Groundwater Quality and Supply in Golden Valley, Washoe County, Nevada

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ABSTRACT

Many rural areas in Washoe County still rely on individual water wells for drinking water and septic tank systems with a leach field for sewage disposal. Ground water can be contaminated by the effluent that is released from septic systems. The presence of nitrates in a water sample can be used as an indicator of waste contamination from septic tanks. Washoe County Department of Water Resources (WCDWR) has conducted a water recharge project for a number of years in an effort to raise groundwater levels. Recharge water meets all state and national drinking water standards. For this project, samples of water were collected from various homes in Golden Valley during the first four months of 2007 and analyzed in a laboratory for nitrates. The results were then compared to previous results from water samples taken in 1993 to determine if any changes had occurred in the quality of the water in regard to nitrates. The results indicate that the wells nearest to the injection wells show an improvement in the level of nitrates from 1993 to 2007.

INTRODUCTION

In the early 1990's, the Washoe County Recharge Demonstration Pilot Study was implemented in cooperation with the U.S. Bureau of Reclamation (BOR) to evaluate artificial ground water recharge techniques (WCDWR, 1996). Permits were granted from Nevada Division of Environmental Protection (NDEP) and Nevada Department of Water Resources (NDWR). Treated drinking water was rerouted from the

Truckee River and injected into the ground through the use of injection wells. Possible benefits of the project were projected to be compensation for over-pumped aquifers causing water level declines, drought storage alternatives, and enhancing the water quality. The need for an artificial recharge system was addressed because property owners were re-drilling and deepening their water wells due to declining water tables. The depletion of the aquifer was also suggested as contributing to the slow sales of houses in the area, as lending institutions were hesitant to provide loans to purchase homes in the area. Installing a municipal water and sewer system was seen as cost prohibitive to the residents of the area. The pilot study ended in early 1996 with reported success (WCDWR, 1994). After evaluation of data collected during the pilot study, artificial recharge was judged to be the most cost effective way to deliver water to the Golden Valley area.

The artificial recharge system was restarted in late 2002 when a new funding source was established. The program continues today and injection in 2006 was approximately 70 acre feet (WCDWR, 2007).

DESCRIPTION OF STUDY AREA

Golden Valley is an unincorporated community located approximately five miles north of the city of Reno, Nevada, and is a rural area with little commercial development (see figures 1 and 2). Most of the houses are situated on one-acre lots and each home has a domestic well to supply water and a septic system for waste. Approximately 25% of the homes have one or more horses on the property, which can contribute to higher water consumption and contamination due to waste products.

Climate

A decline in water levels in Golden Valley is partially due to being located in the rain shadow of the Sierra Nevada and Peavine mountains. Periods of drought are not uncommon in northern Nevada and water levels decline further during the arid summer months when the demand for water is highest (WCDWR, 1996). Average precipitation in the area is estimated at less than 10 inches per year.

Geology

The general geology of the area is fractured granodiorite bedrock capped by thin alluvial layers (WCDWR, 1996). The deepest part of the alluvium is estimated to be less than 200 feet at the east part of the valley with just inches of overlay near the bedrock hills. The valley drains from the east to the west into the adjacent Lemmon Valley.

Fast draining sands in the north central portion of Golden Valley do not allow time for the water to seep slowly into the ground to be filtered (Widmer and McKay, 1994). This can potentially add to the nitrate contamination in the aquifer.

Golden Valley is part of the Basin and Range Province of Nevada and faulting is common in this area. Evidence of this is apparent in some domestic wells drilled in fractured bedrock where water levels are approximately 50 feet below ground while other wells, only 400 feet away, are in solid bedrock with water levels at approximately 130 feet below ground (figure 3).

Hydrogeology

The valley is enclosed by bedrock on three sides: south, east and north. The aquifer does not appear to be confined and there are no apparent barriers to water flow (WCDWR, 1996).

