Bernalillo County Regional Groundwater Monitoring Report

2008 Update

Prepared for:

Bernalillo County Board of Commissioners

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Acronyms and Abbreviations

ABCWUA	Albuquerque Bernalillo County Water Utility Authority
amsl	above mean sea level
BCPW	Bernalillo County Public Works Division
BCEH	Bernalillo County Office of Environmental Health
bgs	below ground surface
btoc	below top of casing
CABQ	City of Albuquerque
EMA	East Mountain Area
GPAB	Groundwater Protection Advisory Board
GPPAP	Groundwater Protection Policy and Action Plan
MCL	Maximum Contaminant Level
MCLG	Maximum Contaminant Level Goal
mg/L	milligrams per liter
NMED	New Mexico Environment Department
OSE	New Mexico Office of the State Engineer
ug/L	micrograms per liter
USGS	United States Geologic Survey
WQPAB	Water Quality Protection Advisory Board

GLOSSARY

Aquifer: Rock or sediment in a formation, group of formations, or part of a formation that is saturated and sufficiently permeable to transmit economic quantities of water to wells and springs.

Drawdown: A lowering of the water table or potentiometric surface caused by pumping of groundwater from wells.

Community well / Community system: A small to large diameter groundwater production well that supplies water to a distribution system with fifteen or more year-round connections or serving 25 or more year-round residents. The well and system may be owned and operated by various types of public and private entities.

Horst: An elongate, elevated block of crust forming a ridge or plateau, typically bounded by parallel, outward-dipping normal faults.

Hydrograph: A graph that shows some property of groundwater or surface water as a function of time. Generally speaking, for groundwater it is a graph of water level and for surface water it is a graph of flow volumes or rate of flow.

Individual well / Individual domestic well: A well that supplies water and associated piping that serves a single lot or household. If the well services more than one, but less than fifteen, connections, it is technically speaking a multiple household or shared well.

Maximum Contaminant Level (MCL): The maximum permissible level of a contaminant in groundwater as defined by NMED. The MCL is synonymous with "Primary Drinking Water Standard". It is the highest level of a contaminant that is allowed in a regulated drinking water source. MCLs are set as close to MCLGs as feasible using the best available treatment technology and considering cost. MCLS are enforceable standards.

Maximum Contaminant Level Goal (MCLG): The level of a contaminant in drinking water below which there is no known or expected risk to heath. MCLGs allow for a margin of safety and are non-enforceable public health goals.

Municipal well / Municipal system: A large diameter groundwater production well that supplies water for distribution through a municipally-owned and operated utility or similarly structured water utility authority

Non-public water system: A system for the provision of water for human consumption for domestic purposes, if such system does not have at least fifteen service connections and does not regularly serve an average of twenty-five individuals at least sixty days out of the year.

Public water system: A system for the provision to the public of water for human consumption through pipes or other constructed conveyances, if the system has at least fifteen service connections or regularly serves an average of twenty-five individuals daily at least sixty days out of the year. A public water system is either a "community water system" or a "non-community water system.

Nested piezometer: A nested piezometer is a well drilling and completion method whereby multiple piezometers are completed in one borehole. Each piezometer screens a different portion of the aquifer.

Piezometer: A non-pumping well, generally of small diameter (less than 4-inches), that is used to measure the elevation of the water table or potentiometric surface. A piezometer generally has a short well screen, relative to total depth of the well, through which water can enter.

Potentiometric surface: A surface that represents the level to which water will rise in a tightly cased well. If the potentiometric head varies significantly with depth in the aquifer, then there may be more than one potentiometric surface for a given aquifer.

Water table: The water table is a particular type of potentiometric surface. For an unconfined aquifer it is the level below which the aquifer is saturated with water.

EXECUTIVE SUMMARY

Groundwater monitoring activities are conducted throughout Bernalillo County by the Bernalillo County Public Works Division (BCPW). Such activities are performed by the Water Resources Program (the Program). The Program is responsible for groundwater monitoring and planning, providing low-income assistance for water and sewer connections, addressing stormwater quality management, and for administering the County's water conservation efforts.

The Program's routine groundwater monitoring activities are planned and implemented by County staff pursuant to the Groundwater Protection Policy and Action Plan (GPPAP), which was previously adopted by the Board of County Commissioners. The GPPAP is overseen by the recently renamed and re-scoped Water Quality Protection Advisory Board (WQPAB). The Program additionally addresses groundwater and water well issues as identified and requested by various County departments including: BCPW, Zoning, Building, and Planning, Parks and Recreation, Bernalillo County Fire Department (BCFD), and the County's Office of Environmental Health (BCEH). Additionally, the Program oversees jointly funded cooperative investigations with the United States Geological Survey (USGS) and also participates in various regional groundwater planning activities and organizations.

In February 2007, the Program produced the *Bernalillo County Regional Groundwater Monitoring Report* (McGregor 2007). That report included Countywide water level and water quality data dating from late 1997 through December 2005. This Update provides evaluation of additional data through collected through February 2008 and provides estimates of well use and water quality within various geographic areas of Bernalillo County.

The Program's routine groundwater monitoring activities since December 2005 have included quarterly water level measurement and annual sampling of 18 wells and piezometers as well as regulatory-required sampling and monitoring of County wells. Sampling of those 18 wells will continue through 2010, at which time a sufficient statistical basis will have been established and the need for routine groundwater sampling of those wells will be reevaluated and possibly discontinued. Quarterly water level monitoring activities will increase in 2008-2009 as existing County wells are retrofitted for water level measurement purposes. Routine water level monitoring will continue into the foreseeable future.

The Program's 2007-2008 activities also included a comprehensive sampling from County facility wells for Primary and Secondary Drinking Water Standard parameters (http://www.epa.gov/safewater/mcl.html), excluding those wells used solely for irrigation or those registered as community systems. County-owned registered systems are subject to routine compliance sampling and only routine sampling of registered systems was conducted since December 2005. Registered systems are subject to compliance with Primary and Secondary Drinking Water Standards, while unregistered County facilities are not. Not all County facilities (e.g., manned fire stations) are required to be registered. Bottled water is supplied for drinking and consumption at unregistered County facilities (i.e., that are not registered systems), where well water does not meet the Primary Drinking Water Standards or where other aesthetic issues with the well water may exist.

For convenience of the remaining discussions in the report, the unincorporated portions of the County have been subdivided into five geographic areas as shown in Figure EX-1: the East Mountain Area (EMA), the Far Northeast Heights, the North Valley / Paradise Hills Area, the South Valley Area, and the North Valley Area.

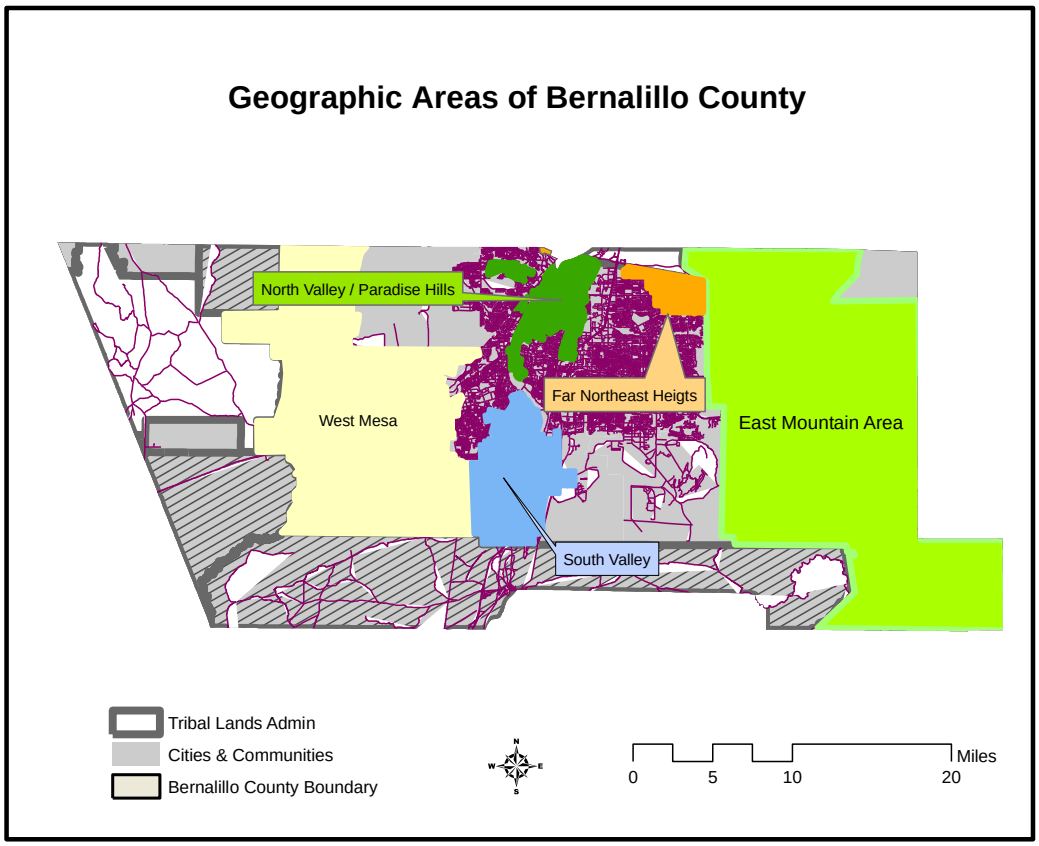

Figure EX-1 Geographic Areas of Bernalillo County

In general, water quality throughout the unincorporated areas of the County meets the Primary and Secondary Drinking Water Standards for most parameters. Common exceptions include elevated concentrations of iron, manganese, aluminum, arsenic. In some cases, particularly near Tijeras and east of the Tijeras Fault system, chloride, sulfates, and total dissolved solids concentrations typically exceed the respective Secondary Standards. Elevated chloride, iron and manganese concentrations in shallow groundwater may be either naturally occurring or may be related to natural degradation of wastewater system leachate. The remainder of the listed parameters are most likely naturally occurring.

Water quality monitoring data during 2006 through 2008 did not indicate any unanticipated results. Water quality in the 18 sampled wells remained consistent with previous results collected since the late 1990's. Only one of the wells shows a continued increasing trend of concern. One well, Sandia Park 1, continues to indicate increasing levels of nitrate (currently

less than 4 mg/L but rising). That well is located in the near the intersection of NM 14 and Frost Road in the East Mountain Area (EMA)/

Additional water level monitoring indicates continuing trends for most areas of the county. There has been a rebound of water levels in wells located on the backslopes of the Sandia Mountains (i.e. west of NM 14) and in wells in the Far Northeast Heights. The rebound is likely reflective of two good years of winter precipitation events. However, the rebound is temporal in nature and a return to declining water levels is expected. Of particular concern, however, is the on-going continued decline of water levels in wells located in the east central portion of the County (i.e. generally from Frost Rd. southeastward to Juan Tomas Rd.) and extending back towards Fire Station 11 (located on NM 337 South near Tranquillo Pines). Water levels in the remainder of the EMA remained stable or are decreasing at minimal rates. Water levels in shallow wells (less than 500 ft depth) in the South Valley, North Valley, and West Mesa appear to be remaining stable, except where under the effects of municipal pumping.

This update also addresses estimates of well use within various geographic areas of Bernalillo County. Table EX-1 provides a summary of estimated well use by geographic area of the County as previously determined in the Water Conservation Plan (Weston 2006) and as independently estimated based on available Assessor parcel and well permit records.

In general, it appears that within the unincorporated areas of Bernalillo County there are approximately 12,000 individual domestic wells likely in use as the primary domestic water supply. At best, only 46 percent of the wells have some type of associated permit (either BCEH or Office of the State Engineer (OSE)), and approximately 25 percent of the wells are properly and fully permitted. The largest uncertainty with respect to the number of wells present, wells in use, wells permitted, and known well locations appears to be in the North and South Valley. Additionally, there is no apparent and reliable way of estimating how many small-diameter, unpermitted irrigation or outside-only wells may be in use. Many of those wells were originally used for domestic purposes as well and were converted for outside use once supplied water was made available, or many of the wells may have been “self- drilled” without benefit of permit.

Table EX-1. Estimated Number of Wells in Use in Bernalillo County

	East Mountain Area		Far Northeast Height		North Valley / Pardise Hillls		South Valley	West Mesa	TOTALS
	North Portion	South Portion	NAA	Sandia Heights	NV/VLR	PH			
Water Conservation Plan			Combined						
Population	13,050	4854	9405		20,000	15046	46,000	7,000	115,355
Number of Households	5,191	1863	3762		8000	5,787	15,000	2300	41,903
Percent on Wells	43%	79%	34%		Unknown	0%	Unknown	Unknown	- -
Persons / Households	2.5	2.6	2.5		2.5	2.6	3	3.2	- -
Households on Wells	2245	1475	1279		Unknown	0	5500	1700 (estimated)	10,499
Combined # of Wells	**3719**		**1279**		**Unknown**		**5500**	**1700**	**12,198**
From Assessor's Data (2006)	Combined		Combined		Combined		Combined	Combined	
Total Number of Parcels	17466		5697		14650		18642	3966	**60,421**
Improved Assessor's Parcels (>$0	6822		4100		10,110		14290	158	35,480
Mobile Homes	929		0		1677		3056	330	5,992
Total Improved Parcels	7751		4100		11787		17346	488	**41,472**
Major System Connections	2230		2400		10286		10499	16	25,431
Other System Connections	1221		424		591		700	344	3,280
Total System Connections	3451		2824		10877		11199	360	**28,711**
Total Parcels Likely on Wells	**4300**		**1276**		**910**		**6147**	**128**	**12,761**
EH Well Permits	2206		1317		450		1517	70	5,560
Improved Lots with Well Permit	1863		867		328		1487	25	4,570
OSE Well Locations	2190		179		259		718	163	3,509
USGS Inventoried Locations	1751		25		27		425	44	2,272
Percent of Wells with EH Permits	**59%**	**51%**	**103%**	**103%**	**Unknown**	**49%**	**28%**	**25%**	**4%**	**55%**	**46%**
Improved Parcels with Permit	**50%**	**43%**	**68%**	**68%**	**Unknown**	**36%**	**27%**	**24%**	**1%**	**20%**	**36%**

Note: The number of BCEH well permits listed in Table EX-1 includes all permitting actions, including permits that have expired, that remain open, or that are void due to insufficient information having been provided by the applicant (i.e., approximately 13 percent of listed permits County-wide). Consequently, the numbers and percentages indicated in Table EX-1 represent a “best case” scenario with regard to permit compliance. The inherent assumption in using all permit actions regardless of status is that if a permit application was initiated, then a well was likely completed. As a result of that assumption, the estimated compliance rate of 103 percent for the Far Northeast Heights is overstated due to a noticeably greater percentage of expired and voided permits (approximately 20 percent of the total permits for the area). The Far Northeast Heights compliance rate based is more reasonably estimated at 80 to 90 percent.

East Mountain Area (EMA)

Three Program-sponsored monitoring investigations are on-going in the EMA. The County's water level investigation includes routine water level monitoring in a total of 16 wells located throughout the EMA. The water level measurements in those 16 wells are made either continuously with in-well data recorders or are measured quarterly by hand. In 2005, monitoring was limited to only four dedicated monitoring wells located in the northern portion of the EMA. The Program's routine water quality monitoring investigation for the EMA is currently limited to only the four dedicated monitoring wells. In 2007, however, water quality sampling was also conducted for County facilities in the EMA if the facility was dependent on a County-operated well. The third investigation is a cooperative program wherein the USGS provides semi-annual water level monitoring of approximately 20 additional individual domestic wells through the EMA, samples spring flow quality to determine recharge rates, and measures precipitation and associated runoff to determine water budget characteristics. In 2008, the USGS cooperative program also addressed sampling of selected domestic wells for the presences of pharmaceuticals (analyses in process).

Recent USGS studies (report in preparation) conducted in part with County funding, now estimate that recharge from the backslopes of the Sandia Mountains in the northern portion of the East Mountain Area ranges between 1 and 20 percent. The recharge estimates are based on changes in spring water quality. Data do not currently allow delineation of specific areas of high or low recharge values, although there appears to be some correlation to subsurface geologic features. Recharge events are evidenced in the water level hydrographs for some wells, while continued water level declines are seen in others. The well response appears to depend on proximity to arroyos and/or position relative to nearby faults. The recharge events and associated well response appear to depend on the occurrence of intense monsoon rainfall events and on snow melt intensity.

Total EMA water use is estimated at 2,030 acre-feet (Weston 2006) with 1,290 produced from within Bernalillo County and the remainder imported from the Estancia Basin via Entranosa Water and Wastewater Association (EWWA). Approximately 690 feet of groundwater is extracted in the northern portion of the EMA and 600 acre-feet in the southern. Estimates described in this report suggest that between 3,500 and 4,300 parcels are dependent on individual wells. Well permit compliance is estimated to be between 50 and 60 percent.

Coupled with the pattern of groundwater use discussed above, the USGS recharge work suggests that recharge appears adequate to supply current and probable near future water demand from individual domestic wells in the areas west of the Monte Largo Horst (i.e. west of NM 14 and north of I-40) assuming that periods of drought due not exceed five years duration. The existing "excess" groundwater is currently discharged via springs and surface waters along the backslopes of the Sandia Mountains. Recharge estimates are not currently available for the southern portions of the EMA. Water levels for wells on parcels in the southern portion of the EMA appear stable to slightly declining. On that basis, it is conservatively assumed that recharge is currently balanced with well domestic well use. Based on conservative assumptions, there appears to be little excess groundwater available for additional large-scale development in the southern EMA without a resulting decline in groundwater levels.

Of particular concern for continuing water level decline is the area bounded by the Monte Largo Horst, the Tranquillo Pines area, Juan Thomas Rd., and the intersection of I-10 and Mountain Valley Rd. A limited number of hydrographs for wells in this area show a steady and precipitous water level decline through the last several years with little or no evidence of rebound due to recharge events. Based on available OSE well depth and initial water level information, there are an estimated 200 wells throughout this area that may be vulnerable to failure in the event of a drought exceeding 5 years. No County facility wells currently appear threatened as adequate saturated thickness exists for such wells to survive a 5-year drought.

To address this concern, the Program is considering installing additional dedicated monitoring wells and refocusing USGS investigation activities to this vulnerable area. Additionally, there is a need for increased public outreach to realtors and neighborhood associations. Public education is needed to inform the areas residents about the hydrologic complexities of the area, the apparent lack of recharge in portions of the EMA, and the resulting need for conservation and prudent land use planning.

Water quality sampling indicates a continued increasing nitrate trend in one of the EMA monitoring wells, Sandia Park 1. This well is located just west of the intersection of NM 14 and Frost Rd. (i.e., in the Triangle). Current nitrate concentrations are on the order of 4.0 mg/L, following the upward trend of approximately 0.2 to 0.4 mg/L increase per year over the last several years. The available data suggest an out-of-compliance septic system(s) in a nearby, hydrologically upgradient neighborhood.

To address this issue, the Program has initiated conversations with BCEH to further investigate nitrate concerns in the immediate area. Possible outcomes might include a neighborhood-focused well sampling campaign to determine the extent of the problem, a review of existing well and wastewater system status on a parcel-by-parcel basis, and possible enforcement action for unpermitted and/or failing systems.

Recent news releases have indicated a nationwide concern with the presence of unregulated pharmaceuticals in the drinking water supply. In response, the Program in cooperation with the USGS sampled select domestic wells throughout the EMA. Those wells with known elevated nitrate concentrations (including Sandia Park 1 mentioned above) were sampled for wastewater indicator parameters including pharmaceuticals in early May 2008. Analyses results were not available for this report. Additionally, if sufficient funding is available, the USGS will also initiate studies to determine the amount of recharge, if any, that may be attributed to release of treated wastewater from individual households.

Far Northeast Heights Area

Program investigations for the Far Northeast Heights include water level monitoring and sampling of two dedicated monitoring wells (Cedar Hill and San Rafael).

Total diversion of groundwater for the area is estimated at 1,640 acre-feet with about 630 acre-feet of that from individual wells (Weston 2006). The remainder is largely supplied by Sandia Peak Utilities, and to a lesser extent, by small independent community systems and by the Albuquerque Bernalillo County Water Utility Authority (ABCWUA). Estimates based on

population surveys, community system data, and parcel data, suggest that 1250 to 1300 wells are in use in the area. Available date suggests an 80 to 90 percent well permit compliance rate. This unusually high compliance rate is impart due to relatively recent development of the area during which permitting with the BCEH was initiated (i.e., since 1987).

The USGS (Anderholm 2001) has estimated recharge in the Sandia Mountain Subarea to range from 5 to 15 percent and totaling 1,470 to 4,260 acre-feet per year for the entire subarea. The identified subarea extends from South Sandia Peak to Sandia Crest. Approximately 50 to 75 percent of this area likely recharges the aquifers beneath the Far Northeast Heights, resulting in recharge of roughly 1,430 to 2,150 acre-feet per year. This suggests that groundwater use in the Far Northeast Heights may slightly exceed the available recharge source. However, this same recharge source area also supplies water for pumping of the ABCWUA system wells located to the south of area. So, on a regional basis it is known that the resource is overutilized, that water is being removed from geologic storage, and on-going water level declines should be expected.

Water levels in the two measured wells (Cedar Hill and San Rafael) have seen a recent rise after a prolonged period of steadily decreasing water levels. The rise is presumably due to monsoonal events in 2005 and two following years of increased winter snowfall. The stabilization of water levels is also evidenced in the USGS-operated NorEste piezometer nest.

Most wells in Far Northeast Heights appear to have adequate saturated thickness for operation during drought conditions not exceeding a 5-year period. Based on available information, potentially 60 wells could be adversely affected in the event of 5-year drought conditions. County-facility wells in the area are currently undergoing evaluation to determine adequacy of saturated thickness.

Accordingly, current Water Resources Program plans include expansion of the water level monitoring program to an additional five County-facility wells as funding for retrofitting of the wells becomes available. The additional points will provide a better spatial distribution of water level data, consistent with the geologic complexity of the area (i.e. either side of the Eubank fault strand). Water level monitoring in the well at Fire Station #5 may also help assess whether any significant recharge occurs in the large flood retention dam located south of the well. An additional monitoring point in the north and eastern portions of the Far Northeast Heights is warranted as are the addition of water level and water quality sampling points in Sandia Heights and possibly in the Tierra Monte and Sandia Heights North neighborhoods.

Available water quality data indicates that there are no particular concerns with water quality in the Far Northeast Heights based on the two wells sampled. One of the wells does indicated nitrate concentrations of 3.6 mg/L, but the concentration appears to be steady and not rising. There is some indication of marginally elevated nitrate concentrations (less than 2 mg/L) is some domestic wells. Unknown is the concentration of nitrates in the Sandia Heights and Tierra Monte neighborhoods where groundwater levels are relatively shallow and the areas's associated septic tank discharges overlay the area of mountain front recharge for the aquifers that flow westward toward the Rio Grande.

North Valley / Paradise Hills Area

There are no active County monitoring program in the North Valley or Paradise Hills area. Principally this is because a high percentage of the population is served by ABCWUA for both water and sewer, and the Paradise Hills area is served by New Mexico Utilities. Spot sampling is conducted by the Program in association with dewatering pumping for utility installation on an as-needed / as available basis.

The USGS maintains piezometer nests around the periphery of the North Valley area to evaluate effects from ABCWUA pumping. Water level trends in the USGS piezometers are mixed. There appears to be some stabilization of water levels where ABCWUA has decreased pumping. Others in the interior portion of the valley continue to show gradual declines in water levels.

Estimating the total number of wells in use in the North Valley is problematic because households may have multiple sources of water (ABCWUA, Middle Rio Grande Conservancy District, and private wells). Development history for the area includes the initial use of well followed by expansion and connection of households to the public supply system. Based on Assessor' parcel data and public supply system connection data, it appears that approximately 1,000 parcels may currently be dependent on individual domestic well. However, if it is assumed that approximately 10,000 developed parcels were initially dependent on individual wells, it is unsettling that less than 10 percent of the parcels can currently be associated to a known or permitted well location and that less than 40 percent of wells probably in use are appropriately permitted. This lack of certainty may be due in part to the existence of a large number of wells prior to OSE and BCEH requirement for well permits and lack of compliance with requirements throughout the intervening years.

Additionally, there is currently no reliable method to determine how many additional wells may be in use for irrigation or outdoor-only purposes, or which may be cross-connected to an existing community system. Many of those "unknown" wells were originally used for domestic purposes and were converted for outside use once supplied water was made available, the wells may have been forgotten but not properly abandoned, or many of the wells may have been "self-drilled" without benefit of permit.

Further action is needed in cooperation with BCEH to identify those parcels without water system connection, to determine whether wells are in use, and whether such wells are appropriately permitted. An effort is also needed to ensure proper abandonment of unused wells throughout the North Valley area. Currently, such activities are limited only to review of those properties undergoing some type of subdivision or permitting action. Discussion is also needed to determine whether landowners in new subdivisions to be supplied water by the ABCWUA should be allowed to drill new wells to provide water for outdoor irrigation purposes or whether such action is contrary to water conservation and the current requirements of the Subdivision Ordinance.

South Valley Area

Program monitoring activities in the South Valley include quarterly water level measurement and annual sampling in six wells or piezometers clustered at two separate locations. An additional

five wells at various County facilities are slated for inclusion into the water level monitoring program as facilities are connected to ABCUWA and as the wells can be retrofitted for monitoring purposes.

Approximately 50 percent of water used in South Valley comes from individual wells and totals approximately 3,150 acre-feet. Based on population data, parcel data, and water system data, it is estimated that there are between 5,500 and 6,150 parcels dependent on individual wells. Well permit compliance is estimated to be as low as 34 percent. Perhaps 44 percent of well locations are known.

Similar to the North Valley, total well use and the total number of wells in use is difficult to estimate because many parcels are supplied water from with multiple sources. Again, there is currently no reliable method to determine how many additional wells may be in use for irrigation or outdoor-only purposes, or which may be cross-connected to an existing community system. Many of those "unknown" wells were originally used for domestic purposes and were converted for outside use once supplied water was made available, the wells may have been forgotten but not properly abandoned, or many of the wells may have been "self-drilled" without benefit of permit.

Similar to the North Valley, further action is needed in cooperation with BCEH to identify those parcels without water system connection to determine whether wells are in use and whether such wells are appropriately permitted. An effort is also needed to ensure proper abandonment of unused wells throughout the South Valley area. As with the North Valley, such activities are limited only to review of those properties undergoing some type of subdivision or permitting action.

There are some limited concerns with water quality. County sampling from both shallow (<500 feet) and deep wells indicates that arsenic, iron, manganese, and aluminum may exceed drinking water standards in some areas of the South Valley. Such concentrations are likely naturally occurring, though elevated iron and manganese concentrations in the shallowest wells (150 feet depth) may also be related to the use of individual wastewater systems.

West Mesa Area

Water Resources monitoring programs for the West Mesa include annual sampling and quarterly water level measurements from five wells clustered at three locations.

According to Weston (2006), it appears, based on population and survey data, there are likely some 1,700 households dependent on individual wells (Weston 2006). However, review of Assessor's parcel data and public supply records suggest the number may be substantially lower (100 to 200 wells). Drought vulnerability cannot be estimated due to lack of permitted wells and records. It also appears that well permit compliance is between only 4 to 15 percent.

With respect to water level trends, the trends are both depth and location dependent. Overall, water level rises are seen in the central portion, but gradual decreases are occurring further west. Additionally, in the west, declines are evidenced in shallow portions of aquifer, while deeper portions show a continual rise.

There are no current plans for significant changes or modification in the West Mesa monitoring program One possible expansion is the addition of an existing deep monitoring well located off of 108th street on SunCal property. If access can be obtained from SunCal, the measurements from the well may used to replace the loss of data from the 98th street USGS piezometer nest which was destroyed by development in 2005.

