JLA Geosciences, Inc.
HYDROGEOLOGIC CONSULTANTS

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Jupiter, Florida 33458
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April 27, 2011

James Harmon, P.G.
Consulting Hydrogeologist
Water Use Regulation Division
3301 Gun Club Road
West Palm Beach, FL 33406

RE: ***Glades Utility Authority, Upper Floridan Aquifer, Aquifer Performance Test***
Aquifer Performance Testing Results

Dear ~~James~~: Jim

Attached, please find one (1) copy of the Glades Utility Authority, Upper Floridan Aquifer, Aquifer Performance Test and Testing Results Technical Memorandum for your use. If you have any questions, Please contact me at 746-0228, x. 102.

Sincerely,
JLA Geosciences, Inc.

James L. Andersen, P.G.
Principal Hydrogeologist

JLA:rmk
Encls.
CC: Emily Richardson (w/ attachments)
Steve McGrew, P.E. (w/ attachments)
Thomas Biggs, P.E. (w/ attachments)

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TECHNICAL MEMORANDUM

To: **Thomas Biggs, P.E., Mock Roos**

Copy To: **Steve McGrew, P.E., Palm Beach County Water Utilities Department**

From: **Jim Andersen, P.G., JLA Geosciences**
Jon Friedrichs, JLA Geosciences

RE: Glades Utility Authority, Upper Floridan Aquifer, Aquifer Performance Test
Aquifer Performance Testing Results

Date: April 1, 2011

EXECUTIVE SUMMARY

JLA Geosciences, Inc. (JLA) provided hydrogeologic consulting services for the implementation of an Upper Floridan aquifer (UFA) performance test (APT) at the Glades Utility Authority (GUA) Upper Floridan aquifer wellfield in Belle Glade, Florida. The aquifer performance test was performed by JLA in cooperation with the GUA water treatment plant staff and the Palm Beach County Water Utilities Department (PBCWUD). A brief summary of the APT procedure and results is presented below, followed by a detailed description.

- Two (2) APTs were successfully completed between March 6 and March 15, 2001. The first APT included pumping PW-3 as the test production well (TPW) and the second APT included pumping PW-6 as the TPW. Drawdown values in the observation wells, generated by both tests were similar.
- Calculated aquifer parameters from the drawdown data are comparable to the original aquifer parameters reported in the 2005 Camp Dresser and McKee (CDM) well completion report for "The Paul Rarden Park Test Production Wells (TP1 and TP2)" (CDM report).
- Averaged results from the PW-3 and PW-6 APT's and results from the CDM Report are summarized in the table below:

Aquifer Parameter	APT Results PW-3 Startup	APT Results PW-6 Startup	APT Results CDM Report
Transmissivity	92,300 gpd/ft	106,500 gpd/ft	117,000 gpd/ft
Storativity	2.0×10^{-4}	2.6×10^{-4}	1.1×10^{-4}
Leakance	0.010 gpd/ft^3	0.018 gpd/ft^3	0.015 gpd/ft^3

- Three wells were pumped during the APT (TP-2, PW-3 and PW-6) at rates between approximately 1710 gallons per minute (GPM) and 1750 GPM. GUA water treatment plant demands required pumping one well (TP-2) for the duration of the APT period until recovery.
- PW-3 and TP-2 SCADA data provided by PBCWUD was on average approximately 20 GPM lower than pumping rate measurements recorded by flowmeters at the actual well.
- Average pumping rate data reported from the PW-6 SCADA measurements were approximately 220 GPM lower than pumping rate measurements recorded by flowmeters at the well.
- Averages of the pumping rates measured at the wells were used to calculate aquifer parameters and pumping well specific capacities. Pumping well drawdown, water levels and specific capacities from the APT are summarized in the table below:

Well	Pumping Rate (GPM)	Static Water Level (Ft. NGVD)	Pumping Water Level (Ft. NGVD)	Draw-down (Ft)	Specific Capacity (GPM/Ft)
TP-2	1750	47.6	-23.7	71.3	24.5
PW-3	1740	49.27	-31.6	79.9	21.8
PW-6	1710	44.1	-43.1	87.1	19.8

- These specific capacities are lower than originally measured for wells TP-2, PW-3 and PW-6. A number of factors may have contributed to the differences and the step drawdown tests will provide more information and more accurate comparisons.
- Field water quality parameters were measured from pumping wells TP-2, PW-3 and PW-6 during the APT. A comparison of the final field water quality parameters measured during the APT and laboratory water quality results from the UFA wells after construction are presented below:

