BORREGO WATER DISTRICT

Final Report

INTEGRATED WATER RESOURCES MANAGEMENT PLAN

March, 2009

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CHAPTER 1

INTRODUCTION

Purpose

The Borrego Water District (BWD or District) has not previously prepared an Integrated Water Resources Management Plan. However, a Groundwater Management Plan (GMP) was prepared and adopted by the District in 2002. The GMP plan contained a number of elements relating to water resources management in the Borrego Valley, including an identification and analysis of alternative projects that could help mitigate the ongoing overdraft of the sole source Borrego Valley Groundwater Basin. The purpose of this Integrated Water Resources Management Plan is to provide an update on the District's efforts to mitigate the aquifer overdraft problem, and to present alternatives for the District to further evaluate as it strives to provide a sustainable water supply for its customers.

Groundwater Management Plan (GMP)

The GMP served as a necessary requirement for the District to become the groundwater management agency for the Borrego Valley Aquifer as allowed under State Statute AB 3030. Thus, the subsequent adoption of the GMP placed the District as responsible for the stewardship of this large but limited resource and as the agency responsible for the resolution of the overdraft. As indicated, the GWMP contained projections of future water demand and identification of potential overdraft mitigation measures.

Since the adoption of the GWMP, new data and studies have become available through the construction of several monitoring wells, the development of a numerical model of the basin, and the preparation of groundwater level and change in storage maps, to name a few items. Additionally, considerable effort has been made towards the feasibility analysis of a pipeline to import water into the Valley. The conveyance system could be used to mitigate the ongoing overdraft and to develop a conjunctive use project, or used strictly as a source of municipal water supply for the Borrego Valley. Furthermore, the District has continued efforts in developing a groundwater preservation program that mitigates the impacts of new water use in the area and a 'Tiered Water' rate schedule which provides for an inverted block rate schedule for domestic water use. Finally, the BWD has adopted a Water Conservation Management Plan that provides

incentives to customers through rebates to upgrade plumbing fixtures to newer, more efficient models, remove turf and providing for free home irrigation audits. The Conservation Management Plan is attached hereto as Appendix "A" and includes a listing of conservation incentives for BWD customers and establishes conservation goals for the District as a whole.

Integrated Regional Water Resources Management Plan

The State has initiated the funding of projects as a result of Proposition 50 (and subsequently Proposition 84), such as the proposed importation pipeline, but require that the agency participate in an Integrated Regional Water Resources Management Plan (IRWMP). This plan requires that an agency develop a water management plan for incorporation in a regional process to integrate its plan with other agencies having responsibilities for water management, creating an IRWMP. In addition to the other purposes of this document, this plan serves also as the initial step in that process.

Stakeholder Involvement

It should be noted that prior to the adoption of the GWMP, an extensive stakeholder process was undertaken. That public outreach has continued with stakeholders participating in the many BWD board workshops, meetings and annual Town Hall meetings. Chapter 10 is a thorough discussion of the District's outreach program.

Report Organization

The water resources management plan is organized by chapters, as follows:

- Chapter 1 - introduction to the report
- Chapter 2 - the Borrego Valley, State and County agencies with jurisdiction in the Valley, and local stakeholder groups.
- Chapter 3 - the physiographic setting, the physical characteristics of the aquifer and the condition and status of the groundwater in storage.
- Chapter 4 - sources of recharge to the groundwater basin.
- Chapter 5 - water use in the Valley
- Chapter 6 – water deficiency or overdraft
- Chapter 7- local water management programs and strategies

- Chapter 8 - non-local water supply enhancement strategies considered
- Chapter 9 - water supply enhancement projects and management actions prioritization
- Chapter 10 - public/stakeholder outreach

CHAPTER 2

THE BORREGO VALLEY AND STAKEHOLDERS

This chapter begins with general description of the Borrego Valley area and proceeds to identify local and regional stakeholders that share in the water resources decision making process.

Borrego Valley Area

This desert locale is situated in the northeastern corner of San Diego County which provides for mild winters and summers of extreme heat. The summertime temperatures sometime exceed 120 degrees, yet in contrast, the winter low temperatures are in the 25-32 degree range. The community is considered a "disadvantaged community" in that the annual household income is less than 50% of the statewide annual median household income.

The isolated region relies on the Borrego Valley Aquifer as its sole source of water, which is shared by agricultural interests, golf course resorts and residential homes. Water levels in the area are dropping from 2-4[1] feet annually and the aquifer has been a state of overdraft for the past 60 years. In 2002, the BWD Board of Directors adopted a groundwater management plan to address the falling water table which has been endorsed by the majority of the community stakeholders.

Community of Borrego Springs

The community is completely surrounded by the Anza-Borrego Desert State Park and plays host to hundreds of thousands of park visitors throughout the year. The community's population ranges from less than 3,000 in summer months to over 8,000 in the height of the winter season. The northern portion of the community is almost entirely dedicated to agricultural production. About 4,000 acres are actively involved in the production of citrus and nursery stock, such as date palms.

The Borrego Water District

The Borrego Water District (BWD) was established in 1962 as a California water district. The District provides water, sewer, and flood control and gnat abatement for areas in the

[1] See Table 1, Chapter 3 and Figure 5, Chapter 3

unincorporated community of Borrego Springs. Additionally, the District adopted a groundwater management plan under Assembly Bill 3030 in 2002 and obtained the authority of a groundwater replenishment district. This designation allows the BWD to do planning for groundwater management and provides the authority, among others, to (a) buy and sell water, (b) exchange water (c) distribute water in exchange for ceasing or reducing groundwater extraction (d) recharge the basin and (e) build necessary works to achieve groundwater replenishment. This also provides the authority to levy a replenishment assessment, but only if replenishment water is available. The BWD is not a member of the San Diego County Water Authority (CWA), the regional member of the Metropolitan Water District of Southern California that imports supplemental water into San Diego County.

In the early 1940's developers began providing community water service through the private Borrego Springs Water Company (BSWC) which was purchased by BWD in 1997. The present day District is divided into four improvement districts, each containing specific financial obligations and varying levels of service.

Improvement District #1 (ID-1) was the first area to utilize the public entity for providing water, sewer and flood control service for the Montesoro (formerly Rams Hill) subdivision. As the town center grew for the tourist industry, several of the resorts pooled funds to link the downtown with the wastewater treatment facility located adjacent to the Montesoro development, southwest of the intersection of Borrego Springs and Yaqui Pass Roads. This created ID-2, the town center sewer system.

Prior to 1990, two areas adjacent to Montesoro were served by the Golden Sands Mutual Water Company. This company merged with BWD to create ID-3 for the Deep Well Trail subdivision and the La Casa del Zorro Resort.

The majority of the residential service came with the purchase of the BSWC and this area is now ID-4.

Committees of the Borrego Water District

An important vehicle used by BWD to inform and to gather public input is the use of both Standing and Ad Hoc Committees of the BWD. The Standing Committees meet on a regular basis with a published agenda. Community members are encouraged to attend and express their concerns on agenda items. Additionally, Ad Hoc Committees are appointed to address specific

issues of concern to the District. The BWD often appoints members of the community as members of these committees. As with the Standing Committees, the Ad Hoc Committees provide full reports of their dialog, including dissenting positions, to the Board. This structure has served to provide the District with community concerns and positions on important issues facing the District.

Borrego Springs Park Community Services District

The BWD surrounds the Borrego Springs Park Community Services District (CSD). The CSD provides water, sewer and trash removal services to a hotel/golf resort and approximately 100 residences. The CSD also operates a small par-three golf course. The CSD has been plagued with well and operational problems including two recent 'boil orders'. The CSD has requested to merge with BWD and the process is currently being reviewed by the San Diego Local Agency Formation Commission (LAFCO).

Anza-Borrego Desert State Park

Anza-Borrego Desert State Park is the largest state park in California. Five-hundred miles of dirt roads, 12 wilderness areas and miles of hiking trails provide visitors with an opportunity to experience the California Desert. The park is named after Spanish explorer Juan Bautista de Anza and the Spanish name borrego, or bighorn sheep. The park features washes, wildflowers, palm groves, cacti and sweeping vistas and fauna including roadrunners, golden eagles, kit foxes, mule deer and bighorn sheep as well as iguanas, chuckwallas and the red diamond rattlesnake.

Flood Control District of San Diego County

This district is charged with providing flood protection throughout the unincorporated areas of the county. However, the BWD has responsibilities for flood control in its Improvement District #1.

The Flood Control District prepared a flood management report for the Valley in 1989 (Boyle, 1989).

Department of Planning and Land Use, County of San Diego

The County of San Diego has regulatory control over land uses. Developers must obtain permits from the Department of Planning and Land Use (DPLU) to develop land in the Borrego Valley. Recently, the DPLU recognized the critical water supply condition in the Valley and adopted an ordinance requiring a CEQA review of potential cumulative impacts to groundwater resources for new proposed projects. The review addresses the following considerations: Would the project substantially deplete groundwater supplies or interfere substantially with groundwater recharge such that there would be a net deficit in aquifer volume or a lowering of the local groundwater table level? Does the project have impacts that are individually limited, but cumulatively considerable?

The DPLU groundwater policy requires projects to offset proposed groundwater use. For Example: taking agricultural or golf course land out of production which would us the equivalent amount of groundwater as the proposed development. For projects which do not propose to offset groundwater use, then an Environmental Impact Report (EIR) is generally required. Projects with previously approved environmental documents must be assessed per Section 15162 of the State CEQA Guidelines. This section provides that the lead agency may require that the prior environmental documents be reviewed in light of new information or other factors.

Save Our Aquifer Coalition

The Save Our Aquifer Coalition (SOAC), a California public interest association, was formed in the early 2000s to draw public attention to and lobby for correction of the aquifer overdraft situation in the Borrego Valley.

The Sponsor Group

The Borrego Springs Sponsor Group is a County of San Diego sanctioned entity that provides local input to the county planning process. Members are appointed by the Board of Supervisors through nominations from the local group. The members have no term limits or official power over planning matters. They are an advisory panel that makes recommendations to the San Diego County Department of Planning and Land Use.

Agricultural Alliance for Water and Resource Education

This California nonprofit mutual benefit corporation was formed in 2003 by the majority of growers in the Borrego Valley. Its' purpose is 'to provide educational information concerning agricultural use of water resources and to protect against the reduction of that use without just compensation…' This entity has been active in helping to define the amount of water used by agriculture and has conducted a seminar on methods to reduce water usage in the Valley.

Golf Course or Recreational Facilities

Recreation is the second most intensive use of groundwater in the Valley (see Chapter 5). Golf courses include the De Anza Country Club course, the Borrego Springs Park and Community Services District courses, the Montesoro course and the Road Runner Country Club course.

The Golf Courses, for the most part, pump their own groundwater, and therefore, under existing state statutes are not subject to provisions that may be enacted by BWD. However, many of the courses are focusing on means to be more efficient with their irrigation methods in order to both conserve water as well as reduce operating costs. Additionally, many are considering reducing the amount of turf under irrigation in recognition of the need to conserve water with the resulting operating cost reductions also being an incentive.

While Golf Courses are the second largest water user in the Valley, they have not formed a representative organization. On occasion, golf course operators have attended and provided input at the BWD meetings.

CHAPTER 3

PHYSICAL SETTING AND THE GROUNDWATER BASIN

This Chapter describes the physiographic setting, the physical characteristics of the aquifer and condition of the groundwater contained in the aquifer system.

Physiographic Setting

Borrego Valley is located in the northeastern portion of San Diego County, California, approximately 85 miles northeast of the city of San Diego (Figure 1). This area of San Diego County is within the Colorado Desert geomorphic province of California and lies along the margin of the desert region to the east.

The Borrego Valley is divided into two areas; the main Borrego Valley and the Lower Borrego Valley. The approximate boundary between the main and lower areas is San Felipe Creek. For purposes of this report, only the water resources of the main Borrego Valley are considered.

The main Borrego Valley is bounded on the north and northeast by Coyote Mountain, on the west and southwest by the San Ysidro Mountains and Pinyon Ridge. The east side of Borrego Valley is bounded by the Coyote Creek fault, with the Borrego Badlands beyond, and Borrego Mountain. As indicated, in the southeast, San Felipe Creek forms the boundary between Borrego Valley and Lower Borrego Valley.

The Borrego Valley is a desert area. It is immediately east of the Peninsular Mountain Range that separates the more temperate coastal plain from the desert. It is separated from the Salton Sea, thirty miles to the east at the northern end of the Imperial Valley, by eroded land known as the Borrego Badlands. It is separated from the Coachella Valley to the north by the Santa Rosa Mountain chain.

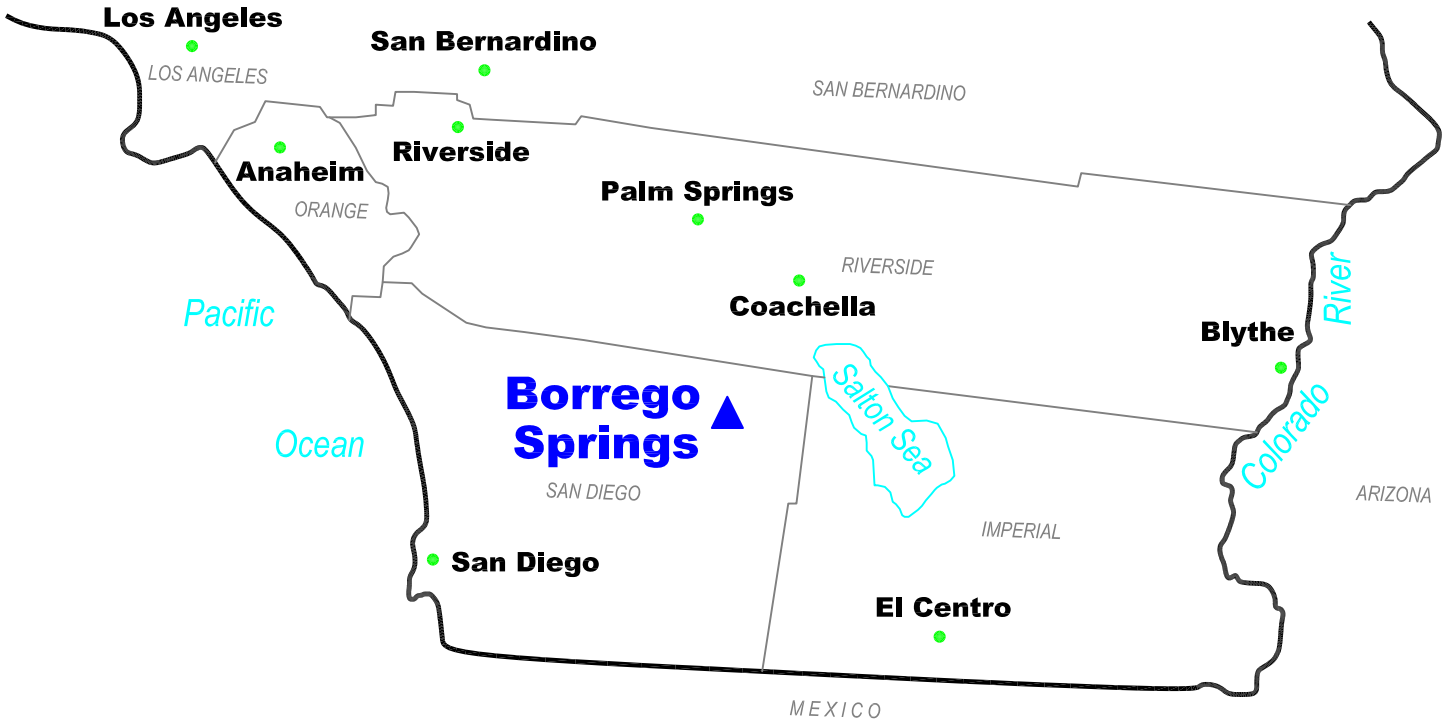
In terms of water resource issues in the Borrego Valley, there are three features to be considered. First is the watershed or drainage basin which includes the surrounding mountains from which runoff from rainfall in the mountains is drained into the valley and recharges the aquifer via canyons and other creeks. Coyote Canyon, at the northwest end of the valley, is the most significant drainage feature.

Borrego Water District
Integrated Water Resources Management Plan

REGIONAL LOCATION MAP

Figure 1

Southern California



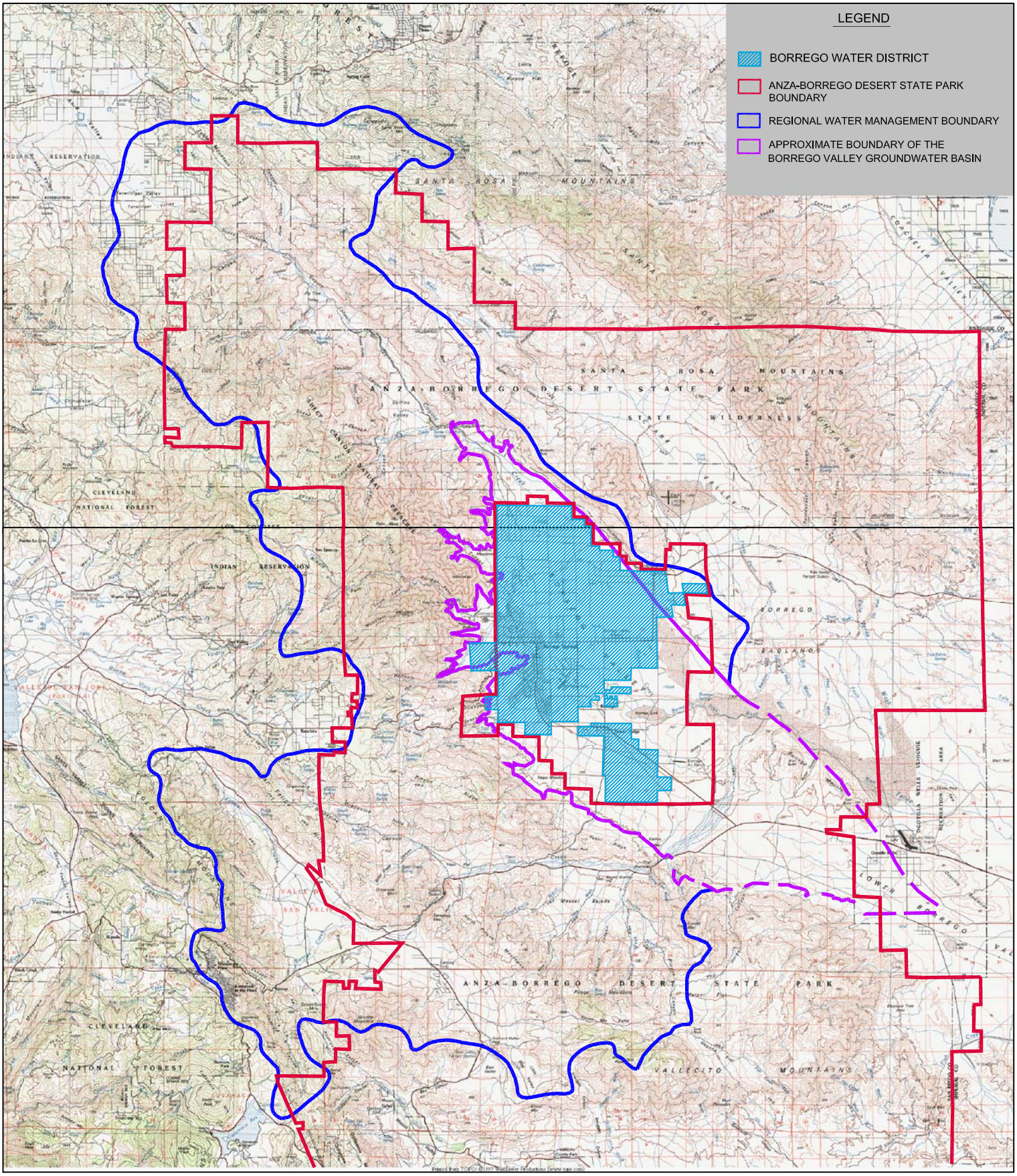
Second is the valley floor, which is bounded and defined by mountains and canyons on the north, west and by the Borrego Badlands to the east. Third is the groundwater basin, which underlies the valley floor.

The Borrego Valley runs in a northwest-southeast direction for about 11 miles and in an east-west direction for about 6-1/2 miles (Figure 2). It includes an estimated 55,000 acres of privately held land with the remaining area of the valley being within the Anza Borrego Desert State Park. Borrego Valley Road is the approximate dividing line between the western half of the valley and the eastern half. The western half is developed with residential and agricultural uses. The eastern half of the valley is primarily open land including the Borrego Sink, the lowest area of the valley to which all natural drainage is directed. The Borrego Sink is the site of a mesquite bosque or woodland, some of which has been designated as a protected feature under County of San Diego land use regulations. The eastern half also includes the airport, some agricultural land north of it, Old Borrego, the original settlement area, La Casa del Zorro and the Montesoro (formerly Ram's Hill) Country Club.

The Borrego Valley watershed area extends several miles to the northeast and southwest. In the north it includes all the mountains around Coyote Canyon up to the community of Anza in Riverside County. In a southwest, includes the drainage area of San Felipe Creek including The Narrows and Scissors Crossing. In contrast, to the east, the drainage basin does not extend much beyond the area of the valley's private land holdings as the Badlands drains toward the Salton Sea and not into the Borrego Valley basin.

Rainfall in the watershed area to the north and west emerges as surface runoff in intermittent streams that enters the valley floor through canyons. This runoff is the main water supply to the groundwater basin. The annual rainfall in the mountains is about sixteen inches, while the valley floor receives about three to six inches. The rainfall on the Valley Floor is generally lost to evaporation.

In 1945 the USGS reported that the groundwater basin was being operated under steady-state conditions. By the mid-1950's it was in an overdraft situation due to the introduction of large-scale agriculture in the valley. This overdraft condition has continued to the present time.



N

SCALE: 1"=5 Miles
May 2008

Borrego Water District
Integrated Water Resources Management Plan

BORREGO VALLEY

San Diego County, California
Figure: 2

Physical Characteristics of the Groundwater Basin

The groundwater basin is identified by DWR (DWR, 2003) as groundwater basin number 7-24 with a surface area of about 150,000 acres (240 square miles) and includes both the main Borrego and Lower Borrego Valley area. The basin, as identified, lies within western Imperial and eastern San Diego Counties. The degree of hydrologic connectivity between the main Borrego and the Lower Borrego Valley basins has not been investigated.

The Borrego Valley Basin is filled with up to 2,400 feet of poorly consolidated to unconsolidated sediments resting on the basement granite. The USGS Report 82-855 identified an upper, middle and lower aquifer. The alluvial sediments filling the basin originated from the weathering action of the rocks in the surrounding mountains. Stream flows then carried the resulting gravels, sands, silts and clay particles into the basin, depositing them in an orderly progression with the larger material (gravels and sands) settling out first and the smaller materials (silts and clay particles) being carried farther into the basin before settling out. Climatological conditions at the time of transportation and deposition considerably influenced the spatial extent of such deposits.

` The base of the groundwater basin is a complex of the oldest geologic units in the vicinity of Borrego Valley and is comprised of the Cretaceous granitic and the Triassic or older metasedimentary rocks of the Southern California Batholith. The basement complex is the ultimate base of the aquifer system and crops out on the north, west and south of the basin as well as at Borrego Mountain.

Geophysical studies were conducted by Agbabian Associates (Agbabian, 1996) in late 1995 and early 1996. Their stated purpose was *"to generate a model of depth to groundwater and basement."* The area surveyed is located in the extreme northwest corner of the Borrego Valley basin and extends only a limited distance (Henderson Canyon Road) toward the south. The electromagnetic soundings and seismic refraction surveys were conducted primarily to map depth to groundwater, while the gravity survey mapped the depth to crystalline basement/bedrock. The combined electromagnetic and refraction work along with the known groundwater elevations from "main station," "oasis" and a well located 1.2 km southeast of "main well" were used to generate several maps.

The gravity data was used to generate a model of depth to granitic basement. The resulting basement contour map shows two distinct basins in the surveyed area. These are

separated by a bedrock ridge, which trends southeast-northwest. Along the north side of the surveyed area, the two basins merge into a singular trough, which parallels the Coyote Creek fault and has an apex extending up into Coyote canyon.

The depth to the basement ridge located by the gravity survey is not significantly different than that profiled in the USGS report (Moyle, 1982). Significant differences were noted in the depth to basement of the two areas paralleling the ridge. The limited data suggests an increased thickness of sediments in the two troughs of some 600-800 feet. This additional depth, as suggested by the gravity survey, suggests that more groundwater is available within these troughs than that inferred by the USGS report. Since there are no wells that penetrate into these two deep troughs, the composition of the sediments or the quantity or quality of water in those sediments is unknown.

The Groundwater Basin

The Borrego Valley Basin is filled with up to 2,400 feet of poorly consolidated to unconsolidated sediments resting on the basement granite. The USGS Report 82-855 identified an upper, middle and lower aquifer (material that stores, transmits and yields significant amounts of water to wells and/or springs). The alluvial sediments filling the basin originated from the weathering action of the rocks in the surrounding mountains. Stream flows then carried the resulting gravels, sands, silts and clay particles into the basin, depositing them in an orderly progression with the larger material (gravels and sands) settling out first and the smaller materials (silts and clay particles) being carried farther into the basin before settling out. Climatological conditions at the time of transportation and deposition considerably influenced the spatial extent of such deposits (DWR 1984).

Upper Aquifer: The upper aquifer is comprised of Holocene to Pleistocene age alluvial, fan, playa and eolian deposits. The unit is about 1,000 feet in thickness at the north end of the basin. Specific yields for these deposits range from 15 to 25 percent (DWR, 1984). This aquifer is the principal source of groundwater in Borrego Valley and well yields are about 2,000 gal/min (Mitten and others 1988).

Middle Aquifer: The middle aquifer is of Pleistocene age and composed of continental deposits, including moderately consolidated sand, gravel, and boulders. Thickness ranges to 700 feet in the middle aquifer and is thickest near the center of the valley, but thins towards the

southeast (Mitten and others 1988). Specific yield ranges from 5 to 10 percent in the middle aquifer (DWR 1984). Groundwater is easily extracted from this aquifer.

Lower Aquifer: The lower aquifer is also of Pleistocene age and consists of continental deposits, including moderately consolidated sand, gravel, and boulders. The lower aquifer reaches 1,800 feet in thickness in the south–central part of the valley (DWR 1984). Specific yield ranges from 1to 5 percent in the lower aquifer (DWR 1984). Data derived from a 1995 test well, indicated that the water in the lower aquifer would be difficult and costly to extract because of its very low specific yield and very low specific capacity (5 gpm/ft. of drawdown or less).

Aquifer Areal Distribution: The USGS analysis of the distribution of the three aquifers indicates that the upper aquifer, which currently supplies most of the groundwater produced from the basin, is thickest in the northern part of the basin and thins to extinction in the southeastern area. The middle aquifer is thickest toward the central portion of the valley adjacent to the Coyote Creek fault and thins toward the Valley's western edge. The lower aquifer is thinnest in the northwest and thickens and becomes dominant aquifer toward the southeast

Faults: The northwest trending Coyote Creek and Superstition Mountain faults form the northeast boundary of the groundwater basin. Water level differences of 100 feet on opposite sides of the Coyote Creek fault indicate the fault is a barrier to groundwater flow (Moyle 1974; 1982). This will be discussed more thoroughly in Chapter 4.

Recharge: Groundwater recharge to the basin is primarily by percolation of stream flow in Coyote Creek and several smaller intermittent streams emanating from mountains north and west of the valley (DWR 1984). A thorough discussion of this water supply element is contained in Chapter 4 of this report.

Groundwater Quantity

The Borrego Groundwater Basin is the sole source of water supply for the Borrego Valley. Consequently, its condition, as measured by withdrawal rates and quality is extremely important to the community. Further, the amount of water in storage that can be relied upon to meet future water demands is critical to developing water resource management plans.

Water Level Elevations: Water level elevation contour maps of the surface of the water table were developed by the USGS (Moyle 1982) for the years 1945, 1952-53, 1965 and 1980. More recently the DWR prepared water level contour maps for the year 1989, 1998, 2000 and

2003. The USGS maps encompass the entire Upper Borrego Basin while the DWR maps include mainly the central and northern area of the Upper Borrego Basin. Figure 3 depicts the DWR interpreted water level contours for the year 2003.