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BACKGROUND INFORMATION

Groundwater monitoring activities are conducted throughout Bernalillo County by the Bernalillo County Public Works Division (BCPW). Such activities are performed by the Water Resources Program (the Program). The Program is responsible for groundwater monitoring and planning, providing low-income assistance for water and sewer connections, addressing stormwater quality management, and for administering the County's water conservation efforts.

Ordinances and Regulations

Bernalillo County reviews the use and regulates the protection of groundwater through the subdivision, water well, wastewater system, water conservation, and utility ordinances. The ordinances provide for the Programs review of major subdivision applications and special use permits with respect to water resource availability, water conservation plans and requirements, and stormwater quality management. The County provides for permitting, and inspection of all wells and wastewater systems and other environmental concerns through the efforts of BCEH. These subject ordinances are promulgated and implemented within the context of State-level regulations (i.e., Office of the State Engineer (OSE) and New Mexico Environment Department (NMED)).

During 2007-2008, the Program has been active in defining the water use and water conservation requirements for subdivision applications and special use permit reviews. These activities have included clarifying the extent and intent of ABCWUA water conservation restrictions listed in availability letters, developing water use and water conservation calculations spreadsheets, resolving water availability issues for major utilities, and developing review guidelines for water conservation plans.

The County does not administer the ownership, application, transfer or adjudication of water rights nor does it oversee drinking water systems operations or groundwater contamination investigations and clean-ups. The County does, however, inform and provide comment to the respective State agencies concerning such matters.

The review and planning functions performed by the Program are informed by the participation in various regional water planning organizations and by conducting on-going groundwater monitoring and investigations. The various investigations are performed in accordance with the Groundwater Protection Policy and Action Plan, and as requested by various County agencies.

GPPAP and WQPAB

As described in the initial report (McGregor 2007), the groundwater monitoring and investigation activities of the Program are directed towards the goals stated in the GPPAP previously adopted by the Bernalillo County Board of Commissioners. The GPPAP goals are three-fold

- **Protect the ground-water resources**
- **Find and clean-up contaminated groundwater; and**
- **Promote the coordinated and prudent use of the ground-water resource through the region.**

With the Albuquerque Bernalillo County Water Utility Authority (ABCWUA) converting from primary groundwater use to use of San Juan Chama Water, the joint City-County Groundwater Protection Advisory Board (GWPAB) was expanded to include ABCWUA representatives and to addressed surface water quality issues. Accordingly, the board was renamed the Water Quality Protection Advisory Board (WQPAB).

Previous Monitoring Report

The *Bernalillo County Regional Groundwater Monitoring Report* (McGregor 2007) was produced by BCPW in February 2007. That report was an extensive analysis of groundwater monitoring programs then supported or performed by the Program. That report provided detailed information and descriptions of administrative and geographic subdivisions of the County as it pertains to groundwater monitoring programs, information and description of monitoring well construction, monitoring well locations, and water level monitoring techniques. It also included a brief discussion of water quality analysis protocols, the applicability of U.S. EPA's National Primary and Secondary Drinking Water Standards, and a discussion of water quality presentation formats. The report provided a detailed discussion of trends and observations in available water level and water quality data. The reader is referred to that document as the detailed information contained therein will be included by reference only in this and future updates to that report.

Water quality and water level data provided in the February 2007 report covered data obtained from the inception of the monitoring programs through December 2005. In the interim, additional water quality samples from Bernalillo County monitored wells have been analyzed, additional water levels have been measured, and the various monitoring programs have been revised to better focus estimations of available water quantity and the interrelationship between climatic events and effects on water levels. This Update addresses the data collected between December 2005 and May 2008.

Primary and Secondary Drinking Water Standards

Reference is made throughout the Update to the U.S. EPA's National Primary and Secondary Drinking Water Standards. Those standards are summarized in Tables 1a and 1b. The National Primary Drinking Water Standards are expressed as Maximum Contaminant Levels (MCLs) for a prescribed list of compounds. The MCLs have been promulgated based on the potential for health-based effects and costs of treatment and availability of treatment technology. They are used to limit the levels of contaminants in public water supplies. While these standards are enforceable standards only for public water supply systems, they are useful for providing a quantitative measure of water quality. Maximum Contaminant Level Goals (MCLGs) are also health-based standards. MCLGs are concentrations below which there is no known or expected health risk.

Table 1a. Primary Drinking Water Standards for Inorganic Parameters

Contaminant	MCLG (mg/L)	MCL or TT (mg/L)	Potential Health Effects from Ingestion of Water	Sources of Contaminant in Drinking Water
Antimony	0.006	0.006	Increase in blood cholesterol; decrease in blood sugar	Discharge from petroleum refineries; fire retardants; ceramics; electronics; solder
Arsenic	0	0.010 as of 01/23/06	Skin damage or problems with circulatory systems, and may have increased risk of getting cancer	Erosion of natural deposits; runoff from orchards, runoff from glass & electronics production wastes
Asbestos (fiber >10 micrometers)	7 million fibers per liter	7 MFL	Increased risk of developing benign intestinal polyps	Decay of asbestos cement in water mains; erosion of natural deposits
Barium	2	2	Increase in blood pressure	Discharge of drilling wastes; discharge from metal refineries; erosion of natural deposits
Beryllium	0.004	0.004	Intestinal lesions	Discharge from metal refineries and coal-burning factories; discharge from electrical, aerospace, and defense industries
Cadmium	0.005	0.005	Kidney damage	Corrosion of galvanized pipes; erosion of natural deposits; discharge from metal refineries; runoff from waste batteries and paints
Chromium (total)	0.1	0.1	Allergic dermatitis	Discharge from steel and pulp mills; erosion of natural deposits
Copper	1.3	TT Action Level=1.3	Short term exposure: Gastrointestinal distress Long term exposure: Liver or kidney damage People with Wilson's Disease should consult their personal doctor if the amount of copper in their water exceeds the action level	Corrosion of household plumbing systems; erosion of natural deposits
Cyanide (as free cyanide)	0.2	0.2	Nerve damage or thyroid problems	Discharge from steel/metal factories; discharge from plastic and fertilizer factories
Fluoride	4.0	4.0	Bone disease (pain and tenderness of the bones); Children may get mottled teeth	Water additive which promotes strong teeth; erosion of natural deposits; discharge from fertilizer and aluminum factories

Table 1a. Primary Drinking Water Standards for Inorganic Parameters (continued)

Contaminant	MCLG (mg/L)	MCL or TT (mg/L)	Potential Health Effects from Ingestion of Water	Sources of Contaminant in Drinking Water
Lead	zero	TT Action Level=0.015	Infants and children: Delays in physical or mental development; children could show slight deficits in attention span and learning abilities Adults: Kidney problems; high blood pressure	Corrosion of household plumbing systems; erosion of natural deposits
Mercury (inorganic)	0.002	0.002	Kidney damage	Erosion of natural deposits; discharge from refineries and factories; runoff from landfills and croplands
Nitrate (measured as Nitrogen)	10	10	Infants below the age of six months who drink water containing nitrate in excess of the MCL could become seriously ill and, if untreated, may die. Symptoms include shortness of breath and blue-baby syndrome.	Runoff from fertilizer use; leaching from septic tanks, sewage; erosion of natural deposits
Nitrite (measured as Nitrogen)	1	1	Infants below the age of six months who drink water containing nitrite in excess of the MCL could become seriously ill and, if untreated, may die. Symptoms include shortness of breath and blue-baby syndrome.	Runoff from fertilizer use; leaching from septic tanks, sewage; erosion of natural deposits
Selenium	0.05	0.05	Hair or fingernail loss; numbness in fingers or toes; circulatory problems	Discharge from petroleum refineries; erosion of natural deposits; discharge from mines
Thallium	0.0005	0.002	Hair loss; changes in blood; kidney, intestine, or liver problems	Leaching from ore-processing sites; discharge from electronics, glass, and drug factories

Table 1a. Primary Drinking Water Standards for Inorganic Parameters (continued)

Contaminant	MCLG (mg/L)	MCL or TT (mg/L)	Potential Health Effects from Ingestion of Water	Sources of Contaminant in Drinking Water
Alpha particles	none ---------- zero	15 picocuries per Liter (pCi/L)	Increased risk of cancer	Erosion of natural deposits of certain minerals that are radioactive and may emit a form of radiation known as alpha radiation
Beta particles and photon emitters	none ---------- zero	4 millirems per year	Increased risk of cancer	Decay of natural and man-made deposits of certain minerals that are radioactive and may emit forms of radiation known as photons and beta radiation
Radium 226 and Radium 228 (combined)	none ---------- zero	5 pCi/L	Increased risk of cancer	Erosion of natural deposits
Uranium	zero	30 ug/L as of 12/08/03	Increased risk of cancer, kidney toxicity	Erosion of natural deposits

Notes

Source: http://www.epa.gov/safewater/mcl.html#mcls last visited on 3/09/06

[1] Definitions:

Maximum Contaminant Level (MCL) - The highest level of a contaminant that is allowed in drinking water. MCLs are set as close to MCLGs as feasible using the best available treatment technology and taking cost into consideration. MCLs are enforceable standards.
Maximum Contaminant Level Goal (MCLG) - The level of a contaminant in drinking water below which there is no known or expected risk to health. MCLGs allow for a margin of safety and are non-enforceable public health goals.
Maximum Residual Disinfectant Level (MRDL) - The highest level of a disinfectant allowed in drinking water. There is convincing evidence that addition of a disinfectant is necessary for control of microbial contaminants.
Maximum Residual Disinfectant Level Goal (MRDLG) - The level of a drinking water disinfectant below which there is no known or expected risk to health. MRDLGs do not reflect the benefits of the use of disinfectants to control microbial contaminants.
Treatment Technique - A required process intended to reduce the level of a contaminant in drinking water.

[2] Units are in milligrams per liter (mg/L) unless otherwise noted. Milligrams per liter are equivalent to parts per million.

Table 1b. Secondary Drinking Water Standards for Inorganic Parameters

Constituent	Secondary Contaminant Level
Aluminum	0.05 to 0.2 mg/L
Chloride	250 mg/L
Color	15 (color units)
Copper	1.0 mg/L
Corrosivity	Noncorrosive
Fluoride	2.0 mg/L
Foaming Agents	0.5 mg/L
Iron	0.3 mg/L
Manganese	0.05 mg/L
Odor	3 threshold odor number
pH	6.5-8.5
Silver	0.10 mg/L
Sulfate	250 mg/L
Total Dissolved Solids	500 mg/L
Zinc	5 mg/L

The MCLGs are non-enforceable and are more restrictive than the MCLs; therefore, this report does not use the MCLGs as a basis for comparison, though the reader may make such a comparison using the values for the MCLGs.

The National Secondary Primary Drinking Water Standards (or Secondary Standards) are not enforceable guidelines. The Secondary Standards are set based on the potential for cosmetic effects (e.g., tooth discoloration) or aesthetic effects (e.g., taste, odor, or color). The Secondary Standards quantify a potential "nuisance" threshold for groundwater users and the report, therefore, uses the Secondary Standards as a basis for comparison.

Geographic Subdivision

For convenience of discussion, the unincorporated portions of the County have been subdivided into five geographic areas as shown in Figure EX-1: the East Mountain Area (EMA), the Far Northeast Heights, the North Valley / Paradise Hills Area, the South Valley Area, and the North Valley Area.

- The **EMA** includes the eastern third of Bernalillo County and encompasses the area from the Sandia and Manzano Mountains eastward to the County line. The EMA encompasses portions of three different OSE groundwater basins: The Middle Rio Grande Basin, the Sandia Basin, and the Estancia Basin.

- The **Far Northeast Heights** includes North Albuquerque Acres (NAA) and Sandia Heights. The southeast quarter of the area falls with the OSE's Critical Management Area of the Middle Rio Grande Basin, wherein special administrative rules apply for permitting new and replacement wells.

- The **North Valley / Paradise Hills** area includes the north central portion and a small portion of the northwestern quadrant of the Albuquerque metropolitan area. Generally speaking, the North Valley is bounded by Edith Boulevard to the east, the Rio Grande Bosque to the west, and lies north of I-40. The Paradise Hills area has been lumped with the North Valley area as a matter of convenience for discussion.

- The **South Valley** encompasses the area from Central Avenue to the Isleta Pueblo, from Coors Road to I-25, and eastward to Kirtland AFB and City of Albuquerque (CABQ) boundaries.

- The **West Mesa** generally includes all areas of the County west of Coors and Unser Boulevards and extending to the tribal lands to the northwest, west, and southwest. The Northwest Mesa, West Mesa, and Southwest Mesa (Pajarito Plateau) above the ceja (ridge) are largely undeveloped.

EAST MOUNTAIN AREA

Background

There are three, on-going Program-sponsored groundwater monitoring programs investigations in the EMA. Since issuance of the February 2007 report, the Program has initiated water level monitoring in three operating County-owned wells. (FS#10, FS #11 Substation, and Whispering Pines Senior Center). Water level monitoring has also been instituted in an additional eight locations in the EMA, resulting in addition of a total of eleven wells to the monitoring system. Seven of the eleven wells are now equipped with continuous water level data recorders. Additionally, the Program continues to collects annual samples from four monitoring wells located along NM 14 (Sandia Park 1 and 2, Pinon Ridge, and Sierra Vista). The four wells are equipped with continuous water level measuring devices that are maintained and monitored by the USGS through a cooperative agreement arrangement discussed below. That program also provides for continuous water level monitoring in a well at Carlito Springs, although the well is not routinely sampled. Hydrographs for monitored wells are provided in Appendix A.

There are two County - USGS cooperative agreements for the EMA. The first provides for the USGS's monthly sampling of springs along the backslopes of the Sandias to determine groundwater recharge rates, measuring water levels semiannually in 20 individual domestic wells located throughout the EMA, maintaining data recorders in the four monitoring wells discussed above, and maintaining five precipitation stations throughout the EMA. A USGS report summarizing data collected to date is in preparation. Sampling of select wells for pharmaceuticals and wastewater derivatives was completed in May 2008 under an extension to the first agreement. The second agreement was set in place to try to correlate precipitation data across the EMA and determine whether there is any relationship between precipitation events, arroyo flows, and changes in nearby water levels. A third cooperative agreement slated to begin in FY 08-09 will be used to determine the amount of recharge that may be occurring from individual domestic wastewater systems.

Well Use in the EMA

Figures 1 and 2 show the approximate location of wells monitored by the County and the USGS in the EMA. The approximate location of known domestic and public supply wells is also shown.

According to the Water Conservation Plan (Weston 2006), approximately 57 percent of the population in the northern half of the EMA are served by a water utility, while in the southern portion less than 30 percent are served by water utility. The northern half of the area is served by one large water utility provider (EWWA), and eleven other smaller subdivision-specific community systems. The southern half of the area is served by only five small community systems. The remainder of the area residents and businesses are served by individual or shared well systems. With the exception of EWWA, the community and non-community water supply wells are generally located along the NM 14 / NM 337 corridor.

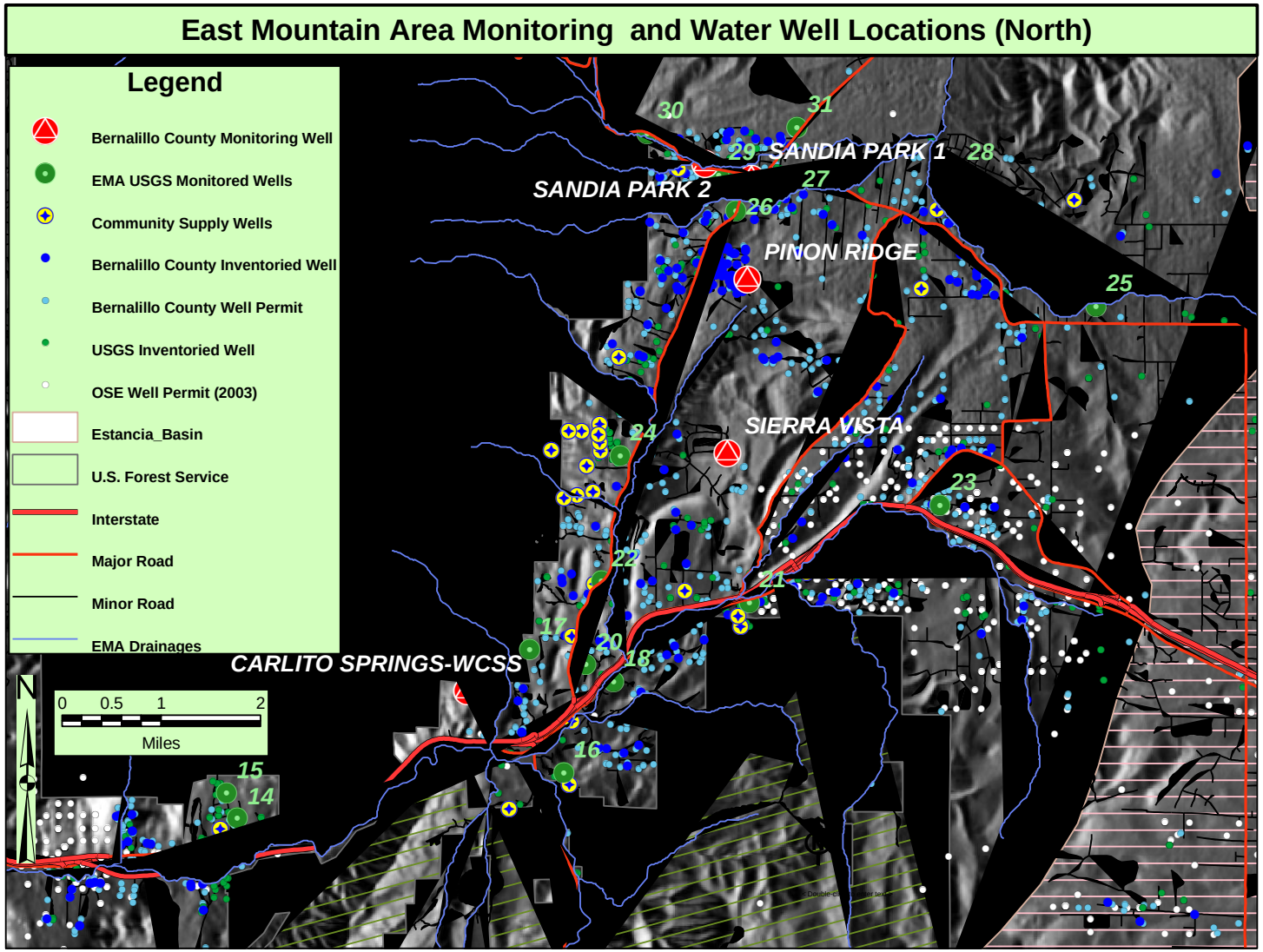

Figure 1. East Mountain Area Wells (North Portion)

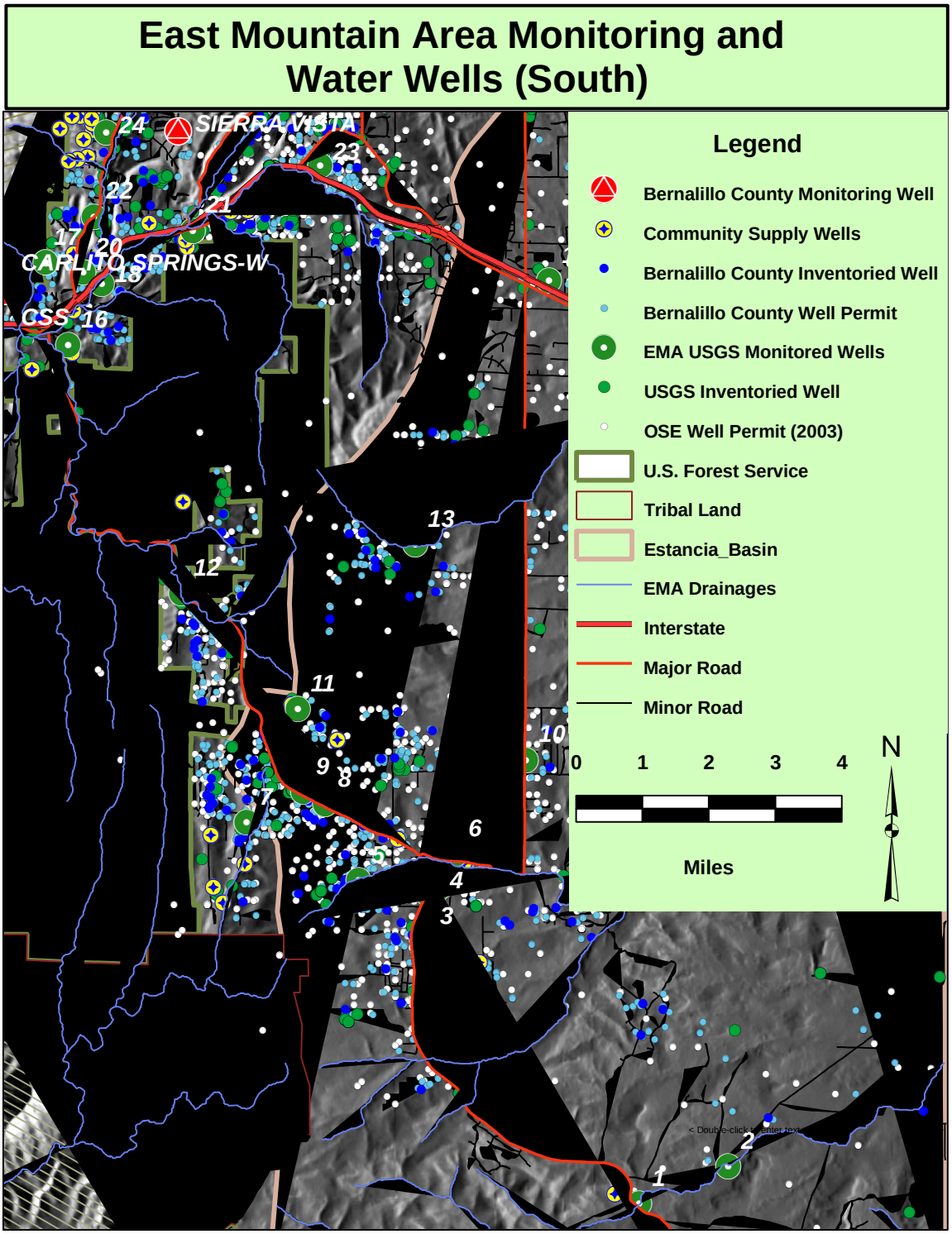

Figure 2. East Mountain Area Wells (South Portion)

Domestic well use ranges from 43 percent of the population in the northern portion of the EMA to over 70 percent in the southern portion (Weston 2006). The report indicates that total water use, including groundwater supplies provided by utilities and water importated from the Estancia Basin, is on the order of 656 million gallons per year, or roughly 2,030 acre-feet per year. Of that amount, approximately 745 acre-feet is imported by the Estancia Basin via Entranosa Water and Wastewater Association (EWWA (based on an assumed use of 0.25 acre-feet per connection). This suggests a total groundwater diversion of 1,290 acre-feet from the portions of the Rio Grande Basin, the Sandia Basin, and the Estancia Basin located within the EMA.

The Water Conservation Plan (Weston 2006) suggests that the total volume of domestic well use for the East Mountains is approximately 427 million gallons per year (1324 acre-feet), about 40 acre-feet greater than that calculated by subtracting the Entranosa supply from the total EMA use. Water use in the northern portion of the EMA is estimated at about 461 million gallons (1,429 acre-feet) of which approximately one-half is imported from the Estancia Basin via EWWA. This suggests that total groundwater diversion solely from within the northern portion of the EMA amounts to approximately 690 acre-feet. In the southern portion of the EMA, the total groundwater use is estimated at 194 million gallons or about 601 acre-feet per year, with only minor portions being supplied by EWWA.

Weston (2006) further states that there are approximately 10,000 households in the EMA, and by use of the above stated percentages and average per captia household size, it appears that some 3719 households in the EMA are dependent on individual domestic wells for their water supply. Evaluation of the number of households on individual domestic wells can also be estimated using other means.

Based on the 2006 Assessor's Parcel records available via the Bernalillo County website, there are 6822 EMA parcels with an improved value greater than "zero" and an additional 929 mobile homes, suggesting a total of 7751 potential households or business properties. Based on the number of connections for each system as presented on the NMED Drinking Water Watch website (http://eidea.state.nm.us/SDWIS), community systems provide water to approximately 1221 households or business, and information from EWWA suggests that EWWA serves an additional 2230 connections within Bernalillo County. Subtracting the number of total number of connections (3451) from the total number of developed parcels (7751) suggests 4300 parcels may be dependent on individual wells.

The County's KIVA system indicates only 2206 EH well permits for the entire East Mountain Area (including those that have been voided or expired), suggesting a permit compliance rate of less than 50 to 60 percent of the known or suspected wells that are likely in use.

Groundwater Level Monitoring Results for the EMA

Appendix A contains a series of hydrographs of available water level measurements for the four Bernalillo County monitoring wells monitored by the USGS, other monitoring wells maintained solely by the County, operating County-facility wells tracked by the Program, and select individual domestic wells measured semi-annually by the USGS.

In general the water level data indicate that recharge is occurring in the northern portion of the EMA west of the Tijeras fault zone. A recent USGS report (in preparation) indicates that the recharge rate for elevations above 7,500 feet on the Sandia backslopes may range from 1 percent to as great as 20 percent of the annual precipitation. The report, and the associated well hydrographs, suggests that recharge may be associated with arroyo areas, that the percentages may be related to geologic structures, and that recharge may only occur when there are significant monsoonal events and/or intense snow melt activity. Recent rises in water levels in the northern EMA appear to be associated with snow melt activity of the last few seasons, as evidenced in the hydrographs for SP-1 and SP-2 as shown in Figure 3. These recharge, high water level events are clearly seen in Figure 3 in March 2005 and again in June of 2007. A response to monsoonal rains is shown in September/October of 2005.