APT WATER QUALITY				HISTORICAL LAB WATER QUALITY		
Date	Well	Spec. Cond. (uS/cm)	TDS (mg/L)	Date	Spec. Cond. (uS/cm)	TDS (mg/L)
3/14/2011	**TP-2**	8357	5432	3/15/05	4260	2550
	PW-3	5170	3360	12/12/06	4690	2600
	PW-6	11250	7310	02/13/07	5430	2900

- The reductions in aquifer water levels in the wellfield are at least in part due to the total dissolved solids (TDS) increases in the production wells. Calculated static fresh water heads and measured static heads for each GUA, UFA well are summarized in the table below:

Maximum Static Water Levels (FT NGVD29)		
Well	**Measured Head**	**Calculated Freshwater Equivalent Head**
TP-1	+46.78	+52.88
TP-2	+47.62	+52.92
PW-3	+49.27	+52.31
PW-4	+45.97	+50.23
PW-5	+39.72	+49.80
PW-6	+44.23	+51.41
PW-7	+45.17	+50.49

- Calculated static fresh water equivalent heads in the GUA, UFA wells are roughly +50 feet NGVD.
- During the APT, there was no measureable pumping influence from the wellfield on the South Florida Water Management District (SFWMD) Floridan Aquifer Monitoring Well cluster PBF-7, located approximately 3-4 miles from the LR wellfield.

Subsequent tasks for this project include MODFLOW and variable density SEAWAT computer modeling that will assist in evaluating changes in UFA water quality and measured head observed since operations commenced at the site. Individual well step drawdown testing will further evaluate changes in pumping water levels, well capacities and water quality.

UPPER FLORIDAN AQUIFER PERFORMANCE TEST PROCEDURE

The GUA, Lake Region, UFA wellfield, APT was completed between March 6 and March 15, 2011. The purpose of the APT was to evaluate the influence of pumping wells on adjacent production wells, and to estimate appropriate aquifer coefficients for the UFA in the vicinity of the wellfield. Implementation of the GUA, APT was contingent upon the operational needs of the GUA WTP during the course of the APT. In order to simulate a one-pumping-well APT for an extended period of time, and meet the daily 5 million gallons per day (MGD) water use demand, a two and three well operational plan was developed to perform the APT.

The APT was conducted by monitoring water levels in all seven (7) GUA, UFA production wells (TP-1, TP-2, PW-3, PW-4, PW-5, PW-6, and PW-7) at the Lake Region UFA wellfield. Three (3) UFA production wells were utilized as pumping wells based on their location within the wellfield and relative to well PW-5. TP-2, PW-3 and PW-6 were pumped at constant rates of approximately 1750 GPM, 1740 GPM, and 1710 GPM respectively. The test involved:

- An approximately 11-hour pre-test background phase with well TP-2 pumping;
- A 26-hour pumping phase with wells PW-3 and TP-2 pumping;
- A 144-hour pumping phase with wells PW-6, PW-3, and TP-2 pumping; and
- An 11-hour recovery phase with all seven (7) wells shut off.

During the pumping and recovery stages of the APT, head changes in the three pumping wells and four non-pumping wells were recorded with electronic pressure transducer data loggers. The data loggers were installed two days prior to the APT and began recording background water levels. Pumping wells TP-2, PW-3 and PW-6 were outfitted with 100 pounds per square inch (psi) data loggers, while observation wells PW-4, PW-5, PW-7 and TP-1 were outfitted with 30 psi data loggers. Manual water level measurements were also recorded during the pumping and recovery stages of the APT as back up for the electronic data logger measurements. Manual measurements were made with electronic water level meters and/or manometer tubes at each UFA well. Pumping rates were recorded using flowmeters at the pumping wells and were continuously monitored and reported using the well flow meters and GUA data telemetry system.

Prior to the onset of pumping, pre-APT static water levels were measured manually using the manometer tubes attached to the wellheads on wells PW-4, PW-5, PW-6 and PW-7, and with an electronic water level tape on well TP-2. Static water levels in wells PW-3 and TP-2 were higher than the manometer tubes and were not manually measured immediately prior to the APT.

Periodically during the APT water level data was downloaded from the data loggers, field water quality parameters were measured from the pumping wells and manual water level measurements were taken from all 7 UFA wells.

Results from the APT were used to calculate aquifer properties of the UFA in the vicinity of the GUA, UFA wellfield. These results were compared to APT results reported in the 2005 CDM Report.

APT RESULTS

The scope of work included analyzing drawdown data collected in seven (7) UFA production wells (TP-1, TP-2, PW-3, PW-4, PW-5, PW-6 and PW-7) during a constant-rate APT and comparing the results of the APT to the results of the CDM Report APT performed on wells TP-2 and TP-1.

