concentrations from the Elena Gallegos well, which is located east and hydraulically upgradient of Sandia Heights. Concentrations in that well in 1997 – 1998 were all less than 0.25 mg/L. The initial nitrate concentrations in the San Rafael well were reported at 3.2 mg/L. Subsequent measurements since 2001 have yielded concentrations of less than 1.5 mg/L. Modeling results presented in Thomson et al. (2000, Figures 5-6 and 5-7) suggest that nitrate concentrations would likely reach a maximum concentration of 6 mg/L based on current septic tank densities and practices, and recharge and water use conditions.

The San Rafael well was sampled and analyzed for the 66 compounds USGS considered indicative of anthropogenic effects on water quality (i.e., emerging contaminants). None of the compounds were detected in the sample from the San Rafael location. The lack of detection is reasonable given the minimal nitrate concentrations in the San Rafael well. Samples from the Cedar Hill well were not analyzed for these compounds.

The two wells have been sampled for volatile and semi-volatile organic compounds. There have been only two reported low-level detections of organic compounds: methyl ethyl ketone and phthalate compounds. Both of these compounds are common laboratory contaminants, and the detections are anomalous events, suggesting they were laboratory-related contaminants.

1.7 ***North Valley Monitoring Wells***

Bernalillo County does not currently conduct groundwater monitoring in the North Valley / Paradise Hills area. The North Valley encompasses the ABCWUA's Griegos, Duranes, Gonzales and Atrisco wellfields. These wells are actively monitored by the ABCWUA and by the USGS. The shallow hydrology of this area is complicated by the interaction of surface and groundwater along numerous irrigation and drainage channels and the Rio Grande. As a result, the USGS also monitors well transects at the Paseo del Norte, Montano, Central Ave., and I-25 bridges where they cross the Rio Grande. Information is available at Bosque Piezometers (http://nm.water.usgs.gov/bosque.html). In addition, the USGS monitors multiple shallow and deep wells on the perimeter of the North Valley.

The following discussion is limited to presentation of data from the USGS- monitored piezometer nests. These piezometer nests are the only source of readily available, long-term water level and water quality data near the North Valley. Additional, short-term water level information for other wells is available at the USGS website (USGS Ground water for New Mexico: Water Levels). All discussion below is based on ABCWUA- and USGS–generated information. Bernalillo County Water Resources does not currently monitor any wells within the North Valley.

Locations of community supply wells, USGS piezometer nests, and individual water wells are shown in Figure 3.33. The piezometer nests are located beyond the perimeter of the North Valley. The piezometers discussed below include:

- the Sister Cities nest,
- the Hunters Ridge nest,
- the Sierra Vista nest,
- the Garfield nest,
- the West Bluff nest.

1.7.1 *North Valley Water Levels.*

Water level and water quality monitoring is routinely conducted by the USGS in piezometer nests outside the perimeter of the North Valley area. The data presented below was collected by the USGS and downloaded for this report from the USGS website (USGS Ground water for New Mexico: Water Levels). It is included for completeness in describing groundwater quality conditions within the unincorporated areas of Bernalillo County.

Sister Cities

The Sister Cities Park nested piezometer is located east of I-25 and south of San Antonio Drive. This location represents conditions along the eastern perimeter of the North Valley area. The deep piezometer (1,308 ft) indicates a minimal downward trend in water levels of one to two feet per year, with seasonal fluctuations of about 10 to 15 feet (see Figure 3.34). The upper well (789 ft.), however, indicates a continual decrease of approximately 6 feet since 1998, with seasonal fluctuations of approximately 4 to 5 feet, a decline rate of approximately 0.75 feet per year.