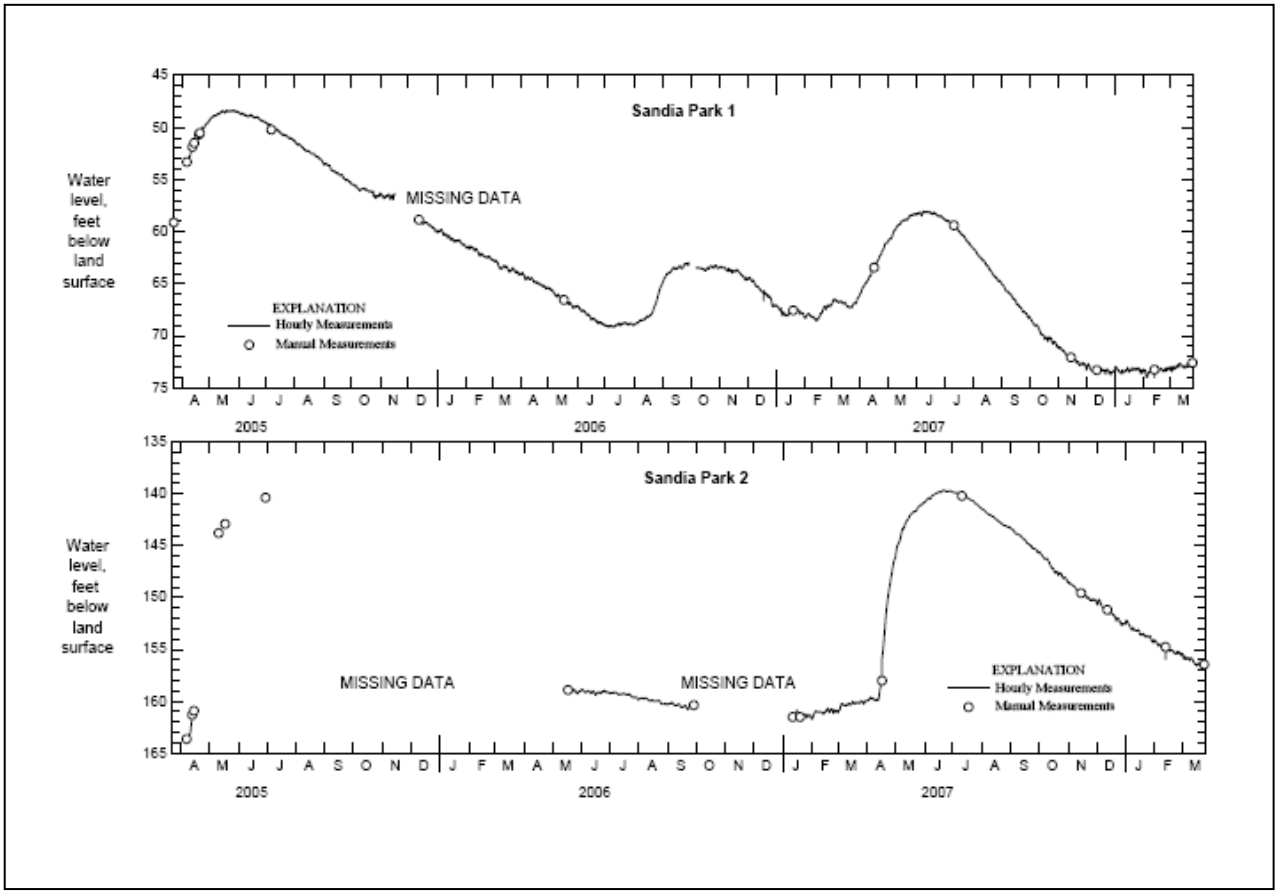

Figure 3. Continuous Hydrographs for Sandia Park 1 and 2

Despite the noted recharge events, there are portions of the EMA where water levels have not recovered despite two years of significant snowfall. (See USGS Domestic Well hydrographs in Appendix A.) These areas occur east and south of the Monte Largo horst and appear to extend south of I-25 to near Juan Thomas and south along NM 337. Water levels in the remainder of the southern EMA appear to have remained steady or are declining only slightly. Figure 4 illustrates this concern with water level measurements taken from an individual domestic well

located in the Sandia Knolls area. This hydrograph shows a nearly 50-foot decline in water levels since 1990, and no response to precipitation events in 2005, 2006, or 2007.

The implication is that wells in areas with minimal recharge (i.e. east central parts of the EMA) are at risk of running dry due to decline in regional groundwater levels associated with drought conditions unless initial well construction provided "adequate wet length" as a contingency for such an event.

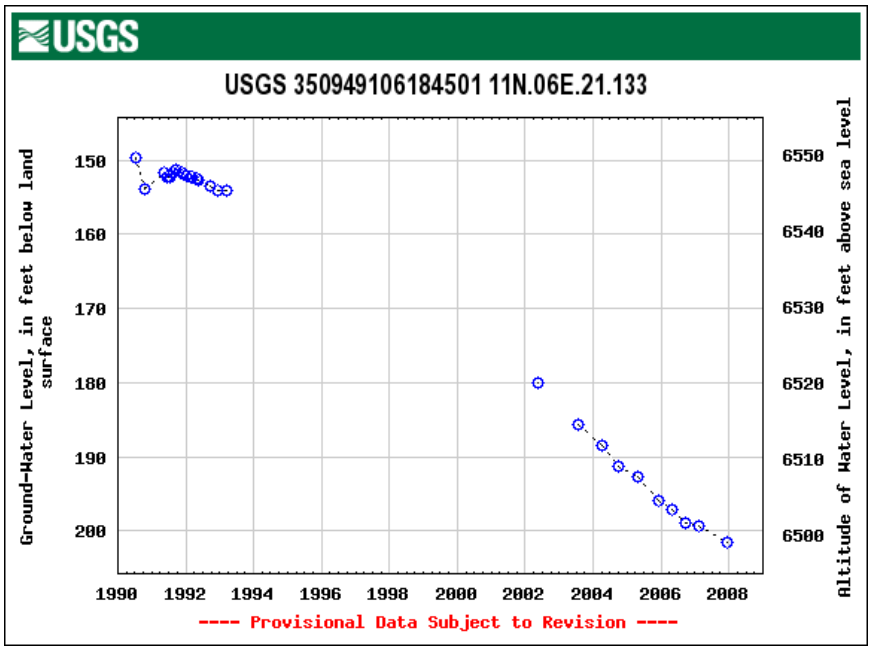

Figure 4 Hydrographs for a Domestic Well near Sandia Knolls

A review of the hydrographs of concern (see Appendix A) suggests that drought declines in excess of 20 to 40 feet occurred during 2002 to 2005. If another 5-year drought occurs, an additional water level decline of 40 feet could reasonably be expected. This suggests that wells with less than 100 feet of saturated thickness (80 feet of drought decline, plus 20 feet for minimal operation) when originally drilled may be particularly vulnerable. Available information indicates that the average saturated thickness of the permitted wells in the area of concern is approximately 170 feet.

A review of OSE database records downloaded in 2003 suggests that as many as 500 wells may exist in the area of concern. But given a 50 percent permit compliance rate, the number of wells could actually be as high as 1,000. Approximately 25 percent of the wells may be vulnerable to another period of drought due to insufficient initial saturated thickness. This suggests that as many as 200 wells in the east-central EMA may be vulnerable under a multi-year drought scenario. The vulnerable wells appear to be concentrated in the Sedillo Hill area. This may warrant installation of a dedicated monitoring well(s) in this are to better track water level fluctuations and to better advise area residents.

Water level records for the wells in use at County facilities are also provided in Appendix A. These hydrographs show the change in non-pumping (static) and pumping (drawdown) water levels. Comparison the of the existing water level, the amount of drawdown caused by pumping, and the total depth of the wells indicate that the County-owned pumping wells have sufficient saturated thickness to continue operating through another 5-year drought period. No immediate action is needed with regard to ensuring sufficient quantity of supply from these wells, although there are some site security and permitting issues which are currently being addressed by the Program.

Groundwater Quality Monitoring Results for the EMA

In addition to the annual sampling program of four monitoring wells, water quality samples were taken from County–facility supply wells during 2007-2008 to verify suitability for drinking water quality. The results of that work are summarized in Appendix F. Irrigation-only wells and dedicated monitoring wells were not sampled. Those wells registered as public water supply systems are routinely monitored per state regulatory requirements and were not resampled.

In the EMA, water quality concerns exists for **Fire Station #10** and for the **EMA Transfer Station** due to high total dissolved solids, chlorides, sulfates, manganese, and iron. Bottled water is supplied for these facilities. **Fire Station #11 Substation** is an unmanned station. Water samples from that well did not meet drinking water standards for public supply system for total dissolved solids and pH, but do not pose a significant health threat due to limited, if any, consumption of the water. The drinking water standards were met for the **Whispering Pines Senior Center,** which is currently undergoing registration as a community-supply system.

A thorough analysis of past water quality data through December 2005 for the four dedicated monitoring wells was provided in the initial report (McGregor 2007). Additional water samples were collected from the four joint USGS-County monitored wells in fiscal year 2006-2007. The results of those analyses are discussed with respect to the findings in the February 2007 report.

Sandia Park 1

McGregor (2007) indicated a concern with rising concentrations in nitrate and total dissolved solids in Sandia Park 1 (see Figure 5 below) and denoted that Secondary Drinking Water Standards for total dissolved solids and chloride have been consistently exceeded. The analyses results for chloride (490 and 340 mg/L) and total dissolved solids (1,100 and 1,100 mg/L) for 2006 and 2007 indicate that the total dissolved solids and chloride concentration have decreased or remained stable. However, nitrate concentrations (3.5 and 4.0 mg/L) have continued to increase though they remain below drinking water standards (10 mg/L). Sandia Park 1 was sampled for volatile organic compounds in 2007. There were no reported detections of volatile organic compounds.

At the current rate of increase, nitrate concentrations may exceed drinking water standards within the next five years. This suggests that identification of the source of nitrate concentration needs to be addressed, and that a potential threat exists to well users in the vicinity of the unidentified threat, particularly to young children.

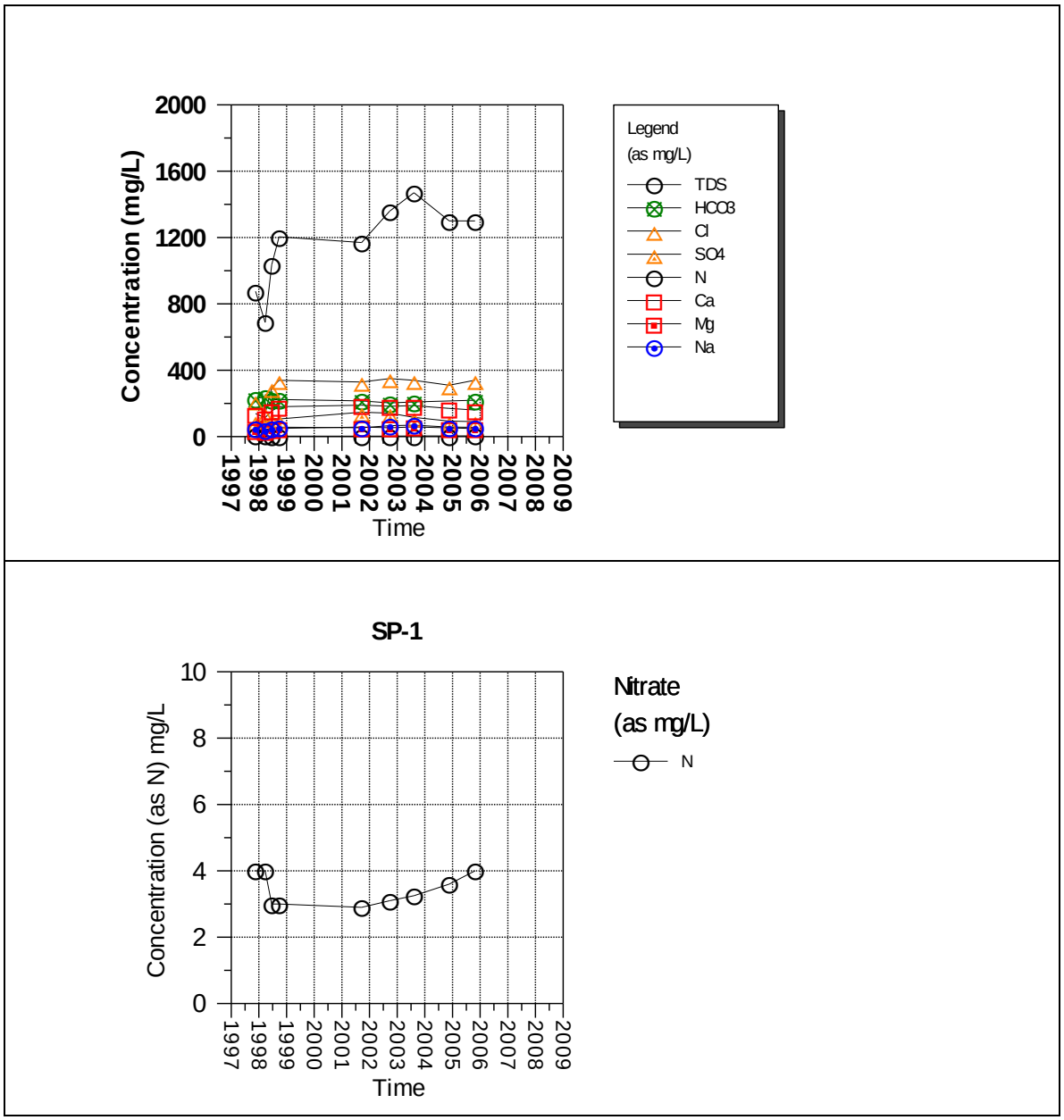

Figure 5 Water Quality Summary for Sandia Park 1

Sandia Park 2

Water quality results for Sandia Park 2 have consistently indicated that water quality does not exceed the Primary Drinking Water Standards. Parameters have regularly exceeded Secondary Drinking Water Standards for total dissolved solids, iron, manganese, and for aluminum. Results from 2006 are consistent with the previous results and include: total dissolved solids (450 mg/L), iron (11.0 mg/L), manganese (0.5 mg/L), and for aluminum (16.0 mg/L). The 2006 data continue to indicate no significant trends. Sandia Park 2 was sampled for volatile organic compounds in 2006. There were no reported detections of volatile organic compounds.

Pinon Ridge

To date, none of the samples from the Pinion Ridge well have exceeded any of the Primary Drinking Water Standards. Secondary Drinking Water Standards are consistently exceeded for total dissolved solids, iron, manganese, and aluminum. For 2006, the respective concentrations were measured at 830 mg/L, 0.56 mg/L, 0.09 mg/L, and 0.160 mg/L. There are no significant trends in the groundwater data. Pinon Ridge was sampled for volatile organic compounds in 2006. There were no reported detections of volatile organic compounds.

Sierra Vista

To date, none of the samples from the Sierra Vista well have exceeded any of the Primary Drinking Water Standards. Secondary Drinking Water Standards for total dissolved solids, iron, and aluminum have been consistently exceeded. Sample results for 2006 for the three parameters (660 mg/L, 1.60 mg/L, and 1.90 mg/L) are consistent with the previous findings. The total dissolved concentrations, while decreasing from the first sampling event, appears to have stabilized over the last three sampling periods. Iron and aluminum concentrations remain slightly elevated (<2 mg/L).

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FAR NORTHEAST HEIGHTS AREA

Background

The Program's groundwater monitoring activities for the Far Northeast Heights currently includes annual sampling and quarterly water level measurement of two wells (San Raphael and Cedar Hill). The San Raphael wel was equipped with a continuous water level recorder in October 2006. The water level recorder was temporarily removed in February 2008 due to equipment malfunction and is scheduled for replacement during 2008-2009. The Cedar Hill well water level is monitored quarterly by hand.

County facilities in the area are supplied by individual wells and include Fire Station #5, Altamont Little League, Sherriff's Communication Center, Big Sky Hang Glider Park, and Vista Sandia Equestrian Center. Those wells are deep and of small diameter and, consequently, are currently inaccessible for water level measurements. As funding and scheduling allows, the County facility wells will be equipped with measuring tubes to allow routine water level monitoring. In March 2008, the Altamont Little League drinking supply well was so equipped, and Fire Station #5 was retrofitted in May 2008. The USGS maintains a piezometer nest in the northeast portion of the area (NorEste Piezometer) through non-County funded programs.

Well Use in the Far Northeast Heights Area

Figure 6 provides an overview of well locations in the Far Northeast Heights Area. .Sandia Peak Utilities serves approximately 94 percent of the residents of the Sandia Heights, while four small community systems service approximately 3 percent of the remaining are residents. ABCWUA-services extend along the south and west of the area and serves an additional small percentage of the area residents and businesses (Weston 2006). Almost all of the residents in North Albuquerque Acres are dependent on individual domestic wells. Overall, the Water Conservation Plan (Weston 2006) indicates that 34 percent of the area's residents are dependent on individual domestic wells.

The total diversion of groundwater is estimated to be about 527 million gallons per year, or about 1640 acre-feet per year. Of that amount, about 630 acre-feet is estimate to be taken from domestic wells, while the remainder is taken chiefly by Sandia Peak Utilities.

Weston (2006) indicates that there are approximately 9,400 residents and the average household size is 2.5 persons. This equates to approximately 3,700 households with about 1250 households being dependent on individual or shared wells. Alternately, evaluation of the number of households on domestic wells can be estimated based on Assessor' parcels and BCEH records.

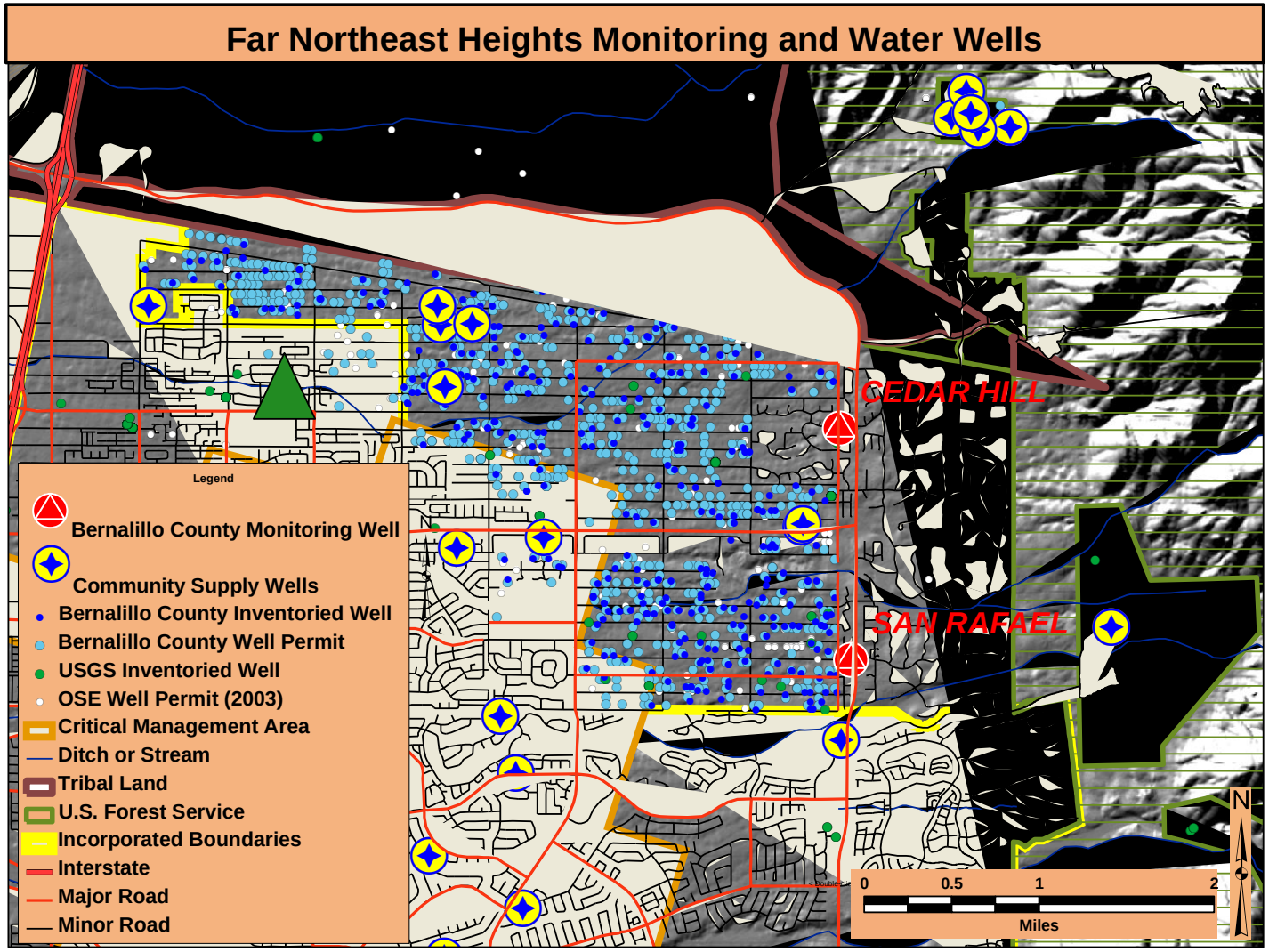


Figure 6. Far Northeast Heights Area Wells

Based on the 2006 Assessor's Parcel records, there are some 5,663 parcels in the Far Northeast Heights Area. Of these, 4,100 parcels are listed as having improved value greater than "zero" thereby suggesting 4,100 potential households or business properties. Based on the NMED Drinking Water Watch website, Sandia Peak Utility lists some 2,400 connections and smaller systems account for at least 105 additional connections. Furthermore, some 319 improved parcels are within 100 feet of ABCWUA waterline locations. This suggests that the remaining 1,276 improved parcels are serviced by individual domestic wells. This agrees favorably with the estimated 1,250 domestic well households suggested in the Water Conservation Plan (Weston 2006).

The KIVA permitting system indicates the initiation of 1,317 permits in the Far Northeast Heights area, suggesting a very high degree of well permitting compliance (in excess of 100 percent). A review of the permit records suggests that 269 of the listed permits are either void or expired, suggesting approximately 1,131 "valid" permits. This suggests a slightly lower and more realistic compliance rate of nearly 90 percent. However, a comparison of lots with improved value greater than "zero" also containing a well permit suggest that only 890 such lots exist. Subtracting the 890 "permitted" lots from the total of 1,250 lots that are likely on domestic wells suggest that as many as 360 lots may not be properly permit, though likely less assuming some error in the plotted location for existing permits. This suggests a worst case scenario of a 70 to 80 percent well permit compliance..

Furthermore, available downloads from the OSE database only indicates 179 wells in the area – Because issuance of OSE permits is required prior to issuance of the EH permits, the low number of located wells is surprising and suggests a high degree of inaccuracy in the OSE database locations for this area.

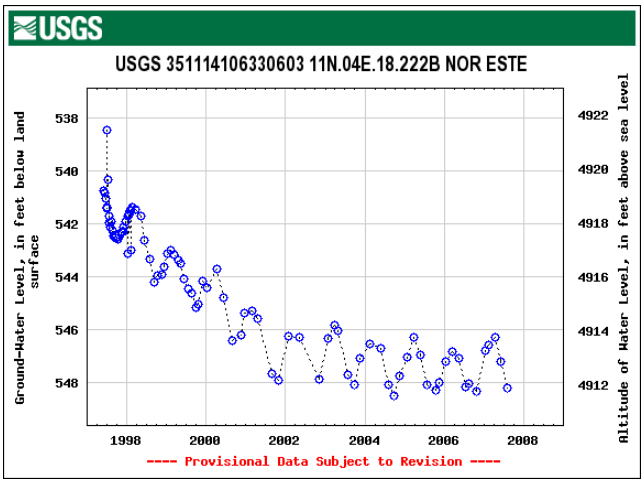
Groundwater Level Monitoring Results for the Far Northeast Heights

Appendix B contains a series of hydrographs for the two County-maintained monitoring wells and for the nearby USGS piezometer nest. In general, the water level data indicate that water use in the area has historically exceeded a truly sustainable supply, resulting in water level declines on the order of 0.5 feet to 1.0 feet per year.

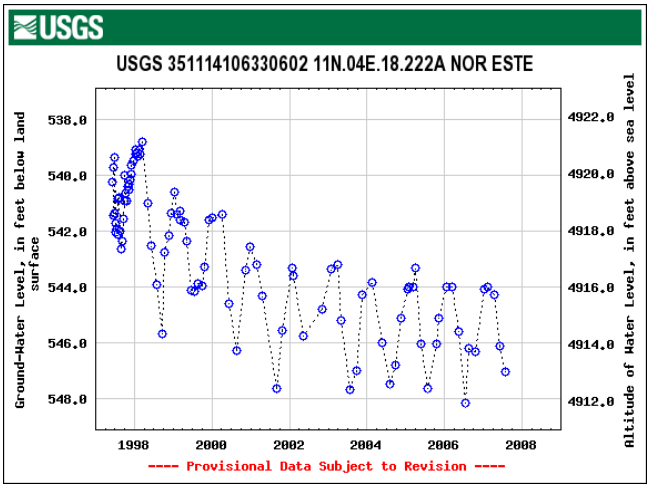
The steady decline of water levels is best illustrated by water level measurements taken in March 2008 in the Altamont Little League drinking water well. When originally drilled in 1987, the proof of completion record indicated a depth to water of 780 feet. In March 2008, the depth to water was measured at 810 feet. This indicates a total decline of 30 feet in approximately 30 years or a rate of decline of one-foot per year. The rate of decline is similar to that noted for the USGS maintained NorEste piezometer located near La Cueva High School (see Figure 7).

The most recent data from the USGS and the County monitored wells indicate a slight rise or stabilization of water levels, rather than a continuing decline. Possible explanations include the possibility of heavy snowfall events having occurred in the mountain front recharge areas which border the eastern edge of the area boundary, or possibly decreased pumping of nearby wells by Sandia Peak Utilities and ABCWUA. Continued monitoring is needed to verify whether the stabilization is temporary or longer term.

At 608 feet



At 1193 feet



At 1525 feet

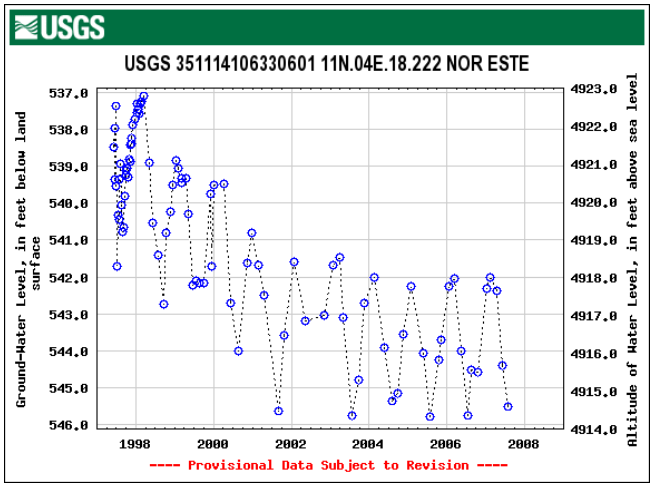


Figure 7. Hydrographs from the USGS NorEste Piezometer Nest

A brief review of available well depth and corresponding water level depth information from both the EH Permit Files and the available OSE database download suggest that the domestic well depths in the Far Northeast Heights ranges from as little as 125 to as deep as 1130 feet and average about 782 feet. Reported depth to water ranges from as little as 12 feet to as deep as 870 feet, and average 562 feet. Associated saturated thickness ranges from 65 feet to 600 feet and averages 220 feet.

Assuming an average rate of decline of 1 foot per year, and assuming a minimum of 30 feet of saturated thickness to allow pump operation, then a minimum of 100 feet of saturated thickness is needed to ensure on-going operation of the domestic wells for a 70-year period. Based on the available data, it appears that most wells in the Far Northeast Heights have sufficient saturated thickness for on-going operations. Assuming that four percent of the wells are deficit in that respect and also assuming an 80 percent permit compliance rate, approximately 60 wells are potentially at risk from insufficient water supplies over a 70-hear period. All but the shallowest of wells are likely sustainable during a 5-year drought period.

Groundwater Quality Monitoring Results for the Far Northeast Heights

In addition to the annual sampling program, water quality samples were taken from County – facility supply water wells during 2007-2008 to verify suitability for drinking water quality. The results of that work are summarized in Appendix F. Irrigation-only wells and dedicated monitoring wells were not sampled. Those wells registered as public water supply systems are routinely monitored per state regulatory requirements and were not resampled.

In the Northeast Heights, water quality samples were taken from the wells at **Fire District 5, Sheriff's Command Center, and Vista Sandia Equestrian Park**. None of the parameters for these samples exceeded any of the Primary or Secondary Drinking Water Standards.

A thorough analysis of past water quality data through December 2005 for dedicated monitoring wells was provided in the February 2007 report (McGregor 2007). Additional water samples were collected from the San Raphael and Cedar Hill wells in 2006-2007. The results of those analyses are discussed with respect to the findings in the February 2007 water report.

San Raphael

Results of the 2007 sample were consistent with results from past sampling events. There are no discernible trends in the parameter concentrations through time. Volatile organic compounds were sampled and analyzed but none were detected. For the 2006-2007 event, parameter concentrations did not exceed the Primary or Secondary Drinking Water Standards.

Cedar Hill

Results of the 2007 sample were consistent with results from past sampling events. There are no discernible trends in the parameter concentrations through time. Volatile organic compounds

were sampled and analyzed but none were detected. For the 2006-2007 event, parameter concentrations did not exceed the Primary or Secondary Drinking Water Standards.

With respect to nitrate concentrations, there was no notable change. Nitrate concentrations were reported as 3.6 mg/L, identical to the concentration in the previous year's sample. While slightly elevated compared to background concentrations, there does not appear to be any increasing trend.