A composite linear scale hydrograph of water levels recorded during the APT for wells TP-1, TP-2, PW-3, PW-4, PW-5, PW-6 and PW-7 is presented as Attachment 1. Attachment 2 and 3 present drawdown-versus-elapsed time data for the observation wells during the 2-well (PW-3 and TP-2 pumping) phase and 3-well (PW-6, PW-3 and TP-2 pumping) phase, respectively.

Drawdown data from observation wells are preferred for estimating aquifer properties such as transmissivity, storativity, and leakance, while recovery data are typically utilized in the absence of suitable drawdown data, or for single-well APTs. The drawdown data from wells PW-4, and PW-5 during the 2-well and 3-well pumping phases of the APT were applied for calculating aquifer properties to provide transmissivity, leakance and storage coefficient values representative of the geologic formations comprising the GUA, UFA production zone.

DETERMINATION OF AQUIFER PROPERTIES

Calculation of aquifer properties was performed using standard curve-fitting methodologies for leaky and non-leaky confined aquifers. Analyses were performed using manual graphical approaches as well as with the Aqtesolve® computer program.

Properties determined by the aquifer testing are defined as follows:

***Transmissivity* (T)** – The measure of the rate at which water flows through a unit width of the saturated thickness of the aquifer under a unit hydraulic gradient;

Storativity **or** ***storage coefficient*** **(S) —** The volume of water that can be withdrawn or injected into an aquifer per unit surface area per unit change in hydraulic head; and

***Leakance* —** For analytical solutions used in the evaluation of APT drawdown data, a quantitative estimate of water that passes through semi-confining beds above and below, the inferred production zone, which typically corresponds to the well completion interval. The entire UFA is for practical purposes isolated or confined from the overlying Surficial aquifer by several hundred-feet of clay-rich deposits. However, the many layers of limestone beds occurring above and below the producing intervals in which the production wells are completed also transmit water horizontally and vertically. The vertical movement of water across these beds is typically referred to as leakage, which can be accounted for by the leakance aquifer parameter as defined for analytical solutions applied to interpret APT drawdown. Accordingly, leakance corresponds to K'/b', where:

- K' = vertical hydraulic conductivity of the adjacent leaky layer(s)
- b' = thickness of adjacent leaky layer(s).

Manual and computer-assisted curve matching approaches used to interpret drawdown data involve application of a variety of analytical solutions. Most of these involve complex equations that include numerous terms or parameters, which can be varied over large ranges to generate a multitude of predicted drawdown curves. These model curves are then compared with observed drawdown data to estimate aquifer hydraulic coefficients. Aquifer coefficients derived from these approaches can then be applied to predict future drawdown at various locations under different pumping scenarios.

All of the curve-matching approaches, whether manual or computer-assisted, employed to interpret APT drawdown, involve numerous assumptions regarding pumping/observation well construction and applicable hydrogeologic conditions. Rarely, if ever, are all the relevant assumptions met for each approach. It is not uncommon to find significant deviations between predicted drawdown response curves and actual observed drawdown. Such discrepancies result most often from heterogeneities in hydrogeologic properties of the aquifer/confining layer system. Virtually all the analytical approaches that evaluate APT data assume homogenous aquifer conditions for properties like hydraulic conductivity, storativity, leakance, and layer thickness; in reality, such homogeneous conditions almost never occur in nature. Even close agreement between measured drawdown and theoretical drawdown curves may not result in accurate and/or realistic values of coefficients derived from each method, due to failure to meet all assumptions inherent in each approach, and the fact various combinations of hydraulic properties may combine to provide non-unique and possibly unrealistic results.

Despite the apparent limitations involved in using curve-fitting approaches to interpret APT data, they are almost universally applied to estimate aquifer coefficients. Given all the constraints and potential limitations involved with interpreting APT results, it is important for potential users of such results to understand and appreciate the uncertainties associated with the application of aquifer coefficients estimated by these methods.

Transmissivity

Transmissivity was first calculated manually from the APT data using the Hantush-Jacob Type Curve method for leaky confined aquifers. Consistent with the well construction details of the UFA wells, the Hantush-Jacob method as applied to the APT data would assume that the UFA production zone for the GUA UFA wells represent a single homogeneous aquifer. Consequently, transmissivity (and storativity) estimates may be assumed to apply to the entire thickness of the production interval. A single leakance value is calculated using this method; it is not known, however, the extent to which the leakage may be derived from leaky layers occurring above or below the production interval. Such information may be extremely important, however, in assessing probable causes of increasing salinity observed in GUA production wells over time.

