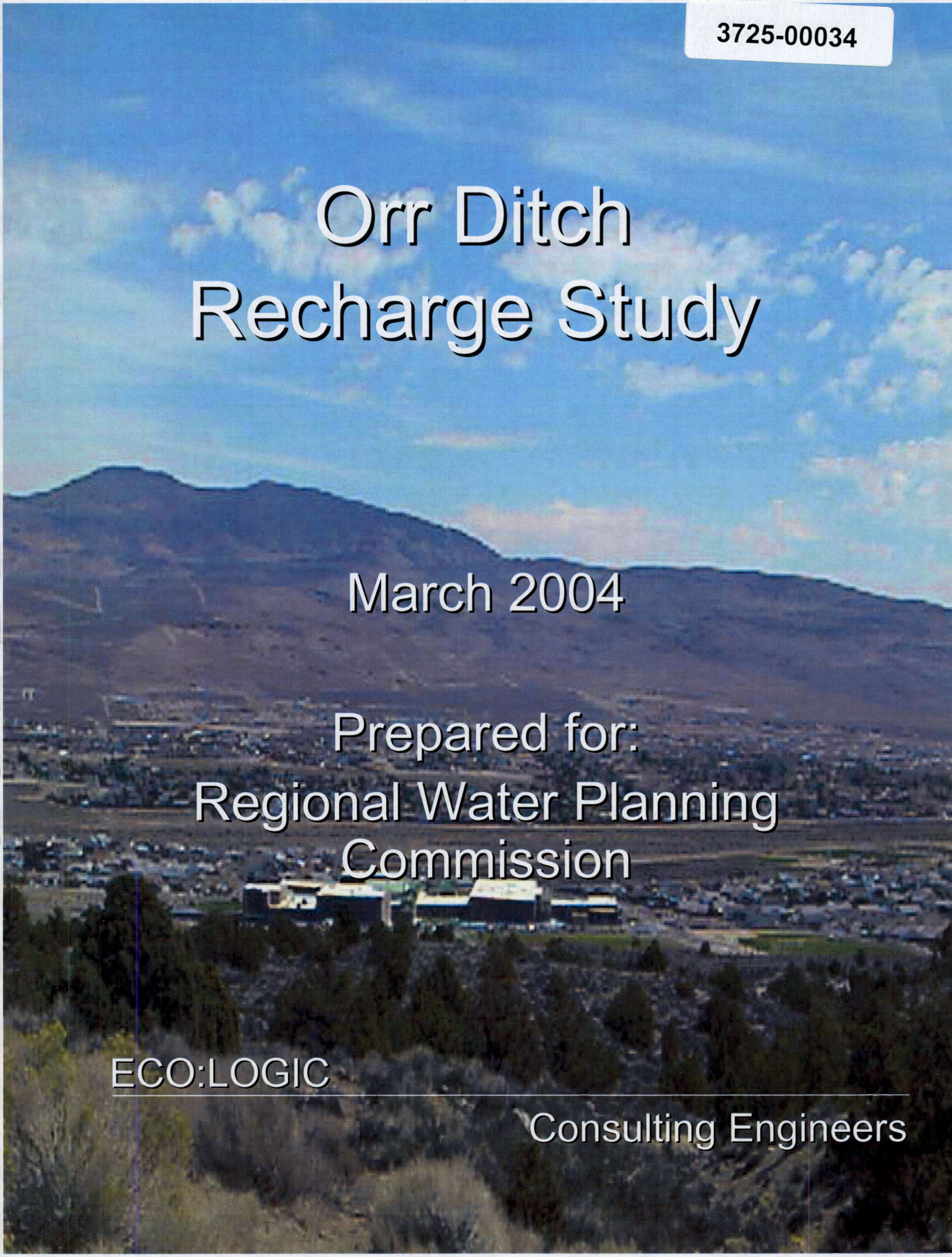

Orr Ditch Recharge Study

March 2004

Prepared for:
Regional Water Planning Commission

ECO:LOGIC

Consulting Engineers

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EXECUTIVE SUMMARY

1. Spanish Springs Valley is undergoing transition from agricultural to urban land use. This change has been accompanied by an increase in water demand for residential and other non-agricultural uses. In 1999, the water demand by customers of the Washoe County water system was 1,716 acre-feet per year (AFA). At build-out of approved units, this demand is expected to increase to approximately 5,600 AFA, of which 1,800 AFA is to be provided by groundwater. The remainder, approximately two-thirds of the total supply, will be provided by water imported to the basin.

2. The largest source of recharge to the groundwater system has historically been seepage from the Orr Ditch and secondary recharge from irrigation. An outcome of urbanization is large reduction in these sources of recharge to the aquifer. Simultaneously, groundwater will be called upon to provide a larger portion of the total water supply in the basin. Previous investigations of the water resources within the basin indicated that urbanization would create a condition where more water is pumped from the basin than is recharged. The result is a water budget imbalance and a reliance on the transitional storage in the aquifer as an interim water supply.

3. The means to balance the water budget were investigated through the application of a three-dimensional numerical groundwater flow model of the aquifers in the basin constructed by the Washoe County Department of Water Resources. The initial model runs indicated the water budget imbalance at build-out is expected to approach approximately 2,700 AFA. A total 17 variations of the model were run to evaluate the ways to balance the budget. The variations included:

   - Secondary recharge from the infiltration of 2 million gallons per day (MGD) of treated effluent from a proposed satellite wastewater treatment facility in the basin.
   - Secondary recharge from the proposed wastewater treatment facility plus aquifer storage and recovery involving injection of water via wells in the southeast portion of the valley.
   - An aquifer storage and recovery (ASR) program relying solely on injection of water via wells in the southeast portion of the valley.

4. The model analysis indicated that the addition of the 2 MGD of secondary recharge from the rapid infiltration galleries went a long way toward balancing the water budget. The addition of 605 AFA of recharge through injection at Spring Creek Wells 5, 6, and 7 balanced the water budget. The result of the balanced budget was a reversal of water level declines and, ultimately, stabilization of water levels in the basin.

5. Attempting to balance the basin water budget solely through injection into wells in the southeast portion of the basin proved to be inefficient. It required an increase in the water needed to balance the budget from 2,846 AFA to 3,962 AFA. The model indicates that of this amount more than 1,500 AFA would be lost to evapotranspiration. In other words, approximately 38% of the water used to recharge the aquifer would be lost under this scheme.

6. The model analysis indicated that water level declines in the aquifer are to be expected. The largest water level declines, as much as 85 feet, are anticipated in the southeast portion of the basin within a highly transmissive fractured volcanic rock aquifer, which is the source of groundwater to Spring Creek Wells 5, 6, and 7, among the highest yielding

wells in the basin. This drawdown is not expected to adversely affect these wells. However, the model results suggest that three County Wells may be affected by declining water levels. The wells include:

- Desert Springs Well 3, where the water level in the well may be drawn down below the top of the perforations.
- Desert Springs Well 1 and Spring Creek Well 2, where water levels are expected to approach the top of the perforations.

7. Domestic wells derive groundwater from the alluvial deposits, which overlie the fractured volcanic rock aquifer in the southeast portion of the basin. Water level declines in these overlying sediments are expected somewhat less, in the range of 70 feet.

8. Land use planning in the more rural portions of the hydrobasin needs to incorporate an analysis of the limited groundwater resource and the sustainability of additional domestic wells as part of the overall decision-making process of approving land uses that would rely on domestic wells for supply. 240 + 740 = 980 afa needed for BO (Need to look at effect of intensifying land use)

9. A minimum of 2,800 AFA is required to bring the basin into balance based on anticipated conditions at 2020.

10. Basin water resource management strategies for long-term sustainability can include a number of variations depending on what turns out to be the more cost effective and efficient use of the community's financial and water resources. This report supports the ongoing cooperative analysis of alternatives to arrive at the optimal configuration of management strategies over time.

    There are a number of infrastructure projects currently under planning and development that may be integral to a long-term strategy. Most significant of these is the proposal to construct a satellite wastewater treatment facility in the northern part of the basin. This facility would provide 2,200 AFA towards the 2,800 AFA anticipated deficit. While this proposed facility helps substantially with the water deficit, there are water quality issues that will need to be addressed relating to the quality of effluent that is infiltrated to the basin. *

    Other key infrastructure includes the City of Sparks effluent delivery system and planned improvements of the Washoe County Department of Water Resources for the municipal water supply.

11. Additional management options include:
    a. Recharge of up to 605 AFA in Spring Creek Wells 5,6, and 7 to maintain water levels in these high production wells. (recharge in excess of this amount in the south portion of the valley leads to increases in evapotranspiration and is thus an inefficient use of water resources.)

    b. Reduction of 620 AFA of groundwater pumping for non-potable uses such as the Red Hawk Golf Course, Granite quarry, Sha Neva quarry, and Donovan quarry, and replacement with an effluent supply. Each of these entities has a significant investment in water rights and pumping infrastructure that needs to be considered in any proposal to reduce pumping.

c. Importation of an additional water resource to either replace municipal groundwater pumping or be recharged in the northern part of the basin. This sort of option would be needed if the satellite wastewater treatment plant were not constructed. Potential resources include importation of additional Truckee River water, Washoe County holdings from Dry Valley/Warm Springs, or water from the proposed North Valleys water importation project.

12. Coordination of stakeholders within the basin is key to the success of a long-term management strategy. Stakeholders include Washoe County, the Truckee Meadows Water Authority, the City of Sparks, domestic well owners, the Red Hawk Golf Course, and the Granite, Sha Neva and Donavan quarry owners.

INTRODUCTION

The region of Washoe County northeast of the Reno-Sparks area that is known as Spanish Springs Valley (Figure 1 (provided by Washoe County Department of Water Resources)) is transitioning from agricultural to urban residential use. The urban water supply is met by a combination of municipal water-supply wells within the valley and water imported to the valley from the Truckee Meadows. Most of the municipal wells are operated by the Washoe County Department of Water Resources. The remaining municipal wells are operated by Utilities, Inc., which operates the Sky Ranch water system. The Truckee Meadows Water Authority imports the remainder of the municipal water supply in Spanish Springs Valley from the Truckee Meadows. In addition to the municipal water supply, groundwater is consumed for residential use by individual domestic wells, golf course irrigation, and limited industrial use such as washing aggregate.

The agricultural land in Spanish Springs Valley has historically been irrigated by surface water imported from the Truckee River via the Orr Ditch. Previous investigations by the United States Geological Survey (USGS) concluded that infiltration of the water delivered by the Orr Ditch (both as seepage losses from the ditch and secondary recharge from the water applied as irrigation) comprised the largest source of recharge to the aquifer system in Spanish Springs Valley (Berger, *et al.*, 1997). The USGS further concluded that groundwater withdrawals to meet the urban demand coupled with the decrease in recharge from the Orr Ditch will result in an overdraft of the aquifer. At total build-out of approved development in the valley, the current Orr Ditch deliveries will decrease by more than 90 percent.