In 1994, natural recharge in Golden Valley was estimated at about 120 acre feet per year with an additional 110 acre feet of septic tank effluent being added to the water aquifer (Widmer and McKay, 1994). Pumping of the aquifer was estimated at 590 acre feet per year with groundwater storage withdrawal estimated at approximately 360 acre feet per year. This causes a depletion in the natural groundwater storage system and possible contamination of the water by the high amount of effluent discharging into the aquifer.

In 2006, 68.72 acre feet were injected into the recharge wells (WCDWR, 2007). If 110 acre feet of septic tank effluent is still being added to the aquifer, then the effluent recharge carries a bigger impact than the water recharge. Artificial recharge rates are limited because of the difficulty of injecting water in fractured bedrock.

Washoe County records show that water levels decline during the spring and summer months when many homeowners water their lawns with well water (figure 3).

DATA COLLECTION

Groundwater samples were collected in 2007 to compare with samples collected in 1993. Water samples were taken from outside water spigots nearest the contributing well, before the water was filtered or stored in a holding tank. The samples were analyzed by a certified laboratory and the results were mailed to WCDWR. Letters were mailed to home owners to ask permission to collect the water samples. Attempts were made to collect at wells that had nitrates data from 1993 so comparisons could be made. This was not always possible as some homeowners did not reply to the permission letters.

Water levels in feet below the top of the well casing were also collected continually in several wells since 1993, on a weekly and quarterly basis. These data are important to monitor on-going fluctuations in groundwater levels.

RESULTS AND DISCUSSION

Golden Valley 1 (GV1) monitoring well is in an aggregate pit on the north-east end of the valley and water is being injected into a nearby injection well approximately 300 feet away. GV1 is not near any domestic wells in the area. Figure 4 shows that the water levels in GV1 over the one-year period of 2006 did not go down appreciably during the year; in fact, the water levels gradually rose from 82.12 feet to 76.64 feet, below ground showing a gain of 5.48 feet. In contrast, Golden Valley 3 (GV3) monitoring well is approximately 2,000 feet from the same injection well site and the water level fluctuated from May to November due to nearby domestic wells pumping out the groundwater, creating water level declines. There was still a rise of 6.88 feet in the overall water level during the year of 2006, between January and December.

Figure 5 is a map comparing the amount of nitrates recorded in 1993 compared to nitrates in 2007. The blue area on the map is where nitrate levels improved in this time period. The red triangles represent the points of water injection.

CONCLUSIONS

The data shows that the nitrate levels from wells nearest the injection wells has declined in the period between 1993 and 2007. The rate of injection is less than the estimated rate of effluent recharge. Adding more injection wells in the valley and raising the amount of water injected could feasibly make a difference in the nitrate levels throughout the valley.

Given the effect of being on the rain shadow side of the Sierra Nevada Mountain range, the rainfall totals for Golden Valley are generally low, about 10 inches per year. Previous studies show that in areas with low rainfall totals, septic system effluent can be a major source of water recharge, thereby raising nitrate levels (Widmer, 1994).

The ability of rocks to drain water below ground can also affect the amount of septic system effluent collecting in certain areas. Fast draining rocks such as fractured granite do not allow water enough time to filter naturally. Slow draining rocks, however, will allow filtering of bacteria but too much effluent can eventually clog the pores of the rock and cause contamination.

Problems with populated areas with septic systems and groundwater wells include limited natural recharge, periods of drought, over pumping of aquifer, bacteria and radioactive contamination and recharge from effluent.

Future progress will include improving water quality, decreasing the water level decline rate and storing water for future drought conditions.