The method involves matching field data plotted on a log-log graph with a family of "type curves" plotted from the Hantush-Jacob equation. After superimposing field data over the appropriate type curve and the two curves are satisfactorily matched, an arbitrary match point is selected. From the match point, values for time (t) and drawdown (s) are obtained for substitution into the appropriate equations to obtain aquifer properties. Transmissivity for Hantush-Jacob is solved as follows:

$$T = \frac{114.6QW(u,r/B)}{s}$$

Where: T = transmissivity (gpd/ft)
Q = discharge rate (gpm)
W(u, r/B) = well function of Hantush = 1
s = drawdown (ft)

PW-3 Startup with TP-2 Pumping
Transmissivity Analysis

PW-4: $T = \frac{114.6(1740)(1)}{2.2} = 91{,}000\ gpd/ft$ **PW-5:** $T = \frac{114.6(1740)(1)}{2.1} = 95{,}000\ gpd/ft$

PW-6 Startup with PW-3 &TP-2 Pumping
Transmissivity Analysis

PW-4: $T = \frac{114.6(1710)(1)}{1.8} = 109{,}000\ gpd/ft$ **PW-5:** $T = \frac{114.6(1710)(1)}{1.8} = 109{,}000\ gpd/ft$

Storativity

From the above results, storativity was then calculated as follows:

$$S = \frac{Tu}{1.87} * t/r^2$$

Where: S = storativity
r = distance from pumping well (ft)
t = time (days)
u, r/B = well function from Hantush-Jacob curve

PW-3 Startup with TP-2 Pumping
Storativity Analysis

PW-4: $S = \frac{91{,}000 * 1}{1.87} * 0.004/800^2 = 3.0x10^{-4}$ **PW-5:** $S = \frac{95{,}000 * 1}{1.87} * 0.0104/1310^2 = 2.1x10^{-4}$

PW-6 Startup with PW-3 &TP-2 Pumping
Storativity Analysis

PW-4: $S = \frac{109{,}000 * 1}{1.87} * 0.0181/1840^2 = 3.1x10^{-4}$ **PW-5:** $S = \frac{109{,}000 * 1}{1.87} * 0.0047/1040^2 = 2.5x10^{-4}$

Leakance

From the above results, leakance was calculated as follows:

Where: K'/b' = leakance in gpd/ft^3
r = distance from pumping well (ft)
T = transmissivity (gpd/ft)

$$K'/b' = \frac{T(r/B)^2}{r^2}$$

PW-3 Startup with TP-2 Pumping
Leakance Analysis

PW-4: $K'/b' = \frac{91{,}000(0.3)^2}{(800)^2} = 0.013\ gpd/ft^3$ **PW-5:** $K'/b' = \frac{95{,}000(0.5)^2}{(1{,}600)^2} = 0.009\ gpd/ft^3$

PW-6 Startup with PW-3 &TP-2 Pumping
Leakance Analysis

PW-4: $K'/b' = \frac{109{,}000(0.75)^2}{(1{,}840)^2} = 0.018\ gpd/ft^3$ **PW-5:** $K'/b' = \frac{109{,}000(0.4)^2}{(1{,}040)^2} = 0.016\ gpd/ft^3$

Additional estimates of these aquifer coefficients were derived using the Aqtesolve® program. A summary of the calculated aquifer properties is provided in Attachment 4.

Results presented in Attachment 4 indicate that different values for aquifer coefficients are calculated depending on the methods used in the analyses. As discussed above, different values calculated for an individual well reflect contrasting assumptions involved with each technique, and the extent to which actual field and operational conditions may apply to each method. It can be seen in Attachment 4 that transmissivity values estimated using the Cooper-Jacob straight-line methods are significantly higher than transmissivities derived from other methods (e.g. Hantush-Jacob, Hantush). This results from the fact that these other methods account for leakage from adjacent layers, whereas the Jacob straight line methods assume flow only within a completely confined aquifer system and no leakage from overlying or underlying units. The

PW-4 and PW-5 drawdown data correlated well with the Hantush-Jacob solution of type curves as did the drawdown data reported in the CDM report.

Based upon evaluation of the data and knowledge of the hydrogeologic conditions at the site, the Hantush-Jacob methodology for leaky confined aquifers has been selected as the preferred analytical solution for estimating representative aquifer properties. Averaged values of aquifer properties estimated by the preferred Hantush-Jacob methods, as presented in Attachment 4 and the CDM report results are summarized in the table below:

Aquifer Parameter	APT Results PW-3 Startup	APT Results PW-6 Startup	APT Results CDM Report
Transmissivity	92,300 gpd/ft	106,500 gpd/ft	117,000
Storativity	2.0×10^{-4}	2.6×10^{-4}	1.1×10^{-4}
Leakance	0.010 gpd/ft^3	0.018 gpd/ft^3	0.015 gpd/ft^3

The transmissivity, storativity, and leakance results are consistent with the CDM Report APT results. The relatively high leakance values are consistent with leaky behavior typically expected for wells completed within portions of the UFA throughout South Florida. A data CD containing water level data from the GUA, APT is included as Attachment 5.