Water Level Trends: Groundwater elevations at selected wells have been monitored and reported by the USGS from 1945 to 1982, then by the County of San Diego from 1982 to present. Well hydrographs for 10 wells in the basin are presented in the USGS report (Moyle 1982) for the period 1945-80. Hydrographs for five selected wells show as gradual and steady decline for the period 1987-2005, as shown on Figure 5. The figure also shows historic trends and projections to the year 2030 if the trends continue at the same rate.

The following table illustrates the accelerated decline in selected wells (San Diego County, 2007). As indicated, the water level decline has increased since the 1980s.

Table 1
Summary and Average of Water Level Changes in Selected Wells

Well	Average Change in Water Levels (feet per year)		
	1980s	1990 to 1997	Since 1998
Empty Irrigation	-1.5	-2.3	-4.1
Fortiner	-0.6	-3.4	-3.9
Levie	-1.0	-2.2	-2.4
State Park 2	-2.4	-2.2	-2.4
UEC North	-1.2	-0.5	-2.1
UEC South	-1.3	-0.5	-2.1
Average of all wells	-1.3	-1.9	-2.8

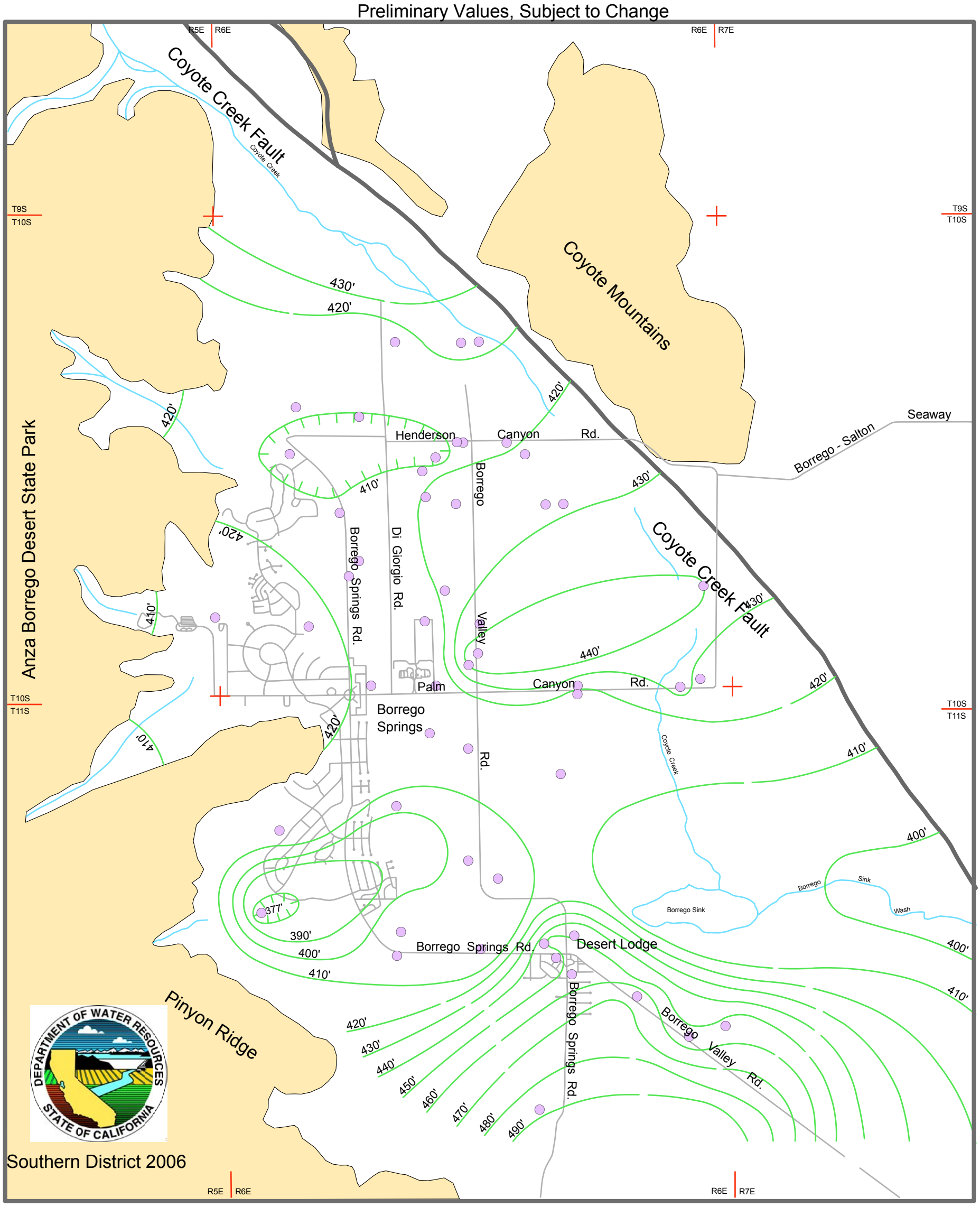
Source: San Diego County DPLU, 2007

Change in Water Level Elevations: Change in water level elevations is also important in assessing the condition of the groundwater basin. The USGS (Moyle 1982) prepared change in water level contour elevation maps for the periods of 1953-65, 1965-80. DWR prepared change maps for 1945-98 and 1989-2000 (DWR, 2002). These are included in this report as Figures 5 and 6, respectively.

Borrego Valley Water Levels 2005

Figure 3

Preliminary Values, Subject to Change



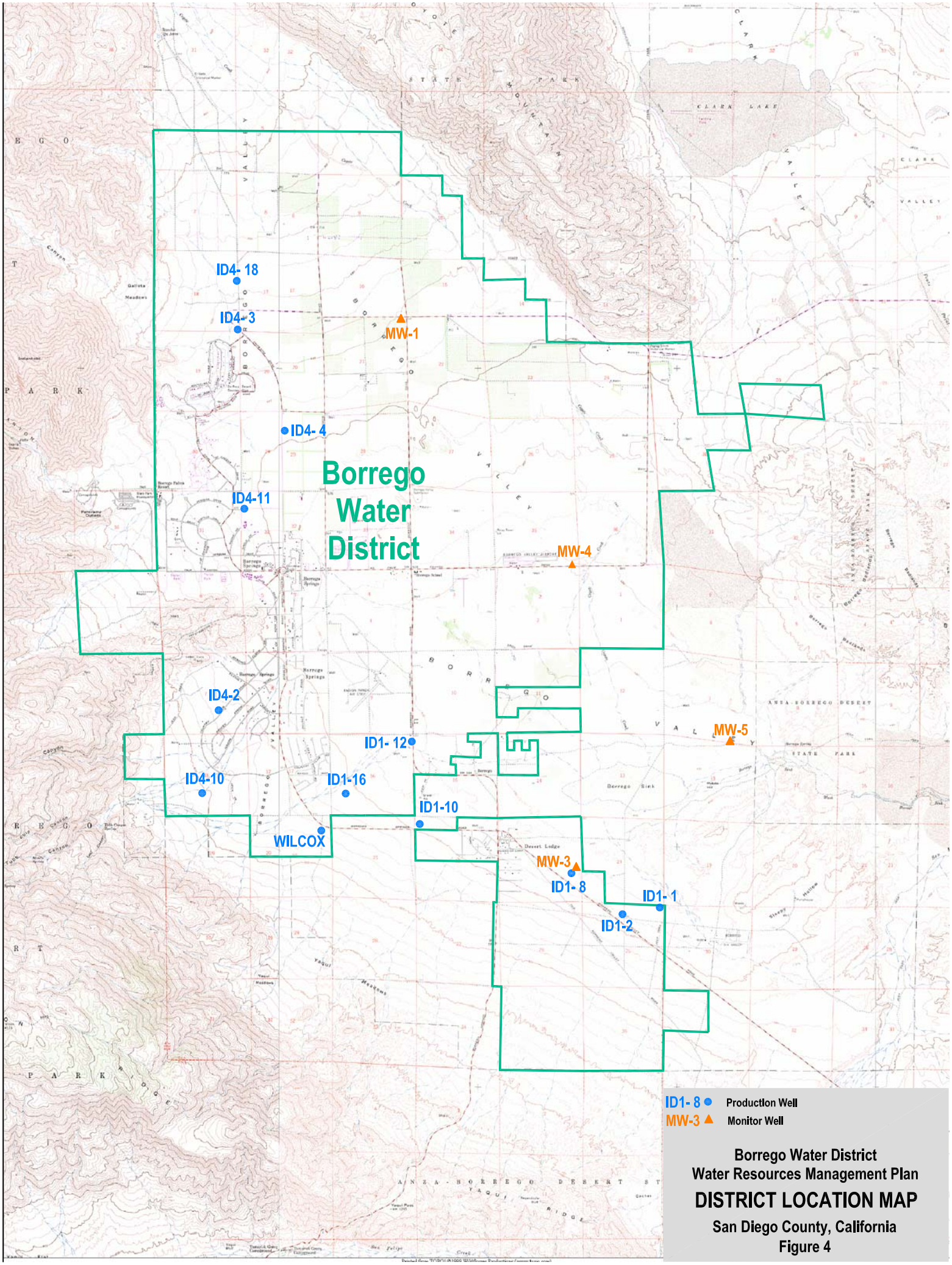
Explanation

Consolidated rock

Fault

Intermittent stream

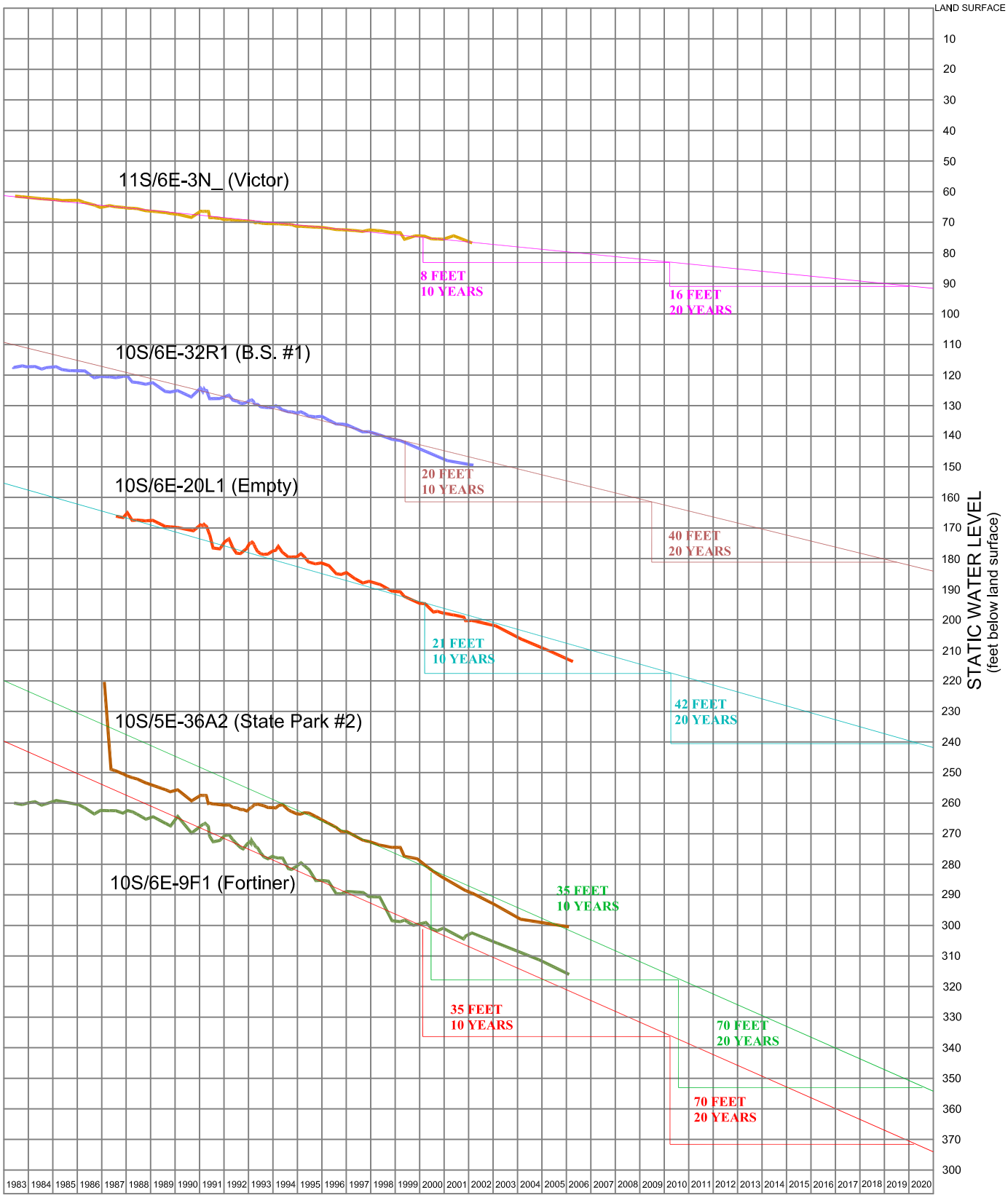
Base map modified from USGS 7.5 minute topographic maps. Groundwater contours area generalized representation of the regional static water level interpreted from 35 wells measured in Spring 2005. Water levels are interpreted to represent unconfined conditions. This interpretation may change if additional information becomes available.

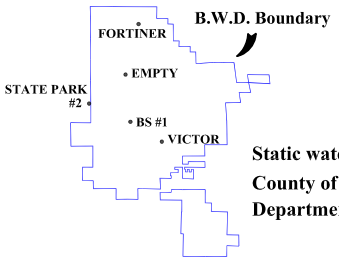


Borrego Water District
Water Resources Management Plan

DISTRICT LOCATION MAP

San Diego County, California
Figure 4





LOCATION MAP

Static water level data collected by:
County of San Diego,
Department of Planning and Land Use

Borrego Water District
Water Resources Management Plan

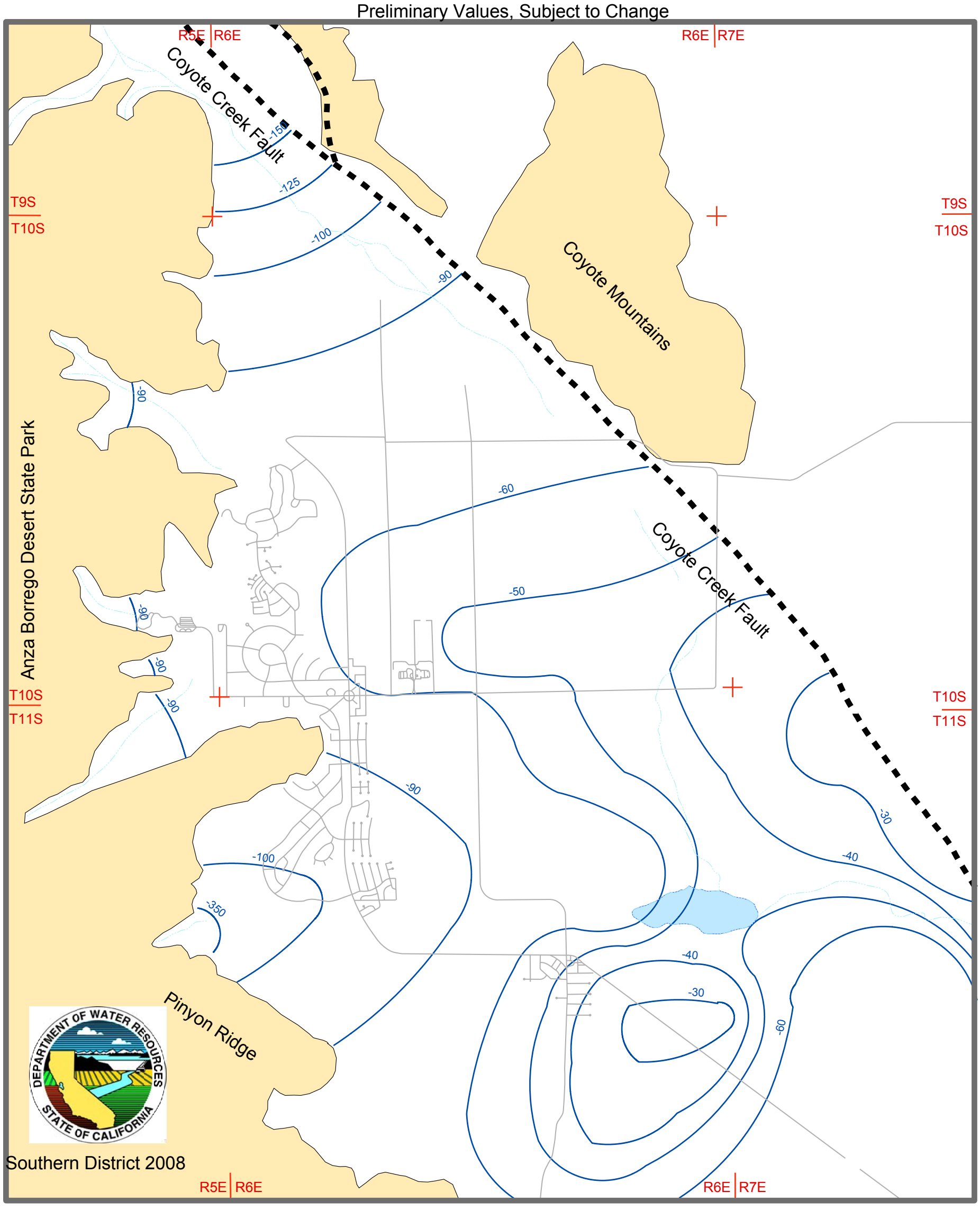
HISTORICAL and PROJECTED HYDROGRAPHS

Figure: 5

Borrego Valley Water Level Change 1945-1998

Figure 6

Preliminary Values, Subject to Change



Explanation

Consolidated rock

Fault

Intermittent stream

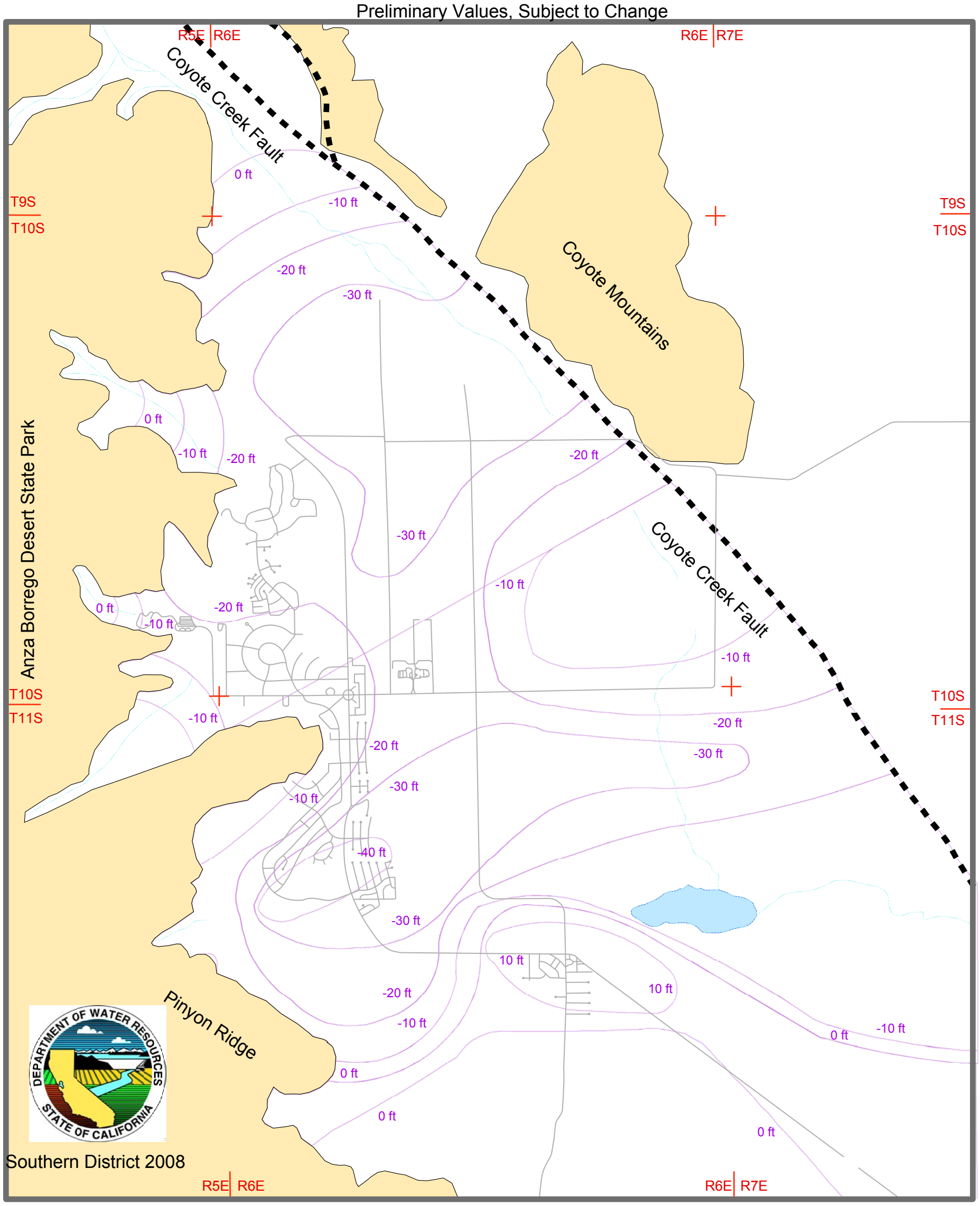
Change in groundwater elevation

Base map modified from USGS 7.5 minute topographic maps. Groundwater contours are a generalized representation of the change in static water levels (in feet) interpreted for 1945 to 1998. Water levels are interpreted to represent unconfined conditions. This interpretation may change if additional information becomes available. 6/02/2008

Borrego Valley Water Level Change
1989 - 2000

Figure 7

Preliminary Values, Subject to Change



Explanation

Consolidated rock

Fault

Intermittent stream

Change in groundwater elevation

Base map modified from USGS 7.5 minute topographic maps. Groundwater contours are a generalized representation of the change in static water levels (in feet) interpreted for 1989 to 2000. Water levels are interpreted to represent unconfined conditions. This interpretation may change if additional information becomes available. 6/02/2008

Change in Amount in Storage: While the amount of water in storage in the basin is more difficult to determine, the change in storage from one year to another year is more easily determined and is a measure of the 'overdraft' for that period. (Overdraft is defined as the amount that net extractions from the groundwater basin exceed recharge to the basin) If the time interval between two years is sufficiently long, with average precipitation and relatively uniform extractions, the change in storage is a direct measure of the overdraft for that period.

The determination is made with estimates of the aquifer characteristic known as 'specific yield'. This is a measure of the amount of water, as a percentage, that can be withdrawn from a cube of aquifer material. When the specific yield is multiplied by the change in water levels, the result is the amount of water lost or gained between the two periods.

DWR (DWR 2002) estimated the storage change associated with the two periods and is depicted on two change-in-storage maps. The change is shown on Figure 8 for the period 1945-98 and on Figure 9 for the period 1989-2000. The results of their analysis are shown in Table 2.

Table 2
Change in Storage for Selected Periods

Period	Total Change in Storage (af)	Average (af/y)
1945-1998	-450,000	-8,500
1989-2000	-100,000	-9,500

Source: DWR, 2003

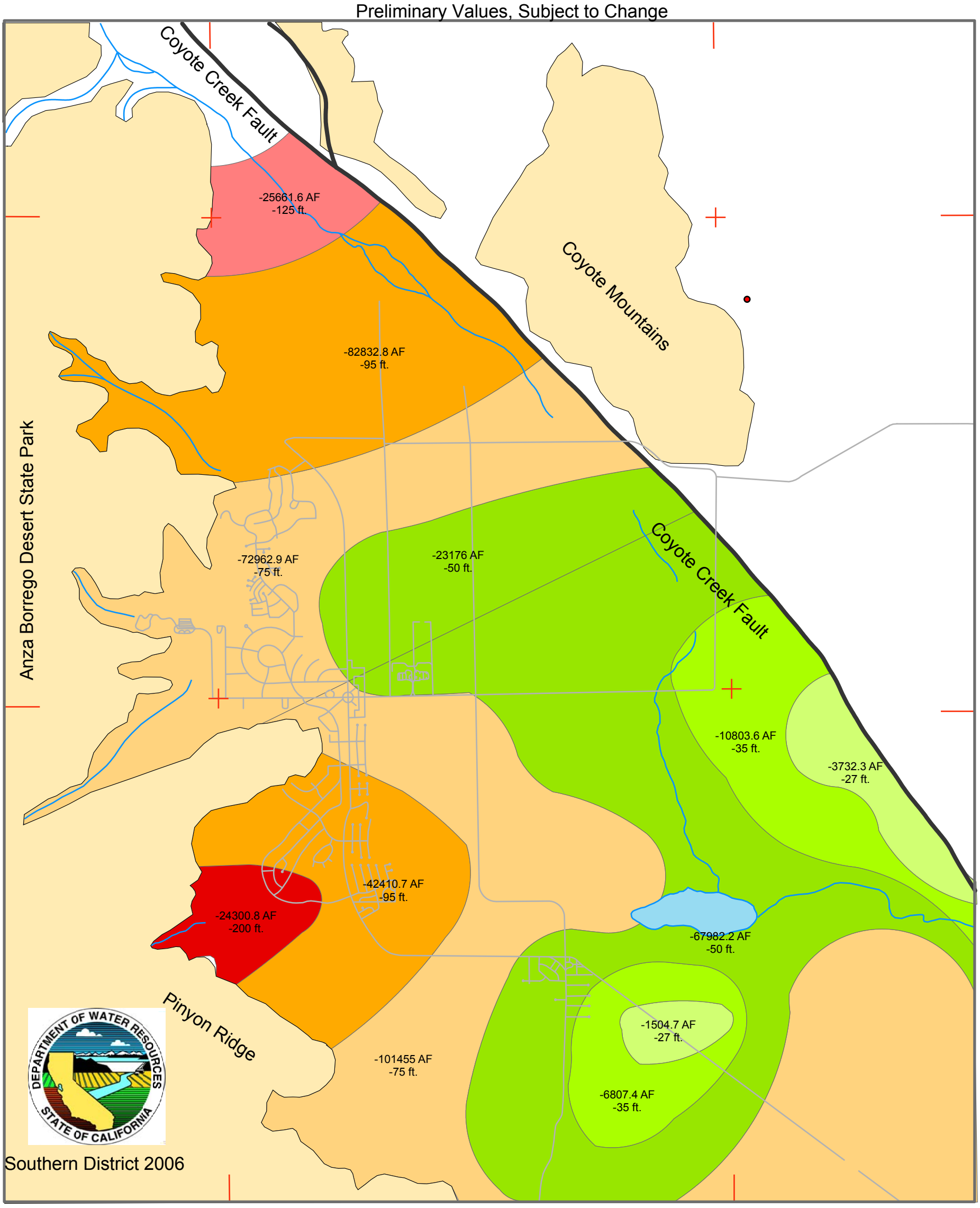
Groundwater in Storage: The amount of water in storage prior to 1945 was estimated to be about 5.5 million af (Moyle 1982). This estimate included the water in storage of the upper, middle and lower aquifers. The net depletion of groundwater from 1945 to 1980 was estimated to be about 330,000 af (Moyle 1982), implying that groundwater in storage for 1980 was about 5,170,000 af in all three aquifers.

In a letter report, Dr. David Huntley (Huntley 1993), discounted the lower aquifer as an economical water supply source thereby reducing the quantity of water in the Borrego Valley to approximately 2,131,000 af in 1945. Huntley also estimated that the overdraft had reduced the water in storage by 1980 to 1,900,500 acre-feet (809,000 acre-feet in the upper aquifer and 1,090,000 acre-feet in the middle aquifer.) These calculations were carried forward by BWD to 1999 at which time BWD estimated the water remaining at approximately 1,685,000 acre-feet.

No estimates of the amount of water in storage have been made by DWR.

