

Draft Report

*Expert Panel for Developing a Hydrogeological  
Investigation Program for the Borrego Valley  
Groundwater Basin*

Conducted on December 3, 2007  
In San Diego, CA

For  
Borrego Water District

Conducted By  
William Mills, PE, PG, DEE  
William Mills and Associates

Report Date  
January 1, 2008

# **Expert Panel for Developing a Hydrogeological Investigation Program for the Borrego Valley Groundwater Basin**

## **Background**

### **Introduction**

The community of Borrego Springs depends entirely on the underlying aquifer for its water supply. Since the aquifer has been in a continuous state of overdraft for more than fifty years, the so called 'life' of the aquifer has been questioned. Early investigators estimated the life at several hundred years. More recent reviews of available data, discount this early estimate.

In an effort to respond to this question and to improve the district's Groundwater Management Plan, the district has obtained State funding to help construct four monitoring wells. The new wells have provided new information that has helped to further define the basin stratigraphy and characteristics of the basin and have also raised new questions about the aquifer life. While the new scientific data is useful, these data do not provide conclusive information regarding this issue. It is apparent that additional physical data and analysis tools are needed to frame this important issue and to define this issue.

To address this issue and to improve the district's Groundwater Management Plan, the Borrego Water District (BWD) approved the assembly of an Expert Panel to address the scientific needs to more fully understand the aquifer and its useful life.

### **Panel Charge**

The expert panel was charged with developing an investigation program to include a prioritized list of investigative procedures/tools and their approximate costs that would define,

with reasonable accuracy, the answer to the issue needing resolution. Such a program might include:

- Well drilling
- Bore holes to the basin floor
- Gravity surveys
- Seismic surveys
- Numeric model development
- Aquifer tests
- Other tools

### **Panel Participants<sup>1</sup>**

Panel participants were chosen based on their knowledge of the Borrego Valley Groundwater Basin and their familiarity with groundwater basin investigation techniques.

Participants were:

- Jim Bennett, Professional Geologist and San Diego County Hydrologist
- Tom Henderson, Professional Geologist with the firm of CH2M HILL
- Steve Netto, Professional Geologist with the firm of Hargis and Associates
- Peter Martin, Professional Geologist with the United States Geological Survey
- Paul Remeika, Geology Instructor at the Anza-Borrego Institute and Palomar College
- William Mills, Professional Engineer and Professional Geologist with William Mills and Assoc., Panel Chair and water resource consultant to Borrego Water District

The Panel was also assisted by two resource individuals:

- Dr. Tim Ross, Professional Geologist with the Department of Water Resources, Southern District
- Jerry Rolwing, Technician with Borrego Water District

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<sup>1</sup> Dr. David Huntley, Professor at San Diego State University agreed to participate but was unable to participate due to last minute commitments.

Panel members were generally knowledgeable of the several prior reports (See References). However, information produced or developed more recently which participants may not have been familiar with were provided to each panel member. These data and reports included two master's thesis and reports on the drilling of the four monitoring wells.

### **Conduct of the Workshop**

The panel was convened a one day workshop on December 3, 2007 in San Diego to consider, discuss and develop the desired product. The workshops proceed in three sessions:

- Session 1: What We Know and What We Have.
- Session 2: What We Don't Know.
- Session 3: What We Need to Define the Water Availability in the Borrego Basin.

Panelists Bennett, Ross, Netto and Henderson provided brief PowerPoint presentations in Session 1. Copies of their presentations are included in the enclosed CD. Remeika presented a paper entitled 'Borrego Badlands'. A copy is on file with the Borrego Water District.

### **Report**

The results of the panel work are summarized in this report. Appendix A is a summary of the identified needs and associated actions required to fulfill each need. Several conclusions were made by this writer and were not discussed during the workshop. Thus the conclusions represent this writer's view. However, these conclusions have been circulated with this report for Panel concurrence or objection.

## **Panel Discussion of Needs and Actions**

Presented in the following section is a discussion of the data needs and actions that the Panel considered to be most important in increasing the understanding of the basin and to address the central issue of water availability from the aquifer. This presentation proceeds to summarize the discussion on each of the elements and to present the Panel's identified need and suggested action to address that need. The needs are also prioritized (high to low) and a rough estimate of the cost to fulfill the need are shown.