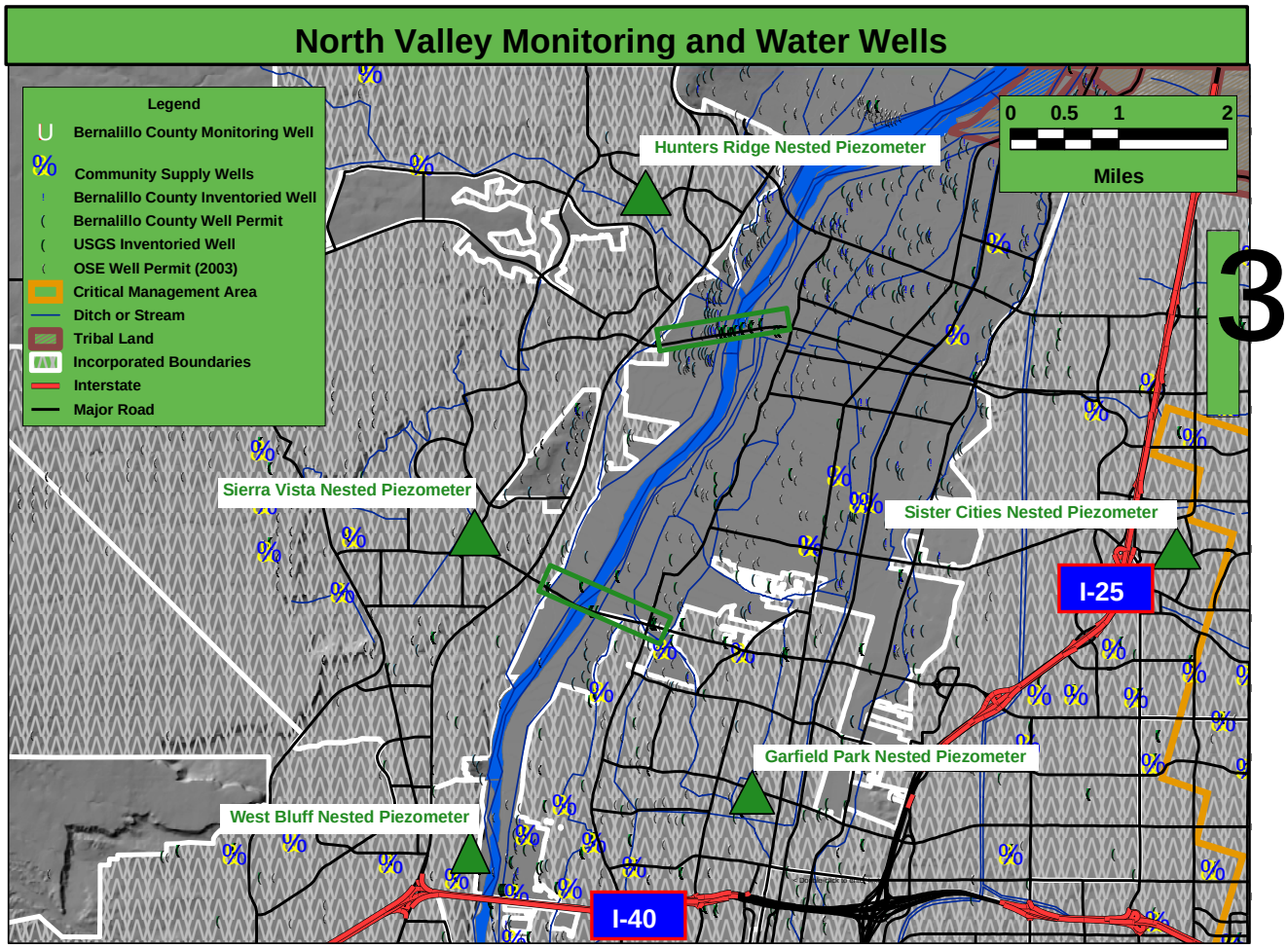
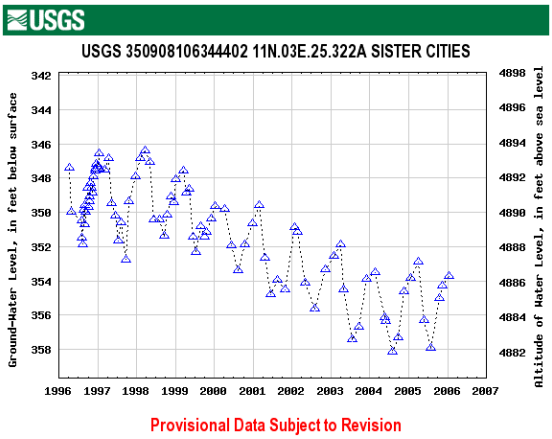


Figure 3.33 North Valley Monitoring and Water Wells

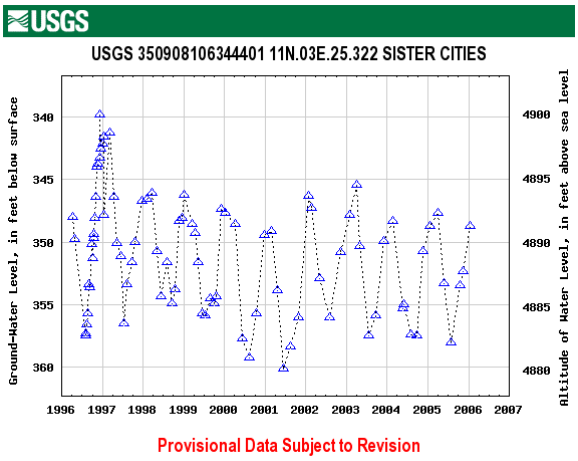


Well Information

Land Surface Elevation: 5,240 amsl.

Top of Screen: 789 ft

Depth of Well: 799 ft.



Well Information

Land Surface Elevation: 5,240 amsl.

Top of Screen: 1,298 ft

Depth of Well: 1,308 ft.

Figure 3.34 Water Levels in the Sister Cities Park Nested Piezometer

The Sister Cities nest lies between two major zones of pumping, with the Coronado wellfield located approximately two miles to the north, and the Vol Andia and Leyendecker wellfields located approximately two miles to the southwest and southeast. The upper piezometer screens the production interval used by the wellfields and thus demonstrates increased drawdown effects compared to the lower piezometer. The vertical gradient at the Sisters Cities site is upward.

Hunters Ridge

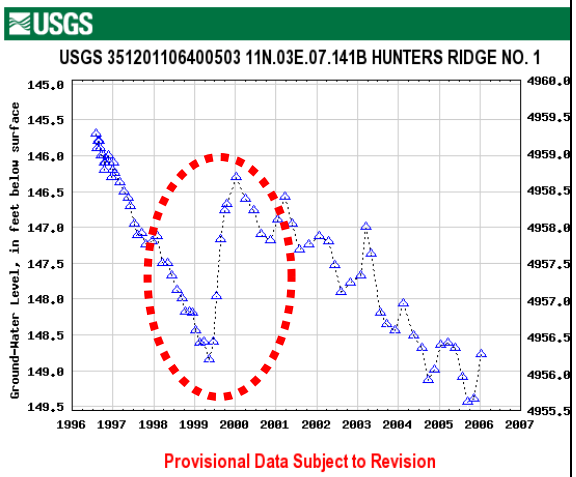
The Hunters Ridge nested piezometer is located along the northwest of the North Valley near the coalescing of two major arroyos draining from the northwest. The location consists of two piezometer nests, with three wells each (see Figure 3.35). The first nest piezometers screen the shallow (128 ft.), middle (845 feet), and deep (1,508 ft) portions of the aquifer. The second nest piezometers screen only the shallow portions of the aquifer (238 ft., 295 ft., and 349 ft.) and screen depths overlap with the screen interval of the shallow well constructed in the first nest. The series of hydrographs indicate a downward hydraulic gradient. The nearest large quantity production wells are located approximately two miles to the west and are operated by New Mexico Utilities.