UPPER FLORIDAN AQUIFER HYDRAULIC HEAD MEASUREMENTS

Maximum static water levels measured during the APT ranged between 39.7 feet NGVD at well PW-5 and 49.3 feet NGVD at well PW-3 due to their placement within the wellfield and water quality differences in each well. To remove the effects of variable water quality (and thus density) on head measurements in the individual UFA production wells, freshwater equivalent heads were calculated and applied to the water level measurements recorded during the APT using the following equation:

$$hf = \left[\frac{r}{(rf \times h)}\right] - \left[\frac{(r - rf)}{rf}\right] \times Z$$

Where: *hf* = freshwater equivalent head
h = measured head in well
r = density of water in well
rf = density of freshwater
Z = elevation of the measuring point (assumed to be midpoint of the well open hole interval).

In performing the freshwater equivalent head calculations, it is assumed that freshwater corresponds to zero salinity and a density of 62.44 pounds per cubic ft (lb/ft^3), and saltwater a salinity of 35 parts per thousand (ppt) and a density of 64.001 lb/ft^3.

Maximum freshwater equivalent head pressures ranged between 49.8 feet NGVD at well PW-5 and 52.6 feet NGVD at well TP-2. The maximum static water levels recorded during the APT and the respective maximum calculated freshwater head values are summarized in the table below.

Maximum Static Water Levels (Ft. NGVD)		
Well	**Measured Head**	**Calculated Freshwater Equivalent Head**
TP-1	+46.78	+52.88
TP-2	+47.62	+52.92
PW-3	+49.27	+52.31
PW-4	+45.97	+50.23
PW-5	+39.72	+49.80
PW-6	+44.23	+51.41
PW-7	+45.17	+50.49

The highest freshwater heads calculated from observed head measurements recorded during the APT were in the outermost wells of the GUA, UFA wellfield (TP-1, TP-2 and PW-3). This may be accounted for by incomplete recovery following extended pumping from the wellfield. Only eleven (11) hours of recovery with all wells not pumping was possible due to the GUA water treatment plant production demands.

APT UPPER FLORIDAN AQUIFER WATER QUALITY

UFA water quality was measured and recorded from the pumping wells at various stages of the APT. Field parameters monitored included pH, temperature, specific conductance, total dissolved solids (TDS), and salinity. Field water quality measurements from the APT are summarized below:

GUA, UFA APT WATER QUALITY RESULTS

Date	Well	Temp. (°C)	Spec. Cond. (uS/cm)	TDS (mg/L)	Salinity (ppt)	pH
3/7/2011	**TP-2**	N/A	N/A	N/A	N/A	N/A
	PW-3	26.46	4928	3203	2.63	8.43
	PW-6	N/A	N/A	N/A	N/A	N/A
3/8/2011	**TP-2**	27.01	7963	5178	4.4	7.5
	PW-3	26.69	5038	3275	2.7	7.64
	PW-6	26.9	10730	6977	6.06	7.68
3/9/2011	**TP-2**	27.02	7967	5182	4.4	7.7
	PW-3	26.68	4998	3247	2.62	7.84
	PW-6	26.87	10800	7017	8.1	7.65
3/11/2011	**TP-2**	26.96	7979	5185	4.40	7.77
	PW-3	26.58	4928	3201	7.73	7.96
	PW-6	26.84	10780	7009	6.09	7.73
3/14/2011	**TP-2**	26.2	8357	5432	4.64	7.67
	PW-3	27.2	5170	3360	2.78	7.85
	PW-6	26.4	11250	7310	6.39	7.54