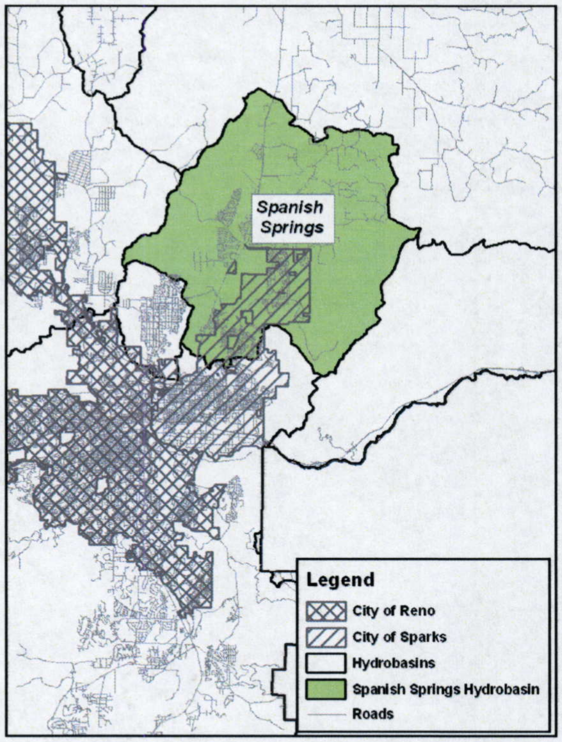

Figure 1: Location Map

PURPOSE AND SCOPE

In September 2001, The Regional Water Planning Commission awarded ECO:LOGIC Consulting Engineers of Reno, Nevada a contract to:

- Analyze the groundwater recharge benefit of irrigation from the Orr Ditch in the Spanish Springs Valley
- Estimate a cost/acre-foot of groundwater recharge if a farm/ranch were purchased to maintain the estimated recharge
- Compare the above cost with a wellhead recharge program for surface water via existing municipal wells

Very early into the project ECO:LOGIC became aware of significant issues related to the initial scope of work. These included:

- The agriculture lands of interest were properties that had already been master planned for development by the City of Sparks, several of which were in various stages of project approvals, such as Stonebrook and the Kiley Ranch.
- City of Sparks planning staff expressed concern with the basic premise of the project since a tremendous amount of staff and development time and money had already been expended towards planning for the development of these lands. It was their assessment that timing for such a proposal was about 10 years too late.

In February 2002, ECO:LOGIC proposed a revised scope of work that addressed the need to develop a long-term water management strategy for the valley. The revised scope of work included an evaluation of the build-out demands on the aquifer associated with currently approved land uses, and development of recommendations for a long-term sustainable resource management plan for the Spanish Springs hydrographic basin. Specific tasks include the following:

- Evaluate the effect of the loss of Orr Ditch recharge due to development and the loss of secondary recharge due to the proposed septic tank conversion project
- Work with County Staff to incorporate build-out demands from municipal and domestic wells into the County's Spanish Springs groundwater model
- Develop recharge scenarios for modeling by County staff
- Coordinate limited field investigations of proposed recharge / infiltration sites to be undertaken by County personnel
- Develop planning level cost estimates of scenarios for comparison purposes
- Provide a ranking of scenarios and associated costs to arrive at a recommended project or phased projects for implementation

The revised scope of work was approved and ECO:LOGIC initiated Phase 1 of the work in January 2003 after the update of the groundwater model of Spanish Springs Valley was completed by the Washoe County Department of Water Resources.

Phase 2 includes detailed site / project specific investigations and development of a management and phased implementation plan. This phase is optional at the pleasure of the RWPC once Phase 1 is completed.

LOCATION AND GENERAL FEATURES

The following description of the project location and the general physical features of Spanish Springs Valley are excerpted from *Hydrogeology and simulated effects of urban development on water resources of Spanish Springs Valley, Washoe County, west-central Nevada* (Berger *et al.*, 1997).

Spanish Springs Valley is located approximately five miles northeast of Reno. It is situated within the Spanish Springs hydrographic basin which covers approximately 80 square miles. The valley floor is three to four miles wide and approximately 11 miles long. The elevation of the valley floor ranges from 4,400 feet above sea level in the south to 4,600 feet in the north. It is bounded on the east by the Pah Rah Range which rises to its highest elevation of approximately 7,400 feet at Spanish Springs Peak. To the west it is bounded by Hungry Ridge and its extensions with elevations of approximately 6,000 feet.

Spanish Springs Valley is tributary to the Truckee River except for a small area in the north known as Boneyard Flat that is internally drained. Surface water enters the valley from the south via the Orr Ditch and exits to the south via the North Truckee Drain. Other than the North Truckee Drain there are no perennial streams within the valley.

Figure 2: Central Spanish Springs Valley

RELATED INVESTIGATIONS AND REPORTS

Hydrogeology

A reconnaissance-level water budget for Spanish Springs Valley was developed in 1967 (Rush and Glancy, 1967) as part of an investigation of the water resources available to Warm Springs and Palomino Valleys. The water resources of the basin-fill deposits were appraised in more detail through the development of a two-dimensional groundwater flow model in 1988 (Hadiarias, 1988). The first truly comprehensive study of the hydrogeology of Spanish Springs Valley is *Hydrogeology and simulated effects of urban development on water resources of Spanish Springs Valley, Washoe County, west-central Nevada* which was undertaken by the United States Geological Survey (Berger *et al.*, 1997). For this study, the USGS formulated a three-dimensional groundwater flow model of the basin, which incorporated detailed assessments of the major components of recharge to and discharge from the recognized aquifer. All of these investigations had one point in common; they all provided relatively consistent estimates of groundwater recharge from precipitation.

The groundwater model utilized in the USGS study was updated in 2003 by the Washoe County Department of Water Resources (Ross, unpublished, 2003). The current model incorporated data that have become available and changes in the valley that have occurred since the U.S.G.S study was completed. This updated model will be employed in this study to evaluate the effects of possible build-out water-balance scenarios.

Water and Wastewater Resources and Infrastructure

The *Spanish Springs Water Facility Plan* identifies the water resources and infrastructure required to support the build-out of approved land uses in the unincorporated area of the valley, as well as estimating the number of domestic wells that existed at the time of the report (Washoe County Department of Water Resources, draft, July 2003).

The *Spanish Springs Valley Nitrate Occurrence Facility Plan* developed alternatives for the management of groundwater quality in areas that are impacted by nitrate contamination of the aquifer. The facility plan, accepted by NDEP, recommends a phased conversion of up to 2,000 septic tanks over a multiple year period as long as 75% federal matching funds are available (Washoe County Department of Water Resources, 2002).

The Washoe County Department of Water Resources has commenced an investigation into the feasibility of constructing a new water reclamation facility in the northern part of the Spanish Springs Valley to serve approximately 8,000 residential units in the unincorporated area (Stantec, Kennedy/Jenks, ongoing).

METHODOLOGY

The investigation of groundwater resources in Spanish Springs Valley by the USGS (Berger, *et al.*, 1997) concluded that changes in land use and increased pumping of groundwater in Spanish Springs Valley may result in water-level declines in the aquifer of 20 to 60 feet by the year 2015. These declines, predicted by a numerical groundwater model, are a consequence of pumping more groundwater than is recharged to the valley's aquifer on an average annual basis.

This current study revisits the potential changes in that aquifer using up-to-date estimates of the water demand at build-out of the approved land uses, decreases in secondary recharge from the Orr Ditch, and reductions in secondary recharge from septic tanks as these are phased out in the future. To evaluate probable changes in the aquifer, estimates of the components of the basin water budget affected by changes in land use were prepared and incorporated in the County's recently updated groundwater model (Ross, work in progress). The region of Spanish Springs Valley incorporated into the model is shown in Figure 3.

Figure 3: Spanish Springs Valley Model Domain

A detailed discussion of the model is beyond the scope of this report.

Basin Water Budget

A water budget is a compilation of the components of recharge to and discharge from the groundwater system. For Spanish Springs Valley, the principal components of the basin water budget at present are:

Recharge

Precipitation which falls on the highlands surrounding the basin
Infiltration of imported surface water (Orr Ditch)
Secondary recharge from irrigation
Secondary recharge from septic systems

Discharge

Evapotranspiration
Subsurface outflow
Groundwater withdrawals from wells
Surface water outflow (North Truckee Drain)

Of the components of the water budget listed above, ECO:LOGIC addressed the following:

- Future anticipated changes in the amount of water imported to the valley via the Orr Ditch. From these data, changes in the amount of water seeping from the ditch and changes in secondary recharge due to irrigation were estimated.
- Changes in secondary recharge from septic systems
- Changes in groundwater withdrawals from Washoe County wells based on updated water facility plan
- Potential secondary recharge from a satellite wastewater plant, which is planned to treat effluent formerly disposed via residential septic tanks

Precipitation

The recently completed groundwater model for Spanish Springs Valley yielded an estimate of the long-term average recharge from precipitation of 786 acre-feet per year (AFA) (Ross, personal communication). This component of recharge originates as infiltration of the precipitation which falls on the mountains. Recharge from precipitation which falls on the valley floor is believed to be negligible.

Infiltration of Imported Surface Water and Secondary Recharge from Irrigation

Surface water from the Truckee River is imported to Spanish Springs Valley via the Orr Ditch. The annual flow in the ditch is variable. The average inflow to the valley via the Orr Ditch averaged approximately 9,220 AFA from 1985 through 1994 (Berger, *et al.*, 1997). The flow for the last three years ranged between 9,306 and 8,760 AFA.

Table 1: Recent Deliveries of Surface Water to Spanish Springs Valley via the Orr Ditch
(source: Records of the Federal Water Master)

YEAR	ANNUAL TOTAL (ACRE-FT/YEAR)
2000	9,306
2001	9,116
2002	8,760

As the remaining agricultural land is developed for residential use, the amount of imported surface water is expected to decrease to approximately 685 AFA (Firth, personal communication, 2002). This amounts to reduction in imported water of more than 90%. Because a portion of this water infiltrates into the aquifer either as seepage from the ditch or deep percolation of applied irrigation water, a large decrease in recharge to the aquifer is anticipated. For purposes of this study it is assumed that inflows via the Orr Ditch will be reduced to 685 AFA by the year 2010. Of this 685 AFA, approximately 131 AFA are expected to reach the aquifer as recharge.

Secondary recharge from residential lawn irrigation is believed to be negligible.

Secondary Recharge from Septic Tank Effluent

Residential septic systems contribute an estimated 756 AFA of secondary recharge to the aquifer in Spanish Springs Valley (Ross, personal communication). They also provide a source of nitrate to the aquifer, which is causing the water quality in some municipal wells to approach the maximum contaminant level for nitrate. The septic systems will be phased out as residences are connected to a community sewer system. This conversion will occur in nine phases. For the analysis in this study, it was assumed that each phase would take one year to complete so that the conversion from septic systems to sewer will be finished by 2010. At the end of this period, secondary recharge from septic tanks will be reduced to an estimated 59 AFA.

Groundwater Withdrawals from Wells

Table 2 below, adapted from the draft Spanish Springs Valley Water Facility Plan, compares the existing water demand for the systems operated by Washoe County in 1999 with the future demand that could result from build-out of approved land uses.

