MEMORANDUM

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Subject: Strategy for the Tikaboo/Three Lakes Hearings and for Developing the Remaining NRS (Revised).

Introduction

Following is our suggested strategy for Tikaboo/Three Lakes hearings and for developing the remaining NRS. Several days ago we distributed a memorandum on this topic. This memorandum represents the editorial revision of that memorandum.

If the NRS is to produce a perpetual water supply (for more than 50 to 100 years), the existing discharges within or from the NRS area must decrease. The current discharges include phreatophyte and irrigation consumption within the NRS area, subsurface flows to the Death Valley groundwater system, subsurface flows to the Colorado River, and Muddy River streamflow to the Colorado River. In the long-term, an acre-foot of yield from the NRS will produce an acre-foot of decreased discharge. However, the NRS can be designed to limit impacts to acceptable parts of the hydrologic system.

The overall strategy for developing the NRS would be to develop groundwater storage within the dry valleys and to capture phreatophyte consumption within the wet valleys. Dry valleys are those containing minimal phreatophytes, such as Three Lakes, Tikaboo, Coyote, Delamar, Dry, and Cave valleys. Wet valleys are those containing extensive phreatophytes, such as Lake, Spring, White River, and Railroad valleys. The dry valleys would be developed as a temporary water supply (50 to100 years), while facilities were being extended to the more distant wet valleys. The wet valleys would be developed as the ultimate perpetual water supply.

Groundwater storage would be developed in the dry valleys within the constraints of Nevada water law. Water rights would be sought for the unappropriated perennial yield in the dry valleys. The average annual pumping would be limited to the obtained

right. However, well locations and depths would be designed to maximize storage extractions from the valley-fill deposits. The objective would be to pump from alluvial wells so as to have minimal impacts on the underlying carbonate system. This would require a much large number of and shallower depth for production wells than previously contemplated. Furthermore, the pumping within the dry valleys would be temporary. Pumping would be limited to a period of perhaps 50 to 100 years, depending on the storage yield of each dry valley. Within such a period, the dry valleys collectively could yield 50,000 acre-ft/yr or more without unacceptable environmental or water-rights impacts.

A perpetual water supply would be developed within the wet valleys based on the capture of the groundwater discharge to phreatophytes. This supply also would be developed within the constraints of Nevada water law, which has as its fundamental and functional basis the expectation of that capture. Water rights would be sought for the unappropriated perennial yield in the wet valleys, and water rights held by others would be purchased as offered. The average annual pumping would be limited to the phreatophyte discharge available for capture. This would require a configuration of shallow wells designed to capture phreatophyte discharge without impacting springs. To accomplish this outcome, a much large number of and shallower depth for production wells would be required than previously contemplated. With such well configurations, the wet valleys collectively could yield 100,000 acre-ft/yr (a conservative estimate) forever, without unacceptable impacts.

The critical institutional constraints to the development of the NRS will be the spring discharges. The suggested development approach avoids all except the smallest impacts on springs. The approach also fits within current Nevada water law. Furthermore, it can be made to fit within NEPA and ESA by directing impacts away from sensitive environmental elements. However, the approach will require obtaining regulatory acceptance for the necessary ultimate impacts on phreatophytes.

Approach with State Engineer

Objections will arise during the water-right hearings regarding impacts on springs. That issue arose during the Coyote Spring Valley hearing, and the issue will arise again during the Three Lakes Valley/Tikaboo Valley and other dry-valley hearings. The difficulty for the SNWA is that the protestants have stated correctly and will continue to state that perpetual pumping will eventually impact the carbonate springs, potentially including Muddy Springs, Corn Creek Springs, Ash Meadows springs, Pahranagat Valley springs, and other springs

The concern can be responded to by pumping within the dry valleys from alluvial wells and pumping for a limited duration. The argument to present in the hearings is: Even though the valley-fill deposits recharged from the adjacent and underlying carbonate rocks, groundwater can be pumped from the valley-fill deposits with only minimal impacts on the carbonate groundwater system. Pumping from a shallow well in

the valley-fill deposits creates a cone of depression that expands three-dimensionally with time. However, the rate of downward expansion is much slower than the rate of radial expansion owing to the anisotropy of valley-fill deposits. The downward expansion would be sufficiently slow, for typical valley-fill deposits, that essentially no effect would penetrate past the base of the valley-fill deposits after pumping for 50 to 100 years. For example, if the valley-fill deposits were to extend 1,500 feet below the pumping zone, a 100-foot head decline within the pumping zone would create only a one-foot decline[1] at the base of the valley-fill deposits after 50 years. If the valley-fill deposits were to extend 2,200 feet below the pumping zone, a 100-foot head decline within the pumping zone would create only a one-foot decline at the base of the valley-fill deposits after 100 years.