### **Water Level Monitoring Network**

The Panel agreed that long-term hydrographs of water levels throughout the basin are important in assessing the trends in the basin and short term responses to recharge (natural or artificial) superimposed on the long-term trends. Analysis of these hydrographs helps in the understanding of the basin.

Six wells have been monitored for water levels since the early 1980s and are sufficient to demonstrate a long term decline in the water levels in the basin. While the current long term monitoring network is sufficient to portray the long-term conditions of the basin, it was noted that there are several areas where water level data coverage could be improved, particularly in the agricultural area. This need is addressed in the next section.

### **Groundwater Elevation Maps**

The ability to construct rational groundwater elevation maps is an essential element in understanding of the basins' reaction to pumping stresses and recharge events. They also are important in evaluating outflows from the basin and across faults, etc.

Groundwater level maps have been prepared for the years of 1998, 2000 and 2003 (DWR) and 2004 (San Diego County). These all appear to show a groundwater ridge trending

across the western portion of the basin in an east-west direction. This feature could be due to an unknown fault or low permeability sediments or possibly faulty data. Anomalies were also noted on the 2004 map that could not be explained, suggesting issues with the timing of measurements or the reference points for the selected wells. It was concluded that additional monitoring points are needed to define these anomalies.

*Need: Monitoring of water levels in the agricultural area could be improved with the addition of new monitoring wells.*

*Action: Rolwing will work with the agricultural community to gain their cooperation for monitoring water levels at selected wells. (Priority- High; Cost-Minimal)*

*Need: Groundwater elevations are dependent on the accuracy of the elevation of the monitoring well's reference point. A simple reference point elevation survey should be conducted to assure that all reference points are accurate.*

*Action: Conduct a 'line of sight relative' GPS survey of all monitoring wells. (Priority-High; Cost-\$3,000)*

*Need: Monitoring well elevation data collection should be conducted at approximately the same time (within one week) so that well data are not influenced by seasonal locations in water levels.*

*Action: Rolwing will work with the County and the agricultural community to gain their cooperation to prior to the measurements scheduled for the winter of 2007-08. (Priority- High; Cost-Minimal)*

*Need: Additional monitoring wells are needed, especially in the areas with apparent anomalies, in the agricultural area and near the State Park employees well.*

*Action: Rolwing will work with the agricultural community to gain their cooperation for monitoring water levels at selected wells. (Priority- Medium; Cost-Minimal)*

*Monitoring wells to address areas of the basin with anomalous water levels and basin outflows are to be considered when other actions are completed (This will be discussed later).*

## **Conceptualization of the Basin's Structure and Configuration**

The panel noted that the cross sections of the basin as included in the Henderson/Netto thesis were very similar to those prepared by the USGS in the 1980s and that more recent well drilling has more or less confirmed the accuracy of these sections. Thus, no 'needs' were identified to improve the knowledge of the basin's stratigraphic configuration.

## **Numerical Model of the Basin**

It was noted that a numeric model of a groundwater basin is the most important tools in assessing data veracity, data needs and management strategies. A model is the best conceptual/management tool for evaluating the question of the amount of water available for extraction from the basin. Model input data must, however, be continually refined as new information becomes available. Models also help to define areas of the basin that need additional study. Further, models are most useful if they incorporate water quality data and other depth dependent data, but these supplements are most difficult to incorporate into a model, primarily because of the lack of physical data.

BWD purchased the numeric model developed by Tom Henderson and Steve Netto as part of their Master's Thesis (Model). Both Henderson and Netto presented information on the model development. They also reported that the new information gained from the four monitor wells did not significantly change the model.

It was noted that the Southern District of DWR had been requested by BWD to operate the model and develop information for planning purposes, but had not been able to do so due to a flaw in the input data relating to aquifer elevations i.e., the aquifer layers overlap and contained gaps. Henderson, confirmed by Martin, responded that the software did not allow for such discrepancies.