Table 2: Projected Changes in Water Demand for Washoe County Systems in Spanish Springs Valley
(source: draft Spanish Springs Valley Water Facility Plan)

Month	1999 Consumption (AF/mo)	Total Build-out Demand (AF/mo)	Build-out Demand met by Imported Water (AF/mo)	Build-out Demand met by Groundwater (AF/mo)
Jan	55	180	180	0
Feb	49	160	160	0
Mar	68	221	221	0
Apr	108	352	352	0
May	206	675	436	239
Jun	261	855	436	419
Jul	338	1,104	550	554
Aug	263	859	550	309
Sep	149	488	296	192
Oct	108	355	254	101
Nov	59	193	193	0
Dec	52	171	171	0
Total (AFA)	1,716	5,612	3,798	1,814

Table 2 shows that the total water demand for Washoe County water-users will increase more than three-fold from 1,716 AFA in 1999 to 5,612 AFA at build-out of the approved land uses. The vast majority of this increase will be supplied by water imported to the valley ~~under a wholesale contract with the Truckee Meadows Water Authority.~~ By comparison, the annual withdrawals from the County wells are expected to increase by approximately six (6) percent. However, the County's withdrawals are significant and will amount to approximately 50 percent of the total groundwater extractions within the valley.

In addition to the wells operated by Washoe County, groundwater is pumped for residential use through individual domestic wells, quasi-municipal wells operated by the Sky Ranch Water Company (Utilities, Inc.), irrigation purposes by the Red Hawk Golf Course, and several gravel or borrow pit operations. For the model simulation, these other groundwater extractions were assumed to remain the same through the year 2020.

The groundwater model computes the other components of outflow from the aquifer; evapotranspiration, subsurface outflow, and groundwater that is discharged at the land surface and exits the basin via the North Truckee Drain.

The initial model run represents a baseline condition that was used as the basis of an evaluation of different strategies to balance the groundwater budget for the basin. Table 3 shows the estimated groundwater discharges for the baseline case 2002 and 2020 for all categories of use in the Spanish Springs Valley. From the table it is obvious that Washoe County will pump the majority of groundwater from the basin.

Table 3: Summary of Estimated Groundwater Recharge and Withdrawals

	2001	2001 % of Total	2020	2020 % of Total
Estimated Groundwater Recharge				
Orr Ditch Transmission Losses	1,168	26%	93	8%
Recharge from Irrigation	1,809	40%	188	17%
Recharge from Septic Systems	756	17%	59	5%
Recharge from Precipitation	786	17%	786	70%
Total	**4,519**	**100%**	**1,126**	**100%**
Estimated Groundwater Discharge				
Domestic Wells	240	4%	240	6%
Sky Ranch Water Company	621	11%	621	16%
ShaNeva Quarry	95	2%	95	2%
Donovan Quarry	120	2%	120	3%
Kiley (Granite Construction) Quarry	100	2%	100	3%
Red Hawk Golf Course	611	11%	611	16%
Washoe County Wells	1,718	30%	1,802	47%
North Truckee Drain outflow	65	1%	0	0%
Evapotranspiration	1,933	34%	94	2%
Sub-surface outflow	252	4%	170	4%
Total	**5,755**	**100%**	**3,853**	**100%**
Estimated Deficit without Mitigation	**-1,236**		**-2,727**	

The model input and output enabled the preparation of water budgets for each year of the simulation period 2001 through 2020. These are summarized in Table 4. From Table 4 and the following figures, it is apparent that groundwater pumping in the basin will result in the capture of most of the evapotranspiration. In addition, groundwater development results in the capture of groundwater formerly discharged to the North Truckee Drain and a small proportion of groundwater underflow to adjacent basins to the north and south. A series of graphs in subsequent sections further illustrates the anticipated changes in the basin water budget over time.

Table 4: Model Inflows and Outflows (Acre-feet per Year)

MODEL INFLOWS AND OUTFLOWS (ACRE-FEET PER YEAR)

	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
RECHARGE																				
Orr Ditch transmission loss	1168	1048	929	809	690	570	451	332	212	93	93	93	93	93	93	93	93	93	93	93
Recharge from irrigation	1809	1738	1628	1504	1351	1172	963	727	464	188	188	188	188	188	188	188	188	188	188	188
Recharge from septic systems	756	756	756	678	550	436	378	295	240	161	128	59	59	59	59	59	59	59	59	59
Recharge from Precipitation	786	786	786	786	786	786	786	786	786	786	786	786	786	786	786	786	786	786	786	786
TOTAL RECHARGE	**4519**	**4328**	**4099**	**3777**	**3377**	**2964**	**2578**	**2140**	**1702**	**1228**	**1195**	**1126**	**1126**	**1126**	**1126**	**1126**	**1126**	**1126**	**1126**	**1126**
DISCHARGE																				
Domestic well discharge	240	240	240	240	240	240	240	240	240	240	240	240	240	240	240	240	240	240	240	240
Sky Ranch discharge	621	621	621	621	621	621	621	621	621	621	621	621	621	621	621	621	621	621	621	621
Sha Neva gravel discharge	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95	95
Donovan discharge	120	120	120	120	120	120	120	120	120	120	120	120	120	120	120	120	120	120	120	120
Kiley (Granite Construction) discharge	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100
Red Hawk discharge	611	611	611	611	611	611	611	611	611	611	611	611	611	611	611	611	611	611	611	611
Non-County well sub-total	*1787*	*1787*	*1787*	*1787*	*1787*	*1787*	*1787*	*1787*	*1787*	*1787*	*1787*	*1787*	*1787*	*1787*	*1787*	*1787*	*1787*	*1787*	*1787*	*1787*
Washoe County Wells	1713	1718	1722	1727	1732	1736	1741	1746	1750	1755	1760	1764	1769	1774	1778	1783	1788	1792	1797	1802
Drain	65	60	54	47	40	32	24	15	8	3	0	0	0	0	0	0	0	0	0	0
Evapotranspiration	1933	1749	1568	1387	1210	1014	813	629	473	340	269	219	189	169	152	138	126	115	104	94
Groundwater outflow	252	250	248	244	241	236	231	225	219	212	205	199	194	189	185	182	179	176	173	170
TOTAL DISCHARGE	**5750**	**5564**	**5379**	**5192**	**5010**	**4805**	**4596**	**4402**	**4237**	**4097**	**4021**	**3969**	**3939**	**3919**	**3902**	**3890**	**3880**	**3870**	**3861**	**3853**
Deficit	-1231	-1236	-1281	-1415	-1633	-1841	-2018	-2262	-2535	-2869	-2826	-2844	-2813	-2793	-2777	-2764	-2754	-2745	-2735	-2727

Figure 4 illustrates the anticipated change in inflows (recharge) to the basin through the year 2020. It graphically shows an anticipated decline in recharge of approximately 75%.

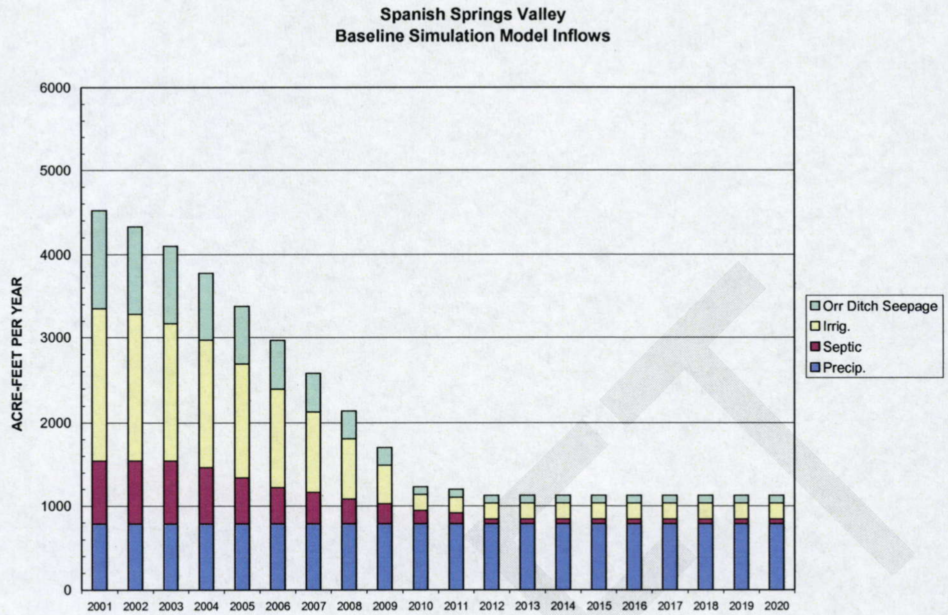

Figure 4: Model Recharge (Baseline Scenario A)

Figure 5 illustrates outflows (discharge) from the basin through the year 2020. The graph shows decrease in discharge, due mostly to capture of evapotranspiration, discharge to North Truckee Drain.

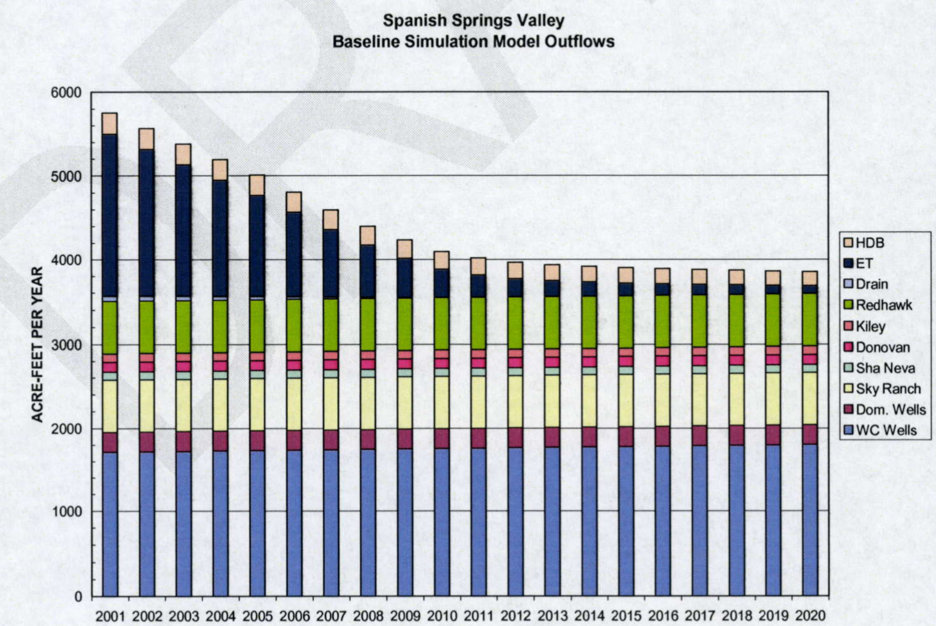

Figure 5: Model Discharge (Baseline Scenario A)

Figure 6 provides a comparison of the total model recharge to total model discharge. By approximately 2010 and continuing through the end of the simulation (2020), approximately 2,700 to 2,800 acre-feet more water will be pumped from the basin each year than that which recharges the basin. In essence, the short-term water supply from the basin will be derived from what is called the transitional storage reserve for the aquifer.