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NORTH VALLEY / PARADISE HILLS AREAS

Background

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. Those well fields are actively monitored by the ABCWUA. Other smaller utilities are also present in the North Valley. The USGS, via cooperative agreements with the ABCWUA, monitors piezometer nests on the perimeter of the North Valley area. Paradise Hills is serviced by New Mexico Utilities. Information on wells in the area of New Mexico Utilities is not readily available. Hydrographs for the wells monitored by the USGS are provided in Appendix C.

Well Use in the North Valley and Paradise Hills Areas

Figure 8 provides an overview of wells locations in the North Valley and Paradise Hills Areas. Two large entities, ABCWUA and New Mexico Utilities, provide services to the vast majority of residents of the North Valley and Paradise Hills Areas. Much of the North Valley is served by the ABCWUA, while the Paradise Hills area is served by New Mexico Utilities. Estimated diversion for New Mexico Utilities is listed in the Water Conservation Plan as 0.7 million gallons per year (2.2 acre-feet per year) for the Bernalillo County portion of the system.Total system diversion for New Mexico Utilities is in excess of 8,000 acre-feet per year for their entire service area.

Originally, the North Valley area was dependent on individual wells. Many of those wells have been retained for use for irrigation and livestock watering, while the interior household supplies are from one of the major utilities. The current use of individual domestic wells appears to be chiefly limited to use of the wells for irrigation and/or outdoor use purposes rather than for domestic consumption. The Water Conservation Plan (Weston 2006) does not provide estimates of the number of wells or identify the number of households that may be dependent on individual domestic wells.

Estimating the number of wells in use for outdoor purposes is problematic because:

1) many of the households in the area were originally supplied by wells prior to the availability of public water supply,

2) many of the wells were drilled prior to permits being required by the OSE or by the County,

3) many of the wells may have been drilled without permits initially, even though required, and/or may have been abandoned without notification to the OSE or the County,

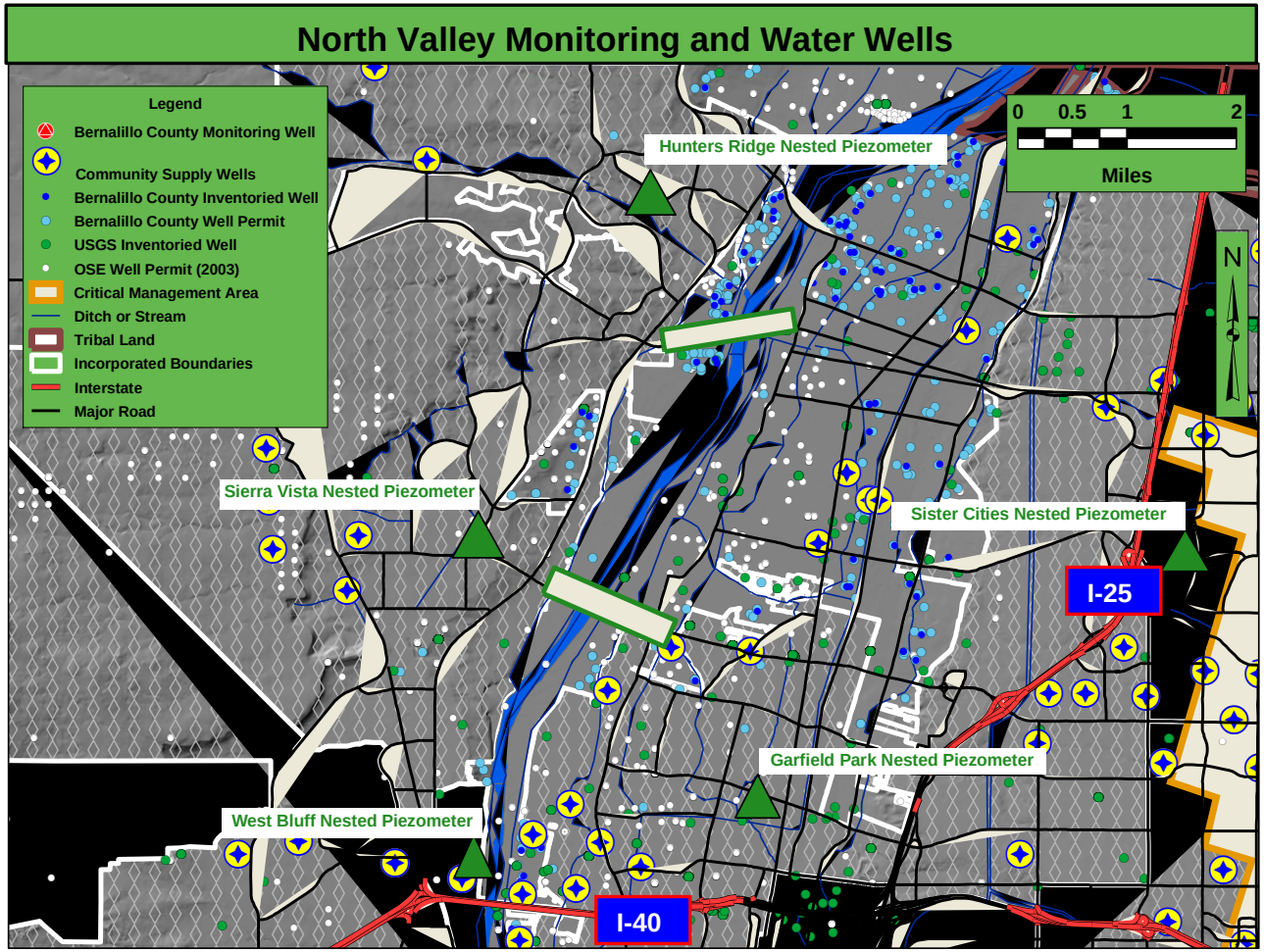

Figure 8. North Valley Area Wells

4) the wells may still exist, but are no longer in use, though not abandoned, and

5) there has never been a thorough door-to-door well inventory conducted by the OSE, USGS, or by the County due to the extensive effort that would be required to do so.

Currently available records, which are known to be deficient, indicate the area encompasses approximately 259 known OSE well permit locations, approximately 450 initiated BCEH well permits, and 27 USGS inventoried wells with at least one water level measurement. Given an approximately 10,000 parcels in the area, most of which predate the expansion of water service to the area by ABCWUA, the number of "known" well locations likely represent less than 10 percent of the wells potentially present in the area.

The number of parcels still dependent on individual domestic wells for domestic supply can be estimated by comparing the number of Assessor's Parcels with value greater than zero to the number of known water service points. The Assessor's Parcels records indicate that there are approximately 10,110 parcels with value greater than "zero" in the North Valley area. Of these, approximately 7,900 contain a recognized water service point, although there are about 9000 water service points listed for the area. The Water Conservation Plan (Weston 2006) also indicates that proximately 1379 residents (or an equivalent of 551 households) are connected to smaller, independent utility systems. A review of the NMED Drinking Water Bureau website suggests a total of 591 household connections for the North Valley Area, excluding the ABCWUA and New Mexico Utilities

This suggests between 1,000 and 2,200 developed parcels may be dependent on individual wells for domestic water supply (or about 10 to 20 percent of total developed parcels). However, there are only 434 initiated well permits for the area, suggesting that less than 40 percent of the existing wells in use for household supply are permitted. This may be because permitting of the wells with Environmental Health was not required until 1987 and much of the development of the North Valley occurred prior to that time. This estimate does not address the high likelihood of parcels which are connected to the ABCWUA or other system which also have unpermitted wells that are used for outdoor uses.

The Assessors Parcels database indicates that there are 2198 parcels with improved values greater than zero in the Paradise Hills area. The Water Conservation Plan (Weston 2006) suggests a total of 2,314 connections (based on 2.5 persons per household). There is only one EH Well Permit listed for the area. Clearly, there is minimal individual domestic well use in the area.

Groundwater Level Monitoring Results for the North Valley and Paradise Hills Areas

Bernalillo County does not actively monitor groundwater levels in the North Valley or Paradise Hills area. Because the area is heavily serviced by the ABCWUA and by New Mexico Utilities and the number of residents dependent on wells for domestic water supply is low compared to the East Mountains and South Valley, water level monitoring efforts are directed elsewhere.

The USGS, however, does maintain water level monitoring piezometer nests near the perimeter of the North Valley area. Hydrographs for those wells are provided in Appendix C. Location of the piezometer nests are provided in Figure 8.

Garfield Park

The Garfield Park piezometers, at all depths, indicate a one-half to one foot rise in water levels in the last two years.

Sister Cities

The Sister City piezometers indicate a stabilization and two feet rise in water in the last two years. This may be due to decreased pumping of nearby well fields, although detailed pumping records have not been evaluated.

West Bluff

Water levels in the West Bluff piezometers continue to decline. Water level measurements for 2007-2008 at each of the various depths are typically one to two feet deeper than the corresponding measurement for 2006-2007.

Sierra Vista

The Sierra Vista piezometers continue to indicate a steadily declining water level, at a rate of approximately one foot per year. The recovery seen in the piezometer nests east of the river are not indicated for the Sierra Vista piezometer nest. This may be due to continued growth, and the requisite increase in water use despite water conservation measures, for development of westside communities.

Hunters Ridge

Water level trends in the Hunters Ridge piezometer are representative of conditions in the Paradise Hills area and largely reflect the effects of pumping by New Mexico Utilities and to a lesser degree by the City of Rio Rancho. Compared to the 2006 measurements, it appears that water levels in the Hunter Ridge piezometers have either stabilized or water levels are slightly rising.

Groundwater Quality Monitoring Results for the North Valley and Paradise Hills Areas

The County does not actively monitor water quality in the North Valley or Paradise Hills Areas.

Water quality samples were taken from County–facility supply water wells during 2007-2008 to verify suitability for drinking water quality. The results of that work are summarized in Appendix F. Irrigation-only wells and dedicated monitoring wells were not sampled. Those wells registered as public water supply systems are routinely monitored per state regulatory requirements and were not resampled. In the North Valley area, water quality samples were taken from the wells at the **Bachechi Open Space (domestic well) and the Sheriff's Posse Arena**. The domestic well at the Bachechi Open Space exceeded the Secondary Standards for iron and manganese. The Sheriff's Posse arena (lease to a private entity) exceeded the Secondary Standard only for manganese. Concentrations of all other drinking water parameters were below the respective standard.

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SOUTH VALLEY AREA

Background

The groundwater monitoring program for the South Valley area includes annual sampling of two jointly operated County-USGS piezometer nests (Rio Bravo and Isleta). The USGS maintains continuous water level measurements at these locations as well at two other locations in the South Valley through non-County funded programs. The City and the County also perform annual compliance monitoring at the now-closed South Broadway landfill under separate programs.

A limited number of County facilities in the area are supplied by individual wells and/or use wells for irrigation supplies. Facilities depending on wells for drinking water currently include the Fire Training Academy and the Los Padillas complex. Other facilities have converted to ABCWUA supplied water, but either have unused wells on the properties (e.g. Fire District #3, District #4 Main and former District #4 Substation, Peanut Butter and Jelly School, and Pajarito Senior Meal Site), or utilize wells for outside uses such as irrigation and livestock (e.g. Sanchez Farms, Mountain View Community Center, District #4 Main, Dennison Polo Park, Raymac Park, Journal Pavilion). The water resources program is currently initiating an effort to address the well status, permitting, and use of all such wells. The water level monitoring program for the South Valley will be expanded as the wells are properly permitted and retrofitted to allow for monitoring use.

Well Use in the South Valley Area

Figure 9 provides an overview of well locations in the South Valley Area. The Water Conservation Plan (Weston 2006) estimates that approximately 5,500 of the15,000 homes in the area rely on domestic wells. That number has since been reduced as the ABCWUA water system now extends as far south as Raymac Rd.

The Water Conservation Plan (Weston 2006) indicates that there are approximately 15,000 households in the South Valley Area. Approximately 9,000 households have water connections from the ABCWUA, and smaller water systems account for an additional 700 connections. The Water Conservation Plan indicates that approximately 5,500 homes are dependent on wells for their household needs. Further it estimates that approximately half of the 2 billion gallons (6,800 acre-feet) of water used annually comes from domestic wells, or approximately 3,150 acre-feet.

Similar to the North Valley, the South Valley was initially developed with a heavy dependence on individual well use. As the ABCWUA system expanded, households have connected to the public supply system, but existing individual wells may or may not have been have been retained for outdoor use only. Similarly, identifying the total number of wells in use, and determining whether those uses are for household or outdoor use is problematic.

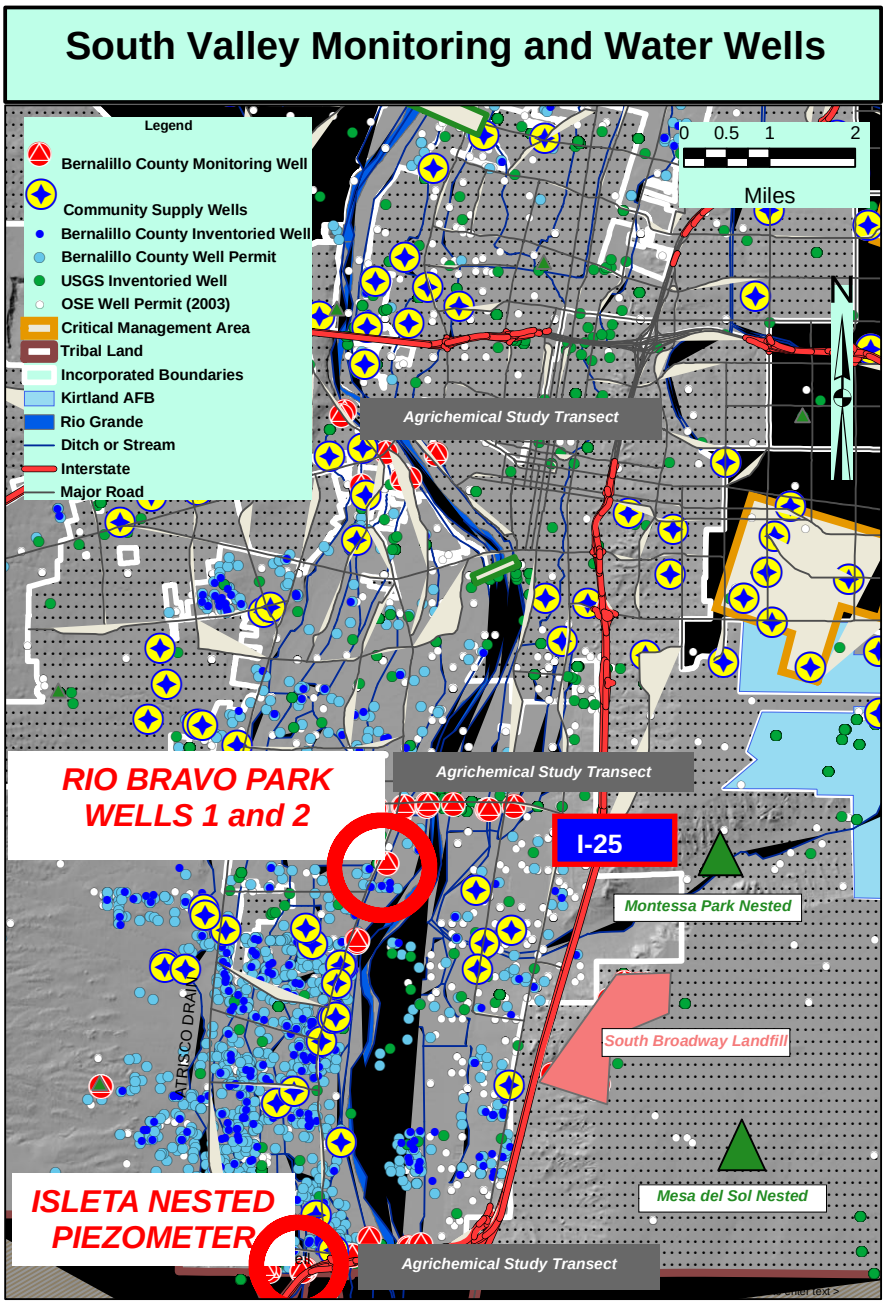

Figure 9. South Valley Area Wells

The number of parcels dependent on individual domestic wells can also be estimated based on the Assessors' Parcels with value greater than "zero" when compared to the number of known water service points. The Assessor's Parcels records indicate a total of 14,290 parcels with an improved value greater than zero and 3,056 mobile homes, suggesting a total of 17,346 developed parcels. This would include both households and business locations. ABCWUA records compared to the improved parcels and mobile home locations suggest 9,180 of the improved parcels are connected to water and approximately 1,319 are within 100 feet of a water service point. Combined, this suggests that approximately 10,500 of the developed parcels are connected to the ABCWUA. A review of the NMED Drinking Water Watch website confirms the estimate of approximately 700 connections to smaller drinking water systems - primarily mobile home park facilities. Added to the estimate of ABCWUA connections, this suggests 11,200 of the developed parcels are on some type of public supply. This leaves a maximum of approximately 6,150 developed parcels that are presumably dependent on individual or shared domestic wells. At a minimum, the number of improved parcels without water service points or EH well permits is 2,772, and the number of mobile homes not near a water service point is 1,743, suggesting a minimum of 4,515 parcels dependent on individual wells.

A review of available well databases indicates only 1571 initiated BCEH well permits in the South Valley, 718 located OSE well permits, and 425 USGS inventoried wells with at least one water level measurement. This suggests that at best, permit compliance is as little as 34 percent, and known versus suspected wells is no better than 44 percent.

Groundwater Level Monitoring Results for the South Valley Area

The Program performs only limited water level monitoring in the South Valley. However, the USGS maintains continuous water level monitoring devices in two jointly-monitored locations, at other USGS-maintained locations, and in ABCWUA municipal wellfields. Hydrographs for the various wells are provided in appendix D.

Rio Bravo Wells

The Rio Bravo wells are located off of Isleta Blvd. and south of Rio Bravo Blvd. near the South Valley Little League fields. Significant changes were noted in water levels in both the deep and shallow piezometers compared to previous year's data. The water levels continue to reflect seasonal water changes, with maximum values occurring during spring melt and high-river stages. In the shallow well, high measurements were noted in late 2007, and exceeded water levels measured since 2001 by about one-half foot, reaching 6 feet below ground surface. The deep piezometer water level measurements appear to have increased during 2007, and may have temporarily halted the downward decline of 2 feet per year that has occurred since 1999.

Isleta Wells

The Isleta piezometer nest is located off of I-25 near the Isleta Tribal Lands northern boundary. There are no significant changes in water level trends in this set of piezometers. The shallowest two piezometers continue to show seasonal fluctuations, with the same fluctuations seen at the intermediate level, but about six months out of phase, suggesting recharge from the shallower to the intermediate zones. The intermediate zone however, continues to show a gradual decrease in water level of no more than 0.5 feet per year. This is offset by the continued rising water level in the deepest of the four piezometers at the site – suggesting drainage / recharge from the intermediate to the lowermost zone.

San Jose #9

Water levels in San Jose Well 9 indicate an approximate 2 to 3 feet increase in water levels since 2006. This corresponds with rises in the Rio Bravo piezometers and may reflect recent good "snow years" and possibly reduced pumping by the ABCWUA.

Montessa Park

The Montessa Park piezometers are located in Tijeras Arroyo near the southwest boundary of Kirtland AFB. The piezometers continue to show decline rates on the order of 1 foot per year at all depths, with strong seasonal fluctuations of seven feet evidenced in the intermediate depth well. This fluctuation likely represents continued pumping from wells at the UNM Championship Golf Course and the Kirtland AFB series of wells.

Mesa Del Sol

There are no significant changes occurring in water levels in the Mesa Del Sol nested piezometers. The rate of decline in water levels continues at 0.5 to 1 foot per year. Vertical flow continues from the shallowest and deepest zones into the intermediate pumped zones. These groundwater conditions represent the combined effects of pumping to supply irrigation at the Mesa Del Sol regional complex, nearby dairying operations, and Kirtland AFB operations.

Groundwater Quality Monitoring Results for the South Valley Area

Water quality samples were taken from County-facility supply water wells to verify suitability for drinking water quality. The results of that work are summarized in Appendix F. Irrigation-only wells and dedicated monitoring wells were not sampled. Those wells registered as public water supply systems are routinely monitored per state regulatory requirements and were not resampled.

In the South Valley Area, water quality samples were taken from the emergency supply well at **Fire District 4 Main** on Don Felipe Rd. and at the **Fire Prevention Training Center** located on Prospect Ave.

Fire District 4 Main is supplied water by the ABCWUA. Well water is not used for human consumption at the facility. The well sampled is maintained as an emergency back-up only. All of the contaminants and indicators that exceeded guidelines are listed as Secondary Drinking Water Standards and included: chloride, iron, manganese, color, total dissolved solids, and turbidity. Whether the sample is representative of groundwater quality or reflects the infrequent use of the well and inadequate well flushing prior to sampling is not known.

Until May 2008, the Fire Training Academy was supplied by an individual well.. The water sample from the well indicated that arsenic levels exceeded the Primary Drinking Water Standard, leading to the plans to convert the facility to ABCWUA supply. The sample results also indicated that the Secondary Standards for chloride, iron and turbidity were exceeded. With its increased use as the Fire Training Academy, the well would have required registration as a community system. As a result, the facility is now connected to the ABCWUA supply and he well will be retained for monitoring purposes.

The County annually samples the Rio Bravo and Isleta piezometer nests.

Rio Bravo

The 2006-2007 water samples from the two Rio Bravo piezometers are consistent with previously sampling results and no significant changes or additional trends are noted. Both piezometers indicated that the groundwater exceeds the Primary Drinking Water Standards for arsenic, with concentrations ranging from not detected to a concentration of 0.05 mg/L in RB-1, the deeper of the two piezometers. Arsenic concentrations (0.26 mg/L) in RB-2 also exceed the standard of 0.01 mg/l. Secondary Drinking Water Standards are not exceeded. The wells continue to remain free of volatile organic contamination and there is no indication of elevated nitrate concentrations in either of the two wells.

Isleta

The 2006-2007 water samples from the four Isleta piezometers are consistent with previous sampling results and no significant changes or additional trends are noted. Groundwater samples have not exceeded the Primary Drinking Water Standards with the exception of arsenic (0.045 and 0.090 mg/L) in the two deepest wells, with the greatest concentration of 0.090 mg/L having been detected in Isleta 1, the deepest of the four piezometers. Concentrations for iron (1.6 and 0.55 mg/L) and manganese (0.03 and 1.30 mg/L) continue to exceed the Secondary Drinking Water Standards in the deepest and intermediate shallow wells. Concentrations for aluminum (2.7 mg/L) again exceeded the Secondary Drinking Water Standard in the deepest of the four wells (Isleta 1). The wells continue to remain free of volatile organic contamination and there is no indication of elevated nitrate concentrations in any of the piezometers.

WEST MESA AREA

Background

The Program's monitoring activities for the West Mesa Area includes the annual sampling of the Niese Rd. piezometer nest (one site containing three piezometers), and two dedicated monitoring wells: the 9-Mile Hill well, located at the closed County Dump, and the Paradise Rd. well located at the ABCWUA soil amendment facility northwest of Double Eagle Airport. The USGS monitors water levels at one additional piezometer nest (Westgate Heights) and in select ABCWUA-supply wells.

Only one County facility located on the west mesa utilizes an individual well; the Dennison Park Cowboy Polo facility. The well is used for livestock and dust control only. The supply well at the Metropolitan Detention Center is owned and operated by the ABCWUA and is not further addressed in this report.

Well Use in the West Mesa Area

Figure 10 provides an overview of well locations on the West Mesa. The Water Conservation Plan (Weston 2006) indicates that there are approximately 2,300 households in the West Mesa area and that only 159 households have connection to the ABCWUA. There are approximately 400 connections to other smaller water systems. Domestic wells are estimated to provide water for up to 1,700 households, based on a population and census track data.

The number of parcels dependent on individual domestic wells can also be estimated based on the Assessors' Parcels with value greater than "zero" and then compared to the number of known water service points and connections. The Assessor's Parcel information suggests that there are approximately 4,000 parcels of records. Of these, only 158 have improved values greater than zero. At this point, the Water Conservation Plan (Weston 2006) and the Assessor's parcels records widely diverge with respect to the number of households present in the West Mesa.

This may be reflective of inaccuracies or dated information in the Assessor's records or an overlap in boundaries with the South Valley Area. Using the number of Assessor's parcel improved values greater than "zero" and adding the number of mobile homs suggest a minimum of 488 households may be present. Of these parcels, it appears that 128 have no water connection and it is presumed that they are serviced by individual domestic wells.

There are only 70 EH-issued well permits for the West Mesa. At best, there is only a 54 percent compliance rate for well permitting on the West Mesa, and it may be substantially lower. Based on the assumed 1,700 households (Weston 2006), the compliance rate could be as low as four percent.

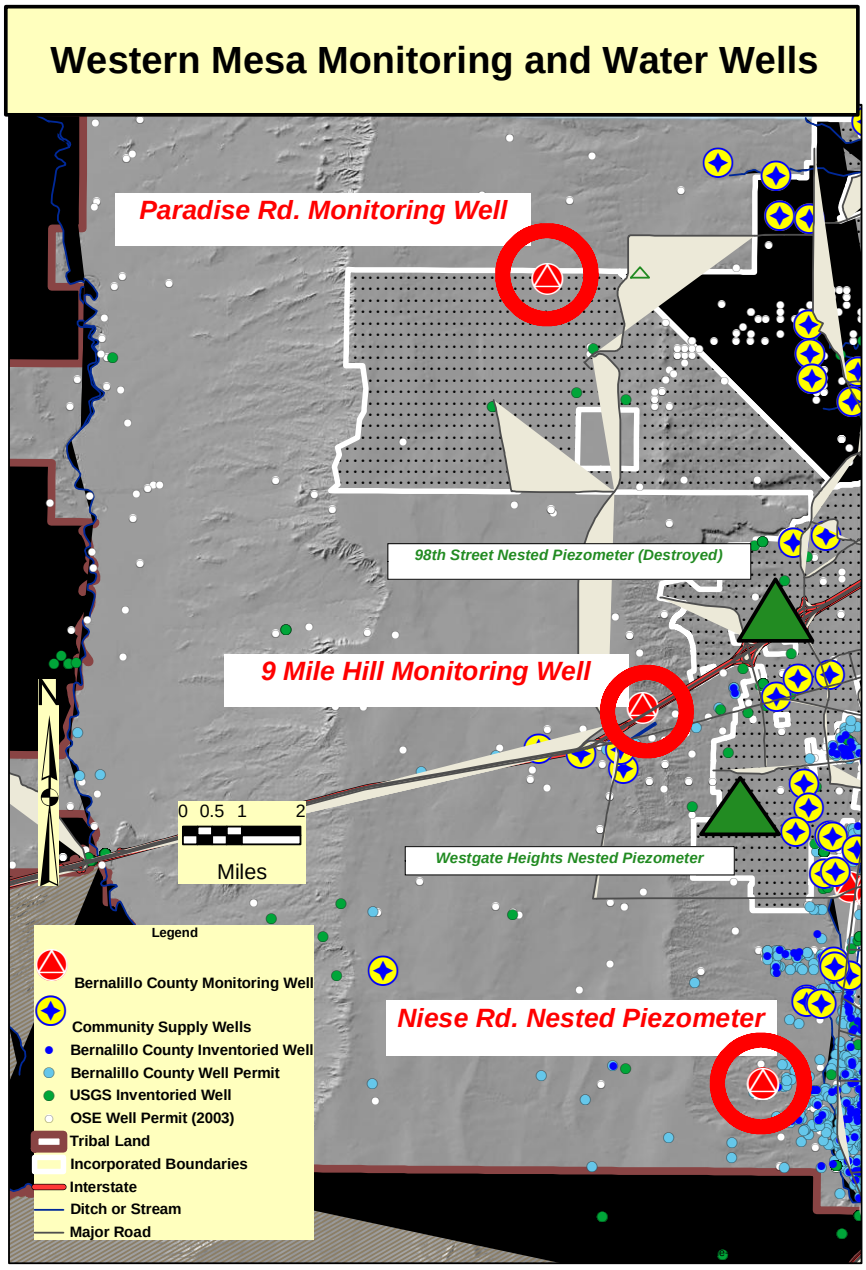

Figure 10. West Mesa Area Wells

Groundwater Level Monitoring Results in the West Mesa Area

Groundwater level monitoring is conducted by the County on an annual basis at three locations in the West Mesa Area. Hydrographs are provided in Appendix E.