Borrego Valley Change in Storage 1945-1998

Figure 8



Explanation

Consolidated rock

Fault

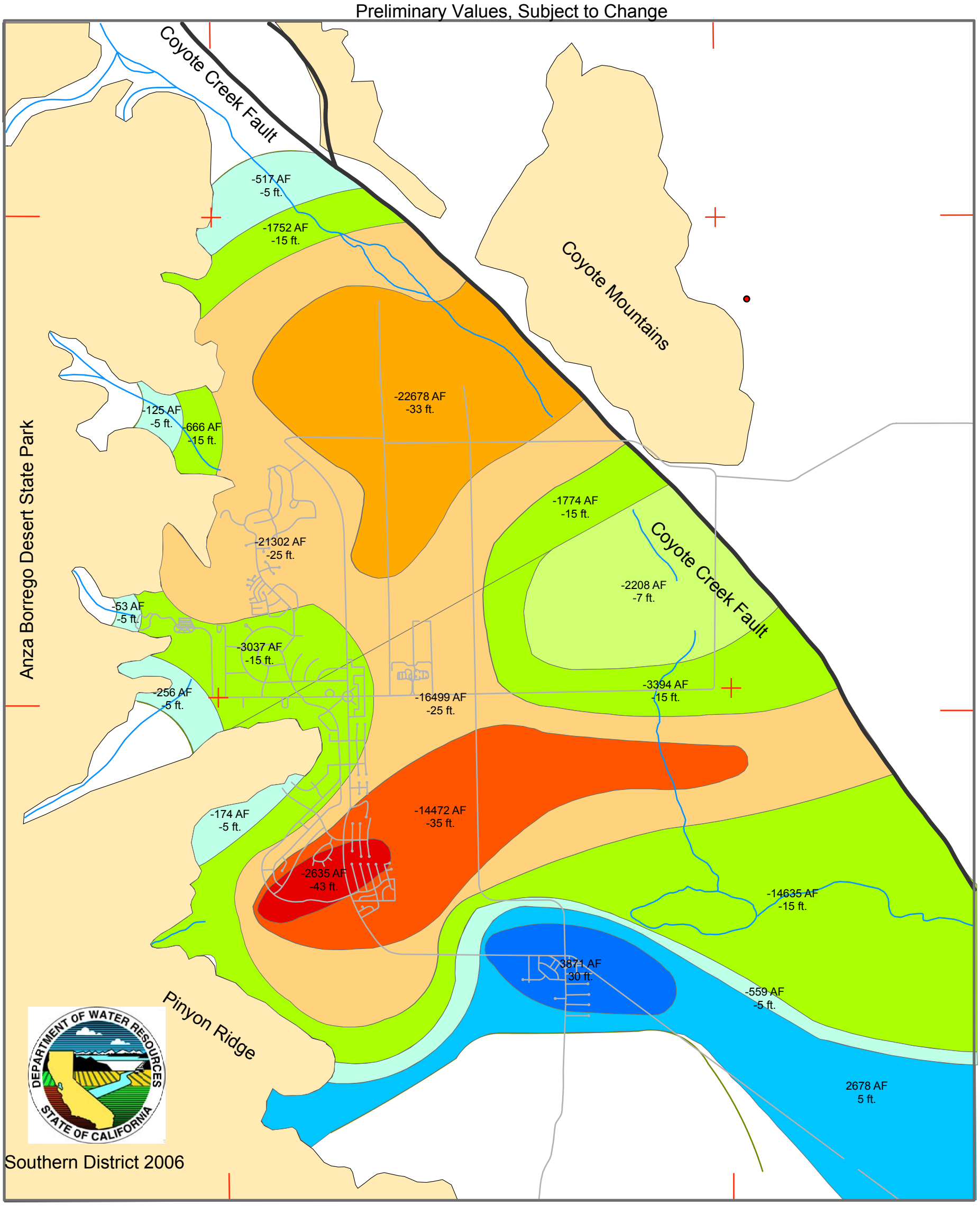
Intermittent stream

Base map modified from USGS 7.5 minute topographic maps. Colored polygons represent areas of equal average water level change in the underlying aquifer. Using a specific yield of 14 percent in the northern part of the basin and 11 percent in the southern part, values of change of water in storage in the portion of the aquifer underlying each polygon are calculated. Total change in storage during 1945-1998 is about -450,000 acre feet (AF), or an average of about -8,500 AF per year.

Borrego Valley Change in Storage 1989-2000

Figure 9

Preliminary Values, Subject to Change



Explanation

Consolidated rock

Fault

Intermittent stream

Base map modified from USGS 7.5 minute topographic maps. Colored polygons represent areas of equal average water level change in the underlying aquifer. Using a specific yield of 14 percent in the northern part of the basin and 11 percent in the southern part, values of change of water in storage in the portion of the aquifer underlying each polygon are calculated. Total change in storage during 1989-2000 is about -100,000 acre feet (AF), or an average of about -9,100 AF per year.

It should be noted that the water in storage is not necessarily an extractable amount. For example, water level drawdown may cause impaired quality waters to invade the aquifer from below or along the periphery of the basin.

BWD is actively pursuing a program to more accurately assess the amount of extractable water in the Borrego Valley Aquifer. This is being accomplished with the aid of both DWR and the USGS. These agencies are collaborating in developing and collecting data needed to update and refine an existing numeric model of the basin that can be use to estimate the amount of extractable water remaining in the basin.

Groundwater Quality

The groundwater throughout most of the Borrego Valley is generally good to excellent in quality. The water extracted by the Borrego Water District wells average less than 500 parts per million (ppm) totals Dissolved solids. (As a comparison, Colorado River water is in the 700-ppm (TDS) range). Any water source above 1,000 ppm is considered non-potable. (See Appendix C for water quality data.) The available data indicates that there has been no serious degradation to the water quality.

The water quality in the main agricultural area is not well defined as very little water quality data have been derived from that area. However, it is expected to be of poorer quality than that derived from the BWD wells due to the long term concentrating effect of irrigation return flows to the groundwater basin. The following examples of this situation have been documented.

Approximately 20 years ago, the Roadrunner Club provided its own irrigation water, as well as its own domestic water to its residents. The concentration of nitrates in their well eventually exceeded the maximum concentration level allowed for drinking water. To remedy this situation, the public water system was extended to the Roadrunner Club to supply the residents of the park. The golf course and landscaping continue to be served from privately operated wells, which have high nitrate concentrations.

Borrego Springs Water Company Well #1, (2475 Stirrup Road) in the late 1960's became contaminated and the water was unsuitable for domestic water service because of high nitrates. It was taken out of service and thereafter used only for construction water. Today the well serves as a monitor well.

Three wells owned by Di Giorgio Corporation (# 11, #14 and#15) located on Borrego Valley Road and north of Henderson Canyon Road all pumped high quality water in the 1960's. By 1985 when the wells were being used for the Roadrunner Tree Nursery, the water quality had deteriorated with TDS ranging from about 1, 700 to 1,800 mg/L and with a nitrate range of 120 to 180 mg/L, far above the drinking water standard of 45 mg/L.

The Valley has no known contamination problems from gasoline stations, which are the only potential industrial contamination risk in the community. The Regional Water Quality Control Board has inspected the two abandoned stations and the three existing stations are centrally located in the town center, away from any production wells. Water quality samples have not detected MTBE (Methyl Tertiary Butyl Ether), the gasoline additive intended to clean up the air that has contaminated groundwater basins in many urban areas.

All wells that service domestic customers are constructed to minimize surface water contamination.

Water Quality Trends: Figure 10 depicts trends from 1960 to present in water quality at seven of the BWD wells located throughout the basin. As indicated, the water quality as measured by Total Dissolved Solids (TDS) for most wells range from 300 to 500 mg/L. However, wells near the agricultural area (north of Palm Canyon Drive and east of Di Giorgio Road) exhibit higher TDS values and have been redrilled or abandoned due to high nitrate values.

Water Quality and Management Strategies: As indicated, the BWD extracted groundwater is of good quality, suitable for domestic use and has not shown to be experiencing degradation. However, there are indications that the groundwater quality in the main agricultural area is of lesser quality than the BWD extracted water and, further, the irrigation return waters with high TDS concentration and nitrate content above drinking water standards are likely to further degrade the water in the main agricultural area. This could present a problem with the BWD wells located adjacent to the agricultural area if there were significant migration of the agricultural area groundwater into the BWD wells.

This situation appears unlikely under present groundwater basin operation where a continued overdraft lowers the water table, especially in the more heavily pumped agricultural

Borrego Water District
Integrated Water Resources Management Plan

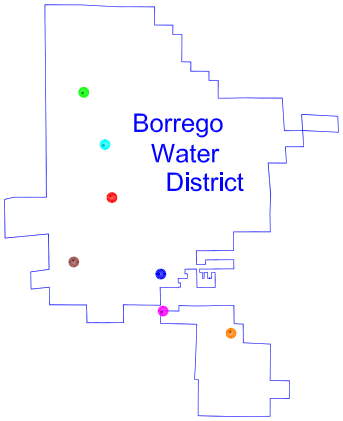
WATER QUALITY FOR SELECTED WELLS

Figure 10

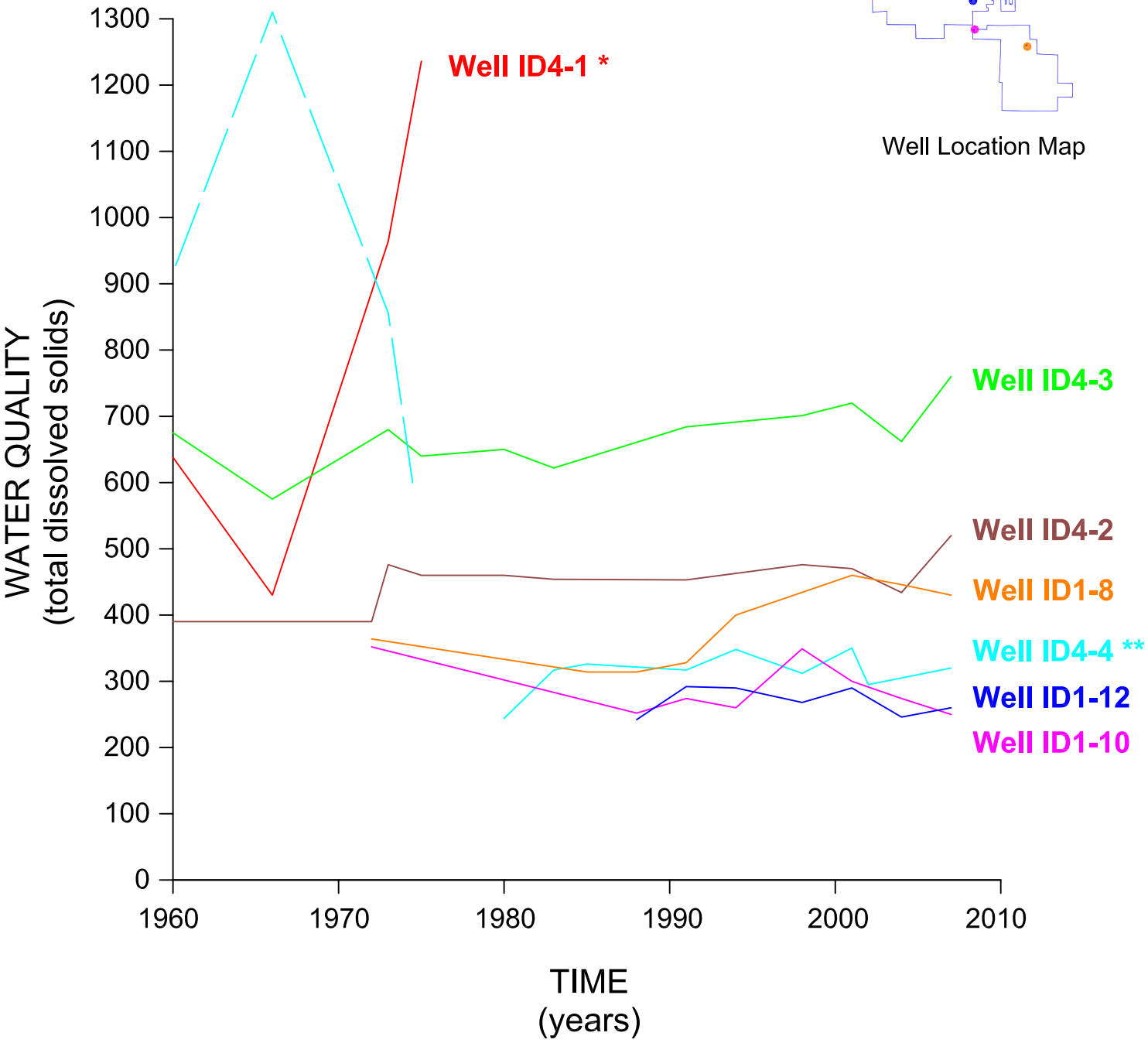
Notes: * Well ID4-1 abondoned (1975) due to high TDS and NO3

** Well ID4-4 redrilled (1979), due to high TDS and NO3 with no perforations for first 400 feet

See Figure 3 for detailed well location map



Well Location Map



area, thus serving to contain the potentially poorer quality groundwater. Figure 3 shows a groundwater depression in the main agricultural area. Thus, groundwater from adjacent areas is drawn towards the depression. However, should an imported water supply be obtained for groundwater recharge in the northern part of the basin, such a recharge operation could substantially impact the groundwater table, changing groundwater gradients with the potential movement of groundwater out of the main agricultural area.

Conversely, if imported water were introduced into the basin south of the agricultural area, the effect would be to create a northward gradient that would prevent southward migration of the poorer quality waters in the agricultural area.

Another concern has been raised about the potential for 'up welling' of potentially poor quality water contained in the lower aquifer (Palm Spring Formation) into the middle and upper aquifers due to the possibility of a higher hydrostatic pressure in the lower aquifer than in the upper water bearing units. This situation could result from a continued lowering of the water levels in the upper aquifers as a result of continued overdraft. To evaluate this potential, an application for a multi-point monitoring well has been submitted to the State of California for grant funding.

CHAPTER 4
WATER SUPPLY

This Chapter presents a discussion of the sources of water supply that recharge the groundwater basin.

Recharge from Natural Sources

Precipitation over the surrounding watershed generates surface water runoff, primarily from the mountains that flank the basin to the north and west of Borrego Valley. Runoff from the surrounding mountains enters the valley along several creeks and intermittent streams and infiltrates into the ground at the head of alluvial fans or along the streambeds as they run out into the valley. This watershed area comprises more than 400 square miles of watershed. Surface water flow into valley floor has been gauged at three of the sub-basins. These are discussed below. Additional, but minor sources include: domestic wastewaters and irrigation return flows.

The water supplies of the Borrego Valley were studied and estimated initially by the USGS (1987). More recently, a study as part of a Master's Thesis was conducted (Netto, 2002). The two studies employ different periods, one a 26 year study period, the other a 56-year study period; both are in general agreement as to the surface inflow into the basin. The main difference between the two studies is in the subsurface inflow to the basin from the mountains west of the valley. This will be discussed later.

Inflow from Gauged Streams: Inflow from three streams in the Borrego watershed has been historically gauged by the USGS in cooperation with the BWD. These include: Borrego Palm Creek, Coyote Creek, and San Felipe Creek. Runoff from these three creeks constitutes the majority of surface inflow and consequently, recharge to Borrego Valley aquifer. The USGS gauging station data is included in the Appendix B.

The most recent estimate of runoff into the valley floor was developed by Netto (2002). The method employed by Netto was based on watershed area/runoff relationships for the three gauged sub-basins and using a 56-year study period (1945-2000). The estimated long-term averages for the gauged streams were: 750 afy on Borrego Palm Creek, 1,750 afy on Coyote Creek, and 430 afy on Upper San Felipe Creek. The total from these three sources is 2,930 afy. (It should be noted that in very wet years, it has been observed that a portion of the runoff from

these sources flow into the Borrego Sink and are lost to evaporation or outflow from Sink. Thus, the total flow from these three watersheds does not constitute recharge to the aquifer.)

The USGS in 1987, using rainfall data for the period of 1951-80 and a study of the channel-geometry (Moyle 1987), estimated inflows from the same three gauged canyons at an average of 2,230 afy. (See Table 1 for a comparison).

Inflow from Ungauged Streams: Annual runoff from 12 ungauged watersheds was estimated for the period 1945 through 2000 using data for the three gauged sources of stream flow described above (Netto 2002). Using an area-runoff method, Netto estimated that these un-gauged areas produced an average of about 930 afy over the study period.
The USGS in 1987, using a study period of 1951-80 and channel-geometry considerations, estimated inflows from the ungauged canyons at an average of 2,600 afy.

Surface Outflow from the Valley Floor: As indicated above, at times storm flows are sufficiently large so as to reach the Borrego Sink and are not recharged into the basin. The USGS methodology accounts for estimated outflows from the Valley by reducing the inflow as recharge to the basin. The Netto study does not account for these occasional outflows from the basin in very wet years.

Recharge from Bedrock: A portion of the precipitation over the watershed infiltrates through the soil and into the underlying bedrock as groundwater recharge to the surrounding drainages. This groundwater then seeps through the surrounding bedrock toward Borrego Valley. Groundwater seeps from the bedrock into the alluvial aquifer of Borrego Valley below ground surface at the contact between the bedrock surface and the alluvial aquifer. This component of recharge cannot be directly measured, but prior studies, using numerical (mathematical) models of basins in the coastal area of Los Angeles, have inferred and partially quantified this recharge element.

Netto (Netto 2002) undertook a detailed study of 9 bedrock drainage areas for the period 1945 through 2000 using a mass balance approach. This approach attempts to account for all water introduced as precipitation over the watershed, runoff as surface water flow, plant transpiration, evapotranspiration and retained soil moisture. Any precipitation water remaining after these water losses is assumed to result in bedrock recharge to the groundwater basin. Since each of these components is estimated, the resulting unknown (recharge from bedrock) is also subject to substantial error. Nonetheless, the Netto study estimated an average bedrock recharge

of about 1,790 afy. The bedrock contribution to basin recharge will be evaluated during the development of a numeric model of the basin as discussed in Chapter 7.

Recharge from Precipitation on Valley Floor: Infiltration of rain falling directly on the valley floor is not considered a significant source of groundwater recharge. Borrego Valley is located within the rain shadow of the Peninsular Ranges and has an arid climate with mean annual rainfall of 3.3 inches measured at Borrego Springs during the period from 1945 to 1966 (Netto 2002). With an annual mean high temperature of 85°F in Borrego Springs (Netto 2002), and mean annual potential evapotranspiration (PET) estimated for Borrego Valley of more than 70 inches (described below), average PET is several times greater than average precipitation throughout the entire year. Thus, recharge to groundwater occurring from infiltration of rain falling directly on the valley floor is expected to be minimal (Netto 2002).

Recharge from Underflow: Another source of groundwater recharge to the Borrego Valley aquifer is underflow from adjacent mountain channels. Groundwater flow from alluvial filled channels entering Borrego Valley is referred to as *underflow*. Underflow along San Felipe Creek was estimated to be approximately 32 afy (Moyle 1982).

Coyote Creek also has a relatively thick alluvial filled channel entering Borrego Valley. However, shallow bedrock and surface outcroppings near Santa Catarina Spring, upstream from the "Third-Crossing" of Coyote Creek, forces underflow through this channel to the surface and virtually all recharge from the Coyote Creek drainage enters the valley as surface water flow. Most other channels entering Borrego Valley contain very little alluvial sediments and underflow from these other channels is expected to be minimal (Moyle 1982).

Summary of Natural Inflow to the Basin

The Netto (2002) and USGS (1987) estimates of recharge to the groundwater basin are compared in Table 3.

Table 3
Estimated Recharge to Borrego Groundwater Basin
From Natural Sources

Stream	Netto Recharge	USGS Recharge
Coyote Creek	1,750	1,700
Borrego Palm Creek	750	500
San Felipe Creek	430	30
Ungauged Creeks	930	2,600
Outflow from Valley Floor	NA	(a)
Subtotal from Creeks	3,860	4,830
Recharge from Bedrock	1,790	NA
Total Recharge	5,650	4,830

a: accounted for as a reduction in recharge.

The difference in inflow from the adjacent watersheds of approximately 1,000 afy is not due to the precipitation differences between the two study periods. The average precipitation for each of the two study periods was determined to be only 3%. Thus, the difference appears to be in the application of the 'channel-geometry' method. For example, the USGS indicates that while the San Felipe gauge indicated a long-term average of 400 afy, the 'channel-geometry' method suggested that only 30 afy actually recharged the basin.

A further significant difference in the two estimates is the underflow from the adjacent mountain basin bedrock. As indicated in the text and table, the USGS did not identify this as a component of recharge to the basin.

Recharge from Applied Water Uses

Recharge to the basin occurs, in addition to natural sources, from applied water use for irrigation of crops, golf courses and from domestic wastewaters. The sources, although minor, are discussed in the following section of the report.

Recharge from Irrigation: Irrigation typically involves the over-application of water to prevent salts from accumulating by causing them to infiltrate down and return to groundwater as recharge. Irrigation efficiencies have been estimated after the collection of field samples at two locations in Borrego Valley. These ranged from an irrigation efficiency of 22% for a citrus grove and 14% for a golf course (Netto 2002). Based on estimates of water use for these irrigation uses, Netto proposes that irrigation return flows for citrus be computed at 22% of the applied water delivered and at 14% for all other irrigation in the valley.

Recharge from Domestic Wastewater: Some of the water delivered to domestic users in the valley becomes domestic wastewater and is sewered to the BWD wastewater treatment plant. This facility provides secondary treatment, but all discharge to final settling ponds is evaporated. Therefore, none of the sewered wastewater is a recharged source to the basin.

The majority of homes in the area utilize septic tank treatment and disposal systems. BWD (Rolwing 2007) estimated that about 80% of the domestic water deliveries are to homes with septic tank systems. The amount of the potential recharge from this water use is believed to be a small amount and difficult to quantify and is therefore assumed negligible[2].

[2] Assuming that 1600 homes are on septic tanks with an average indoor usage of 100 gpd/home and a 50% loss rate due to evaporation and transpiration, the total return from these homes would be about 90 af/year.

CHAPTER 5
WATER USE

This chapter describes the current, past and future water uses in the Valley. The chapter also defines important terminology in defining water use.

Current Water Use in the Valley

Extractions of groundwater are measured by meters for only a small part of the production in the valley. Consequently, much of the production must be estimated through the use of irrigated acreages of various crops and their estimated water delivery and water consumption.

Water Deliveries vs. Water Consumption

Hydrologists and water resources engineers find it useful to distinguish gross water deliveries to homes and irrigated lands from that which is lost to the atmosphere by vegetative consumption. The gross amount of water delivered is typically referred to as delivered water, applied water or water duty. Some of this water is consumptively used through evaporation or vegetative consumption or transpiration. This is known as consumptive use.

For residential and commercial use, some portion of the delivered water is used to transport wastes from the facility. This water if collected in a sewerage system is available for reclamation or reuse, after appropriate treatment. In metropolitan areas, these wastewaters constitute an important water supply source.

Vegetative plants (turf, ornamental plants, agricultural crops) extract water and nutrients from applied waters leaving behind the salts or minerals that are included in the irrigation water. These salts will accumulate in the root zone of the plant. When the salinity of water in the root zone reaches a saline level specific to each plant, the growth and/or agricultural crop yield of is adversely impacted. Thus, irrigation managers apply more water than the plants consumptive water needs in order to maintain favorable salinity levels in the root zone. In some areas, the annual rainfall is sufficient to prevent salinity build-up in the root zone. However, rainfall in the Borrego Valley is insufficient to accomplish this.

Applied waters in excess of a plant's consumptive water requirements are described as irrigation return flows. These waters pass through the root zone and are available for

groundwater recharge if there are no subsurface impediments to the downward percolation of the waters. Where downward percolation of these return flows is prevented, such as in the Imperial Valley of California, subsurface drains are installed to collect and dispose of these return flows. For example, return flows are the primary water supply to the Salton Sea.

The DWR has performed numerous investigations throughout the state of California to empirically derive the consumptive use water requirements of each commercial crop. (DWR, 1974).

Recent Estimates of Water Use

The amount of water delivered and consumptively used by agriculture has been of considerable concern due to its magnitude relative to other water uses and the natural recharge of the basin. Three recent water use studies, all since 2000, have been conducted to define the amount of groundwater extracted from the basin and the amount of that extracted water or return flow, percolates back into the groundwater basin. These studies have used similar but somewhat different methodology to arrive at these estimates. The results of the three studies are presented next.

Borrego Water District 2008 Study: Agricultural usage has been calculated by BWD by determining irrigated acreage by assessor parcel for the year 2008. The acreages of each crop type, when multiplied by a standard water delivery amount for crop type, were used to calculate water delivered or applied for each crop type. It was determined that applied water per acre per year for citrus groves (both lemon and grapefruit) was approximately six acre-feet, nursery stock about 4 feet, and palm groves three acre-feet. Applied water for potato fields, which are a winter crop and are rotated every three years, is approximately 2.5 acre-feet per acre over a three year cycle.

This methodology does not take into account that young citrus trees water usage is much less than that of mature trees and thus the water usage by this method tends to overstate the actual usage (See Netto Master's Thesis). Based on this methodology, a calculation of the total agricultural applied water is shown in Table 4.

Table 4
Applied Agricultural Water Use in 2008 by BWD

Crop	Acreage (acres)	Applied Water (afy)	Total Applied Water (afy)
Citrus	2,191	6.0	13,147
Palm	767	3.0	2,301
Nursery	143	4.0	572
Potatoes	781	2.5	644
Total	3,882		16,664

Source: From 2008 survey, BWD

Estimates of net water use were not made by this study.

Netto Master's Thesis: A similar methodology to that used in the BWD study was used in a Master's Thesis (Netto 2002). Additionally, a field investigation was conducted to determine the amount of applied water consumptively used. The result is the net water used, with the remainder of the applied water leached through the crop root zone in order to prevent the accumulation of salts in that zone. Thus, the study estimated both applied and net water use for the year 2000. The investigation found that 22% of the delivered water for Citrus was leached beyond the root zone and summarily, 14% of the delivered water for 'other' crops was leached beyond the root zone.

This study also took into account that young citrus trees water usage is less than that of mature trees and thus the water use for immature trees was reduced. The results of the study are shown in the table 5.

While the Netto thesis was reviewed by an academic review committee, it was not subjected to a 'Peer' review. Peer reviews are conducted by a group of practicing professionals, from both the private and public sectors, having substantial work experience in the required fields.

Table 5
Net Water Use in 2000 by Netto (afy)

Crop	Irrigated Acreage	Delivered Water	Net Water	Return Water
Citrus	2,587	8,433	6,578	1,855
Other	1,723	3,445	2,963	482
Total	4,310	11,878	9,541	2,337

AAWARE Report: This report (AAWARE 2003) was prepared on behalf of the Agricultural Alliance for Water and Resource Education (AAWARE) and utilized a completed questionnaire the from the growers and data from the California Irrigation Management Information System (CIMIS).

The total acreage encompassed by the survey included about 5,100 acres. About 88% of the irrigated acreage was reported by the survey questionnaire. The water use in non-reporting areas, including the non-AAWARE acreage, was estimated based on local knowledge. The survey showed that about 3,400 acres were irrigated and approximately 1,700 acres were fallow. Also, the survey found that the most commonly used irrigation techniques were found to be drip and micro spray. These two efficient application methods were used on about 85% of the irrigated acreage.

The survey technique for determining the amount of water extracted and delivered to various crops utilized electrical power records and well production information for the most part. A total of about 14,700 af was determined to be extracted and applied to the irrigated acreage within the Valley.

The irrigation return amount was computed for each grower and crop, based on their reported delivery rate and the known ET value for the crop as developed using the CIMIS station in Oasis, CA. The following table shows the delivered, evapotranspiration and return amounts for each crop type.

Table 6
Agricultural Delivered Water, Net Water Use and Return Flow Estimates (afy)

Crop Type	Delivered Water	Net Water Use	Return Flow
Citrus	11,100	7,750	3,350
Palms	1,750	1,250	500
Other	1,800	1,450	350
Total	14,650	10,450	4,200

Source: AAWARE (2003)

As indicated table 6, the net water use is estimated at about 10,450 af. This value compares to the value published in the Netto Master's Thesis of 9,540 af. Considering the differences in methodology used in developing these estimates, it is concluded that the results are comparable.

Agricultural Water Use

Historically, Borrego Valley has been primarily an agricultural community. Although agricultural irrigation remains the single most intensive use of groundwater, the valley has gradually changed since 1960 to an accumulation of farms, retirement communities, residential homes, and golf resorts.

Agricultural development rapidly expanded in Borrego Valley after 1945, and is today still the most intensive use of groundwater in the valley. Primary crops grown in the valley have included row crops, table grapes, citrus orchards, and a variety of other agriculture such as date orchards, tree farms and ornamental nurseries, flowers, alfalfa, and potatoes. This water demand is generated by approximately 4,000 acres of agriculture, some of it, such as the potato fields, only uses water periodically.

