STATE OF NEW MEXICO
WATER QUALITY CONTROL COMMISSION

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| **IN THE MATTER OF APPEAL OF SUPPLEMENTAL DISCHARGE PERMIT FOR CLOSURE (DP-1341) FOR PHELPS DODGE TYRONE, INC.,** | ) | **Docket Nos. WQCC 03-12(A) WQCC-03-13(A) (Consolidated)** |
| **Petitioner.** | ) | |

**WRITTEN TESTIMONY OF MICHAEL S. JOHNSON, R.G.**

My name is Michael S. Johnson. I am the Chief of the Hydrology Bureau in the Water Resources Allocation Program within the Office of the State Engineer (OSE). I am presenting this written testimony on behalf of the New Mexico Environment Department in the proceeding on the appeal of the Supplemental Discharge Permit for Closure, DP-1341, for the Phelps Dodge Tyrone, Inc. open-pit copper mine (Tyrone Mine) located in Grant County, New Mexico. The matter is before the New Mexico Water Quality Control Commission on remand from the New Mexico Court of Appeals. My written testimony is marked as NMED Exhibit 27.

## I. Educational Background and Work Experience

I have served as Chief of the Hydrology Bureau since May 2006. As Bureau Chief, I am responsible for overseeing the work of the Bureau which includes developing groundwater flow models for different hydrologic regions of the State, developing guidelines for the administration of water rights in different basins within the State, conducting hydrologic evaluations of water rights applications throughout the State, and providing technical support for water rights adjudications throughout the State. As Hydrology Bureau Chief, I also manage professional services contracts in the amount of approximately $600,000 annually to collect hydrologic data and conduct hydrologic studies throughout the State. These contracts include joint funding agreements with the U. S. Geological Survey (USGS) to collect groundwater level data and

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conduct interpretive hydrologic studies throughout the State. I also chair the STATEMAP Advisory Committee which develops priorities for geologic mapping in New Mexico conducted by the New Mexico Bureau of Geology and Mineral Resources under a cooperative program with the USGS. I supervise a staff of thirteen persons, including ten hydrologists and one geographic information systems or GIS expert.

I have a Bachelor of Science degree in Environmental Studies from The Evergreen State College in Olympia, Washington, with a geology emphasis, and a Master of Science degree in Geology, with a hydrogeology emphasis, from Eastern Washington University. I am a registered Professional Geologist in the State of Arizona.

I began working for the OSE as a Water Resource Engineering Specialist in the District IV Las Cruces office of the Water Rights Division in 1999. In that capacity, I served as basin supervisor for the Hot Springs, Las Animas Creek and Lower Rio Grande Underground Water Basins, and I evaluated and recommended final action to the District Supervisor on 25 water rights applications in these basins. From 1999 to 2006, I was a hydrologist with the Hydrology Bureau, where I conducted over 40 hydrologic evaluations of water rights applications in seven basins. These evaluations included performing field investigations to locate wells, springs and other hydrologic features; measuring water levels and flows; analyzing aerial photography and satellite imagery, diversion records and other evidence to evaluate historical water use; and estimating hydrologic effects such as water-level drawdown and stream depletions. To estimate hydrologic effects, I have used a variety of methods including analytical techniques such as the Theis and Glover-Balmer equations and numerical groundwater flow models. I developed groundwater flow models for the Animas, Lordsburg and Silver City areas and used or worked on such models in the Mimbres, Hueco, Jornada and Lower Rio Grande Basins to evaluate water rights applications and assist in water rights administration and regional water planning in these areas. A selected listing of the technical reports I have prepared or assisted in the preparation of appears in my resume, which is NMED Exhibit 28. I have testified as an expert witness in hydrology at four OSE administrative hearings and one district court trial related to water rights applications. One of the administrative hearings for which I provided expert testimony involved a water rights transfer to the Town of Silver City's Franks well field.

## II. Summary of Testimony

The purpose of my testimony is to analyze whether the existing municipal water supply in the Silver City area is adequate to meet the future demand for water over the next 40 to 60 years. In general, my opinion is that the municipal demand for water in the Silver City area will likely exceed the supply available to existing sources by the year 2040, and that therefore the Town of Silver City and surrounding communities will need to seek new sources of water in the near future.

