SUMMARY AND CONCLUSIONS

The Public Works Division's Water Resources program is engaged in on-going groundwater monitoring efforts. These activities are conducted under the guidance of the Groundwater Protection Policy and Action Plan. The goals of the activities conducted under this guidance are three-fold

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

Accordingly, activities of the Water Resources program include groundwater quality monitoring, water level monitoring, and planning and coordination of investigations with other County departments, the CABQ, USGS, ABCWUA, and surrounding planning entities. Administration of water rights is the purview of the Office of the State Engineer, which administers groundwater within Bernalillo County through the designation of three basins: The Middle Rio Grande Basin (which covers the vast majority of the County), the Sandia Basin, and the Estancia Basin.

Hydrogeologically, the County can be divided into five areas: the East Mountain Area, the Far Northeast Heights, the North Valley, the South Valley, and the West Mesa. The existing regional monitoring program conducted by Bernalillo County actively monitors water quality and water levels in a limited number of locations within each area:

- Four sites in the East Mountain Area north of I-40
- Two sites in the Far Northeast Heights,
- Two sites in the South Valley,
- Three sites total on the West Mesa, including one site each on the Northwest Mesa, West Mesa, and Southwest Mesa

Other programs address monitoring of the South Broadway Landfill and monitoring of agrichemical water-quality impacts in the South Valley.

Summaries and findings of this report are discussed by area.

1.10 ***East Mountain Area***

The East Mountain Area is geologically complex but can be subdivided into separate geologic / hydrologic terranes. The number of such terranes varies depending on the reference cited. Titus (1980) proposed eight (8) terranes based primarily on geology; Kues (1990) initially examined three "type" areas based on clastic rock sequences, alluvial systems, and the Madera Group aquifer. For the North Portion of the EMA there may be as many as eight different subzones. The area south of I-40 (i.e., the South Portion) can be subdivided into approximately four zones based on predominate faults and topographic basins. These differences in terrane are evidenced in the differing response of water levels to precipitation events.

Hydrographs of monitored wells indicate marked declines in water levels since 1997. The declines are about 1 to 2 foot per year. The author believes in most cases that the declines are largely due to drought conditions rather than a significant increase in pumping. This is because many of the monitored wells are in areas where growth and well use have stabilized. Additionally, there is ample evidence of water level recovery due to heavy precipitation for wells in the northeast portion of the EMA. However, areas east of the Gutierrez fault and south of I-40 have not evidenced similar rates of decline or recovery. Consequently, the author believes that recharge west of Gutierrez fault and south of I-40 is from the immediately surrounding landscape rather than being related to precipitation events occurring on the backslope of the Sandia Mountains.

There are only four dedicated regional monitoring wells for the entire area, all located adjacent of State Highway 14 and north of I-40. Yet 7,400 residents are dependent on individual domestic wells. The four regional monitoring wells have been monitored since 1997. The wells were initially installed to focus on potential contamination of groundwater by nearby septic systems. Eight or more samples have been collected from each of the wells, and data appears sufficient to support statistical analysis of water quality and trends in the data.

Groundwater monitoring in the East Mountain Area largely consists of the USGS monitoring 31 privately owned, domestic use wells. Permission to monitor these wells is through informal agreements with the well owners and is subject to "at will" revocation. While contamination from septic wastes is localized, there is some indication of neighborhood-scale contamination of the groundwater resource, and several East Mountain neighborhoods may be affected. In short, of the 31 USGS monitored wells, 14 of the wells (approximately half) yielded nitrate concentrations suggestive of septic tank contamination.

Groundwater composition in the East Mountains is predominated by calcium and either bicarbonate or sulfate. Concentrations of inorganic constituents in the East Mountain Area typically do not exceed the primary drinking water standards, although there are instances of nitrate concentrations exceeding the primary drinking water standard. Secondary standards for total dissolved solids, chloride, sulfate, and fluoride may be exceeded.

