following a programmatic process that allows for assessing impacts based on actual facilities, the NSE may add conditions that clearly define requirements for the protection of public interests, including those of existing water right holders and the environment. The programmatic process allows the NSE to grant changes in withdrawal rates based on assessing impacts using the best available hydrological tools and actual pumping stresses. Hence, the NSE should rely on basin-specific groundwater models to objectively establish standards as to when mitigation would occur. Each step of the NSE's process of granting permission for the withdrawal of water under the GWD Project would involve the public in the decision making.

In order to facilitate the NSE's ability to determine if unreasonable impacts will occur to water rights, the environment, and other public interests, we recommend additional monitoring and reporting to be included in the approval process. Without additional monitoring and reporting, the NSE will continue to be constrained from reasonably assessing the impacts of the project. The recommended studies and reporting will allow the NSE to adopt objective standards for mitigation, based on refined scientific tools and data, so unreasonable impacts may be avoided. Furthermore, our recommended process allows the NSE to develop a plan that supports his office's ability to provide oversight of the entire Project Area through transparency and public involvement.

The initial approval of a Comprehensive Baseline Study demonstrates that monitoring requirements are in place to provide baseline data to facilitate the development of an "early warning system", and to improve the calibration and predictive abilities of the numerical groundwater flow models. The refined early warning system and an assessment of the predictive abilities of the numerical models should then be assessed prior to approving subsequent staged development. This process can occur at the NSE's office through his requirement to approve a

Comprehensive Baseline Study and subsequent Stage Performance Reports. A series of steps that would support the NSE to develop objective mitigation standards include:

1) Adopt Additional Monitoring Requirements

Identify monitoring wells that provide an early warning system for predicting long-term impacts to existing water rights and environmental resources. Additional monitoring wells are necessary to provide for improved model calibration for predicting future impacts under a programmatic process.

2) Develop Comprehensive Baseline Study

Applicant must develop a Comprehensive Baseline Study that documents data, analyses, hypothesis, adaptive management techniques, and objective measures for mitigation before groundwater withdrawals are allowed. The study will document physical, hydrologic, and biological monitoring data relied upon to refine, calibrate, and validate basin-specific models used to perform environmental impact analysis. Consultation activities with Tribes and other members of the public related to establishing objective measures for mitigation would be documented for future water managers.

3) Comprehensive Baseline Study Approval

In the event that ROWs are granted by the BLM for groundwater production wells under the tiered environmental analysis, the Comprehensive Baseline Study would then be submitted to the NSE for approval of groundwater withdrawals. The NSE must have adequate time approve or deny the Comprehensive Baseline Study, including at least a 90-day public review period. If approved, comments from the public should be incorporated in the NSE's decision and be included in his response to SNWA and the TRP.

4) Stage 1 Project Operations

Stage 1 operations may commence only upon the NSE's acceptance of the Comprehensive Baseline Study. Annual Reports submitted to the NSE will include, but not be limited to, monitoring activities, changes in adaptive management methods, project operations, performance of the project related to goals and objectives of the

stakeholder, changes to basin-specific groundwater model, and mitigation activities (Action Items) that took place.

5) Stage Performance Report

Based on a minimum of no less than 10 years, including representative periods of wet and dry hydrologic cycles, SNWA should submit a Stage Performance Report to the NSE for approval prior to proceeding with the next stage of groundwater withdrawal. The Stage Performance Report shall include a summary of past performance under the existing stage and provide a plan for Stage 2 development. Predictive analysis based on Stage 1 operation data, updated hydrologic tools and basin-specific groundwater models shall be used for evidence that supports increased withdrawal rates. The predicted impacts shall be consistent with those consulted on with the BLM during the tiered NEPA analysis.

The NSE must have adequate time to approve or deny the Stage Performance Report before additional groundwater withdrawals could occur, including at a minimum, a 90-day public review period. If approved, comments from the public shall be incorporated in the NSE's decision and be included in his response to SNWA and the TRP.

Specific Recommendations to Obtain Objective Measures for Project Implementation include:

- Perform Tribal and public consultation to develop mitigation measures for specific impacts.
- Address the protection of hydrological, environmental, and cultural resources in the WRFS and Millard and Juab Counties, Utah.
- Develop Basin-Specific Groundwater Models to quantify thresholds for objectively determining when mitigation is required.
- Plan installation of early warning monitoring wells (1-year and 5-year) to assess model integrity and improve long-term predictive capabilities.
- Document a comprehensive adaptive management plan.
    - Identify Goals and Objectives of all stakeholders
    - Establish Triggers for all Constraints
- Provide Detailed Plans and schedules for mitigation.

