APPENDIX 2-D
Copy of San Juan Basin Groundwater Management and Facility Plan

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SAN JUAN BASIN GROUNDWATER MANAGEMENT AND FACILITY PLAN

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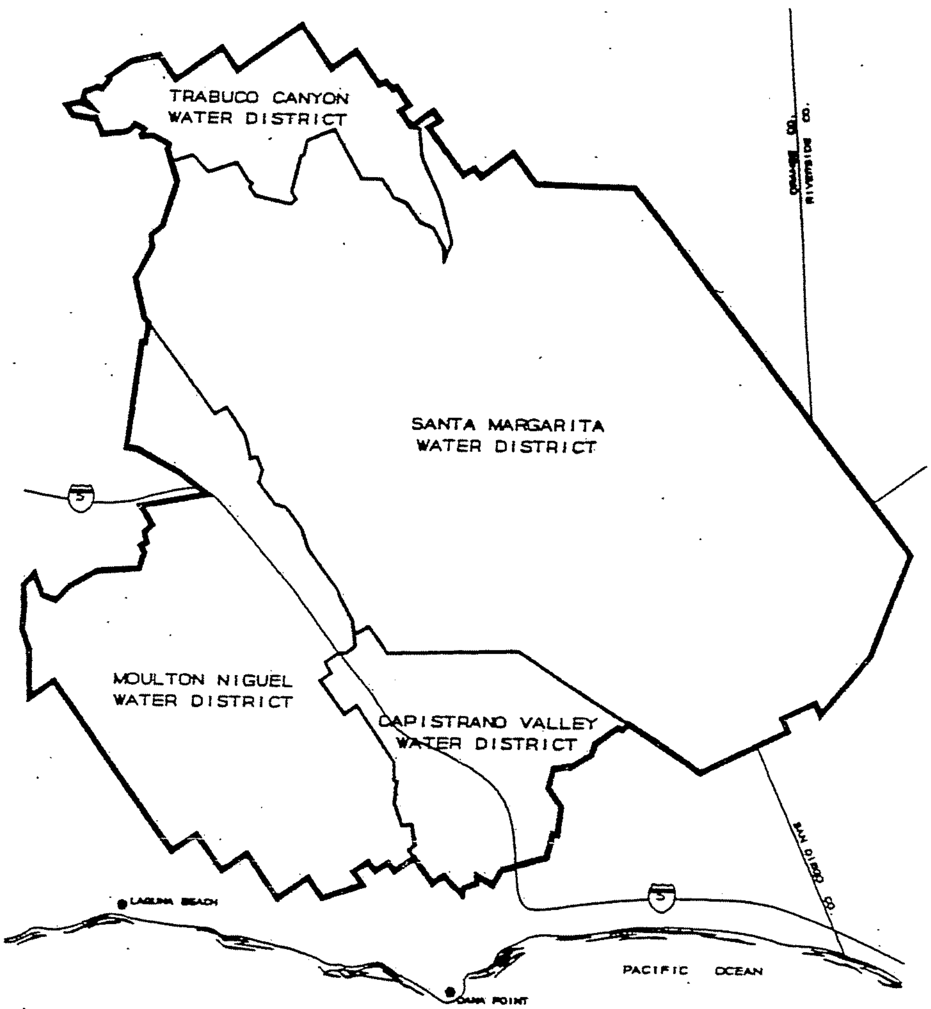

May 1994

Prepared For The
San Juan Basin Authority
And
The Metropolitan Water District
Of Southern California

By:

NBS LOWRY

ENGINEERS & PLANNERS

SAN JUAN BASIN GROUNDWATER MANAGEMENT AND FACILITY PLAN

Prepared for the:
SAN JUAN BASIN AUTHORITY
and
THE METROPOLITAN WATER DISTRICT OF SOUTHERN CALIFORNIA

Prepared by:
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Irvine, California

May 1994

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EXECUTIVE SUMMARY

The San Juan Basin Groundwater Management and Facility Plan is the first step being taken to implement the recently adopted mission of the San Juan Basin Authority, which is:

> *"to develop and maintain a reliable, good quality and economical local water supply for the residents in the San Juan Basin by maximizing use of local ground and surface water, the San Juan Creek and its tributaries, with due consideration for the preservation and enhancement of the environment, including, but not limited to, the natural resources, fish and wildlife, infrastructure improvements, and the cultural heritage of the area."*

The California Department of Water Resources in the five-year update of the California Water Plan (Bulletin 106-93) released the following information:

- California's population is projected to increase to 49 million by 2020, driving water demand up about 3.8 million acre-feet to 10.5 million acre-feet, even with 1 million acre-feet of urban water conservation.

- Increased demand, combined with reduced supplies from the Colorado River, results in shortages in the South Coast region for 2020 of 0.4 million acre-feet for average years and 1.0 million acre-feet in drought years, even with the planned Domenigoni Reservoir. Shortages could be larger if the Sacramento-San Joaquin Delta problems are not solved. Statewide water shortages could amount to over 7 million acre-feet in drought years.

These projections highlight the need for developing local water supplies to the maximum extent possible. New water supplies that can be developed locally will lessen the burden on the long import systems of the Metropolitan Water District. Managed groundwater basins used conjunctively with imported water can provide emergency storage and seasonal storage capability. With the rapidly developing criteria for the uses of reclaimed water, the managed groundwater basins can also be used to store reclaimed water as well as storm runoff under controlled conditions.

This plan proposes the construction of the following facilities.

Phase I will consist of a 4 mgd desalter, five extraction wells with piping, and a pump station and product water pipeline to CVWD's water delivery system. Phase II will expand the desalter to 8 mgd and a total of 12 extraction wells, and the product water pipeline extension and pump station to the South County Pipeline. The total estimated cost of all facilities (Phases I and II) is $33,812,000. Phase I facilities are estimated at $15,160,000.

The Phase II facilities will have the maximum treated project water yield of approximately 7,000 to 8,000 acre-feet per year for a three-year drought or emergency period. At other times, the project will produce 3,500 to 4,000 acre-feet per year.

The Phase I facilities will produce a potable water supply of 1,800 acre-feet annually from sustained yield. Phase I will control groundwater gradients to minimize subsurface outflow to the ocean, provide seasonal storage capacity and provide 3,600 acre-feet per year emergency potable supplies from basin storage.

A rigorous economic, financial and benefit-to-cost analysis was performed for the Phase I project. Benefit-to-cost ratios based on present worth of 0.96 to 1.18 can be demonstrated depending on MWDSC water cost scenarios and the evaluation of drought/storage aspects of the project. The higher benefit-to-cost ratios (1.08 to 1.18) justify a water supply project providing 1,800 acre-feet per year. The drought/storage aspects of the project are more difficult to evaluate with benefit-to-cost ratios of 0.96 to 1.10. Non-quantifiable benefits must also be considered. These include the available storage created by accessing basin storage, the improved reliability due to less dependence on imported water, local water resource control and the local impacts of the dynamic MWDSC water pricing and availability.

RECOMMENDATIONS

The following specific recommendations are proposed:

1) Continue with the water rights appropriation with the goal to appropriate all unappropriated waters of the San Juan Creek for the project.

2) Develop and implement a cooperative strategy with MWDOC to request MWDSC funding assistance by applying for participation in their Groundwater Recovery, Seasonal Storage and Local Projects programs. Explore the possibility of MWDSC participation in capital funding participation.

3) Initiate the CEQA process for the entire project.

4) File application for financial aid from State of California in the form of a low-interest loan.

5) Initiate the process to obtain a 25 percent grant from USBR.

6) Develop and implement a local funding plan for the portion of the project not funded by State loan or USBR grant.

7) Acquire rights-of-way or easements for the necessary facilities which include: desalting facility, well sites and pipelines.

8) Initiate design of Phase I facilities and develop a construction phasing plan.

9) Develop and initiate a monitoring and data reporting program that includes: measurement of groundwater levels, metering of pumped water, and groundwater quality sampling programs.

10) Develop a basin management program that includes the evaluation of the monitoring program and integration into the mathematical model to develop a projected annual water balance for the basin each year.

11) Initiate studies to explore the use and integration of reclaimed water into the basin. In particular, explore the use of recharged reclaimed water to increase sustained yield and recharged reclaimed water near the coast to aid in the control of water quality in the Lower San Juan Basin.

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CHAPTER 1

INTRODUCTION

PROJECT PURPOSE

The purpose of this project is to develop a management strategy for groundwaters of the San Juan Basin of Southern Orange County, Figure 1-1. This report presents analyses that provide the basis for operational studies to maximize the use of the basin for potable water supplies. Facilities envisioned include a desalting plant to treat poor to marginal quality groundwater in the lower portion of the basin, new wells to pump groundwaters, recharge facilities for recharging imported water, and pipelines and other ancillary equipment. These facilities would allow the groundwaters of the San Juan Basin to be used as a storage element in the local and regional water supply systems and particularly provide a supplemental supply during periods of drought or emergency.

This project was authorized and funded by the San Juan Basin Authority (SJBA) and the Metropolitan Water District of Southern California (MWDSC). Member agencies of the San Juan Basin Authority are: Capistrano Valley Water District (CVWD), Moulton Niguel Water District (MNWD), Santa Margarita Water District (SMWD) and Trabuco Canyon Water District (TCWD).