More specifically, for my analysis I evaluated two scenarios. Scenario 1 considered the municipal demands of Silver City, Santa Clara and Bayard separately. Scenario 2 assumed that Santa Clara and Bayard would be served by a regional water system supplied by the Silver City wells. For Scenario 1, I concluded that the Silver City wells will likely not be capable of meeting the projected demand by 2060, and that new sources of water supply would be necessary. I also found that the existing well fields for Santa Clara and Bayard will not be capable of meeting the projected demand of these communities through 2040, and that connection to a regional water system may be the only viable option for these communities. For Scenario 2, I concluded that by 2040 the Silver City wells will not be capable of meeting the projected demand for Santa Clara and Bayard in addition to the demands of Silver City, and that additional sources of water supply will need to be developed.

My conclusions are consistent with the conclusions arrived at by others who have recently evaluated the future municipal water demand and supply in the Silver City area. Others have found that demand will exceed supply from existing sources in the Silver City area between 2020 and 2050.

## III. <u>Basis of Testimony</u>

My testimony is principally based on a report which I authored with two other OSE staff persons, *Analysis of Effects of Ground-Water Development to Meet Projected Demands in Regional Planning District 4 Southwest New Mexico* (*Ground Water Development Analysis*), issued in March 2002, which is NMED Exhibit 29. For this testimony, I also reviewed other reports, identified within this testimony, including the *Supplement on Water Use and Wellfield Service – Town of Silver City Water Plan* (*Silver City Wellfield Service Report*), dated April 2006, which was authored by Balleau Groundwater, Inc. (Balleau Groundwater), and which is NMED Exhibit 30. This report updates and supplements a report entitled *A 40-Year Water Plan for the Town of Silver City, New Mexico* by Engineers, Inc. (*Silver City 40-Year Plan*), dated October 1993.

## IV. <u>Analysis of Future Municipal Supply and Demand for Water in Silver City Area</u>

### A. Introduction

In 2002, to support regional water planning efforts, the Interstate Stream Commission (ISC) requested that the OSE Hydrology Bureau evaluate existing groundwater supplies and estimate the feasibility of attempting to meet selected future water demands through continued groundwater pumping. I was assigned to lead this project, and I worked in coordination with my colleagues and co-authors of the report, Linda Logan and Douglas Rappuhn. Among other tasks identified by ISC, we were asked to evaluate the ability of existing groundwater supplies to meet municipal demands for 40 years for the central Grant County area, including demands for the Town of Silver City and the communities it currently serves, Tyrone, Piños Altos, Rosedale and Arenas Valley, and the demands for Santa Clara, and Bayard. I conducted this portion of the evaluation and completed this task myself. This work was reviewed by Tom Morrison, P.E., Hydrology Bureau Chief, and by ISC project manager Craig Roepke.

**B. Summary of Approach**

To accomplish this task I first reviewed and summarized the available literature regarding the geology, hydrology, and water use in the area. I then compiled information on the construction of the wells currently used by Silver City, Santa Clara, and Bayard to serve municipal demands in the area. I modified a groundwater flow model of the Silver City area and updated the historical calibration of the model to the year 2000. (This model is discussed in more detail below in section IV.G titled "Methods".) I used this model to estimate effects of future pumping to meet projected water demands for municipal, commercial, industrial, mining and power uses by simulating pumping at the various wells and well fields within the model area, using water demand projections. I adjusted cell drawdowns calculated by the model to estimate drawdowns within the municipal wells to account for model discretization effects and well efficiency. I compared these drawdowns to water columns in the wells to determine whether wells might remain viable in 2020, 2040, and 2060, using 100 feet or 30 percent of remaining water column as the criteria for whether wells may be able to remain in service.

**C. Regional Hydrogeologic Setting**

The upper and middle units of the Gila Group, herein referred to simply as the upper Gila Group, comprise the principal aquifer within the Silver City model area. These consist of slightly to partly consolidated sand, gravel, silt and clay. The lower unit of the Gila Group consists of partly to well-consolidated sandstone, conglomerate, and mudstone, and generally yields less water than the upper unit. Reported well yields in the upper Gila Group range from less than 10 to 1,000 gallons per minute (gpm); yields from the lower Gila Group are generally in the range of a few gpm. Hydraulic conductivity of the upper Gila Group reportedly ranges up to 10 feet per day, one to four orders of magnitude greater than the lower Gila. Groundwater also occurs in younger bolson-fill and alluvial deposits of major drainages. The Gila Group and younger basin-fill deposits can be considered part of the same regional flow system, and for my analysis were grouped together as "basin-fill". In some areas this basin-fill flow system is underlain by confined flow systems of unknown extent occurring in Tertiary volcanic rocks and related sediments. Mountain-front recharge to the basin-fill aquifer occurs along the Big Burro Mountains and the Piños Altos Range, and elsewhere along the Continental Divide. Groundwater in the basin-fill aquifer in the Silver City area ultimately discharges either to the Gila River to the northwest, or as underflow to the larger Mimbres Basin to the southeast.