Figure 3.35 provides the water level graphs for each of the piezometers in the Hunters Ridge nest. The graphs have been organized by depth of the screened intervals rather than retaining the nested groupings. From shallowest to deepest, the graphs are ordered top to bottom and then left to right – the shallowest well (128 feet) is in the upper left hand corner of the figure and the deepest (1,508 ft) is in the lower right-hand corner.

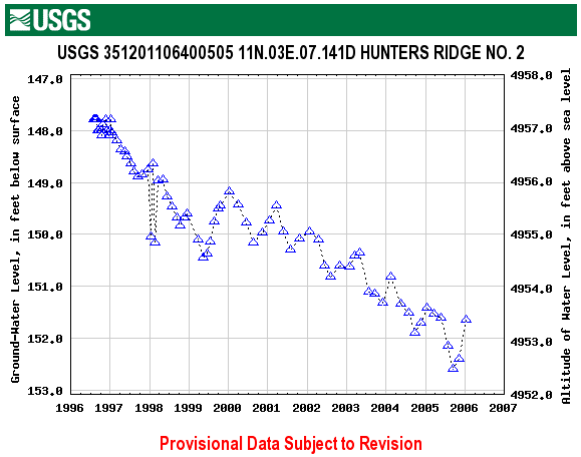
Two salient trends are readily identifiable. First, in each of the graphs there is a continual decline in water levels with respect to the initial measurements in the wells taken in 1996. The amount of decline is approximately 5 feet in the shallowest well, and increases to 6 to 8 feet in the deeper intervals below about 300 feet. This equates to a 0.5 to 1.0 feet of decline per year. Seasonal fluctuations are approximately 1 to 2 feet in the shallower portions of the aquifer, and approximately 2 to 4 feet in the deeper intervals. Water level declines in this area are the result of municipal pumping, with the nearest municipal well being the New Mexico Utilities Well #2 located approximately 2 miles to the west.

The second noticeable feature of the graphs is a marked jump in water levels occurring in 1999. In mid-1999, there was an approximately 3-foot jump in water levels in the shallowest of the piezometers. The rise is also clearly seen in each of the piezometers with screens located above approximately 300 feet.