*Need: Resolve the discrepancy identified by DWR.*

*Action: Rolwing will send the data set to Henderson and he will review and confer with Ross. (Priority- High; Cost- 0)*

Martin discussed the fact that the model did not depict the coyote fault as a barrier and that in his experience all faults are barriers to groundwater travel. Martin also questioned the recharge/discharge component, specifically the components relating to the flow across the Coyote Creek fault, model generated flow to the southeast near Ocotillo and input data concerning inflow from the western mountain complex (over estimated).

*Need: Martin and Henderson both suggested that Time Domain Electromagnetic (TDEM) surveys could assist in determining the existence of a possible west/east fault structure (Ross interpretation) as well as the flow across the Coyote fault system. The survey could utilize student labor. San Diego State University contact is George Jiracek, geophysical professor.*

*Action: Rolwing to contact Professor Jiracek and investigate possible study scope and costs. (Priority- Moderate to High; Cost- Unknown)*

The possibility of updating the USGS model constructed in the 1980s was discussed as an alternative to the Model, but it was concluded that the Model, with refinements would be the best alternative for modeling of the Borrego Basin.

*Need: The Model cannot be operated by BWD staff.*

*Action: Consider Henderson or Netto performing future scenarios with the model, with the USGS in a review capacity. (Priority- Moderate to High; Cost- Unknown, but could be \$100,000 over 2-3 years)*

*Action: Rolwing and Mills to consider possible contracting methods. (Priority- Moderate; Cost- Minimal)*

## **Physical Data Needs**

The panel discussed surface geophysical investigation methods for obtaining important information that could help define the life of the aquifer in lieu of construction additional monitoring wells. Surfaces geophysical methods of seismic refraction, seismic reflection,

gravity, magnetic, resistivity, radar and electromagnetic techniques were briefly discussed. (It was noted that a gravity survey had previously been conducted in the northwestern portion of the basin.)

The panel agreed that these techniques are typically used in basins where little is known about the subsurface structure of the basin. Fortunately, the subsurface of the Borrego Basin is fairly well defined through the review and study of more than 170 driller's logs, the data derived from four new monitoring wells and the prior gravity survey. Thus, the panel felt that information derived from these geophysical techniques would not alter the current concept of the basin's structure significantly and that such techniques are very expensive to conduct.

The panel recommended the drilling of new monitoring wells targeted in specific areas of the basin that need additional definition, such as the so called 'ridge' previously mentioned, but suggested that the Model be used initially to assess the problem.

The panel also recommended more testing of existing monitoring wells such as slug tests, specific capacity evaluation and full scale aquifer tests (an aquifer test was conducted at MW 3).

Their recommendation included the construction of new monitoring wells that could provide depth dependent data and identify potential water quality problems in the deeper portions of the aquifer system. This issue could portend a future upwelling of poor quality water into the main aquifer system. It also could be viewed as a potential new water supply, after treatment, for domestic uses.

*Need: Additional aquifer data derived from testing the monitoring wells*

*Action 1: Conduct slug tests and specific capacity tests at each of the four existing new monitoring wells. (Priority- Moderate to High; Cost- Unknown)*

*Action 2: Conduct aquifer tests at the four monitoring wells if cooperation from surrounding pumpers can be obtained. (It was noted that a test was attempted at MW 1 with the cooperation of adjacent pumpers, but was curtailed due to weather conditions.). (Priority- Moderate to High; Cost- \$5,000 per well)*

*Action 3: Construct a new monitoring well in the vicinity of Palm Canyon Dr. and Borrego Valley Road for obtaining depth dependent data. The well would include four individual small diameter well casings to monitor the hydraulic pressure in the Palm Spring*

*Formation and each of the overlying aquifers. One casing should be large enough to accommodate down-hole (electromagnetic) geophysics to test for changes over time in water quality. Cores would be extracted for detailed study. The USGS has a drilling rig that is especially equipped to obtain scientific information from the borehole. (Priority- High; Cost- \$250,000)*

Previous attempts to construct more than one well in a single bore hole have been denied by the County even though it is practiced in other areas of the State.