**D. Demand Projections**

For the *Ground Water Development Analysis* I used projections of future water demands for the period 2000 to 2060 for Silver City and communities currently served by the Silver City municipal water system (Arenas Valley, Piños Altos, Rosedale, and Tyrone), and for the communities of Santa Clara and Bayard made by Brian Wilson, P.E., OSE Water Use and Conservation Bureau Chief, in his report, *Projected Water Demands in Grant, Hidalgo, and Luna Counties, New Mexico, 2000 to 2040* (*Projected Water Demands*), dated December 16, 2001. He based these water demand projections on population projections by Adelamar Alcantara from the University of New Mexico's Bureau of Business and Economic Research, as published in her report, *Population Levels and Trends in Nine New Mexico Water Planning Regions: 1960-2060,* issued in 1996. Estimated demands for commercial, industrial, mining and power uses in Grant County for this period are also provided in *Projected Water Demands*. For my investigation I combined commercial and industrial demands with municipal demands to evaluate pumping effects at the municipal wells and well fields, assuming that most of these demands would be met by the municipal water systems in the area. I simulated pumping to meet mining and power demands from separate wells and well fields associated with those uses. Demands for self-supplied domestic, livestock, and reservoir evaporation were not included in the analysis.

**E. Well Field Conditions**

**1. Silver City**

The Franks well field is located in the Mangas sub-basin within the Gila-San Francisco Underground Water Basin, about one to 2.5 miles west of the Continental Divide, and about 16 miles from the Gila River. Production began in 1946, and for some 12 years the Franks field provided essentially all of Silver City's water. The upper Gila Group is present at land surface, and the log for well GSF-1014-S-6 indicates that this unit may be over 1,000 feet thick, although the *Silver City 40-Year Plan* reported that the upper Gila is at most 900 feet thick at Silver City's well fields. From 1946 to 2000, the Franks well field averaged almost 50 percent of total annual water production by Silver City. Since 1958, when the Woodward well field went into production, pumping at the Franks well field averaged less than 30 percent of the Town's total annual pumping. From 1946 to 2000 maximum production was about 1,033 acre-feet in 2000.

In response to declining water levels at the Franks well field, in the late 1950's the Woodward well field was put into production, across the Continental Divide in the Mimbres

Underground Water Basin, and a few miles southeast of the Franks well field. The Woodward wells produce from the same aquifer as the Franks wells, and the properties of the Gila Group at the two locations are similar. According to the *Silver City 40-Year Plan,* the upper Gila Group is about 900 feet thick at the Woodward well field. Since 1958, the Woodward well field averaged almost 60 percent of Silver City's total annual water production. Maximum production was 1,692 acre-feet in 1976.

Silver City also pumps from two other wells in the Mimbres Basin, the Hayes and Anderson wells. The Anderson well is completed in the Gila Group aquifer. The Hayes well produces from an underlying aquifer in Tertiary volcanic rocks. The extent and properties of this aquifer and its relationship to the overlying basin-fill aquifer are not well understood. Successful simulations of water-level changes in the basin-fill aquifer that have assumed the Hayes well affects the same flow system as pumping at Silver City's other wells indicates there may be significant hydrologic connection between the two aquifers. The Hayes well is located in an area where aquifer properties the same as those at the Woodward well field have been used. From initial production in 1986 through 2000, the Hayes well provided an average of over 30 percent of Silver City's total annual water production. Maximum production from the Hayes well was about 1,404 acre-feet in 1987. The Anderson well has provided an average of about four percent of total annual production from 1977 to 2000, although in recent years production from this well has been minor. Maximum production from the Anderson well was about 305 acre-feet in 1984.