9-Mile Hill

The last four measurements in the 9-Mile Hill well consistently indicate that water levels are on the order of 710 feet, rather than the 690 feet indicated for 2003. It is believed that those previous measurements may have been made using a pumping rig depth indicator that has since been shown to have a depth error of 10 to 20 percent over the total depth indicated. None the less, water levels in 2008 are approximately 5 feet higher that accurately measure in 2005. The reason for the rise is not known.

Paradise Rd.

The hydrograph for the Paradise Rd. well indicates that water levels have decreased approximately 1 foot between 2001 and 2008, or approximately 0.1 ft per year - a barely discernible rate. However, given the general lack of pumping in the area, this does raise concerns with respect to water supplies for future development.

Niese Rd.

The Niese Rd. piezometer nest includes three piezometers completed at differing depths. The existing trends are generally confirmed. The shallowest piezometer shows a steady decline of about 0.25 feet per year, either because of drainage/recharge to lower portions of the aquifer and/or the effects of domestic well pumping. The intermediate depth shows seasonal fluctuations of about 0.75 feet, but water levels trends remain essentially stable. The deepest well shows consistently rising trends on the order of 1 foot per year since 2003.

Westgate Heights

The Westgate Heights piezometer is monitored by the USGS and shows trends similar to that for the Niese Rd Wells. The shallowest piezometer shows a consistent decrease in water levels on the order of 0.5 feet per year. The intermediate and deeper units, however, show seasonal fluctuations imposed on a generally increasing water level. The seasonal trends likely reflect the influence of seasonal increases in pumping in nearby ABCWUA supply wells.

ABCWUA Supply Wells

The USGS also measures water levels in select ABCWU-supply wells. Hydrographs are available for College 2 (water level remains stable), Volcano Cliffs 2 (continued decrease of 3 feet per year), and Zamora 2 (continued decrease of about 1.5 feet per year).

Groundwater Quality Monitoring Results in the West Mesa Area

Water quality samples were taken from County-facility supply water wells during 2007-2008 to verify suitability for drinking water quality. The results of that work are summarized in Appendix F. Irrigation-only wells and dedicated monitoring wells were not sampled. Those wells registered as public water supply systems are routinely monitored per state regulatory requirements and were not resampled.

In the West Mesa area, water quality samples were taken from the livestock well located at **Dennison Polo Park**. No Primary Drinking Water Standards were exceeded, and only manganese exceeded the Secondary Drinking Water Standard.

The County annually samples the wells and piezometers at 9-Mile Hill, Paradise Rd., Niese Rd.

9-Mile Hill

The 9-Mile Hill well was sampled in 2004, 2005, and 2006. The well was sampled in fiscal year 2007-2008, but analysis results were not available at the time of report preparation. The 2006 sample has not been previously reported. The 2006 analyses results were consistent with the previous sampling results. No Primary Drinking Water Standards have been exceeded. Secondary Drinking Water Standards for iron (4.2 mg/L) were again exceeded but were substantially lower than in the previous two sampling events. Manganese concentration was below the standard in 2006 and no aluminum analysis was performed. No volatile organic compounds were detected.

Paradise Rd.

The 2006 analyses results for the Paradise Rd. well are consistent with previous sampling results. Arsenic was not analyzed for the 2006 sampling event. It exceeded the Primary Drinking Water Standard in the previous sampling events. Chromium and manganese concentrations were below their respective standards but were detected (0.032, 0.05 mg/L, respectively). Iron and aluminum concentrations (3.2 and 3.7 mg/L, respectively) though less than in previous samples, continued to exceed Secondary Drinking Water Standards. No volatile organic compounds were detected.

Niese Rd.

Past analyses have indicated that arsenic concentrations in the Niese Rd. piezometers may from time to time exceed the Primary Drinking Water Standard for arsenic. The 2006-2007 analysis results, however, do not show any such exceedance. Similar to other West Mesa wells, Secondary Drinking Water Standards for iron and manganese may also be exceeded. The 2006-2007 analysis indicates that concentrations for iron and manganese were below their respective standards. Consistent with previous results, the Secondary Drinking Water Standard for aluminum was exceeded in all three piezometers (0.14, 0.11, and 0.28 mg/L). No other inorganic Primary or Secondary Drinking Water

Standards were exceeded in the 2006-2007 analysis. No volatile organic compounds were detected.

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CONCLUSIONS AND RECOMMENDATIONS

Groundwater level monitoring by the Program generally indicates that trends in water levels remain consistent with previous reports. There has been some slight improvement in select locations, but a return to long-term decline in water levels is anticipated.

There has been a rebound of water levels in wells located on the backslopes of the Sandia Mountains (i.e. west of NM 14) and in wells in the Far Northeast Heights. The rebound is likely reflective of two good years of winter precipitation events. However, the rebound is temporal in nature and a return to declining water levels is expected. Of particular concern, however, is the on-going continued decline of water levels in wells located in the east central portion of the County (i.e. generally from Frost Rd. southeastward to Juan Tomas Rd.) and extending back towards Fire Station 11 (located on NM 337 South near Tranquillo Pines). Water levels in the remainder of the EMA remained stable or are decreasing at minimal rates. Water levels in shallow wells (less than 500 ft depth) in the South Valley, North Valley, and West Mesa appear to be remaining stable, except where under the effects of municipal pumping.

Groundwater quality monitoring likewise indicates that trends in quality remains consistent with previous reports. In general, water quality throughout the unincorporated areas of the County meets the Primary and Secondary Drinking Water Standards for most parameters. Common exceptions include elevated concentrations of iron, manganese, aluminum, arsenic. In some cases, particularly near Tijeras and east of the Tijeras Fault system, chloride, sulfates, and total dissolved solids concentrations typically exceed the respective Secondary Standards. Elevated chloride, iron and manganese concentrations in shallow groundwater may be either naturally occurring or may be related to natural degradation of wastewater system leachate. The remainder of the listed parameters are most likely naturally occurring.

Expansion in the water level measurement program appears to be justified, particularly in the EMA south of I-40 where on-going decline in water levels and lack of recharge has been noted. Public outreach is warranted to better advise residents of the situation and to increase awareness of a potential risk to homeowners in the event of a drought of 5-year duration or longer. Further evaluation of recharge potential and delineation of recharge areas in the EMA both north and south of I-40 is needed. Expansion of water level measurements in the Far Northeast Heights is similarly needed, although the threat to residents is somewhat less than in the EMA due to better well construction practices (i.e.,greater saturated length of well) than in the EMA.

The consistency of groundwater quality monitoring results suggests that the long-term continuance of the existing groundwater monitoring program may be of limited value. Continuing the program until a statistically valid basis is available is warranted, but the programs should be reevaluated at that time and sampling efforts redirected to better assess potential threat to aquifer health or redirected to quantification of available supply.

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Weblisting

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http://www1.ncdc.noaa.gov/pub/orders - last visited 3/28/06

United States Environmental Protection Agency – List of Drinking Water Contaminants and MCLs. http://www.epa.gov/safewater/mcl.html - last visited on 3/09/06

United States Geological Survey USGS Ground Water for New Mexico: Water Levels – http://nwis.waterdata.usgs.gov/nm/nwis/waterlevels? – last visted on 10/06/06

APPENDIX A

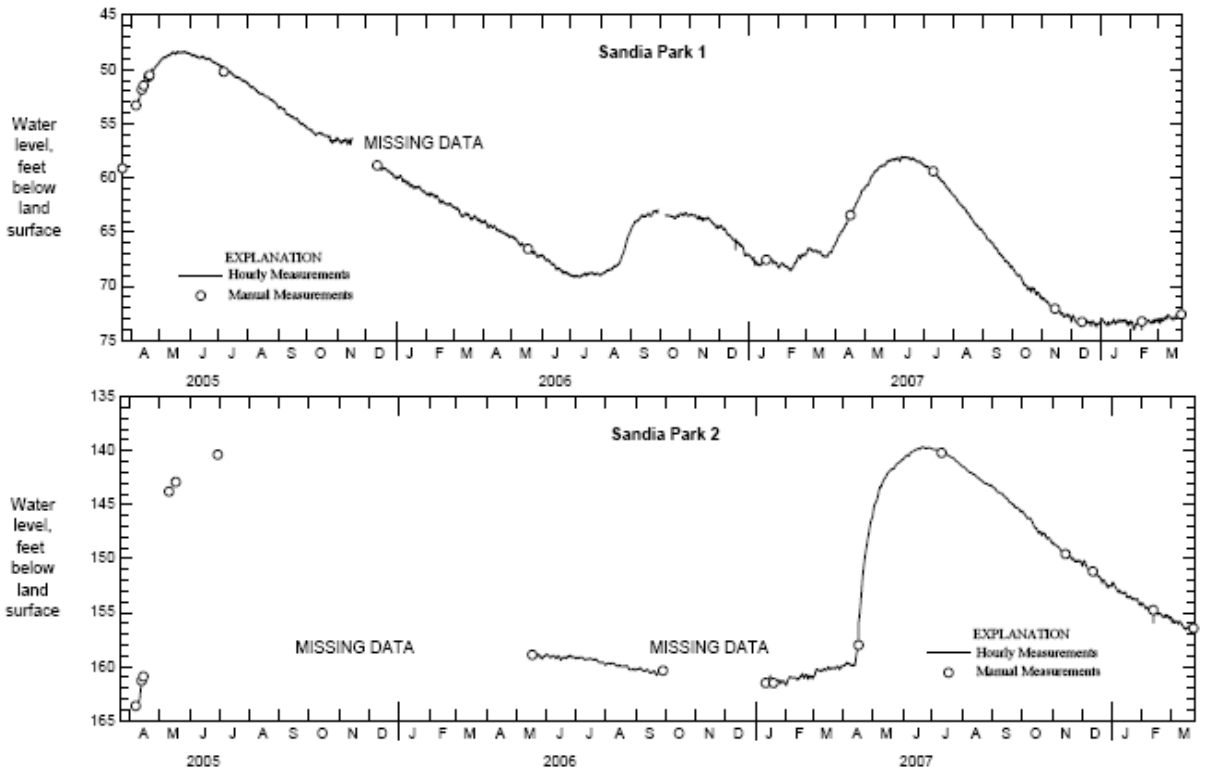
East Mountain Area Water Level Monitoring Data