Based on the review of aerial photos, interviews with farmers and other residents, and on published literature, citrus groves have been present and actively irrigated in Borrego Valley since approximately 1953 (DPLU; Moyle, 1982). By 1979 citrus had become the primary agricultural product grown in Borrego Valley and has continued as such to the present day, currently occupying approximately 2245 acres.

Summary of Agricultural Water Use: The following table compares the results from the three previously mentioned studies.

Study	Irrigated Acreage	Delivered Water	Net Water Use	Return Flow
BWD [1]	3,882	16,664	Not estimated	Not estimated
Netto [2]	4,310	11,878	9,541	2,337
AAWARE [3]	3,400	14,650	10,450	4,200

Notes: 1-year 2003; 2-year 2000; 3-year 2002

Municipal Water Use

Historically, municipal use has been a relatively small but growing component of the total groundwater use in Borrego Valley. The urban water use is generated by the existing commercial development and approximately 2 ,500 residences (probably less than half are occupied year around).

Several districts have provided water to meet the municipal demand in the valley, including the BWD. These include the former Borrego Springs Water Company (BSWCo) (which was acquired or annexed by the BWD), the Borrego Springs Park Community Services District (BSPCSD), and the Borrego Air Ranch.

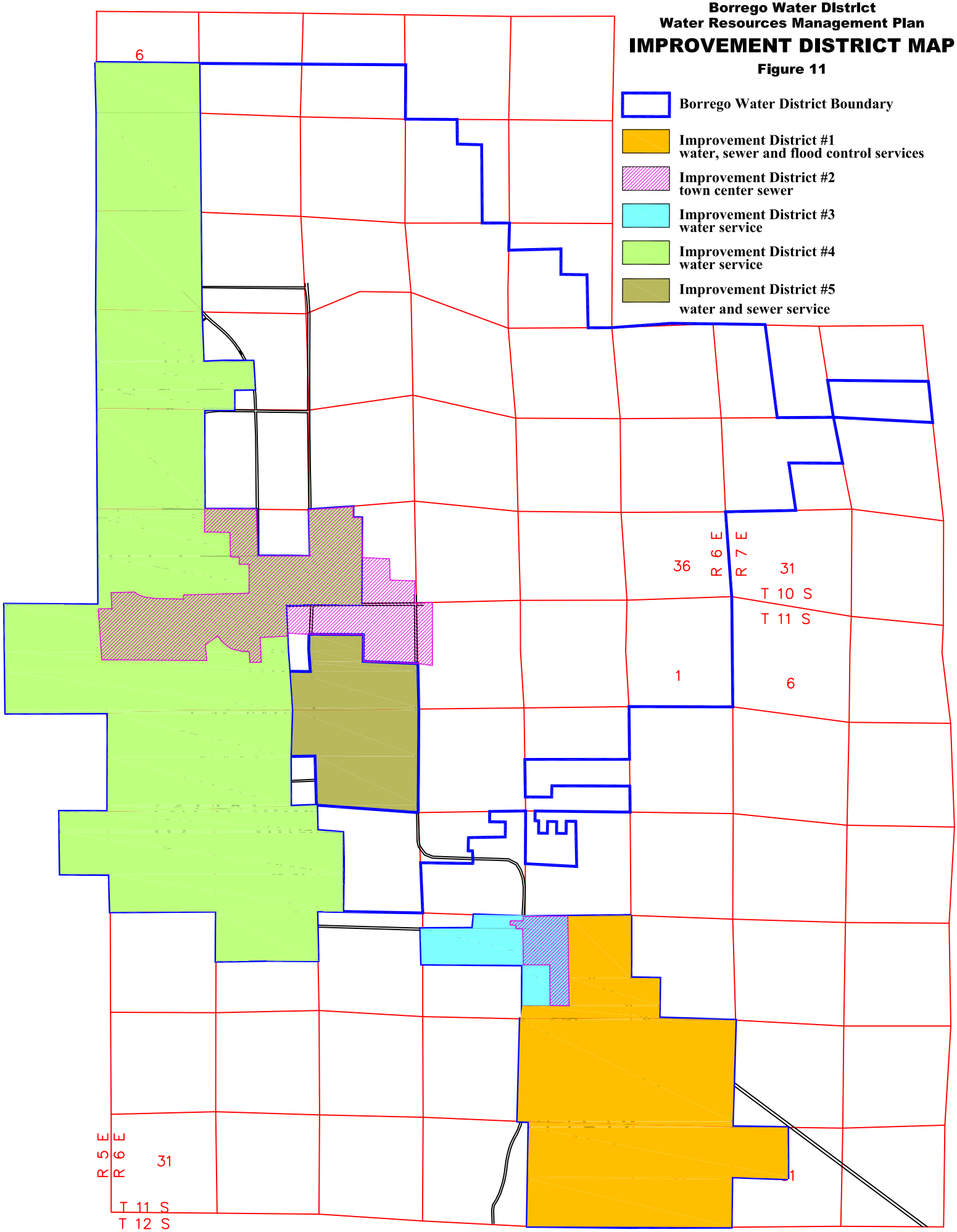
Additionally, the BWD has four improvement districts each representing a new service area added to the District and are shown on Figure 11. ID 1 covers Montesoro water, sewer and flood control. ID 2 included the sewer line extended from the treatment plant at Ram's Hill to the Palm Canyon Resort and all the properties along it that may connect to it from Palm Canyon Resort to La Casa del Zorro. ID 3 includes water service for Rancho Borrego, La Casa del Zorro and Deep Well Trails. ID 4 includes water service for the area acquired from the Borrego Springs Water Company and is basically the area from Indian Head Ranch south to Ocotillo Heights and west from the Park Headquarters to the Roadrunner Club. This constitutes four-fifths of the service area.

Water use by both the Borrego Water District (excluding the Montesoro Golf Course) and the Borrego Springs Park Community Service District (excluding Club Circle Golf Course) are metered. Total municipal water use is estimated to be approximately 1,923 acre-feet in 2007. All municipal water use was derived from water meter data.

Borrego Water District
Water Resources Management Plan

IMPROVEMENT DISTRICT MAP

Figure 11



Recreational Water Use

Recreation has become the second most intensive use of groundwater in Borrego Valley. The primary use of water for recreational activities in Borrego Valley is for irrigation of the several golf courses in the valley. Annual total groundwater production for all golf courses is estimated at approximately 4,402 acre-feet for 2008. These estimates are shown in Table 7. Delivered water to these golf courses was estimated from water meter sales, acreages and applied water factors and reports to the County of San Diego.

Landscape Water Use

Several areas, including street medians, parks are landscaped. These areas use about 839 acre-feet per year (BWD 2008). All values were determined from water meters.

Table 7
Applied (Delivered) Water Use for Municipal, Golf Course and Landscape Use (afy)

AREA	MUNICIPAL & COMMERCIAL	GOLF COURSE	LAND--SCAPE	TOTAL
BWD ID-1&3 [3] Montesoro/La Casa	309	1749	313	2,371
BWD ID-4 (Former Borrego Springs Water Company)	1,360		526	1,886
The Springs RV Resort Golf Course		243		243
BSPCSD	200	1181		1,381
Roadrunner Club	(a)	270		270
De Anza	(a)	959		959
Borrego Air Ranch	10			10
Other Private Wells	44			44
TOTAL	1,923	4,402	839	7,164

Source: BWD, 2008 Note (a): Municipal use included in ID-4 Municipal and Commercial Use

[3] The Borrego Water District has four improvement districts each representing a new service area added to the district. ID 1 covers Montesoro water, sewer and flood control. ID 2 included the sewer line extended from the treatment plant at Ram's Hill to the Palm Canyon Resort and all the properties along it that may connect to it from Palm Canyon Resort to La Casa del Zorro. ID 3 includes water service for Rancho Borrego, La Casa del Zorro and Deep Well Trails. ID 4 includes water service for the area acquired from the Borrego Springs Water Company and is basically the area from Indian Head Ranch south to Ocotillo Heights and west from the Park Headquarters to the Roadrunner Club.

Current Total Extracted Groundwater (Applied Water Use): Using the data for municipal, golf course and landscape irrigation shown in Table 7 (BWD 2008) and the BWD estimate for agricultural water use shown in Table 4 (2008), it is estimated that the total amount of extracted groundwater or applied water use in the Borrego Valley is about 23,800 afy. Of this amount 70 percent of the extracted groundwater from the aquifer was used for agricultural irrigation, 22 percent for recreational purposes (golf course and landscape irrigation), and 8 percent for municipal supply. This water usage is equivalent to about 25,000 dwelling units, based on an average dwelling unit use in Borrego of 0.95 afy.

Current Net Extracted Groundwater

As indicated earlier, not all extracted groundwater is lost to the atmosphere. Some of this water is returned to the groundwater basin as return flow. Return flows from agriculture have been estimated in both the Netto Thesis and the AAWARE report. For this report, the average of the two estimates will be used, as about 10,000 afy.

For municipal water use, it is assumed that the wastewaters from this small water use are diminimous (See Chapter 4, footnote 2), thus the net water use is equal to the delivered amount of 1,920 afy.

For golf course and landscape, the net water use is estimated at 86% of the delivered amounts, as determined by Netto. Thus, using the combined delivered amounts for these two categories (5,240 afy), the net water use is about 4,510 afy.

Total net water use is the sum of these three water use categories, or 16,430 afy.

Historical Total Extracted Groundwater (Applied Water Use)

The past delivered water use in the Valley have been estimated by various sources and is shown for the period 1950-1999 in Table 8.

Table 8
Historical Applied Water Use or Extracted Groundwater (afy)

YEAR(a)	MUNICIPAL	AGRICULTURAL	GOLF COURSE & LANDSCAPE	TOTAL
1950	170	11,435	90	11,795
1958	225	22,455	790	23,470
1962	265	13,455	1,725	15,820
1968	475	7,260	1,720	9,455
1972	530	5,320	2,270	8,120
1978	600	5,705	2,050	8,355
1980	430	10,600	2,100	13,130
1999	2,272	15,590	4,435	22,297

Sources: Applied water use 1950-1978 from PRC Toups Engineering; Applied water use 1980 from USFS, US Census and DWR population, land use and water use data. 1999 data reflects the acquisition of the Borrego Springs Water Company in 1997. Applied water use data for 1999 compiled by BWD using records of metered water use for municipal purposes, inspection of irrigated acreage and reports from golf course operators.

Future Water Use

Water use in future years is dependent on the County's General Plan, and any modification that may occur, as well as County and BWD policies.

The General Plan for Borrego Valley

The County's current general plan provides for about 16,000 dwelling units (du's) in the Valley. Approximately 2,500 du's are in existence and about 3,725 du's have approved but stand currently as vacant lots. Additionally, about 599 du's and 122 condominiums are being reviewed by the County. This leaves a potential for future/additional development of about 9,400 du's. The County General Plan is presently under revision, and is expected to be completed in 2011. The effects on the build-out projected for the Borrego Valley is not known at this time; but is not expected to be greater than what has been projected in the past. Therefore, for the purposes of this study, the existing General Plan figures will be utilized.

County DPLU Groundwater Policy

Recently, the County's Department Planning and Land Use (DPLU) established a policy on all new developments requiring water in the Borrego Valley. The policy requires a CEQA review

of potential cumulative impacts to groundwater resources for all proposed projects. The review would address the following:

- *Would the project substantially deplete groundwater supplies or interfere substantially with groundwater recharge such that there would be a net deficit in aquifer volume or a lowering of the local groundwater table level?*
- *Does the project have impacts that are individually limited, but cumulatively considerable?*

In essence, projects are encouraged to offset proposed groundwater use. For example, a project could mitigate its projected water use by fallowing agricultural land or removing golf course land out of use. And projects which do not propose to offset groundwater use, an Environmental Impact Report (EIR) would generally be required. Finally, projects with previously approved environmental documents must be assessed per Section 15162 of the State CEQA Guidelines.

Thus, the County is requiring a 1:1 off setting water mitigation for projects that have not been platted. Previously platted developments are exempt from the County mitigation requirement. Thus, 3,725 dwelling units do not have to meet the County requirement.

BWD Groundwater Mitigation Policy

The BWD recently adopted a Groundwater Mitigation Policy requiring either the fallowing of irrigated land or the payment of a mitigation fee in lieu of fallowing for all new water uses, regardless of their platting status. The BWD Policy requires a 2:1 mitigation, but will accept the County's 1:1 mitigation as meeting one-half of the BWD requirement. The BWD mitigation fee, based on a 2:1 requirement, is $3,250 per single family residence. (This also computes to approximately $1,650/af at the 2:1 mitigation requirement). Funds derived from this mitigation fee can be used to purchase water restricting easements on agricultural lands (fallowing) and to obtain a new water supply for importation to the Valley.

Table 9 illustrates how the two policies affect the various form of potential development.

Table 9
Potential GP Development in Borrego with Mitigation Policies

Development	County Mitigation-Fallowing @1:1	BWD Mitigation-Fee @ 1:1	BWD Mitigation-Fee @ 2:1
599 du's & 122	Yes	Yes	No
3725 du's	No	No	Yes
9,400 du's	Yes	Yes	No

Note that BWD will also accept fallowing in place of the mitigation fee.

Ultimate Water Requirements from New Development

The current developmental plans (599 du's and 122 condominiums) that are in the County review process will require about 600 afy, based on assumptions of 0.95 acre-feet/year per home and 0.3 acre-feet/year per condo. The development will be subject to the 1:1 BWD mitigation fee of one-half of $3,250 per du, or the provision of irrigated lands being converted to lower or zero (fallowing) water use.

The 3,725 du's (approved, but vacant), assuming 0.95 afy per du, will require about 3,540 afy and the 9,400 du's (remaining in the current General Plan) would need another 8,930 afy for a total of 13,070 afy. However, since the 600 and 8,930 afy of new demands must be off-set by fallowing of land, there will be no new demand on the aquifer. These du's are also subject to the BWD mitigation fee on a 1:1 basis.

The 3,530 afy of potential new demand posed by the currently entitled lots does not require fallowing, but is subject to the full BWD mitigation fee/policy at 2:1. This demand could add to the water extractions from the aquifer unless the mitigation fees are used for agricultural land fallowing or for importing water.

It is important to note that as residential development occurs in the Valley that the current agricultural net water usage after fallowing is insufficient to mitigate the new demands. The following table (No.10) illustrates this issue.

The Table 10 shows that the current net water use by a complete fallowing of agriculture using the county offset program and BWD mitigation fees would fall short of offsetting the potential new municipal water demands by about 3,000 afy. Thus, the current net water use would increase by about 3,000 afy. This increase is due to the 3,500 afy of new demands that are

not subject to the County offset and the unavailability of agricultural lands for new demand mitigation.

Table 10
Future and Current Net Water Use Estimate using Hydrologic Components (afy, rounded)

Water Use Component	Quantity	Source or Comment
Current agricultural net water use	10,000	Chapter 5, average value
Reduction in net water use from County fallowing policy: Current plans in review Remaining General. Plan lots	 (600) (8,900)	Based on County 1:1 requirement
Reduction in agricultural net water use from BWD mitigation	(500)	Remaining agricultural net water use assumed fallowed by BWD mitigation fee
Agricultural net water use	0	Amount of agricultural net water use remaining after County and BWD mitigation of remaining agricultural net water use
Golf Course & Landscape net water use	4,500	BWD: Table 7, Chapter 5 [(a)]
Current Municipal net water use	1,900	BWD: Table 7, Chapter 5 [(b)]
Increase in Municipal net water use Current plans in review Vacant lots-existing[(c)] Remaining General. Plan lots	 600 3,500 8,900	New domestic water use allowed after County 1:1 fallowing policy Assumed that all Municipal use is consumptively used (see text)
Total Golf Course & Landscape and Municipal net water use Future Net Water Use Current Net Water Use	 19,400 16,400	Chapter 5, Tables 6 and 7
Increase in Net Water Use	3,000	Difference in future and current net water use (see Chapter 6 for overdraft impacts)

a: Delivered use reduced by 14% (4,402+839) x 0.86 = 4,507)
b: All delivered water assumed consumptively used
c: Not subject to County 1:1 fallowing policy

Water Conservation Impact on Future Water Needs: The analysis shown in Table 10 is predicated, in general, on a current water duty of a single family residence of 0.95 afy. This duty is based on empirical data from BWD's water usage data base. This water duty is approximately twice that of the water duty (0.5 afy) in the coastal and inland areas of Southern California.

Granted that the desert areas require a higher delivery rate than the coastal and inland areas, an effective water conservation program in Borrego might lower the current water duty. If so, what effect would a lower municipal water duty have on the net water use in the future?

For discussion purposes only, assume that an effective water conservation program could reduce the duty per dwelling unit, for both current and future residents, to 0.75 afy. This represents a little more than a 20% reduction in water use. Also for discussion purposes only, assumed that the County would change their groundwater offset requirements to the new duty factor of 0.75.

Under these assumptions, the future net water use remains about the same as today's, after fallowing about 100% of the agricultural water use. Since the net water use is minimally affected, there would be no impact on the withdrawals from the groundwater basin, and thus, the current overdraft will remain unaffected, as will be discussed in the following chapter.

To define the range of impacts from water conservation, a 0.5 afy/du municipal water duty was assumed achievable and that the County's mitigation require was also reduced to 0.5 afy/du. In this instance, there is more than enough agricultural water to mitigate all new municipal demands. If the agricultural water use remaining after the mitigation for new municipal water use were subsequently fallowed through a purchase program, then the net water use would be reduced by about 4,100 afy from today's net water use. However, a significant groundwater overdraft would continue.

Summary: If the current municipal water duty rate remains unchanged in the future and if all of the dwelling units currently in the general plan are developed at build-out and all of the agricultural lands are fallowed, an increase in net water use of about 3,000 afy could result because there is insufficient agricultural use to mitigate the increase in demand. This would result in an increase in the overdraft by the 3,000 afy, as will be discussed in the next chapter.

Further, an effective water conservation program and the fallowing of all agricultural lands could mitigate this increase in net water use. It should also be noted that the new demands could also be partially mitigated through the development of a wastewater recycling program.

Finally, the BWD financing and fee program to be developed through its Financial Plan would apply to all of the new development and at the current mitigation fee level would generate nearly $30 million. It is projected that a water importation project will cost approximately $60

million, thus the Financial Plan[4] must look at a full array of alternative strategies to fund this sustainable water supply option.

[4] The District is initiating a twenty year Financial Plan and Rate Study to evaluate the best programs for financing the infrastructure improvements, and arriving at the most equitable means of collecting the funds, i.e. water resource fee, availability fee, as well as examining different financing options including bonds, grants or private/public partnership.

CHAPTER 6

WATER DEFICIENCY AND OVERDRAFT

This Chapter defines the current and future water deficiency in the Valley. Since the area is solely dependent on the groundwater basin for its' supply, this deficiency is known as 'overdraft'.

Current Estimate of Overdraft

The overdraft or net water consumption between supply and net groundwater extractions can be estimated using an evaluation of the change in storage between recent periods and by an estimation of the net groundwater extractions from the basin as compared to the long term native supply to the basin. Each method is subject to error in estimating. Both methods are presented here.

Change in Storage Method

The DWR has estimated the current overdraft at about 14,300 afy, based on the change in storage computations for two periods; the 1945 – 1998 period indicated about 450,000 af of decline in stored water while the 1945-2005 period indicated about 550,000 af decline in stored water. The difference in these analyses of 100,000 af over 7 years (1998-2005) produced an average decline of about 14,300 afy.

Comparison of Supply and Net Groundwater Extractions Method

Using data contained in this report, the deficiency between native supply and net extractions would be about 11,600 afy as developed in Table 11.

Table 11
Overdraft Estimation by Hydrologic Components year 2007

Hydrologic Component	Quantity (afy)	Source in Report
Net Water Use by Agriculture	10,000	Chapter 5, p 31
Municipal Water	1,920	Table 5
Golf Course & Landscape [1]	4,510	Table 7
Supply to Basin	(4,830)	Table 3
Overdraft in yr 2007	11,600	Difference between supply and net water use

Note; 1- Gross extractions for golf courses and landscape irrigation from Table 7 reduced by 14% for return flow to basin.

Summary

As shown, the overdraft rates as developed by the two methods range from 11,600 to 14,300 afy. The two methods are in substantial agreement considering that the potential error inherent in each method. For purposes of this report, it is assumed that the overdraft is equal to the average of these two methods, or about 13,000 afy.

Future Overdraft

As shown and discussed in Chapter 5, if all of the dwelling units currently in the general plan are developed, a new demand on the aquifer of about 3,000 afy could result. However, the likelihood that all agricultural water use will be eliminated is not reasonable to project; and thus the total amount of overdraft will be significantly greater, and further diminish the ability to depend upon the local aquifer as a sustainable water supply for the Borrego Valley.

Data in Chapter 5 also showed that even with the most optimistic water conservation program that would reduce the municipal water duty from today's 0.95 afy/du to 0.5 afy/du, the net water use would be reduced by only 4,100 afy. This would reduce the overdraft by an equivalent amount or to about 9,000 afy.

CHAPTER 7

LOCAL WATER MANAGEMENT PROGRAMS AND STRATEGIES

The District adopted its Groundwater Management Plan in 2002 to halt and/or mitigate the rate of the increase in the overdraft of the aquifer. The GWMP identified several approaches to mitigation, including, reducing unregulated water use in the agricultural areas overlying the aquifer. The following programs are in concert with the GWMP objectives.

Groundwater Preservation Fee

By resolution, the BWD implemented a groundwater mitigation program that works in conjunction with the recently adopted County of San Diego's development policy in the Borrego Valley as described in Chapter 5 of this report. The county policy requires all new developments to be reviewed for adverse impacts on the Borrego groundwater basin. The new projects must demonstrate that the proposed water demands are off-set by an equal water demand reduction or additional water supply. The BWD has implemented a similar requirement that requires an additional off-setting reduction or new supply. Thus, all new development in Borrego must now retire existing demands on a 2:1 basis. One-half of this mitigation can, in some cases, be accomplished through the payment of a mitigation fee, as explained in the following.

The BWD will accept an in-lieu payment for the required reduction in demand. Mitigation fees derived from this fee can be used to fund various overdraft mitigation programs. These could include: the purchase of agricultural land for fallowing, construction of artificial recharge basins for capturing storm events, development of groundwater extraction and conveyance systems to convey water to Borrego from nearby areas and for purchasing supplement water supplies and the constructing a pipeline to convey them into the Borrego Valley area. This fee may need to be adjusted to reflect future costs.

Fallowing Policy (Proposed)

As indicated, the District desires to decrease the draw on the aquifer underlying the Borrego Valley by encouraging the permanent fallowing of actively irrigated farmland. This proposed policy seeks to implement this approach to mitigation. The proposed policy is for property

owners seeking to fallow actively irrigated farmland while maintaining their ability to rely on such fallowing as mitigation for future development within the Borrego Valley

Historically, some property owners have refrained from fallowing farmland because the policies of the District and the County were not coordinated and because existing policies only recognized fallowing that occurred within the preceding 5 years as mitigation for new development. Therefore, owners who might desire to fallow their farmland may continue to water crops (sometimes without ever intending to or actually harvesting those crops) in order to preserve their ability to use the farmland for mitigation of future development. The proposed Fallowing Policy seeks to encourage immediate fallowing while allowing property owners to hold and transfer "Mitigation Entitlement Certificates" that may be used to mitigate the groundwater impacts of future development and is designed to encourage immediate fallowing of farmland by allowing (1) fallowing of actively irrigated farmland in exchange for durable mitigation entitlements issued by the District, and (2) providing a mechanism to control, enforce and monitor the fallowing and entitlement issuance and/or transfer.

The Policy has not been approved by the County Board of Supervisors; however, the District hopes to obtain such approvals in the near future.

Agriculture Land Purchase

The BWD has concluded a purchase of a water easement over existing agricultural lands. While the land can still be used for non-water uses, the purchased easement effectively retires the agricultural or other high water use on the property. Recently, BWD purchased such an easement on 40 acres of active citrus production, retiring 150 afy of water use. The cost of the restricting easement was $720,000 or a one-time cost of $4,800 per af. The annualized unit cost of this water is computed to be about $240 per af per year (50 year period and 4.5% opportunity cost).

A more recent transaction included the sale of 25 afy of water on currently fallowed land (approximately 6.3 acres). The cost of the transaction is about $6,000 per afy of retired water.

It is projected that the value of these retired "water credits" could escalate to $10,000 per afy (equal to approximately $40,000 per acre given the water application rates for citrus), thus providing a powerful economic incentive for farmers to consider fallowing their active agricultural properties. However, the associated economic costs of losing this commercial base,

as well as the impacts on the farming families and workers must also be a part of the analysis of this program, particularly in light of the fact that fallowing all of the agricultural land will not solve the overdraft problem in the area.

Tamarisk Removal

Tamarisk is an aggressive, woody invasive plant species that has been planted as a windbreak along many roadways in the agricultural area of the Borrego Valley. Tamarisk is a facultative phreatophyte that has the ability to draw water from groundwater but once established it can survive without access to groundwater (Mojave Weed Management Program, 2009). It is reported to consume large quantities of water, thus its removal would be of benefit the water resources of the area.

The BWD has recognized this value and has provided 'water credits' for its removal as part of its Water Mitigation and Entitlement Policy (BWD, 2009).

Artificial Recharge

The Department of Water Resources (1984) conducted a brief study of constructing artificial recharge facilities to capture and recharge storm waters emanating for the Coastal Range mountains on the west side of the basin. The report proposed the construction of shallow dike systems that would intercept the storm flows from the steep canyons and spreading the water over a large area behind the dikes, thus allowing the waters to infiltrate. As the dikes filled and overflowed, downstream dikes would capture the overflow and provide an opportunity for the water to infiltrate. Dike systems were envisioned at the terminus of the Tub, Hellhole, Borrego Palm, Henderson and Coyote canyons. DWR estimated that an additional 300-500 afy might be expected through catchment basins in exceptionally wet years.

Eleven catchment dykes were subsequently constructed. Their conditions were observed in 2000 as noted in the BWD Groundwater Management Plan. These catchment basins were rapidly filled with sediment after storm events and were unable to capture water.

More recently a planned residential development, known as the Viking Ranch, near the Coyote Creek has proposed to incorporate channels within the development recharging diverted Coyote Creek storm waters. The project is under consideration.

In 2006, the De Anza Country Club excavated a storm water detention basin located immediately up-stream of their development. The basin was originally constructed to protect the development from flood flows from the Borrego Palm Canyon Creek. Since its construction, however, the basin had become filled with sediment and no longer provided flood protection. Storm flows in 2005 caused significant damage to the De Anza properties. The Borrego Water District (BWD) is interested in investigating the potential for a cooperative use of the basin as both a flood retarding and a water conservation basin.

Conservation Management Program (Tiered Water Rates)

BWD has been developing a 'tiered' water rate proposal for several years. (A tiered rate structure is considered a 'demand management' program.) The process included a citizen committee and two BWD directors. In January of 2008, the BWD board unanimously decided to publish notification of their intent to adopt the committees' proposed rate structure as might be modified by subsequent public hearings. In June of 2008, the BWD formally adopted a tiered rate structure that incorporated the comments and suggestions of many of its rate payers.

The program works as follows: For customers whose monthly water use exceeds a baseline of 35 hcf in the winter and 45 hcf in the summer must reduce their usage based on their prior 4-year average of water use, by 10% below this average for the subsequent month or be billed at rates that are 50% higher than rates that would have applied if had they not exceeded the historic average usage for their usage above the afore mentioned baselines..

The tiered rate structure is designed to encourage water conservation and penalize wasteful water use. The proposed structure provides a rate reduction for potentially 40% of the BWD customers who are presently using excessive levels of water, and are incentivized to reduce their usage through landscape changes, fixture upgrades, and irrigation audits and improved outdoor water application strategies.

The rate structure allows more water use in the summer period as compared to the winter period of use. Funds received from the higher tiers of water use would be earmarked for a rebate program to encourage customers to purchase water conserving devices such as low flow toilets, washing machines or water-efficient irrigation systems.

Installation of a California Irrigation Management Information System (CIMIS) in Borrego Valley

The BWD, in cooperation with the California Department of Water Resources (DWR) has established a CIMIS (California Irrigation Management Information System) station in the Borrego Valley. Since weather conditions in the Colorado River Desert Region are quite variable and the nearest CIMIS station to Borrego is located in Indio, CA, a local station will provide the growers with better information to manage their water application rates. The station was completed in early 2008.