### 2. Santa Clara and Bayard

Municipal demands at Santa Clara are supplied by the four wells in the Lone Mountain well field, which are completed in the Gila Group. Depth to water at these wells when drilled ranged from about 45 feet to almost 170 feet below land surface. The shallow wells in the

Bayard well field are completed in the alluvium of Cameron Creek and the underlying Gila Group; the deeper wells may produce from underlying aquifers in Tertiary volcanic rocks or Paleozoic limestones. For the *Ground Water Development Analysis* I simulated all pumping by Santa Clara and Bayard as occurring in the basin-fill aquifer.

### F. Water-Level Declines

Water levels have declined in the vicinity of pumping wells in the area as pumping has mined groundwater from storage in the basin-fill aquifer. Some of the most significant water-level declines have occurred in the vicinity of the wells supplying municipal demands. Depth to water at the Franks well field was initially less than 250 feet, but from 1946 to 2000 had declined to over 300 feet, an average annual rate of decline of over one foot per year. Depth to water at the Woodward well field was initially about 300 feet, but has declined at average rates of 3 to 4 feet per year since pumping began. The Balleau Groundwater *Silver City Wellfield Service Report* simulated historical drawdown from 1945 to 2005 near Silver City's wells ranging from 60 to over 100 feet. Water levels declined at rates of 0.7 and 1.0 feet per year from 1954 to 1979 at Lone Mountain wells 1 and 2, respectively. Water levels at a well located near the Lone Mountain well field in Section 15, T18S, R13W declined about 28 feet from 1956 to 1983, or about 1.0 foot per year.

### G. Methods

To estimate effects of future pumping to meet projected demands in the area, I used a model that I had developed to evaluate effects of pumping at Silver City's well fields, which I have referred to as the Silver City model. The Silver City model is a finite-difference groundwater flow model with one layer that represents the flow system primarily in the basin-fill aquifer, with a grid of 48 rows by 50 columns and 1,413 active cells. The model grid covers a large part of central Grant County, extending from the Gila River near Cliff on the northwest to the northwest corner of Luna County at the Grant-Luna County line to the southeast. Model cells range in size from 0.25 square miles at Silver City's well fields to one square mile. I simulated boundary conditions that included mountain-front recharge and regional discharge to the Gila River and as underflow to the larger Mimbres Basin. I calibrated the Silver City model to regional steady-state conditions, and to transient conditions for the period 1946 to 2000 at Silver City's Franks, Woodward and Anderson well fields. In addition to diversions by Silver City, I also simulated historical withdrawals at the Santa Clara and Bayard well fields, at the Cron Ranch wells, at the Tyrone Mine and four wells in the Mimbres Basin by Phelps Dodge Tyrone, Inc., and at several well fields south of Hurley by Chino Mines Company. I did not simulate the effects of pumping at domestic wells in the model for this analysis, and therefore drawdown may be underestimated in some localized areas influenced by such pumping.

In a finite-difference model such as the Silver City model, drawdowns are calculated at cell nodes, based on heads that are averages for the entire area within the cell. Actual drawdowns at pumping wells located within a model cell would differ from these values. Also drawdown in a pumping well is typically greater than drawdown in the aquifer just outside the well due to inefficiencies in the well. To better estimate effects of pumping on water columns within the wells themselves I adjusted the drawdowns calculated by the model to account for model discretization and well efficiency. I adjusted for discretization using a method described on pages 147-151 in the text by M. P Anderson and W. W. Woessner titled *Applied Groundwater Modeling: Simulation of Flow and Advective Transport*, published in 1992. To adjust drawdown to account for well efficiency I assumed a uniform efficiency of 70 percent for all wells and divided the adjusted drawdown values by 0.70.

Wells in unconfined aquifers may become uneconomical to operate with about 30 percent or less remaining water column. All wells require some water column for the pump to function. Previous investigations of Silver City's wells have assumed different thresholds for when a well's productive service life ends, including 50 percent of the initial water column, 120 feet of water column, and 200 feet of water column. Analysis of water levels in the Mimbres Basin as part of my investigation indicated that the wells evaluated required at least 100 feet of water column to function. For this investigation, a minimum water column of 100 feet or 30 percent of the well's initial water column, whichever was greater, was assumed necessary for the well to remain functional.

### H. Model Scenarios

I used the model to simulate two pumping scenarios. In Scenario 1, municipal demands of Silver City, Santa Clara and Bayard were simulated as being pumped separately from each community's existing wells. In Scenario 2, projected municipal demands of Santa Clara and Bayard were added to those of Silver City, assuming a regional system served solely by Silver City's well fields. Pumping in this scenario of the entire combined municipal demands of Silver City, Santa Clara and Bayard was simulated as occurring at Silver City's wells.