May 2008

JOINT COUNTY-USGS MONITORING WELLS

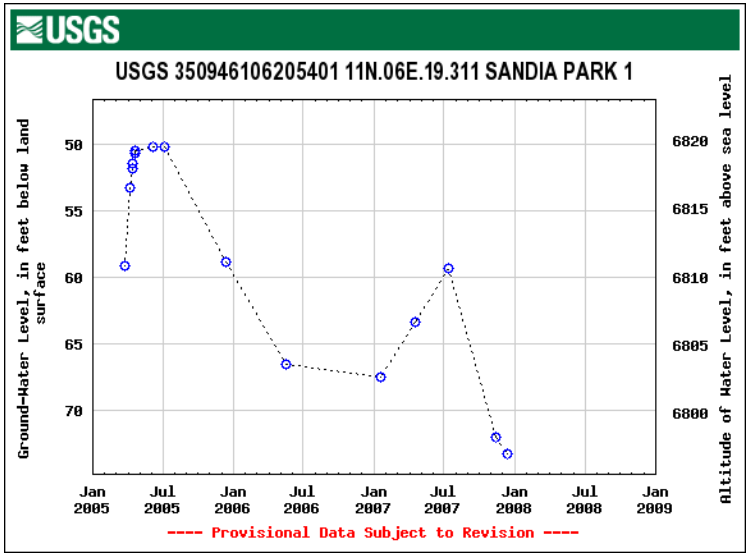
Sandia Park 1 and 2

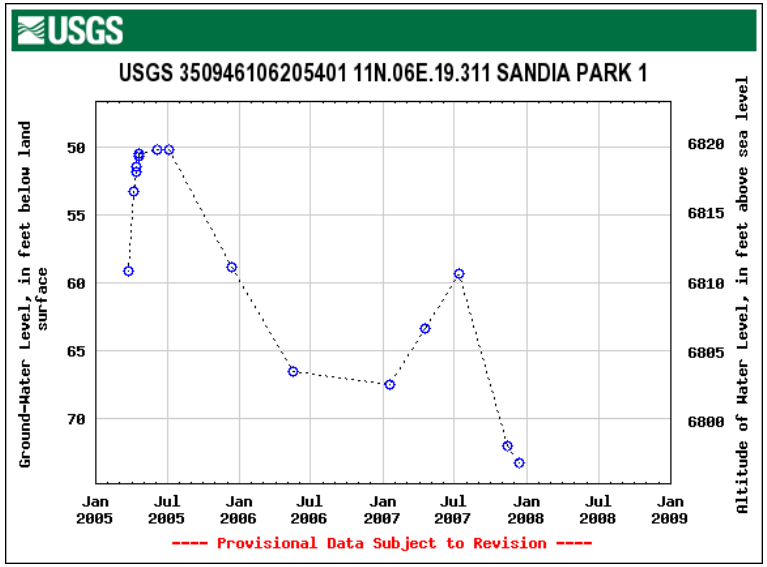
Continuous Monitoring Data



Sandia Park 1 and 2

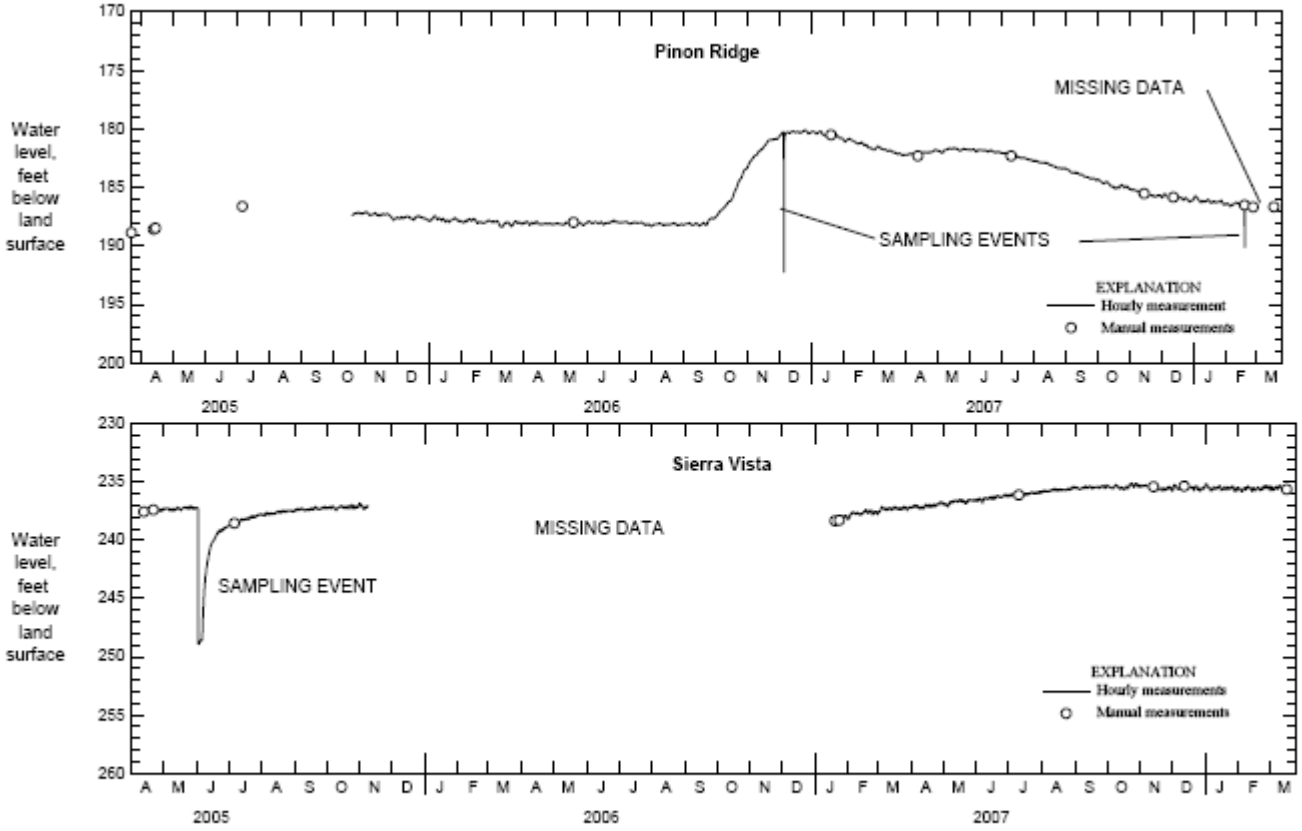
Hand Measurement Data





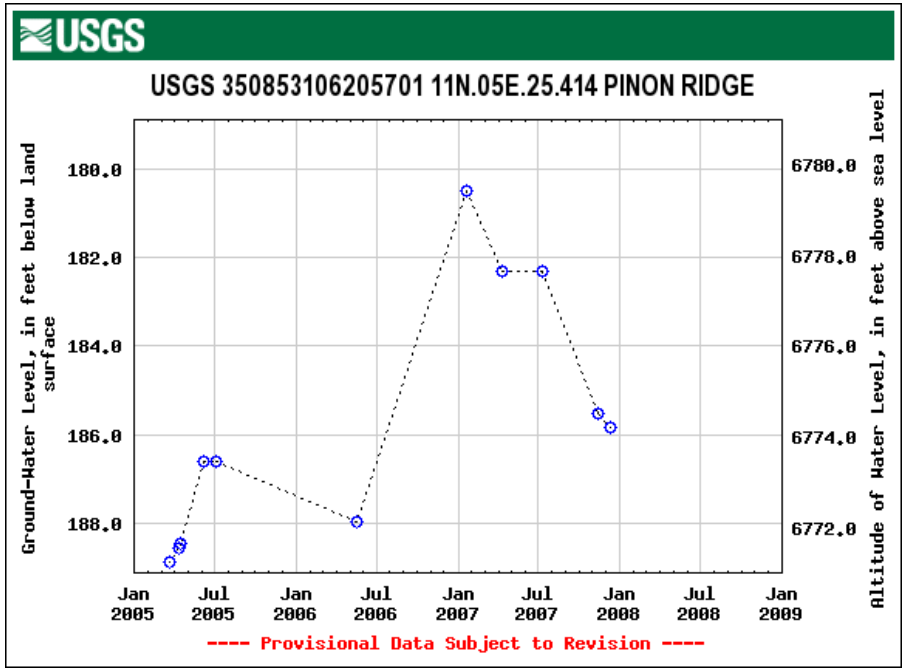
Pinon Ridge and Sierra Vista

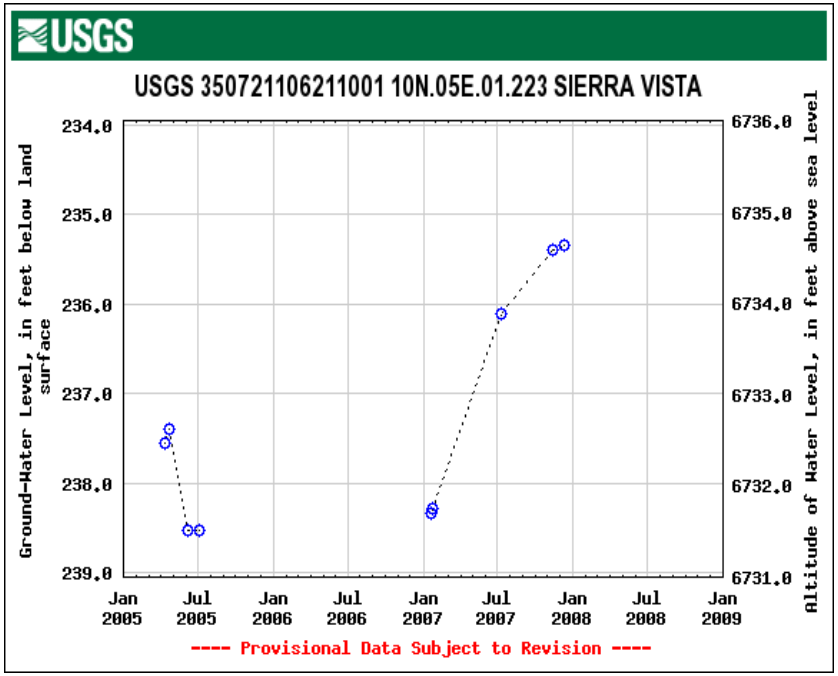
Continuous Monitoring Data



Pinon Ridge and Sierra Vista

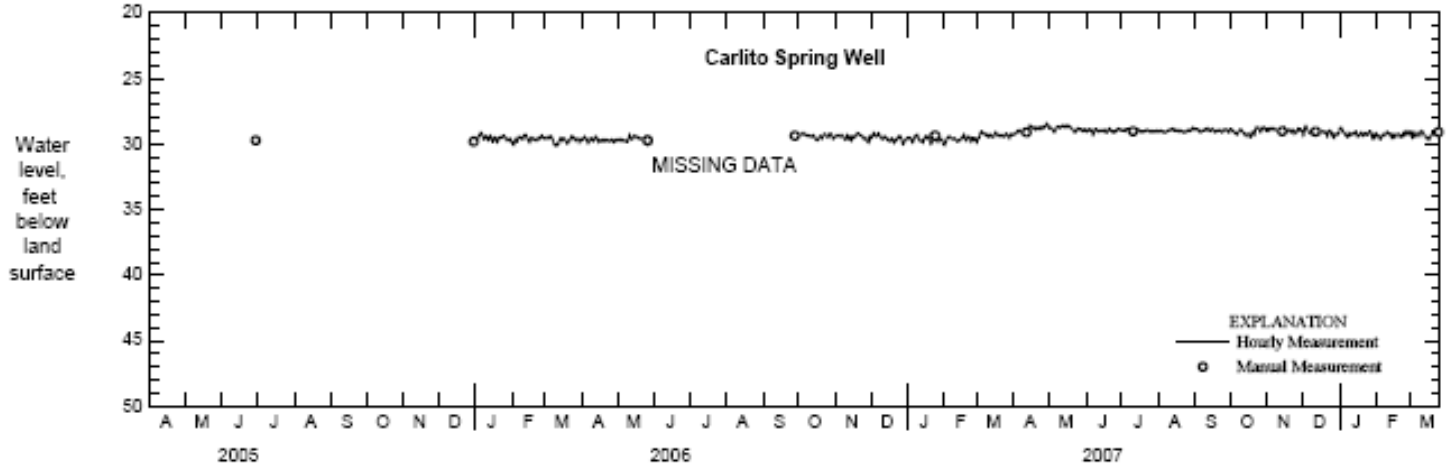
Hand Measurement Data





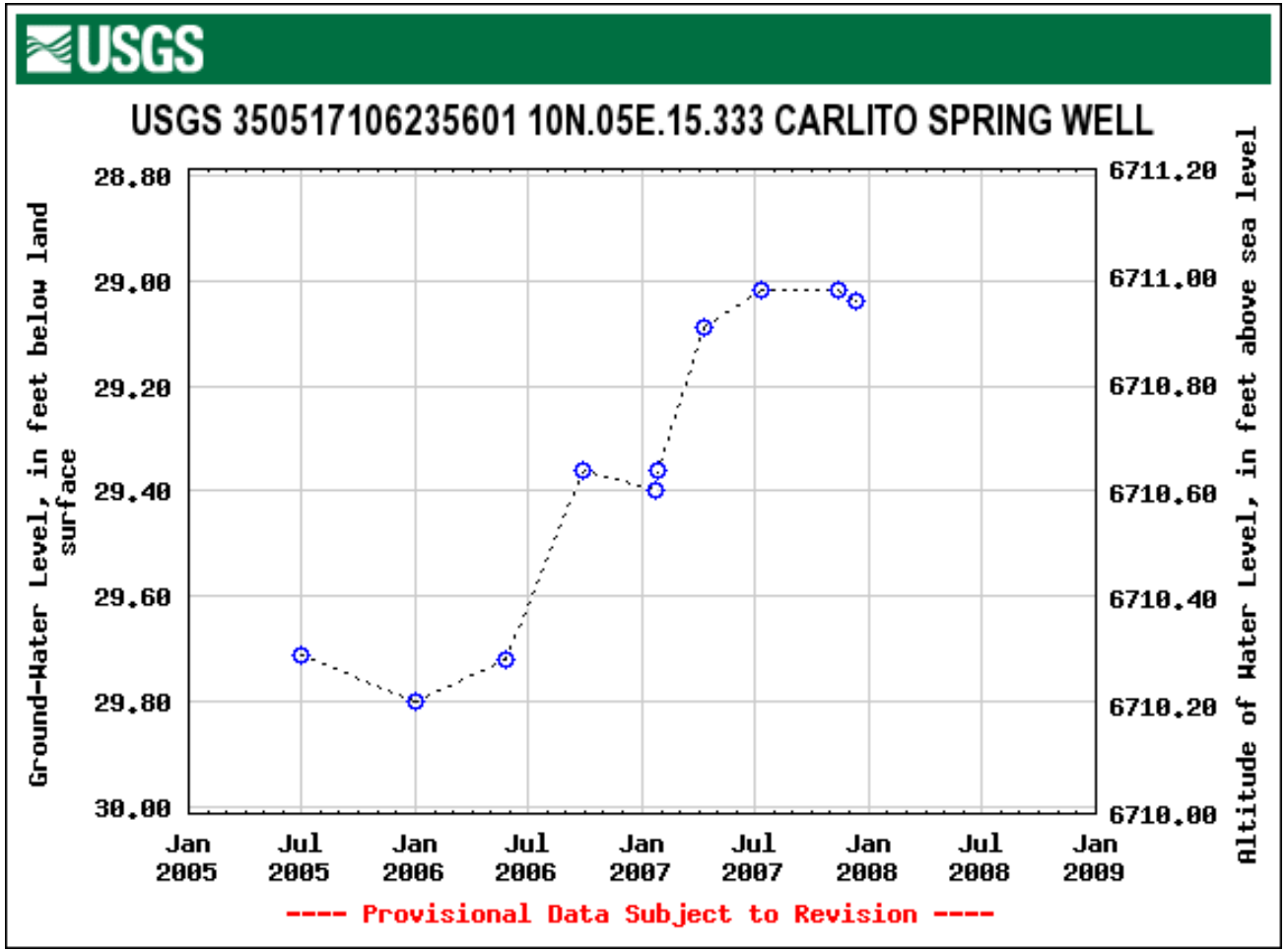
Carlito Springs

Continuous Measurement Data



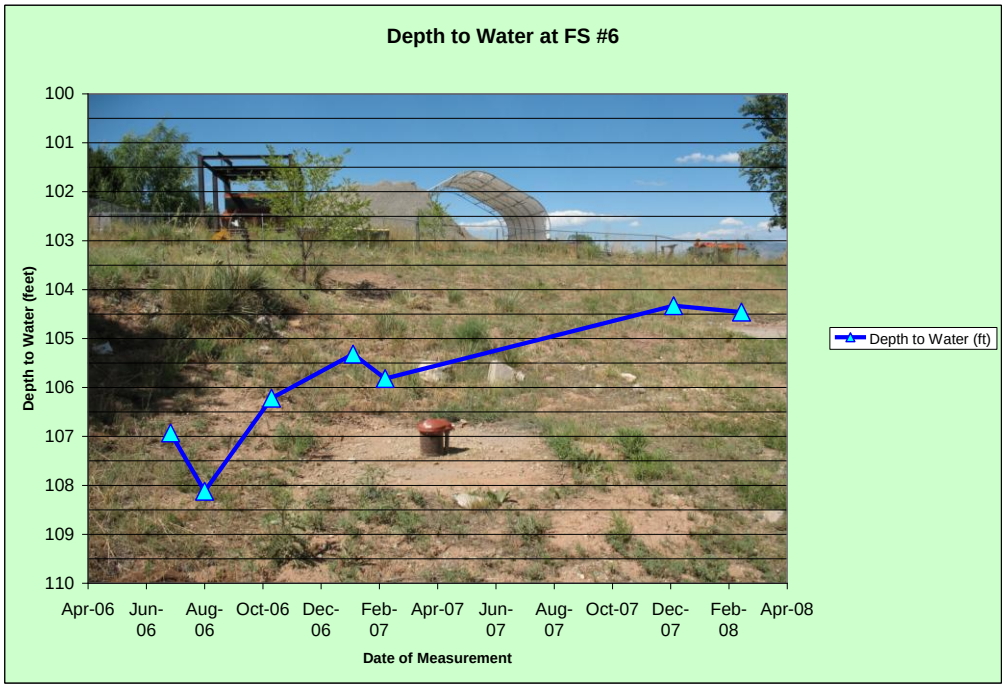
Carlito Springs

Hand Measurement Data

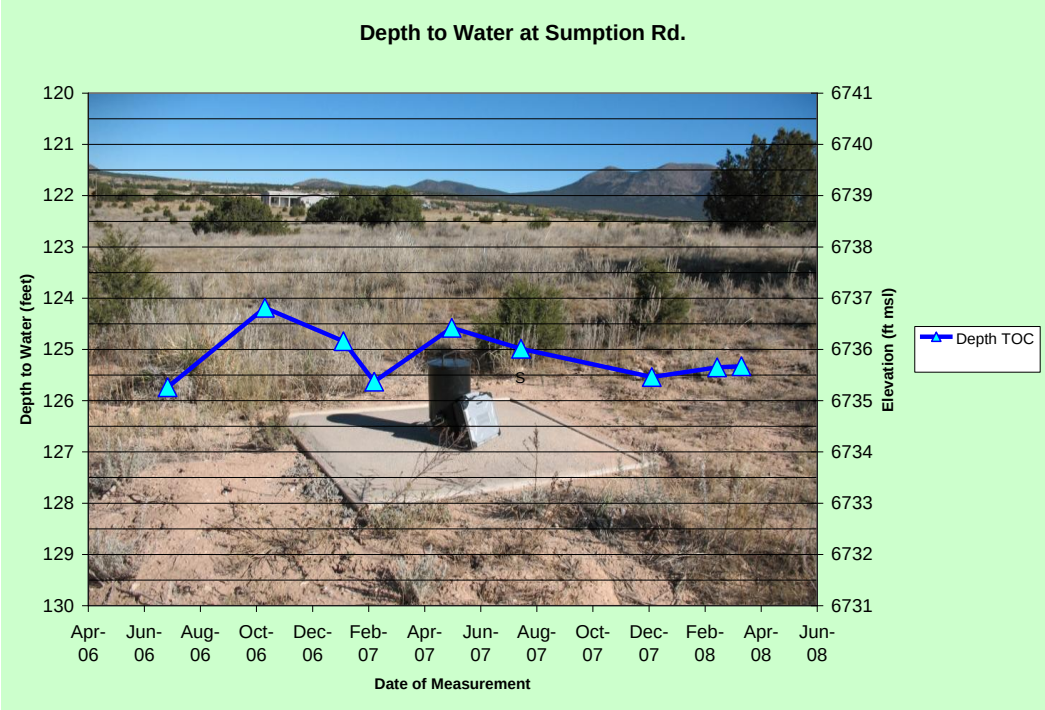


COUNTY MONITORING WELLS

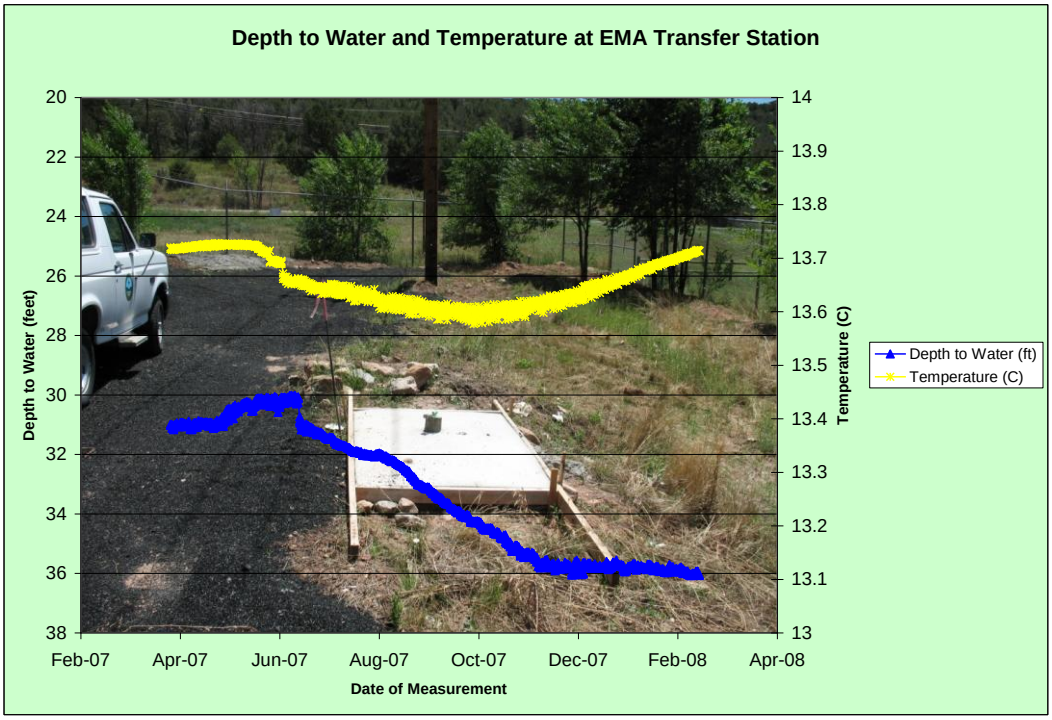
Fire Station #6



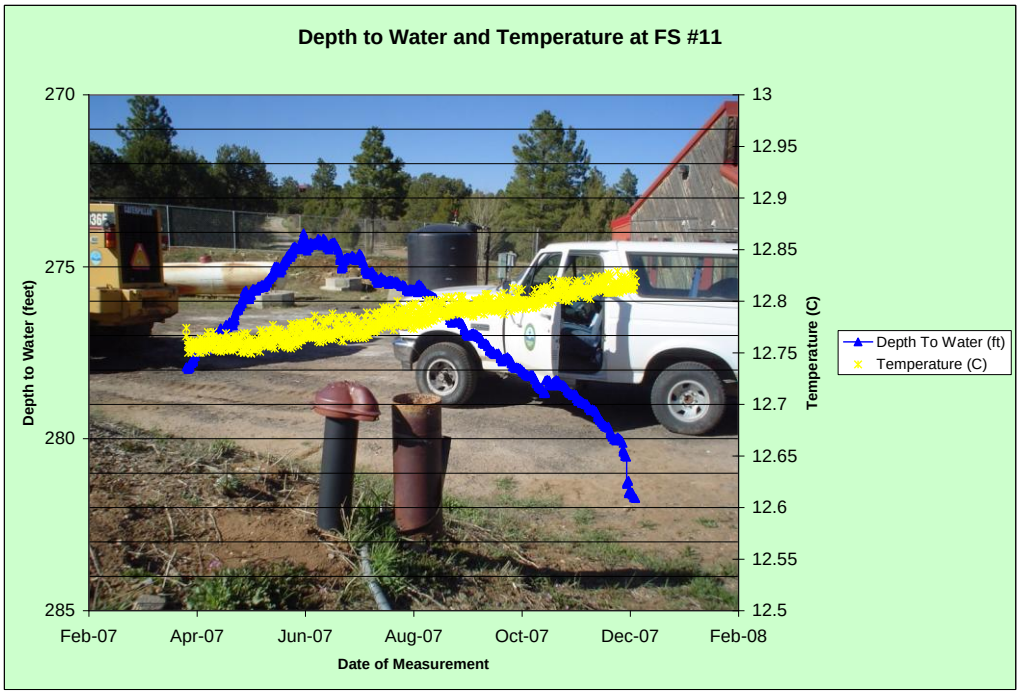
Sumption Rd Well



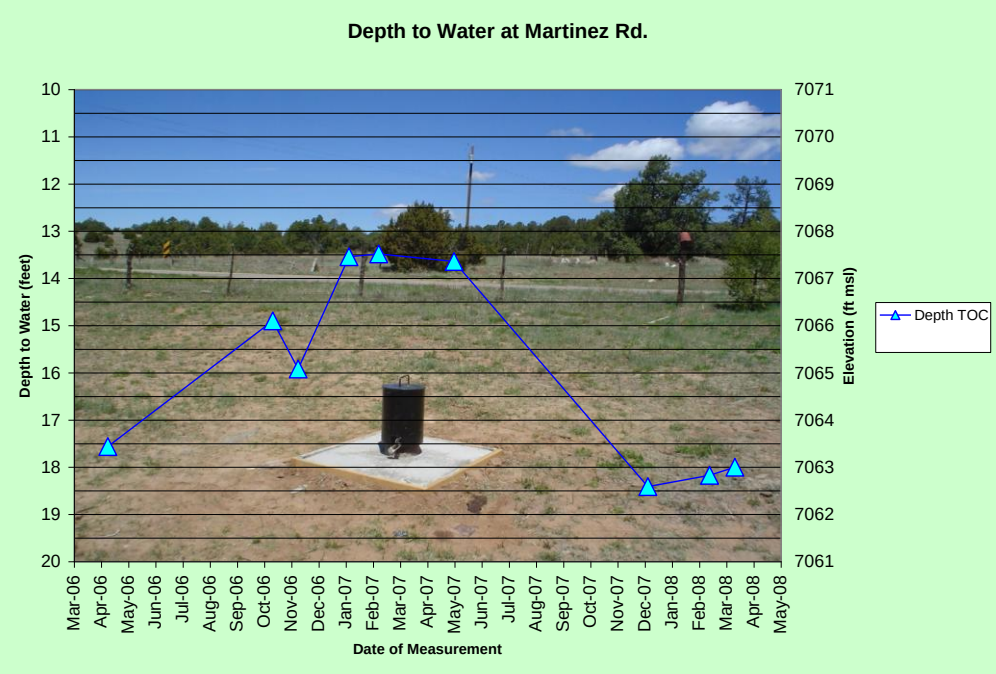
EMA Transfer Station



Fire Station #11

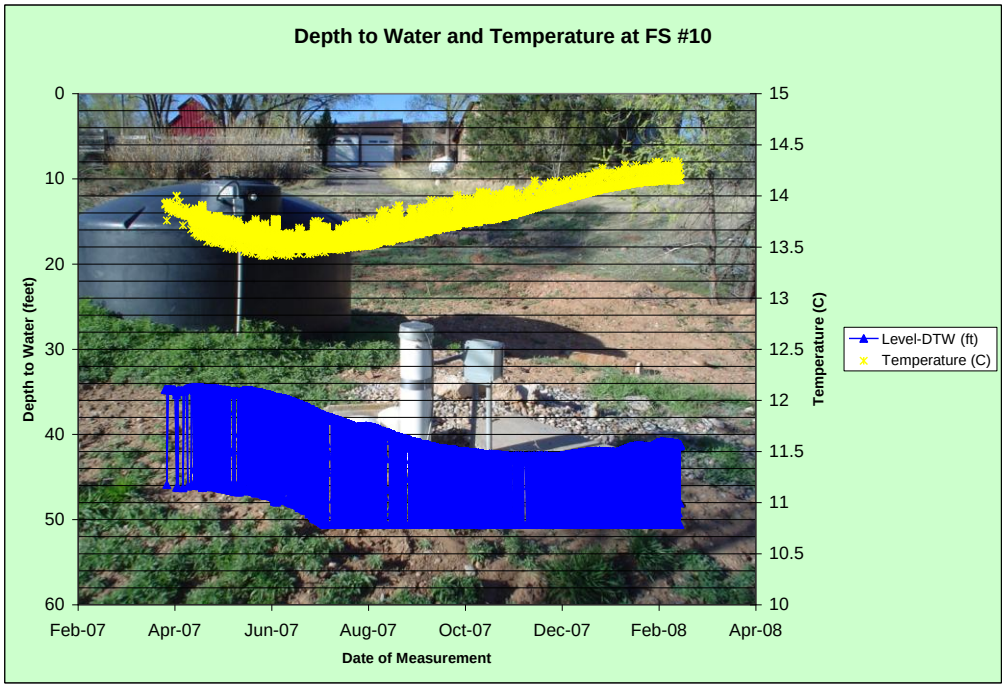


Martinez Rd. Well

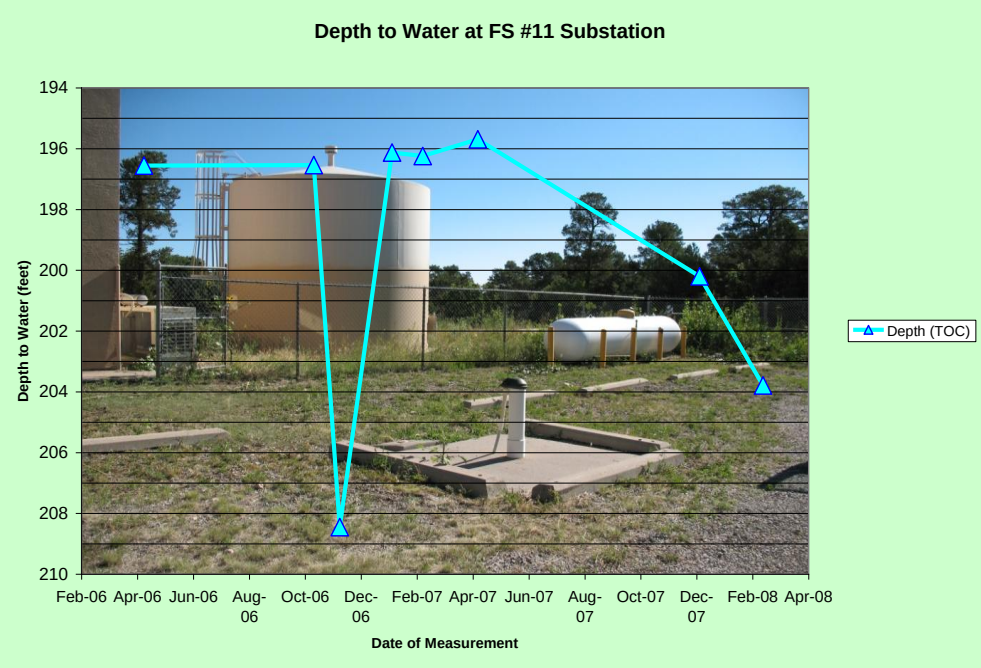


COUNTY-OWNED FACILITY WELLS (IN USE)

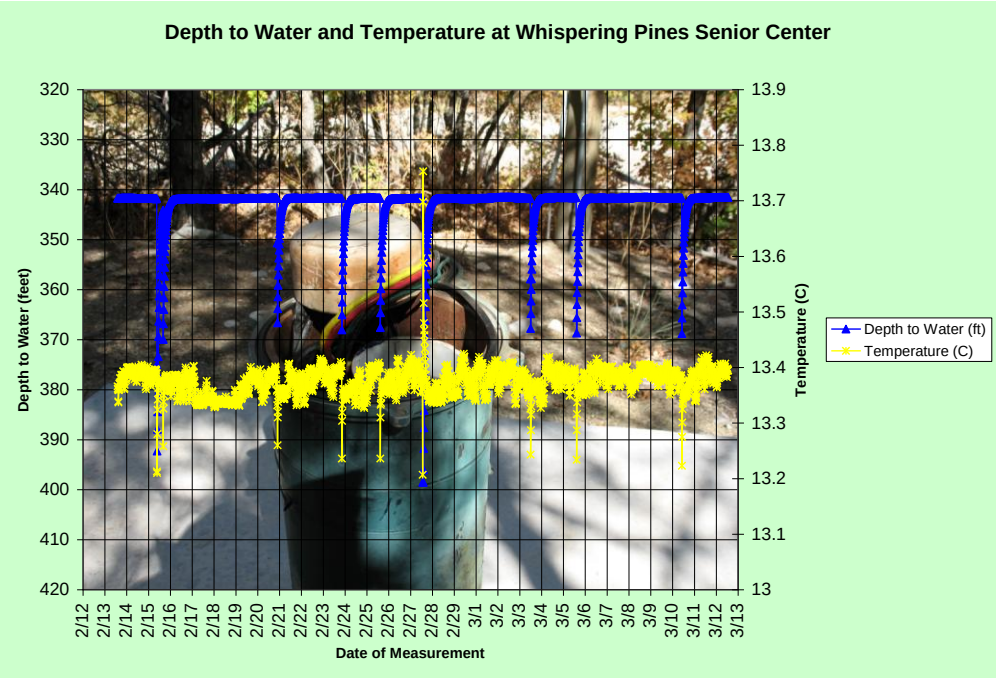
Fire Station #10 / EMA Command



Fire Station #11 Substation (NM 217)

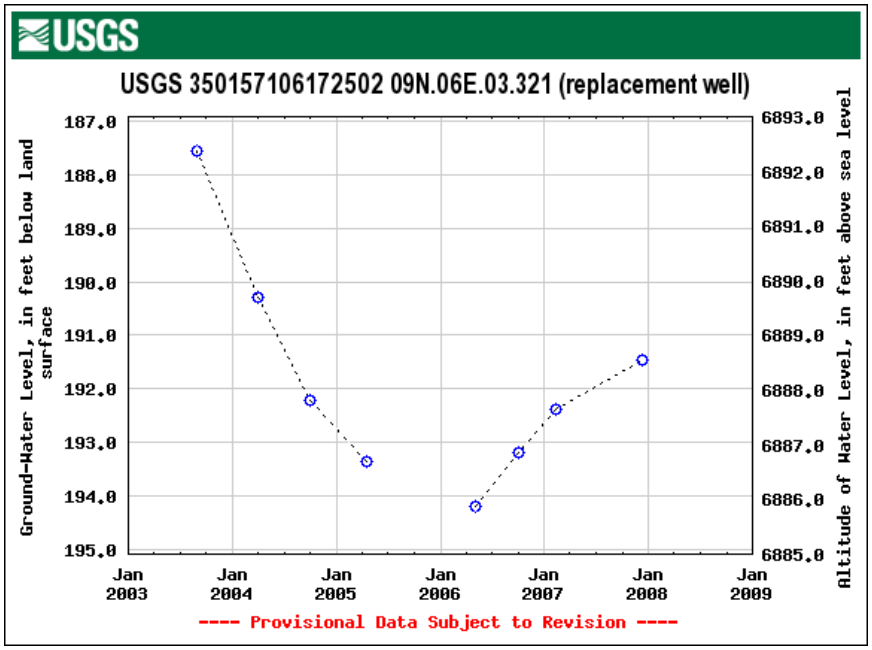


Whispering Pines Senior Center

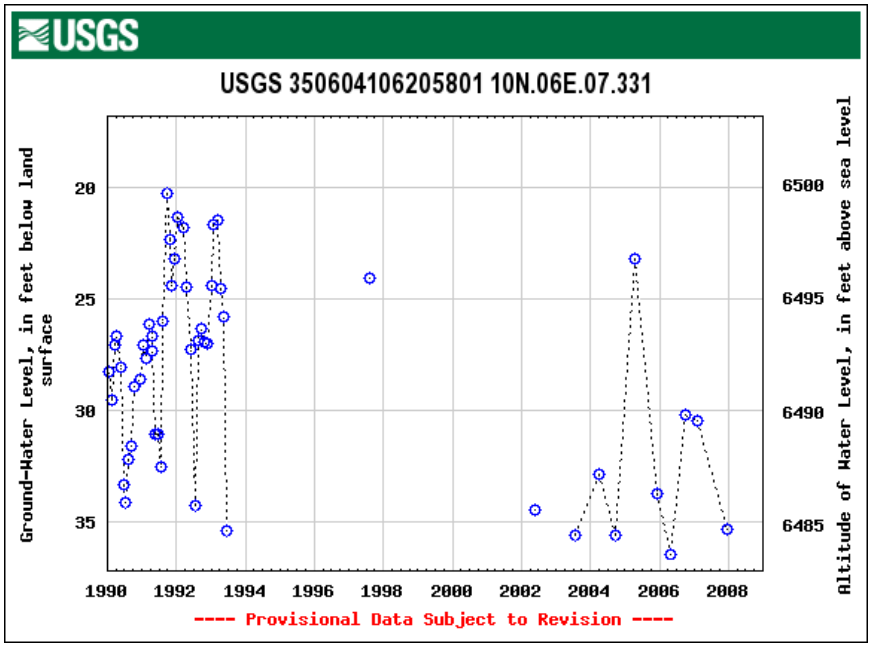


USGS MONITORED DOMESTIC WELLS OF CONCERN

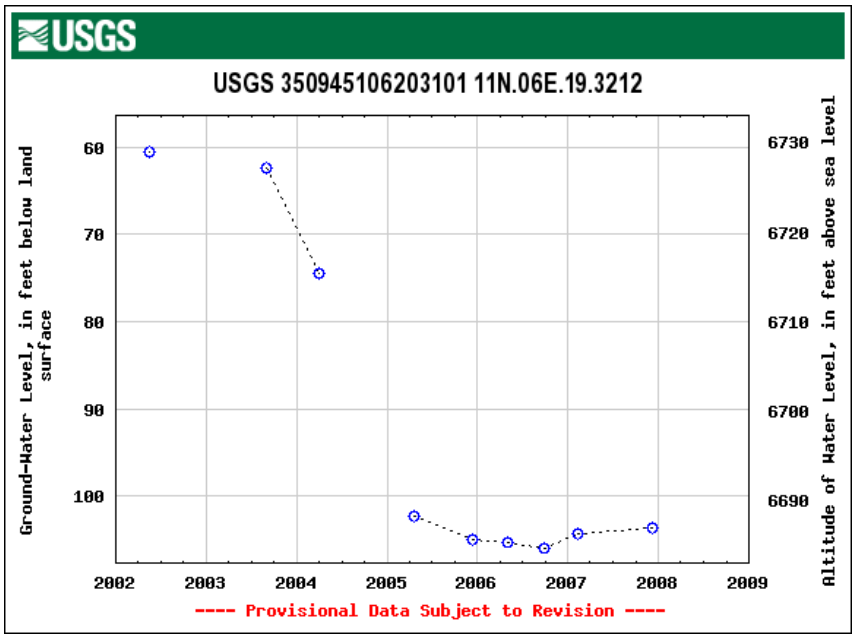
Well 22 / 350157106172502 (Juan Thomas Rd.)



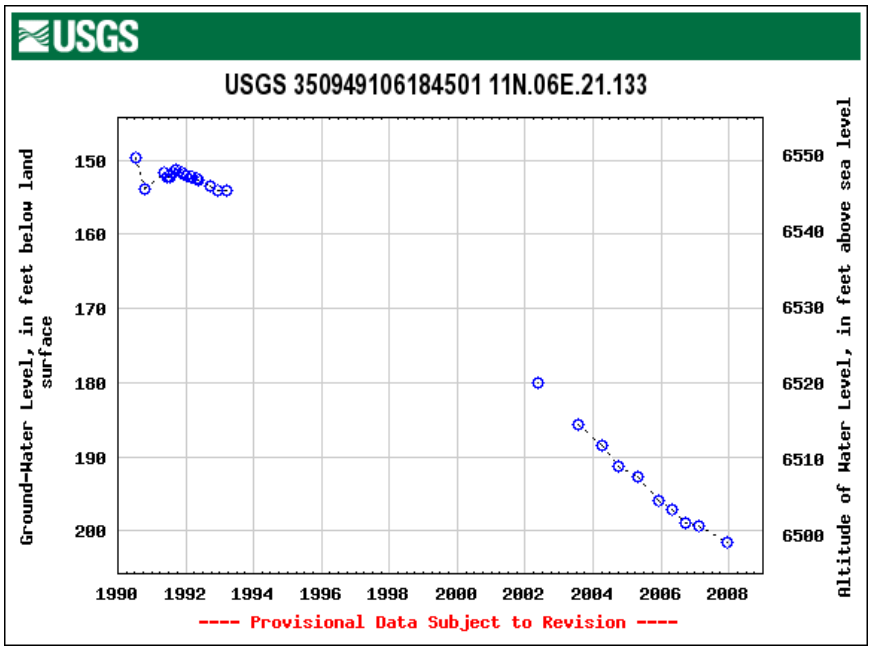
Well 27 / 350604106205801 (Tablezon / Eagle Crest)



Well 31 / 350945106203101 (Sandia Park – Fire Station #6 Well)