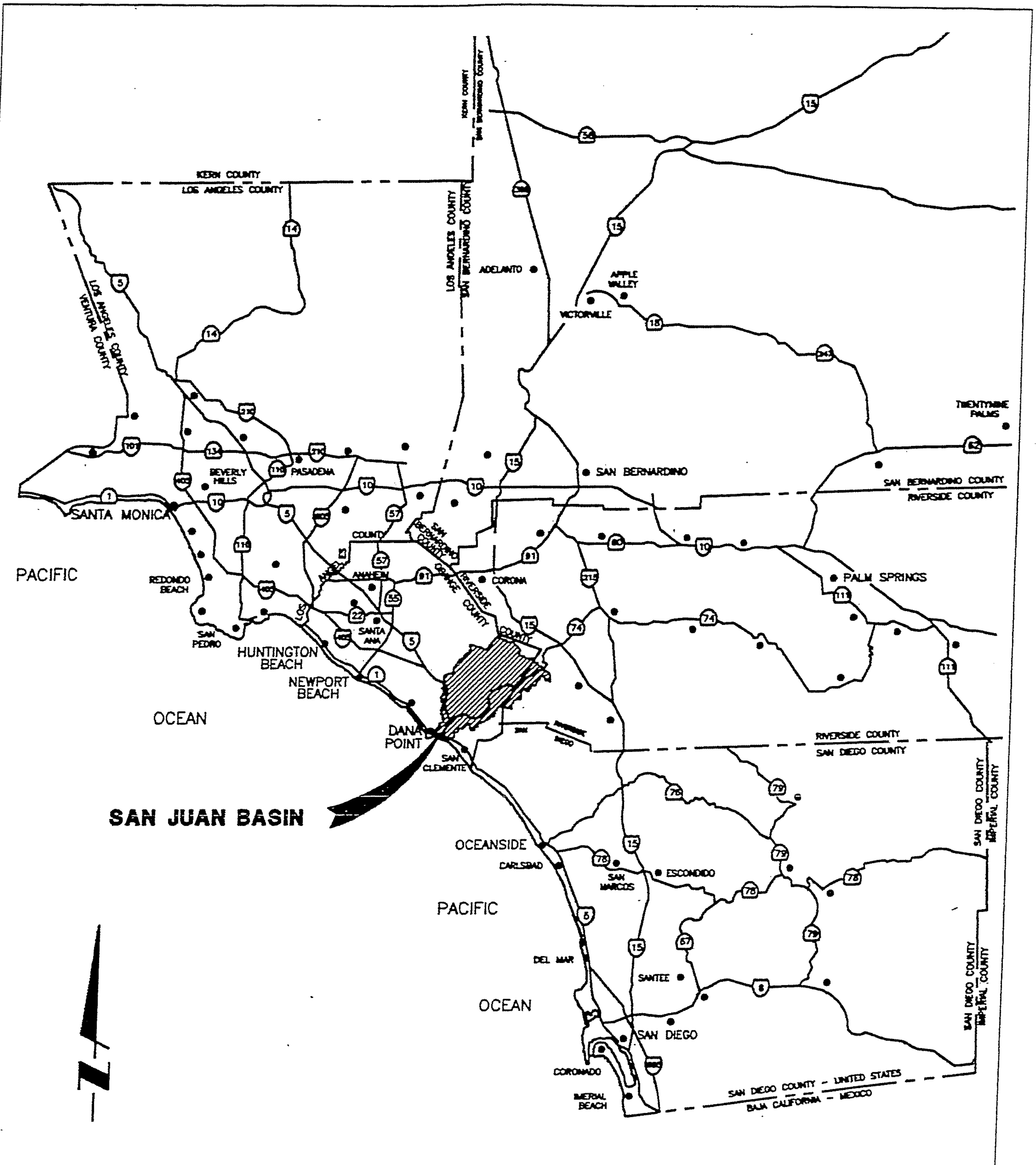
OBJECTIVES

The objective of this study was to mathematically model surface and groundwaters of the San Juan Basin with sufficient accuracy so that model simulations could be conducted to develop a best management strategy. Such a plan would include maximization of groundwater withdrawals of in situ waters, use of the basin for storage of imported MWDSC water, and withdrawals of stored water during times of drought or emergency. Groundwater withdrawals and use of the basin for storage would include the lower portion of the basin near the coast where sediments are the thickest. The groundwater storage is greatest in this part of the basin; however, the water quality is poor to marginal with a TDS in the 2,000 mg/l range. It is envisioned that water quality problems would be dealt with by using a desalting facility to be constructed in the area.

Such studies will provide the basis for conceptual design, the development of cost estimates and a financing plan. Specific objectives are to determine the flow capacity of a desalting plant and estimate the quality of the supply stream, size and location of extraction wells, as well as size and location of potential artificial recharge sites.

PROJECT SCOPE

This project primarily relies on previously published reports and sparse available data on historical hydrologic conditions for the San Juan Basin and its vicinity. However, extensive



San Juan Basin Authority

LOCATION OF
THE SAN JUAN BASIN

NBS LOWRY	SCALE: AS SHOWN	FIGURE 1-1

efforts were undertaken to determine the location of existing and historic wells in the basin. Both historical records, local accounts and field reconnaissance were used to locate wells. Field work was also conducted to locate potential new facilities such as a desalting plant, wells, and recharge facilities.

RELATED INVESTIGATIONS

One of the primary sources of data for this study was the 1972 Department of Water Resources (DWR) Bulletin No. 104-7, "Planned Utilization of Water Resources in the San Juan Creek Basin Area." This report provided sufficient information on geology and hydrologic factors to attempt more detailed studies conducted herein. Because original studies on geology, climate and hydrologic parameters were not conducted as part of the investigation reported herein, the reader is referred to the DWR report for information of this nature.

In 1977, the Jack G. Raub Company published a report prepared for the Mission Viejo Company on "Feasibility Investigation, Restoration of Lower San Juan Creek Basin by Removal of High Salinity Groundwater for Beneficial Use." This report was useful in that it attempted to better reconcile various estimates of the depth of bedrock in the lower portion of the basin, drawing data from a number of sources. One of the main thrusts of the Raub report was to estimate groundwater storage in the lower basin area.

More recently in 1987, Camp Dresser & McKee (CDM) performed studies on the San Juan Basin for the Project Authority to develop management plans to better use the local groundwaters. Their work is reported on in several progress reports and summary reports. The main thrust of their work was to conduct sampling of surface and groundwaters and develop a mathematical model of water quality. The main result from this work is that it was determined that the poor to marginal quality groundwaters in the lower basin area did not originate from point or non-point surface sources. Apparently, poor quality groundwaters are the result of geochemical processes related to dissolution of in situ rock.

CHAPTER 2

GEOHYDROLOGY

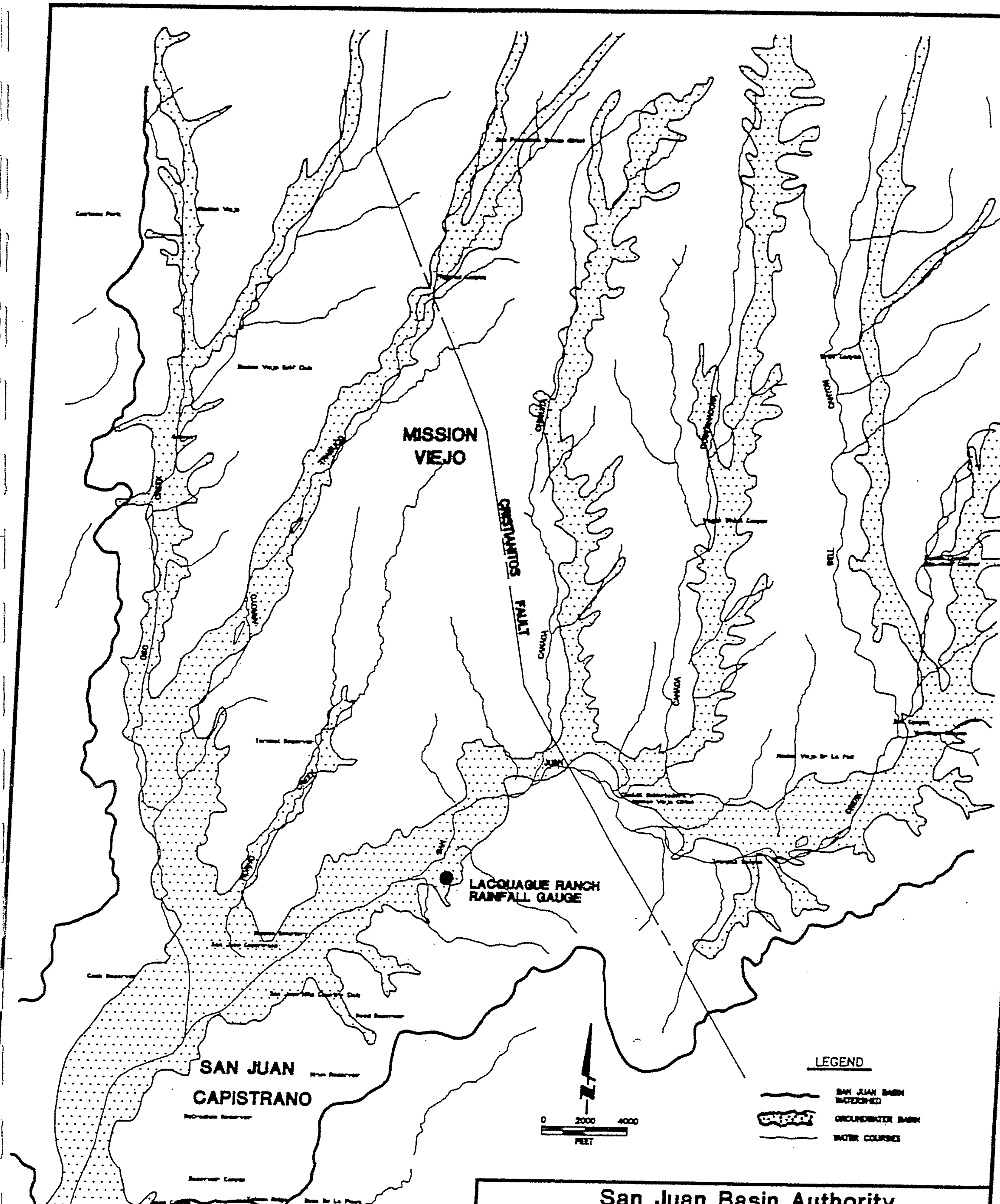
THE GROUNDWATER REGIME

Groundwater exists in generally narrow, shallow alluvial valley fill that has been deposited in the San Juan Canyon area and its tributaries: Trabuco, Oso and numerous other smaller canyons (Figure 2-1). Groundwater in these alluvial fill areas is unconfined. According to the various reports reviewed and discussed previously, the alluvial fill material is underlain by nonwater-bearing Tertiary siltstones, claystones, and sandstones. Alluvial fill ranges from reported depths of 200 feet at the coast to essentially zero at the end of the small alluvial fingers tributary to the main canyons. The widest part of the alluvial fill is about one mile at the confluence of Trabuco and San Juan Creeks. Typical widths in the main canyons are less than one-half mile.

For purposes of the study reported herein, only the main groundwater-bearing alluvial fill was considered: San Juan Canyon from the coast to a point about 11 river miles upstream of the coast and Lower Trabuco Canyon about 2.5 river miles upstream from the confluence with San Juan Creek to the intersection of Oso and Trabuco Canyons (Figure 2-1). The many upstream and tributary fingers of generally shallow alluvium were considered as input elements to the main basins, but were not included in the mathematical model area of the basin.

The major structural feature in the area influencing groundwater movement is the Cristianitos Fault (Figure 2-1), which generally traverses the area in a north-south direction and crosses the San Juan Canyon at a narrows about 3.5 river miles upstream from the confluence of San Juan and Trabuco Creeks. Both previously published reports and the mathematical modeling studies conducted herein indicate that this fault and narrows effectively separate the groundwater alluvium into an upper and lower area. Consequently, a basin designation scheme used by CDM will be employed in this report and the basin areas will be designated as depicted in Figure 2-2. The three basins downstream from the Cristianitos Fault are referred to as the "lower basins."