The DWR, in conjunction with the BWD, will hold a series of seminars in 2008, possibly in conjunction with the BWD, to inform farmers, golf course personnel and local landscape contractors how to utilize CIMIS data. The seminar is planned to include the topic of alternative low water use crops such as jojoba, guayule, agave, and others.

Irrigation Reduction by Mulching

A pilot program was initiated by Seley Ranches to evaluate the benefits in terms of reduced water delivery from the application of heavy mulch in a citrus grove. A test area and an adjacent area were selected based on similarities in soil types, irrigation techniques and the ability to measure application rates. The pilot test was conducted over two growing seasons. The conclusion from the test was that mulching in a mature grapefruit grove allowed for a 15-16% reduction in irrigation applications. It was estimated that the savings would probably be higher in immature groves because immature groves are subject to more surface evaporation due to sun and wind exposure. It was further estimated that if a 15% reduction in delivered water due to mulching could be achieved for all agricultural in the Valley, that a savings of about a 1,500 - 2,000 afy could be realized (Smiley, 2003).

Water Recycling

Water recycling has been proposed for the irrigation of the golf course at Rams Hill. The irrigation system was constructed as a separate water system from the domestic system. Also, the wastewater treatment facility serving the planned development was designed to produce an effluent to meet CA Department of Public Health Services requirements for landscape irrigation.

Unfortunately, current sewage flows into the treatment plant been insufficient to provide a supply for the golf course and are primarily lost to evaporation.

BWD has applied for grant funding under Prop 50 to conduct a feasibility study for connecting all residences to a central collection and conveyance system to the treatment plant.

Construction of Monitoring Wells

Recognizing the data collected on the characterization of the groundwater basin was obtained solely from well completion reports, the BWD proposed to construct several professionally logged monitoring wells in various parts of the basin. The District was successful in obtaining grant funding and constructing four monitoring wells in 2003 and 2005. Information from these wells, which were professional logged by DWR staff, has increased the knowledge and understanding of the basin.

Defining the Reliability of Groundwater Supply

The amount of useable groundwater in storage is not well defined and therefore the amount of time available for implementing new water supply projects is unknown. Consequently, an Expert Panel was convened to address this issue. Panel participants were chosen based on their knowledge of the Borrego Valley Groundwater Basin and their familiarity with groundwater basin investigation techniques. 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, this issue. The panel was convened at a one day workshop on December, 2007 in San Diego. Several significant conclusions were derived from the workshop and are shown below.

- There is no single investigative technique that can provide an answer to the question concerning the so called ‘life’ of the Borrego aquifer system.
- The most important tool in assessing this question is a numeric model of the groundwater basin.
- Depth dependent data in the basin is important in assessing the future conditions in the basin as water levels continue to fall changes in groundwater quality may occur.
- A Data Management System to house all groundwater data would greatly assist in analysis and investigations of the basin.

The BWD is pursuing actions in response to these conclusions. (See following paragraphs for progress on these items.)

Numeric Model Development

The USGS performed an investigation of the hydrology of the Borrego area and constructed a simplified numeric model of the groundwater basin with data up to the year 1980. The model was not used to estimate future conditions in the basin.

The Master's Thesis program at San Diego State University, as mentioned earlier (Chapter 4), produced two thesis' in 2002 directly related to the Borrego Valley Groundwater Basin; one on the hydrology and water resources of the Borrego Valley and the other on a numeric model of the groundwater basin. The effort included bringing up to date the hydrology information in the prior USGS model to include the 1980-2000 period; to analyzing and comparing all well data developed since 1980; modifying the conceptual geohydrologic structure of the basin and to constructing a numeric model using today's standard software. Recognizing the substantial research, analysis and data collection involved in these efforts, BWD purchased the rights to the data and model for possible use in estimating future conditions. The model was never employed, due to some deficiencies in its construction, but the basic data was retained for future use.

BWD has recently requested that the US Geological Survey develop a working numeric model of the basin using as much as possible the basic data developed in the Master's Thesis' process previous mentioned. The USGS is currently completing their proposal, which includes a Federal 'cost share' component. Their approach is to update their prior working model with the thesis data and operate the model to identify any areas of possible deficiency. Their next step would be to translate the older model into today's standard software, modify the geohydrologic characteristics of the basin, as now defined by the thesis data and operate the model to estimate future impacts on the basin from various development and extraction scenarios. The model will also be useful in defining impacts to establishing future alternative water management strategies for the basin that will be discussed in Chapter 8.

Geographical Information System

BWD has recently contracted for the development of a GIS system or data base, as recommended by the Expert Panel. The system will incorporate all data (water level, water quality, etc.), reports and maps (groundwater contours, land use, etc.) concerning the groundwater basin and water usage (extractions, recharge, etc.). The system will be important in providing the necessary data for the numeric model but also in performing studies and investigations in the Valley.

Depth Dependent Aquifer Data

As indicated, the Expert Panel raised a concern about the possible 'upwelling' of poor quality water from the deepest aquifer as water levels fall (due to continued overdraft). Thus the panel suggested the construction of a 'nested' (four small diameter wells immediately adjacent to each other) monitoring wells that could provide data on potential water level differences in aquifers and water quality differences and changes in the future.

In December of 2007, BWD submitted a proposal to DWR for grant funding to construct the nested monitoring well but the proposal was not accepted. BWD is searching other funding opportunities to construct the monitoring well.

DWR Local Assistance Program

In 2004, the Southern District of DWR initiated an effort to assist BWD with its groundwater assessment. Until that year and while there had been annual water level measurements taken at a network of wells for the construction of well hydrographs, no agency or investigator had analyzed the collected data or prepared contour maps of the water surface in the groundwater basin since 1980. DWR constructed groundwater elevation maps for several years and, after a review of the many well completion (driller's logs) reports, defined the water holding characteristics (specific yield) of the upper aquifer units in the basin and subsequently estimated the changes in groundwater storage for several periods (see Chapter 3).

More recently, the DWR has submitted a proposal to perform a well inventory and to obtain and analyze water quality from pumping wells. This work will be coordinated with, and utilized by the investigation (numeric model, groundwater study) to be performed by the USGS.

CHAPTER 8

NON-LOCAL WATER SUPPLY ENHANCEMENT PROJECTS CONSIDERED

This Chapter presents and discusses several non-local water supply opportunities. These are evaluated and prioritized in Chapter 9. The methodology for financing these major infrastructure and water supply enhancements will be the subject of the aforementioned Financial Plan, and will be a process that will include significant interface with the community to solicit their comments and ideas for allocating the costs in the most equitable manner among those benefiting from the program. Additionally, the BWD is seeking a number of grants and low interest loans to reduce the impact on its rate payers.

Each alternative is presented with estimated project costs. It should be pointed out that these costs estimates are 'reconnaissance' level only and should not be relied upon without further investigation and study. Costs to construct pipelines, pump stations, wells etc., depend on many factors, including rights of way, alignments and general economic conditions, to name a few. However, the project cost estimates are believed to be sufficiently accurate to compare the several alternatives.

Importation from Adjacent Groundwater Sources

Three adjacent sources are investigated to determine if additional water could be found in close proximity to the Borrego Valley. The areas include: Clark Dry Lake, which lies just to the east of the Coyote Creek Fault near the Peg Leg Smith monument on the Borrego-Salton Seaway (county highway S-22); Dr. Nel property, near the intersection of Highway 78 and Borrego Springs Road and Ocotillo Wells/Allegretti Farms area, located in the Lower Borrego Valley.

All of these projects have the potential to supplement the water supply of the Borrego Valley; however, the export of water from these areas will undoubtedly impact the natural resources of their respective regions.

Clark Lake Basin

The Clark Lake hydrologic area and groundwater basin lie immediately east of the northern portion of the Borrego Valley aquifer. This Clark Lake and Borrego Valley basins are separated by the northwest-southeast trending Coyote Creek fault. This fault is a hydrologic barrier. The

watershed above Clark Lake basin drains into Clark Lake where the storm flows are subsequently evaporated.

The land area comprises approximately 13,000 acres and shown on Figure 12. The area has two small ranches, a historical rock house and a sand and gravel operation. This small basin is formed geologically similar (block faulting) to and contains sediments similar to the Borrego Valley basin. Subsurface data below the total depths of wells is sketchy at best, and is open to interpretation. The sediments are thought to be in a wedge shape with the thinnest edge along the western edge of the valley and the thickest edge along the northwest-southeast trending fault at the eastern side of the valley. The basin has produced limited amounts of water for individual landowners of the area.

Existing water production from the Clark Lake basin is minimal. A few water wells have been constructed to supply an existing residence and sand and gravel operation. A large portion of the Clark Lake basin is overlain by the Anza Borrego State Park.

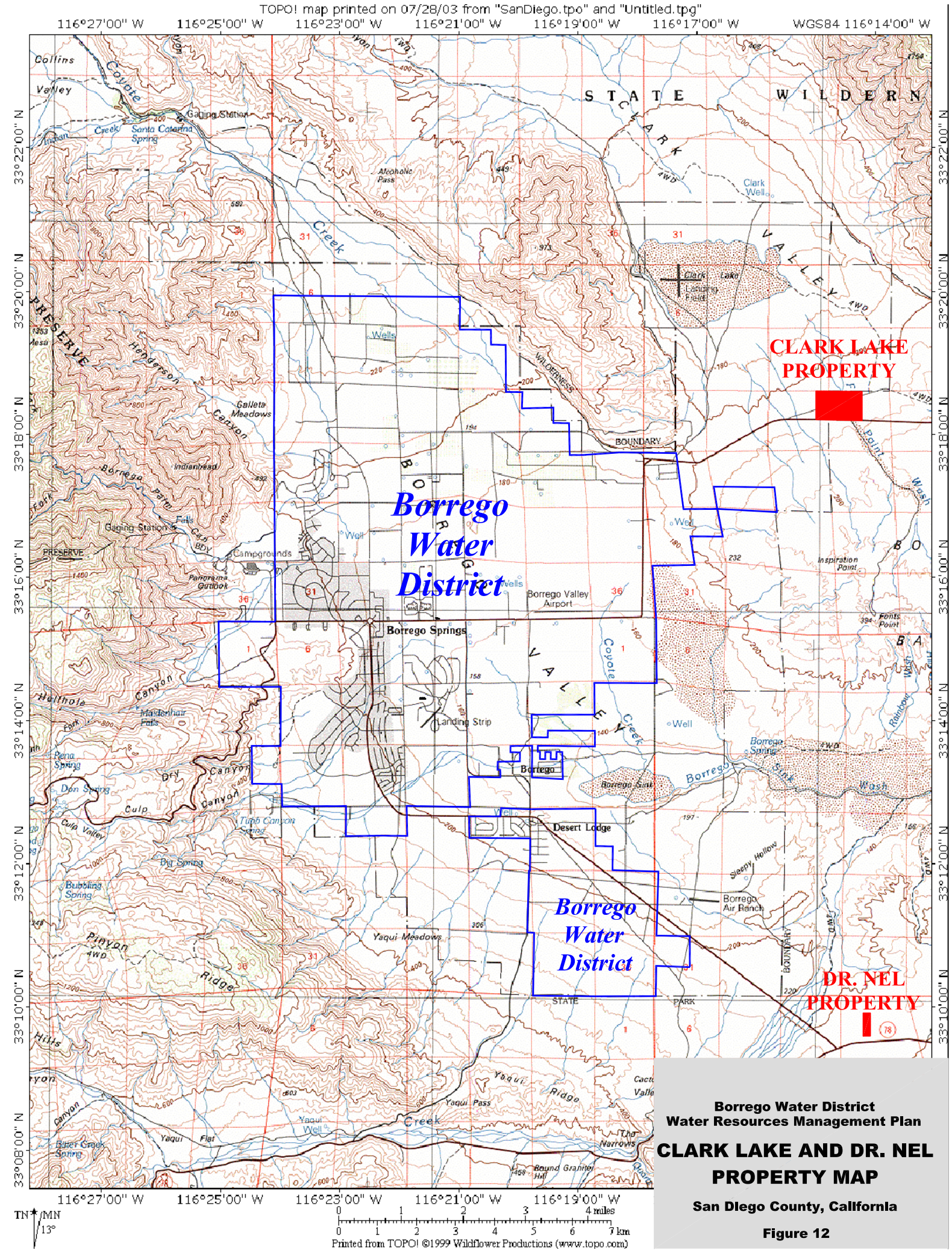
The project under consideration consists of an initial production test well to be constructed on a 240 acre parcel owned by BWD. The well will be located in the NW ¼ of Section 15, T10S, R7E San Bernardino Meridian, USGS Map Fonts Point Quadrangle. This well, when fully developed, will be used to assess the hydrologic and water quality aspects of the basin.

A 1,000 foot plus deep test hole was drilled on this parcel by BWD in 1990, but was not completed because the water quality from the lowest portion of the well contained high salinity. However, water quality data from the few existing wells suggests that the water quality of the shallower portions of the aquifer might be of suitable quality for domestic use.

Should this initial production test well provide favorable information, it is planned to construct several additional productions wells and a pipeline to convey the extracted water to the BWD water transmission and distribution system, a distance of about 8 miles. It is expected that the project could produce about 2,000 afy.

It is also contemplated that if the quality of the shallow water from the initial production well contains more salt than that allowed for domestic use, then a desalination and brine disposal facility might be constructed.

Brine disposal can be expensive if evaporation ponds are used. However, the area required is dependent on the salinity of the source water and its chemistry, especially the



Borrego Water District
Water Resources Management Plan

CLARK LAKE AND DR. NEL PROPERTY MAP

San Diego County, California

Figure 12

Calcium concentration. Alternately, brine disposal through deep well injection should be considered.

The estimated cost of the conceptual project is shown in Table 12.

Table 12
Estimated Costs to Construct Clark Lake Project [1]

Initial production well design, construction and testing	$200,000
CEQA/NEPA for full scale project	70,000
Construct 5 additional production wells: Design, drilling, testing & well heads	1,000,000
Collection piping	380,000
Transmission pipeline	4,000,000
Extension of electrical system	500,000
Total Construction Cost	5,880,000
Engineering and Inspection (10%)	600,000
Contingency (10%)	600,000
Total Project Cost	$7,080,000

Note: 1- Modified from memorandum by L. Burzell, October 12, 2006.

Dr. Nel Property

The San Felipe Creek collects surface water (and possibly fracture-flow groundwater) from rainfall and runoff in the mountains to the west of Borrego Springs. This drainage meanders in a southerly direction through San Felipe Valley. As that valley intersects state highway 78, the creek turns east passing through Tamarisk Grove Campground and The Narrows, then veers north across the Texas Dip to the eastern edge of the Borrego Valley near the original Borrego spring. At this point the drainage collects the overflow from the Borrego Valley then traverses easterly through the desert to Ocotillo Wells, before emptying in to the Salton Sea.

The area near the Texas Dip and southeasterly thereof (westerly portion of Lower Borrego Valley) is of interest because the underlying lower aquifer is relatively deep and is subject to recharge from San Felipe Creek. An 850 foot deep test well drilled in 1995 by the District confirmed the depth of the formation and that it was saturated. The pump test, however, indicated that the formation was typical of the tight lower aquifer and that completed wells would be relatively low capacity and also that it would require many wells, widely spread in order to extract a significant quantity of water.

The production of groundwater from this area is minimal, but appears to be of good quality for domestic use. As in the Clark Lake project, should an initial production test well in Section 3, T12S, RD7E SBM, USGS Map *Borrego Mountain* Quadrangle, near the intersection

of Highway 78 and Borrego Springs Road (see Figure 12), provide favorable information, the plan would be to construct several additional production wells and a pipeline to convey the extracted water to the BWD water transmission and distribution system, a distance of about 7 miles. It has been estimated (Burzell, 2006) that the project could produce about 2,000 afy and could be delivered to the BWD distribution system without treatment.

A review, however, of the initial pump test data from the small diameter (5-inch casing) exploratory well suggests that additional testing, possibly through 'slug' aquifer tests, is needed to confirm or reassess the sustained pumping capacity of larger diameter production wells in the area. Nonetheless, the estimated cost of the conceptual project as described by Burzell is shown in Table 13.

Table 13
Estimated Costs to Construct Dr. Nel Project [1]

Initial production well design and construction	$200,000
CEQA/NEPA for full scale project	60,000
Construct 10 additional production wells: design, drilling, testing & well head facilities	2,000,000
Collection piping	500,000
Transmission pipeline – up to 16 in	3,400,000
Extension of electrical system	150,000
Total Construction Cost	6,050,000
Engineering and Inspection (10%)	600,000
Contingency (10%)	600,000
Total Project Cost	$7,250,000

Note: 1 – Modified from memorandum by L. Burzell, September 20, 2006

Allegretti Farms

The small community of Ocotillo Wells lies in the northeastern extremity of San Diego County, adjacent to the Ocotillo Wells State Vehicular Recreation Area. The central portion of the valley is dotted with individual home sites and several small recreation vehicle parks, each with their own domestic water well. Geologically, this area is referred to as the Lower Borrego Valley. It is situated between Borrego Mountain (with granitic material exposed) and the granitic Vallecitos Mountains on the south. Sediments found in this narrow trough were largely derived from the alluvial fans along the Vallecitos Mountain front and, according to some knowledgeable geologists, were also deposited from the stream flow of the ancestral San Felipe Creek drainage.

It seems unlikely that the underlying thickness of sediments would be very great, perhaps in the order of 800 to 1,000 feet. The action of the creek flowing down the trough was probably predominantly erosional, not depositional. In an east-southeast direction from Ocotillo Wells, the thickness of sediments should increase gradually toward the Salton trough to about 20,000 feet. Groundwater in the area is found mainly in shallow (250 foot deep) wells, which produce sufficient water for individual dwellings.

The area three miles south and seven miles east of Ocotillo Wells known as the Allegretti Farms has high capacity wells (2,000 gpm). A 1995 report (Krieger and Stewart, 1995 and supplement 2002) of the hydrogeologic character of the area indicated that both a shallow and deep aquifer system existed below the Farm. Further, the water produced from the shallow aquifer was of very poor quality. The report also identified a deeper aquifer which supplies the Allegretti irrigation wells. The quality of the groundwater from these irrigation wells was 1,200 to 1,800 mg/L. However, a shallow domestic well was lower in TDS at about 930 mg/L, according to the report.

The historic estimated annual production for the period 1983-1994 ranged from about 3,500 to 6,500 afy.

A 2004 report (Zandt, 2004) using satellite information concluded that there was land subsidence at the Farm due to groundwater withdrawal. The 1995 report also concluded that the water levels in the Farm's wells were dropping at a rate of 3 ft/yr. Thus, the basin beneath the Farm is in overdraft, according to these facts.

Another report (Koebig & Koebig, 1970) computed the amount of water in the basin beneath the Farm at about 5.75 million af. The report did not estimate the amount of this water that would be recoverable.

However, this area is within the Imperial County, which has adopted a General Plan component which requires obtaining a license to export groundwater out of the County. The District intends to initiate discussions with Imperial County to determine if they would accept a water trade to allow for export of the water from the Allegretti Farm.

A memorandum report (Burzell, 2000) proposed and analyzed a project to develop about 6,000 afy of groundwater for delivery to BWD with approximately 32 miles of transmission pipelines to the BWD system. The product water was envisioned to be used only for irrigation of crops, landscaping and golf course irrigation, due to its high salt content.

The project has been revised to deliver water into the BWD system near the intersection of Borrego Valley Road and Borrego Springs Road, a distance of about 15.5 miles from the Allegretti Farms. The pipeline and pumping stations are sized to deliver 10,000 – 15,000 afy. The project's estimated cost is about $27,000,000, exclusive of land acquisition costs, are shown in Table 14.

Table 14
Estimated Project to Construct System to Allegretti Farms [1]

Preliminary Studies	$300,000
CEQA/NEPA	200,000
Transmission system (24 in.)	15,000,000
Electrical	200,000
Pumping stations	4,500,000
Extraction wells	800,000
Collection system	400,000
Monitoring wells	500,000
Total Construction Cost	22,400,000
Engineering and Inspection (10%)	2,200,000
Construction Contingency (10%)	2,200,000
Total Project Cost	26,800,000
Land	Not estimated

Notes: 1 – Modified from memorandum report by L. Burzell, July 24, 2000

Combining and Phasing of Dr. Nel and Allegretti Farms Projects

A further possibility is a phased project. If it can be determined that the Dr. Nel project could produce a reasonable amount of exportable water, then the first phase would be the development of the Dr. Nel project, but with up-sizing of the transmission pipeline into BWD, to allow additional water transport from the Allegretti Farms at a later time, when the domestic sector of Borrego could afford the additional costs of an expanded importation system. The second phase would include an extension of the pipeline, with additional pumping and storage facilities, to the Allegretti Farms area and most likely a demineralization facility at Allegretti to reduce the salinity of the extracted groundwater to meet domestic water quality requirements.

As indicated above, the Dr. Nel project might supply about 2,000 afy (an amount that must be evaluated through additional aquifer testing) and the Allegretti Farms about 6,000 afy, for a total of 8,000 afy. Or if the Dr. Nel proved to be uneconomical to develop, then a the 6,000

afy from the Allegretti Farms would satisfy the majority of the domestic water supply needs of BWD and could provide a significant contribution to the overdraft issue.

A third and final phase could be considered; an extension of the system to access water transported though the IID system from the Colorado River. This phase would include the construction of conveyance facilities to IID's Carter Reservoir near the intersection of SR78 and 86, and then to the main IID system if necessary. The estimated cost to extend the system from Allegretti Farms to Carter Reservoir, a distance of about 18 miles, is shown in Table 15.

Table 15
Estimated Project Cost to Extend System
From Allegretti Farms to Carter Reservoir

Preliminary Studies	$200,000
CEQA/NEPA	200,000
Transmission system (24 in.)	13,000,000
Electrical	200,000
Pumping stations	2,000,000
Extraction wells	800,000
Collection system	400,000
Monitoring wells	500,000
Total Construction Cost	15,600,000
Engineering and Inspection (10%)	1,600,000
Construction Contingency (10%)	1,600,000
Total Project Cost	18,800,000
Land	Not estimated

Finally, if the groundwater reserves in the basin beneath the Allegretti area were found to substantial and exportable to BWD, a strategy could be to acquire the Farm for future water supply development at such time that the local Borrego basin exhibits signs of impairment.

Importation Pipeline Projects from Imperial Irrigation District or Coachella Valley

Since the quantity of water that may be available from the nearby groundwater areas is not well defined due to the lack of hydrogeologic data, it is necessary to consider obtaining a source of water from the Colorado River, State Water Project or other sources.

It is envisioned, as an example, that BWD would acquire a contract to purchase water from Northern California. The water would be 'wheeled' through the State Water Project, then through MWD's system to IID. While this appears complicated, it could be accomplished via an exchange agreements where MWD would utilize the Borrego water from Northern California

and reduce its diversion of Colorado River water so that IID could then divert more Colorado River Water (as Borrego's water). The water would be 'wheeled' through the IID system and transported to Borrego through a pipeline. A similar but slightly more complicated program would be in conjunction with the Coachella Valley Water District. Figure 13 shows the approximate alignment of these pipelines.

If it was desired to deliver the water directly into the BWD distribution system as opposed to groundwater recharge, it would be necessary to construct a water treatment system to meet drinking water requirements. If the water were to be delivered into the Borrego Groundwater Basin though artificial recharge basins, no water treatment would be necessary.

Conceptually similar importation projects could potentially utilize water obtained from other states with Colorado River rights, or purchase of product water from a future desalination plant, either on the coast of California or from re-start of the Yuma Desalting plant.

Imperial Irrigation District Project and Potential Water Banking

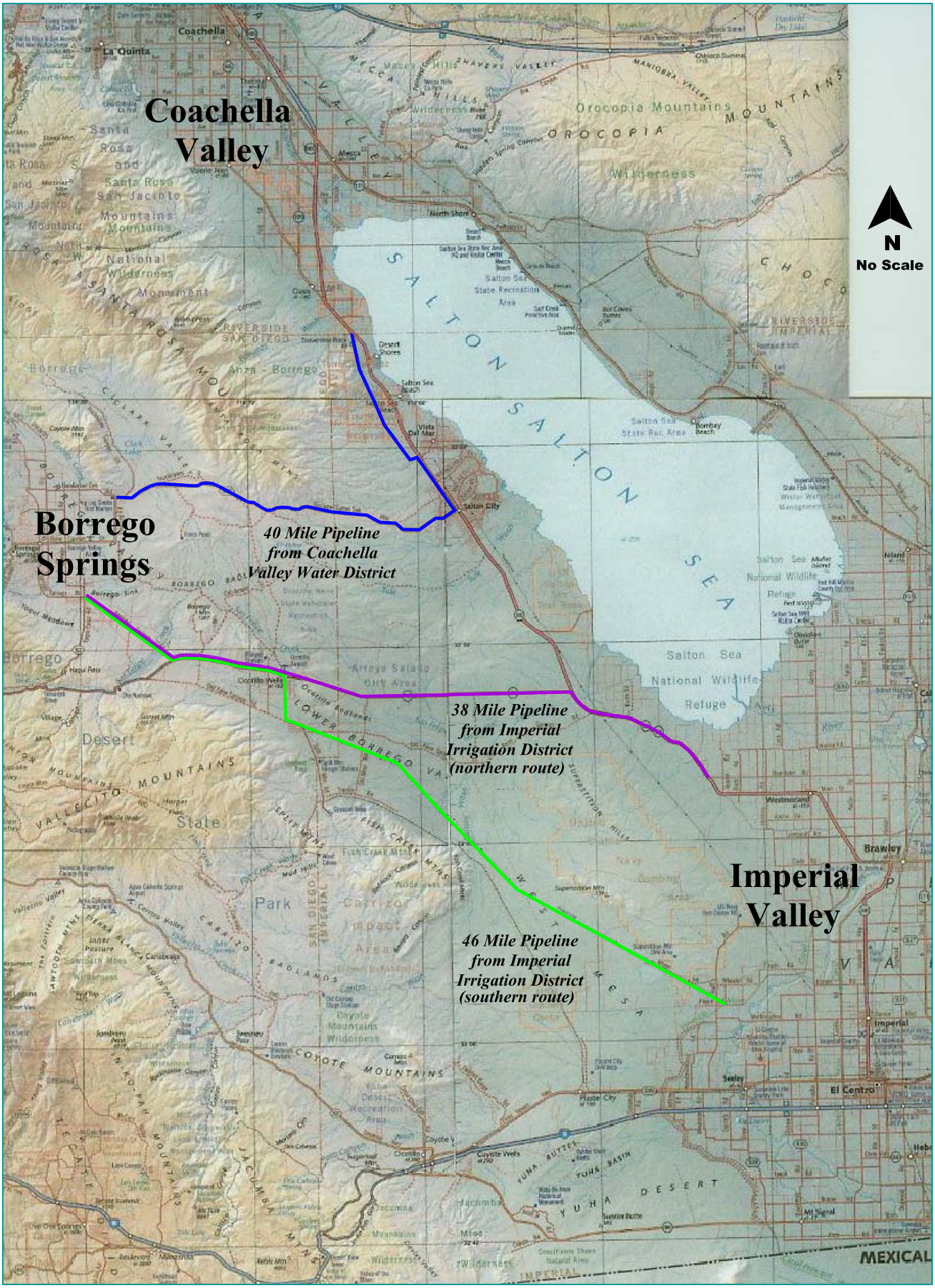
This conceptual project would consist of a 46 mile pipeline and two pumping stations to deliver water from the Imperial Irrigation District's (IID) West Side Canal to the BWD distribution system near the intersection of Borrego Valley Road and Borrego Springs Road. This route would utilize existing rights-of-way to minimize environmental issues with the Anza Borrego State Park and facilitate construction. This routing is pipeline routing is beneficial for a possible water banking project where it would be necessary to return the banked water in the same pipeline to the IID system for conjunctive use. The project cost estimate presented here, however, is for a single purpose project, designed to deliver water to satisfy the needs of the Borrego Valley. If a 'water banking' partner were interested in participating in a conjunctive use project to deliver, recharge and extract 'banked' water, an expansion of the project would be necessary. The conjunctive use or 'water banking' concept is discussed more fully later in this chapter.

For the single purpose project, a 24-inch pipeline is sized to convey approximately 10,000 to 15,000 afy (14 – 20 cfs) to Borrego. The system as presented her would deliver water to a location near the BWD system near the intersection of Borrego Valley Road and Borrego Springs Road. From that location, the water could be transported further to the north for groundwater recharge, conveyed to nearby golf course for direct use or treated to for domestic

Borrego Water District
integrated Water Resources Management Plan

IMPORTATION PIPELINE ALTERNATIVES MAP

Figure 13



use and injected into the BWD distribution system. These alternatives would add additional cost to the project.