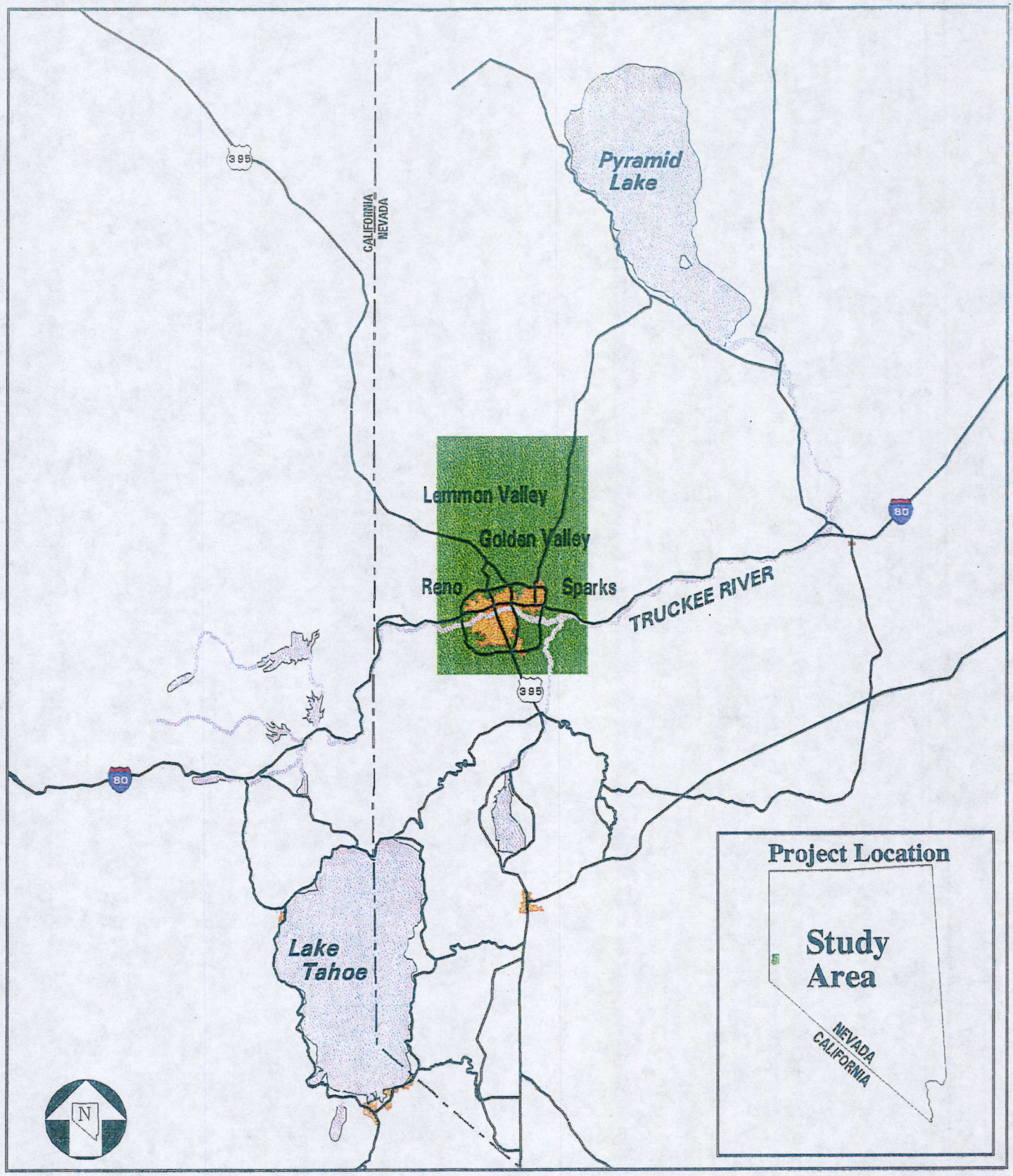
REFERENCES

Washoe County Department of Water Resources (WCDWR), 1996, *High Plains States Groundwater Demonstration Program,* WCDWR, 79 pgs.

Washoe County Department of Water Resources (WCDWR), 2007, *Washoe County Artificial Recharge Project, Golden Valley, Washoe County, Nevada, 2006 Annual Report*, WCDWR, 34 pgs.

Widmer, Michael and McKay, W. Alan, 1994, *Ground Water Contamination from Septic Tank Effluent in a Closed Basin, Washoe County, Nevada,* Washoe County Department of Public Works, 66 pgs.

FIGURE 1.