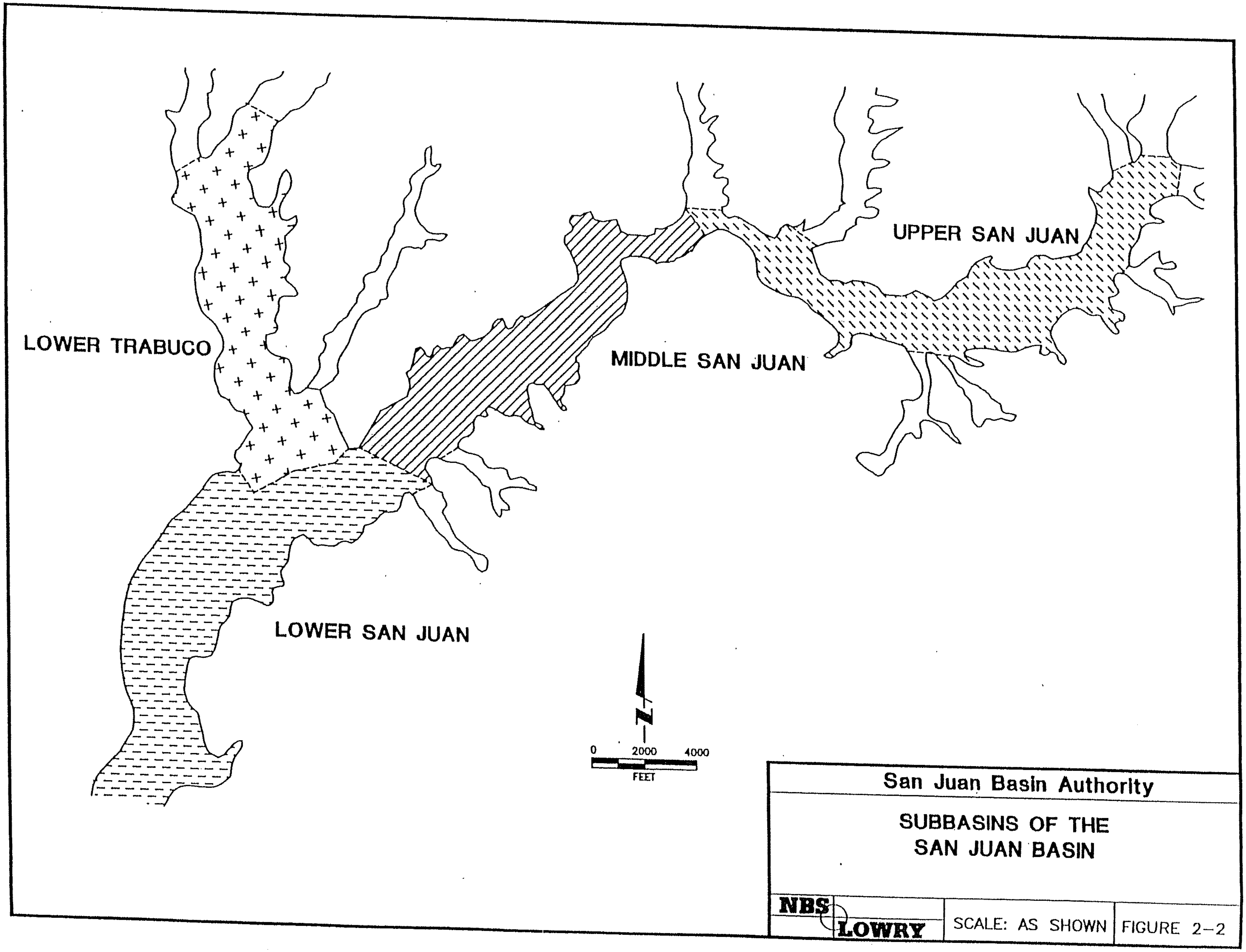
Based upon a review of previous studies and inspection of the area, it is apparent the groundwaters generally flow downslope in the canyons toward the Pacific Ocean. The origin of groundwater in the main subbasins adopted for study is subsurface inflow from tributary alluvial fingers, Figure 2-1, and recharge from streambed, rainfall and (to a lesser extent) applied water percolation. Outflow or discharge from groundwater is subsurface outflow to the ocean, consumption by abundant phreatophytes (that may be seen along most water courses), and extraction by wells. Along many reaches of the San Juan Creek, high groundwater tables intersect the creek bottoms causing seepage to the creek which may subsequently percolate back to the groundwater or flow out to the ocean as streamflow. Estimated mean annual individual components of the hydrologic cycle range from less than a thousand to several thousand acre-feet. Combined groundwater storage capacity in the Upper, Middle and Lower San Juan, and Lower Trabuco subbasins is estimated to be somewhat over 63,000 acre-feet.



San Juan Basin Authority

ALLUVIAL AREAS OF THE SAN JUAN BASIN AND ITS TRIBUTARIES AND OTHER FEATURES

NBS LOWRY | SCALE: AS SHOWN | FIGURE 2-1


LOWER TRABUCO
MIDDLE SAN JUAN
UPPER SAN JUAN
LOWER SAN JUAN
0
2000
4000
FEET
San Juan Basin Authority
SUBBASINS OF THE
SAN JUAN BASIN
NBS
LOWRY
SCALE: AS SHOWN
FIGURE 2-2

GROUNDWATER STORAGE CAPACITY

Groundwater storage capacity for an unconfined aquifer is estimated from the volume of sediments multiplied by the specific yield which is defined as the ratio of water that can be drained by gravity to the total volume of sediments (including mineral soil and pore space). Typical values of specific yield range from 3 percent for clays to 25 percent for medium sands. Values used for specific yield herein were based upon general guidelines published by the U.S. Geological Survey and the various previous reports cited.

The most difficult aspect in estimating groundwater storage capacity in this study was determining the base of the aquifer. The most helpful information for the lower basin was provided by the Raub report. This information was combined with information from the DWR report and other sources to estimate sediment depths. In general, the DWR report was regarded as the most definitive and efforts were made to reconcile estimates developed here with the DWR report.

It should be recognized that the actual effective depth may be more. It is possible that the assumed underlying indurated sedimentary rock may be weathered and fractured, contributing groundwater storage. Detailed geological studies would be required to determine if this is the case.

Table 2-1 presents estimates of groundwater storage capacity for each of the main subbasins. It should be recognized that these estimates assume storage is available between the ground surface and bedrock surface. Obviously, this could not be achieved since it would entail waterlogging building foundations. From a practical standpoint, only the basin sediments 10 to 15 feet below the surface to bedrock could be used for storage.

TABLE 2-1

GROUNDWATER STORAGE CAPACITY OF THE SAN JUAN BASIN

Subbasin	Storage Capacity (ac-ft)
Middle San Juan	9,640
Lower Trabuco	11,940
Lower San Juan	20,020
Lower Basins	41,600
Upper San Juan	21,620
Total	63,220

SELECTION OF STUDY PERIOD

One of the objectives of the hydrologic modeling phase is to determine the sustained (or safe) yield of the San Juan Basin under current conditions. Secondly, it is essential to calibrate the mathematical model over a representative period of record. Both needs can be met by carefully selecting a historical study period. The criteria to accomplish this is to select a recent period where, hopefully, data on historical conditions will be adequate, select a period long enough so meaningful results can be achieved, and select a period that reasonably represents long-term conditions. This latter criteria implies that the mean natural conditions (say precipitation) during the study period selected should equal the long-term mean and that there should be a number of above-normal water supply years and a number of below-normal water supply years.

An accumulated departure from the mean precipitation diagrams is a tool to aid in the selection of a study period. Figure 2-3 was prepared using historical annual precipitation at the Lacouague Ranch gage (Figure 2-1). This figure indicates that from the mid-1940's there has been generally below-normal precipitation to the mid-1970's, from the mid-1970's to the mid-1980's generally above-normal precipitation, and from the mid-1980's to present there have been drought conditions.

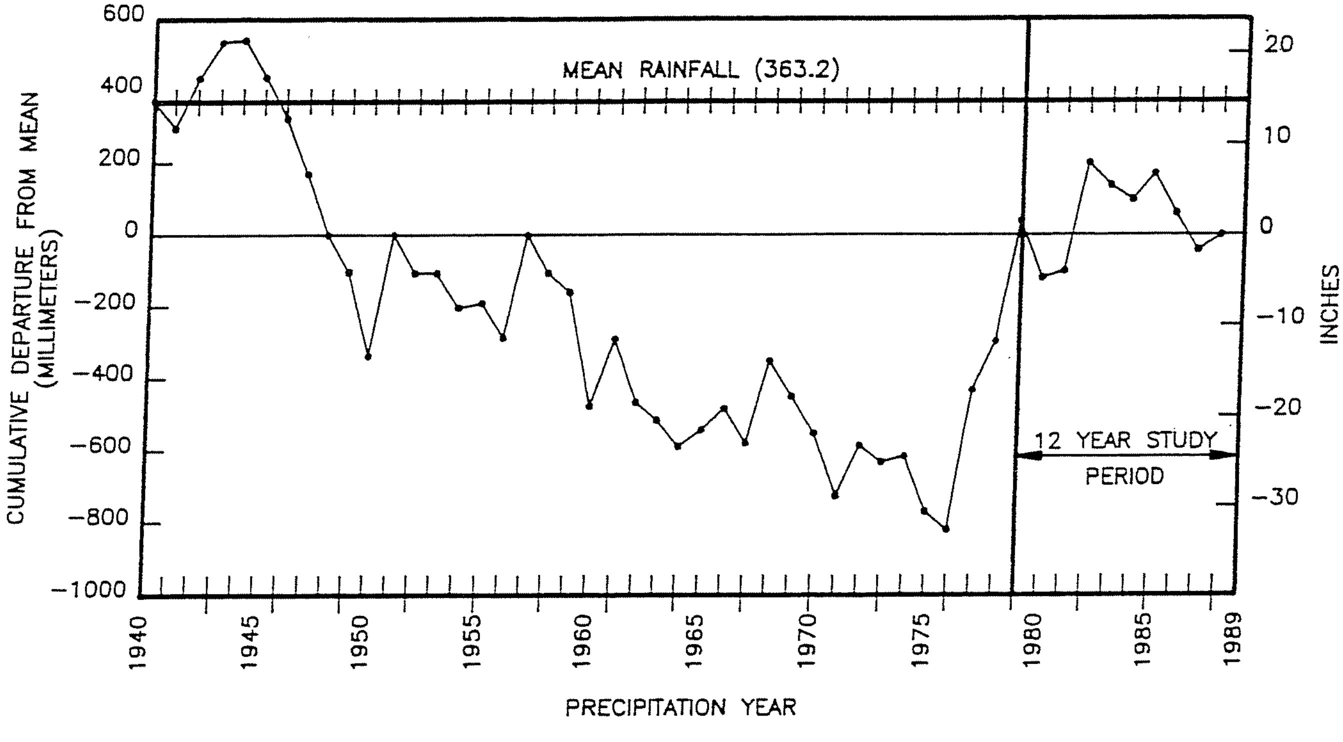
A 12-year study period, 1979-1990, was selected as the study period. This period represents long-term conditions of natural water supply to the San Juan Basin and meets the other criteria for selection of a study period, with perhaps the exception that some important historical data such as pumpage is not available. However, this data is not readily available for any historical period.