Two pumping plants are necessary to overcome the net pumping head differential of about 800 feet plus frictional head losses in the 46 mile pipeline. The initial pumping plant would be located at the IID Westside Canal; the second plant would be located near the community of Ocotillo Wells.

The estimated project cost, exclusive of land and rights-of-way are shown in Table 16.

Table 16
Estimated Project Cost to Deliver
Water from IID Westside Canal to BWD

Preliminary Studies	$500,000
CEQA/NEPA	500,000
Transmission system (24 in.)	34,500,000
Electrical	200,000
Pumping stations	7,400,000
Total Construction Cost	43,100,000
Engineering and Inspection (10%)	4,300,000
Contingency (10%)	4,300,000
Total Project Cost	51,700,000
Land	Not estimated

Unit Cost of Water: The water cost to the end user is a measure of the relative economic comparison of the project and is dependent on financing rates, electrical energy rates and the cost of acquiring water. For informational purposes, this project is analyzed in additional detail to define the cost impacts to the BWD rate payers considering the project and the source water acquisition costs.

Amortization of Capital Cost: As indicated, the initial cost of the project is approximately $52 M. Interest rates for financing municipal projects such as this are approximately 5% with a repayment period of 30 years. Based on delivering about 15,000 af per annum, the unit water cost of the capital portion would be $225 per af.

Energy Cost: The proposed project originates at the IID facilities and it is assumed that their current rate of 7.6 cents /kwhr would be available at the initial pumping station and that the San Diego Gas and Electric rate (9.5 cents/kwhr) would be available at the second pumping station. Considering the pumping requirements to lift water from the IID system to Borrego, the resulting unit cost for energy would be about $165 per af.

Pipeline Maintenance Cost: Cost to maintain the pipeline are estimated at 0.25% of the capital cost or about $150,000 per year initially, but would increase in later years. This amounts to approximately $10/ af.

Amortized capital, pipeline maintenance and energy cost to transport water from the IID system to Borrego are about $400 per af, and shown in the following table (17).

Table 17
Summary of Unit Cost of
Transporting Water to Borrego ($/af)

Capital Cost	225
Pipeline Maintenance	10
Energy	165
Total	400

Source Water Cost in Northern California: Sources that are knowledgeable in structuring water sales from Northern California to Southern California were consulted. A prevailing consensus was that the current water supply situation in the State, i.e. drought, regulatory restrictions on pumping from the Delta and pending Delta Vision Task Force report coupled with a burgeoning water transfer market make it extremely difficult to predict water acquisition costs. Further, water sales also depend on the type of source water (dry or wet year), origin of water (SWP, CVP or appropriative). Nevertheless, the Metropolitan Water District has acquired over 50,000 af of water from Northern California this year (2008). Their average cost, after considering losses to transport the water through the Delta, is approximately $250 per af. Additional cost for energy to move the water into the MWD system is about $150 per af.

Total Unit Cost of Water from Northern California to Borrego: Adding the source water cost to the transmission cost from IID to Borrego results in a cost of about $800 per af[5].

[5] Affordability: If the cost of importing 15,000 af per year were evenly distributed as a replenishment assessment on the entire 22,000 af of groundwater production each year, the resulting assessment would be about $563 per af of production. Domestic and commercial commodity water rates are currently about $500 per af. Thus the importation water costs would raise the commodity rate to more than $1,000 per af. As a comparison, the single family domestic commodity rate in the City of San Diego is approximately $1,100 per af.

Current agricultural water production costs in the Borrego Valley are reported to be about $75 to $100 per af. If the agricultural community were assessed the full cost of the importation of water, it is clear that the community could not compete with agricultural production from other areas. (The MWDSC Interim Agricultural Water Program rate is about $260 per af but this program provides for water supply curtailment in drought times.). Agricultural production costs have been subsidized in some areas, such as Orange County Water District.

Other Sources of Water: Other potential sources of water include the purchase of water from the Indian Tribes that have rights to the Colorado River water. Another source is water from an ocean desalinization plant, such as the one nearing the completion of the permitting process and located in Oceanside, CA. These waters could be 'exchanged' through the MWD system into the Colorado River for diversion to Borrego.

Coachella Valley Water District (CVWD) Project

A similar project might be feasible with CVWD. A pipeline beginning in the Torrez-Martinez Indian Reservation (TMIR) and ending in Borrego area would be about 30 miles in length but with a greater elevation change than the IID pumping lift to Borrego. The pipeline would follow highway 86 south to the intersection with state highway 22. The route would then travel westward along highway 22 and end north of Borrego Springs. This route would minimize environmental issues with the Anza Borrego State Park and facilitate construction.

This routing is shorter but somewhat more complicated than the IID routing as it does not appear that the CVWD has any pipeline capacity to bring Colorado River water into the TMIR area.

Conjunctive Use or Water Banking Project

Population increases throughout the state of California, environmental and institutionally induced cut backs on the major importation projects delivering water into Southern California, coupled with unpredictable but certain droughts, provide an enormous challenge to water supply agencies. Water agencies are now turning to an old concept but until recently sparsely practiced. The concept is known as conjunctive use or water banking. Simply stated, surface water, in excess of water requirements in wet years is stored in ground water basins. During dry years, when surface supplies cannot meet water needs, the stored waters are withdrawn to meet the deficiency in the surface supply system.

This concept was initiated on a large scale in the 1980s by the Department of Water Resources. The Department developed the Kern Water Bank, which was later taken over by the Semitropic Water Storage District. Semitropic has now 'leased' aquifer storage space of over 1,000,000 acre feet to agencies from Los Angeles to Silicon Valley.

A water banking project would require a conveyance pipeline from IID (Westside Main Canal) or from the CVWD to the Borrego area, a distance of about 46 or 40 miles, respectively.

In times of surplus water availability to any of the agencies having water rights to the Colorado River, water would be conveyed through the agency's transmission systems to be pumped to the Borrego Springs area for recharge into the Borrego Aquifer, using surface spreading basins.

The withdrawal phase of the storage project would work as follows: when a participant in the storage project anticipates or experiences a shortage in its supplies, the stored water would be pumped from the Borrego basin and delivered to the IID or CVWD via the supply pipeline where the recovered water would be consumptively utilized. If the storage project participant were other than IID or CVWD, either agency would consumptively utilize the recovered stored water and subsequently reduce their diversions form the Colorado River, thus allowing another agency, such as MWDSC to withdraw from the Colorado River an additional amount of water. This water could then be used by MWDSC or transferred to another participating agency through an exchange agreement.

The partnering agency would be requested to fund all or a major portion of the importation system and to contribute a portion of the stored water to the benefit of the groundwater basin.

Importing Water from the San Diego County Water Authority

The BWD groundwater management plan included an analysis of the cost to join the San Diego County Water Authority. The analysis indicated that a unit cost would be about $7,675 per acre-foot to construct an importation pipeline. Additionally, it would be necessary to pay back taxes to both the San Diego County Water Authority and the Metropolitan Water District of Southern California. No further analysis was deemed necessary due to the substantial cost of joining the agency.

CHAPTER 9

WATER SUPPLY ENHANCEMENT PROJECTS AND MANAGEMENT ACTIONS PRIORTIZAITON

Several water resource enhancements have been identified in Chapters 7 and 8. This Chapter presents an evaluation and ranking of those projects and actions.

The BWD Screening Model

The BWD screening model includes six evaluation criteria: Source Water Reliability, Institutional Difficulty, Regulatory Constraints, Cost, Ability to Satisfy Existing Overdraft and BWD Rate Payer Protection. These are explained in more detail in the following paragraphs. An evaluation matrix is presented as an initial step in the evaluation process. Ratings proceed from Low (L) to High (H).

Source Water Reliability: Water extracted from groundwater basins is considered very reliable due to the generally large amount of water in storage. Thus, droughts do not affect their water supply reliability, especially as compared to projects that depend on surface water flows.

The latter supply sources, including the State Water Project, are subject to frequent shortages. The Colorado River (CR) has been somewhat of an exception because of the very large capacity of the storage system on that river and with past system demands less than entitlements. Conditions on the CR are rapidly changing as current diversions are at their maximum entitlement levels which are known to exceed the long-term supply of the system.

Further, local water supply projects are generally less likely to be impacted from remote situations (e.g., endangered species discovery) that can result in a diminishment of the project supplies. However, local projects that depend on surface runoff are also considered low reliability because of the infrequency of signification rainfall and runoff from adjacent mountainous areas.

Institutional Difficulty: Since the Borrego water using community is completely surrounded by the Anza Borrego State Park, importation of water must traverse the park. It is expected that there would be opposition to traversing the park lands due to potential disturbance of the fragile desert environment. Pipelines could be situated within existing rights-of-way for highways or electrical transmission corridors to minimize environmental disturbance.

Importation of water from distant sources, such as the State Water Project or the Colorado River Project will require working with the governing jurisdictions in order to overcome statutory restrictions on deliveries outside the project designated member boundaries. Further, certain Counties have adopted ordnances that prohibit the export of groundwater outside of the County boundary.

Regulatory Constraints: Importation of water into the Borrego Valley will also be subject to the regulations of the Regional Water Quality Control Board of the Colorado River Basin. While Regional Boards in other areas have established limitations on the quality of the water that may be recharged or discharged into the groundwater basins, the local board has not, but recharge of non-local water or wastewaters with salinity concentrations exceeding primary drinking water standards would probably be unacceptable to the regulators.

Costs (Affordability): The cost of the water supplies, whether from management actions or from projects, is an important comparative indicator as measures the cost effectiveness of each project or management action. Further, the per acre-foot cost of extracting local irrigation water plus a replenishment charge may make the agricultural community uncompetitive. Additionally, domestic water rates should not exceed comparable rates in other urban areas of San Diego County.

Satisfy Existing Overdraft: This evaluation criterion considers whether or not the action or project is capable of fully satisfying the current overdraft. Table 15 includes these criteria as 'overdraft correction'.

BWD Rate Payer Protection: The project evaluation criteria should also recognize that there is competing water user communities dependent on the sole source aquifer of the Borrego Valley: these include, the agricultural, the golf courses and the municipal communities. The BWD has rate making authority only with municipal community. Thus, management actions and projects that are funded solely by the municipal community and do not have a direct benefit to the rate payers but serve to extend the groundwater supply and lengthen the time period before adverse groundwater impacts from continued overdraft occur, provide benefits to all water using

communities. Consequently, this evaluation considers those types of actions and projects as having a 'low' rate payer protection. Conversely, if an action or project direct benefits to the rate payers of BWD, such as an import project that delivers water directly into the BWD distribution system, it is considered as having a 'high' rate payer protection even though such an action would extend the life of the aquifer for other producers.

Initial Screening

The following matrix has been prepared as an initial assessment of each of the local and non-local water supply programs. It is intended that this assessment be revised from time to time as new information becomes available and specifically if State and Federal funding opportunities can be obtained for detailed investigations or through a joint public and BWD review process.

Table 18
Evaluation of Alternative Projects and Management Actions

No.	Program or Project	Water Reliability	Institutional Difficulty	Regulatory Compliance	Cost	Overdraft Correction	Rate Payer Protection
1	Groundwater Preservation Fee	H	L	L	L	M	L
2	Fallowing Policy	H	L	L	L	M	L
3	Ag Land Purchase	H	L	L	M	H	L
4	Artificial Recharge	L	M	L	UNK	L	L
5	Tiered Water Rates	H	L	NA	L	L	L
6	Water Recycling	L	L	M	L	L	H
7	Clark Lake Import	L	M	L	H	L	H
8	Dr. Nel Import	H	M	L	H	L	H
9	Allegretti Farms Import	H	H	L	H	M	H
10	Phased Dr. Nel-Allegretti Farms Import	M	H	L	H	M-H	H
11	IID Import	M	H	M	H	H	H
12	CVWD Import	M	H	M	H	H	H
13	SDCWA Import	M	H	M	H+	H	H

UNK – Unknown
NA – Not Applicable

L = Low
M = Moderate
H = High

Management Actions in the Implementation Phase (yellow)

Several management actions in Table 17 (colored yellow) are being implemented by BWD. All of these projects have 'high' water reliability and 'low' institutional and 'low' cost, except for agricultural land acquisition, which has moderate cost. A possible exception to this situation is that the agricultural land purchase program can be financed through the BWD mitigation fee and thus result in a 'low' cost rating.

Since each of these actions result in extending the groundwater supply, thus benefiting all water user communities and not solely the BWD rate payers, they are considered 'low' in rate payer protection.

Elimination of Projects (pink)

Project No. 13 (SDCWA Import), has a very high cost as compared with other projects with moderate Water Reliability. It is therefore eliminated from further review and is colored pink in Table 17.

Prioritization of Remaining Projects

Low Priority (orange): Of the remaining projects, Artificial Recharge (No. 4) and Wastewater Recycling (No. 6) have only small potential for providing significant new water supplies for overdraft correction and are therefore prioritized as 'low'. Wastewater recycling would score higher if there were substantial amounts of wastewater available for direct use on landscape and golf courses. Thus, this evaluation could be changed when significant residential development occurs and the sewer system for the area is expanded.

Importation from CVWD is considered a 'low' priority because of the difficulty in transporting water from an imported water source through their system into a transportation system to Borrego.

Medium Priority (no color): The Clark Lake (No. 7) project is rated as 'medium' due to its high rating for Rate Payer Protection even though it is rated poorly with regards to cost and overdraft correction. Further, it is known that brackish waters are located at depth in the aquifer.

The Dr Nel Import project (No. 8) is rated similar to the Clark Lake project, but if combined with other water supply projects located to the east of Borrego its rating improves.

The Allegretti Farms project (No. 9) as a stand-alone project is rated as a 'medium' priority, primarily due to its high cost and potentially significant issue of exporting groundwater from Imperial County (Institutional Difficulty). Its rating would improve to high when combined with the Dr Nel project (No. 10), or with the IID import project (No.11) or if State or Federal funding becomes available.

High Priority (blue): Importing water from IID (No. 11) is evaluated favorably in most categories and has a 'high' evaluation for satisfying both Overdraft Correction and Rate Payer Protection as the imported waters could be used for groundwater recharge or direct use by BWD.

As previously mentioned, the Phased Dr Nel-Allegretti Farms (No. 10) project could potentially provide significant reduction in the overdraft and Rate Payer Protection for the present time and near future and therefore scores very well in nearly all evaluation categories. Further, the phasing aspect is beneficial for obtaining grants from the USDA and allows time to evaluate the full feasibility of obtaining an imported water supply in conjunction with the IID import project. For these reasons, this project is also considered as having a high priority.

Implementation Schedule

As indicated above, several projects and actions are in the implementation phase. All other projects depend on thorough investigations of the opportunities and constraints offered by the project or action. Since this prioritization is based on available but limited knowledge of these issues, efforts must be made to define and characterize the many issues involved in each of the alternative projects and management actions. The issues can be defined and evaluated only through thorough study. Both State and Federal funding are available from time to time to perform the investigations and BWD has and should continue to pursue these when the opportunity arises. (BWD has recently received a Federal study grant to investigate three importation system routing alignments into Borrego Valley and to identify available water sources on the Colorado River and the State Water Project.) Consequently, it would be premature to speculate on an implementation schedule for these actions.

CHAPTER 10

PUBLIC/ STAKEHOLDER OUTREACH

A significant public involvement program was used to develop the District's Groundwater Management Plan. Stakeholder and public involvement has continued since the adoption of that plan. These efforts are described in this Chapter.

Public/Stakeholder Outreach involvement in the GMP

The BWD successfully conducted an outreach program leading to the development and adoption of a groundwater management plan in 2002**.** That process is fully described in the Groundwater Management Plan.

Public/Stakeholder Outreach Process since the Adoption of the GMP

After the GWMP adoption, the BWD relied on its monthly regular board meetings and its annual Town Hall meetings regarding the GWMP to keep the public and stakeholders involved. Nonetheless, a controversy over BWDs lack of action in implementing solutions to the aquifer's overdraft developed. Additionally, the growers in the valley were increasingly identified as adversarial. The growers responded by forming the Agricultural Alliance for Water Resources Education (AAWARE).

BWD attempted to respond by establishing a Groundwater Management item on every regular board meeting agenda, where members of the public could speak on the issue. However, since the BWD meet only once each month and sometimes not during the summer months, it became necessary to expand communication with the public and the organizations concerned about the status of groundwater in the valley.

Outreach Difficulties in the BWD area

It should be pointed out that the community within the Borrego Water District is very small. It consists of about 2,000 connections with an estimated population of about 3,000. Further, the population is distributed over a large area and it is seasonal, with most of the population residing in the area during the non-summer period. For example, about half of the restaurants close during the summer in response to the large summer vacancy. Public outreach is therefore very

difficult in Borrego Valley. Thus, the outreach program in Borrego has adapted to these challenges.

Current Outreach Program

Outreach is accomplished through a substantially increased number of regularly meetings committee and board meetings of the water district and through the weekly publication, *the Borrego Sun*. The success of the BWD committee and board meeting outreach will be discussed first and followed by the use of the local newspaper.

Committee Meetings: In 2006, BWD appointed two standing committees; the Groundwater Management (GWM) and Conservation committees.

The GWM committee was established in January of 2006 and met on ten monthly occasions during that year. These meeting were well attended with an average of over 20 residents attending, including board, staff and public. In the following year, six meetings were held with an average of 18 residents of the valley attending. At the conclusion of the year, it was decided to fold this standing committee into an additional (adjourned) regular board meeting to be held on the second Wednesday of each month. (Normally, the district's regular board meeting is the fourth Wednesday of the month) The addition of a second board meeting each month devoted solely to groundwater management was an important step in expanding the district's outreach. Attendance at these meeting has continued to be significant.

Conservation Committee: The Conservation committee is devoted to public and board discussions of issues aimed at the encouragement of reduced water usage by the BWD water users. Typical discussion items include:

- An education process with the Borrego Unified School District
- A shared cost program for the installation of water saving devices
- A continuing water savings/facts article in the Borrego Sun.
- A tiered water rate schedule.

During calendar 2007 and the first half of 2008, a total of 19 meetings of this committee were held and more than 300 residents of the valley attended (including board members, BWD staff).

Public Meetings: Considering that each regular board meeting continues to include a groundwater management discussion item, when the these regular meetings are combined with the Conservation, Groundwater Management Committees meetings and the adjourned regular board meetings (formally the Groundwater Management Committee), a total of over 60 public meetings occurred during calendar 2006, 2007 and the first six months of 2008 with nearly 1,300 valley residents attending. Water resource management was discussed in each of these meetings. Considering the small population of the area, these meeting served, and continue to serve, as a primary means of outreach in the community.

MOU in Support of Grant Funding: An important stakeholder process occurred in July 2004 when the Borrego Water District began an extensive outreach program to enlist the support of the local community in the grant application process. Presentations were made to all local stakeholders to explain the need for expanding the knowledge of the aquifer in the form of a series of monitor wells to provide field derived data of specific yield, aquifer depth etc. The parties signed a memorandum of understanding (MOU) that demonstrates solidarity of the Borrego Springs community for supporting the acquisition of additional data for assessing the water resources of the area. Parties to the MOU included the Agricultural Alliance for Water and Resources Education (AAWARE), the Save Our Aquifer Coalition (SOAC), and the Anza-Borrego Desert State Park. Also party to this agreement were the local golf courses and the various community groups.

Other Activities: BWD also participates by including an information booth at the annual Borrego Days Festival and Health Fairs. BWD also maintains a permanent space in the *Sun* for conservation tips and provides a list of conservation actions on their website.

Borrego Sun: This element of the outreach program is not directed by BWD. Instead, this local newspaper has been the primary means of reaching the community with news about the areas water resources and the actions taken by BWD to resolve the controversy concerning the overdraft of the aquifer. The effectiveness of this independent element of the outreach is substantial as will be shown in the following paragraphs.

The editor and general manager of the *Borrego Sun* (*Sun*) attend all regular and adjourned board meetings and all Groundwater Management Committee meetings. They subsequently report on each of these meetings in this biweekly publication.

The *Borrego Sun* newspaper reaches nearly every resident in the Valley and many who do not reside there but wish to continue to keep up on the occurrences in the Valley. While there are approximately 2,500 residences in the Valley, the *Sun's* circulation was reported in October of 2007 (Meier 2008) to be over 3,300.

As indicated, reporters from the *Sun* attend nearly every regular and adjourned board meeting of BWD and subsequently report on the significant discussions and decisions of the BWD Board. As shown in the following tables for years 2003-2008, an article on BWD occurred in nearly every publication. The tables also show the page number where the article was placed. Articles on BWD are often placed on the first page of the publication.

For the four years (2000-2003) an average of 16.3 articles per year appeared in the Sun. For the subsequent four years (20004-2007) the average number of articles increased to 23.8 per year. For 2008, a partial year (to 08/07/08), 12 articles have been published with 1/3 of the articles appearing on the first page of the publication. Additionally, the *Sun* also includes articles about the Board and its employees as opposed to those relating to water resources management. For the period beginning in February 2002 and ending in March of 2008, nearly 30 articles were written and published on this topic.

The *Sun* has provided the dispersed population of this desert area with current information about the water resources of the area and therefore providing the residents the ability to respond to the district's proposed actions with a thorough base of knowledge.

The following are tabulations of the Sun articles that report on the discussions and decisions of the BWD.

2003	**Date**	**Page**
Water line failure floods parking lot of new Crosswinds	1/16/03	4
Texas Dip farming proposal raises concerns	3/13/03	1
Water District adds three projects to Groundwater Management Plan	3/13/03	
BWD receives $64,000 as partial energy settlement	3/13/03	35
BWD directors decide to lobby for state grants -	4/10/03	3
BWD directors weigh, then OK donation for infrared faucets PHOTOS	5/8/03	9
Water district begins budget work; eyes hiring consultant, grant worker	6/5/03	7

Water district allocates $100,000 and pledges action on groundwater issues	7/3/03	3
Getting rid of milky water WILDART 8	7/17/03	8
Supervisors direct planning staff to work with Borregans on overdraft solution	7/17/03	1
Water District board is weighing decisions with long-term impact	9/25/03	3
Water district plans workshop to evaluate and compile aquifer data	10/23/03	1
BWD initiates investigation	12/4/03	1

2004	**Date**	**Page**
Water district eyes using doctoral duo's data	1/1/04	3
Waterline break near post office floods Sunset Road, Circle	1/15/04	8
Facing our water challenge PHOTOS	1/15/04	9
Water district making contingent offer to buy 40-acre parcel	1/29/04	1
BWD directors drop bid to buy former agricultural property, well	2/12/04	1
Computer model could show future to aquifer planners	2/26/04	1
Water board delays purchase of aquifer model as proposal studied	3/11/04	18
Brown Act: Keeping a public agency's business public	5/6/04	17
Higher sewer fees proposed in 2004-05 BWD operations budget	5/20/04	3
Water board OKs purchase of aquifer model; signs MOU	6/3/04	1
BWD probes potential overdraft solution	8/12/04	1
Groundwater plan to be revisited; figures could be updated	9/9/04	1
Water district rebuilds northern well, averts emergency	9/9/04	13
BWD begins review of 2002 groundwater plan	9/23/04	3
BWD takes action to eliminate milky water PHOTO	10/7/04	3
BWD applying for two groundwater grants	12/16/04	1

2005	Date	Page
Possible water-mitigation policy eyed by BWD	3/10/05	4
BWD preparing grant applications	4/7/05	4
Mitigation policy works at water district	5/19/05	1
Water board OKs 3-1 mitigation rate for developments	6/30/05	1
Aquifer-recharge concept OK'd for developer by Water District board	8/11/05	3
Household water usage exceeds standard, study shows CHARTS & MAP	8/11/05	7
Nonprofits seek exemption from BWD mitigation policy	8/25/05	11
Tiered-rate proposal would tie water costs to usage	8/25/05	14
BWD installs meters at 3 ranches to substantiate groundwater data PHOTO	9/8/05	3
Formula eyed for water preservation policy	9/8/05	4
Water-usage data for two Rams Hill communities switched during compilation	9/8/05	14
Water board to consider in-lieu fee Sept. 28	9/22/05	1
BWD board approves in-lieu fees, due when building permit issued	10/6/05	4
Golf-course representatives conspicuous by absence	10/6/05	8
Nonprofits can't have a lower rate of water mitigation, lawyer states	0/20/05	4
Water-fee confusion doesn't bring exemption	11/3/05	1
Conservation committee works on tiered-rate proposal	11/3/05	14
Land-exchange bank proposed as aid in ground water mitigation	11/3/05	17

Brochure, classes promoting native landscaping touted for conservation	12/1/05	9
BWD directors mull surrender of water rights, Santiago annexation	12/15/05	4
Aquifer recharge: Its potential and limitations for Borrego valley - PHOTO	12/15/05	8
More comments on aquifer recharge	12/1/5/05	8
Developer proposes recharge plan as community benefit	12/15/05	9
Groundwater committee reviews proposal to create district-wide fee	12/29/05	4

2006	Date	Page
Santiago Estates seeks annexation to BWD; must get CSD OK first	1/12/06	4
Tiered-rates proposal presented to BWD	1/26/06	1
Consultant begins study of benefit assessment with fiscal goal defined	1/26/06	7
Tiered water rates in limbo as BWD board avoids vote on issue	2/9/061	
Water-saving measures eyed by committee	2/23/06	3
Bumping up water awareness - PHOTO in EAR	3/23/06	32
BWD submits proposal for conjunctive water use - MAP	4/6/06	3
More water mitigation measures posed	4/20/06	3
Community submits annual update on Groundwater Management Plan	4/20/06	17
Water mitigation ordinance to pinpoint costs of new use	5/4/06	8
Conjunctive-use proposal advances	5/18/06	31
Water district opposes nursery expansion	6/1/06	1
Water main washout WILDART	6/15/06	19
Conjunctive-use project pitched to county water agency	6/29/06	5
Groundwater management takes major place in BWD '06-07 budget	7/13/06	5
Unearthing a mystery WILDART	7/27/06	1
Test wells bring new data on Borrego aquifer to surface - PHOTOS	7/27/06	21
Water district ponders mitigation details	8/10/06	3
Water District approves potential tax rates in step toward facilities district	9/7/06	1
BWD board sides with developer on fee	9/7/06	4
Informational meeting set Sept. 27 on BWD's proposed assessment	9/21/06	1
Updated mitigation fee on agenda for Sept. 27 BWD board meeting	9/21/06	5
Proposed tax to fund groundwater projects draws fire - CHART	10/5/06	1
Water district bounces groundwater mitigation policy back to committee	10/5/06	4
Groundwater Preservation Policy, implementation go back for review	10/19/06	5
BWD says no bonds, lowers proposed taxes	11/2/06	1
Clarification: Well #1 - GRAPH	11/2/06	4
Santiago Estates files application to annex to BWD	11/2/06	5
BWD public hearing postponed	11/16/06	3
Water district recognizes outgoing directors and retiring legal counsel	11/30/06	15
The new faces of BWD WILDART	12/14/06	8

2007	Date	Page
BWD takes loophole out of policy; rescinds exemption to developer	1/11/07	5
BWD was to consider expanding preservation fee to all land-uses	1/25/07	21
Mitigation ratio coming back for review	2/8/07	3
Water district debate on mitigation grows	2/22/07	1

BWD votes down Nel test-well; advances one at Clark Dry Lake	3/8/07	7
Public hearing set on mitigation measures	3/8/07	25
BWD board will act on preservation fee March 28	3/22/07	1
required water mitigation ratio cut from 3:1 to 2:1	4/5/07	1
BWD ponders well alternatives, preservation fee details	4/19/07	8
Tiered water-rate proposal would reduce bills for 41 percent in BWD	5/3/07	3
LAFCO to review Borrego water agencies	5/3/07	4
BWD board, 3 Montesoro entities OK bond financing	5/3/07	11
BWD seeks explanation of report	5/17/07	10
BWD OKs levying special tax in bond refunding; pricing set June 12	5/31/07	3
County, BWD cooperate to facilitate voluntary fallowing of farmland- CHART	6/28/07	3
Water district expands groundwater preservation fee	7/12/07	1
Water board agrees to consider sustainability concept - CHART	7/12/07	10
Clarification - holding agency	7/12/07	21
Intertie, annexation topics intertwined for districts	8/9/07	1
BWD updated on grant applications	8/9/07	8
BWD takes 2 steps toward consolidation with BSPCSD	9/20/07	5
It's a first: Agreement reached on fallowing farmland	10/18/07	1
BWD allocates funds to partner with state on valley aquifer study	11/29/07	4
Assets grow, liabilities decline at BWD, audit says	12/27/07	12

2008 (to 08/07/08)	Date	Page
Ratepayers to get notice of tiered rate proposal from water district - CHARTS	1/24/08	3
Irrigation water-users learn about tiered rates	2/21/08	4
Process to protest tiered-water rates clarified, is based on property ownership	2/21/08	9
Well canvass eyed as first project in joint study of aquifer	2/21/08	9
Tiered-rate protests dominate BWD meeting	3/6/08	1
Water District sets special board meeting	3/6/08	1
New water ruling eases concerns about circle park and tiered rates	3/20/08	7
Tiered rates draw fire; may also bring grant funding	3/20/08	8
Water district convenes negotiations on tiered-rates	4/3/08	1
BWD steps toward refunding ID4 bonds	4/3/08	8
Old tiered-rate proposal discarded, new process begins	4/17/08	1
KSD becomes first developer to utilize BWD's fallowing process	4/17/08	7
Water agencies wrestle with merger details	5/1/08	1
BWD analysis shows water use of more than 21,000 acre feet in 2007 - CHART	5/29/08	3
CSD receives revised documents on merger with BWD	5/29/08	13
BWD continues lobbying efforts to obtain federal funding for studies	6/12/08	5
BWD anxious to reach agreement with county on entitlement plan - PHOTO	6/26/08	4
Consolidation request goes to LAFCO for action after OK by BSPCSD, BWD	7/10/08	1
Modified tiered-rate proposal approved - CHART	7/10/08	1
Water district to fund $6,000 update for Circle park's sprinkler system	8/7/08	4

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Appendix A

Conservation Management Program

The Conservation Management Program consists of 5-year "Management Plans" with the First Management Plan proposed to be initiated on July 1, 2008. Tiered Rates are a central component of the program. The overall goal of the Conservation Program is to insure that water usage by the District's customers is made as efficient as possible through the application of improved technologies, rate structures, education, and incentives to reduce present water usage to levels consistent with similar communities, and to insure the community's realization of achieving a sustainable water supply.