Project Location

Lakes & Reservoirs

Cities

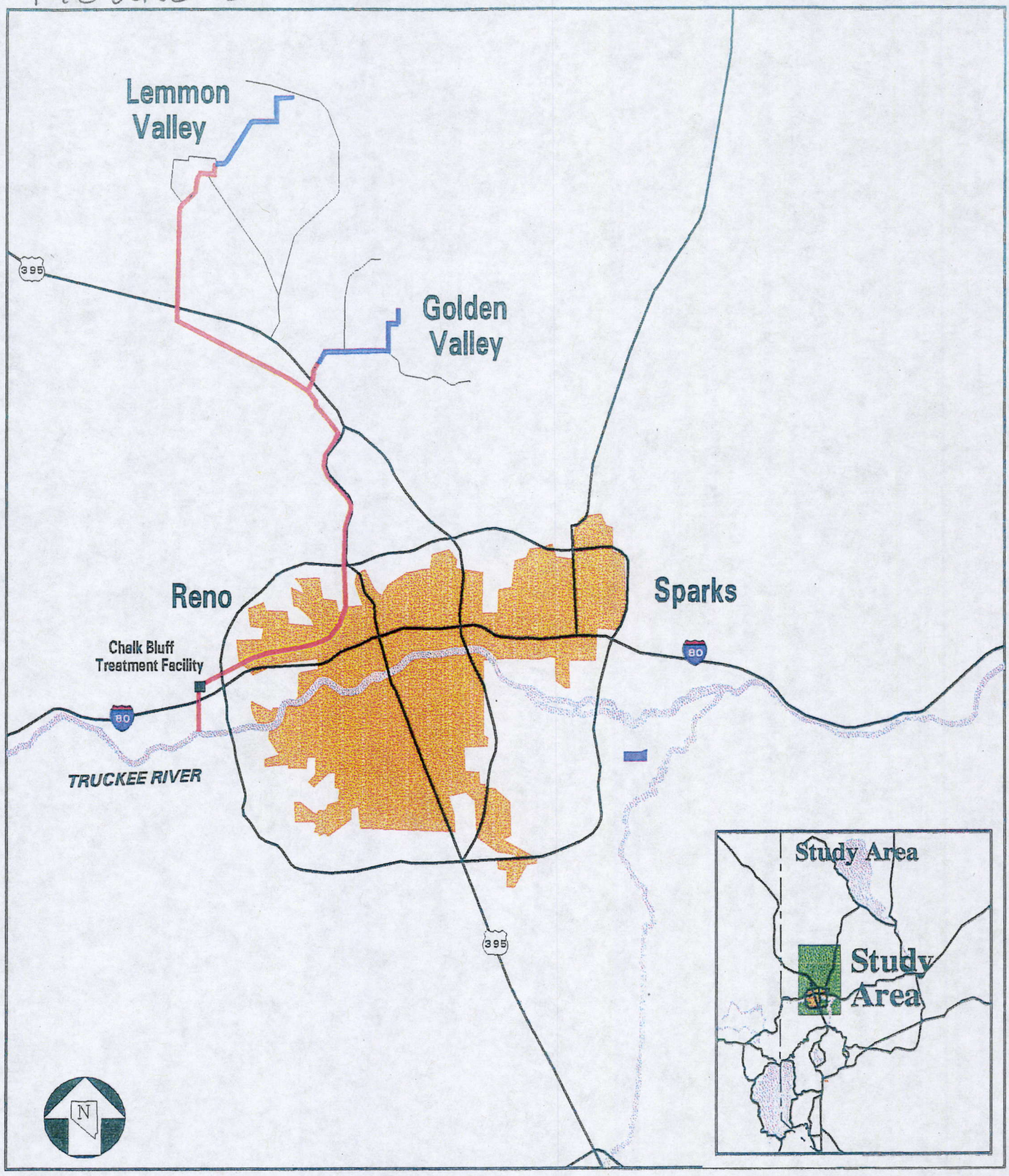
Truckee River & Tributaries

Major Roads

MILES

0 5 10 20

FIGURE 2.