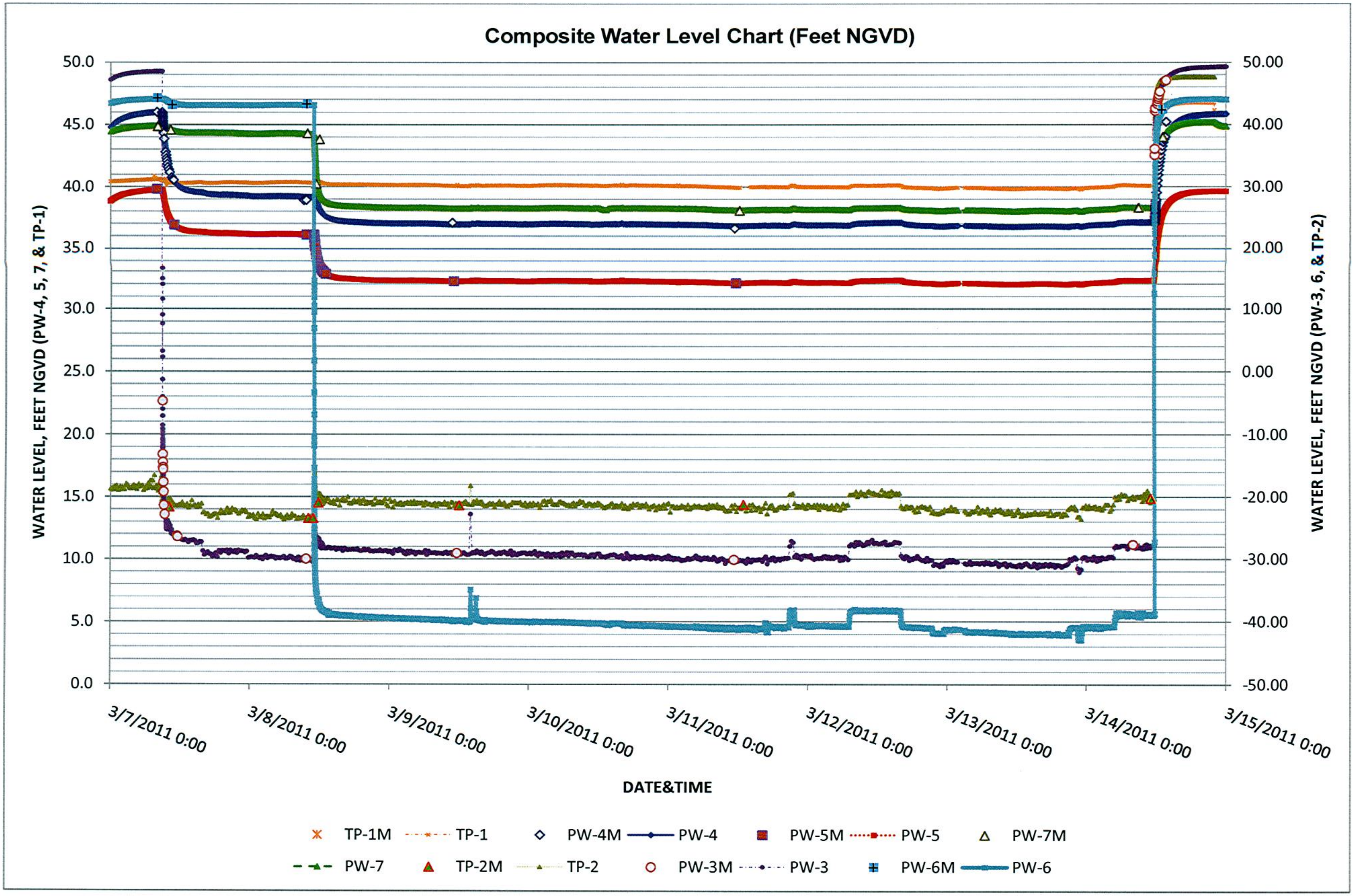
CONCLUSIONS AND RECOMMENDATIONS

The March 2011 GUA, UFA APT was successful in generating drawdown data that could be utilized for determining aquifer properties using analytical solutions for groundwater flow in confined and leaky aquifers. The determination of transmissivity, storativity, and leakance from the APT data using the Hantush-Jacob method provided representative estimates for the UFA in the vicinity of the GUA, UFA wellfield. Additionally, the APT results agreed well with the results reported in the 2005 CDM report.

Following the successful completion of the APT, JLA will proceed with the modeling elements of the project to assist in identifying changes in UFA water quality and hydraulic heads at the site, and individual well step drawdown testing to evaluate changes in pumping water levels and