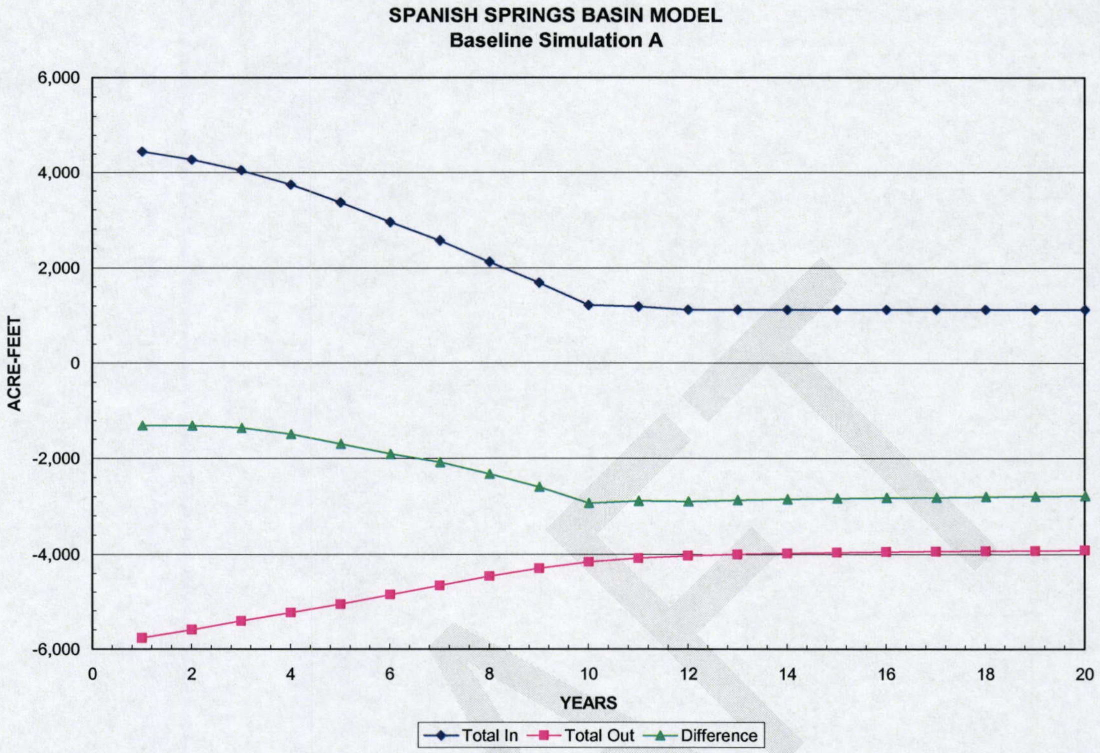

Figure 6: Total Recharge, Discharge and Groundwater Deficit (Baseline Scenario A)

From the foregoing information, it is apparent that the basin will experience a groundwater overdraft of approximately 2,700 to 2,800 AFA at build-out of the approved land uses. The consequences of this budget deficit are declines in water levels within the basin.

Figures 7, 8 and 9 illustrate drawdown in the three model layers at the end of the year 2020. From these figures, the largest drawdown, in the range of 70 to 140 feet, will be experienced in the southeastern portion of the basin in the vicinity of Washoe County's Spring Creek Wells 4, 5, 6, and 7.

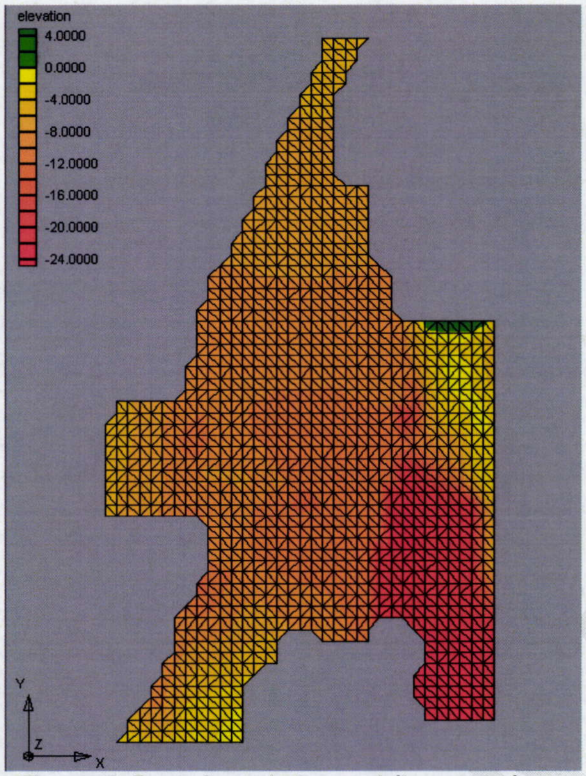

Figure 7: Drawdown in Layer 1 (in meters) (Baseline Scenario A)

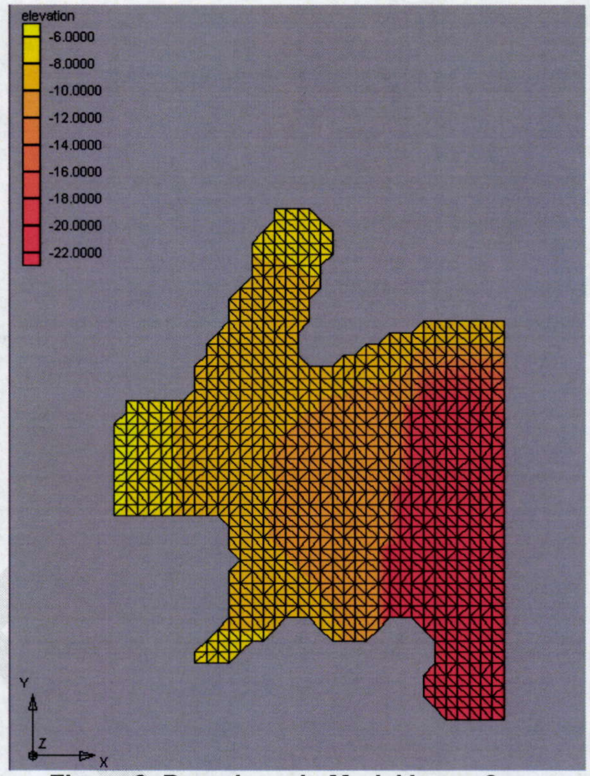

Figure 8: Drawdown in Model Layer 2 (in meters) (Baseline Scenario A)

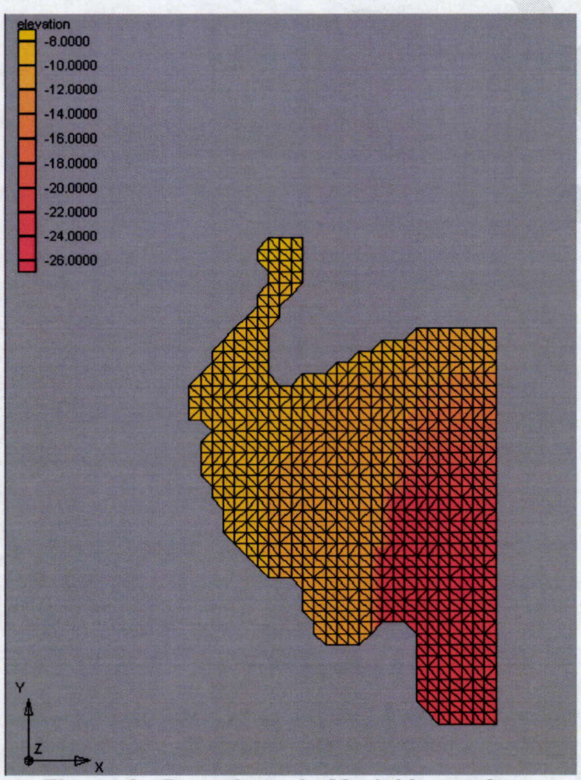

Figure 9: Drawdown in Model Layer 3 (in meters) (Baseline Scenario A)

There are domestic wells in the southeast portion of the model area in the general vicinity of Spring Creek Wells 4, 5, 6, and 7. These all are completed in Layer 1 of the model. Water levels in these wells are expected to decline approximately 35 to 70 feet by the year 2020.

(Figures 7, 8 and 9 provided by Washoe County Department of Water Resources)

Hydrographs of simulated water levels in the municipal wells (Desert Springs and Spring Creek water systems) were reviewed to determine whether these levels should be considered excessive; that is, whether water levels can be expected to decline to a level below the top of the well screens. Modeling indicates that this may occur in Desert Springs Well No. 3. Desert Springs Well No. 1 and Spring Creek Well No. 2 may also be affected. These three wells represent 1,700 gpm of the Washoe County pumping capacity (22% of planned capacity).

Uncertainty with Regard to Baseline Model Predictions

The baseline model analysis (Scenario A) clearly indicates a groundwater deficit in the basin at build-out. The results suggest that the existing resources can meet the demand until the year 2020; so there appears to be sufficient time to plan for and remedy the problem. However, it is important to realize that the fractured rock aquifer beneath southeastern Spanish Springs Valley that will be relied upon to provide a large proportion of the supply via Spring Creek wells 5, 6, & 7 is not very well understood. These three wells have a planned capacity of 4,750 gpm (61% of planned capacity). Boundary effects not recognized during aquifer stress testing conducted to date could affect the accuracy of the predictions. Pumping these wells at relatively high rates for an extended period of time may provide information which changes the current conclusions. New data and information should be incorporated into the model as they become available.

ANALYSIS OF BASIN WATER BUDGET DEFICIT REDUCTION

The model discussed above provided a baseline with which to examine the means to alleviate the anticipated groundwater budget deficit that will result at build-out. A series of simulations were performed to investigate the effectiveness of various recharge scenarios. The baseline model discussed previously is referred to as Scenario A. The remaining scenarios are:

<u>B. Secondary recharge from the proposed satellite wastewater treatment plant.</u>

Scenario B entails a series of model runs that incorporate 2 MGD (2,200 AFA) of recharge to the aquifer from the proposed satellite WWTP using rapid infiltration basins (RIBs). The secondary recharge from the wastewater treatment facility includes the effluent formerly discharged from residential septic tanks that are phased out during the simulation period. The simulation period is 2001 through 2020, consistent with the Baseline Scenario A. The recharge from the RIBs results in a significant decrease in the amount of water needed to balance the basin water budget at build-out.

Potential sites for the RIBs were identified from the investigation report by Kennedy-Jenks [2001], which evaluated potential recharge sites throughout Washoe County. In addition, measurements of field hydraulic conductivity were obtained by Washoe County Department of Water Resources staff from three different sites. These were located:

- North of La Posada and west of State Route 445
- The Donovan Pit
- South of La Posada and east of State Route 445

Table 5: Field Hydraulic Conductivity Measurements Measured by WCDWR using a Guelph Permeameter					
APN 08916053 North of La Posada & west of S.R. 445		Donovan Pit		APN 5280208 South of La Posada & east of S.R. 445	
Field Hydraulic Conductivity		Field Hydraulic Conductivity		Field Hydraulic Conductivity	
FT/DAY		FT/DAY		FT/DAY	
0.6		11.4		0.85	
0.4		8.5		0.23	
3.6		8.2		1.7	
2.6					
0.28					
8.5					
Max	8.5	Max	11.4	Max	1.7
Min	0.28	Min	8.2	Min	0.23
Avg	2.7	Avg	9.4	Avg	0.9

The field measurements show considerable variability in the hydraulic conductivity of the soils. Overall, the least permeable soils were indicated south of La Posada. The most permeable soils were indicated in the Donovan Pit area. Intermediate values for permeability were indicated in the area west of the Pyramid Highway and north of La Posada. The effectiveness of rapid infiltration basins will require detailed field investigations to design these facilities.