Past and existing water quality data indicate that high nitrates and trace amounts of anthropogenic organic compounds have entered the groundwater through individual septic systems. Though few wells yield water with nitrate concentrations in excess of the drinking water standard, many of the wells sampled contain elevated nitrate levels (i.e. greater than 2 mg/L). Changes in the concentrations of nitrate and other inorganic constituents appear to correlate to fluctuations in water levels in several cases. Concentrations may either increase or decrease with sudden rises in water levels, suggesting "flushing" of the hydrogeologic system with increases in water level in some areas of the EMA. The geologic complexity of the area allows water from different strata to intermingle in some areas and remain isolated in others. This means that water quality is not uniform across the EMA. It is location, depth, and in some cases, time dependent.

Given that 57 percent of EMA residents are dependent on individual wells and 50 percent of the wells may be impacted, then as many as 28 percent of EMA residents may be at risk of consuming water marginally impacted by septic tanks wastes. However, in almost all cases, the concentrations of nitrates and other detected compounds are below drinking water standards, so health risks are minimal for the general populace.

1.11 *Far Northeast Heights*

The Far Northeast Heights includes North Albuquerque Acres and Sandia Heights. Most residents in the area are dependent on individual or shared domestic wells and most utilize individual septic systems. Two monitoring wells were installed to assist in defining the extent and migration of nitrate contamination from septic tanks westward from Sandia Heights. The two monitoring wells are located on the eastern edge of North Albuquerque Acres and on the east side of faults running roughly north-south through the area. USGS monitoring in the area is limited to one nested piezometer and municipal wells located along the southern and western boundaries of the area.

Water levels in the two Bernalillo County wells, the Nor Este piezometer, and nearby municipal wells all indicate steady decline in groundwater levels at a rate of 1 to 2 feet per year. Decline rates in the monitoring wells appear to be greater than those measured in the Nor Este nested piezometer. The greater decline rate is most likely due to the presence of nearby domestic pumping. There is no concentration of either domestic or municipal pumping near the Nor Este piezometers.

The two Bernalillo County monitoring wells located along Tramway Boulevard represent shallow water quality, while information on the Nor Este piezometer to the west represents deeper water quality. Calcium and bicarbonate predominate at shallow depths and through natural processes are replaced with sodium and sulfate or chloride with increasing depth. Samples from municipal wells indicate an intermediate chemistry, suggesting intermixing of waters due to pumping from multiple depths.

Water quality generally is generally acceptable for the Far Northeast Heights. However, the primary drinking water standards for arsenic is routinely exceeded in samples from the two Bernalillo County monitoring wells and in the municipal wells. Secondary standards are occasionally exceeded for iron and manganese. There is no evidence of contamination by organic compounds.

Water level monitoring and water quality sampling is not currently conducted in the Sandia Heights, an area with significant septic tank density and likely groundwater impact. This may be due to the

lack of exposure from domestic wells because Sandia Heights is provided water from Sandia Peak Utilities whose wells are located southeast of the area. Water level monitoring and water quality sampling is conducted only on the periphery of North Albuquerque Acres along Tramway Boulevard, along the southwestern margin from ABCWUA municipal wells, and at the Nor Este piezometer site. No monitoring is conducted in the interior portion of the area. North Albuquerque Acres, however, is a likely growth area that will be dependent on individual domestic or shared wells and septic systems.

1.12 ***North Valley***

Bernalillo County does not monitor wells within the North Valley. The ABCWUA monitors in the North Valley well fields, and the USGS monitors piezometers nests on the perimeter of the North Valley.

Hydrographs for the USGS piezometer nests typically indicate decline rates of about 1 to 2 feet per year, and downward hydraulic gradients. Shallow piezometers near arroyos indicate that significant rises in water levels can occur over a short duration, and shallow piezometers nearer the river may show rises in water levels from increased seasonal streamflow. This suggests recharge to the shallow aquifer through these natural features. At depth, the magnitude of the recharge events decrease and continually decreasing water levels are observed. The decreasing water levels are due to municipal pumping.

Water quality in the North Valley shows a wider distribution in composition than for samples taken from the East Mountains or Far Northeast Heights. There is an almost continuous and linear range in cation composition that ranges from calcium to sodium. This distribution demonstrates that magnesium is seldom a significant component, and that the importance of sodium increases with depth. The greatest shift in composition with depth appears to be for the Sister Cities and West Bluff piezometer nests, which are located on either side of the Rio Grande and in areas of significant municipal pumping.