ESTIMATED BASIN INPUTS AND OUTPUTS UNDER HISTORICAL CONDITIONS

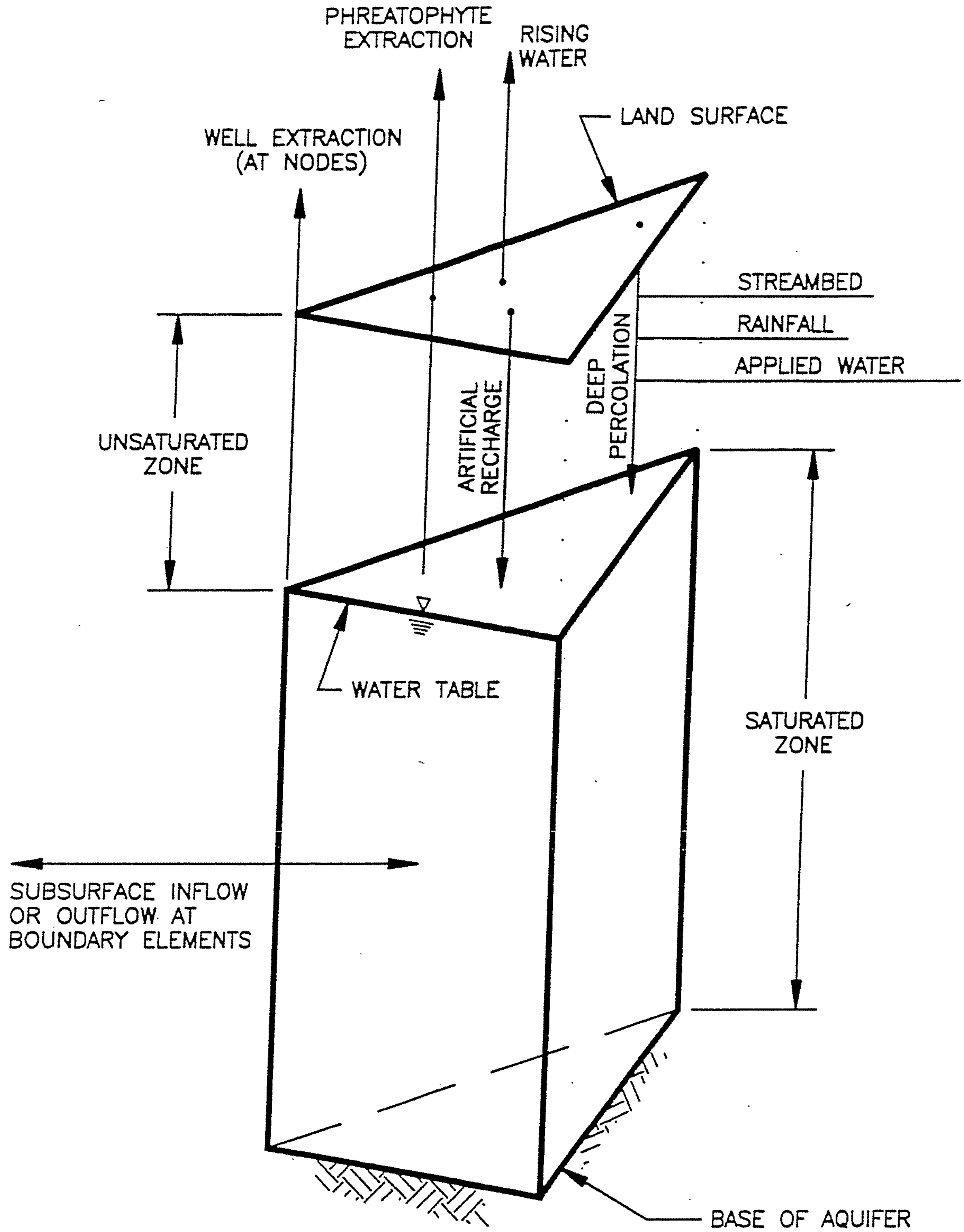
One of the main objectives of this study was to develop a mathematical model of the San Juan Basin groundwater system; consequently, the basin inputs and outputs are evaluated on the basis of the saturated zone as a lumped system. In fact, because of the incompleteness of historic data on inputs and outputs, they were determined in the mathematical modeling calibration and verification phase of this study.

Figure 2-4 depicts the components of recharge (inputs) and discharge (outputs) for the saturated zone of the basin. Recharge consists of streambed percolation in the mainstem streams: San Juan and Trabuco Creeks, rainfall infiltration and deep percolation to the water table, deep percolation of applied water from landscape and agricultural irrigation, and subsurface inflow from tributary alluvial riverbed areas. Figure 2-4 also depicts an artificial recharge component which has not historically occurred. This component is included because artificial recharge is one of the management tools envisioned for the future. Discharges (outputs) from the basin consist of well extractions, extraction by phreatophytes (which are capable of obtaining water from near the water table), and subsurface outflow to the Pacific Ocean. An additional output consists of so-called "rising water" which is a historic term that means seepage to a stream channel when the water table intersects the stream channel.

SAN JUAN BASIN CUMULATIVE DEPARTURE FROM MEAN PRECIPITATION, LOCOUAGUE RANCH GAUGE



San Juan Basin Authority		
SAN JUAN BASIN CUMULATIVE DEPARTURE FROM MEAN PRECIPITATION, LACOUAGUE RANCH GAUGE		
NBS LOWRY	SCALE: AS SHOWN	FIGURE 2–3



San Juan Basin Authority

SCHEMATIC DEPICTION OF ELEMENT INPUTS AND OUTPUTS OF THE SAN JUAN BASIN

NBS LOWRY | SCALE: AS SHOWN | FIGURE 2–4

TABLE 2-2

PARAMETERS USED TO ESTIMATE COMPONENTS OF THE HYDROLOGIC CYCLE FOR THE SAN JUAN BASIN

Parameter	Value
Residential Landscape Applied Water Duty	2.5 ft./yr.
Agricultural Applied Water Duty	3.0 ft/yr.
Precipitation Percolation Factor	0.17
Pan Evapotranspiration (ET) Factor	0.70
Applied Water Leaching Fraction	0.15
Hydraulic Conductivity (K)	
Ocean Outflow	1.5 ft./hr.
Subsurface Inflow	5.2 ft./hr

In the case of the San Juan Creek, this condition has historically occurred from time to time in several river reaches in the basin.

Estimates of input and output for natural hydrologic components were based upon a rainfall index station and estimated pan evaporation (Appendix A). Percolation of rainfall was estimated by using annual historical rainfall for the Lacouague Ranch gage and multiplying by a constant infiltration factor, Table 2-2. Streambed percolation was estimated by first estimating stream inflow at the basin boundaries using a lumped stream model that used synthetic rainfall versus streamflow relationships developed from gaged watersheds in the vicinity of the San Juan Basin. This model will be subsequently described. To develop baseline model calibration data, it was assumed that stream inflow was primarily from precipitation with little or no contribution from urban applied water runoff originating from imported potable water. Streambed percolation was estimated from the following function:

$$Q = 0.30\, Q_S \text{ , if } 0 \leq Q_S \leq 17{,}404$$

$$Q = 20.9\, Q_s^{0.556} \text{, if } Q_S > 17{,}404$$

where Q_S is streamflow at the basin boundary in cubic feet/hour.

This function was determined by calibration and information presented in the DWR report. Subsurface inflow was estimated by using the lumped streamflow model referred to above and estimating the water table elevation adjacent to the main groundwater basin. Using simulated water surface elevations in the basin to compute water table gradients, Darcy's Law was used to estimate subsurface inflow as follows:

$$Q = A \cdot K \cdot grad\, H$$

where H is the water surface elevation, A is the cross-sectional area, and K is the hydraulic conductivity (Table 2-2), sometimes called permeability.

Man-influenced recharge of applied water was estimated by an applied water duty for agricultural irrigation and irrigation of parks, lawns, and other open irrigated space in developed areas. Aerial photos were used to determine land use acreage, and typical duty factors were used with a leaching factor to determine percolation of applied water (Table 2-2). Land use was considered static during the study period.

Outflow (discharge) consists of three natural components: subsurface outflow, phreatophyte extraction, and rising water; and one man-influenced component: well extraction. Subsurface outflow was estimated by Darcy's Law (above) using simulated water table elevations in the basin adjacent to the coast and sea level to estimate gradients. Phreatophyte extraction was estimated by a modified Hargraves approach

$$Q = A \cdot f \cdot E$$

where A is the area of phreatophytes estimated from aerial photos and field reconnaissance, E is pan evaporation, and f is an evapotranspiration (ET) factor (Table 2-2). Rising water was determined in the mathematical modeling phase by keeping track of areas where simulated water tables intersected the ground surface.

Extractions by wells were difficult to estimate because historic records are incomplete or unavailable. Through field reconnaissance and anecdotal information, extraction wells were identified (pocket map). In consultation with SJBA member agencies, particularly the Capistrano Valley Water District, approximate annual pumping rates were determined for each active well. These estimates are shown in Table 2-3, and they are assumed to be constant for the 12-year study period. In the model, these pumpage values are considered maximum since in several areas of the basin wells are known to run dry during the summer months. A feature is included in the model to discontinue pumpage if the model simulates water tables that reach bedrock. Pumpage values were distributed to the closest nodes in the model.

Estimated inputs and outputs for the San Juan Basin for the period 1979-90 are tabulated in Table 2-4. Streambed percolation is based upon estimated surface inflows that are based upon precipitation runoff and do not include future inflows from landscape irrigation. Estimates in Table 2-4 are based upon historic land use in the tributary watersheds and it was assumed that contributions from landscape return flows were negligible.

The main components of the hydrologic cycle tabulated in Table 2-4 are subsurface inflow from the various alluvial tributaries along the northern flank of the main basin and groundwater pumpage in the main basin. Percolation of applied water from landscape irrigation in the main basin and extraction by phreatophytes were assumed constant for the 12-year study period although both varied by a small amount due to land use changes and annual climatic fluctuations. It will be noticed that rising water in the San Juan River averaged about 0.6 cfs, which is in the

TABLE 2-3

SAN JUAN BASIN
ESTIMATED GROUNDWATER PUMPAGE, 1979-90

Basin Division	Average Annual Pumpage (ac-ft/yr)	Description
Upper SJB	600	Oda Nursery
Upper SJB	50	Sand and Gravel
Upper SJB	237	Others, Including: Misc. Ag Sea Tree Nursery Tree of Life Nursery
Middle SJB	200	Others, Including: D&M Nursery Valley Crest Nursery Capistrano City of San Juan Capistrano
Middle SJB	600	CVWD #5
Middle SJB	450	San Juan Hills Country Club
Lower SJB	120	Rancho Los Cerritos
Lower SJB	150	City of San Juan Capistrano/ Kinoshita
Lower SJB	100	Vermuellen
Lower SJB	500	CBCWD
Lower Trabuco	600	CVWD Rosenbaum #1
Lower Trabuco	600	CVWD Rosenbaum #2
Lower Trabuco	250	City of San Juan Capistrano/ Misc. Ag
Lower Trabuco	87	Other Misc.
Lower Trabuco	800	CVWD Marbella
Lower Trabuco	300	CVWD Hollywood #2A
Total Estimated Pumpage	**5,644**	

Sources:
1. CDM, Groundwater Quality, TDS, Task 6, Sept. 19, 1987 and Task 7, Nov. 19, 1987
2. NBS/Lowry, Nichols Institute Report, Feb. 1990
3. Capistrano Valley Water District
4. Santa Margarita Water District
5. Individual pumpers

TABLE 2-4

ESTIMATED INPUTS AND OUTPUTS FOR THE SATURATED ZONE OF THE SAN JUAN BASIN, 1979-90 (ACRE-FEET)

Year	Percolation of Precipitation	Percolation of Applied Water	Streambed Percolation	Subsurface Inflow	Total Input	Rising Water	Pumpage	Phreatophyte Extraction	Ocean Outflow	Total Output	Net Input
1979	1295.	934.	811.	1038.	4078.	2239.	5644.	417.	393.	8693.	-4615.
1980	1816.	934.	3407.	1941.	8098.	1106.	5644.	417.	977.	8144.	-46.
1981	459.	934.	318.	2118.	3829.	488.	5644.	417.	827.	7376.	-3547.
1982	942.	934.	632.	2300.	4808.	300.	5644.	417.	812.	7173.	-2365.
1983	1715.	934.	2579.	2350.	7578.	507.	5644.	417.	934.	7502.	+76.
1984	729.	934.	490.	2401.	4554.	209.	5644.	417.	832.	7102.	-2548.
1985	833.	934.	568.	2451.	4786.	101.	5644.	417.	801.	6963.	-2177.
1986	1047.	934.	729.	2467.	5177.	63.	5644.	417.	801.	6925.	-1748.
1987	645.	934.	399.	2468.	4446.	16.	5644.	417.	727.	6804.	-2358.
1988	597.	934.	361.	2452.	4344.	0.	5644.	417.	625.	6686.	-2342.
1989	983.	934.	634.	2469.	5020.	0.	5605.	417.	590.	6612.	-1592.
1990	1000.	934.	634.	2494.	5062.	0.	5404.	417.	557.	6378.	-1316.
Mean	1005.	934.	963.	2246.	5148.	419.	5621.	417.	740.	7197.	-2049.

range of historically observed flows. It will also be noticed that the basin was overdrafted by an average of about 2,000 acre-feet per year.