Well 32 / 350949106184501 (Sandia Knolls



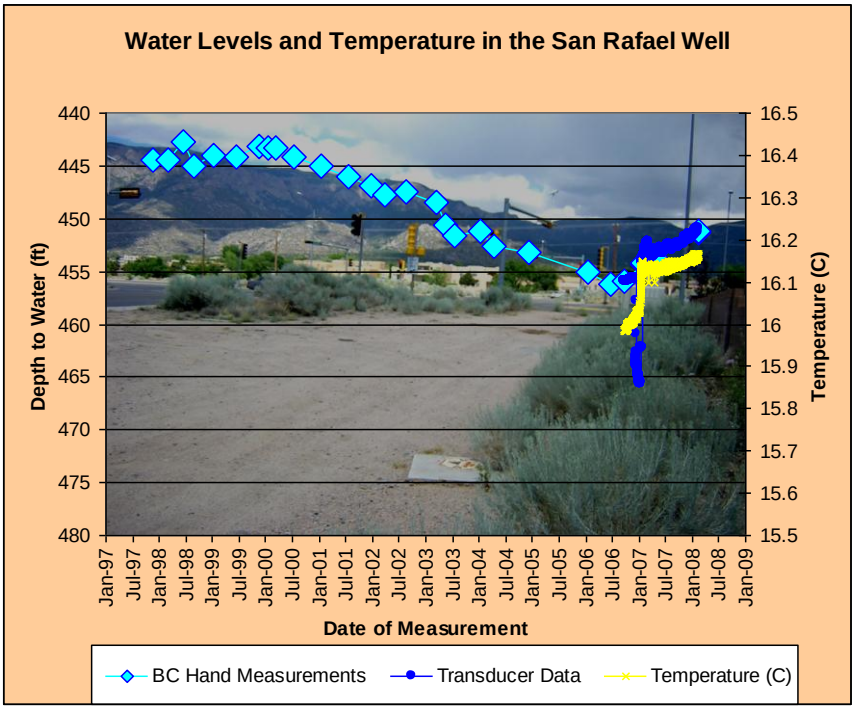
APPENDIX B

FAR NORTHEAST HEIGHTS AREA WATER LEVEL MONITORING DATA

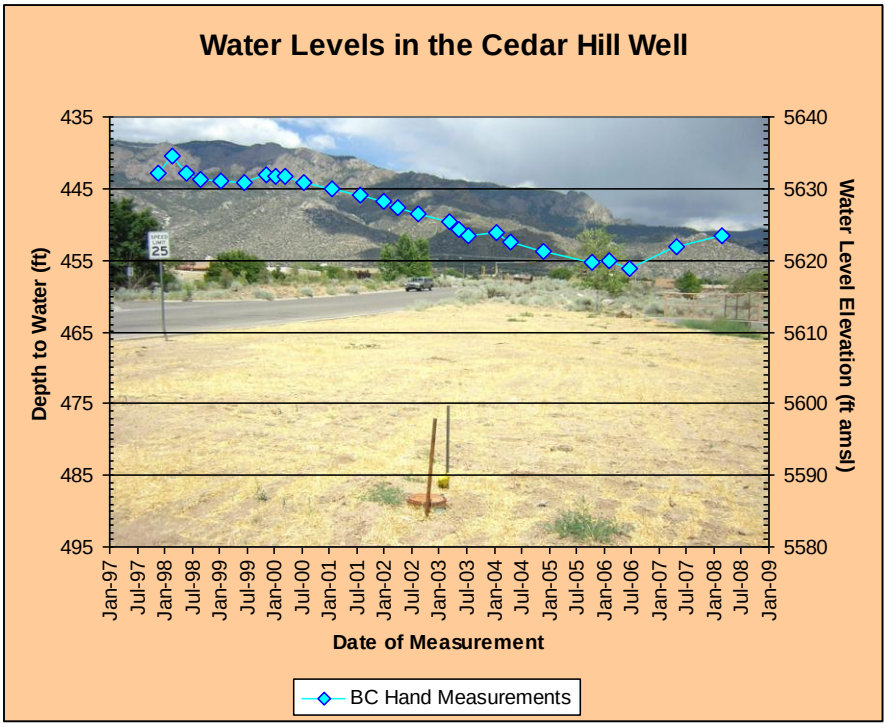
May 2008

COUNTY-OWNED MONITORING WELLS

San Raphael

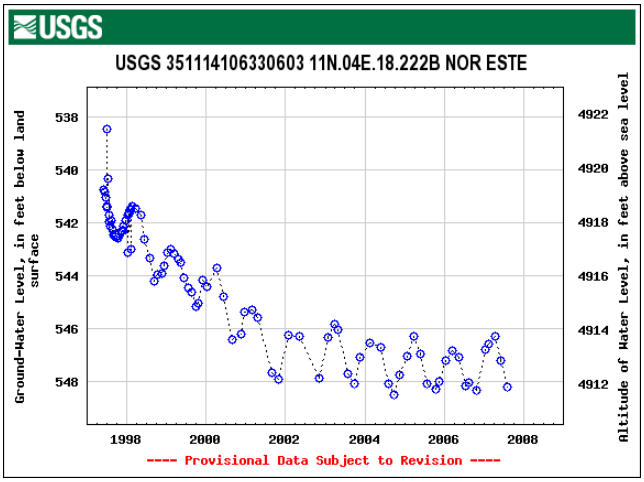


Cedar Hill

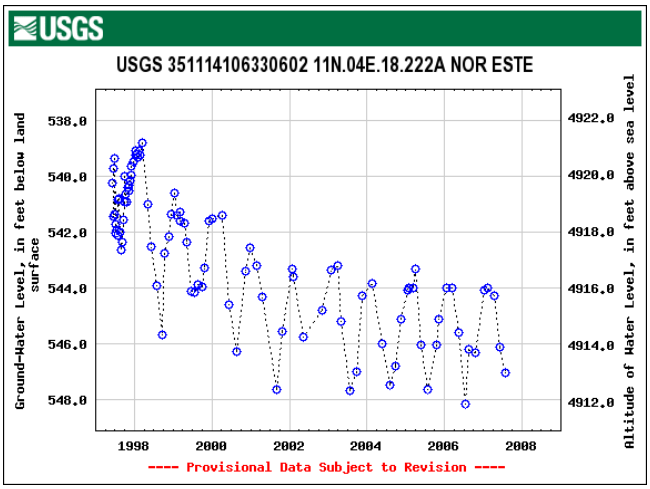


USGS
NorEste Piezometer Nest

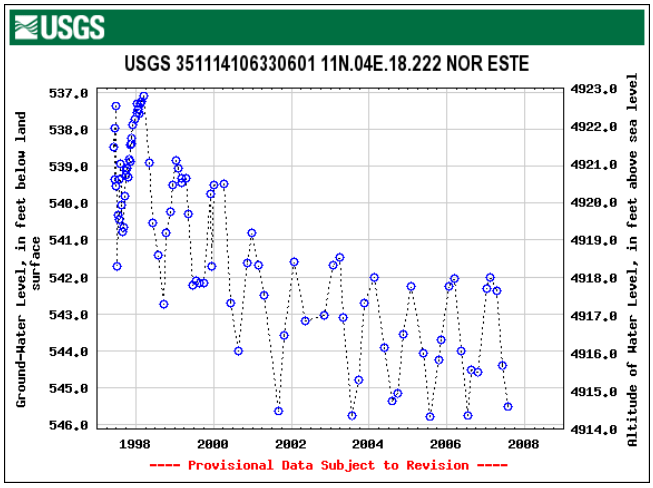
At 608 feet



At 1193 feet



At1525 feet



APPENDIX C

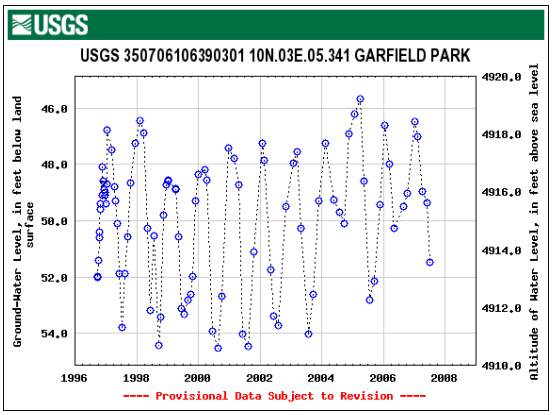
North Valley and Paradise Hills Area Water Level Monitoring Data

May 2008

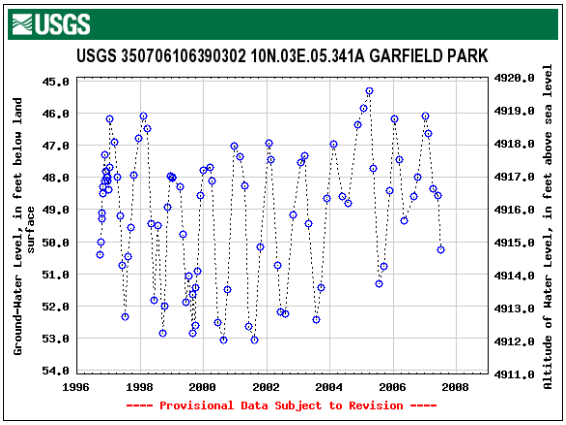
USGS PIEZOMTER NESTS

Garfield Park

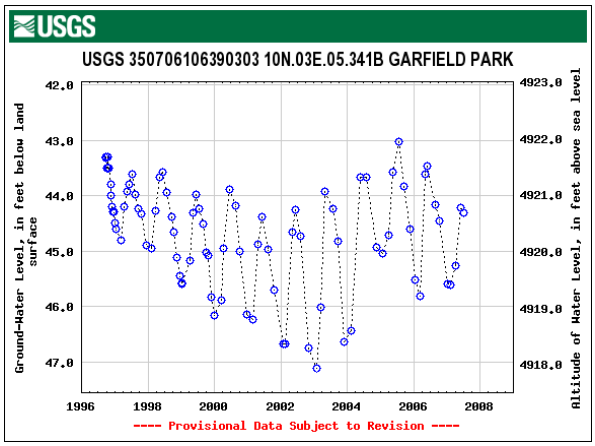
93 feet



582 feet

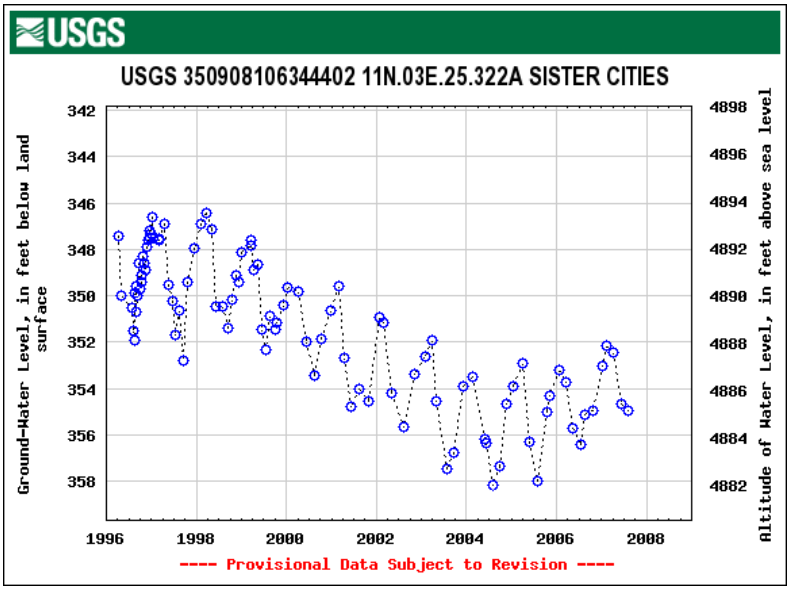


1020 feet

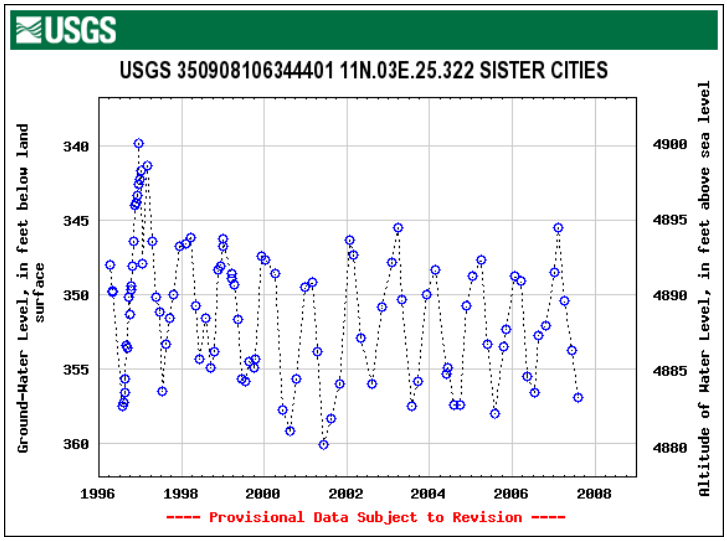


Sister Cities

789 feet

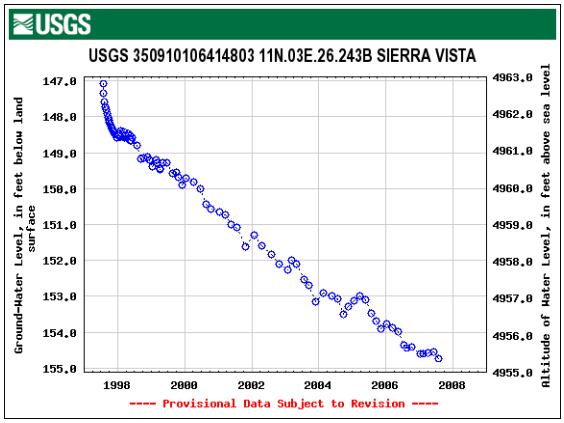


1,308 feet

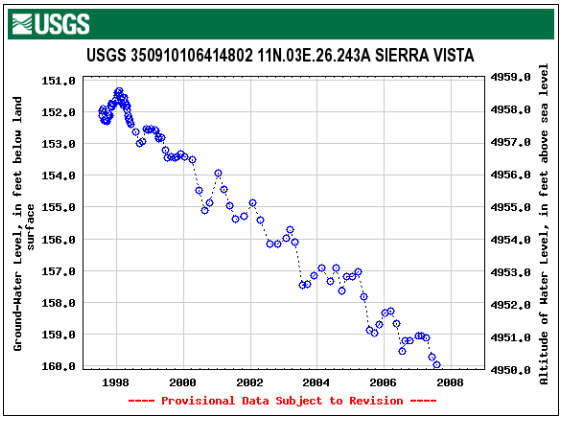


Sierra Vista

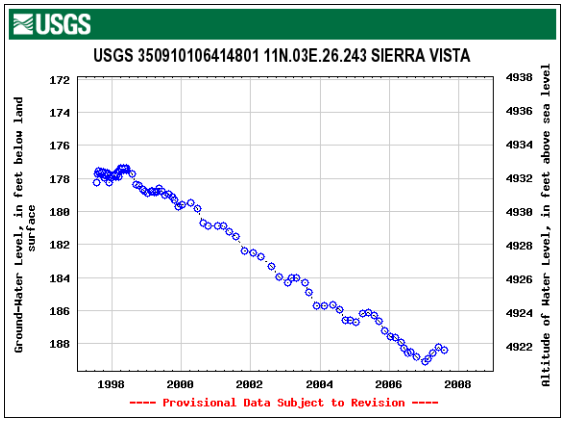
210 feet



928 feet

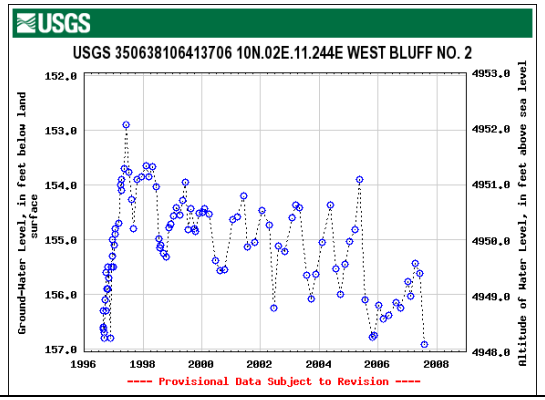


1644 feet

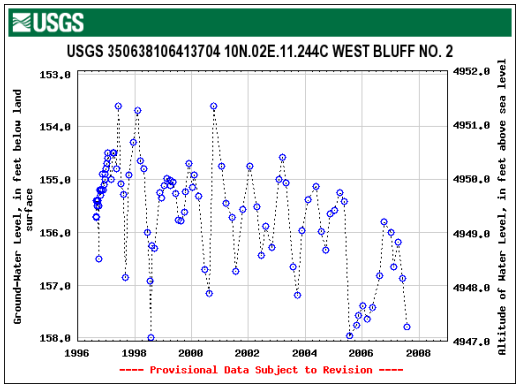


West Bluff

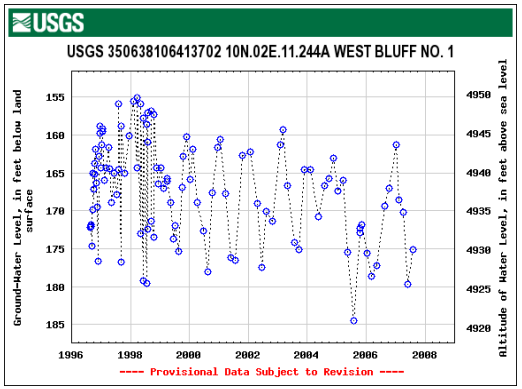
173 feet



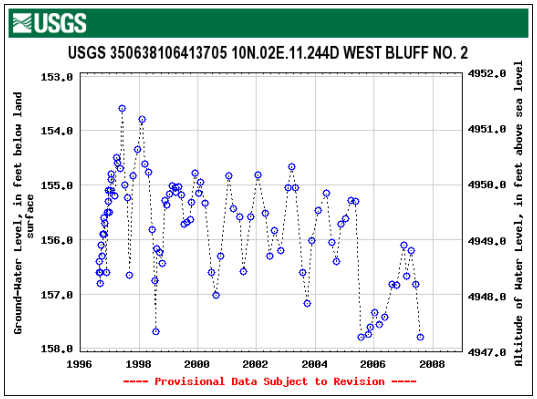
328 feet



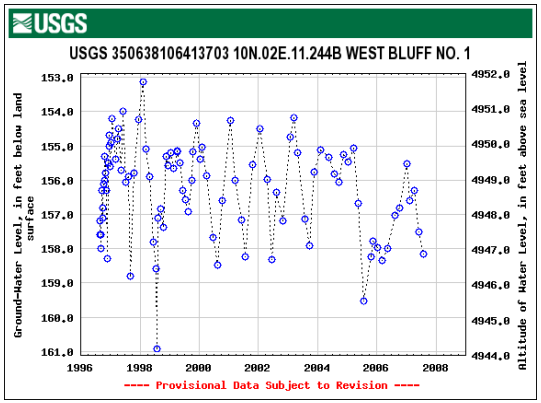
689 feet



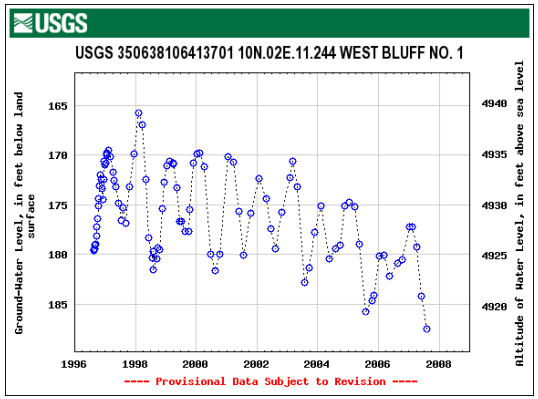
254 feet



433 feet

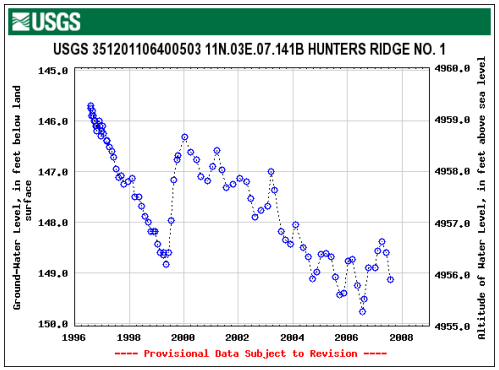


1095 feet

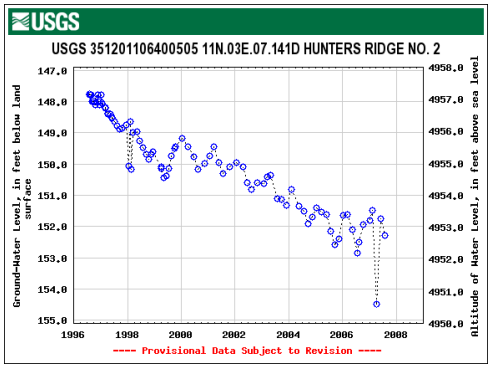


Hunters Ridge

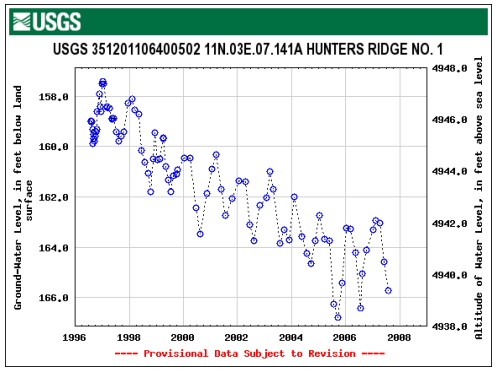
238 feet



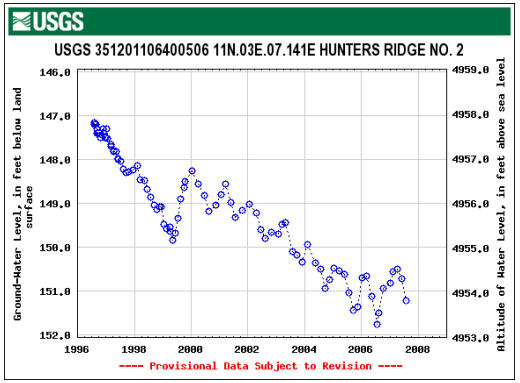
305 feet



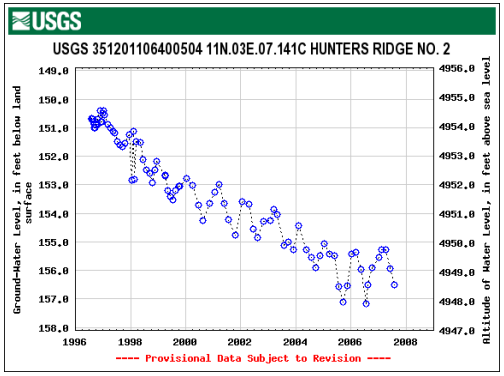
855 feet



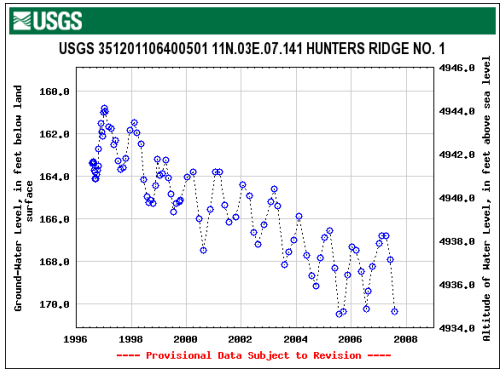
263 feet



359 feet

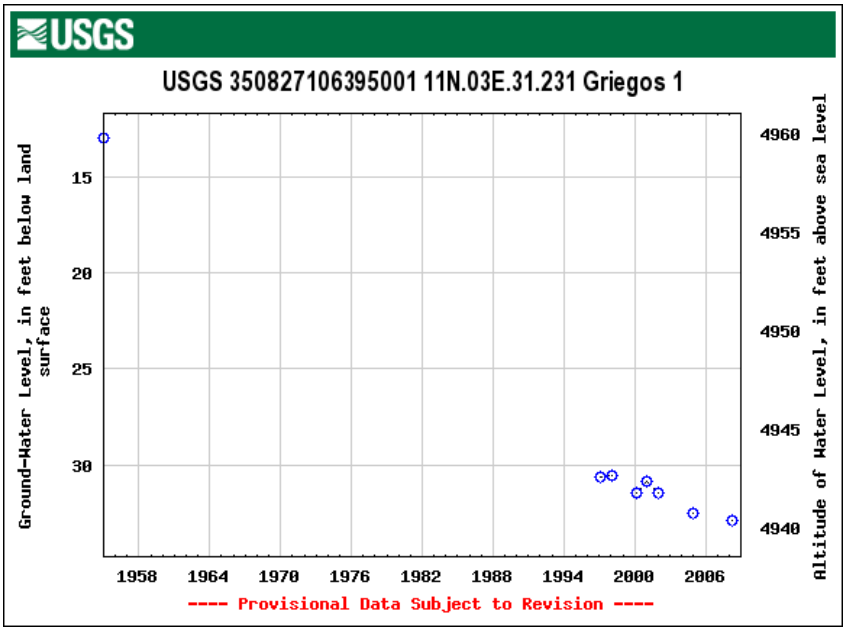


1518 feet



ABCWUA WELLS

Griegos



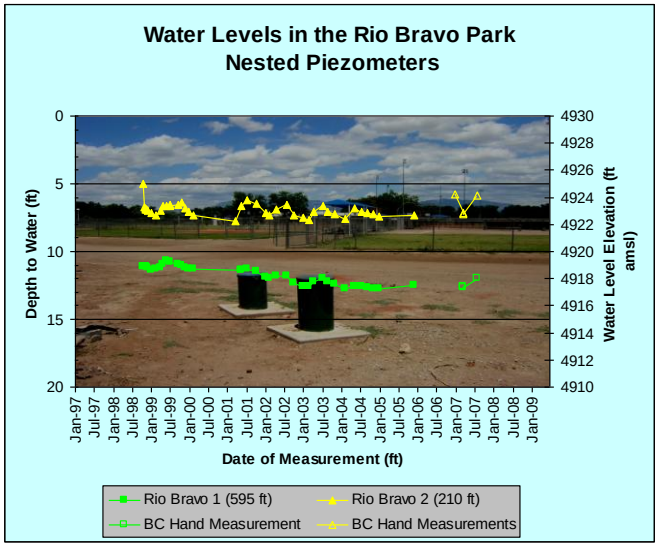
APPENDIX D

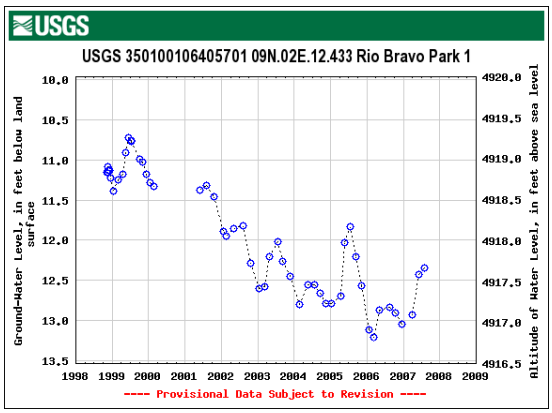
South Valley Area Water Level Monitoring Data

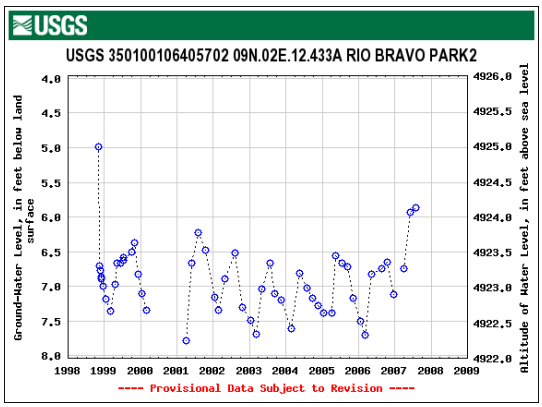
May 2008

JOINT COUNTY-USGS MONITORING WELLS

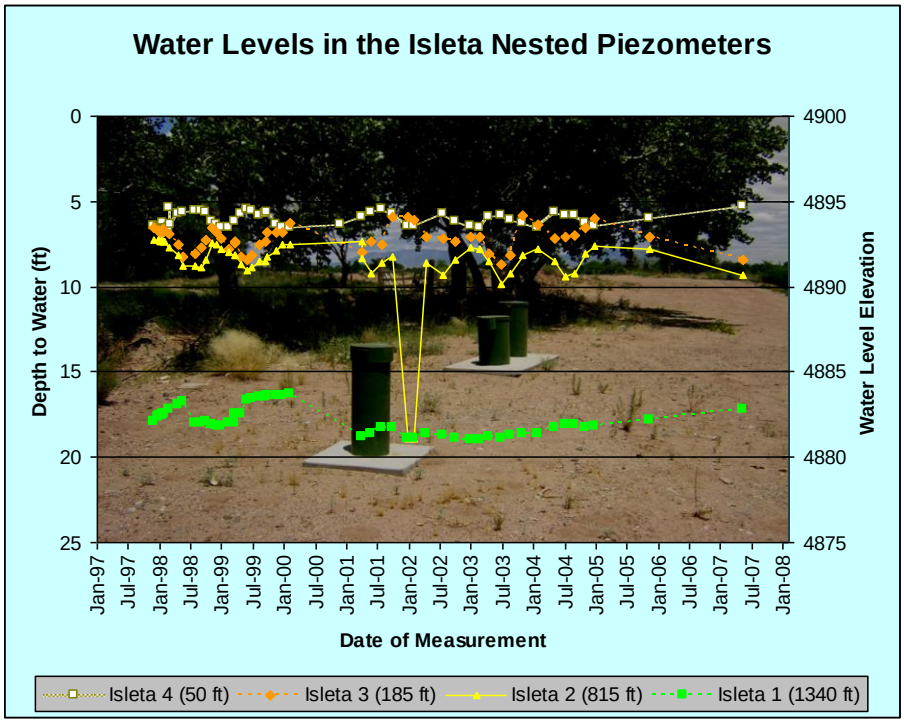
Rio Bravo 1 and 2

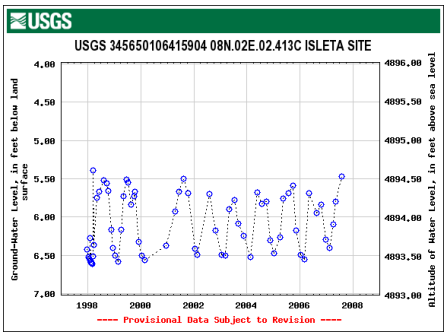


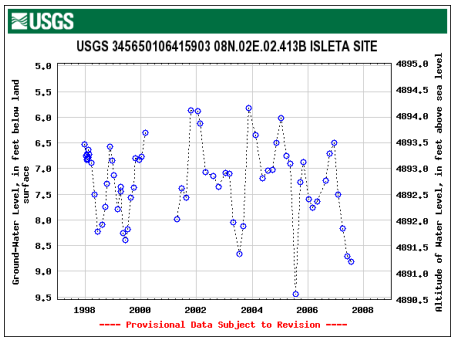


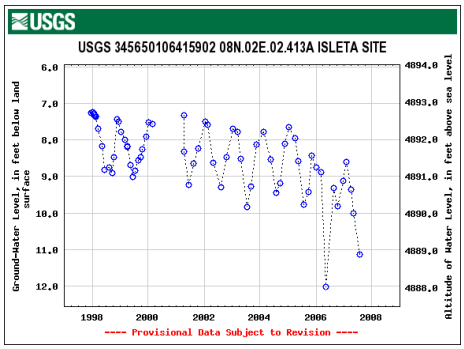


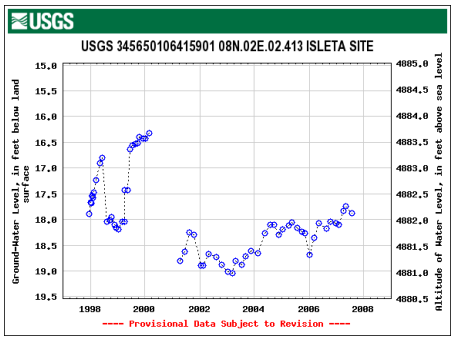
Isleta 1, 2, 3, 4,


Water Levels in the Isleta Nested Piezometers
Depth to Water (ft)
Water Level Elevation
0
5
10
15
20
25
4900
4895
4890
4885
4880
4875
Jan-97
Jul-97
Jan-98
Jul-98
Jan-99
Jul-99
Jan-00
Jul-00
Jan-01
Jul-01
Jan-02
Jul-02
Jan-03
Jul-03
Jan-04
Jul-04
Jan-05
Jul-05
Jan-06
Jul-06
Jan-07
Jul-07
Jan-08
Date of Measurement
Isleta 4 (50 ft)
Isleta 3 (185 ft)
Isleta 2 (815 ft)
Isleta 1 (1340 ft)