*Need: The ability to construct multiple monitoring wells in a single borehole.*

*Action 1: Bennett agreed to speak with the County (Kevin Heaton) and resolve his concern. (Priority- High; Cost- 0)*

*Action 2: Prepare a grant application for a monitoring well under DWR's AB 303 Local Assistance Program. Utilize the USGS drilling rig and staff to collect well data. . (Priority- High; Cost- \$5,000-\$10,000)*

The panel also suggested the testing of existing BWD wells to obtain information about the relative contributions of from aquifers or strata water entering into the production wells. Such information is useful in evaluating the transmissibility (water yielding capacity) of the aquifers and the water quality in each aquifer.

The procedure is to test for the velocity of water entering the well at various elevations. These velocity tests should be run on each production well to determine the zone where most of the flow is entering the casing. This data will be a key factor as water quality becomes an issue in the groundwater supply. For the cost effectiveness, schedule test when the pump is out for repairs. Test can be completed while pump is in the hole as long as there is a minimum of 2 inch clearance between casing and column pipe.

*Need: Data on aquifer yielding capacity at various depths in production wells*

*Action: Schedule velocity tests at each BWD production well. (High Priority; Cost- \$1,000 per well)*

Rolwing expressed his experience that in the drilling of a monitoring well, it has been difficult to establish the elevations of perforations in wells due to the problem of the drilling contractor charging for standby while a decision is being made. A more expedient procedure is needed.

*Need: A procedure to rapidly obtain recommendations for establishing perforation locations when drilling a monitoring well.*

*Action: When drilling of new well begins, contact the Expert Panel and establish a conference call procedure and information dissemination process so that the group can make an assessment and recommendation in a timely manner. (High Priority; Cost- \$3,000)*

### **Data Management (DMS)**

The group consensus was that all accumulated data needed to be incorporated into GIS format. The panel was in agreement that the understanding of the basin would be greatly facilitated through a DMS. This would entail assembling all information on the basin and entering the information a digital format into the BWD existing GIS. For example, all data, water levels, well logs, reports etc would be digitized for each well. Additionally, all maps (water level, geologic, transmissibility, etc.) would be digitized and also entered into the data base. This will allow for overlaying different data sets and greatly assist in future evaluations of the basin.

*Need: Existing data on basin is not easily accessed for review and analysis.*

*Action: Contract with a firm or individual to implement a Data Management System and enter existing data. (High Priority; Cost- \$20,000-\$40,000)*

Hydrogeologic and subsurface information is difficult to illustrate to non-professionals such as the public. Existing software programs are available to provide, using DSM data, 3D

geologic model visualization. These include Earth Vision and EVS but both require expensive license fees and are labor intensive.

*Need: Prepare three dimensional graphics for assisting in the public's ability to visualize groundwater basin and other concepts.*

*Action: Hire a consultant to develop a 3D visualization capability such as Earth Vision or EVS. (Low Priority; Cost- \$10,000-\$15,000)*

## **Subsidence**

The panel suggested that subsidence of the land surface from continued lowering of water levels may be a future issue and should be evaluated.

*Need: No data are currently available to assess if the land surface of the basin is subsiding due to the continued lowering of water levels.*

*Action: Martin agreed to review the USGS subsidence network to determine if it contained any reference points in the Borrego Basin. (Priority- Moderate; Cost- 0)*

## **Conclusions**

1. The BWD Groundwater Management Plan can be greatly improved with the accomplishment of the many actions suggested in this report.
2. There is no single investigative technique that can provide an answer to the question concerning the so called 'life' of the Borrego aquifer system.
3. The most important tool in assessing this question is the numeric Model.
4. The construction of groundwater level maps is important in the understanding of the basin's reaction to pumping and recharge. Source data must be accurate and collected in a quality assurance manner.
5. Depth dependent data in the basin is also important in assessing the future conditions in the basin as water levels continue to fall changes in groundwater quality may occur.

6. Monitoring wells provide specific information about the subsurface in a limited area of the basin, but when the data derived from the wells are incorporated into the Model, the Model becomes a more reliable investigative tool.
7. A working Model can be used to test hydrologic inputs, i.e., recharge and basin outflows to arrive at reasonable values without the construction of new monitoring wells and to evaluate anomalies.
8. A Data Management System to house all groundwater data would greatly assist in analysis and investigations of the basin.