- Expand Annual Reports to reflect project performance and changes in the hydrologic tools and the adaptive management plan process.
- Expand the Biological Monitoring Reports to include resources outside Spring, Hamlin, and Snake Valleys.

The documents and data reviewed and discussed in this report suggest that the burden to prove the absence of adverse impact from the GWD Project on Tribal or public resources rests with the owner. Typically, it is the responsibility of the project proponent to develop the appropriate level of hydrological and environmental tools to show how their project will affect the environment. Development of a Comprehensive Baseline Study, which includes consultation with Tribes and the public, will provide the basis that allows the NSE to set objective standards for establishing mitigation measures. Furthermore, through a programmatic process for allowing groundwater withdrawals, the NSE will assure public involvement and oversight in successfully monitoring the affected basins.

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Document Path: J:\jn2636\SpringValley_cultural.mxd

South Fork
Ely
Goshute Indian Reservation
Village 1 - Tupa
Village 2 - Supuva
WV - Schellbourne
Village 4 - Basawinuba
Village 5 - Aidumba
Village 6 - Sosowosugu
Village 9 - Basamba
Village 7 - Basawinuba
WV - Trout Creek
WV - Salt Marsh
Spring Valley 184
Village 3 - Wongovitwuninogwap
Village 8 - Haiva
Village 10 - Tuhuva
Village 15 - Toziup
Village 11 - Biabauwundu
Swamp Cedar North
Village 12 - Basonip
Village 14 - Basiarnba
Village 24
Village 25
WV - Garrison
Village 13 - Bauumba
Swamp Cedar South
Village 26

- Pine Nut Location
- Swamp Cedar
- Village
- Winter Village
- BLM Inventoried Spring
- SNWA Proposed Spring Monitoring Location
- Stream
- Basin Boundary
- Phreatophytic Vegetation Zone
- County Boundary
- Indian Reservation
- State Boundary

Hydrogeologic Units

- Basin alluvial sediments (QTs)
- Volcanic rocks (QTb; Tv)
- Low-permeability rocks (TJi; CpCs; pCm)
- Older sedimentary rocks (KTRs; Ms; Tos)
- Carbonate rocks (PPPc; MOc; Cc)
- Water

Notes:

1. BLM Inventoried Spring Locations are taken from Table F3.3.1-1A in the Clark, Lincoln, and White Pine Counties Groundwater Development Project Final Environmental Impact Statement, 2012.

2. Proposed Spring Monitoring Locations taken from the Hydrologic Monitoring and Mitigation Plan for Spring Valley (Hydrographic Area 184), 2011.

3. All Goshute cultural locations are approximate. Based on Figure 2 of A Shoshone/Goshute Traditional Cultural Property and Cultural Landscape, Spring Valley, Nevada, 2010.

STETSON ENGINEERS INC.