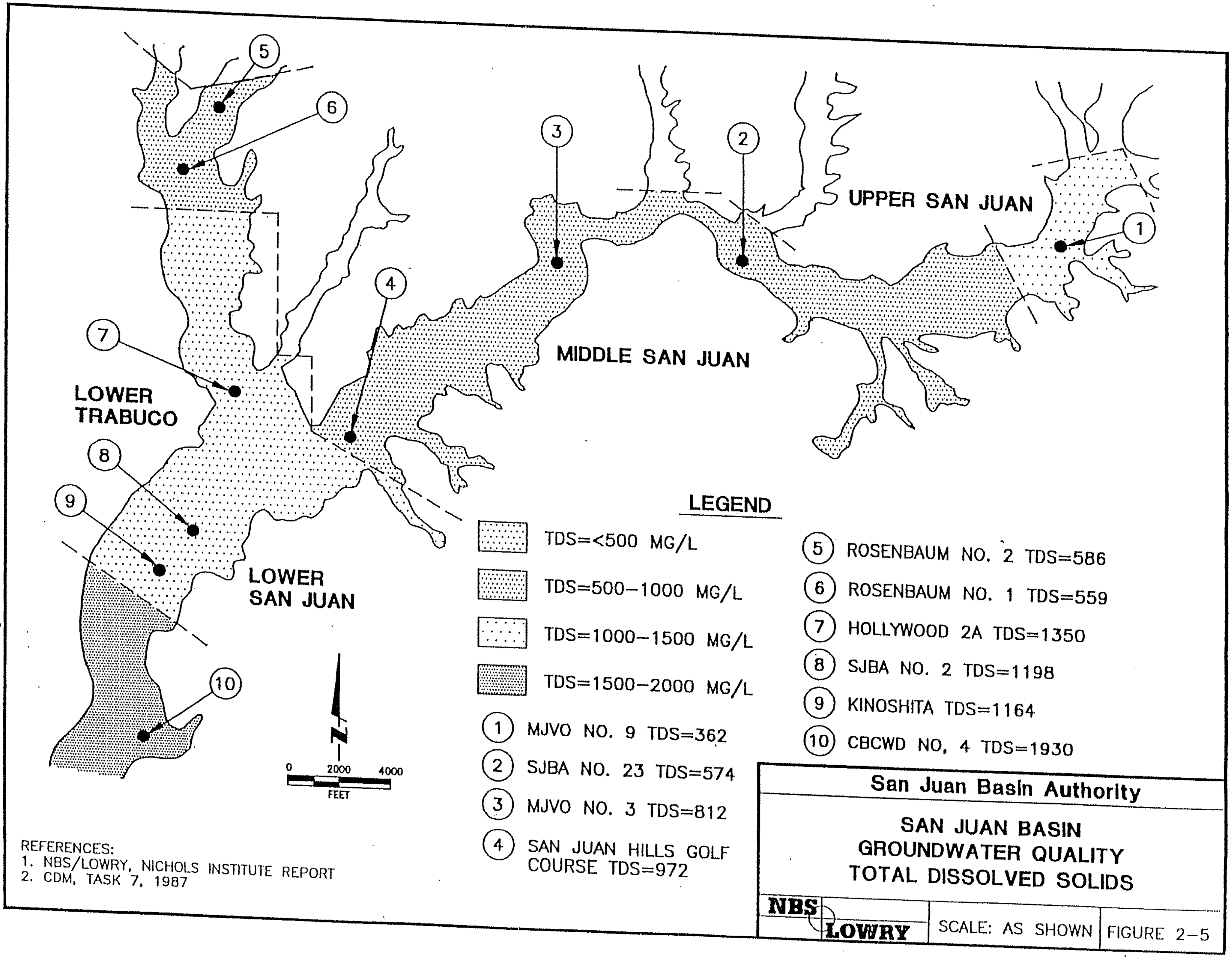
There is a moderate level of uncertainty associated with estimates of the various components of the hydrologic cycle for the San Juan Basin. As noted above, pumpage data is very uncertain. As will subsequently be described in the model calibration phase, every effort was made to refine estimated inflows and outflows to achieve as much accuracy as possible. Nevertheless, it is prudent to observe that the coefficient of variation of estimated sustained yield may be relatively high, perhaps as much as 50 percent. Consequently, assuming no rising water, no contribution from landscape return flows in the tributary watershed, and subsurface outflow to the sea is nil, there is a high level of confidence that sustained yield is between 2,200 and 6,600 acre-feet per year for historical cultural conditions.

WATER QUALITY

There apparently is little recent data on groundwater quality in the San Juan Basin. The most recent historical data available is summarized in the 1987 CDM report which contains some historical data prior to 1965 and groundwater quality data for 1987. According to this report groundwaters in the general San Juan Basin area had the following ranges in 1987:

	mg/l			
Subbasin	TDS	SO_4	Iron	Mn
Lower San Juan	1500 - 2000	500 - 750	> 2.0	0.5 - 1.5
Lower Trabuco	1000 - 1500	250 - 500	0 - 0.3	0 - 0.05
Middle San Juan	500 - 1000	250 - 500	0.3 - 2.0	0.5 - 1.5
Upper San Juan	0 - 500	0 - 250	0 - 0.3	0 - 0.05

General water quality is depicted in Figure 2-5.



San Juan Basin Authority

SAN JUAN BASIN GROUNDWATER QUALITY TOTAL DISSOLVED SOLIDS

FIGURE 2-5

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CHAPTER 3

MATHEMATICAL MODELS

THEORETICAL BASIS

Flow Equation

A two-dimensional model of the unconfined aquifer system of the San Juan Basin was developed by assuming groundwater flows in a horizontal plane relative to the earth's surface. The vertical direction in the saturated zone is regarded as an integrated average wherein vertical velocity components are assumed to be zero.

The model is based upon the two-dimensional continuity equation and Darcy's Law as follows:

$$\frac{\partial}{\partial x}(K_x h\,\partial H/\partial x) + \frac{\partial}{\partial y}(K_y h\,\partial H/\partial y) = S_y\frac{\partial H}{\partial t} + Q_A$$

where x and y are coordinates in the horizontal plane tangent to the earth's surface, t is time, h is saturated thickness, H is elevation of water table, Q_A is a sink such as pumping, K_x and K_y are hydraulic conductivity in the x and y directions, respectively, and S_y is the specific yield. In this case it was assumed that K_x equals K_y.

The above equation assumes the basin materials are nondeformable. It is assumed that basin materials are locally homogeneous relative to specific yield. As discussed in the previous chapter, some inputs and outputs, i.e. sources or sinks, occur at the basin surface (an example being percolation of rainfall). It is assumed that these quantities flow through the intervening unsaturated zone in a short period of time and equal the Q_A term which applies to the saturated zone.

To solve the above flow equation, initial and boundary conditions are required. Initial conditions consist of known or assumed water table elevations at the beginning of a specified study period. Boundary conditions are of three types: no-flow along the flanks of the basin, specified water table elevations at the coast (i.e. zero elevation), and estimated subsurface inflow from tributary narrow fingers of alluvium. This latter boundary condition required a separate model linked to the basin model since this boundary condition is nonlinear.

Water Quality Model

The transport of dissolved salts in the saturated zone is governed by the complete mass transport equation which includes: advection, dispersion, mass accumulation, sorption, and geochemical dissolution. There is some speculation that high TDS in the lower portions of the San Juan Basin may be partly caused by dissolution of in situ rock. These processes proceed over long periods of time and can be ignored where changes in storage in the basin are relatively rapid, as they are in the various management alternatives investigated in this report.

The water quality model used to simulate groundwater quality is based upon a conservative nonreacting species (e.g., TDS), advection and mass accumulation. Dispersion is ignored since it is assumed to be negligible compared to the dominant advection processes. Thus, the mass transport equation is simplified to the two-dimensional model:

$$\frac{\partial C}{\partial t} + \frac{\partial (V_x C)}{\partial x} + \frac{\partial (V_y C)}{\partial y} + Q_s = 0$$

where C is concentration expressed as mg/l (ppm), V_x and V_y are velocity flux in the horizontal directions x and y, respectively, Q_s is a source/sink term (such as dissolved salts in percolating water), and t is time.