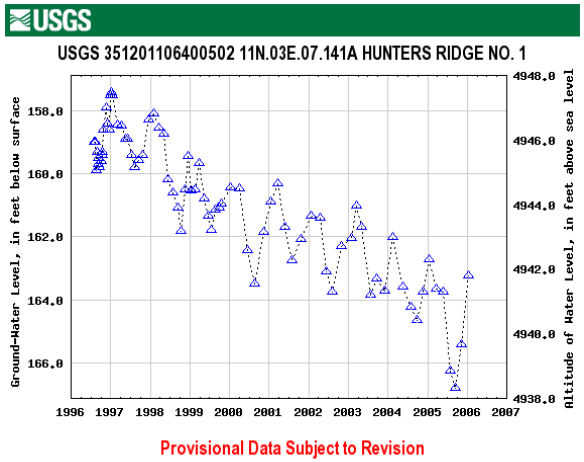
Well Depth: 238 ft Top Screen: 128ft



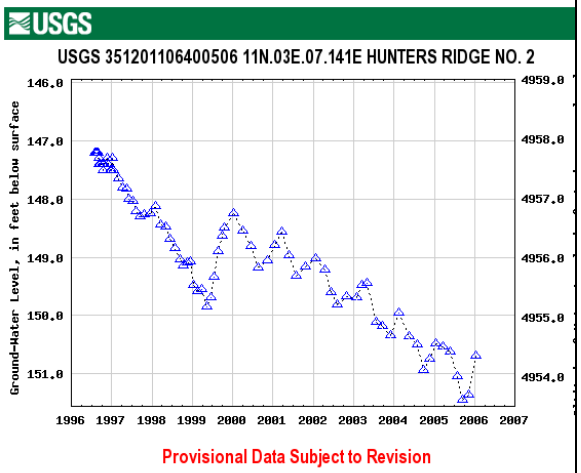
Well Depth: 305 ft Top Screen: 295 ft



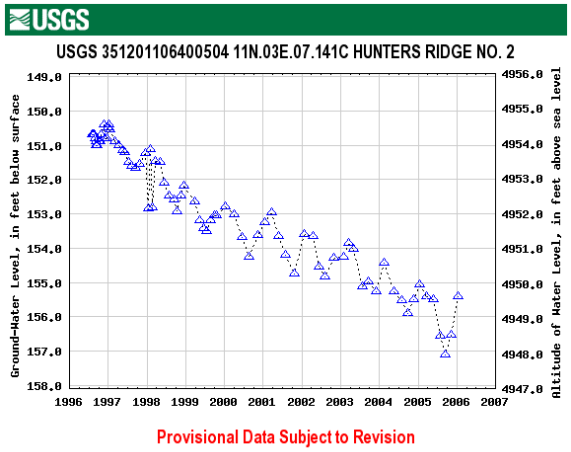
Well Depth: 855 ft Top Screen: 845 ft



Well Depth: 263 ft Top Screen: 238 ft



Well Depth: 359 ft Top Screen: 349 ft



Well Depth: 1,518 ft Top Screen: 1,508 ft

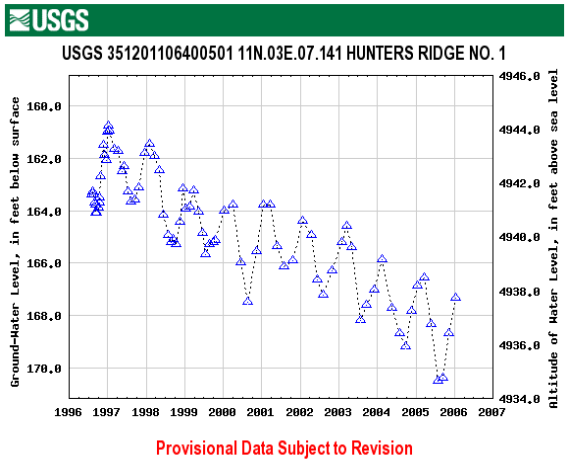


Figure 3.35 Water Levels in the Hunter's Ridge Nested Piezometer

However, this rise is not discernible in the three deeper wells (349 ft., 845 ft., and 1,508 ft.). This suggests that some surface-related phenomena occurred, such as increased recharge from the arroyos or cessation of pumping from a nearby shallow well. The piezometer nests are located near Arroyo de las Calabacillas and Black Arroyo. No stream gauging stations are available at that location. A review of the peak flow records for surface water gauging stations on Boca Negra Arroyo located approximately 5 mile southwest show a significant flow event stemming from the West Mesa in mid-1999. This characteristic indicates that significant recharge to the shallow portions of the aquifer can occur via the arroyos, but any gains at depth may be masked by continually declining water levels stemming from municipal pumping.

Sierra Vista

The Sierra Vista nested piezometer is located west of the Rio Grande near the intersection of Montano Rd. and Valle Vista Rd. This location is west of the North Valley (see Figure 3.33). Hydrographs are provided as Figure 3.36. Hydrographs for each of the piezometers (210 ft., 928 ft., and 1,644 ft.) indicate an approximately 7-foot decline in water levels since 1997, with the vertical gradient being downward in this area. The water levels in early 2006 ranged from 154 feet in the shallowest well to 188 feet in the deepest. The Sierra Vista nest is located approximately two miles east of the Volcano Cliffs wellfield and one mile east of the Zamora wellfield. The rate of decline, 0.7 ft / year is similar to that demonstrated by the shallow well in the Sister Cities nest. The nests are similarly situated with respect to nearby municipal production wells.

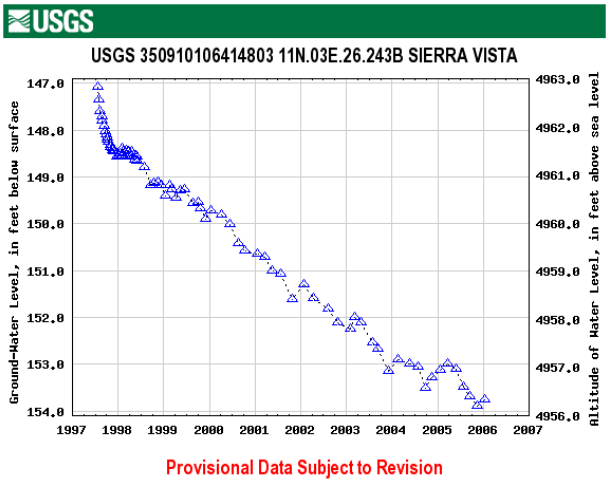
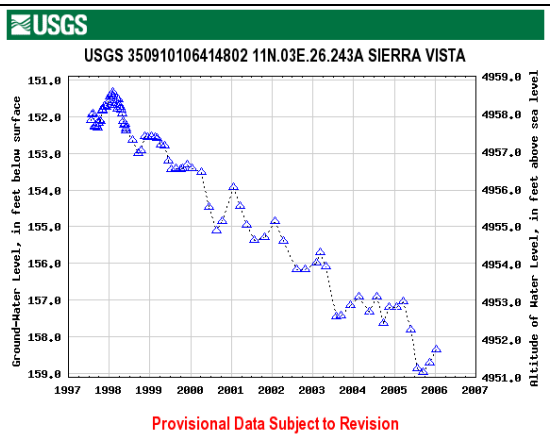
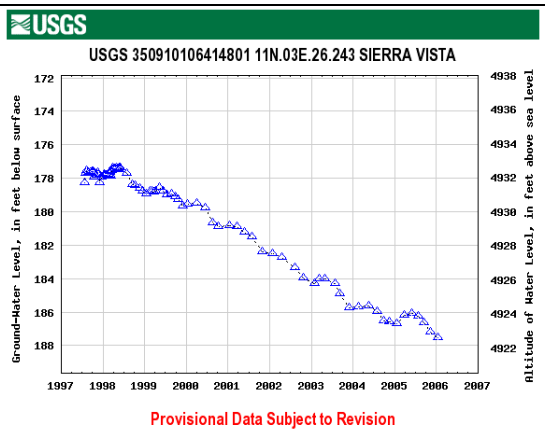
	**Well Information** Land Surface Elevation: 5,110 ft. amsl Top of Screen: 140 ft. Depth of Well: 210 ft.
	**Well Information** Land Surface Elevation: 5,110 ft. amsl Top of Screen: 918 ft. Depth of Well: 928 ft.
	**Well Information** Land Surface Elevation: 5,110 ft amsl Top of Screen: 1,634 ft. Depth of Well: 1,644 ft.