Study Area

Sierra Pacific Water Line

Washoe County Water Line

Minor Roads

Retired Farmland

MILES

0 1 2 5

Figure 3 - Domestic Water Levels 2006

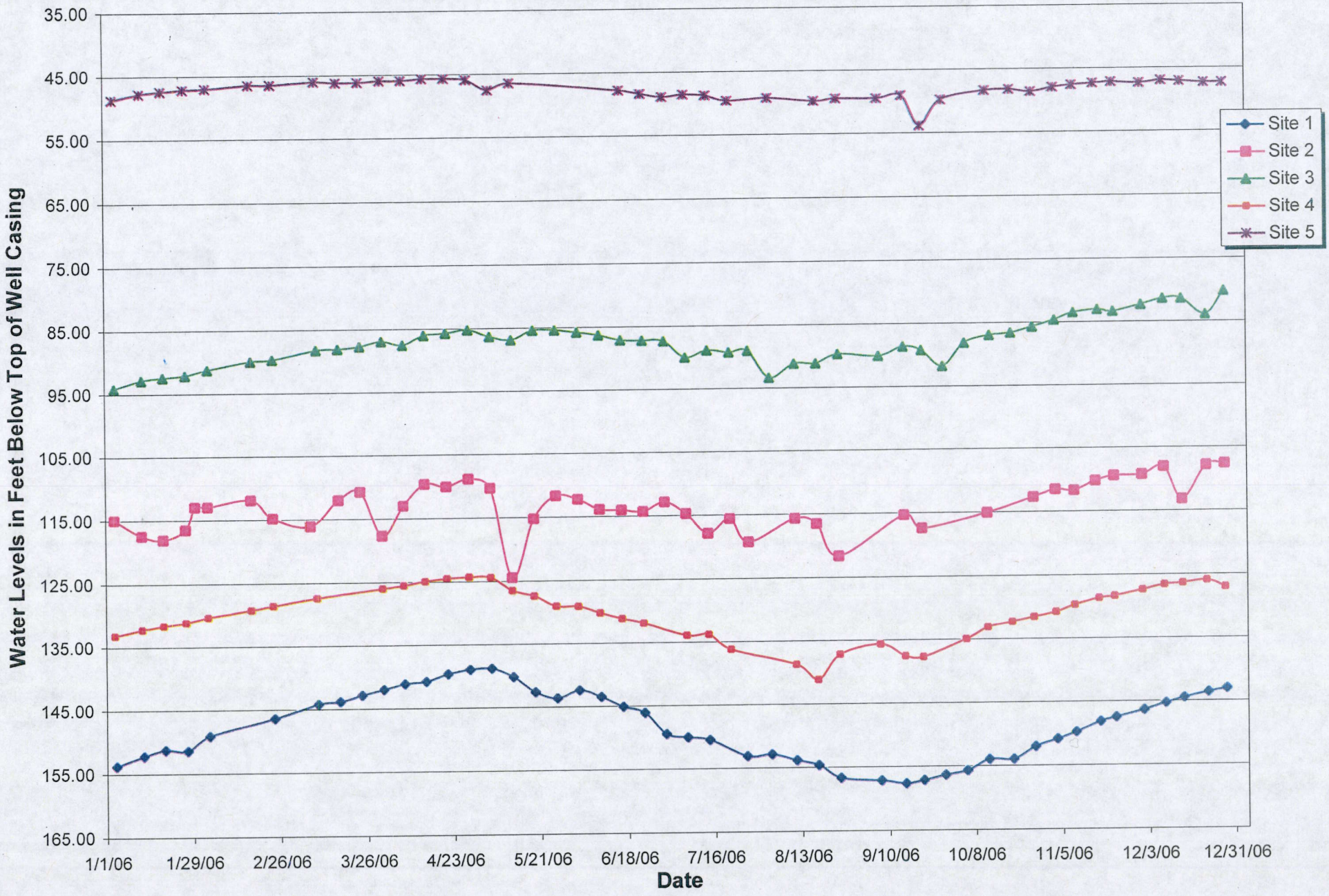