NUMERICAL MODELS

Main Basin Flow Model

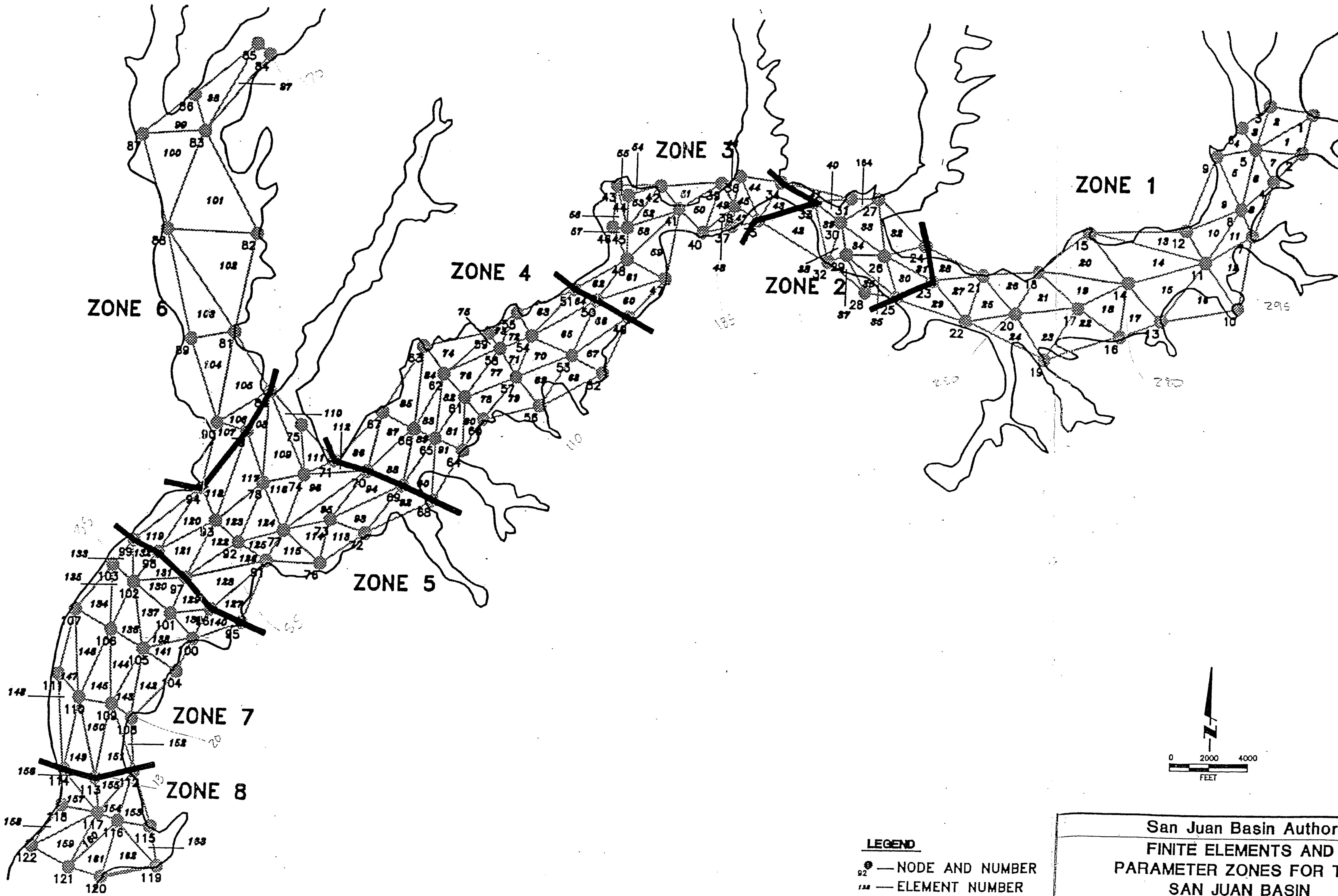
The basin flow equation can not be analytically solved because of the complicated nature of the basin and its boundary conditions. Consequently a numerical analog must be developed for the flow equation. Secondly, because of the nonlinear nature of the subsurface inflow boundary conditions from the upper basins, a second numerical model is required. Both will be described in this section.

The basin numerical model analog was developed by the finite element method. The basin is discretized, in this case, into triangular elements and the state variable, water surface elevation, is assumed to be a linear plane in each element. Following appropriate mathematical manipulation the flow equation is reduced to a system of linear ordinary equations that can be solved on the computer. The resulting equation is as follows:

$$\underline{S}\,\{H\} + \underline{P}\,\{\overset{\circ}{H}\} = \{F\}$$

where $\underline{S}$ is a symmetric matrix representing the hydraulic conductivity and geometry of the basin, $\underline{P}$ is a symmetric matrix representing the specific yield of the basin, $\{F\}$ is a load vector incorporating sources and sinks and boundary conditions, $\{H\}$ is a vector of unknown water surface elevations, and $\{\overset{\circ}{H}\}$ is the temporal vector of unknown water surface elevations. The temporal part of the above finite element equation is solved by the Crank-Nicolson method.

To apply the numerical model, the San Juan Basin was divided into 163 triangular elements and 122 nodes (vertices of triangular elements), Figure 3-1. As can be seen the boundary of the basin is approximated by straight lines. Elements were drawn with respect to land use, location of stream channels (primarily the San Juan Creek), and other features. Nodes 1, 2, 3, 27, 34, 36, 71, 75, 80, 84, 85 and 87 represent subsurface inflow conditions and Nodes 119 through 122 represent a fixed head boundary condition. All other boundary nodes are no-flow boundary conditions.



San Juan Basin Authority

FINITE ELEMENTS AND PARAMETER ZONES FOR THE SAN JUAN BASIN MATHEMATICAL MODEL

NBS LOWRY | SCALE: AS SHOWN | FIGURE 3-1

Figure 2-4 depicts the source-sink components for each element. Source-sink terms were estimated as previously described.

To specify basin hydraulic parameters, eight subregions were identified as shown in Figure 3-1. The model permits variable hydraulic conductivity and specific yield parameters which must be specified for each zone. Table 3-1 presents calibrated hydraulic conductivity, specific yield, and porosity for each zone.

Tributaries Model

To estimate subsurface inflow from the upper basins, a special numerical model based upon a lumped parameter cascaded cell approach was developed. Figure 3-2 depicts the structure of this model and the hydrologic components included in the model. The lumped parameter model is based on a water budget concept. The region is divided into several model reaches. Model reaches are cascaded by equating inflow to the subsequent reach with the computed outflow from the adjacent upstream reach. The surface water hydrologic balance for a reach i over a time step of δt is as follows:

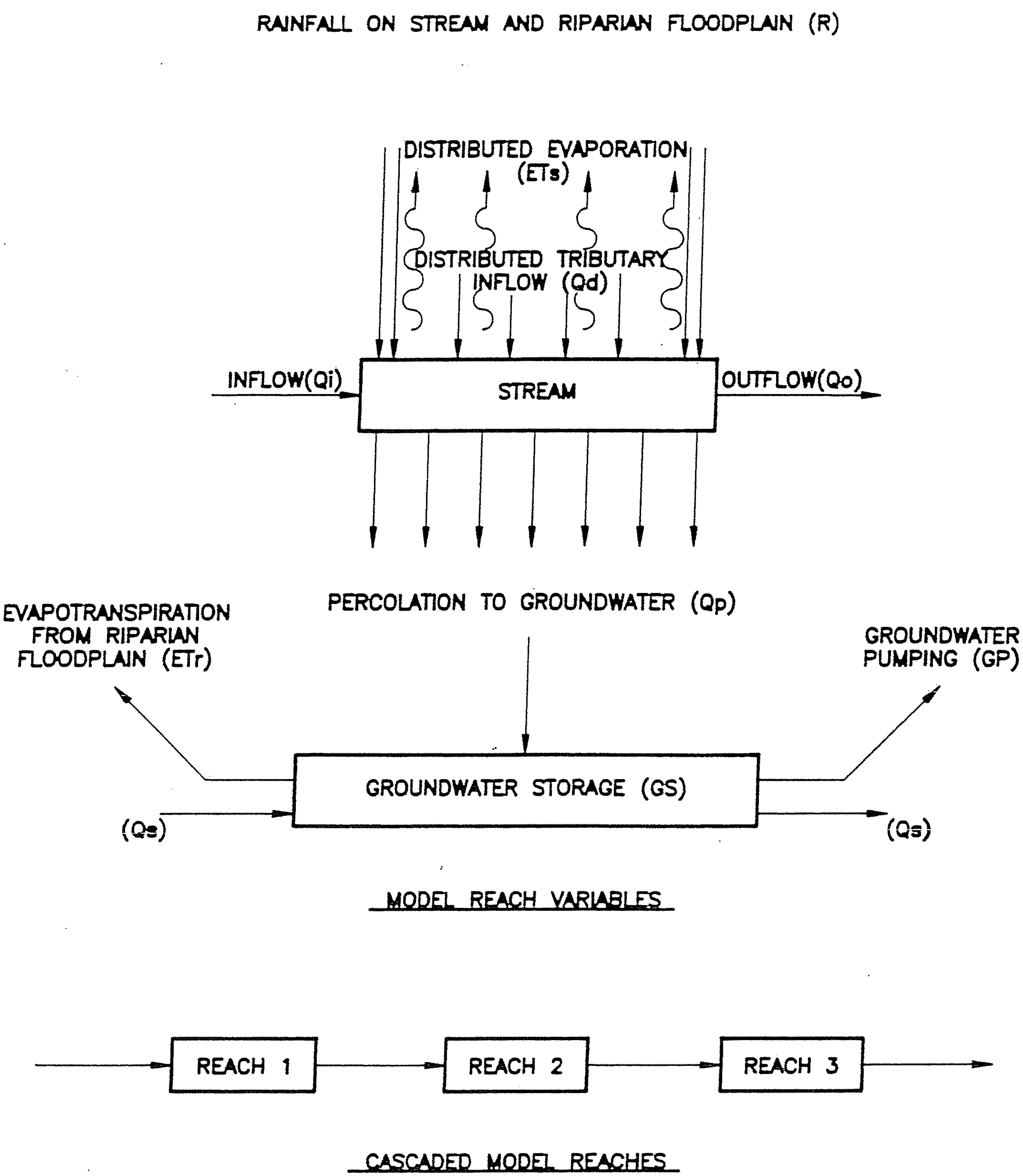
$$ {}^{i}_{n}Q_{I} + {}^{i}_{n}R + {}^{i}_{n}Q_{T} + {}^{i}_{n}Q_{D} - {}^{i}_{n}ET_{S} - {}^{i}_{n}Q_{O} - {}^{i}_{n}Q_{P} = 0 $$

This equation is coupled with the groundwater hydrologic balance equation for each reach through the term ${}^{i}_{n}Q_{P}$ as follows:

$$ {}^{i}_{n}Q_{S} + {}^{i}_{n}Q_{P} - {}^{i}_{n}ET_{R} - {}^{i}_{n}GP - {}^{i}_{n}\delta GS = 0 $$

where ${}^{i}_{n}Q_{I}$ is the inflow, ${}^{i}_{n}R$ is the rainfall, ${}^{i}_{n}Q_{T}$ is the point tributary inflow, ${}^{i}_{n}Q_{D}$ is the distributed tributary inflow, ${}^{i}_{n}ET_{S}$ is the distributed evaporation, ${}^{i}_{n}Q_{O}$ is the outflow, ${}^{i}_{n}Q_{P}$ is the percolation to groundwater, ${}^{i}_{n}Q_{S}$ is the subsurface linkage between reaches, ${}^{i}_{n}ET_{R}$ is the evapotranspiration from the riparian floodplain, ${}^{i}_{n}GP$ is the groundwater pumping and ${}^{i}_{n}\delta GS$ is the change in groundwater storage for each i at time t^{n}. In general, these equations may require additional or less variables; i.e. the hydrologic balance equations are individualized for specific river basins.

Seepage or springs which may contribute to baseflow are included in the estimates of distributed tributary inflow, Q_D. Point tributary inflow Q_T from large ungaged tributary watersheds or from distributed tributary inflow was estimated from rainfall-runoff relationships developed for several gaged watersheds in the general region of the study basin. Based on isohyetal lines available and a consideration of topography, "foothill" and "mountain" area, rainfall-runoff relationships were developed relating the annual precipitation at a point close to or in the basin, the watershed area, and the annual runoff.



San Juan Basin Authority

LUMPED PARAMETER MODEL

NBS LOWRY | SCALE: AS SHOWN | FIGURE 3-2

TABLE 3-1

HYDRAULIC PARAMETERS USED FOR THE CALIBRATED SAN JUAN BASIN MODEL

Parameter Zone[a]	Hydraulic Conductivity (ft/day)	Specific Yield	Porosity
1	125	0.18	0.3
2	100	0.18	0.3
3	125	0.13	0.3
4	100	0.13	0.3
5	60	0.12	0.3
6	70	0.13	0.3
7	48	0.10	0.3
8	36	0.10	0.3

a) See Figure 3-1.