Figure 3.36 Water Levels in the Sierra Vista Nested Piezometer

Garfield Park

The Garfield Park nested piezometer is located near Matthew Ave. and east of 12th Street, approximately 2 miles east of the Rio Grande. The location is representative of the groundwater conditions in the inner valley floor.

Hydrographs for the piezometers are provided in Figure 3.37. The water levels in the shallow piezometer (83 ft.) show a declining trend of about two feet from 1996 through 2003. Since 2003, water levels in the well have risen by that same amount. Whether this rise is due to conservation efforts, decreased pumping from nearby individual domestic wells, or changes in river conditions or inner valley irrigation is unknown. Seasonal fluctuations are about 1 to 3 feet. The intermediate depth well (582 ft.) shows a similar pattern, although the rise in water levels appears to have begun as early as 2000. Again, seasonal fluctuations are about one to three feet. The deepest of the piezometers (1,020 ft.) provides a hydrograph quite similar to that of the intermediate well. The vertical gradient in this area appears to be downward, with water levels ranging from about 45 feet in the shallowest piezometer to 50 feet in the deepest. This suggests loss of water from the surface to the deeper subsurface, indicative of loss of water from the river to the aquifer, or from the shallow aquifer to the deeper pumped zones.

West Bluff

The West Bluff nest consists of two sets of piezometers located on the western bluff, north of the I-40 bridge. This piezometer nest is tied into a transect of shallow piezometers stretching across the floodplain, which is actively monitored by the USGS to aid in determining shallow groundwater / stream interactions.

Figure 3.38 provides the hydrographs for the piezometer nest. The water levels in each of the piezometers clearly reflects seasonal fluctuations in water levels, with low water levels occurring during the summer months, and then recovering through the winter months to peak in the January

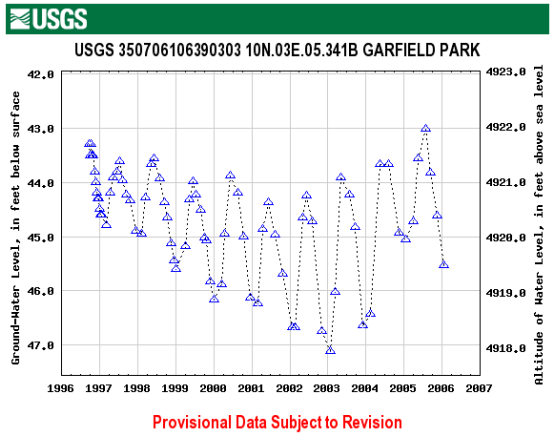
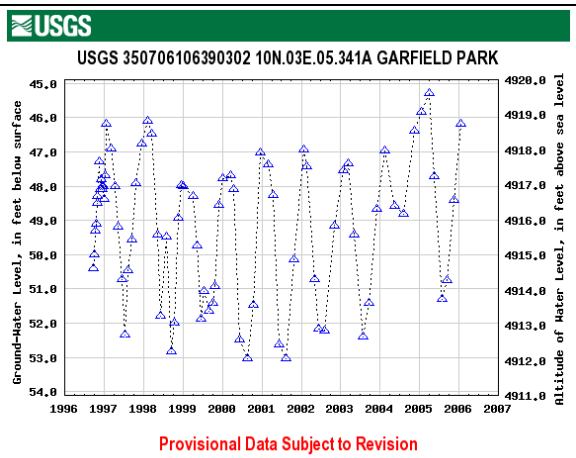
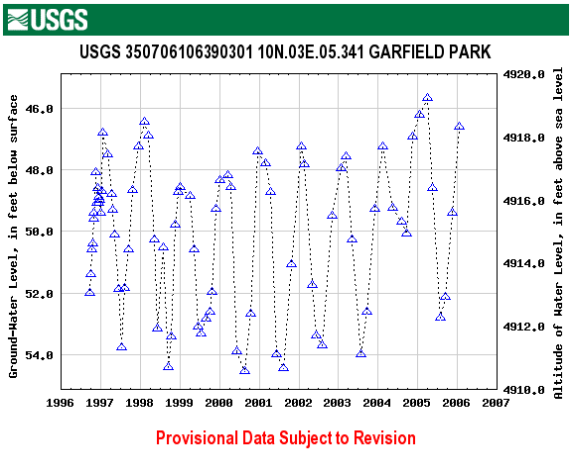
	**Well Information** Land Surface Elevation: 4,965 ft amsl. Top of Screen: 43 ft Depth of Well: 93 ft.
	**Well Information** Land Surface Elevation: 4,965 ft amsl. Top of Screen: 552 ft Depth of Well: 582 ft.
	**Well Information** Land Surface Elevation: 4,965 ft amsl. Top of Screen: 995 ft Depth of Well: 1020 ft.