## **References**

- Bureau of Reclamation, Inland Basins Projects, Borrego Valley, California. June 1968
- USGS, Water Resources of Borrego Valley and Vicinity, California, Phase 1—Definition of Geologic and Hydrologic Characteristics of Basin, Open-File Report 82-855. 1982
- California Department of Water Resource, Borrego Valley Water Management Plan. June 1984
- USGS, Water Resources of Borrego Valley and Vicinity, California, Phase 2 – Development of a Groundwater-Water Model. Open-File Report 87-4199. 1987
- Netto, S.P., Water Resources of Borrego Valley San Diego County, California. Master's Thesis, Sand Diego State University, Fall 2001
- Henderson, T.W., Hydrogeology and Numerical Modeling of the Borrego Valley Aquifer System. Master's Thesis, San Diego State University, Fall 2001
- Borrego Water District, Groundwater Management Plan. 2002

## Appendix A

### List of Needs and Actions

(Highlighted Actions are High Priority)

*Need:* Monitoring of water levels in the agricultural area could be improved with the addition of new monitoring wells.

*Action:* Rolwing will work with the agricultural community to gain their cooperation for monitoring water levels at selected wells. (Priority- High; Cost-Minimal)

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*Need:* Groundwater elevations are dependent on the accuracy of the elevation of the monitoring well's reference point. A simple reference point elevation survey should be conducted to assure that all reference points are accurate.

*Action:* Conduct a 'line of sight relative' GPS survey of all monitoring wells. (Priority-High; Cost-\$3,000)

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*Need:* Monitoring well elevation data collection should be conducted at approximately the same time (within one week) so that well data are not influenced by seasonal locations in water levels.

*Action:* Rolwing will work with the County and the agricultural community to gain their cooperation to prior to the measurements scheduled for the winter of 2007-08. (Priority- High; Cost-Minimal)

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*Need:* Additional monitoring wells are needed, especially in the areas with apparent anomalies, in the agricultural area and near the State Park employees well.

Action: Rolwing will work with the agricultural community to gain their cooperation for monitoring water levels at selected wells. (Priority- Medium; Cost-Minimal)

Monitoring wells to address areas of the basin with anomalous water levels and basin outflows are to be considered when other actions are completed (This will be discussed later).

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Need: Resolve the discrepancy in the Model identified by DWR.

Action: Rolwing will send the data set to Henderson and he will review and confer with Ross. (Priority- High; Cost- 0)

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Need: Martin and Henderson both suggested that Time Domain Electromagnetic (TDEM) surveys could assist in determining the existence of a possible west/east fault structure (Ross interpretation) as well as the flow across the Coyote fault system. The survey could utilize student labor. San Diego State University contact is George Jiracek, geophysical professor.

Action: Rolwing to contact Professor Jiracek and investigate possible study scope and costs. (Priority- Moderate to High; Cost- Unknown)

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Need: The Model cannot be operated by BWD staff.

Action: Consider Henderson or Netto performing future scenarios with the model, with the USGS in a review capacity. (Priority- Moderate to High; Cost- Unknown, but could be \$100,000 over 2-3 years)

Action: Rolwing and Mills to consider possible contracting methods. (Priority- Moderate; Cost- Minimal)

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Need: Additional aquifer data derived from testing the monitoring wells.

Action 1: Conduct slug tests and specific capacity tests at each of the four existing new monitoring wells. (Priority- Moderate to High; Cost- Unknown)

Action 2: Conduct aquifer tests at three of the four monitoring wells if cooperation from surrounding pumpers can be obtained. (It was noted that such attempts have been made but nearby pumpers were not cooperative.) . (Priority- Moderate to High; Cost- \$5,000 per well)

Action 3: Construct a new a monitoring well in the vicinity of Palm Canyon Dr. and Borrego Valley Road for obtaining depth dependent data. The well would include four individual small diameter well casings to monitor the hydraulic pressure in the Palm Spring Formation and each of the overlying aquifers. One casing should be large enough to accommodate down-hole (electromagnetic) geophysics to test for changes over time in water quality. Cores would be extracted for detailed study. The USGS has a drilling rig that is especially equipped to obtain scientific information from the borehole. (Priority- High; Cost- \$250,000)

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Need: The ability to construct multiple monitoring wells in a single borehole.