ATTACHMENT 1

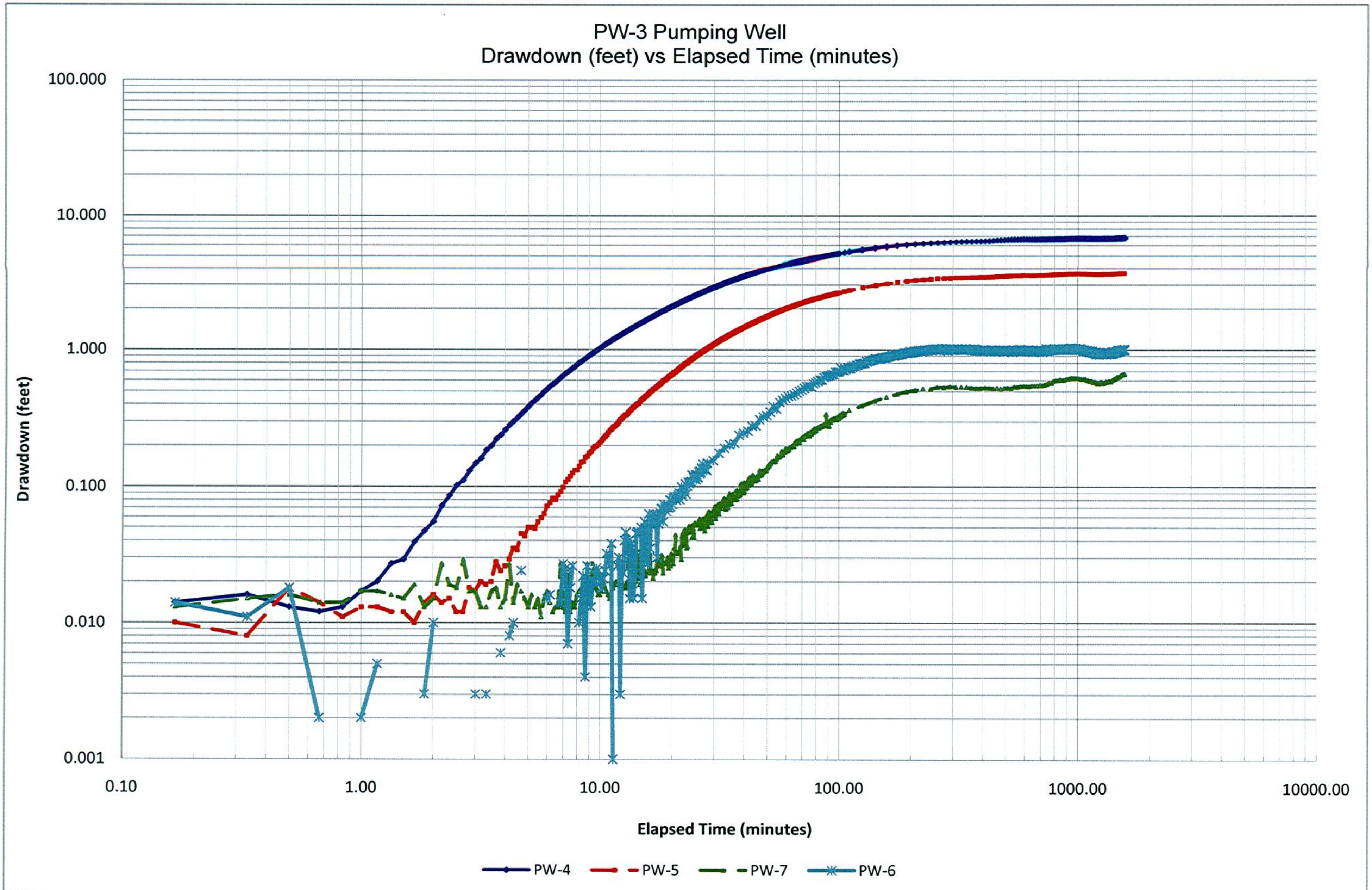
GLADES UTILITY AUTHORITY
FLORIDAN AQUIFER PRODUCTION WELLS



JLA Geosciences, Inc.