Figure 3.37 Water Levels in the Garfield Park Nested Piezometer

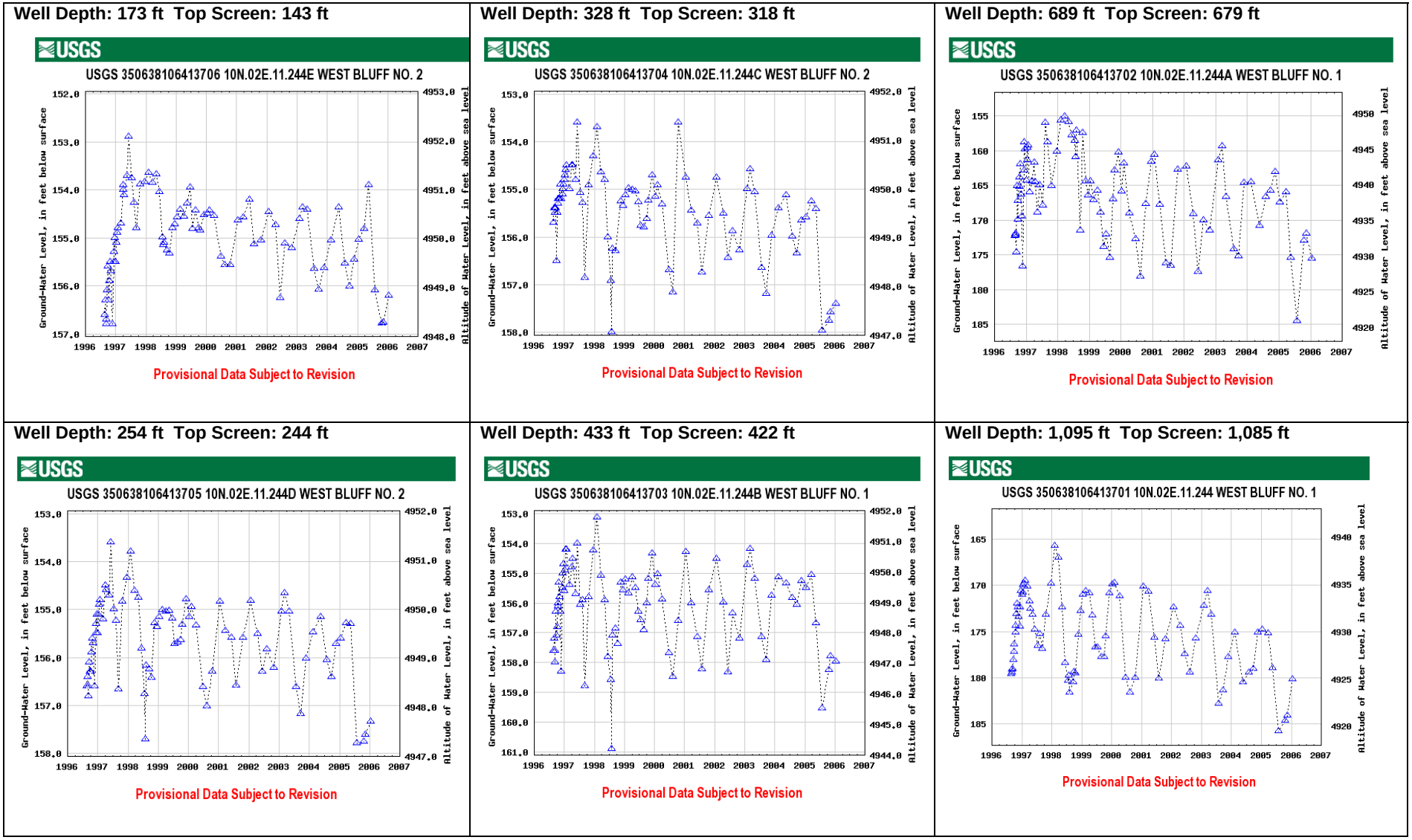


Figure 3.38 Water Levels in the West Bluff Nested Piezometer

to March time frame. Peak water levels were measured in 1997 and 1998 in each of the wells. Peak water levels appeared to remain reasonably stable through 2003, but record low measurements were measured in 2005. The record low was approximately 1 to 1.5 feet less than the preceding measurements for the piezometers completed above a 500 foot depth. In the two deeper piezometers, the drop was approximately three to five feet. The water levels indicate a downward vertical gradient, suggesting stream loss recharging to the underlying aquifer system and/or the effects of municipal pumping from deeper portions of the aquifer. This response is expected as the piezometer site lies in close proximity and between the Gonzales wellfield to the west and the Duranes wellfield to the east. The measured water levels and the wide seasonal fluctuation are a function of both river stage and increased pumping during the summer months.

With respect to trends, the shallowest of the wells suggests an overall decline of only two feet from 1996 to the low measurement in 2006, the other wells show either a lesser decline or minimal decline for most of the measurement period. This lack of trend is due largely to recharge occurring from the river.

1.7.2 *North Valley Water Quality*

The USGS has collected and analyzed water samples from throughout the North Valley, under a cooperative agreement with the CABQ. Water quality data for the USGS piezometer nests were provided by CABQ and are summarized below. Figure 3.39 and 3.40 present a Piper Plot and a statistical summary for the metals and inorganic concentrations for water samples taken from the piezometer nests.

The Piper plot for the North Valley piezometers shows a much broader composition than those previously demonstrated for the East Mountain area and in the Far Northeast Heights. The samples shown are either mean values based on the period of record (i.e., designated as “stat”) or are the most currently available sample. The lower right diagram shows an almost continuous and linear range in calcium to sodium contribution. This distribution indicates that magnesium is seldom a

