

## **Indian Wells Valley Cooperative Groundwater Management Committee -Signatory Achievements-**

### **Well Location**

Navy

Navy well locations (since 1995) have been based on a number of issues including; drilling costs, existing utility and distribution piping locations, range access, and hydrogeologic conditions focusing on long-term impacts to groundwater elevations, water levels, water quality conditions, proximity to known contaminants, and proximity to potential mixing with low-quality groundwater. Since the Navy signed the Cooperative Groundwater Management Plan, only two production wells remain in the Intermediate Wellfield (Navy Well #18 and Navy Well #28).

IWV Water District

The Water District has spread out pumping by relocating major water production farther to the west/southwest of the City and not constructing new wells in the vicinity of the City.

### **Well Design**

Navy

Navy wells are typically designed to provide high volume flows from the aquifer with screened intervals at more than 600 feet below land surface. It is Navy policy to drill production wells to total depths of around 1,000 feet and extract water from deeper zones than the typical private domestic well which is screened in the 250-350 feet range. Bentonite seals are placed at certain intervals or “zones” to help prevent vertical aquifer mixing. Separation of the two types of wells is important with respect to well interference (water levels and possible industrial/domestic contamination).

Searles Valley Minerals Corporation

Searles Valley Minerals re-designed two of its production wells (#35 and #36) to minimize well interference with private wells. Well #35 was completed to 805 feet which replaced Well #34 which was drilled to 403 feet. Similarly, Well #36 was completed to a depth of 982 feet.

### **Well Spacing**

Navy

New Navy wells (Navy Well #30 and Navy Well #31) have been drilled with at least ½ mile horizontal separation to reduce well interference (both water level and water quality). The only wells the Navy currently operates that are closer than ½ mile are Navy Well #15 and Navy Well #27 located in the Harvey Wellfield. Replacement wells were drilled at those original (circa 1944) well sites based on existing water lines, water storage, utility line availability, and continued use of the Navy land corridor in Inyokern, as well as the fact, that water from Navy Well #15 and Navy Well #27 can be gravity-fed from Inyokern to the “B” Mtn reservoirs.

## **Water Blending**

Navy

Navy Well #18 and Navy Well #28 run simultaneously when in production due to the concentrations of naturally-occurring arsenic in Well 18. The State has approved this blending as a treatment method for the elevated arsenic concentrations in Navy Well #18 (concentrations range from 8.5ppb-11.0 ug/l since 2003). The only time one well operates without the other is during well maintenance or well failure, at which time, another well in the system is run simultaneously with Navy Well #18.

## **Well Destruction**

Navy

Since 1995, the Navy has destroyed approximately 30 former production wells and monitoring wells that had either failed or were in poor condition. Each well was properly destroyed per the State of California Well Standards.

IWV Water District

The Water District has recently taken Well #16 and Well #19 out-of-service. They are scheduled to be destroyed in 2010.

Searles Valley Minerals Corporation

Searles Valley Minerals sealed and destroyed production Well #34 per State of California Well Standards in March, 1991. Properly destroying the well prevents potential contamination of neighboring wells.

## **System Monitoring and Conservation**

Searles Valley Minerals Corporation

In the past 15 years, Searles Valley Minerals has undertaken installation of several flow meters and a telemetry system to monitor potable water use throughout its operations and continues to publish a weekly report of water use at each of its facilities. This information has been used to justify a number of projects to re-use streams and improve efficiencies within our processes. Despite production increases throughout the operations, water use has been maintained at a relatively stable rate since 1983.

When possible, SVM utilizes lower quality brackish water sources available locally to offset use of potable water within its facilities.

Navy

The recent (March 2008) Navy Water Conservation Policy has robust plans to conserve up to 20% of water production from 2008 through 2010. Current projects include turf reduction plots, xeriscape landscaping designs, redesigning and installation of water-conserving irrigation systems, and installation of low-flow toilets/showers/faucets.

IWV Water District

The District has constructed monitoring wells along Victor Street and in the Southwest area of the valley and has committed to installing a monitoring well each time a new production well is installed.

The District hired a Conservation & Education Coordinator in 2006 who is reaching out to the community in many forms, including workshops, seminars, presentations at schools and community groups, the Home Show, and creation of educational materials. The District also has a group of award-winning programs that use volunteers to assist community members with conversion of turf to xeriscape.

Most significantly, the District has passed two new water conservation ordinances (Ordinances 90 and 91) limiting turf for new single family residences to backyard only and 50% for commercial/multifamily/institutional developments. The District also entered into an MOU with the City of Ridgecrest to establish a Water Efficient Landscape Ordinance (WELO). The City has adopted the ordinance and the District is planning to adopt a “mirror” ordinance that limits water times during the summer and runoff onto pavement and sidewalks. The District will also be hiring staff to enforce the WELO.

### **Groundwater Level and Groundwater Elevation Monitoring**

The Kern County Water Agency (Agency) with assistance from the Navy has measured 200+ monitoring wells on a semi-annual basis since the late-1980s. The data is compiled by the Agency into the Geographic Information System created during the first AB 303 Project and is used to compile “Depth To Groundwater”, “Groundwater Elevation”, and “Change in Groundwater Elevation” maps for the Indian Wells Valley. The Agency also completes water level/elevation hydrographs on a semi-annual basis that are used for trend analysis purposes. These data are presented to the Working Group and are posted on [iwv.groundwater.org](http://iwv.groundwater.org).