USGS
USGS 345650106415904 08N.02E.02.413C ISLETA SITE
Ground-Water Level, in feet below land surface
Altitude of Water Level, in feet above sea level
---- Provisional Data Subject to Revision ----

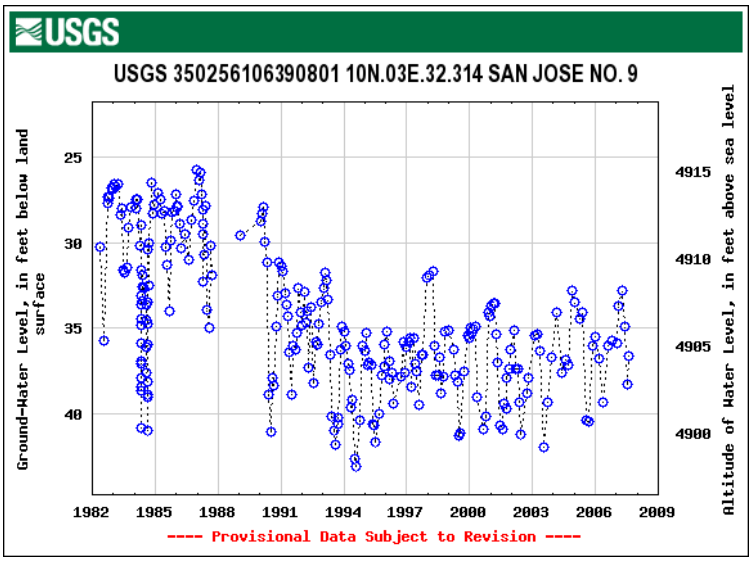

USGS
USGS 345650106415903 08N.02E.02.413B ISLETA SITE
Ground-Water Level, in feet below land surface
Altitude of Water Level, in feet above sea level
---- Provisional Data Subject to Revision ----


USGS
USGS 345650106415902 08N.02E.02.413A ISLETA SITE
Ground-Water Level, in feet below land surface
Altitude of Water Level, in feet above sea level
---- Provisional Data Subject to Revision ----


USGS
USGS 345650106415901 08N.02E.02.413 ISLETA SITE
Ground-Water Level, in feet below land surface
Altitude of Water Level, in feet above sea level
---- Provisional Data Subject to Revision ----

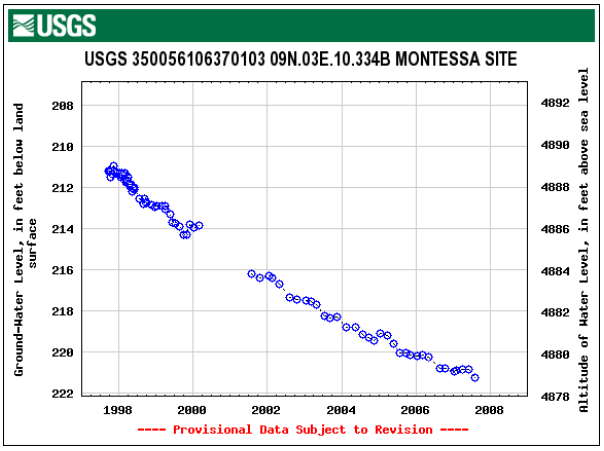
USGS MONITORING WELLS

San Jose Well 9

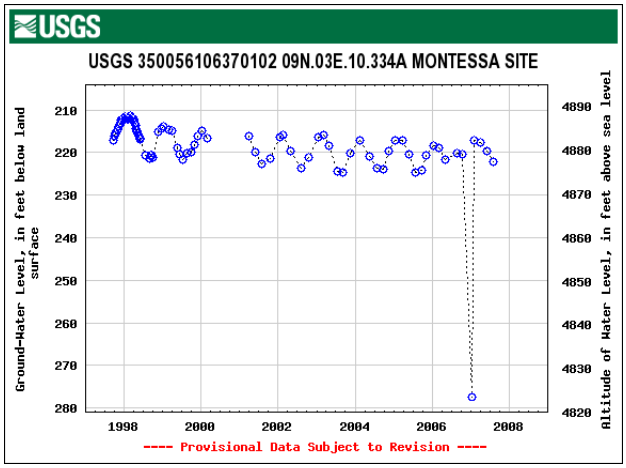


Montessa Park

330 ft.



699 ft.



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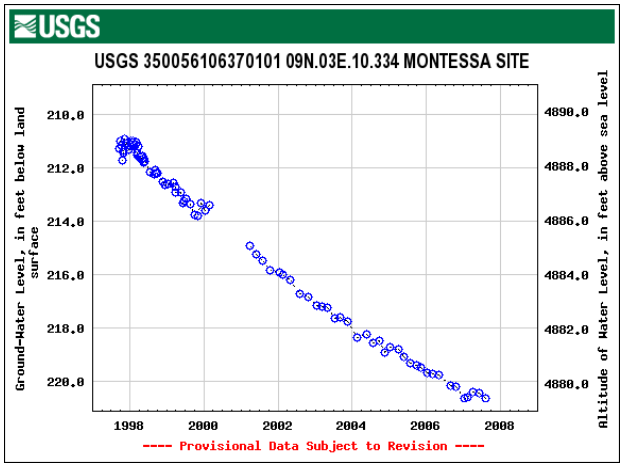

Mesa del Sol

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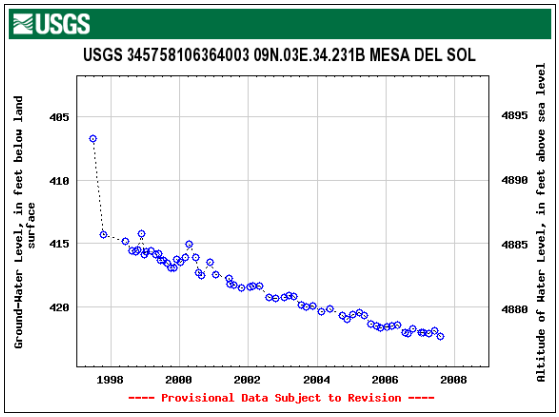

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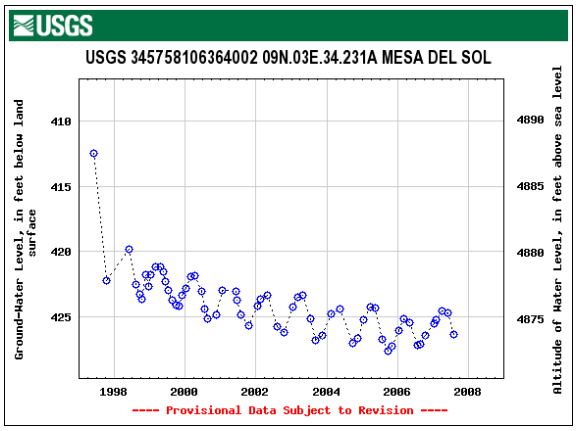

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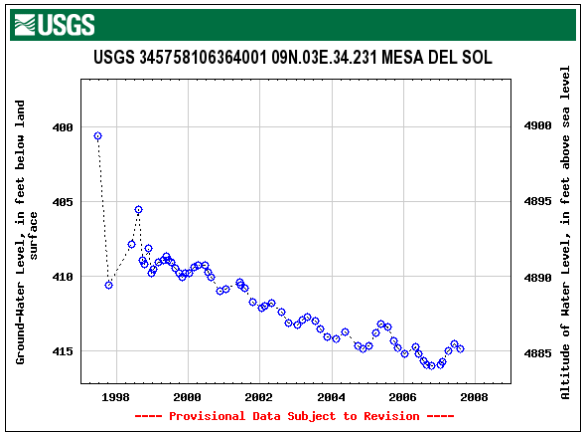


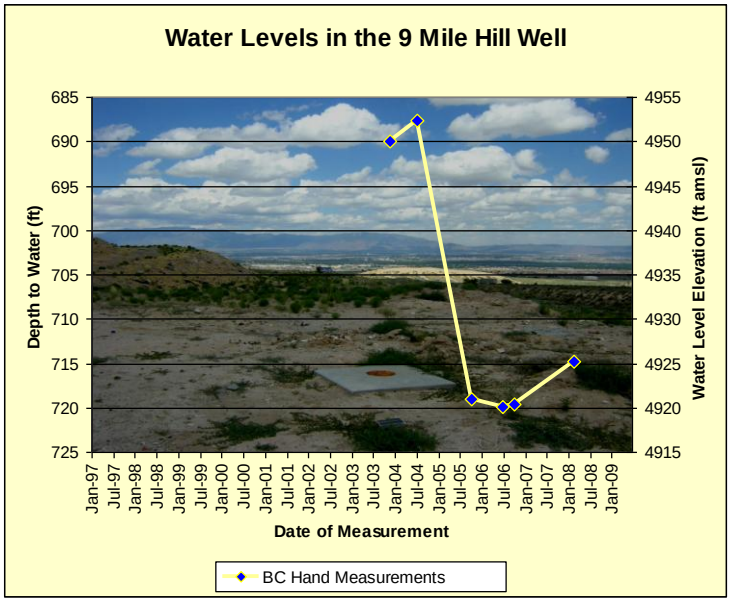
APPENDIX E

West Mesa Area Water Level Monitoring Results

May 2008

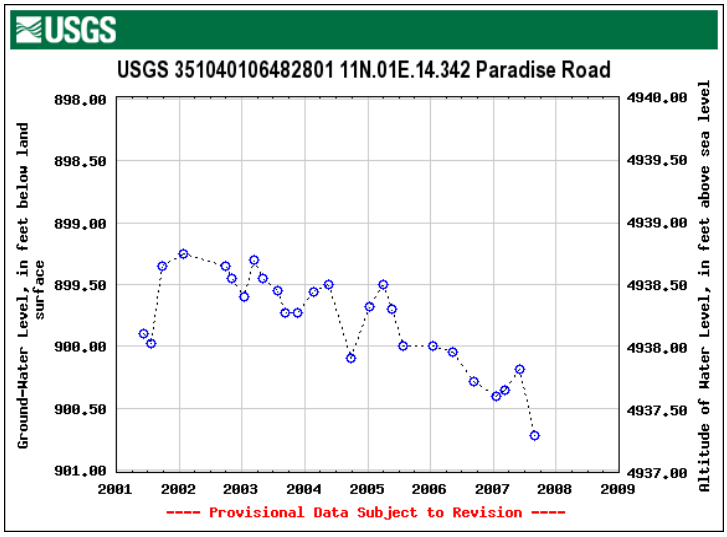
COUNTY MONITORING WELLS

9-Mile Hill

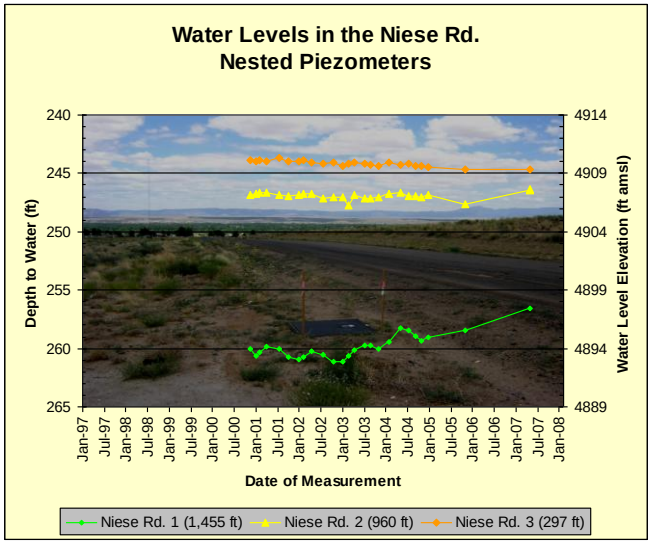


JOINT COUNTY-USGS MONITORNG WELLS

Paradise Rd.



Niese Rd.



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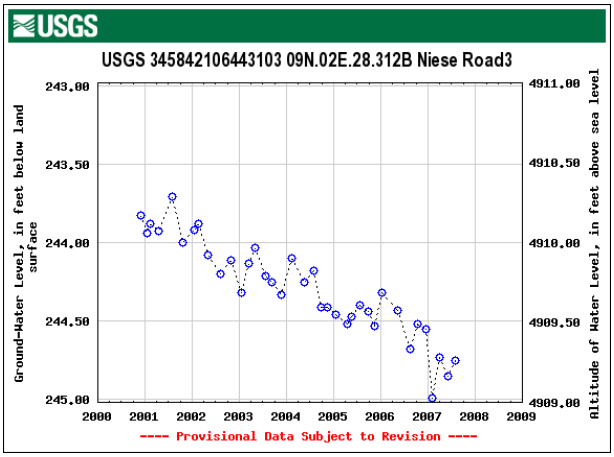

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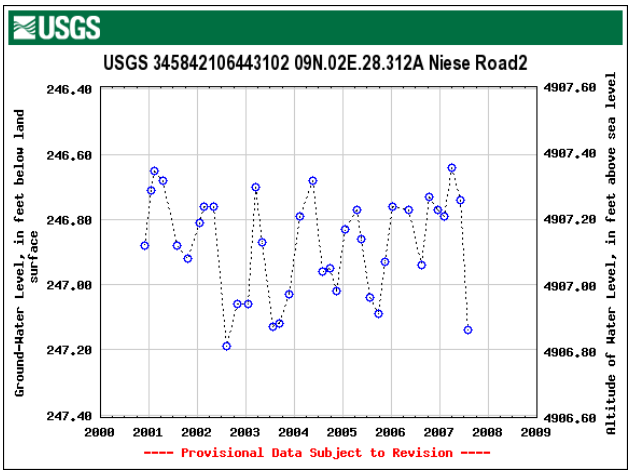

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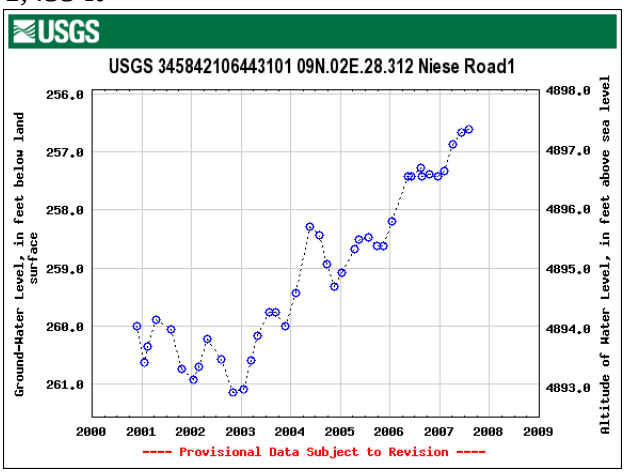
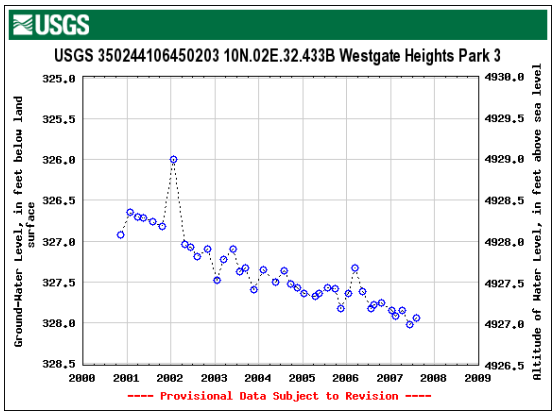


USGS MONITORING WELLS

Westgate Heights Nested Piezometer

370 ft.



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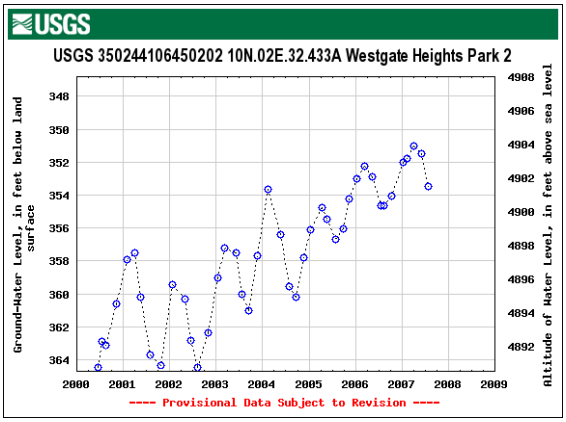

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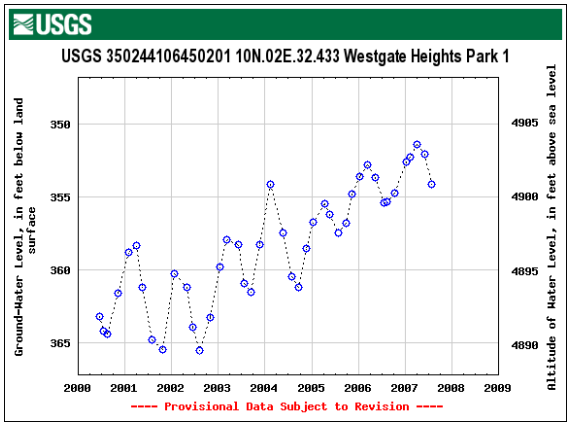
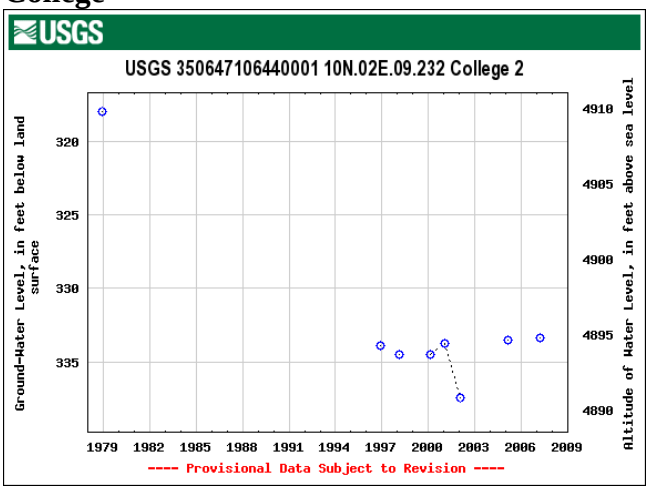
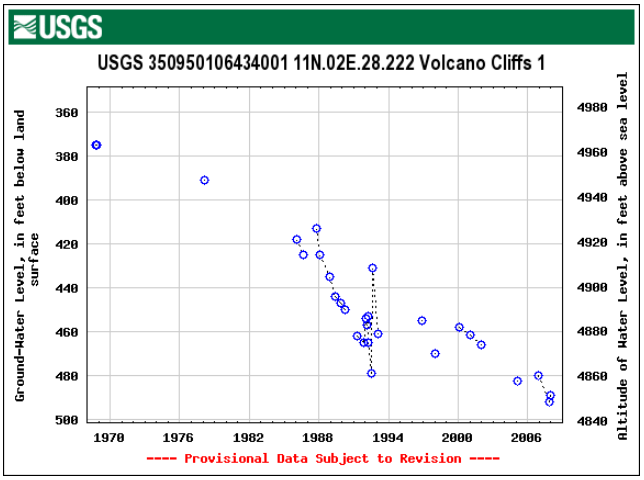


ABCWUA SUPPLY WELLS

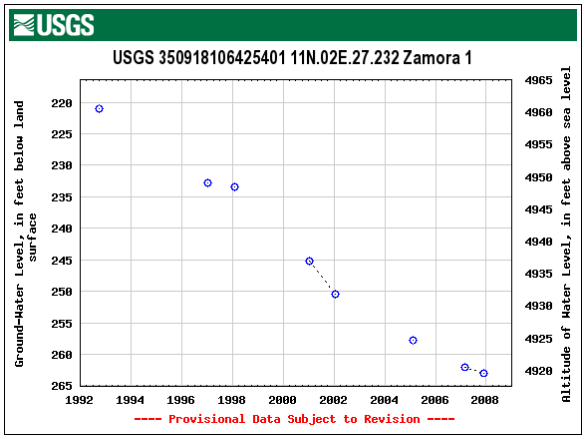
College



Volcano Cliffs



Zamora



APPENDIX F

County Facility Well Water Quality Results

May 2008

Water Quality Analysis for Bernalillo County Properties Utilizing Wells

Water was tested at Bernalillo County properties that rely on well water for drinking water, and other utility uses such as dish washing and bathrooms. Samples were taken for testing of Primary and Secondary Drinking Water Standards.

Primary drinking water standards are legally enforceable standards that apply to public water systems. Primary standards protect public health by limiting the levels of contaminants in drinking water. Secondary drinking water standards are non-enforceable guidelines regulating contaminants that may cause cosmetic effects (such as staining or discoloration) or aesthetic effects (such as taste, odor, or color) in drinking water.

Facilities tested include:

EAST MOUNTAIN AREA

Fire District 6 Main
East Mountain Transfer Station
East Mountain Command Center/Fire District 10 Main
Fire District 11 Substation
Whispering Pines Senior Center

FAR NORTHEAST HEIGHTS

Fire District 5 Main
Sheriff's Command Center
Vista Sandia Park

NORTH VALLEY

Bachechi Open Space
Sheriff's Posse Arena

SOUTH VALLEY

Fire District 4 Main
Fire Prevention Training Center

WEST MESA

Dennison Park

A summary of results is provided below. Only contaminants that exceeded the maximum contaminant level (MCL) or secondary standard are listed in tables. All parameters not listed were at or below the regulatory MCL / standard.

EAST MOUNTAIN AREA:

Fire District 6 Main

No parameters exceeded standards.

East Mountain Transfer Station

Iron, Manganese, and Sulfate are listed as Secondary drinking water standards. Turbidity is a measure of the cloudiness of water. Turbidity and total dissolved solids are used to indicate water quality and filtration effectiveness. Higher turbidity levels are often associated with higher levels of disease-causing microorganisms. Coliform are naturally present in the environment and are not a health threat themselves, but the presence of coliform is used as an indicator that other potentially harmful bacteria may be present.

Contaminant/Parameter	MCL / Standard	Result	Units
Iron	0.3	1.12	mg/L
Manganese	0.05	0.0925	mg/L
Sulfate	250	903	mg/L
Turbidity	5	11.6	NTU
Total Dissolved Solids	500	1880	mg/L
Total Coliform		Present	

East Mountain Command Center/Fire District 10 Main

Chloride, Manganese and Sulfate are listed as Secondary drinking water standards. Total dissolved solids are used to indicate water quality and filtration effectiveness.

Contaminant/Parameter	MCL / Standard	Result	Units
Chloride	250	871	mg/L
Manganese	0.05	0.058	mg/L
Sulfate	250	1030	mg/L
Total Dissolved Solids	500	3110	mg/L

Whispering Pines Senior Center

No parameters exceeded standards.

Fire District 11 Substation

pH is a measure of the acidity or alkalinity of water. A higher number indicates alkalinity. Total dissolved solids are used to indicate water quality and filtration effectiveness.

Contaminant/Parameter	MCL / Standard	Result	Units
pH	6.5-8.5	8.81	pH
Total Dissolved Solids	500	558	mg/L

FAR NORTH EAST HEIGHTS

Fire District 5 Main

No parameters exceeded standards.

Sheriff's Command Center

No parameters exceed standards.

Vista Sandia Park

No parameters exceeded standards.

NORTH VALLEY

Bachechi Open Space

Iron and Manganese are listed as Secondary drinking water standards. Coliform are naturally present in the environment and are not a health threat themselves, but the presence of coliform is used as an indicator that other potentially harmful bacteria may be present.

Contaminant/Parameter	MCL / Standard	Result	Units
Iron	0.3	0.595	mg/L
Manganese	0.05	0.149	mg/L
Total Coliform		Present	

Sheriff's Posse Arena

Manganese is listed as a Secondary drinking water standard.

Contaminant/Parameter	MCL / Standard	Result	Units
Manganese	0.05	0.192	mg/L

SOUTH VALLEY

Fire District 4 Main

Water at this facility is provided by the City of Albuquerque water system. Water was sampled to determine if it would be available as a potential alternative water resource in the case of an emergency. The valve used to fill pumper trucks was used to take samples.

All of the contaminants and indicators that exceeded guidelines are listed as Secondary drinking water standards. Bacteria were detected in the sample, but a verification sample was not taken, due to the high pressure and volume of water released from the valve. Disinfection of the large hose bib would also prove difficult.

Contaminant/Parameter	MCL / Standard	Result	Units
Chloride	250	259	mg/L
Iron	0.3	0.466	mg/L
Manganese	0.05	1.91	mg/L
Color	15	40	PCU
Total Dissolved Solids	500	780	mg/L
Turbidity	5	79.4	NTU

Fire Prevention Training Center

Arsenic is a Primary contaminant that poses a health risk. Arsenic exposure can result in skin damage, circulatory problems, and may increase cancer risk. Chloride and iron are listed as Secondary drinking water standards. Turbidity used to indicate water quality and filtration effectiveness. Higher turbidity levels are often associated with higher levels of disease-causing microorganisms. Continued use of the well at this site would require installation of a treatment system to remove the arsenic, which would be costly. Recommendation would be to connect the facility to the City of Albuquerque water system.

Contaminant/Parameter	**MCL / Standard**	**Result**	**Units**
Arsenic	0.01	0.0175	mg/L
Chloride	250	359	mg/L
Iron	0.3	0.537	mg/L
Turbidity	5	8.22	NTU

WEST MESA

Dennison Park

Manganese is listed as a Secondary drinking water standard.

Contaminant/Parameter	**MCL / Standard**	**Result**	**Units**
Manganese	0.05	1.21	mg/L