Evaporation from the stream, ET_S, and evapotranspiration from adjacent riparian areas, ET_R, are estimated from pan evaporation data as follows:

$$ET_S = f \cdot E \cdot L \cdot b$$

and

$$ET_R = f \cdot E \cdot L \cdot (b_o - b) \cdot C \cdot (GS/GS_o)$$

where f is the pan evaporation coefficient, assumed equal to 0.7 in our case, E is the pan evaporation, b is the average stream reach width, L is the reach length, b_o is the average reach total width of floodplain and riparian area, C is the percent of the reach's riparian area covered by vegetation, GS is the amount of groundwater in storage, and GS_o is the maximum groundwater storage capacity for a specific reach.

Average stream widths, b, and other flow characteristics are determined from regime equations as follows:

$$b = a_1 Q^k,$$

$$y = a_2 Q^l,$$

$$v = a_3 Q^m,$$

where

$$k + l + m = 1,$$

$$a_1 \cdot a_2 \cdot a_3 = 1,$$

where y is the stream average depth in feet, and v is the stream average flow velocity in feet per second. The flowrate Q in cubic feet per second is the sum of all the input discharges minus any diversions, such that

$$Q = Q_I + Q_T + Q_D$$

Some constraints on the application of these equations are imposed, based upon the observed regime and bed material of the stream under study. This was done by requiring that streamflow conditions could not exceed selected Froude numbers.

Groundwater storage is updated every time step according to

$$^{i}_{n+1}GS = {}^{i}_{n}GS + {}^{i}_{n+1}\delta GS$$

as long as $^{i}_{n+1}GS \leq {}^{i}GS_O$. When the maximum groundwater storage is exceeded, percolation is assumed to be zero. Groundwater depth can easily be determined knowing the effective surface area of the groundwater reach.

This modeling approach was applied to alluvial areas tributary to the main San Juan Basin which are: Arroyo Trabuco, Canada Chiquita, Canada Gubernadora, Bell Canyon, and San Juan Creek. These tributary areas were considered to have significant surface and subsurface flows which are inputs to the main San Juan Basin. Other tributary areas such as Oso Creek, Horno Creek, and Verdugo Canyon were assumed to contribute negligible amounts of subsurface inflow; however, they would contribute measurable surface inflows. Surface inflows were estimated from rainfall-area relationships described above. All surface inflows were routed through the main basin to estimate streambed percolation as was previously described.

Water Quality Model

The water quality model is solved by integrated finite differences where it assumes that concentration is averaged over the vertical profile (i.e., sediments in the basin are thin relative to basin aerial dimensions). Because some nodes dry out due to excessive pumpage, a special algorithm was required to accommodate this problem. The model is integrated into the flow model described previously and uses the same basin grid system. The strength of the water quality model is its ability to estimate differences in groundwater quality resulting from alternative management strategies.

APPLICATION AND CALIBRATION OF MODEL

Water Quantity

To apply the model to the San Juan Basin, annual estimates of surface inputs and outputs to the saturated zone are made (i.e., excluding subsurface inflows and outflows). These estimates are then distributed to each month of the year by using average monthly distributions (Table 3-2). Rainfall distributions were used to estimate monthly streamflow and hence monthly streambed percolation and monthly percolation of rainfall. Monthly pan evaporation was used to estimate monthly percolation of applied water, monthly extraction by phreatophytes and monthly extraction from wells. The numerical solution time-step was one month. As was described previously, subsurface inflows and outflows were internally computed for this same time-step.

TABLE 3-2

AVERAGE MONTHLY DISTRIBUTION OF RAINFALL AND PAN EVAPORATION FOR THE SAN JUAN BASIN

Month	Rainfall	Pan Evaporation
Jan	19.6	3.7
Feb	17.4	3.6
Mar	16.8	6.4
Apr	8.4	8.4
May	2.1	10.6
Jun	0.3	13.3
Jul	0.0	15.2
Aug	0.8	13.4
Sep	1.9	9.7
Oct	3.1	7.8
Nov	14.2	4.7
Dec	15.4	3.2

The model was applied to the 12-year study period, 1979-90, to attempt the best calibration possible in view of uncertain data on pumpage. In addition to the problem associated with lack of data on pumpage, there is very little data on groundwater levels. The usual way to calibrate a mathematical model is to simulate water levels over a historical period and compare simulated results with measured water levels. Unfortunately, water level data is available for only one year, 1987, during the study period. Consequently, a great deal of reliance had to be placed upon judgement and the analysis presented in the 1972 DWR report on the San Juan Basin. Calibration consisted of first estimating inputs and outputs to the basin, assigning hydraulic conductivity and specific yield to each element of the model, and estimating geometric factors such as bedrock elevation. Simulated results were evaluated and parameters in the various components of the model were adjusted to perform additional simulations. After numerous such trials the model was considered calibrated.

Table 2-3 lists the annual calibrated inputs and outputs to the basin as was described previously. Figures 3-3, 3-4 and 3-5 show simulated water levels at various nodes throughout the basin. The dashed lines in these figures depict the one water level observation available for 1987.

During the calibration phase, it was apparent that the San Juan Basin acts as two separate basins, an upper basin and a lower basin. There is a definite geological constriction below the confluence of the San Juan Creek and Canada Chiquita which tends to constrict subsurface flow to the lower basins. The Cristianitos Fault crosses San Juan Creek in this area, and this fault in conjunction with a constriction of the canyon separates the San Juan Basin into the Upper San Juan Basin and the lower basins consisting of the Middle San Juan, Lower San Juan, and Lower Trabuco Basins.

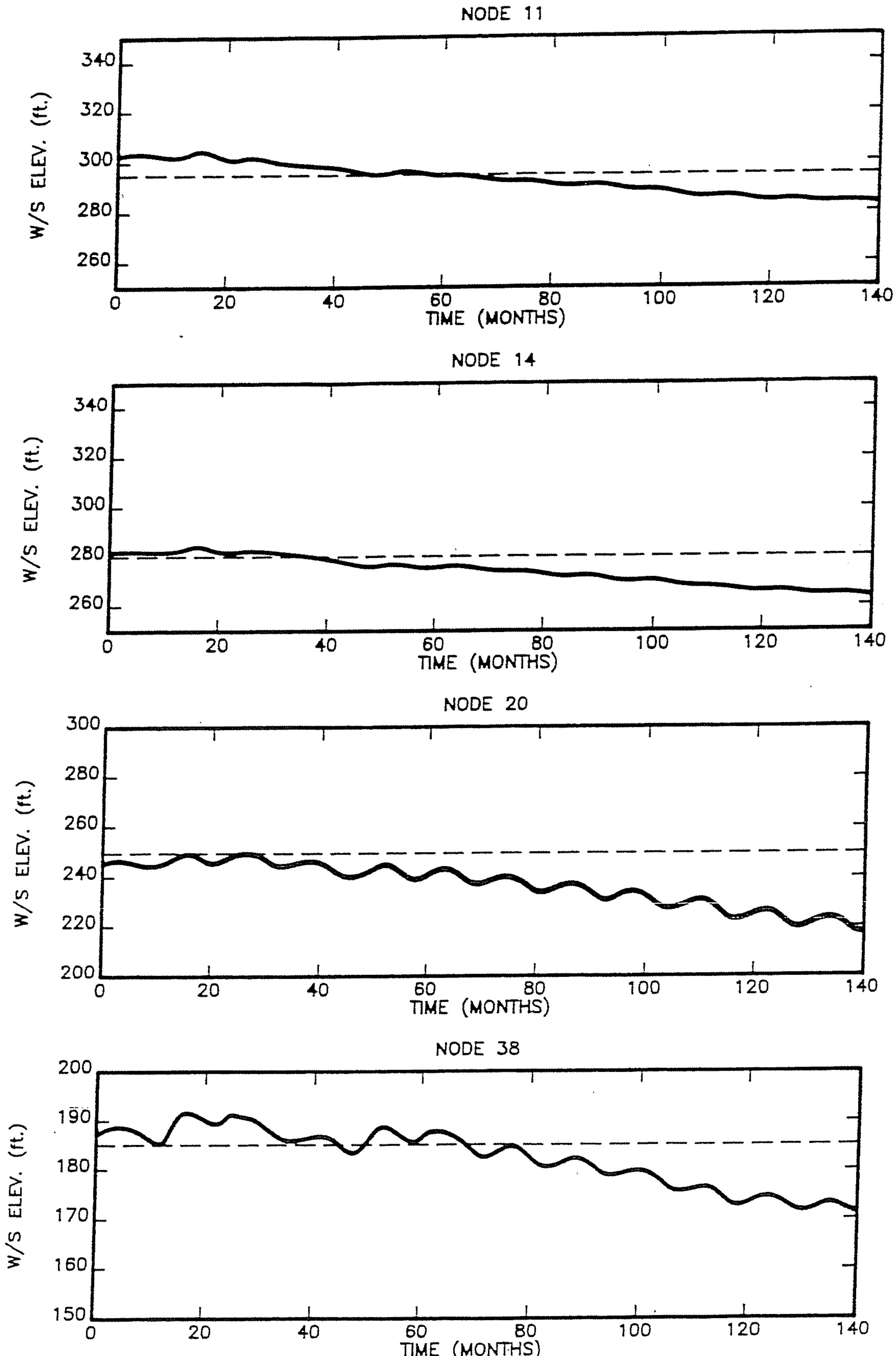
As was previously mentioned, the level of confidence for estimated inputs and outputs is moderate at best. However, the main power of mathematical modeling is not so much the ability to precisely predict a groundwater systems state at a particular time, but the ability to predict derivatives due to management changes. That is, what are the differences in behavior of the system between various management strategies? It is believed that the model has been sufficiently calibrated so that there is a good level of confidence in evaluating management scenarios.

Water Quality

Water quality simulations were carried out in parallel with the above described water quantity simulations. Tributary TDS input estimates were provided by Nolte and Associates and are shown in Table 3-3. As can be seen, current TDS values, which are assumed to represent historical conditions, are divided into storm and non-storm values. Non-storm TDS are assumed to represent baseflow and groundwater inflow which the tributaries model estimates. Stormflows are also estimated in the tributaries model. Precipitation percolation on the main basin was assumed to have a TDS of zero, and percolation of applied water and recharge was assumed to have a TDS of 800 mg/l. Sensitivity analysis of this last figure indicates there was little difference between a TDS of 600 and 800 mg/l on simulation results.

Table 3-4 compares historical and simulated groundwater quality at selected nodes in the mathematical model. As can be seen, simulated results are similar to historical sparse data that was previously described.

Simulation of both groundwater levels and groundwater quality aided in calibrating the model since one would act as a constraint to the other. Thus, choices in varying parameters and boundary conditions were limited, improving the calibration.