<u>C. Secondary Recharge from the Satellite WWTP, plus Injection of 800 AFA via Spring Creek Wells</u>

Scenario C entailed modifying Scenario B to include injecting approximately 800 AFA of imported potable water into Spring Creek wells 5, 6, & 7 for the period 2000 through 2020 for a first approximation of the potential for an aquifer storage and recovery program to alleviate the water budget deficit. This injection (recharge) quantity was divided evenly between the 3 wells without regard to their respective production capacity. This scenario constituted an intermediate step in the quest to arrive at recharge or injection rates needed to balance the budget. It, too, entailed five variations addressing the different locations of the RIBs. The results illustrated a potential to balance the water budget through aquifer storage and recovery. The results also indicated that excess water injected into the aquifer may be lost to evapotranspiration.

<u>D. Secondary Recharge from the Satellite WWTP, plus Injection of 605 AFA via Spring Creek Wells to Balance the Water Budget</u>

The model Scenario C was modified by extending the simulation period from 20 to 100 years and apportioning the injection rates at Spring Creek 5, 6, & 7 according to their pumping capacity. The increase in the simulation period from 20 to 100 years was necessary because a new steady-state condition in the aquifer was not achieved within the original 20-year simulation period of Scenario C. The injection rate for Scenario D was varied iteratively until a steady-state condition was reached. That is, water level declines were reversed and the basin water budget was effectively balanced. A total of 605 AFA of water injected into the model via the Spring Creek Wells was found to reverse, and then stabilize water levels in the basin.

E. No Secondary Recharge from the Satellite WWTP and Balancing the Water Budget Solely via an ASR Program involving Injection Wells

There is no guarantee that the satellite WWTP will dispose of effluent via infiltration within the basin. Consequently, a scenario was developed where no recharge from the facility was incorporated into the model. Under this scenario, the water budget was balanced solely by injection of imported water. This scenario was designed to be flexible in the event it was impractical to alleviate the deficit via an ASR project using injection solely via Spring Creek Wells 5, 6, and 7. The simulation allowed for the use of additional wells beginning with the Red Hawk wells if insufficient recharge capacity was indicated. It also allowed for simulation of recharge due to infiltration of raw water, if necessary.

There are many more scenarios that can be addressed regarding the water supply options for the basin. These include the effects of importing potable water from Warm Springs Valley. However, these are outside of the scope of the present investigation.

Model Results

In all, 17 variations of the groundwater models were investigated. Of these, four representative simulations are discussed in detail. These include the Baseline Scenario, and one variant of Scenarios B, D, and E. Scenario C is not discussed in the same detail because it represents an intermediate stage of the analysis that guided the development of Scenarios D and E. The other simulations represent variations that only minimally affect changes in model output.

The results of the baseline model (Scenario A) were discussed previously. The ensuing discussion comprises a comparison of the subsequent model runs with the baseline model.

Scenario B. Secondary Recharge from the Proposed Satellite Wastewater Treatment Plant

Table 6 illustrates that the addition of 2 MGD (approximately 2,200 acre-feet per year) of secondary recharge from the RIBs is expected to reduce the basin water budget deficit by approximately 80%.

Table 6: Budget Summary for Scenario B

	Baseline 2020 AFA	Scenario B 2020 AFA
Groundwater Recharge		
Orr Ditch Transmission Losses	93	93
Secondary Recharge from Irrigation	188	188
Recharge from Septic Systems	59	59
Recharge from Precipitation	786	786
Recharge from Satellite WWTP	Not Applicable	2,242
Recharge via Injection	Not Applicable	Not Applicable
Total	1,126	3,367
Groundwater Discharge		
Domestic Wells	240	240
Sky Ranch Water Company	621	621
Sha Neva Quarry	95	95
Donovan Quarry	120	120
Kiley (Granite Construction)	100	100
Red Hawk Golf Course	611	611
Washoe County Wells	1,802	1,802
North Truckee Drain outflow	0	0
Evapotranspiration	94	117
Sub-surface outflow	173	198
Total	3,853	3,904
Deficit	2,727	537

Figure 10 illustrates the anticipated change in inflows (recharge) to the basin through the year 2020. Comparison with Figure 4 highlights the increased recharge from the RIBs at the satellite WWTP.

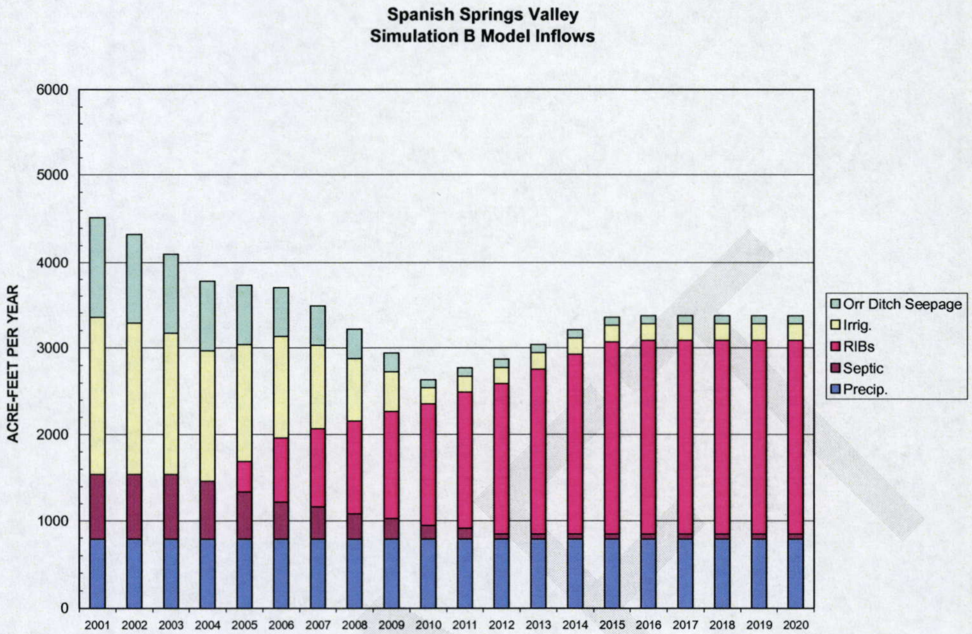

Figure 10: Model Recharge (Scenario B)

Figure 11 illustrates outflows (discharge) from the basin through the year 2020. Comparison with Figure 5 shows a small change in outflow from the baseline simulation.

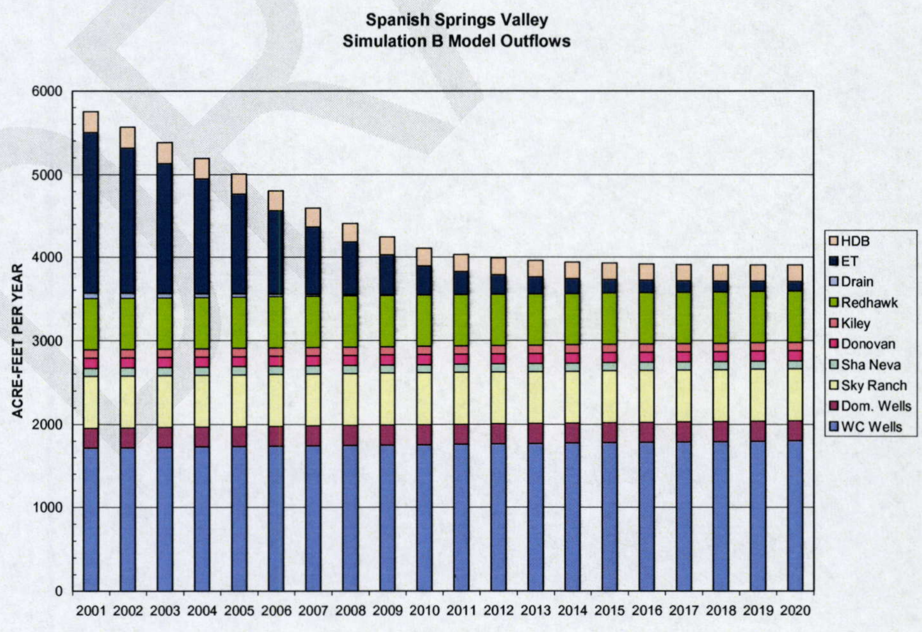

Figure 11: Model Discharge (Scenario B)

Figure 12 provides a graphical comparison of the total recharge to and the discharge from the model Scenario B. The graph illustrates an approximately 80% reduction in the year 2020 basin budget deficit from 2,727 AFA to 537 AFA.

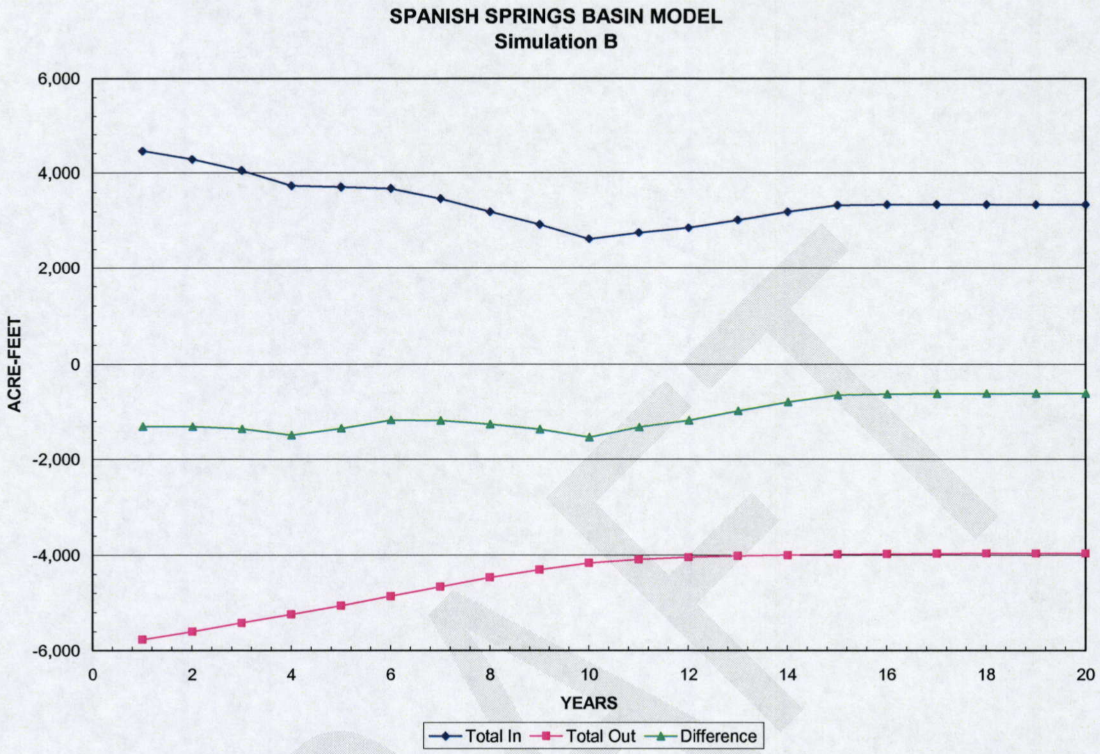

Figure 12: Total Recharge, Discharge and Groundwater Deficit (Scenario B)

Figures 13, 14 and 15 illustrate drawdowns in the three model layers at the end of the year 2020. From these figures it is apparent that water drawdown in the Desert Springs and western Spring Creek Wells 2 and 3 are less than for the baseline scenario. However, the drawdown in the eastern wells (Spring Creek 4, 5, 6, and 7) and the Red Hawk well is not significantly reduced by the year 2020.