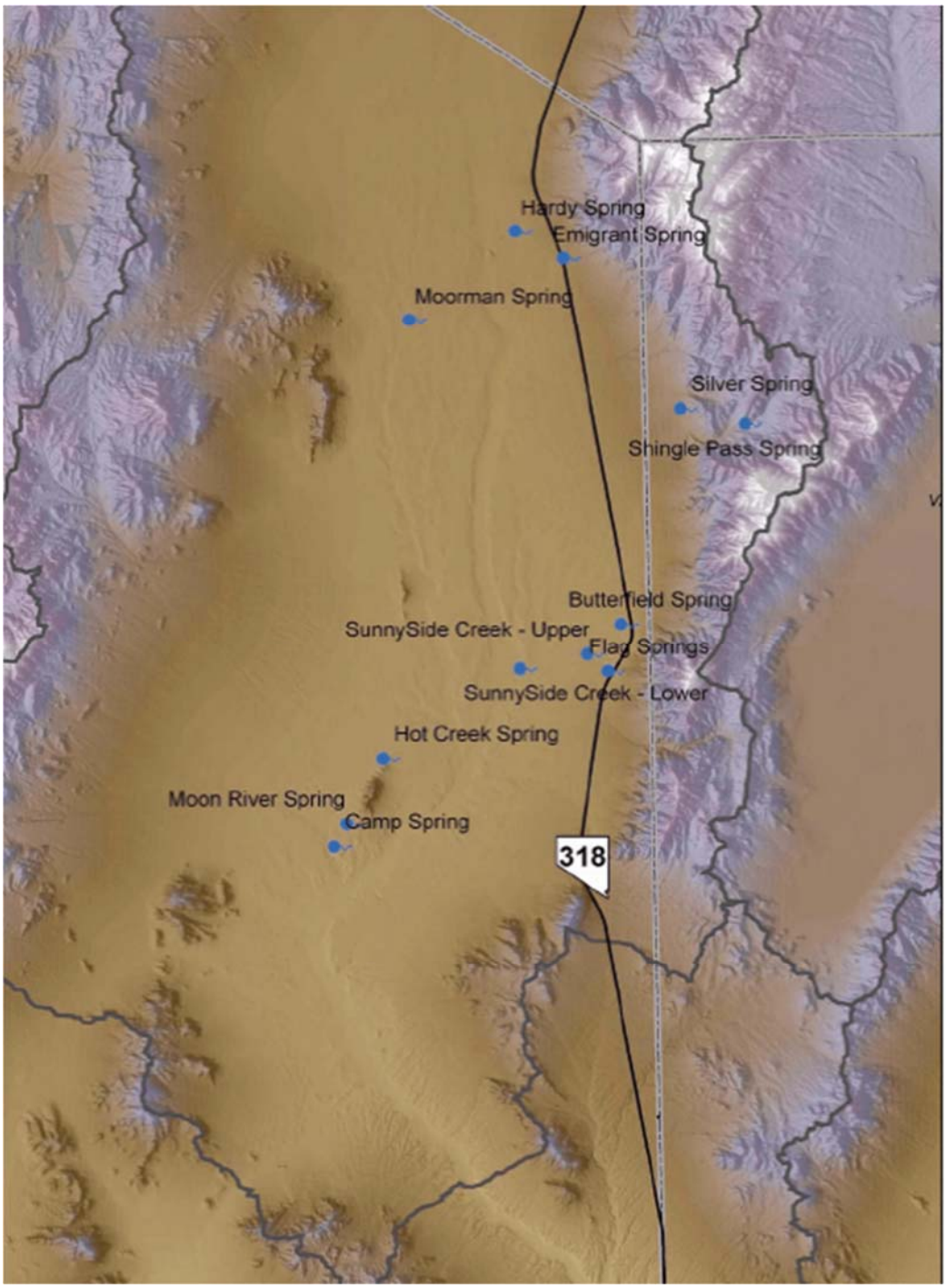
GOSHUTE CULTURAL SITES AND CURRENT SPRING LOCATIONS
ADMINISTRATIVE GROUNDWATER BASIN 184
SPRING VALLEY, NV

0 5 10 Miles

N

FIGURE 3

Map Showing Springs in White River Valley:



Map Showing Springs in Pahranagat Valley:

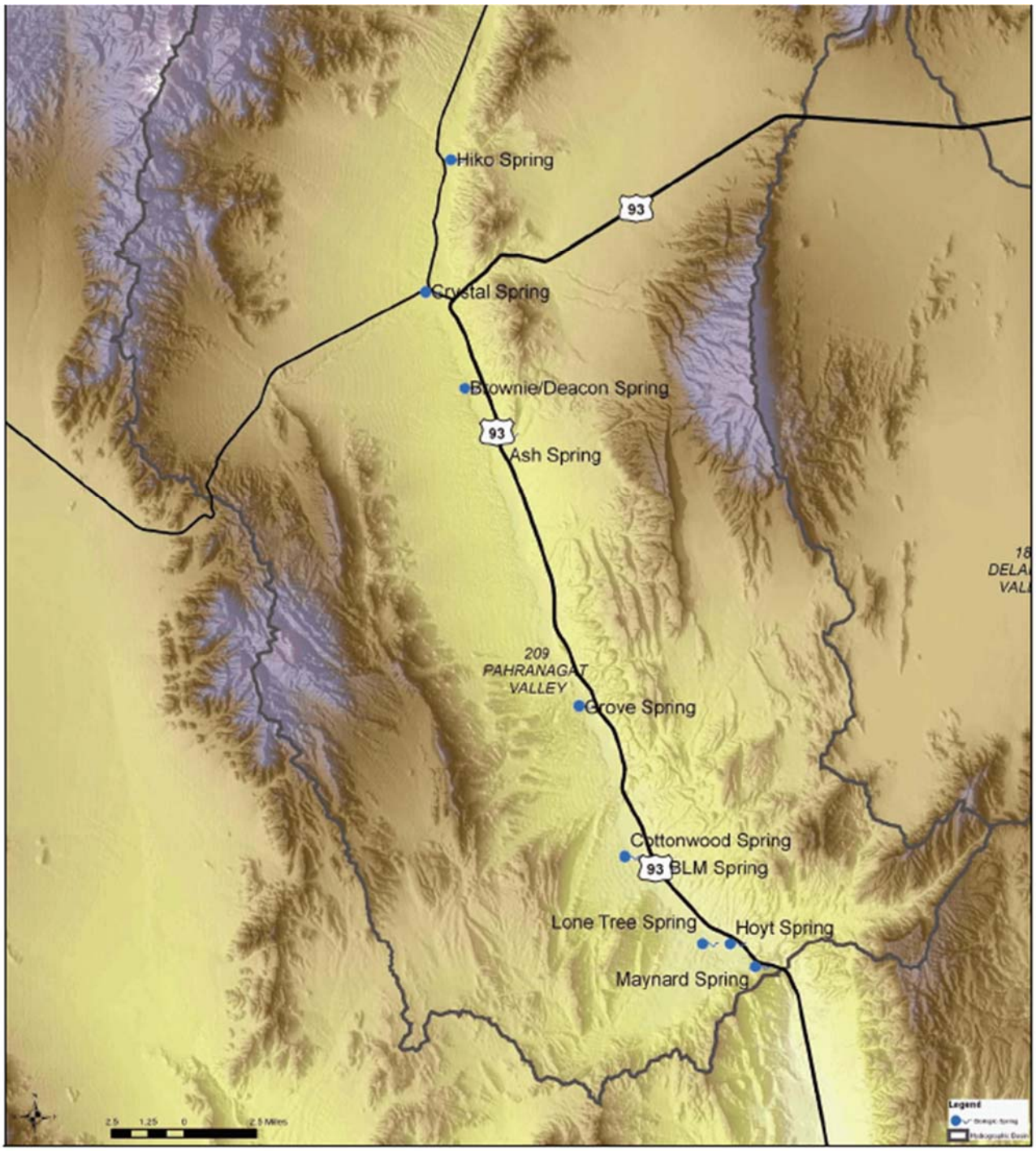