Action 1: Bennett agreed to speak with the County (Kevin Heaton) and resolve his concern. (Priority- High; Cost- 0)

Action 2: Prepare a grant application for a monitoring well under DWR's AB 303 Local Assistance Program. Utilize the USGS drilling rig and staff to collect well data. . (Priority- High; Cost- \$5,000-\$10,000)

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Need: Data on aquifer yielding capacity at various depths in production wells

Action: Schedule velocity tests at each BWD production well. (High Priority; Cost- \$1,000 per well)

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Need: A procedure to rapidly obtain recommendations for establishing perforation locations when drilling a monitoring well.

Action: When drilling of new well begins, contact the Expert Panel and establish a conference call procedure and information dissemination process so that the group can make an assessment and recommendation in a timely manner. (High Priority; Cost- \$3,000)

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Need: Existing data on basin is not easily accessed for review and analysis.

Action: Contract with a firm or individual to implement a Data Management System and enter existing data. (High Priority; Cost- \$20,000-\$40,000)

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Need: Prepare three dimensional graphics for assisting in the public's ability to visualize groundwater basin and other concepts.

Action: Hire a consultant to develop a 3D visualization capability such as Earth Vision or EVS. (Low Priority; Cost- \$10,000-\$15,000)

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Need: No data are currently available to assess if the land surface of the basin is subsiding due to the continued lowering of water levels.

Action: Martin agreed to review the USGS subsidence network to determine if it contained any reference points in the Borrego Basin. (Priority- Moderate; Cost- 0)

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## **Expert Panel for Developing a Hydrogeological Investigation Program For the Borrego Valley Groundwater Basin**

### **History of Investigations in Borrego Valley**

The Borrego Valley Groundwater basin has been the subject of numerous studies and reports, dating from the late 1960s to the early 2000s. A partial but pertinent list of those investigations and reports is shown below.

Collection and development of field data was limited in the referenced studies to a review of drillers well logs. In limited cases, electric logs were available for review.

During the period 2004-06, four professionally logged wells were drilled. These have been constructed to provide aquifer characteristics, water quality data and water level observations.

### **Issue needing resolution**

Early investigators defined a large and extensive groundwater basin and estimated that groundwater extractions, if maintained at the then current rate, could be supported for 500 years.

More recent investigators have questioned the assumptions inherent in that estimate, but have not offered new estimates of the 'life of the aquifer'. Most recently, the DWR estimated that the next 100 feet of aquifer could provide between 30 and 50 years of supply, at the current rate of extractions (Tim Ross, Presentation to Borrego Water District, September, 2007).

It is well documented that the basin water supply has been in a state of depletion since about 1945 and that water levels are currently declining by about 2 to 2 1/2 feet per year. Borrego residents have become increasingly concerned about the continued aquifer depletion and are actively seeking programs to lessen that decline. The water district has implemented a groundwater basin preservation program and is pursuing grant funding to investigate the feasibility of importing water. However, the question that is often asked of the district: "How much water is available for extraction from the Borrego Groundwater Basin?"

In an effort to respond, the district has obtained State funding to help construct four monitoring wells. The new wells have provided new information that has helped to further define the basin stratigraphy and characteristics.

### **Panel Charge**

The expert panel is charged with developing an investigation program to include a prioritized list of investigative procedures/tools and their approximate costs that would define, with reasonable accuracy, the answer to the issue needing resolution. Such a program might include:

- Well drilling
- Bore holes to the basin bottom
- Gravity surveys
- Seismic surveys
- Numeric model development
- Aquifer tests

- Other tools

### **Conduct of Panel**

It is planned to convene a one day work shop to consider, discuss and develop the desired product. The workshop will proceed in three sessions:

- Session 1: What We Know and What We Have.
- Session 2: What We Don't Know.
- Session 3: What We Need to Define the Water Availability in the Borrego Basin.

Several panelists will be asked to prepare brief presentations in Session 1.

The results of the panel work will be summarized into a report. The report will be prepared by the chairman of the panel and submitted to the district after panel participants have signed-off on its content.