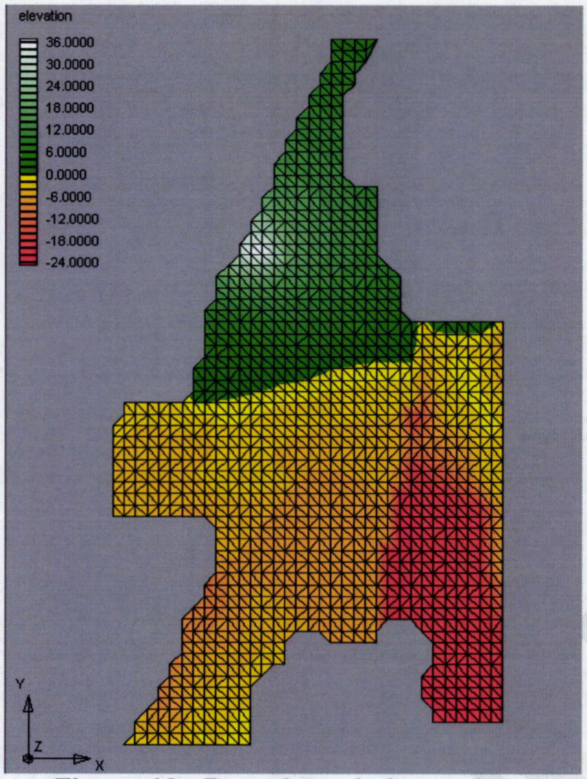

Figure 13: Drawdown in Layer 1 (in meters) (Scenario B)

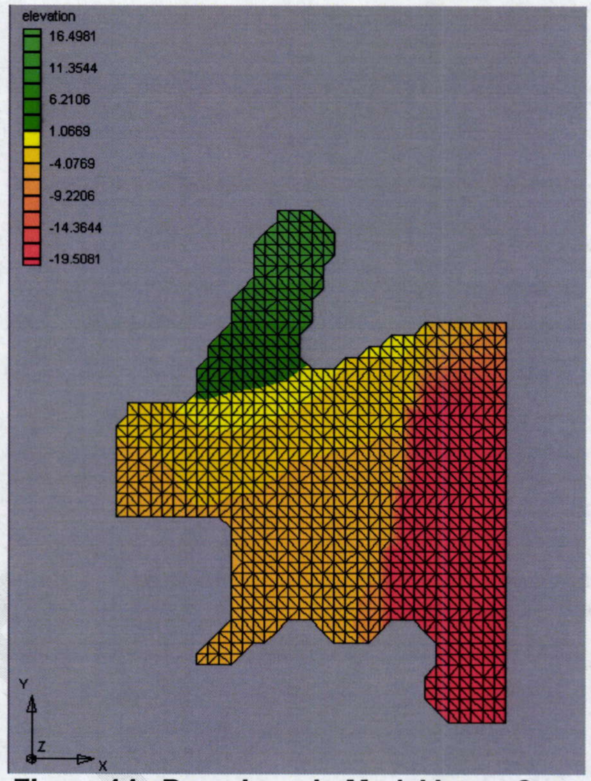

Figure 14: Drawdown in Model Layer 2 (in meters) (Scenario B)

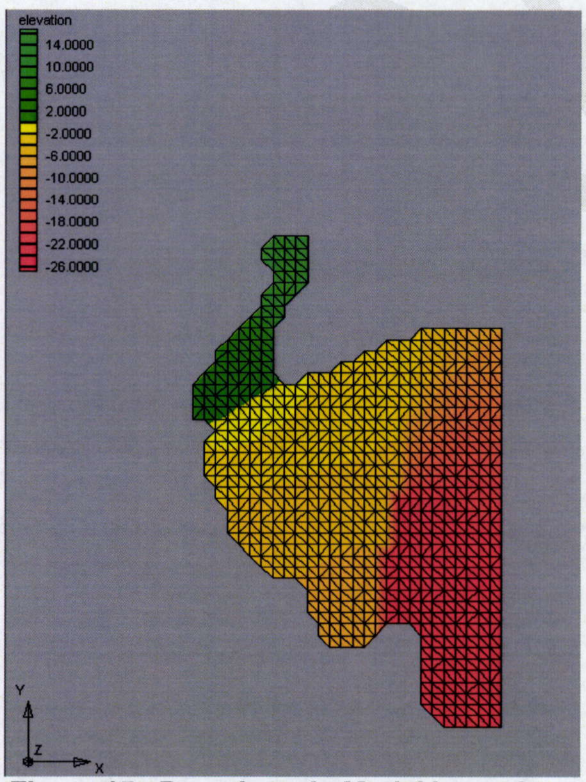

Figure 15: Drawdown in Model Layer 3 (in meters) (Scenario B)

(Figures 13, 14 and 15 provided by Washoe County Department of Water Resources.)

Scenario C. Secondary Recharge from the Satellite WWTP, plus Injection of 800 AFA via Spring Creek Wells

One potential means of alleviating the basin water budget deficit is an aquifer storage and recovery (ASR) program involving importing potable water from outside the basin and injecting it via existing production wells. Spring Creek Wells 5, 6, and 7 were selected for ASR analysis because they will be called upon to meet a large proportion of the County's groundwater demand and are expected to experience large drawdown over time. The aquifer exploited by these wells is highly transmissive. Consequently, it is anticipated that the large volumes of water can be injected into these wells at high rates.

The principal conclusion from Scenario C is that it appears to be technically feasible to alleviate the basin water budget via an ASR program. Scenario C provided a basis for subsequent simulations which were used to hone in on the optimum injection rate for balancing the budget. It also clarified that a 20-year simulation was not adequate to evaluate a new steady-state condition in the aquifer. Consequently, the simulation period was increased to 100 years for subsequent analyses.

Scenario D. Secondary Recharge from the Satellite WWTP, plus Injection of 605 AFA via Spring Creek Wells

An ASR program which entailed injecting potable water into the highly transmissive portion of the aquifer in southeast Spanish Springs Valley was added to Scenario C. The simulation involved Spring Creek Wells 5, 6, and 7. The injection volumes in model Scenario D were varied iteratively until the basin water budget was brought into balance. The results of the final simulation are provided in Table 7.

Table 7: Budget Summary for Scenario D		
	Baseline 2020	Scenario D 2100
	AFA	AFA
Groundwater Recharge		
Orr Ditch Transmission Losses	93	93
Secondary Recharge from Irrigation	188	188
Recharge from Septic Systems	59	59
Recharge from Precipitation	786	786
Recharge from Satellite WWTP	Not Applicable	2,242
Recharge via Injection	Not Applicable	605
Total	1,126	3,972
Groundwater Discharge		
Domestic Wells	240	240
Sky Ranch Water Company	621	621
Sha Neva Quarry	95	95
Donovan Quarry	120	120
Kiley (Granite Construction)	100	100
Red Hawk Golf Course	611	611
Washoe County Wells	1,802	1,802
North Truckee Drain outflow	0	0
Evapotranspiration	94	197
Sub-surface outflow	173	216
Total	3,853	4002
Deficit	2,727	32

Figure 16 illustrates the anticipated change in inflows (recharge) to the basin through the year 2100. It differs from Figure 10 in that it includes recharge via Spring Creek Wells 5, 6, and 7, beginning in 2021.

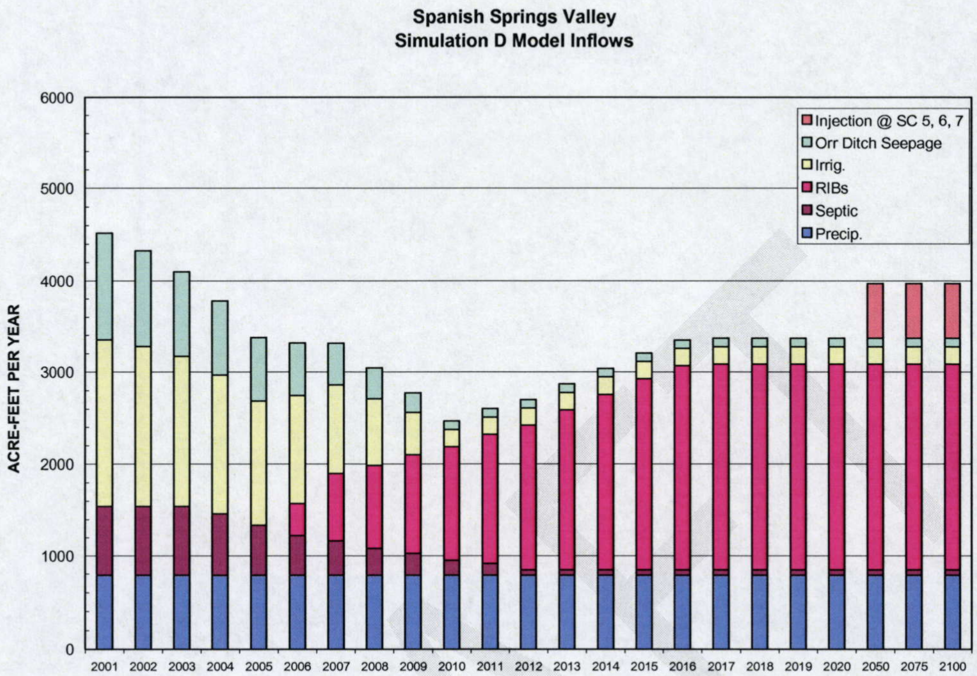

Figure 16: Model Recharge (Scenario D)

Figure 11 illustrates outflows (discharge) from the basin through the year 2100. Comparison with Figure 5 shows a small change in outflow from the Baseline Scenario. Comparison with Figure 11 shows a small increase in discharge, primarily from ET compared to Scenario B evident after the year 2020.

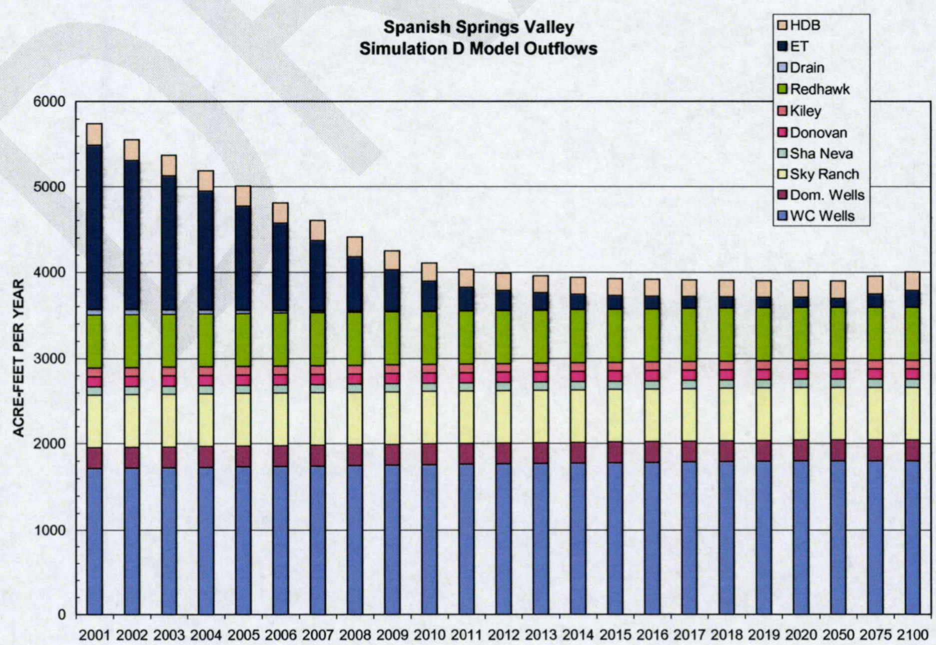

Figure 17: Model Discharge (Scenario D)

Figure 18 provides a graphical comparison of the total recharge and discharge for Scenario D. The plots clearly show the basin budget is in nearly in balance soon after recharge is initiated in Spring Creek Wells 5, 6, and 7 beginning in the year 2021, but almost 70 years are required for the basin to achieve steady state.