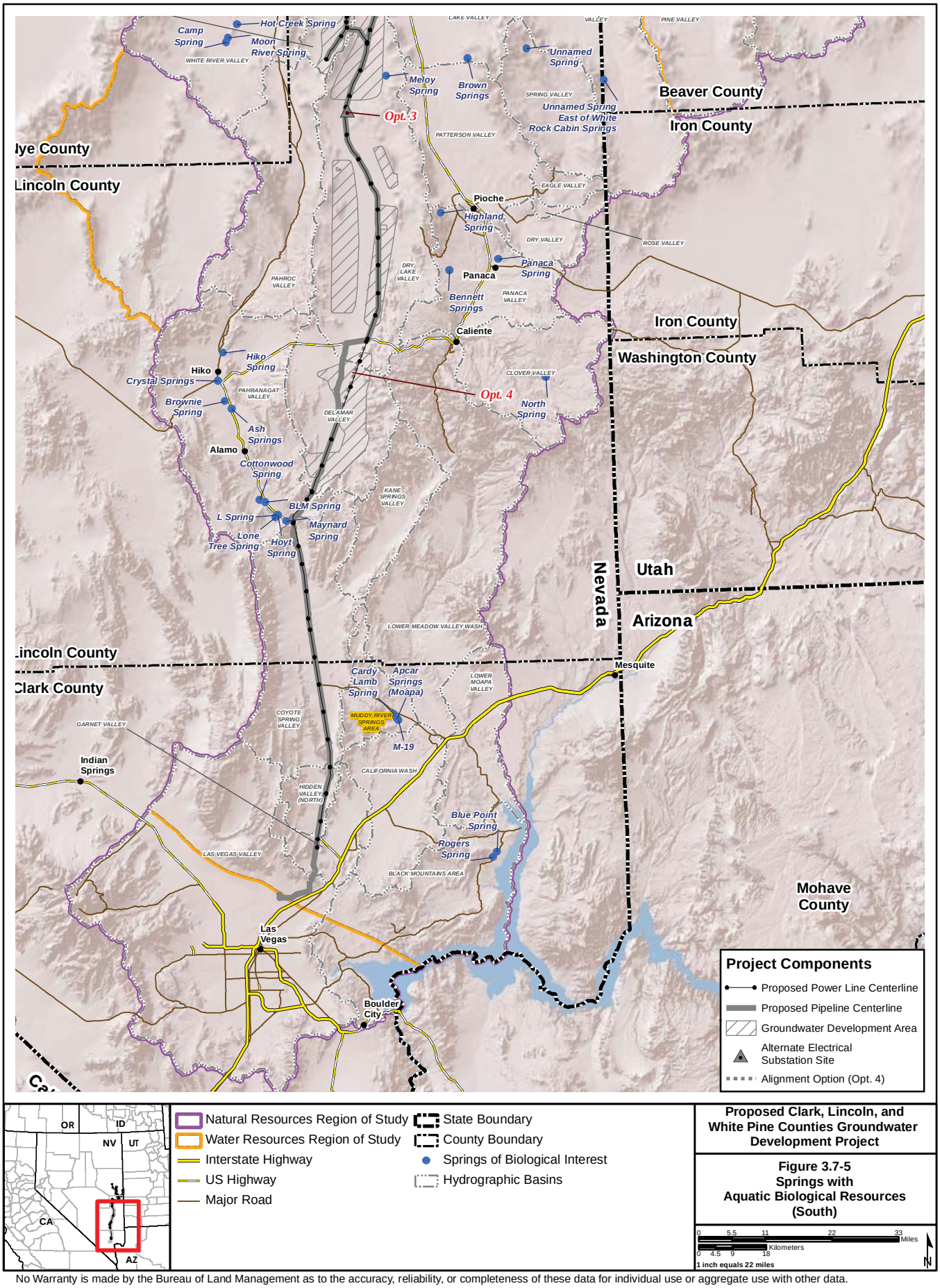