### I. Results

#### 1. Scenario 1

Results of the Scenario 1 analysis indicated that by 2040 at least four Silver City wells currently in operation and representing approximately 40 percent of total pumping capacity would have less than 100 feet or 30 percent of their water column remaining. I concluded that only with careful management and distribution of pumping would it be possible to meet Silver City's demands with the current well field locations until the year 2040. Results for 2060 showed that by that year at least five Silver City wells currently in operation and representing approximately 46 percent of total pumping capacity would have less than 100 feet and/or 30 percent of their water column remaining. From this I conclude that it is unlikely that it would be possible to meet Silver City's demands with the current well field locations until the year 2060.

Drawdown by 2040 is predicted to leave water columns of less than 100 feet at the Santa Clara and Bayard well fields, which indicates those well fields cannot sustain the production necessary to meet projected demands for the entire period. In my opinion, management of drawdown at either well field by pumping those wells with more available water column at higher rates and/or by deepening wells to attempt to regain production from the basin-fill aquifer is not practical. Additional wells may extend the productive life of Santa Clara's Lone Mountain well field, but this option is probably not feasible for the Bayard well field. It might be possible to attempt to produce from the underlying aquifers, but the extent and nature of these units in the area is not well known and is thought to be limited. I concluded that connection to a regional water system using other sources of supply within the next 20 years may be a more viable option for these communities.

**2. Scenario 2**

The results of the Scenario 2 simulation indicated that by 2040 at least seven of Silver City's wells currently in operation and representing approximately 60 percent of total pumping capacity would have less than 100 feet or 30 percent of their water column remaining. I concluded that Silver City's existing well field locations cannot withstand the drawdowns estimated to occur if production were increased to meet the demands of Santa Clara and Bayard in addition to Silver City. In my opinion, deepening wells at their current locations would generally not be feasible, given the limited thickness of productive aquifer at the well fields, but additional wells in the basin-fill aquifer to the southeast in the Mimbres Basin could reduce drawdowns by spreading pumping laterally. New wells in either the Mimbres or Gila-San Francisco Basins are options, although both basins are fully appropriated, meaning no additional pumping can be accomplished without transfers of existing water rights. Also, it is important to note that, presently, the outflows from the Mimbres Basin are estimated to exceed the inflows by 33,680 acre-feet per year. *Southwest New Mexico Regional Water Plan* (Southwest New Mexico Regional Water Plan Steering Committee, May 2005), Table 7-1, which is NMED Exhibit 31. Other sources such as the Tertiary volcanic aquifer currently tapped by the Hayes well could also possibly be exploited, although data suggest this aquifer and the basin-fill are hydrologically connected. Without provision of some other source, it is likely that the communities of Bayard and Santa Clara will have to rely on some regional system utilizing groundwater as the source of supply, and Silver City's wells appear at present to be the most likely source for such a system. Therefore new sources of water supply will need to be developed for Silver City, Santa Clara and Bayard in the next 40 years.

## V. <u>Other Reports</u>

As part of and subsequent to my evaluation, I reviewed several studies conducted by various hydrologists and engineers that included predictions of drawdowns and expected longevity of the well fields supplying the municipal demands of Silver City, Santa Clara, and Bayard. The studies I reviewed in preparing my report included a report by F. C. Koopman, F. D. Trauger and J. A. Basler, entitled, *Water resources appraisal of the Silver City area, New Mexico* (OSE Technical Report 36), dated 1969; a report by F. D. Trauger, D. N. Jenkins and R. L. Link entitled *Water Resources Appraisal for East-Central Grant County, New Mexico*, dated January 1980; and a report entitled *A 40-Year Water Plan for the Town of Silver City, New*

*Mexico* by Engineers, Inc. dated October 1993. Subsequent to my evaluation, I reviewed a report by Balleau Groundwater entitled *Supplement on Water Use and Wellfield Service – A 40-Year Water Plan for the Town of Silver City, New Mexico* (*Silver City Wellfield Service Report*), dated April 2006. This report is discussed in more detail below and is NMED Exhibit 30. In the more recent of these reports, which used different methods of analysis and different criteria for when a well would become non-functional, Silver City's various wells as they are currently constructed are estimated to end their useful life due to drawdown between about 2020 and 2050. These findings are generally consistent with my conclusions. Several of these reports also identified developing additional wells and well fields in the area as alternatives including expanding and developing new well fields in the Mimbres Basin.