It is envisioned that one or more of the program elements will be included in funding requests from State and Federal agencies or totally funded entirely by the BWD.

### **Location of Panel Workshop**

The expert panel will convene at a hotel conference room in San Diego on a date mutually agreed upon. The workshop would begin at 8 am and conclude by 4:30 pm.

### **Expenses at Workshop**

Panel participants will be provided working lunch on the day of the workshop.

### **Consulting Fees**

Participants requiring fee remuneration will receive a \$1,500.

### **Panel Participants**

Panel participants have been chosen based on their knowledge of the Borrego Valley Groundwater Basin and their familiarity with groundwater basin investigation techniques.

Invited participants are:

Jim Bennett, SD County Hydrologist  
Tim Ross, Department of Water Resources  
Tom Henderson, CH2M HILL  
Steve Netto, Hargis and Associates  
Bill Mills, William Mills and Assoc., Chair and representing Borrego Water District

### **Background Information and Resource Staff**

It is assumed that each of the participants has knowledge of or reviewed all or most of the reference material cited in the attachment. Information produced or developed more recently which participants may not be familiar with include two master's thesis and reports on the drilling of the four monitoring wells. Consequently, CD's of these items are included for participant perusal.

Additionally, a numeric groundwater model of the Borrego Valley Groundwater Basin developed in the Henderson master's thesis has been purchased by the water district. DWR was requested to operate the model, but declined to do so upon discovering a discrepancy in the basin data. DWR has proposed to construct a model of the basin.

Jerry Rolwing of BWD will attend the workshop and provide information regarding more recent data, studies and other information about local developments.

### **Schedule**

8:00 Convene workshop and review panel charge and conduct Bill Mills

#### **Session 1: What We Know and What We Have.**

8:15	Water level monitoring in the Borrego Basin	Jim Bennett
8:30	Finding and conclusions from drilling new monitoring wells	Tim Ross
9:00	Break	
9:15	Conceptual Basin/ Cross-section development	Steve Netto
9:45	Numeric model development	Tom Henderson

#### **Session 2: What We Don't Know.**

10:15 Discussion All

#### **Session 3: What We Need to Define the Water Availability in the Borrego Basin.**

12:00	Lunch, working	All
12:30	Discussion of and definition of investigation program	All
4:30	Adjourn	

### **References**

Bureau of Reclamation, Inland Basins Projects, Borrego Valley, California. June 1968

USGS, Water Resources of Borrego Valley and Vicinity, California, Phase 1—Definition of Geologic and Hydrologic Characteristics of Basin, Open-File Report 82-855. 1982

California Department of Water Resource, Borrego Valley Water Management Plan. June 1984

USGS, Water Resources of Borrego Valley and Vicinity, California, Phase 2 – Development of a Groundwater-Water Model. Open-File Report 87-4199. 1987

Netto, S.P., Water Resources of Borrego Valley San Diego County, California. Master's Thesis, Sand Diego State University, Fall 2001

Henderson, T.W., Hydrogeology and Numerical Modeling of the Borrego Valley Aquifer System. Master's Thesis, San Diego State University, Fall 2001

Borrego Water District, Groundwater Management Plan. 2002

## Follow-Up Program for Actions from Expert Panel

No	Need and Action	Priority Cost	Accomplished by:	Responsibility	Status
1	Assessing and understanding groundwater movement and status: in the agricultural area, in the areas with apparent anomalies and near the State Park employees well, could be improved by incorporating existing production wells into the water level monitoring network - work with the agricultural community to gain their cooperation for monitoring water levels at selected existing production wells.	High Cost-Minimal	A. Determine water level data gaps from County and DWR for constructing groundwater level contour maps. B. Make formal request to AAWARE for assistance in obtaining water level information at selected agricultural wells	Rolwing  Williamson	
2	Groundwater elevations are dependent on the accuracy of the elevation of the monitoring wells' reference point - a 'line of sight relative' GPS survey of all monitoring wells should be conducted.	High Cost-\$3,000	Contract with surveying firm or other professional with appropriate equipment to perform the survey.	Rolwing/Williamson	
3	Since groundwater elevation data should be collected at approximately the same time (within one week) and with adequate well recovery time, so that the data are not influenced by seasonal fluctuations in water levels and/or residual pumping depressions, BWD should work with the agricultural community to gain their cooperation prior to the County measurements scheduled for the winter of 2007-08	High Cost-Minimal	Make formal request for AAWARE's assistance in obtaining water level information at selected agricultural wells.  Incorporate in request in 1B above.	Williamson/Rolwing	
4	Resolve the discrepancy in the model identified by DWR - send data set to Henderson for his review and with DWR.	High Cost- 0	Send data set to Henderson and review with DWR.	Rolwing	Completed