However, this argument requires explaining in the hearings that the overall strategy involves limited pumping from the dry valleys and eventual perpetual pumping from wet valleys. In either case, SNWA would not request to pump at any time more than the available perennial yield for a particular valley. This general strategy would be implemented as follows:

Obtain rights for the unappropriated perennial yield in Three Lakes Valley and Tikaboo Valley. While the right would be for the perennial yield, the right would be developed to maximize storage extractions from the alluvium. The purpose of this approach is to minimize impacts on the carbonate groundwater system, and correspondingly to minimize impacts on Corn Creek Springs, Ash Meadows, and Muddy Springs. The pumping would be temporary. However, this approach likely will produce lower groundwater levels at the State Prison and Indian Springs wells. This can be addressed if necessary by providing water to or deepening the wells for the State Prison and Indian Springs. However, Nevada water law does not guarantee prior groundwater-right holders that they will not impacted by subsequent appropriations, and impacts would be mitigated only to the extent that water law might define them as unreasonable.

A well field along the US 95 corridor will impact the wells at the State Prison, probably within a few years, and potentially will impact the Indian Springs ground-water system. These impacts will occur particularly if all the groundwater in the Three Lakes South basin is withdrawn from south of the Las Vegas Shear and not along the Alamo Road. This presents a real hydraulic dilemma because groundwater movement across the shear zone is restricted in general and perhaps is even more restricted through the valley-fill deposits. A way to deflect opposition is to negotiate serving the prison and buying the Indian Springs Water Company.

Preceding the onset of negotiations, groundwater applications should be filed in the Indian Springs Valley for 10,000 to12,000 acre-ft/yr of unappropriated recharge. The pumping would be from alluvial wells for a finite duration such that Devils Hole and Ash Meadows would not be impacted. The preferential use would be within Indian Springs

[1] Based on the equation $\Delta h = \Delta h_0 \, erfc\left(z \Big/ 2\sqrt{K_z t / S_s}\right)$ with $K_z = 10^{-4}$ ft/day and $S_s = 10^{-4}$ 1/ft.

Valley, with the excess being exported to Las Vegas Valley. The export for Indian Springs Valley would greatly increase the yield of the US 95 pipeline project.

Design alluvial well field for Coyote Springs Valley. The current plan for pumping in Coyote Spring Valley is to pump from carbonate wells. However, such pumping will produce the largest and most immediate impacts on Muddy Springs. The impacts can be minimized by limiting the pumping duration and pumping from valley-fill wells. The location of the valley-fill wells would be selected to eliminate impacts on Muddy Springs. One configuration would be to locate the pumping wells to the west along SR 93. Wells would be located north and south from the latitude of MX-5 along a 15-mile stretch of SR 93. This will require some backtracking with respect to the State Engineer, the U. S. Fish and Wildlife Service, and engineering design.

Obtain rights for the unappropriated perennial yield in Delamar Valley, Dry Valley, and Cave Valley. While the right would be for the perennial yield, the right would be developed to maximize storage extractions from the valley-fill deposits. The pumping would be temporary. The pumping would be design to minimize impacts in Pahranagat Valley, because only the valley-fill deposits would be pumped.

Obtain rights for water in Lake Valley and Spring Valley by appropriation and purchase. The pumping would equal the available phreatophyte discharge and would be designed to capture the discharge without impacts to springs or wetlands. This would require consideration of purchasing applications senior to LVVWD's in Spring Valley, or development in conjunction with White Pine County (also in Spring Valley). In Lake Valley all the applications and permits prior to LVVWD's applications have been put to beneficial use. Thus Lake Valley groundwater is available through purchase only.

Obtain rights for water in White River Valley by purchase. The pumping would equal the available phreatophyte (or agriculture) discharge and would be designed to capture the discharge (or change manner of use) without impacts to springs or wetlands.

Obtain rights for water in Railroad Valley by appropriation and purchase. Railroad Valley could provide additional water supplies for very long-term needs. The pumping would equal the available phreatophyte and bare soil discharge and again would be designed to capture the discharge without impacts to springs or wetlands. There will undoubtedly be additional water for sale.

Information Needs

Obtaining particular hydrologic information will be critical to implementing this strategy for developing the NRS. Information is needed on the expected storage yield from the valley-fill deposits. Information also is needed on the phreatophyte discharge that can be captured.

With respect storage yield, information is needed on the hydraulic characteristics of the valley-fill deposits in Three Lakes, Tikaboo, Coyote Spring, Delamar, Dry, and Cave valleys. Information is needed also on the horizontal hydraulic conductivity, vertical hydraulic conductivity, specific yield, and specific storage. A data-collection program should be developed to obtain these data. Such a plan deviates from the current emphasis on constructing carbonate monitoring wells. Fewer carbonate monitoring wells would be constructed, and the otherwise unused funds would be used to construct valley-fill monitoring wells.

With respect to phreatophytes, information is needed on the actual consumptive use of phreatophytes within Lake, Spring, White River, and Railroad valleys. A data-collection program should be developed to obtain field measurements of the consumptive use, because this may be the only water the State Engineer will allow to be exported.