The Agency also funded and completed the construction of surface water flow gauging stations in Grapevine Canyon and Sand Canyon. Both stations record daily surface water flows near the mouths of each canyon. Agency personnel maintain, download, analyze, and report the data to the Technical Advisory Committee and the Working Group on a semi-annual basis.

### **Use of Reclaimed Water**

Navy

New chlorination equipment, infrastructure upgrades (new block building), and filtration system have been installed at the reclaimed water treatment facility. This should ensure it’s capability to continue the reclaimed water use (up to 1.4 MGD) at the China Lake golf course for years to come.

### **Water Sampling**

Navy

The Navy has conducted numerous rounds of water quality and isotope sampling throughout the Indian Wells Valley and surrounding areas including surface streams and natural springs. This data has been used by a variety of investigators including hydrogeologic consultants (Navy, Water District, and Searles Valley Minerals Corporation), public agencies, academia, and private citizens. The data has been used to establish groundwater types, groundwater flow paths, groundwater ages, groundwater travel times, and potential areas of recharge and where recharge is limited.

## **HYDROGEOLOGIC DATA COLLECTION, ANALYSIS, AND INTERPRETATION**

### **Bureau of Reclamation Well Drilling Project (1991-1993)**

The IWV Water District, Searles Valley Minerals, and the Navy matched funding with the United States Bureau of Reclamation to drill nine deep (to 2,000 feet), nested piezometers to characterize the hydrogeologic conditions throughout the Indian Wells Valley. Hydrogeologic data collected from the wells included drilling logs, geologic logs, geophysical logs, and water samples. The monitoring wells are used to this day for water level measurements and as water quality sampling points.

### **Basewide Hydrogeologic Characterization Study (2003)**

The Navy expanded their original plan of investigating potentially contaminated sites to also include drilling deep boreholes and monitoring wells in the City of Ridgecrest and other areas off Station property. The hydrogeologic characterization investigation confirmed no contaminants mixing with groundwater and migrating off-Station. The Fenceline Study is an on-going investigation that includes water level and water quality monitoring at selected wells along the Station boundary fenceline to assure no groundwater migration is occurring.

### **SeaBee Well Drillers (1986-Present)**

The SeaBees have drilled monitoring wells throughout the Indian Wells Valley. The well depths range from 300 feet to 1200 feet. Perforated intervals vary at each well usually depending of formation (cuttings) samples and required depth of subsequent water samples to be collected. Each well is located based a set of particular data needs, ie., monitoring well near an existing production well, exploratory monitoring well (no wells in an area to set baseline water level and/or water quality parameters), monitoring wells located in areas of concern (water quality issues, potential contaminants, etc). Searles Valley Minerals Corporation has provided their electric logging services on many of the SeaBee wells.

### **Well Video Logging**

Searles Valley Minerals Corporation and the Navy have conducted video surveys of 30+ wells in an effort to collect well depth, screened intervals, water levels, and well condition information on wells in key locations that previously had little to no available information.

### **Monitoring Well Re-Development**

Searles Valley Minerals Corporation and the Navy have re-developed and/or sampled numerous monitoring wells using the air-lift method. Wells that were selected for this program showed irregular water levels (ie., no fluctuation) or exhibited signs of limited development during construction (high turbidity influenced by drilling muds, etc.).

### **AB303 Project (2003)**

The focus of this effort was the completion of a Geographic Information Systems database for all the hydrogeologic information in and around the Indian Wells Valley. Once the GIS software was installed, the Kern County Water Agency was capable of creating groundwater maps of all types (water levels, water elevations, change in elevations, water quality, etc.)

An updated groundwater conceptual model was completed and published in the Final Report.

### **Southwest Well Field Groundwater Recharge Study (2003-2005)**

The IWV Water District received Proposition 13 funding for conducting a study at it's Southwest Well Field to determine the viability of recharge in this area of the Valley.

### **AB 303 Project (2005)**

Eight deep monitoring wells were drilled and completed by the Navy SeaBees in the SW Area of the Indian Wells Valley. Over 70 sites throughout the Valley were sampled for water chemistry and isotopic composition. Hydrogeologic conditions of the SW Area, with supporting geologic cross-sections, groundwater flow paths, relative groundwater ages, and travel times, were interpreted and published in the final report.

### **Global Positioning Satellite (GPS) Surveys**

The Navy with contractor (Epsilon System Solutions and the National Imagery and Mapping Agency (NIMA)) and Kern County Water Agency support has completed GPS surveys at over 300 individual monitoring, domestic, major production wells and USGS benchmarks in the Valley. These data are used by the Kern County Water Agency to generate their state-of-the-art groundwater contour maps.

### **Contribution of Resources**

#### **Remote Access Weather Stations**

Bureau of Land Management, Searles Valley Minerals, IWV Water District, and the Navy have contributed funding and man-power to support installation and maintenance of Remote Access Weather Stations (RAWS) to gather weather data within the Indian Wells Valley watershed.

**Groundwater Flow Model**

Searles Valley Minerals, Indian Wells Valley Water District and the Navy provided funding for the development of a groundwater flow model for the basin. This model will provide a valuable tool for managing the groundwater resources within the valley by producing predictive results for various pumping scenarios. The groundwater flow model will be updated and refined as more hydrogeologic data becomes available.