5	Time Domain Electromagnetic (TDEM) surveys could assist in determining the existence of a possible west/east fault structure (DWR interpretation) as well as the flow across the Coyote fault system - contact geophysical professor at San Diego State University and investigate possible study scope and costs.	Moderate to High Cost- Unknown at this time	Contact George Jiracek, at San Diego State University, and investigate possible study scope and costs.	Rolwing	
6	Since the model cannot be operated by BWD staff, consider Henderson/ Netto performing model refinement and operation, with the USGS in a review capacity - consider possible contracting methods.	High Cost of Model development- about \$100,000 over 2-3 years	Consider contracting options: use of large consulting firm or a 'Team' approach using several Expert Panel members.	Rolwing and Mills	Completed: Mills submitted a proposal for a Team' approach with Mills as Program Director
7	Additional aquifer data should be obtained from new monitoring wells - conduct slug tests and specific capacity tests at each of the four existing new monitoring wells.	Moderate to High Cost- Unknown	Contract with DWR to perform the tests.	Williamson/Rolwing	
8	Same as No. 9, but conduct aquifer tests at three of the four monitoring wells.	Moderate to High Cost- \$5,000 per well	Contract with DWR to perform the tests.	Williamson/Rolwing	
9	Construct a 'nested' monitoring well in the vicinity of Palm Canyon Dr. and Borrego Valley Road for obtaining depth dependent data to monitor the hydraulic pressure in the Palm Spring Formation and each of the overlying aquifers; obtain cores for study.	High Cost \$250,000	Construct nested monitoring well.	BWD after grant award (see No. 10 below)	Awaiting grant award from State
10	Seek grant funding for monitoring well described in No. 9 above under DWR's AB 303 Local Assistance Program.	High Cost- \$5,000-\$10,000	Submit a grant application for well construction to DWR (AB 303 Program)	Rolwing and Mills	Completed (12/11/07) - awaiting award

11	Data on aquifer yielding capacity at various depths in production wells - schedule velocity tests at each BWD production well.	High Cost- \$1,000 per well	Conduct test during well maintenance.	Rolwing	Waiting for well maintenance shut-down.
12	Develop a procedure to rapidly obtain recommendations for establishing perforation elevations when drilling a monitoring well - use the Expert Panel and establish a conference call procedure and information dissemination process so that the group can make an assessment and recommendation in a timely manner.	High when well drilling is planned Cost- \$3,000 per well	No action necessary until the drilling of a monitoring well is planned. Contract with Expert Panel members in advance of monitoring well drilling.	Williamson/Rolwing	No action need at present.
13	Existing data on basin are not easily accessed for review and analysis - implement a Data Management System and enter all existing data.	High Cost- \$20,000-\$40,000	Investigate firms with expertise and knowledge of BWD; solicit proposal.	Rolwing	Rolwing has contacted Autodesk ISV for a proposal
14	Three dimensional graphics assist the public's ability to visualize groundwater basin and other concepts - consider hiring a consultant to develop a 3D visualization capability such as Earth Vision or EVS.	Low Cost- \$10,000-\$15,000	Panel not convinced of necessity of this item. Investigate firms with expertise and knowledge of BWD; solicit proposal.	Rolwing	No action at this time due to low priority and uncertain need.
15	No data are currently available to assess if the land surface of the basin is subsiding due to the continued lowering of water levels - USGS may have bench mark in Borrego.	Low Cost- 0	Review the USGS subsidence network to determine if it contained any reference points in the Borrego Basin.	Mills/Martin	