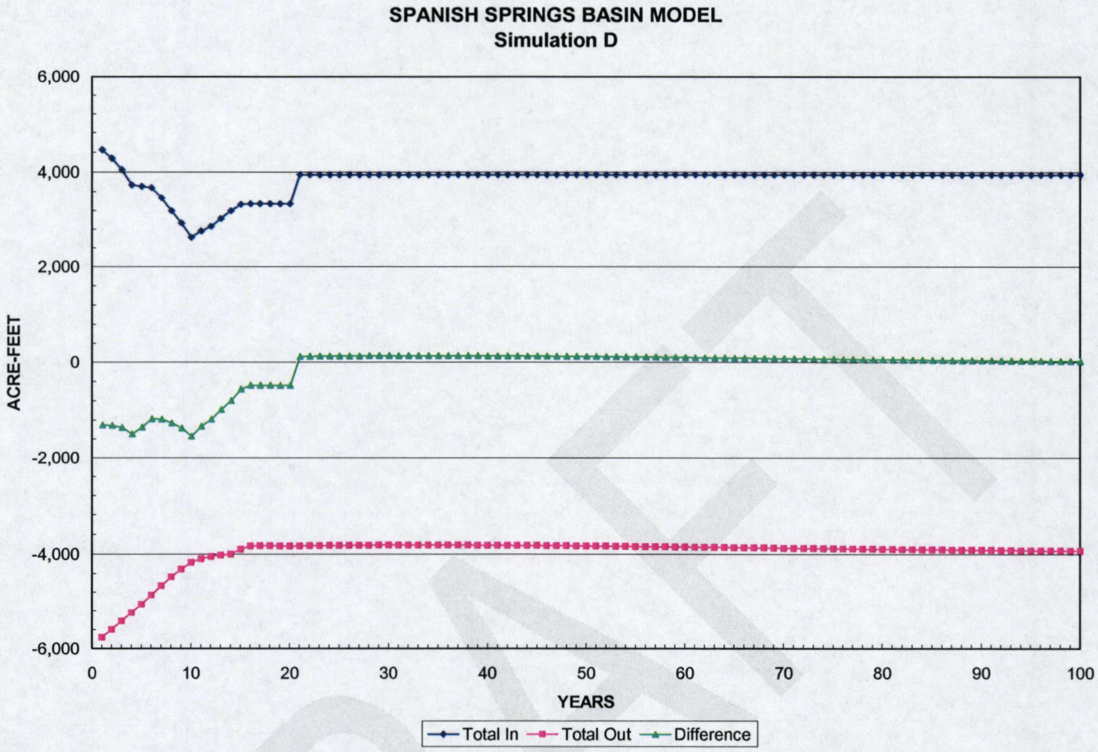

Figure 18: Total Recharge, Discharge and Groundwater Deficit (Scenario D)

Figures 19, 20 and 21 illustrate the maximum drawdowns in the three model layers at the end of the year 2100. From these figures, the largest drawdowns, in the range of 60 to 90 feet, will be experienced in the southeastern portion of the basin in the vicinity of Washoe County's Spring Creek Wells 4, 5, 6, and 7.

Although model Scenario D assumes recharge to the aquifer from infiltration of treated effluent from the proposed satellite wastewater treatment facility, it could also entail infiltration of raw (untreated) water. As the following discussion of Scenario E shows, consideration as to the location of the infiltration facilities is crucial to an efficient recharge program.

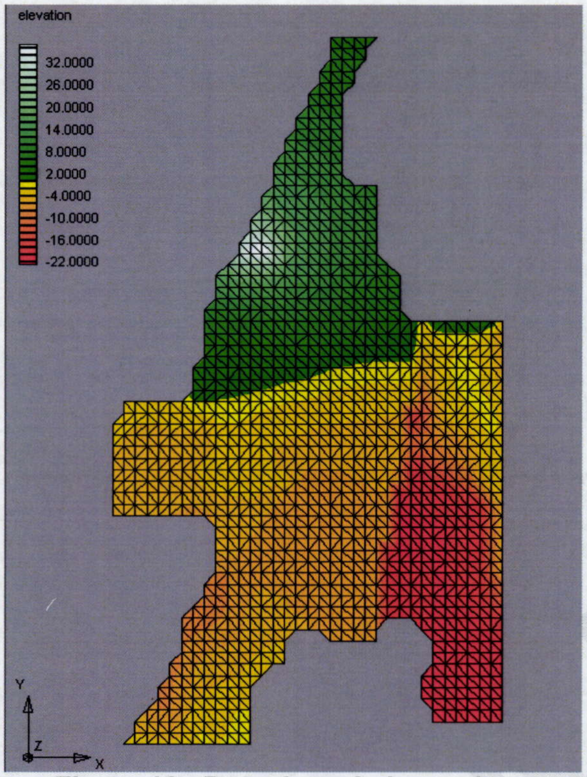

Figure 19: Drawdown in Layer 1 (in meters) (Scenario D)

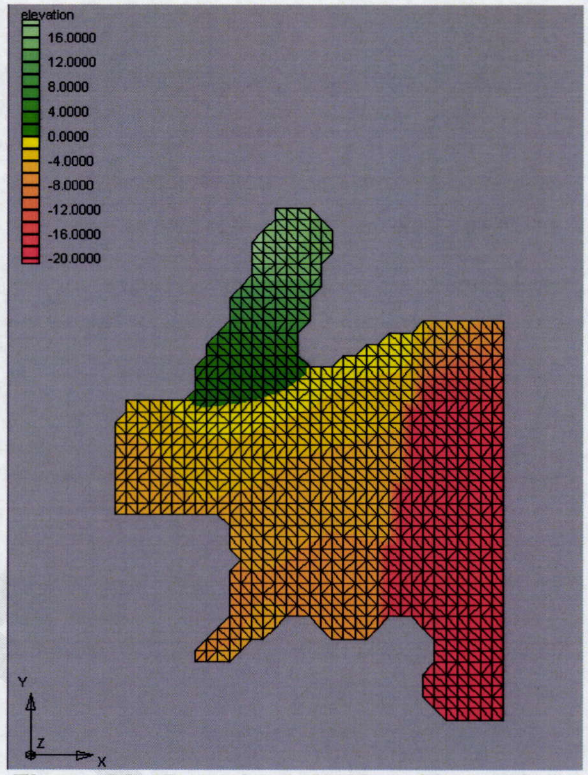

Figure 20: Drawdown in Model Layer 2 (in meters) (Scenario D)

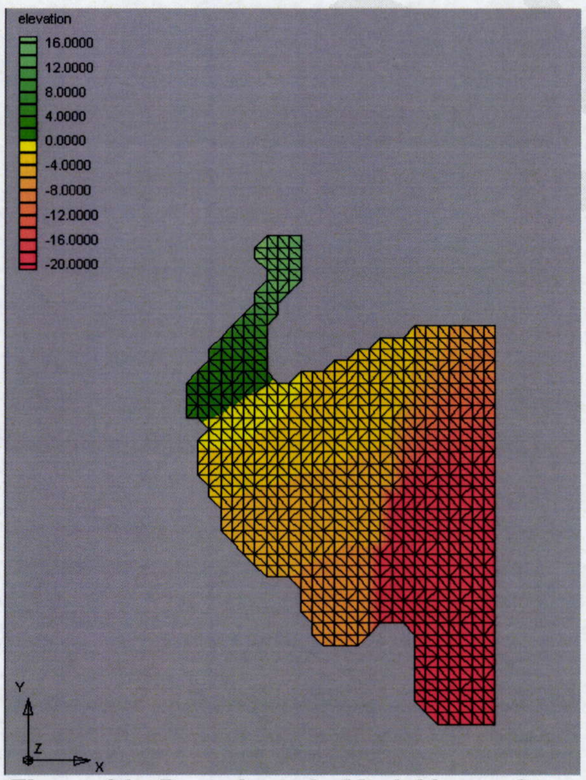

Figure 21: Drawdown in Model Layer 3 (in meters) (Scenario D)

(Figures 19, 20 and 21 provided by Washoe County Department of Water Resources.)

Scenario E. No Secondary Recharge from the Satellite WWTP and Stabilizing Water Levels via an ASR Program involving Injection Wells

Scenario E is an attempt to balance the basin water budget without relying on recharge of the aquifer using the proposed satellite wastewater treatment plant RIBs. The initial result, summarized in Table 8, indicated a more than six-fold increase in the injection rate was needed to balance the budget.

Table 8: Budget Summary for Scenario E

	Baseline 2020	Scenario D 2100	Scenario E 2100
	AFA	AFA	AFA
Groundwater Recharge			
Orr Ditch Transmission Losses	93	93	93
Secondary Recharge from Irrigation	188	188	188
Recharge from Septic Systems	59	59	59
Recharge from Precipitation	786	786	786
Recharge from Satellite WWTP	Not Applicable	2,242	Not Applicable
Recharge via Injection	Not Applicable	605	3,962
Total	1,126	3,972	5,088
Groundwater Discharge			
Domestic Wells	240	240	240
Sky Ranch Water Company	621	621	621
Sha Neva Quarry	95	95	95
Donovan Quarry	120	120	120
Kiley (Granite Construction)	100	100	100
Red Hawk Golf Course	611	611	611
Washoe County Wells	1,802		1,802
North Truckee Drain outflow	0	0	0
Evapotranspiration	94	197	1,629
Sub-surface outflow	173	216	64
Total	3,853	4002	5,282
Deficit	2,727	32	194

Comparison of the results from Scenario E with the results of Scenario D shows that Scenario E is inefficient. That is, balancing the basin water budget solely through injection into wells completed in the highly transmissive fractured-rock aquifer in the southeastern Spanish Springs Valley results in loss of a large proportion of the potable injected water to evapotranspiration.

An unexpected result of Scenario E is a realization that the location of the RIBs is critical to efficient use of the resource. Locating them in the northwestern portion of the basin helps to stabilize water levels while allowing water levels in the southeastern portion of the basin to be drawn down sufficiently to facilitate ASR via wells.

Figure 22 illustrates the model result that groundwater development in Spanish Springs Valley results in the capture of groundwater, which is discharged via evapotranspiration. The reduction in ET also results from a decrease in recharge from the Orr Ditch. Scenario D allows balancing the basin water budget without causing a large increase in ET, while Scenario E results in a dramatic increase in discharge from ET, which is an inefficient use of potable water.