The efforts in the first year of the First Management Plan are composed of activities by the District and the community to implement changes in water usage patterns in preparation for the implementation of a tiered rate structure in July of 2009. These efforts are designed to arrive at a plan which allows for the achievement of conservation goals through a phased, comprehensive and community cooperative effort to realize the goals of the Conservation Program.

INITIATION OF TIERED RATES BILLING:

First Billing in July, 2009.

TIERED RATES SCHEDULE:

RESIDENTIAL:

ID 1:

First Tier: $1.02/unit
Second Tier: $1.53/unit

ID 3:

First Tier: $1.23/unit
Second Tier: $1.84/unit

ID 4:

First Tier: $1.12/unit
Second Tier: $1.68/unit

Conservation Incentive: For those customers whose bill fall into the Tier 2 rates for the subject billing month based on a 4 year average of water use, with the first year of billings to utilize the 2004 through 2007 usage records, said customer must reduce usage by 10% below the aforementioned 4-year average for the month in order to be eligible for their usage being billed at the Tier 1 rate. If this conservation target is not met for the month, then the usage over the Tier 1 limit will be billed at Tier 2 rates. Each subsequent year shall use the subsequent 4-year period for determining the 4-year average, and the related conservation objective of 10% of the average usage during the period for the subject billing month. For the first "Management Period", the objective shall be an average reduction of 10% in per dwelling unit usage for the District prior to July 1, 2011. If the 10% objective is not met, then the Conservation Committee shall propose additional measures to achieve the conservation level through the addition of another tier,

increased higher tier rates, or other measures as may be deemed most appropriate upon examination of the results of the program through periodic reviews throughout the Management Period.

At least once during each subsequent Management Period, the District shall develop increasing levels of conservation, with program elements designed to accomplish the conservation objective set by the Board of Directors upon the advice and recommendation of the Conservation Committee made up of two Board members, and interested customers. The District may utilize consultants to advise the committee in these efforts.

COMMERCIAL: All commercial usage will be charged tier 1 rates

IRRIGATION: All irrigation usage will be charged tier 1 rates

CONSERVATION INCENTIVE ELEMENTS/POLICIES:
Revenue generated by the tiered water rates described above will be returned to the rate payers in the form of conservation incentives. The conservation incentives include the following:

Low Flush Toilet Replacement – The District will provide a one hundred fifty dollar ($150.00) rebate to rate payers for the replacement of an existing toilet (i.e. 2.8 gallons per flush or more) with a low flow toilet (i.e. 1.6 gallons per flush or fewer). The District will make up to one hundred (100) such rebates each fiscal year. The approximate cost of this rebate program, per fiscal year, is fifteen thousand dollars ($15,000.00). The potential water savings is approximately 409,464 gallons per year.

Low Water Use Washing Machines – The District will provide a four hundred dollar ($400.00) rebate to rate payers who replace their high water use washing machines (45 gallons per load or more) with low water use washing machines (15 gallons per load or fewer). The District will make up to forty (40) such rebates each fiscal year. The approximate cost of this rebate program, per fiscal year, is sixteen thousand dollars ($16,000.00). The potential water savings is approximately 364, 800 gallons per year.

Turf Removal – The District will provide one dollar ($1.00) per square foot rebate to rate payers for the removal of up to 2,500 square feet of existing turf. The District will make up to twenty (20) such rebates each fiscal year. The approximate cost of this rebate program, per fiscal year, is fifty thousand dollars ($50,000.00). The potential water savings is approximately 1,496,000 gallons per year.

Irrigation Efficiency Audit – The District will provide inspections of a rate payer's irrigation system and recommend improvements. The District may also provide financial assistance to such rate payers in an amount of up to twenty percent (20%) of the cost to complete the recommended improvements. The approximate cost of this incentive, per fiscal year, is forty thousand dollars ($40,000.00). The potential water savings is unknown by this program will be assessed after year one.
In addition to the conservation incentives identified above, the following activities will also be a part of the Conservation Program:

Provide educational programs regarding water conservation strategies for all classes of customers, but with the primary focus on the residential class.

Make available remote read meters at cost to customers so that they may monitor their usage on a continual basis from inside their residence.

Maintain a list of qualified, licensed contractors who are able, and are interested, in performing irrigation improvements (i.e. drip irrigation systems, etc) for Borrego Water District customers, at the customers expense.

Provide regular community updates on the status of conservation efforts, and progress towards meeting the water conservation goals.

FIRST CONSERVATION MANAGEMENT PLAN WATER USE REDUCTION GOAL:

The subject plan's water reduction goal to be achieved by July 1, 2014 is to realize an average water use per dwelling unit that is 15% below the average usage calculated for the period of July 1, 2004 through June 30, 2008.

Appendix B

Historic Gauged Stream Flow Data for Borrego Palm,Coyote and San Felipe Creeks

USGS Data

Water Year Oct-Sep	Borrego Palm Creek(1)	Coyote Creek(2)	San Felipe Creek (3)
1945	1433		
1946	597		
1947	158		
1948	206		
1949	305		
1950	0		
1951	274	2451	
1952	982	2325	
1953	238	1715	
1954	303	1852	
1955	357	1689	
1956	226	1578	
1957	152	1440	
1958	718	1820	
1959	138	1533	253
1960	149	1469	245
1961	38	1502	151
1962	128	1098	198
1963	59	1090	115
1964	114	1285	151
1965	174	1147	85
1966	266	1494	153
1967	115	1333	543
1968	121	830	125
1969	716	1582	
1970	127	1089	185
1971	55	870	120
1972	9	952	67
1973	258	592	100
1974	47	911	91
1975	65	652	92

Water Year Oct-Sep	Borrego Palm Creek(1)	Coyote Creek(2)	San Felipe Creek (3)
1976	97	328	133
1977	312	1468	123
1978	770	1631	731
1979	2458	2161	426
1980	5697	10772	4749
1981	1124	3524	312
1982	1561	3096	592
1983	4994	3238	7819
1984	1406	1372	
1985	967		
1986	790		
1987	514		
1988	400		
1989	228		
1990	171		
1991	600		
1992	475		
1993	3786		
1994	269		
1995	1479		
1996	293		
1997	297		
1998	1543		
1999	285		
2000	218		
2001	185		
2004	81		
2003	525		
Low	0	328	67
Average	**679**	**1834**	**702**
High	5697	10772	7819

Notes:

(1) USGS Station No. 10255810

(2) USGS Station No. 10255800

(3) USGS Station No. 10255700

well number	date	solids, total dissolved	nitrogen, nitrate
ID1-1	6/6/1972	560	0.5
ID1-1	3/17/1988	724	0
ID1-10	9/26/1972	352	0.42
ID1-10	3/17/1988	252	1.3
ID1-10	5/22/1991	274	1.47
ID1-10	2/28/1994	260	7.14
ID1-10	5/17/2001	780	7
ID1-10	4/15/2004	274	3.63
ID1-10	5/8/2007	250	6.8
ID1-10	6/3/2008	0	6.9
ID1-12	3/17/1988	242	0.44
ID1-12	5/22/1991	292	0.42
ID1-12	2/28/1994	290	2.21
ID1-12	9/8/1998	268	2.24
ID1-12	5/17/2001	290	2
ID1-12	4/15/2004	246	1.73
ID1-12	5/8/2007	260	1.7
ID1-12	6/3/2008	0	1.7
ID1-16	2/25/1997	330	4
ID1-16	5/17/2001	360	6
ID1-16	4/15/2004	326	4.87
ID1-16	5/8/2007	320	5
ID1-16	6/3/2008	0	4.7
ID1-2	7/10/1972	400	1.5
ID1-2	2/8/1983	496	4.7
ID1-2	3/17/1988	290	4.2
ID1-8	0/10/1972	364	0.89
ID1-8	3/17/1988	0	0
ID1-8	5/22/1991	328	1.29
ID1-8	2/28/1994	400	0
ID1-8	5/17/2001	460	7
ID1-8	4/15/2004	446	5.75
ID1-8	5/8/2007	430	8.3
ID1-8	6/3/2008	0	8.3
ID4-1	6/23/1975	484	39
ID4-10	6/19/1989	629	1.7
ID4-10	6/11/1991	529	1.49
ID4-10	2/28/1994	528	10.7
ID4-10	9/8/1998	516	10.6
ID4-10	5/17/2001	530	12
ID4-10	4/15/2004	459	9.78
ID4-10	5/8/2007	490	9.3
ID4-10	6/3/2008	0	8.5
ID4-11	5/17/1995	396	0.96
ID4-11	9/8/1998	387	1.71
ID4-11	5/17/2001	390	0

well number	date	solids, total dissolved	nitrogen, nitrate
ID4-11	4/15/2004	318	1.59
ID4-11	5/8/2007	390	1.9
ID4-11	6/3/2008	0	2
ID4-18	6/18/1984	594	0.12
ID4-18	12/9/1985	562	0.34
ID4-18	6/11/1991	617	0.18
ID4-18	2/28/1994	617	1.46
ID4-18	9/8/1998	604	2.23
ID4-18	5/17/2001	620	0
ID4-18	4/15/2004	558	1.24
ID4-18	5/8/2007	590	0
ID4-18	6/3/2008	0	<2
ID4-2	5/19/1975	460	6.3
ID4-2	3/31/1980	460	4.3
ID4-2	2/4/1983	454	5.8
ID4-2	12/9/1985	428	1.6
ID4-2	6/11/1991	453	1.32
ID4-2	2/28/1994	474	5.61
ID4-2	9/8/1998	476	5.1
ID4-2	5/17/2001	470	5
ID4-2	4/15/2004	434	3.92
ID4-2	5/8/2007	520	3.7
ID4-2	6/3/2008	0	3.3
ID4-3	5/19/1975	640	1.8
ID4-3	3/31/1980	650	0.66
ID4-3	2/4/1983	622	2
ID4-3	12/9/1985	572	0.36
ID4-3	6/11/1991	684	0.85
ID4-3	2/28/1994	808	10.1
ID4-3	9/8/1998	701	5.22
ID4-3	5/17/2001	720	7
ID4-3	4/15/2004	662	6.4
ID4-3	5/8/2007	760	12
ID4-3	6/3/2008	0	11
ID4-4	5/19/1975	508	2.2
ID4-4	7/17/1979	244	3
ID4-4	9/26/1979	360	3.5
ID4-4	3/31/1980	322	3.5
ID4-4	2/4/1983	310	4.3
ID4-4	12/9/1985	326	0.86
ID4-4	6/11/1991	317	0.91
ID4-4	2/28/1994	348	4.05
ID4-4	9/8/1998	312	4.05
ID4-4	5/17/2001	350	4
ID4-4	4/15/2004	295	4.56
ID4-4	5/8/2007	320	3

well number	date	solids, total dissolved	nitrogen, nitrate
ID4-4	6/3/2008	0	2.8
ID4-5	6/11/1991	435	0.52
ID4-5	2/28/1994	440	6.31
ID4-7	3/12/1980	704	4.2
ID4-7	2/4/1983	780	1.7
ID4-8	2/10/1954	592	0
ID4-8	2/4/1983	260	8.1
LA CASA	3/19/1984	572	1.2
LA CASA	5/22/1991	510	1.47
RB-1	3/20/1984	580	1.5
RB-CTNW	3/19/1984	340	1.8
TRIANGLE	0/29/1980	861	2.7
TRIANGLE	4/4/1981	826	0
TRIANGLE	5/22/1991	368	1.6
WILCOX	1/27/2000	267	8.4
WILCOX	5/17/2001	250	7
WILCOX	4/15/2004	200	1.77
WILCOX	5/8/2007	210	4.4
WILCOX	6/3/2008	0	4.1

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I am mindful that the IRWMP has as its expressed purpose qualifying the district for Proposition 50 and Proposition 84 funds, but it will inevitably serve another equally important purpose as well; i.e., it will become a part of the historical record of scientific research on the Borrego Valley aquifer. For that reason it must be as accurate a representation of current science on the aquifer as possible.

Progress on groundwater management in the valley has historically been frustrated by special interests distorting data to achieve their own ends. In so doing, these interests have nullified the self-corrective nature of scientific inquiry as it applies to the Borrego basin. It is important, therefore, that the IRWMP be based on and contribute to sound science about the aquifer and furthering knowledge thereof; and the BWD has a special duty to see that it does. Its stated purpose should not lead to the corruption of data about the basin in the interest of achieving narrow, short-term, and selfish ends. It appears, however, that the author has, from time to time, sacrificed scientific ends to others.

The BWD's Integrated Water Resources Management Plan (IWRMP) presents a fair summary of recent data regarding the Borrego Basin. When it goes beyond a mere recitation of findings, however, it ceases to be objective and becomes a polemic. As a result, it is analytically flawed, empirically misleading, and, at times, verges on junk science; i.e.,

> "…extensively corrupted science, science corrupted in objectivity and/or method, the corruption either deliberate or involving sloppy methods or due to ignorance of what science is about, the outcome useless conclusions that make false statements about the natural world…"[1]

> "…what seems clear about junk science in America is that one usually finds a conflict between special interest and group interest, where… group interest is public interest, the interest of the group at large…"[2]

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A part of the IWRMP's manifest lack of objectivity is surely traceable to the recent employment history of its principal author, Bill Mills. Mills worked for a number of years as a consultant to and lobbyist for AAWARE, the local farmers mutual benefit corporation, and represented local agriculturalists views and interests. It appears that he continues to do so, whether or not he is still retained as a consultant.

Nowhere in the document, however, is the identity of the principal author disclosed, let alone his possible conflict of interest arising from long-standing affiliation with an interest group that is responsible for more than 70% of the water pumped annually from the Borrego Valley aquifer and has a financial interest in continuing to do so. That, quite simply, is intellectually dishonest.

The principal author's identity and, because of its prejudicial potential, relevant occupational history should be disclosed up-front and in detail; and he should be required to disclose his present relationship with joint and several agricultural interests in the valley, if any, or when and how his previous professional relationship(s) were terminated if they have been. In the interest of full disclosure, information about the author's possible conflicts of interest should as well be made a proper part of all drafts of this document distributed locally for information and comment.

Quoted below are specific passages from the IWRMP that I believe are especially problematic. My comments in Arial 12 point Italic type appear immediately below the quoted material which is presented in the New Times Roman 12 point type of the original and surrounded by a text box.

> The purpose of this Integrated Water Resources Management Plan is to provide an update on the District's efforts to mitigate the aquifer overdraft problem, and to present alternatives for the District to further evaluate as it strives to provide a sustainable water supply for its customers. (p. 1)

I would rewrite the above as follows:

"The purpose of this Integrated Water Resources Management Plan (IRWMP) is to update the District's Ground Water Management Plan (GMP), report on efforts to mitigate the aquifer overdraft since the GMP was adopted in 2002, and provide

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a plan that can be integrated with the plans of other agencies having responsibility for water management to create an IRWMP."

The IRWMP *does not "present alternatives for the District to further evaluate," as claimed, but rather is an argument for one general solution – importing water – and a specific instantiation of that solution, i.e., the "Phased Dr. Nel – Allegrati Farms Import." It dismisses all other options; most specifically sustained use of groundwater in the basin.*

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> Conservation Management Plan is attached hereto as Appendix "A", and also includes the provision of best management practices implementation for irrigation and commercial users, (p.2)

There is no list of BMP included. If that is not what the above means, then it is badly phrased.

> The Save Our Aquifer Coalition (SOAC) was formed in the early 2000s to draw public awareness of the Borrego Valley. The non-profit group has sponsored water conservation programs with the local school children and distributes water awareness bumper stickers that were designed by school contest winners. (p. 7)

The original language purposely distorts SOAC'S mission and trivializes its efforts on behalf of the aquifer which consisted mainly of more direct and assertive attempts to provoke action on groundwater management in the basin. Rewrite as:

"The Save Our Aquifer Coalition (SOAC), a California public interest association, was formed in the early 2000s to draw public attention to and lobby for correction of the aquifer overdraft situation in the Borrego Valley."

> This is a measure of the amount of water, as a percentage, that can be withdrawn from a **unit-less** cube of aquifer material.. (p. 15)

"Unit-less" needs to be explained or changed to something more easily understood. It probably could just be deleted.

> It should be noted that this study [Netto's thesis] was conducted under the review of an academic review committee. This review process is aimed at ensuring that scientific methodologies were employed and differs than from that of a 'peer' review process which is concerned with both the methodology and the reasonableness of the values derived from any estimation process. (p. 26)

The above statement is patently false, as anyone who has ever been through a Master's degree or Ph.D. thesis defense knows full well. It implies that all the academic examining committee is interested in is the logic of the argument and completely disregards the truth/falsity of the conclusions drawn. That is preposterous. The only possible purpose for its inclusion here is to create an unwarranted bias in favor of the farmers figures (AAWARE 2003) to help justify the "conclusion" on p. 28 that the results of the AAWARE study and Netto's thesis "are compatible" (see below). It should be deleted.

> Considering the differences in methodology used in developing these estimates [Netto's and AAWARE's], it is concluded that the results are compatable (sic). (p. 28)

The BWD Groundwater Management Plan (2002) used nominal values for delivered water and ignored return flow. The AAWARE 2003 study determined the amount of delivered water from electrical power records for pumping and well production information supplied by the farmers to arrive at 14,700 af of delivered water. Netto did not have access actual figures such as these and so estimated applied water based on nominal values to arrive at 11,878 af of delivered water, a difference of 2,822 af.

Delivered Water/Acre for each study

Study	Irrigated Acreage	Delivered Water	Delivered Water/Acre
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Netto on the other hand, relied on a "field investigation," i.e., empirical tests conducted in the Borrego Valley, "to determine the amount of applied water consumptively used" the results of which showed a return rate of 22% for citrus and 14% for all other crops, or an overall return rate of 19.67%. The AAWARE study used purported nominal values of 32.2% for citrus and a 25.7% average return rate for all other crops or an overall return rate of 29.01% - nearly ten points higher than Netto's.

Values from table on page 29, IWMRP 2008 (Return Flow % added)

Study	Irrigated Acreage	Delivered Water	Net Water Use	Return Flow	Return Flow %
Netto	4,310.00	11,878.00	9,541.00	2,337.00	19.68%
AAWARE	3,882.00	14,650.00	10,450.00	4,200.00	28.67%

Thus the AAWARE study offers the most reliable estimate of applied water while the Netto study offers the most reliable value for return flow since both are empirically determined values specific to the Borrego Valley. It follows, therefore that the most reliable method of determining the Net Water Use is to use AAWARE's value for applied water (14,700 af) and Netto's value for return flow (22% for citrus and 14% for all other crops). Doing so yields a different, but more scientifically sound and reliable, result than the one Mill's methodology offers.

Using Netto's Return Flow rate and AAWARE's estimate of Delivered Water/Acre

Study	Irrigated Acreage	Delivered Water/Acre	Delivered Water	Return Flow %	Return Flow	Net Water Use	Net Water Use/Acre
Netto	4,310.00	3.77	16,265.20	19.68%	3,200.18	13,065.02	3.03
AAWARE	3,882.00	3.77	14,650.00	19.68%	2,882.39	11,767.61	3.03
Difference						1,297.41	
Diff %						11.03%	

Moreover, Mill's analysis ignores a significant difference in the size of the two areas on which the respective studies were based to conclude that the results of the two studies are "compatible". Netto's calculations are based on a test area of 4,310 acres vice AAWARE's which are based on a test of area of only 3,882 acres; a difference of 910 acres. To eliminate this disparity and arrive at values that are comparable, it is necessary to compare Net Water Use per acre rather than gross Net Water Use as Mills did. Calculation of the Net Water Use per acre using AAWARE's more robust estimate of delivered water and Netto's empirically established local return flow rate yields aDdelivered Water rate of 3.77af/acre and a Net Water Use of 3.03 af/acre. Applying the latter to the 4,310 acres on which the AAWARE study is based yields a Net Water Use of 11,768 af, or 1,318 af more than the value published in the AAWARE study (10,450 af), a difference of 11.2%. This compares to the putative difference in Net Water Use between the two studies of only 910 af used by Mills to determine that the two

studies are "compatible", a difference of 540 af, or 59% - not an insignificant difference.

> It is important to note that as residential development occurs in the Valley that the current agricultural net water usage after fallowing is insufficient to mitigate the new demands… current net water use by a complete fallowing of agriculture using the county offset program and BWD mitigation fees would fall short of offsetting the potential new municipal water demands by about 3,000 afy. (p. 34)
>
> …if all of the dwelling units currently in the general plan are developed, a new demand on the aquifer of about 3,000 afy could result. However, the likelihood that all agricultural water use will be eliminated is not reasonable to project; and thus the total amount of overdraft will be significantly greater, and further diminish the ability to depend upon the local aquifer as a sustainable water supply for the Borrego Valley. (p. 39)

In the first instance, the county's current General Plan population projections have been acknowledged to be unrealistic even by DPLU planners. They are driven by esoteric formulae which originally projected a terminal population of more than 35,000

"The past application of single-use "Eudidean" zoning techniques to the Borrego Springs area [resulted in] an outdated view of the area's future development, in which prior planners envisioned 35,000+ residents…rather than the likely population of 8,000 envisioned in this Plan." ("Borrego Springs Updated Community Plan," 2008, p. 31)

That number was reduced only after members of the Borrego Springs Community Sponsor Group vigorously protested the reasonableness of the values derived from the county's estimation process. Given the growth rate of Borrego Springs to date, projecting an increase such as the county projects any time in the foreseeable future is not only unreasonable; it is ridiculous.

"While current county land use regulations would permit a potential full-time population of 13,000, we are far from the growth curve that would yield such demographics. A more realistic maximum full-time population would be 8,000." ("Borrego Springs Updated Community Plan," 2008, p, 14)

As an indication of the extremely slow pace of development in Borrego, "Many residential parcels were first created over 50 years ago and remain undeveloped." ("Borrego Springs Updated Community Plan," 2008, p. 30)

In addition to grossly over estimating Borrego's growth potential, Mills relies on his low-ball estimate of Net Water Use by agriculture in the valley to support the above statements. Moreover, his entire discussion of "Ultimate Water Requirements from New Development" (p. 34 – 37) is biased in favor of importing water by focusing entirely on the end-state itself and ignoring the amount of time and complex, interactive processes involved in getting to that end-state. In so doing, he assumes a much compressed, essentially durationless, process that has no intermediate states; a totally fantastic assumption.

The process of phasing out agriculture and other inappropriate, water intensive enterprises in the valley would likely involve a transition over an indefinitely long period of time; although the Desert Area Initiative committee believes it can be accomplished in as little as 11 years:

"Convert existing agricultural uses to other, less-consumptive uses by 2020 consistent with a Plan population of 8,000." ("Borrego Springs Updated Community Plan," 2008, p. 32)

Given Borrego's historically slow rate of residential growth, it would be a relatively simple matter to encourage reduced water use through fallowing by institution of a pump tax and issuance of "durable mitigation entitlements" and conservation measures such as tiered water rates, conservation incentives, development of a wastewater recycling program, artificial recharge, etc. Such measures would or could bring significant reductions in pumping that would far exceed demands coming from residential growth over the same period and thereby slow draw-down of the aquifer and provide additional time to define the reliability of the groundwater supply in the basin, allow legislative action by the state and county to regulate groundwater pumping in some reasonable way, and develop other strategies to obviate the need for or reduce the scale of exorbitantly expensive public works projects to import water into this small and sparsely populated valley.

Finally, Mills is unnecessarily pessimistic about the possibility of reducing residential water use. (p. 36) If communities in Arizona can limit residential us to 1/3 af/du, then, given proper incentives, there is obviously no reason to believe that Borrego cannot.

In a word, this whole section should be completely reworked to be less dogmatic, more realistic, and flexible enough to accommodate alternate strategies that rely, at least in part, on sustainable use of groundwater.

> Additionally, the growers in the valley were increasingly identified as the adversarial. (sic) The growers responded by forming the Agricultural Alliance for Water Resources Education (AAWARE). (p. 66)

The above is both false and gratuitous. The farmers formed AWWARE for the sole purpose of defending their rights to continue mining the aquifer. It had nothing to do with defending their honor, as implied above. This language again betrays Mill's bias toward the farmers, adds nothing to the discussion, and should be deleted.

In addition to the above discrepancies, the entire document would profit from rigorous copy editing to eliminate numerous spelling, grammatical and diction errors, and, in places, deflate bloated prose.

Thank you for the opportunity to comment on the IWRMP.

Response to Comments by Dennis W. Dickinson of December 17, 2008

The format used to respond to the comments is identified as 'Response to Comment X'. The response is boxed and highlighted as in this instance.

Critique of the Borrego Water District's
Integrated Water Resources Management Plan
Draft No. 4
October 2008

By
Dennis W. Dickinson
17 December 2008

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Progress on groundwater management in the valley has historically been frustrated by special interests distorting data to achieve their own ends. In so doing, these interests have nullified the self-corrective nature of scientific inquiry as it applies to the Borrego basin. It is important, therefore, that the IRWMP be based on and contribute to sound science about the aquifer and furthering knowledge thereof; and the BWD has a special duty to see that it does. Its stated purpose should not lead to the corruption of data about the basin in the interest of achieving narrow, short-term, and selfish ends. It appears, however, that the author has, from time to time, sacrificed scientific ends to others.

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> "…extensively corrupted science, science corrupted in objectivity and/or method, the corruption either deliberate or involving sloppy methods or due to ignorance of what science is

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Comment 1:
A part of the IWRMP's manifest lack of objectivity is surely traceable to the recent employment history of its principal author, Bill Mills. Mills worked for a number of years as a consultant to and lobbyist for AAWARE, the local farmers mutual benefit corporation, and represented local agriculturalists views and interests. It appears that he continues to do so, whether or not he is still retained as a consultant.

Response to Comment 1:

Mills is a well known and respected professional in the field of engineering and in California water issues. He is a professional engineer, a professional geologist, a Diplomat in the American Academy of Environment Engineers, and a Fellow in the American Society of Civil Engineers. His achievements include such awards as the Outstanding Water Leader of the Year (ACWA, 1992) and Engineer of the Year Orange County (1998). His long and distinguished career has been noted in the United States House of Representatives' Congressional Record by Congresspersons: C. Cox, G. Miller and L. Sanchez.