The Town of Silver City has prepared the *Silver City Wellfield Service Report,* which updates and supplements the *Silver City 40-Year Water Plan.* Balleau Groundwater used a modified version of the Silver City model to evaluate the service life of Silver City's well fields under different growth and water availability scenarios. I have reviewed that report and provide the following opinions and conclusions regarding it.

Modifications to the Silver City model made by Balleau Groundwater included simulating the effects of pumping from domestic wells in the model area, simulating recharge to the aquifer from effluent discharges from Silver City's wastewater treatment plant, and using the MODFLOW multi-node well package to simulate declines in well yield as a result of drawdown. These modifications are reasonable and incorporate aspects of the hydrologic system not included in the model version I used for the *Ground Water Development Analysis*.

In general, the *Silver City Wellfield Service Report:*

- Affirms the utility of the Silver City model for the purpose of evaluating effects of pumping on aquifer and well water levels in the vicinity of Silver City's wells;

- Evaluates the 40-year period 2005 to 2045;
- Uses two growth schedules of water use, low and high, with annual growth rates of 1.2 and 2.9 percent, respectively, based on observed growth rates in the number of connections to Silver City's municipal water system from 1993 to 2004;
- Also presents results for a medium growth rate in groundwater pumping of 1.45 percent, assuming a scenario wherein half the high growth demand is met by imported water;
- Predicts that water demand will exceed permitted diversions totaling 4,566.64 acre-feet per year by 2043 under the low growth scenario and by 2021 in the high growth scenario;
- Predicts, based on a population growth rate of 1.31%, that the Town's projected demand for water will exceed its permitted use in 35 years, by 2040;
- Concludes that "it is reasonable to begin seeking water rights to transfer into the Town water system. Planning now will provide time to account for the uncertainty of future demand and the timeline associated with water-rights acquisition." (Pp. 16-17.);
- Uses a water column reserve of 120 feet;
- Presents drawdowns in 2045 in the vicinity of Silver City's well fields that are similar to those that I estimated for the year 2040 in the *Ground Water Development Analysis*;
- Concludes that as presently configured the Silver City wells can supply the high growth rate in demand for about the next 30 years until yields of some wells begin to decline, and can supply the medium growth rate in demand without any loss in yield for 40 years;
- Concludes that the Silver City well fields as they are presently configured can sustain a long-term yield of 4,200 acre-feet per year, which is less then 2040 demand under the high growth schedule and that used in the *Ground Water Development Analysis*;

- Assumes that Silver City's wells could be deepened 300 feet to extend service life and increase yields, resulting in a long-term sustainable yield of 6,600 acre-feet per year. However, the report notes that this yield would come at the expense of yields at wells serving other uses in the area, and that the two categories of use interfere with each other.

In general I agree with the approach and conclusions reached in the *Silver City Wellfield Service Report*. I agree that, under the population growth scenario examined, Silver City's projected demand will exceed its permitted water rights to divert by the year 2040. This conclusion is also consistent with the *Southwest New Mexico Regional Water Plan*, referred to above, which found that Silver City's projected demand will exceed its permitted water rights by 2040, and with the *Projected Water Demands* report, which presented projected Silver City demands that exceeded permitted water rights before 2040. I also agree with the conclusion that a reasonable long-term yield of Silver City's existing wells is on the order of 4,200 acre-feet per year, which is insufficient to meet projected demands by 2040.

I disagree with the assumption that wells could be successfully deepened in the basin-fill aquifer to replace yield lost with declining water levels, given the uncertainty of productivity of the lower Gila Group likely to be penetrated at depths of hundreds of feet below those penetrated by the existing wells. The one-layer Silver City model simulates aquifer productivity as being uniform with depth, and so cannot be used in its current configuration to examine effects of pumping from deeper parts of the aquifer that potentially have significantly lower productivity then the upper Gila Group.

This concludes my direct testimony.

I, Michael S. Johnson, swear that the foregoing is true and correct.

Michael S. Johnson

Michael S. Johnson

Subscribed and sworn to before me this 3rd day of July, 2007 by Michael S. Johnson.

Melissa Y. Morrow

Notary Public

My commission expires:

April 3, 2011