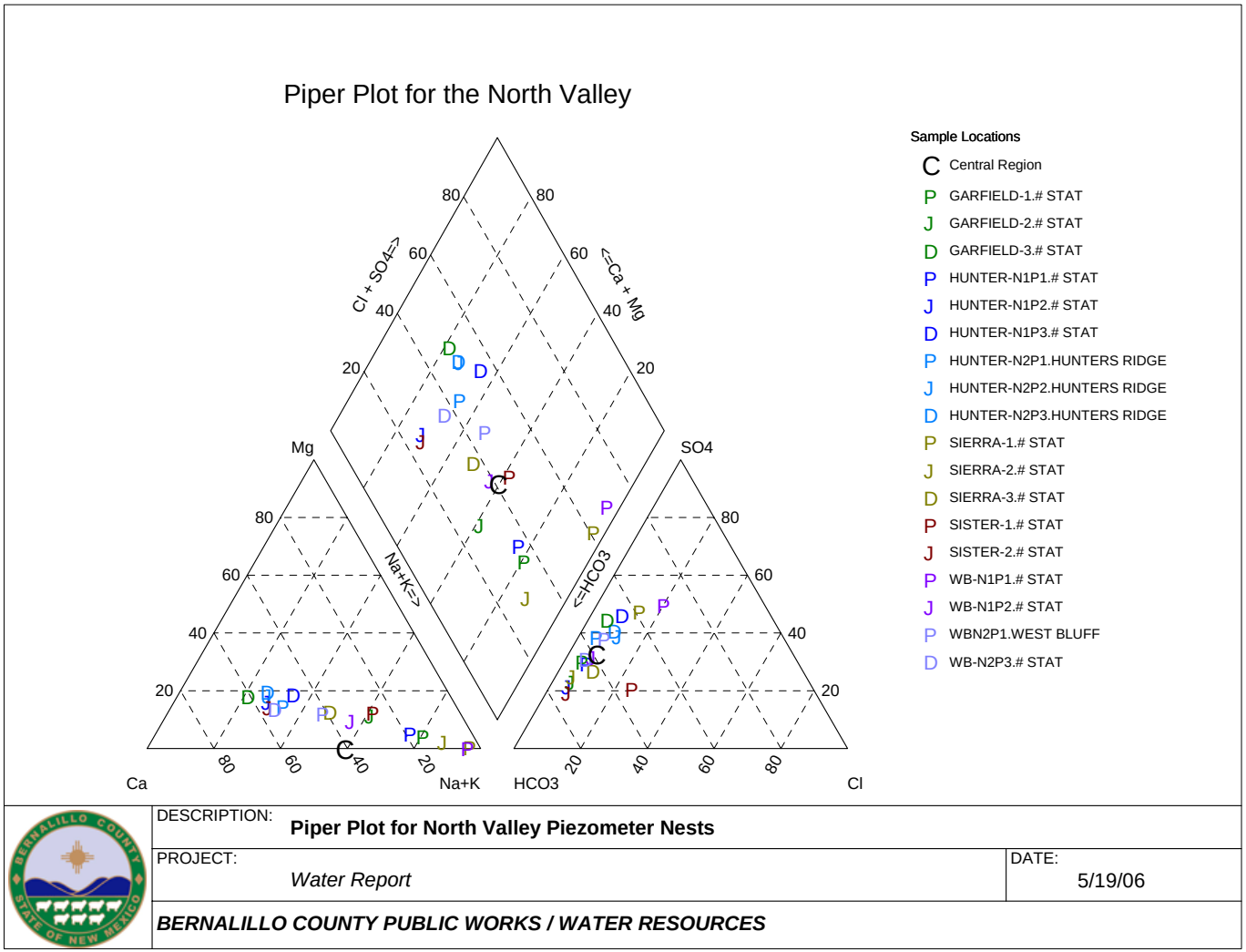


Figure 3.39 Piper Plot for the USGS North Valley Piezometer Nests

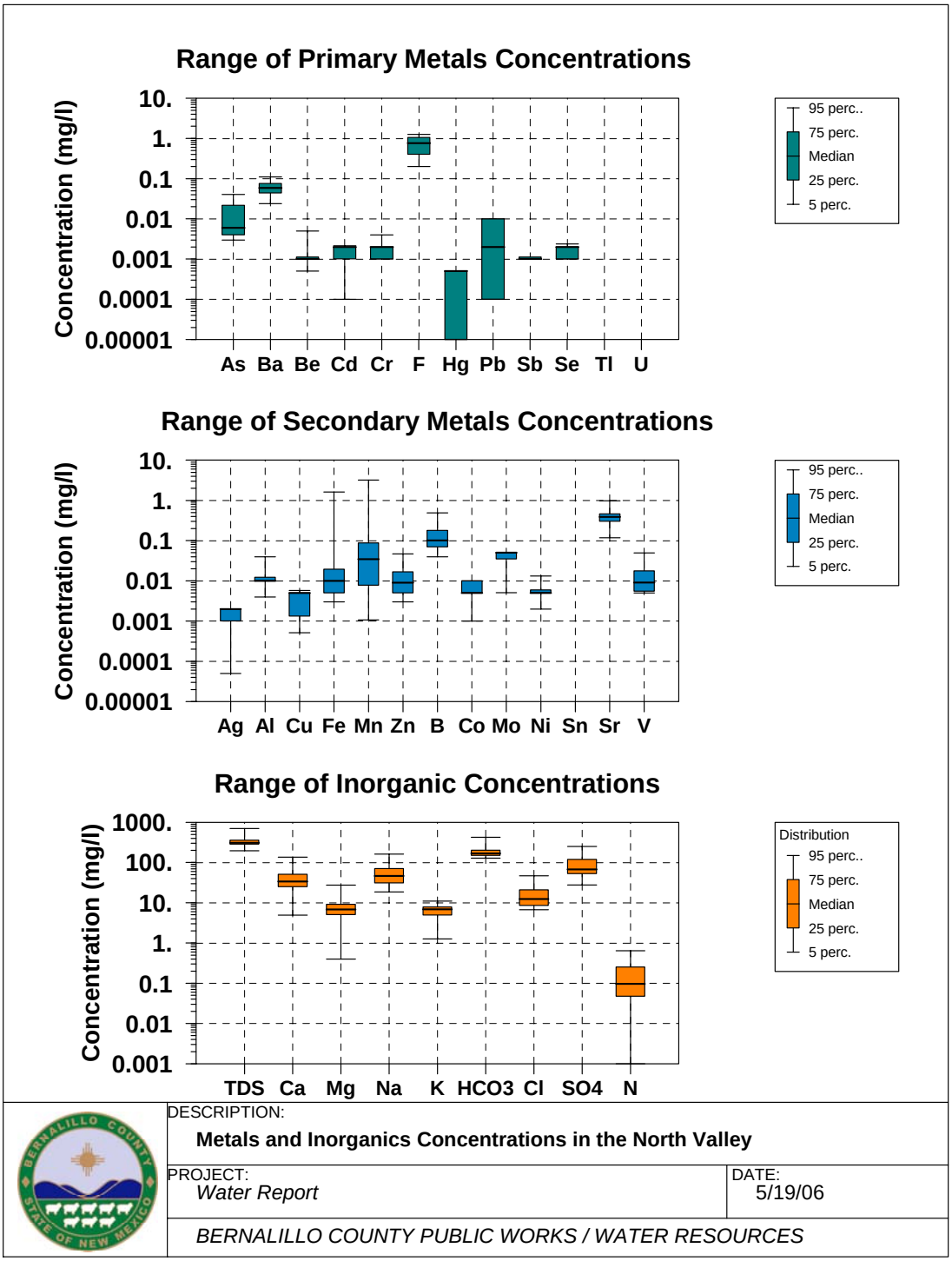


Figure 3.40 Metals and Inorganic Concentrations in the North Valley

significant component. The Piper plot also indicates that the importance of sodium increases with depth (i.e. the plots at the Na+K vertices are all for deep piezometers.) The greatest shift in composition appears to be for the Sierra Vista and West Bluff piezometer nests, which are both located on the west side of the Rio Grande and in areas of dense municipal pumping.

The lower right diagram indicates that chloride contributes to less than 20 percent of the anion loading and that bicarbonate is still the predominant anion but with increased distribution of sulfate compared to other areas of the County. There does not appear to be a relationship between depth and the relative types of anion contribution, although three exceptions occur. The deep wells for West Bluff Nest 1, Sierra Vista, and for Sister Cities demonstrate an increased contribution from chlorides compared to the other nested piezometer locations and their respective shallow wells. The trends and observations are all consistent with a downward migration of water and subsequent exchange of the calcium and sodium cations with increasing depth. A "mean" composition for the Central Region bordering the Rio Grande is plotted. However, it is not representative of the wide distribution in anion-cation values than can occur due to differences in location and depth.

A summary plot of metals and inorganics for the North Valley is also provided. The plotted values are based on all readily available data from the USGS monitoring program, not just from the piezometers indicated above. (USGS inventoried well locations are shown in Figure 3.3 along with the piezometer locations). Exceedances of drinking water standards are shown in Table 3.10 and include significant exceedance of the arsenic standard (i.e., the 75th percentile value is 0.02 mg/L compared to a standard of 0.01 mg/L, maximum concentration was 0.5 mg/L) and there is occasional exceedance of the beryllium standard. The 95th percentile values for the remainder of the metals are below the respective MCLs. Total dissolved solids, iron, and manganese also occasionally exceed their respective secondary standards.