Comment 2:
Nowhere in the document, however, is the identity of the principal author disclosed, let alone his possible conflict of interest arising from long-standing affiliation with an interest group that is responsible for more than 70% of the water pumped annually from the Borrego Valley aquifer and has a financial interest in continuing to do so. That, quite simply, is intellectually dishonest.

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Response to Comment 2:

Mills' former relationship with AAWARE has been well documented in BWDs official minutes and in the *Borrego Sun*. The cover sheet will be modified to indicate that the report was prepared by William Mills & Associates.

Quoted below are specific passages from the IWRMP that I believe are especially problematic. My comments in Arial 12 point Italic type appear immediately below the quoted material which is presented in the New Times Roman 12 point type of the original and surrounded by a text box.

Comment 3:

The purpose of this Integrated Water Resources Management Plan is to provide an update on the District's efforts to mitigate the aquifer overdraft problem, and to present alternatives for the District to further evaluate as it strives to provide a sustainable water supply for its customers. (p. 1)

I would rewrite the above as follows:

"The purpose of this Integrated Water Resources Management Plan (IRWMP) (sic?) is to update the District's Ground Water Management Plan (GMP), report on efforts to mitigate the aquifer overdraft since the GMP was adopted in 2002, and provide a plan that can be integrated with the plans of other agencies having responsibility for water management to create an IRWMP."

Response to Comment 3:

The Dickinson rewrite does not provide a more definitive description of the purpose of the plan. No change to the text.

Comment 4:
The IRWMP (sic) *does not "present alternatives for the District to further evaluate," as claimed, but rather is an argument for one general solution –*

importing water – and a specific instantiation of that solution, i.e., the "Phased Dr. Nel – Allegrati Farms Import." It dismisses all other options; most specifically sustained use of groundwater in the basin.

Response to Comment 4:

The BWD IWRMP does, in fact, 'present alternatives for the District to further evaluate'. Chapters 7 and 8 describe several alternatives, and Chapter 9 attempts to prioritize them based on six important criteria (page 63). Further, it is noted on page 65 that the prioritization in the draft report would be revised after input from the community and the BWD Board of Directors. Finally, all of the alternatives, in one or more ways, act to 'sustain' the aquifer by either direct recharge or indirectly through a reduction in demand on the aquifer through conservation or importation of new water supplies. No action on comment.

Comment 5:

The State has initiated the funding of projects as a result of Proposition 50 (and subsequently Proposition 84), such as the proposed importation pipeline, but require that the agency participate in an Integrated Regional Water Resources Management Plan (IRWMP). This plan requires that an agency develop a water management plan for incorporation in a regional process to integrate its plan with other agencies having responsibilities for water management, creating an IRWMP. In addition to the other purposes of this document, this plan serves also as the initial step in that process. (p.2)

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Response to Comment 5:

The Dickinson rewrite does not provide a more definitive description of the need for the IWRM plan. No change to the text.

Comment 6:

> Conservation Management Plan is attached hereto as Appendix "A", and also includes the provision of best management practices implementation for irrigation and commercial users, (p.2)

There is no list of BMP included. If that is not what the above means, then it is badly phrased.

Response to Comment 6:

> As noted, the text does not include a full list of best management practices, known in the water industry as BMPs. However, it includes a partial list, including Low Flush Toilet Replacement, Low Water Use Washing Machines, Turf Removal and Irrigation efficiency Audit. Text is revised accordingly.

Comment 7:

> The Save Our Aquifer Coalition (SOAC) was formed in the early 2000s to draw public awareness of the Borrego Valley. The non-profit group has sponsored water conservation programs with the local school children and distributes water awareness bumper stickers that were designed by school contest winners. (p. 7)

The original language purposely distorts SOAC'S mission and trivializes its efforts on behalf of the aquifer which consisted mainly of more direct and assertive attempts to provoke action on groundwater management in the basin. Rewrite as:

"The Save Our Aquifer Coalition (SOAC), a California public interest association, was formed in the early 2000s to draw public attention to and lobby for correction of the aquifer overdraft situation in the Borrego Valley."

Response to Comment 7:

> The comment is a more accurate description of SOAC. The text will be modified to incorporate the comment.

Comment 8:

> This is a measure of the amount of water, as a percentage, that can be withdrawn from a **unit-less** cube of aquifer material.. (p. 15)

"Unit-less" needs to be explained or changed to something more easily understood. It probably could just be deleted.

Response to Comment 8:

Unit-less will be deleted from the text.

Comment 9:

> It should be noted that this study [Netto's thesis] was conducted under the review of an academic review committee. This review process is aimed at ensuring that scientific methodologies were employed and differs than from that of a 'peer' review process which is concerned with both the methodology and the reasonableness of the values derived from any estimation process. (p. 26)

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Response to Comment 9:

The sensitivity of the academic review process is noted. Mills always recommended that the Henderson and Netto model undergo a thorough 'peer' review by practicing hydrologists and modelers. After the acquisition of the model, the CA Department of Water Resources refused to operate the model after discovering important discrepancies in its construction that were overlooked by the academic review. Subsequently, a cursory 'peer' review by the US Geological Survey member of the Expert Panel charged with reviewing available information on the Borrego Valley identified numerous discrepancies in the hydrologic inputs and in the formulation of the numeric model (also overlooked by the academic committee.) The text will be modified accordingly.

Comment 9*:*

> Considering the differences in methodology used in developing these estimates [Netto's and AAWARE's], it is concluded that the results are compatable (sic). (p. 28)

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Using Netto's Return Flow rate and AAWARE's estimate of Delivered Water/Acre

Study	Irrigated Acreage	Delivered Water/Acre	Delivered Water	Return Flow %	Return Flow	Net Water Use	Net Water Use/Acre
Netto	4,310.00	3.77	16,265.20	19.68%	3,200.18	13,065.02	3.03
AAWARE	3,882.00	3.77	14,650.00	19.68%	2,882.39	11,767.61	3.03
Difference						1,297.41	
Diff %						11.03%	

Moreover, Mill's analysis ignores a significant difference in the size of the two areas on which the respective studies were based to conclude that the results of

the two studies are "compatible". Netto's calculations are based on a test area of 4,310 acres vice AAWARE's which are based on a test of area of only 3,882 acres; a difference of 910 acres. To eliminate this disparity and arrive at values that are comparable, it is necessary to compare Net Water Use per acre rather than gross Net Water Use as Mills did. Calculation of the Net Water Use per acre using AAWARE's more robust estimate of delivered water and Netto's empirically established local return flow rate yields aDdelivered Water rate of 3.77af/acre and a Net Water Use of 3.03 af/acre. Applying the latter to the 4,310 acres on which the AAWARE study is based yields a Net Water Use of 11,768 af, or 1,318 af more than the value published in the AAWARE study (10,450 af), a difference of 11.2%. This compares to the putative difference in Net Water Use between the two studies of only 910 af used by Mills to determine that the two studies are "compatible", a difference of 540 af, or 59% - not an insignificant difference.

Response to Comment 9:

The commenter attempts to utilize data from different studies and reports to show that the net use of water by agriculture is greater than that reported in the IWRM report.

There are a number of logic errors in these computations and tabulations. For example, there is a major difference in the irrigated area as reported by each of these studies. The IWRM plan identifies these reports as the year in which the report was published. For example, Netto thesis published in 2000 reported 4,310 acres irrigated. His sources were aerial photographs taken in 1995. He further assumed that the acreages and crops remained constant to 2000. In contrast, the BWD Groundwater Management Plan (Appendix F) reported a total of 3,545 acres irrigated. The source of these data was aerial photographs taken in 1996. The AAWARE report relied upon a questionnaire to each grower and completed in 2003 and reported a total of about 3,400 acres.

It should be noted that the BWD Groundwater Management Plan (GWMP) did not attempt to estimate the consumption us by agriculture. So the only two studies that estimated consumptive use relied on data separated by eight years. Further, as to total acreages, the Netto thesis acreages are significantly greater than the GWMP acreages even though the aerials were taken at only one year apart.

The differences may be due to the methods used to scale up from the aerials.

Estimating the delivery and the consumptive use of crops is, at best, inaccurate. The primary use of this procedure is to provide a reasonableness check to overdraft estimates developed through change in storage calculations, which depend on knowledge of the specific yield of the aquifer.

There are numerous differences and inaccuracies that enter into the 'consumptive use' procedure. To name a few: (1) irrigation methods may vary over time (there appears to have been a general movement by the growers to employ more water efficient methods); (2) delivery amounts also vary according to irrigation methods (flood, spray); (3) acreages as determined by aerial photographs are not precise due to scale-up factors; (4) unit values for consumptive use are different (Netto used average delivery amounts

and a single irrigation return flow field test to apply to all irrigated agriculture to arrive at consumptive use while the AAWARE investigation used empirical data from a CIMIS station (5) acreages determined by assessor parcel numbers and legal areas do not account for access roads and housing, etc. (this method is currently used by BWD.

Thus, comparing one estimate against another is difficult due to differences in irrigated areas and irrigated crops, as occurs when different years are compared. At best then, the water use by unmetered areas is an imprecise, but does tend to define the order of magnitude of an important component of the overdraft estimation.

The current work in developing a verified model of the aquifer being conducted by the US Geological Survey, will more accurately define the overdraft through a verification of the physical characteristics of the aquifer and changes in water levels.

Consequently, no change in the text is warranted.

Comment 10:

It is important to note that as residential development occurs in the Valley that the current agricultural net water usage after fallowing is insufficient to mitigate the new demands… current net water use by a complete fallowing of agriculture using the county offset program and BWD mitigation fees would fall short of offsetting the potential new municipal water demands by about 3,000 afy. (p. 34)

…if all of the dwelling units currently in the general plan are developed, a new demand on the aquifer of about 3,000 afy could result. However, the likelihood that all agricultural water use will be eliminated is not reasonable to project; and thus the total amount of overdraft will be significantly greater, and further diminish the ability to depend upon the local aquifer as a sustainable water supply for the Borrego Valley. (p. 39)

In the first instance, the county's current General Plan population projections have been acknowledged to be unrealistic even by DPLU planners. They are driven by esoteric formulae which originally projected a terminal population of more than 35,000

"The past application of single-use "Eudidean" zoning techniques to the Borrego Springs area [resulted in] an outdated view of the area's future development, in which prior planners envisioned 35,000+ residents…rather than the likely population of 8,000 envisioned in this Plan." ("Borrego Springs Updated Community Plan," 2008, p. 31)

That number was reduced only after members of the Borrego Springs Community Sponsor Group vigorously protested the reasonableness of the

values derived from the county's estimation process. Given the growth rate of Borrego Springs to date, projecting an increase such as the county projects any time in the foreseeable future is not only unreasonable; it is ridiculous.

"While current county land use regulations would permit a potential full-time population of 13,000, we are far from the growth curve that would yield such demographics. A more realistic maximum full-time population would be 8,000." ("Borrego Springs Updated Community Plan," 2008, p, 14)

As an indication of the extremely slow pace of development in Borrego, "Many residential parcels were first created over 50 years ago and remain undeveloped." ("Borrego Springs Updated Community Plan," 2008, p. 30)

In addition to grossly over estimating Borrego's growth potential, Mills relies on his low-ball estimate of Net Water Use by agriculture in the valley to support the above statements. Moreover, his entire discussion of "Ultimate Water Requirements from New Development" (p. 34 – 37) is biased in favor of importing water by focusing entirely on the end-state itself and ignoring the amount of time and complex, interactive processes involved in getting to that end-state. In so doing, he assumes a much compressed, essentially durationless, process that has no intermediate states; a totally fantastic assumption.

The process of phasing out agriculture and other inappropriate, water intensive enterprises in the valley would likely involve a transition over an indefinitely long period of time; although the Desert Area Initiative committee believes it can be accomplished in as little as 11 years:

"Convert existing agricultural uses to other, less-consumptive uses by 2020 consistent with a Plan population of 8,000." ("Borrego Springs Updated Community Plan," 2008, p. 32)

Given Borrego's historically slow rate of residential growth, it would be a relatively simple matter to encourage reduced water use through fallowing by institution of a pump tax and issuance of "durable mitigation entitlements" and conservation measures such as tiered water rates, conservation incentives, development of a wastewater recycling program, artificial recharge, etc. Such measures would or could bring significant reductions in pumping that would far exceed demands coming from residential growth over the same period and thereby slow draw-down of the aquifer and provide additional time to define the reliability of the groundwater supply in the basin, allow legislative action by the state and county to regulate groundwater pumping in some reasonable way, and develop other strategies to obviate the need for or reduce the scale of exorbitantly expensive public works projects to import water into this small and sparsely populated valley.

Response to Comment 10:

The IWRM plan is predicated on the current County General Plan which is under review and possible revision. At such time that a revision is made, then the plan should be updated. The commenter also suggests several ways to reduce the water use including the institution of a pump tax and water recycling. The BWD, as I understand, cannot institute a pump tax unless it recharges the basin with imported waters. Wastewater recycling would need further study, as the time of greatest need for recycled water for golf course irrigation is the summer months when the population within BWD greatly diminished. No change in text will be made.

Comment 11:
Finally, Mills is unnecessarily pessimistic about the possibility of reducing residential water use. (p. 36) If communities in Arizona can limit residential us to 1/3 af/du, then, given proper incentives, there is obviously no reason to believe that Borrego cannot.

In a word, this whole section should be completely reworked to be less dogmatic, more realistic, and flexible enough to accommodate alternate strategies that rely, at least in part, on sustainable use of groundwater.

Response to Comment 11:

The IWRM plan analyzed the impacts on the basin overdraft if water use could be reduced from its present level of 0.95 afy/du to 0.75 afy/du and 0.5 afy/du. The latter delivery rate is essentially that within most of the coastal region of Southern California. Even with the lowest water use rate per dwelling unit, the overdraft on the basin would be reduced to about 9,000 afy. No change in the text is warranted.

Comment 12:

Additionally, the growers in the valley were increasingly identified as the adversarial. (sic) The growers responded by forming the Agricultural Alliance for Water Resources Education (AAWARE). (p. 66)

The above is both false and gratuitous. The farmers formed AWWARE for the sole purpose of defending their rights to continue mining the aquifer. It had nothing to do with defending their honor, as implied above. This language again

betrays Mill's bias toward the farmers, adds nothing to the discussion, and should be deleted.

Response to Comment :

The commenter's speculated opinion. No text revision is warranted.

In addition to the above discrepancies, the entire document would profit from rigorous copy editing to eliminate numerous spelling, grammatical and diction errors, and, in places, deflate bloated prose.

Thank you for the opportunity to comment on the IWRMP.

COMMENTS BY MELVIN ON

INTEGRATED WATER RESOURCES MANAGEMENT PLAN October, 2008

DEMAND FOR WATER

In the Report there is an extensive discussion of the supply of water but not as much on demand, and what there is sometimes confusing. For example, on page 29 we are told that there are 1,500 residences, on page 32 it is claimed that there are 2,500 dwelling units, and on page 69 *we* are told that there 2,000 residences. According to the US census there were 1,280 occupied housing units in Borrego Springs in 2000. The historical water use statistics *in Table 8, page 32, do not seem reasonable, with a 528% increase in municipal water use* between 1980 and 1999 (from 430 to 2,272 acre feet (af)), No information on the number of active water meters is provided, information that would be useful in predicting future use.

Using the information provided, we find that the total water use in 1958, 1999 and 2008 are almost exactly the same (pages 30 and 32). These *were* the highest water-use years, with demand falling by as much as 65 % in some intervening years. Since the best predictor of the future is the past we conclude that the demand for water will be stable in the foreseeable future at about 23,000 afy.

SUPPLY OF WATER

On the supply side it was estimated that in 1945 there were 5.5 million af of water in the three aquifers underlying Borrego Springs (page 15). Discounting the lower aquifer because of costs of extraction, and updating the data to 1999, shows 1.7 million af in the upper and middle aquifers. With an overdraft of 13,000 afy this implies that there was enough water for 130 years in 1999, or enough for 120 years today.

But why discount the lower aquifer for cost reasons? Surely it is not more costly than a desalination plant or constructing a pipeline from the Imperial Valley, two of the non-local enhancement strategies discussed in Chapter 8. The lower aquifer contains some 3.4 million of water. Somewhat paradoxically, the high mat of extraction will be a benefit for Borrego residents, because it will mean that it will not be cost-effective for farmers to use that water. The non-agricultural use of water is 7,164 afy (page 38) and a recharge of 4,800 afy would produce an overdraft of 2,346 afy- Thus the lower aquifer would supply water for 1,450 years, and this in addition to the 120 years from the upper and middle aquifers. What would the worst-

case scenario be? Interestingly, the worst outcome for Borrego homeowners would be if the extraction costs for the lower aquifer were no higher than for other water in the Valley, for then agriculture would continue to exist. Then the overdraft would be 13,000 afy (page 38) and the lower aquifer would only last 260 years, so that we would be out of water in 380 years (260 + 120).

There a number of problems with this analysis:

The amount of water in storage is not the amount of water that can be withdrawn. This can only be estimated through the use of a numeric model (currently under development). Note that prior investigators have assumed a 50% recovery of the water in storage.

The reason that the lower aquifer is discounted is due to its small specific yield (3%). District wells that tap this source in the southern area of the district have found that the groundwater is almost irrecoverable.

Finally, if the lowest aquifer were productive, then there is reason that the growers in the Valley would not access the water. If the aquifer were found to be productive, its static water level would not doubt be hundreds of feet above the upper level of the aquifer due to the substantial amount of soils and aquifer material lying above it.

WATER MANAGEMENT PROGRAMS

Comments on mitigation, fallowing and agricultural land purchase will be made in a separate piece. For comments on tiered rates and the Clark Lake project see my earlier submission. The additional non-local programs share the same deficiencies as the Clark Lake project and are all economically infeasible and should be abandoned.

CONCLUSIONS

The arguments made above are all derived from information from the Management Report, and this information has been vetted by the Borrego Water District. The inescapable conclusion is that there is no water shortage now and probably never will be. Even if there is a water shortage in 380 years, it would make no sense to put an infrastructure in place now to deal with the problem_

submitted by Jim Melvin

Responses are shown in a block format.

COMMENTS BY JIM MELVIN ON
INTEGRATED WATER RESOURCES MANAGEMENT PLAN October, 2008

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In the Report there is an extensive discussion of the supply of water but not as much on demand, and what there is sometimes confusing. For example, on page 29 we are told that there are 1,500 residences, on page 32 it is claimed that there are 2,500 dwelling units, and on page 69 *we* are told that there 2,000 residences.

According to the 2000 Census, there are about 2,500 housing units. 2,500 units are used throughout the report.

According to the US census there were 1,280 occupied housing units in Borrego Springs in 2000. The historical water use statistics *in Table 8, page 32, do not seem reasonable, with a 528% increase in municipal water use* between 1980 and 1999 (from 430 to 2,272 acre feet (af)), No information on the number of active water meters is provided, information that would be useful in predicting future use.

The Borrego Springs Water Company was acquired in 1997 and is now identified as ID 4 (see Table 7). Its large water use accounts for the increase in 1999.

Using the information provided, we find that the total water use in 1958, 1999 and 2008 are almost exactly the same (pages 30 and 32). These *were* the highest water-use years, with demand falling by as much as 65 % in some intervening years. Since the best predictor of the future is the past we conclude that the demand for water will be stable in the foreseeable future at about 23,000 afy.

Both the San Diego County DPLU Groundwater and the BWD Groundwater Mitigation Policies act to stabilize and to reduce future water use in the Valley.

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The amount of water in storage is not the amount of water that can be withdrawn. This can only be estimated through the use of a numeric model (currently under development). Note that prior investigators have assumed a 50% recovery of the water in storage.
The reason that the lower aquifer is discounted is due to its small specific yield (3%). District wells that tap this source in the southern area of the district have found that the groundwater is almost irrecoverable. No modification to text.

WATER MANAGEMENT PROGRAMS

Comments on mitigation, fallowing and agricultural land purchase will be made in a separate piece. For comments on tiered rates and the Clark Lake project see my earlier submission. The additional non-local programs share the same deficiencies as the Clark Lake project and are all economically infeasible and should be abandoned.

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Comments by Clark Shimeall

Mr. Rich Williamson
General Manager, BWD

Dear Rich: I trust the following comments and observations regarding Draft 4 of the Integrated Water Resources management Plan (October , 2008) are not too late to be considered before the final document is assembled.

Chapter 2

Page 4: the reference to freezing temperatures is misleading. The '18 deg. low" must be a one time deal. Most of the lowest temperatures are in the range of 25-32 deg.

Page 7: with regard to SOAC, I concur with Dennis Dickenson's report recently submitted to your office.

Page 8: Final Paragraph: suggest more specificity by saying " golf courses are the second largest user of valley water".

Chapter 3

Figure 2: The location of the purple boundary line limits of the Borrego Valley Groundwater Basin should either be in dashed form (indicating exact limits unknown) as it is extended east of Texas Dip area, or should be shown to exist a short distance east of the intersection of Hy 78 and Borrego Springs Road. Although USGS has made reference to an extension of the Basin to include the Lower Borrego Area, I am of the opinion that enough evidence does not exist to connect the two areas without doubt. In fact, this is one of the problems the 'expert' group should look at by gathering well data in the problem area to resolve the question.

Page 11: Based on lack of evidence, the first paragraph should be restated to show the need for more study of well data to substantiate the connection of sediments (the aquifer) between Borrrego Basin and Lower Borrego area.

Page 12: in second to last paragraph, Upper Aquifer, the second line regarding 'ranges to.... ...'is incomplete. Ranges from 1000' to what?

Chapter 4

Page 21: in second to last paragraph, the reference to "channels entering Borrego Valley contain very little alluvial sediments" is somewhat misleading because evidence in the several 'catchment basins' constructed at mouths of canyons emptying into the valley wherein the small basins were silted up in a very short time, thus proving their inability to really handle much run-off.

Page 26: This is an assumption about thesis review committies and should be verified prior to being put into print. My personal recollection of my own Master's thesis faculty review group tends to confirm more to Dennis Dickinson observations.

Chapter 5

Page 33: with reference to the 3,725 units, this all may change if they are not constructed

Responses to
Comments by Clark Shimeall of January 6, 2009

The format used to respond to the comments is boxed and highlighted as in this instance and shown immediately below the comment

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Will modify text accordingly.

Page 7: with regard to SOAC, I concur with Dennis Dickenson's report recently submitted to your office.

Will modify text as proposed by Dickinson.

Page 8: Final Paragraph: suggest more specificity by saying “golf courses are the second largest user of valley water".

Will modify text accordingly.

Chapter 3

Figure 2: The location of the purple boundary line limits of the Borrego Valley Groundwater Basin should either be in dashed form (indicating exact limits unknown) as it is extended east of Texas Dip area, or should be shown to exist a short distance east of the intersection of Hwy 78 and Borrego Springs Road. Although USGS has made reference to an extension of the Basin to include the Lower Borrego Area, I am of the opinion that enough evidence does not exist to connect the two areas without doubt. In fact, this is one of the problems the 'expert' group should look at by gathering well data in the problem area to resolve the question.

Will modify figure with a dashed line.

Page 11: Based on lack of evidence, the first paragraph should be restated to show the need for more study of well data to substantiate the connection of sediments (the aquifer) between Borrrego Basin and Lower Borrego area.

Will modify text accordingly.

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Chapter 4

Page 21: in second to last paragraph, the reference to "channels entering Borrego Valley contain very little alluvial sediments" is somewhat misleading because evidence in the several 'catchment basins' constructed at mouths of canyons emptying into the valley wherein the small

basins were silted up in a very short time, thus proving their inability to really handle much run-off.

The text refers to subsurface flow (groundwater) entering the basin from the small alluvial channels and not surface flow from these canyon mouths. The text has been modified for clarity.

Page 26: This is an assumption about thesis review committees and should be verified prior to being put into print. My personal recollection of my own Master's thesis faculty review group tends to confirm more to Dennis Dickinson observations.

See comments regarding this issue in Dickinson responses. Have changed text accordingly

Chapter 5

Page 33: with reference to the 3,725 units, this all may change if they are not constructed prior to the finalization of the General Plan.

Agreed. See comments regarding this issue in Dickinson responses.

Chapter 7

Page 42: with reference to artificial recharge, no mention was included about the 'catchment basins' which were actually constructed at the mouths of many of the canyons (some 5-7 in Henderson Canyon alone) but proved ineffective in ponding much water because of silting in short period of time.

Will modify text accordingly.

Chapter 8

Page 49: Second line is misleading. A study of the contour map of the area shows that in the unlikely event that the Clark Lake would overflow, the lowest point is near Peg Leg, and thus the drainage would be into Borrego Basin.

Will modify text accordingly.

Page 49: Last line should include “at considerable cost “with reference to the ' brine facility construction.

Will modify text accordingly.

Page 50: In the second paragraph, I would suggest clarification of the exact area by editing to read " thereof (extreme westerly portion)

Will modify text accordingly.

Page 53: Much of the information about Allegretti Farms area seems to have been written by L. Burzell, former BWD engineer, a few years ago, possibly about 2006. None of the information in the IWRMP report includes reference to the lawsuit between Allegretti and IID of a few years ago. My recollection is that IID sued Allegretti to keep the farm from drilling deeper or more wells for irrigation purposes because of what would happen to the water table. B"s files should have references to this.'

Allegretti's applied for a conditional use permit to activate a well on its property on the condition, imposed under a County ordinance, that Allegretti extract no more than 12,000 acre/feet per year of water from the aquifer underlying its property. At the close of Allegretti's liability case, the trial court ruled there was no compensable taking and entered judgment on specific findings, that the County's restriction did not deprive

Allegretti of all economically viable use of its property, and Allegretti had not show that the County's regulation did not advance a legitimate state interest. Thus, the Superior Court of Imperial County concluded that the County's actions, either during the course of the permitting process, in approving the permit with the use restriction, or in defending against Allegretti's inverse condemnation action, did not effect a physical or regulatory taking. Accordingly, affirmed the judgment.

Comments by Steven Smiley (via email dated 3/19/09)

In Chapter 5, page 25 there is a section titled Borrego Water District 2008 Study. I don't remember authorization for that ever coming before the board, nor do I recollect any presentation of the study to the board or GW Management Committee. Who conducted the study and what was the methodology? Is there a written report on the study?

In Chapter 7, page 41 it is stated that some farmers have continued watering their land " without ever intending to harvest or actually harvesting those crops ". Do you know of an example of that occurring? I don't.

Later on in Chapter 7, page 44 the mulching trial cooperatively conducted by Seley Ranch and BWD is discussed. The statement is made that " there was no significant (measurable) difference " between the controls and the treatments. That actually is not correct. In my report given at the Town Hall Meeting in 2003, I stated that mulching in a mature grapefruit grove allowed for a 15-16% reduction in irrigation applications. I speculated that the savings would probably be higher in immature groves because they are subject to more surface evaporation due to sun and wind exposure. If a 15% savings in water across all the cultivated land in Borrego was realized, that could result in a 1,500 - 2,000 acre feet/year reduction in applied water.

There should be a title page stating who prepared the report (yourself) and under what authority. I think this will give the report more credibility.

In general I think the report is well crafted and very comprehensive. It should help us a lot as we try for financial help from the state and feds. Thanks for all your hard work on this.

Reponses shown in block format.

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This is a study performed by staff on an annual basis, using assessor parcel information and direct knowledge of the land uses. No text revision.

In Chapter 7, page 41 it is stated that some farmers have continued watering their land " without ever intending to harvest or actually harvesting those crops ". Do you know of an example of that occurring? I don't.

The one instance was a the pepper farm that sowed oats, but they only watered one or twice with a water truck in an attempt to keep their farming status. Text modified to indicate such a possibility.

Later on in Chapter 7, page 44 the mulching trial cooperatively conducted by Seley Ranch and BWD is discussed. The statement is made that " there was no significant (measurable) difference " between the controls and the treatments. That actually is not correct. In my report given at the Town Hall Meeting in 2003, I stated that mulching in a mature grapefruit grove allowed for a 15-16% reduction in irrigation applications. I speculated that the savings would probably be higher in immature groves because they are subject to more surface evaporation due to sun and wind exposure. If a 15% savings in water across all the cultivated land in Borrego was realized, that could result in a 1,500 - 2,000 acre feet/year reduction in applied water.

The text has been modified to reflect the above.

There should be a title page stating who prepared the report (yourself) and under what authority. I think this will give the report more credibility.

The report has been modified to show that the report was prepared by William Mills.

In general I think the report is well crafted and very comprehensive. It should help us a lot as we try for financial help from the state and feds. Thanks for all your hard work on this.