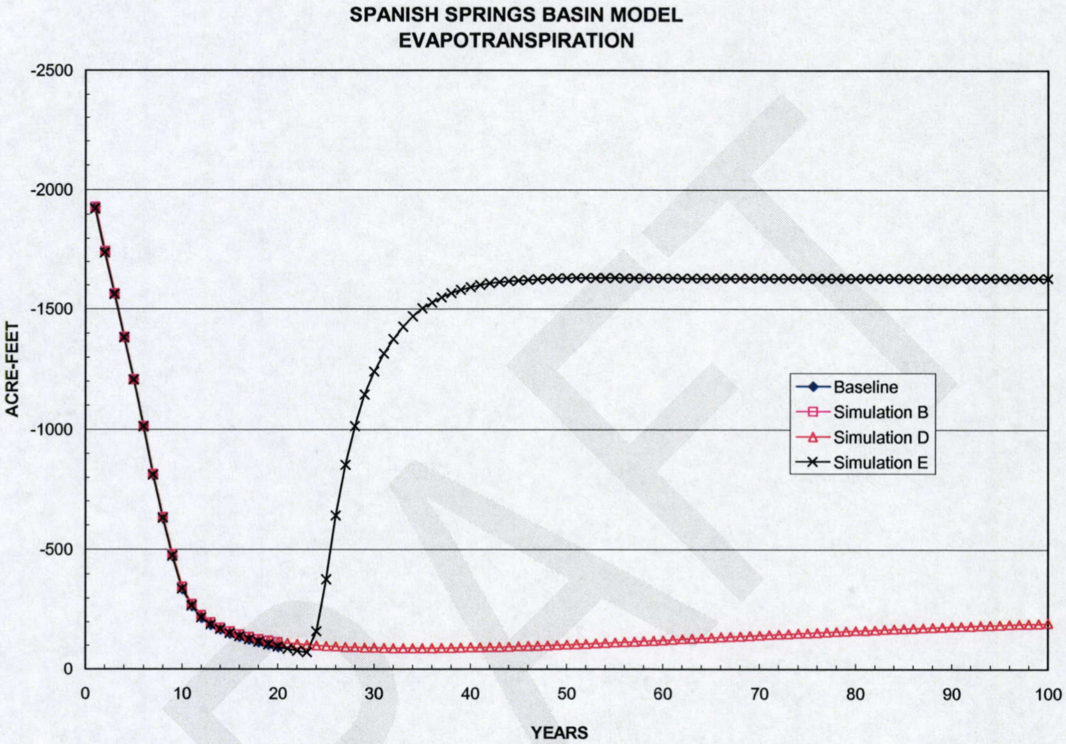

Figure 22: Groundwater Discharge from Evapotranspiration for the Spanish Springs Groundwater Model Scenarios A (Baseline), B, D, and E

COST ESTIMATES

There are a number of basin management elements that could be combined in several long-term strategies to arrive at a sustainable water resource condition in the Spanish Springs Valley. Because a number of these elements are under current investigation, detailed costs are not available. Future work by others will provide more information on the specific projects. The potential management elements are described below.

A. 600 AFA recharge of TMWA wholesale water in Spring Creek Wells 5, 6, and 7:

Well retrofit: $23,000 per well x 3 wells	=>	$ 69,000
Water rights: $3,800 per AF x 600 AF	=>	$2,280,000
Increase in Wholesale Contract to 4,450 gpm	=>	unknown

Note: 4,450 gpm wholesale supply required during shoulder months of the recharge period. Planned 4,200 gpm wholesale delivery capacity is adequate for the remainder of the time. Deliveries: 1,400 gpm at Canoe Hill inter-tie, 2,150 gpm at Campello Drive inter-tie.

No additional improvement required on Washoe County side of system as long as Spring Creek Well No. 7 is constructed such that it has the capability of receiving wholesale water from the Campello Drive inter-tie.

B. 620 AFA reduction in pumping from non-potable users (Red Hawk, Granite quarry, Sha Neva quarry, Donovan quarry). Demands could be satisfied with City of Sparks effluent:

Not estimated for this report. Cost estimates may be available from the City of Sparks.

C. 2,200 AFA recharge via rapid infiltration basins at proposed Spanish Springs satellite wastewater treatment facility:

Costs would be included as part of facility construction. There would also be a water rights requirement for this facility to provide return flow for the non-consumptive use portion of Truckee River water that would no longer be returned to the river.

D. 2,200 AFA recharge of a different water resource:

Not estimated for this report. Washoe County is currently updating the feasibility analysis of developing its water holdings in the Dry Valley / Warm Springs hydrobasins. It has not been determined what such a supply would be used for.

RECOMMENDATIONS

Groundwater modeling of existing and potential build-out conditions indicates that there is not an urgent need to implement a groundwater mitigation program. Rather, a management strategy needs to be developed and implemented over a longer timeframe. This provides the opportunity to continue evaluating and refining the possible management strategies to arrive at a least cost sustainable solution for the long term.

The recommendations contained in this report relate to water quantity. It is recognized that there are issues concerning water quality that enter into a long-term management strategy for the basin.

Numerically, if no action is taken, the basin will be out of balance by 2,800 AFA at the build-out of current approved land uses, assumed to occur by 2020. As noted in the modeling scenarios, water level declines are concentrated in the area of greatest pumping, the southeast portion of the valley, and will result in water level declines ranging from 70 – 140 feet in the vicinity of Spring Creek Wells 4 through 7. The wells that may experience difficulty from water level declines are some of the older wells in the Desert Springs and Spring Creek systems that are not drilled as deep as the newer wells.

Long-term Sustainable Water Balance

The history of water resource development in this basin is such that no single entity outside of the State Engineer has control over the quantity of groundwater pumped. Additionally, state water law entitles entities with water rights to put those rights to use. The available water rights in Spanish Springs far exceeds the perennial yield, even when considering the secondary recharge from septic systems, the Orr Ditch, and agricultural irrigation.

Washoe County has taken several measures to respond to this out of balance condition over the past 20 years. Part of the difficulty in managing the basin has been in the challenges to estimates of perennial yield. Entities and individuals holding groundwater rights wanted to realize the value of those rights by dedicating them for municipal water service. The questions regarding perennial yield and estimates of secondary recharge were finally resolved with the publication of the previously discussed USGS report (Berger, et. al., 1997). This provided Washoe County with the necessary justification to adopt its current water rights dedication policy for new development. The State Engineer regulates other entities such as the Sky Ranch Water Company, Red Hawk Golf Course, and industrial/agricultural users of groundwater. To date, the State Engineer has not elected to limit groundwater pumping in this basin.

In this situation of many entities, comprehensive management of groundwater resources is a shared responsibility. If a comprehensive strategy were developed it would be appropriate for all entities to share in the cost of implementing that strategy, a task that would be complex.

Rather than a single solution, a multi-faceted approach is suggested to manage the various demands on the groundwater resource while providing flexibility to arrive at the optimum configuration of facilities to achieve a sustainable groundwater supply.

Recommendations: Basin Water Level Management

1. Non-potable water demands should be satisfied with effluent to the extent possible. This effluent would likely originate at the Truckee Meadows Water Reclamation Facility. The City of Sparks will shortly complete the extension of effluent transmission facilities to the northern part of the valley. Approximately 620 AFA of non-potable irrigation / industrial demands could be supplied with effluent (50% of Red Hawk demand, Donovan, Granite Construction, and Sha Neva). Each of these entities has investments in groundwater pumping infrastructure that would need to be considered in an overall groundwater pumping reduction program.

2. If the groundwater withdrawal reductions identified in Item No. 1 above cannot be implemented, another strategy would be to recharge as much as 600 AFA in the Washoe County Spring Creek Wells 5,6, and 7. This would provide two benefits, 1) it would assist with the basin water balance and 2) it would help to maintain water levels in the vicinity of the greatest withdrawals.

3. Construction of the proposed satellite wastewater treatment plant with construction of rapid infiltration basins would go a long way towards balancing the basin. The 2,200 AFA from this facility plus 620 AFA identified in No. 1 or 600 AFA identified in No. 2 above would result in a completely balanced basin.

4. If the satellite wastewater treatment plant is not constructed, another source of water will need to be found. This water can either be recharged or used to supply municipal demands and offset groundwater pumping. Potential sources of water include raw or treated water from the Truckee River, imported water from Washoe County's holdings in Dry Valley / Warm Springs, or water from the proposed North Valleys water importation project.

5. It would be prudent for water purveyors to monitor municipal well levels to track the potential for localized groundwater level declines that might affect well output, even with an overall balance of water resources in the basin.

6. Washoe County's policy regarding water rights dedications has already been discussed. Other water purveyors in the basin and non-municipal users should implement similar measures to ensure there is no further development of the groundwater resource without supplying the means to mitigate the additional imbalance.

Domestic Wells

Domestic well levels on the east side of the basin, where municipal pumping will be greatest, may have water level declines of 35 to 70 feet. The impact of this decline on individual domestic wells will vary depending on their unique construction configuration (depth, screened interval, location in the aquifer).

The model scenarios assume that the number of domestic wells remains constant. This is not realistic over the long term. Based on existing approved land use, there could be as many as 693 additional wells. Using the Regional Water Planning Commission's estimate of 1.12 AFA per well, this would amount to an additional groundwater demand of 776 AFA.

The County's water rights dedication policy requires new parcels less than or equal to 40 acres in size that are to be served by a domestic well to dedicate 2.02 AFA of groundwater rights and 1.01 AFA of Orr Ditch surface water rights. While this dedication policy provides a mitigating water resource, there is not a mechanism to fund infrastructure improvements that would be required for recharge or replacement water service if domestic wells begin to interfere with each other in areas where there is not municipal water service available. Many of the domestic well parcels are at elevations above the area served by the municipal water systems.

Additionally, Washoe County is in the process of developing a Community Management Plan that would allow for even smaller parcel sizes than the current General Rural designation that exists on the fringes of the basin, resulting in the potential for an even greater domestic well demand.

Recommendations: Domestic Well Management

1. Continue current support to domestic well owners regarding technical advice and monitoring of domestic well water levels.

2. Carefully consider the sustainability of additional domestic wells when evaluating proposals for new parcel maps, large parcel divisions, and changes in land use that permit further dividing of General Rural parcels for domestic well service.

3. Create a mechanism to notify the developers of new lots with domestic wells of anticipated build-out water levels so this information can be used to enhance the sustainability of future wells at the time of initial construction.

4. Implement the recommendations of the Washoe County Groundwater Task Force that were subsequently adopted by the Board of County Commissioners (*Final Report to the Regional Water Planning Commission by the Groundwater Task Force,* June 20, 2003).

Institutional Issues

The three water purveyors, City of Sparks, Washoe County, domestic well owners, and industrial users, and the State Engineer all have a part to play in the long-term sustainability of water resources in this basin. Coordinated planning and management strategies between these entities could conceivably result in a long-term solution for the basin that is very economical to implement because it makes use of existing infrastructure that is already planned and, in many cases, already constructed.

Recommendations: Institutional Issues

1. A portion of the Spanish Springs hydrobasin has been identified as a Cooperative Planning Area in the 2002 Truckee Meadows Regional Plan. In this context, Spanish Springs is an Area of Interest for the City of Sparks. This requirement for cooperative planning can be seen in a positive light to provide a means to coordinate

the planning of water resource issues. Specific resource issues needing coordination include:

a. Mitigation or prevention of any future groundwater development projects that result in an increase in long-term groundwater withdrawals. Development of new wells for purposes of providing peaking supply is sustainable as long as the cumulative withdrawals from the aquifer are managed.
b. Reduction of non-potable groundwater demands with effluent to the extent practical in both the unincorporated area and within the City of Sparks.

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