Figure 29. Map of locations of aquatic systems of interest in Pahranagat Valley, Lincoln County, Nevada.



No Warranty is made by the Bureau of Land Management as to the accuracy, reliability, or completeness of these data for individual use or aggregate use with other data.

ATTACHMENT A

Example of Monitoring Well Placement for Early Time Response

Theis Nonequilibrium Equation

$$s = \frac{Q}{4\pi T} W(u)$$

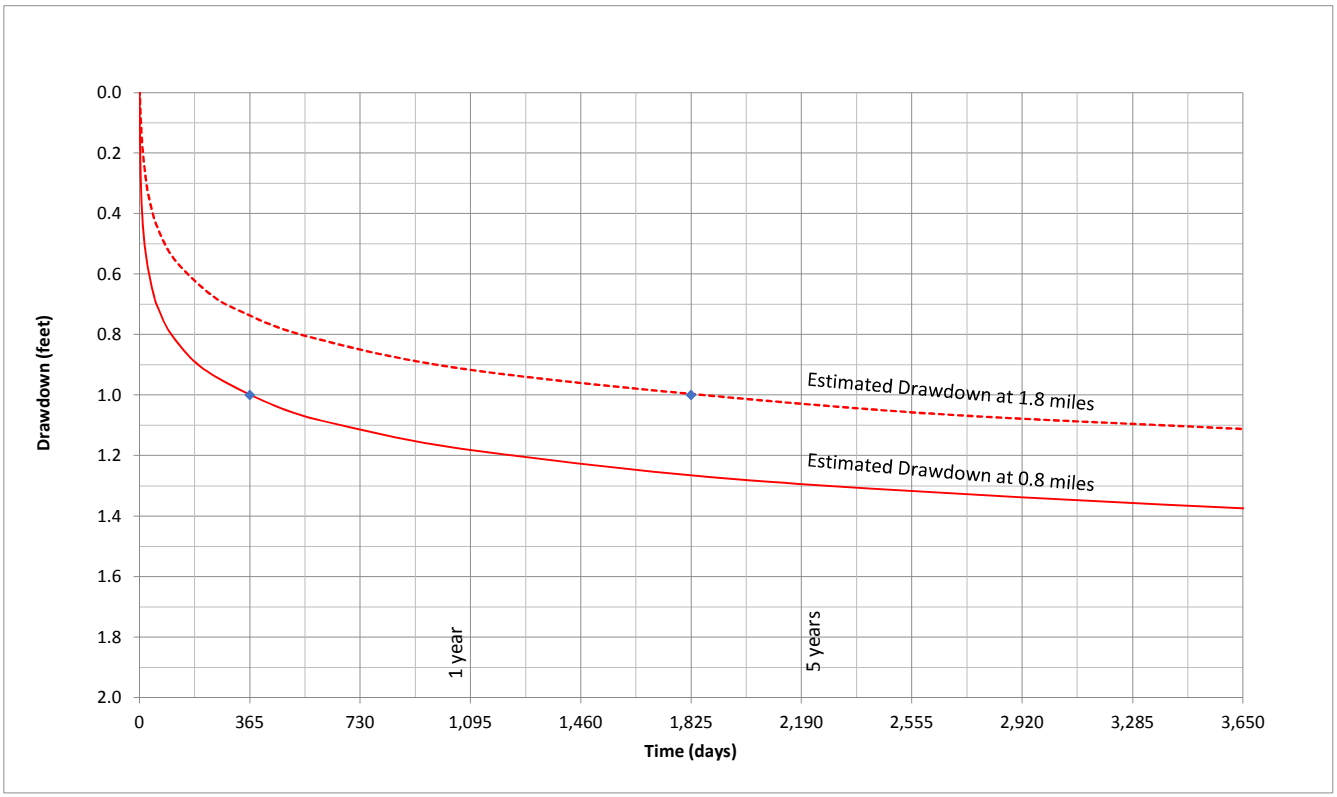
$$u = \frac{r^2 S}{4Tt}$$

Criteria at 1 Year

pumping rate		distance	transmissivity	storage
Q [L^3/T]		**r [L]**	**T [l^2/T]**	**S [ ]**
153990		4224	75000	0.0075
ft^3/day		*feet*	*ft^2/day*	*unitless*
	Drawdown (s) =	Q/4 pi T	u =	r^2S/4T
		0.163		0.446
gpm		*MW distance*	*thick, K*	*thick, Ss*
800		***0.8***	*1500*	*1500*
			50	*0.000005*

Criteria at 5 years

pumping rate		distance	transmissivity	storage
Q [L^3/T]		**r [L]**	**T [l^2/T]**	**S [ ]**
153990		9504	75000	0.0075
ft^3/day		*feet*	*ft^2/day*	*unitless*
	Drawdown (s) =	Q/4 pi T	u =	r^2S/4T
		0.163		2.258
gpm		*MW distance*	*thick, K*	*thick, Ss*
800		***1.8***	*1500*	*1500*
			50	*0.000005*



The Theis equation is based on many simplifying assumptions, including uniform characteristics of the aquifer and a fully efficient well. This attachment is shown only as an example that provides a general magnitude of probable distances required for monitoring wells. Monitoring well placement should be based upon site specific testing and available data.

Equation from: Driscoll, Fletcher, 1986. Groundwater and Wells. Johnson Filtration Systems Inc., St Paul, Minnesota.

Based on: Theis, C.V., 1935. *The relation between the lowering of the piezometric surface and the rate and duration of discharge of a well using ground water storage.* Transactions, American Geophysical Union, Washington, D.C.

Attachment B

List and Location of CTGR Cultural Sites

Villages

	Village No.	Village Name	Location* Easting	Location* Northing
Northern Spring Valley	1	Tupa	712270.019	4420766.303
	2	Supuva	709480.606	4416100.483
	4	Basawinuba	708195.076	4402886.492
	5	Aidumba	707257.932	4396405.248
	6	Sosowosugu	712903.801	4396452.818
	9	Basamba	709912.018	4392795.760
	7	Basawinuba	712693.543	4386149.287
	3	Wongovitwuninogwap	715157.735	4361300.616
	8	Haiva	715249.053	4356501.274
	10	Tuhuva	716032.681	4352147.943
	11	Biabauwundu	716651.149	4347790.081
	12	Basonip	716787.190	4336760.318
Southern Spring Valley	15	Toziup	731373.253	4350773.775
	14	Basiamba	725599.936	4323659.416
	13	Bauumba	725961.988	4303715.073
Southern Snake Valley	26	n/a	748190.735	4293387.352
	24	n/a	740013.583	4321844.597
	25	n/a	743929.972	4321751.484
Snake Valley	WV	Trout Creek	760568.908	4396689.573
	WV	Salt Marsh	757507.732	4371125.239
	WV	Garrison	750323.526	4313146.441
Steptoe Valley	WV	Schellbourne	704134.678	4404175.559

n/a indicates not available.

Pine Nut Locations

Location* Easting	Location* Northing
707971.842	4410644.258
734668.789	4390693.173
708961.290	4390234.799
711324.151	4371554.408
729947.874	4369829.327
730824.207	4358719.569
711444.613	4355068.365
710473.411	4342358.403
709126.614	4331189.208
727828.657	4330018.374
727951.604	4318182.536
731736.654	4297855.697

*UTM NAD83 Zone 11