Water quality at depths below 500 feet in and surrounding the North Valley is generally quite good. The primary standard for arsenic is exceeded in some instances, and iron and manganese may exceed the secondary standards from time to time, though sulfate and chloride concentrations typically remain below the respective standards. Nitrate contamination at depth does not appear to be a significant problem within the North Valley. However, the available data is biased in that samples of shallow, individual domestic wells are not included in the available database. Municipal sewer has been extended into the North Valley in the last two years and has significantly lessened the dependence on septic tanks.

1.13 ***South Valley***

The South Valley encompasses a wide variety of land uses including heavy industrial, residential, and agricultural. Investigation and remediation of groundwater contamination from commercial and industrial activities are conducted under NMED regulations and purview. Contamination in the South Valley east of the Rio Grande and in areas along Isleta Boulevard is an on-going concern. Of primary concern are organic compounds present in groundwater beneath the San Jose neighborhood, elevated nitrate concentrations in groundwater in the Mountain View neighborhood, and petroleum storage tank clean-ups along Isleta Blvd. Bernalillo County has conducted an agrichemical water-quality impact study in two transects across the South Valley. The study indicated that there is no significant impact from agricultural chemical use in drains, canals, and shallow groundwater, although fecal coliform concentrations on the order of 1,000 to 10,000 cfu/100ml have been detected in the vicinity of the Barr Canal (McGregor 2006).

Bernalillo County performs regional monitoring at two nested piezometer locations in the inner valley: at Rio Bravo Park and near I-40 at the Isleta Pueblo boundary. The USGS monitors two nested piezometers on the East Mesa. Water level graphs do not show any significant trends for the Rio Bravo Park locations, although declines are seen in USGS piezometers located on the eastern mesa near municipal pumping. Water levels in wells and piezometers on the mesas to the east indicated on-going declines of 1 to 2 feet per year.

At the Isleta location, the influence of surface water recharge via canals and drains is evidenced. Vertical gradients between the shallow and intermediate portions of the aquifer are seasonally dependent, with downward gradients prevailing during the irrigation season. There is no evident long-term water level decline in the intermediate or deep portions of the aquifer at the Isleta location.

Primary drinking water standards are not exceeded for the two piezometer sites within the inner valley, with the occasional exception of arsenic in the Rio Bravo Park nested piezometer. There are no apparent trends in concentrations with time in the Rio Bravo wells. There is no indication of nitrate contamination problems in the monitored wells.

At the Isleta location, the influence of surface water recharge via canals and drains is evidenced in the composition of samples from the shallow groundwater wells. Changes in composition with depth, presumably due to interaction with changing lithology, are also observable. The presence of nearby basalt outcropping also may be influencing groundwater chemistry in the deepest of the Isleta piezometers by contributing "spikes" of aluminum, iron, and manganese.

1.14 ***West Mesa***

The West Mesa includes the Northwest Mesa, West Mesa, and Southwest Mesa. The USGS monitors piezometer nests and municipal wells in the West Mesa area. Groundwater information for the area is of particular interest because, like the East Mountain Area, future population growth will be in those areas.

Water levels in the Northwest Mesa show only minimal declines due to drought conditions. There is no significant municipal pumping in the area to cause the declines. Water level trends in the West Mesa are dependent on the proximity of municipal well fields. In some instances, water levels are rising due to decreases in pumping needed to control contribution of arsenic-bearing waters into the ABCWUA distribution system. Pumping has shifted eastward to wells yielding water with acceptable arsenic concentrations. There is no evidence of decline in water levels at the Niese Road or Paradise Road locations, due primarily to the lack of nearby municipal pumping.

Water quality in wells from the West Mesa is problematic due, primarily, to the presence of arsenic-rich sediments. However, other trace metals may also exceed drinking water standards from time to time due to the volcanic nature of the sediments comprising the Santa Fe Group aquifer under the West Mesa. There is no indication of organic compound contamination in the Paradise Road Well, 9 Mile Hill well, or Niese Road piezometer.

Monitoring wells were installed in the West Mesa starting in 2001 and only a limited number of samples have been collected. Consequently, statistical analysis of water quality data is of limited value at this time due to the lack of samples.