ATTACHMENT 2

GLADES UTILITY AUTHORITY
FLORIDAN AQUIFER PRODUCTION WELLS



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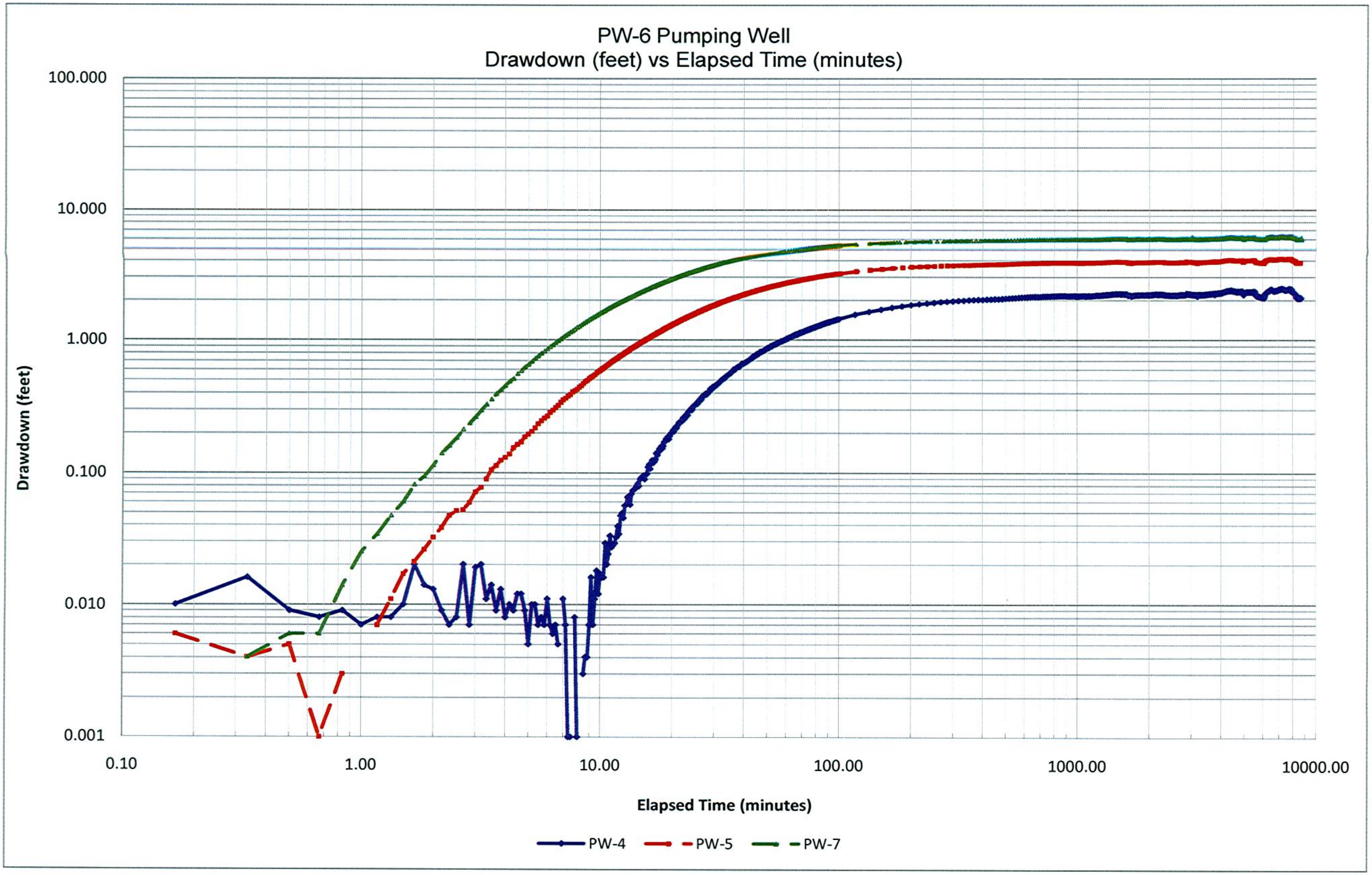
ATTACHMENT 3

GLADES UTILITY AUTHORITY
FLORIDAN AQUIFER PRODUCTION WELLS



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ATTACHMENT 4

GLADES UTILITY AUTHORITY
FLORIDAN AQUIFER WELLFIELD

AQUIFER PERFORMANCE TEST RESULTS

PW-3 STARTUP WITH TP-2 PUMPING									
WELL NO.	PUMPING RATE (gpm)	MAXIMUM DRAWDOWN (ft.)	DISTANCE FROM TEST PRODUCTION WELL (ft.)	TRANSMISSIVITY (gpd/ft)			STORAGE COEFFICIENT		LEAKANCE (gpd/ft3)
				ANALYSIS METHOD					
				Hantush Jacob*	Hantush*	Cooper Jacob *, ***	Hantush Jacob*	Hantush*	Hantush Jacob*
PW-3	1740	79.15	0	--	--	--	--	--	--
PW-4	--	6.82	800	**90,110**	88,150	97,240	**0.00025**	0.00029	**0.009**
PW-5	--	3.64	1600	**94,440**	94,220	140,600	**0.00020**	0.00020	**0.011**
AVERAGE				**92,275**	91,185	118,920	**0.0002**	0.0002	**0.010**

PW-6 STARTUP WITH PW-3 & TP-2 PUMPING									
WELL NO.	PUMPING RATE (gpm)	MAXIMUM DRAWDOWN (ft.)	DISTANCE FROM TEST PRODUCTION WELL (ft.)	TRANSMISSIVITY (gpd/ft)			STORAGE COEFFICIENT		LEAKANCE (gpd/ft3)
				ANALYSIS METHOD					
				Hantush Jacob*	Hantush*	Cooper Jacob *, ***	Hantush Jacob*	Hantush*	Hantush Jacob*
PW-6	1710	86.15	0	--	--	--	--	--	--
PW-4	--	2.45	1840	**104,030**	95,630	215,800	**0.00027**	0.00028	**0.018**
PW-5		4.14	1040	**108,900**	106,700	159,700	**0.00024**	0.00023	**0.019**
AVERAGE				**106,465**	101,165	187,750	**0.0003**	0.0003	**0.018**

Abbreviations:

ft. = feet

gpd = gallons per day

* Solutions derived with Aqtesolve® Software

*** Analysis does not calculate leakance