There was no evidence of elevated nitrate concentrations in the samples included in the summary. Of the available 123 samples, approximately 40 percent indicated concentrations greater than 0.1 mg/L and less than 1 percent indicated concentrations greater than 1 mg/L.

Table 3.10 Exceedances of EPA Drinking Water Standards – North Valley

Parameter	Primary Standard	Secondary Standard	Total Number of Samples	Percent of Samples Exceeding Standard
Arsenic	0.010		212	25
Beryllium	0.004		155	5
Total Dissolved Solids		500	136	10
Iron		0.3	198	10
Manganese		0.5	203	12

The maximum reported nitrate concentration was 2.8 mg/L. The lack of elevated nitrate concentrations is a bit surprising because the North Valley septic systems are generally older than those in the East Mountains, North Albuquerque Acres, and Sandia Heights, and the valley has been populated for much longer period. The limited range of nitrates may be the result of a spatial sampling bias – that is that the majority of the samples included in the summary are from areas serviced by the ABCWUA wastewater system. Alternatively, the samples may have been collected in areas where groundwater conditions are anoxic, resulting in elevated iron and manganese concentrations, but lacking elevated nitrate concentrations. The soils present in the inner valley may be more conducive to septic disposal due to depth, texture, and biologic activity than those in other areas of the County. This benefit is offset by the shallow water table and the greater probability for older, improperly constructed wells and anoxic conditions.

1.8 ***South Valley Monitoring Wells***

The South Valley encompasses the area from Central Avenue to Isleta Pueblo and from Coors Rd. to I-25. The northern urbanized neighborhoods of the South Valley merge into the semi-urban and agricultural areas farther south. This area has a highly diversified land use pattern including agriculture, residential, and commercial and industrial use. Generally, as one moves from north to south through this area, the availability of ABCWUA-supplied municipal water and sewer decreases and reliance on individual wells and septic tanks increases. The existing water and sewer infrastructure are undergoing significant expansion in these areas.

Groundwater in the San Jose and Mountain View neighborhoods, as well as other areas, has been significantly impacted by industrial and agricultural land use and by petroleum products. The