Figure 4 - Monitoring Wells Water Levels 2006

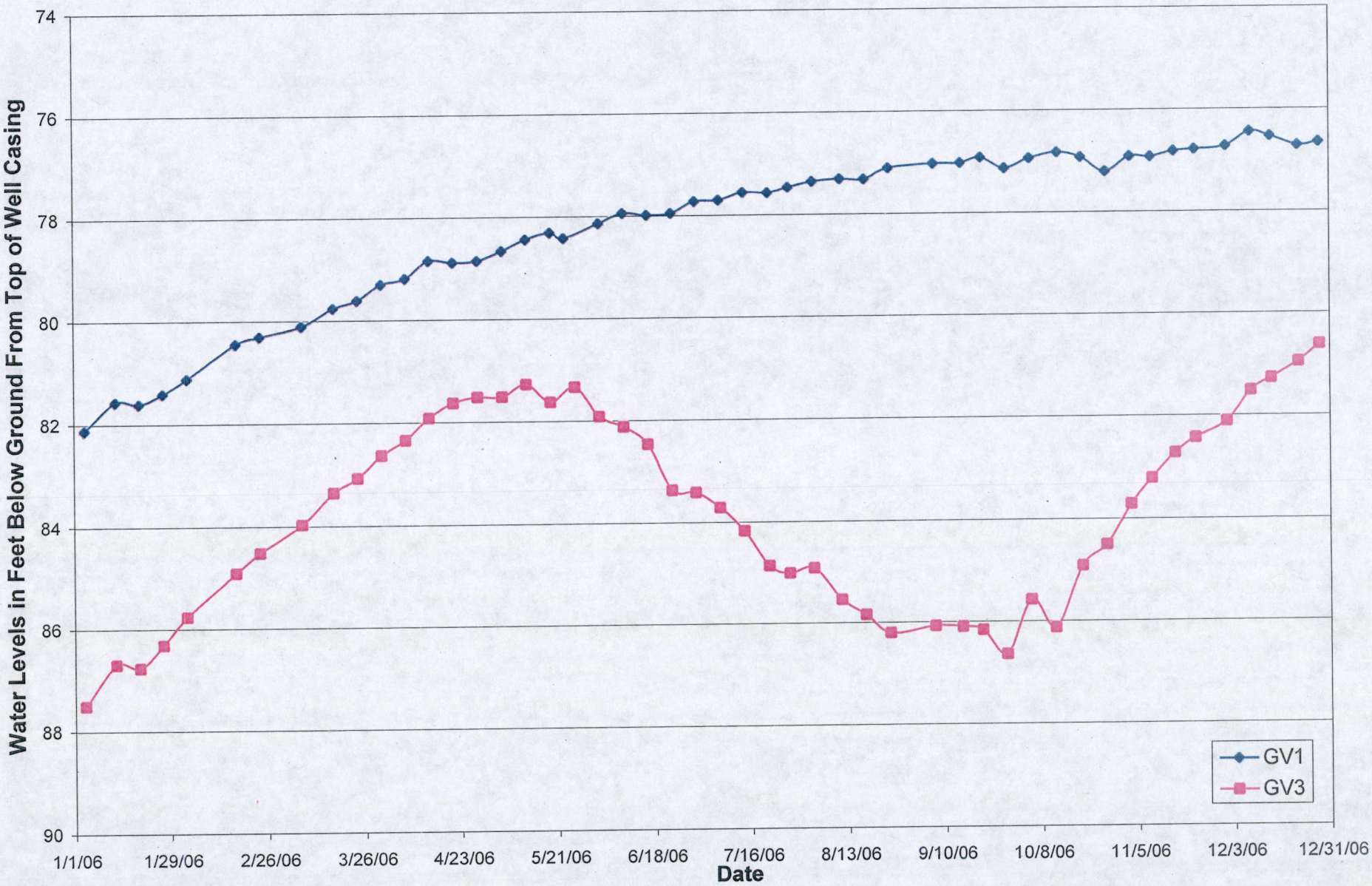
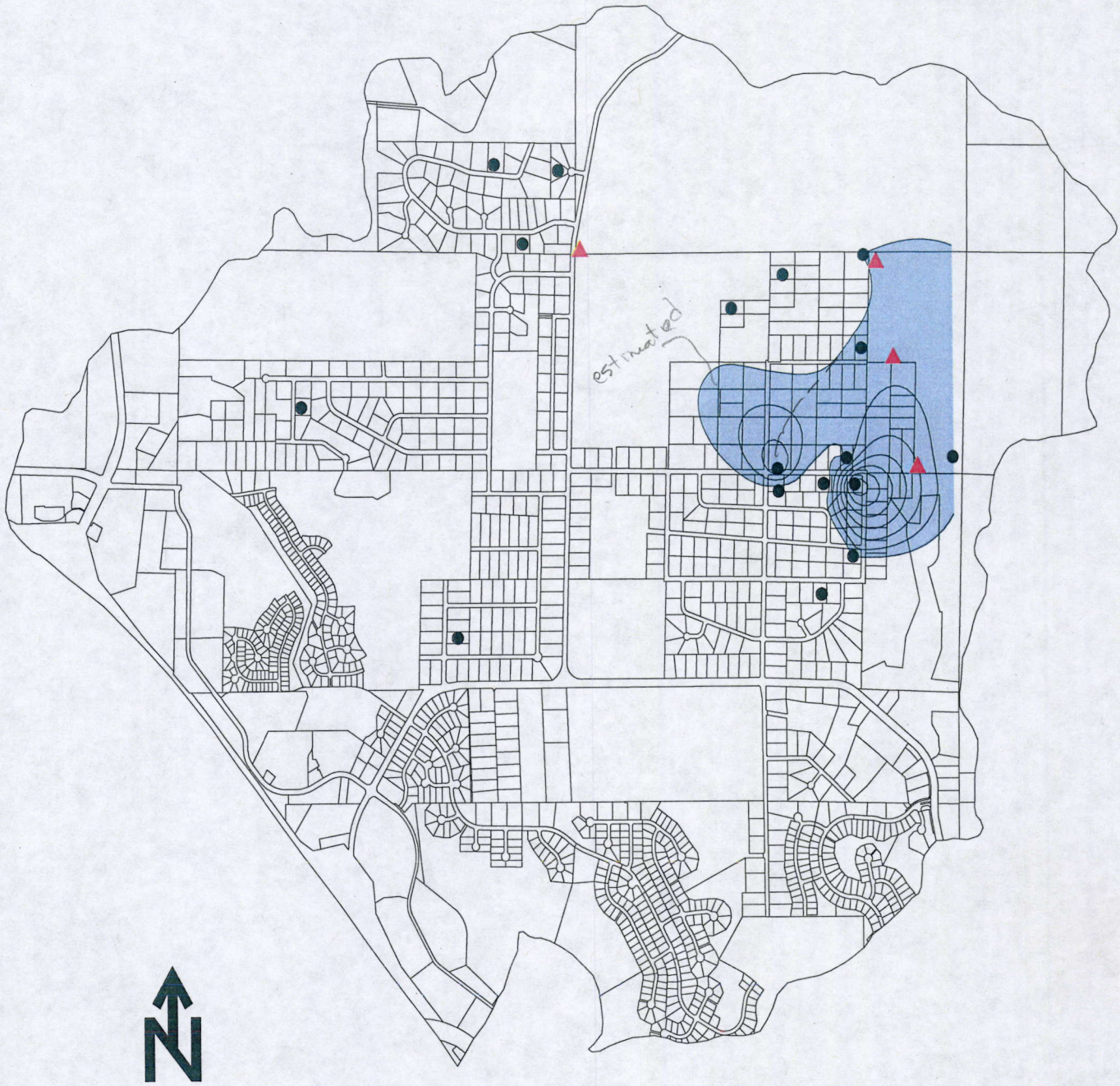


Figure 5 - Difference in Nitrates Between 1993 and 2007

Golden Valley, Washoe County, Nevada



Blue is where nitrate levels improved between ~1993 and 2007.

Red triangles represent location of injection wells.

0 2000 4000 6000 8000 (feet)