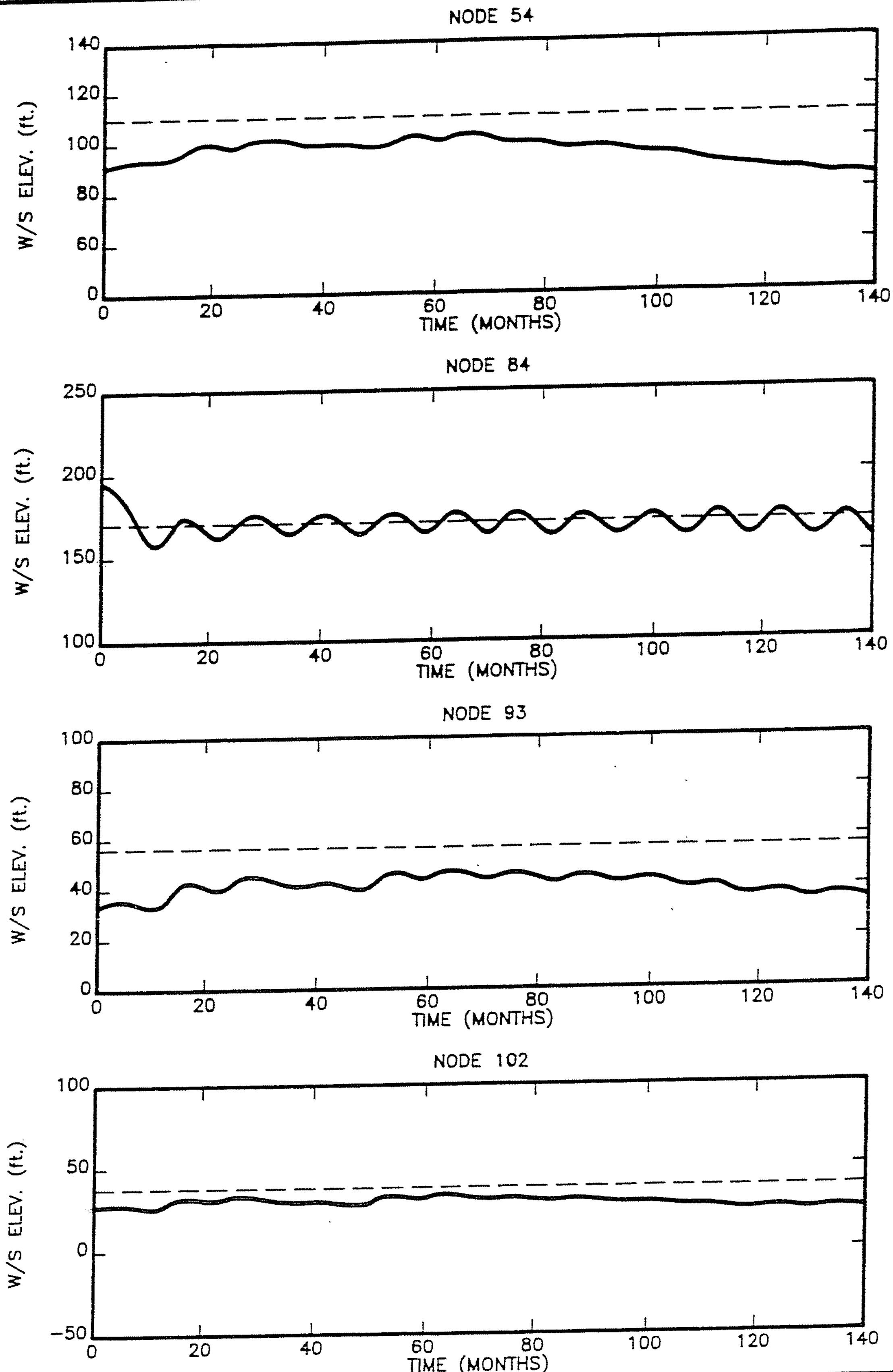
LEGEND

SOLID LINE: SIMULATED
DASH LINE: MEASURED 1987

San Juan Basin Authority

SIMULATED HISTORIC WATER LEVELS, NODES 11,14,20,38 OF THE SAN JUAN BASIN MODEL

NBS LOWRY | SCALE: AS SHOWN | FIGURE 3-3



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SOLID LINE: SIMULATED

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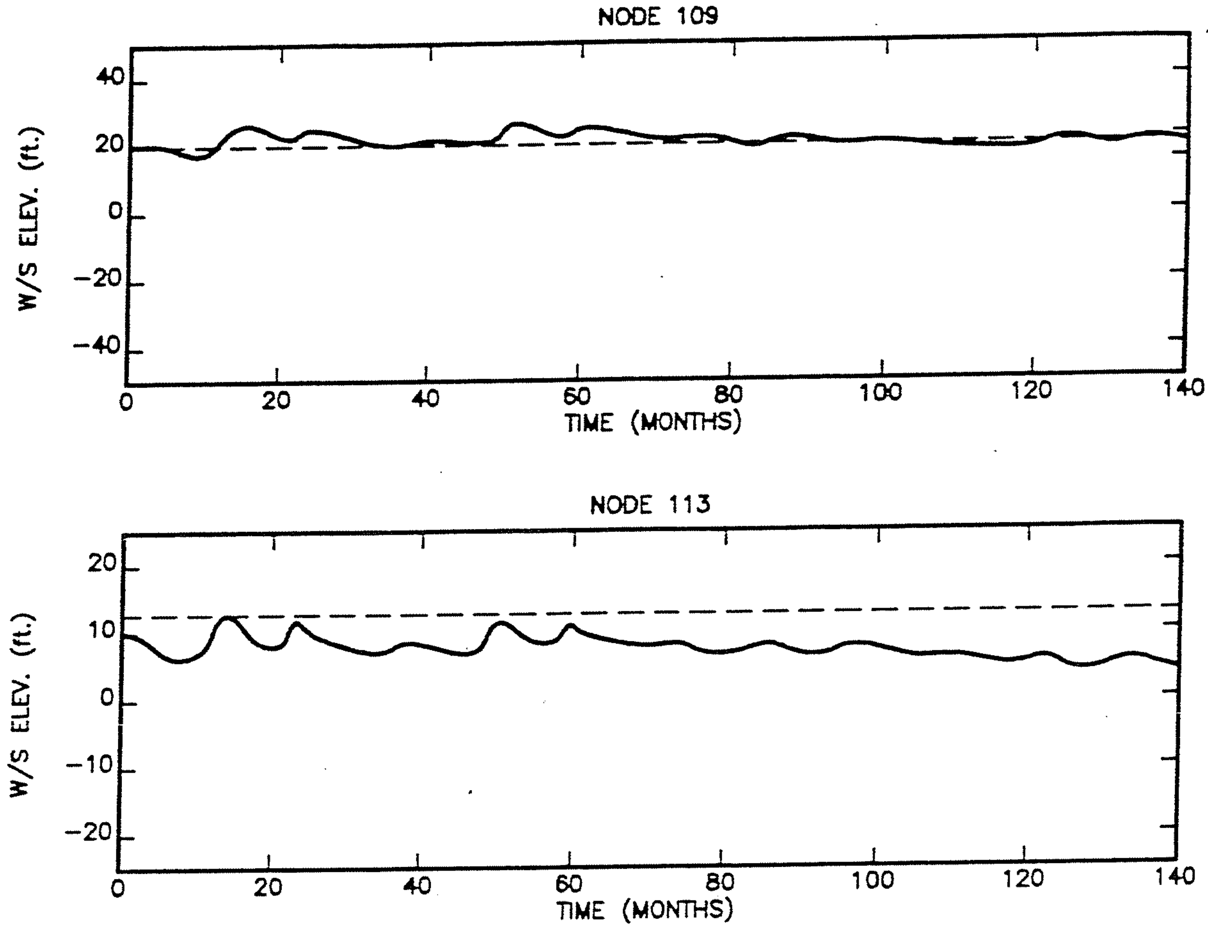
San Juan Basin Authority

SIMULATED HISTORIC WATER LEVELS, NODES 54,84,93,102 OF THE SAN JUAN BASIN MODEL

NBS LOWRY | SCALE: AS SHOWN | FIGURE 3-4



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SOLID LINE: SIMULATED
DASH LINE: MEASURED 1987

San Juan Basin Authority

SIMULATED HISTORIC WATER LEVELS, NODES 109,113 OF THE SAN JUAN BASIN MODEL

NBS LOWRY | SCALE: AS SHOWN | FIGURE 3-5

TABLE 3-3

ESTIMATED AVERAGE WATER QUALITY TDS VALUES FOR TRIBUTARIES TO THE SAN JUAN BASIN*

Tributary	Current (TDS)	
	Storm	Non-Storm
Upper/Middle Trabuco	150	500
Oso Creek	600	2,193
Canada Gobernadora	200	750
Horno Creek	600	5,200
Canada Chiquita	200	800
Bell Canyon	150	350
Upper San Juan Creek	150	300

* From Nolte and Associates

TABLE 3-4

COMPARISON OF HISTORICAL AND SIMULATED GROUNDWATER QUALITY

Node Number	Historical TDS (mg/l)	Simulated Current Condition TDS (mg/l)
29	574	547
48	812	737
70	972	851
85	586	539
87	1,850	1,944
79	1,560	1,394
97	1,198	1,125
105	1,164	1,131
116	1,930	1,947

Note: See Figure 3-1 for location of node numbers.

CHAPTER 4

OPERATIONAL STUDIES AND IMPLEMENTATION PLAN

STUDY PERIOD

A 24-year period was selected for operational studies. The first 12 years of the period included the 12-year historic period where historical conditions of precipitation, extractions, etc. were used in the model. The last 12-year period, 1991-2004, employed the same historical conditions for land use, precipitation and pan evaporation, and historical pumping. Superimposed on these conditions were additional pumpage in various areas of the basin and artificial recharge of water in various areas of the basin. Only the lower basins were manipulated. The Upper San Juan Basin was assumed to be operated in the same historical manner.

PRELIMINARY OPERATIONAL STUDIES

The purpose of preliminary studies was to screen a number of possible management scenarios to identify the most promising management strategies for more detail study. Among management variables studied were best location of new wells and artificial recharge sites and storage characteristics of the basin for various amounts of annual pumpage and recharge. Over 25 different schemes were looked at.

Based upon these preliminary numerical simulations, the following concepts emerged:

1) The lower basins can store water over moderately long periods of time for use in drought periods; however, there is a penalty because some of this water will be lost to subsurface outflow unless water table gradients at the coastline are controlled to minimize subsurface outflow to the ocean.

2) Three primary management strategies emerged.

    a) A no ocean outflow barrier.
    b) A recharge ocean outflow barrier.
    c) An extraction ocean outflow barrier.

3) Outflow barrier strategies can also be used to minimize seawater intrusion and thus limit the TDS of extracted groundwater in the Lower San Juan Basin.

4) Any one strategy can be implemented in a way to minimize seawater intrusion and consequently minimize TDS in the Lower San Juan Basin.

5) Inducing seawater inflow will increase sustained yield.

6) Absolute pumping amounts from any one well were limited by the depth of sediments which are relatively shallow throughout the basin.

7) Rising water can be limited by pumping; however, excessive amounts of recharge will lead to lost water through rising water.

It was assumed that for all of the various management schemes investigated, desalination would be implemented and there was therefore no need to explicitly manage the basin to maximize groundwater quality. It was assumed that groundwater quality in the Lower San Juan Basin would remain marginal or could deteriorate somewhat due to seawater intrusion.

FINAL OPERATIONAL STUDIES

The guiding strategy adopted for the three management strategies identified in the preliminary management studies was to maximize extractions over various periods of time. That is, what would be the maximum that could be extracted over a one-year period, a three-year period, etc? Maximum pumping of new wells will also include minimizing subsurface outflow to the ocean and outflow due to rising water. Generally three-year drought pumping periods will be considered because of potential financial incentives that may be provided by MWDSC.

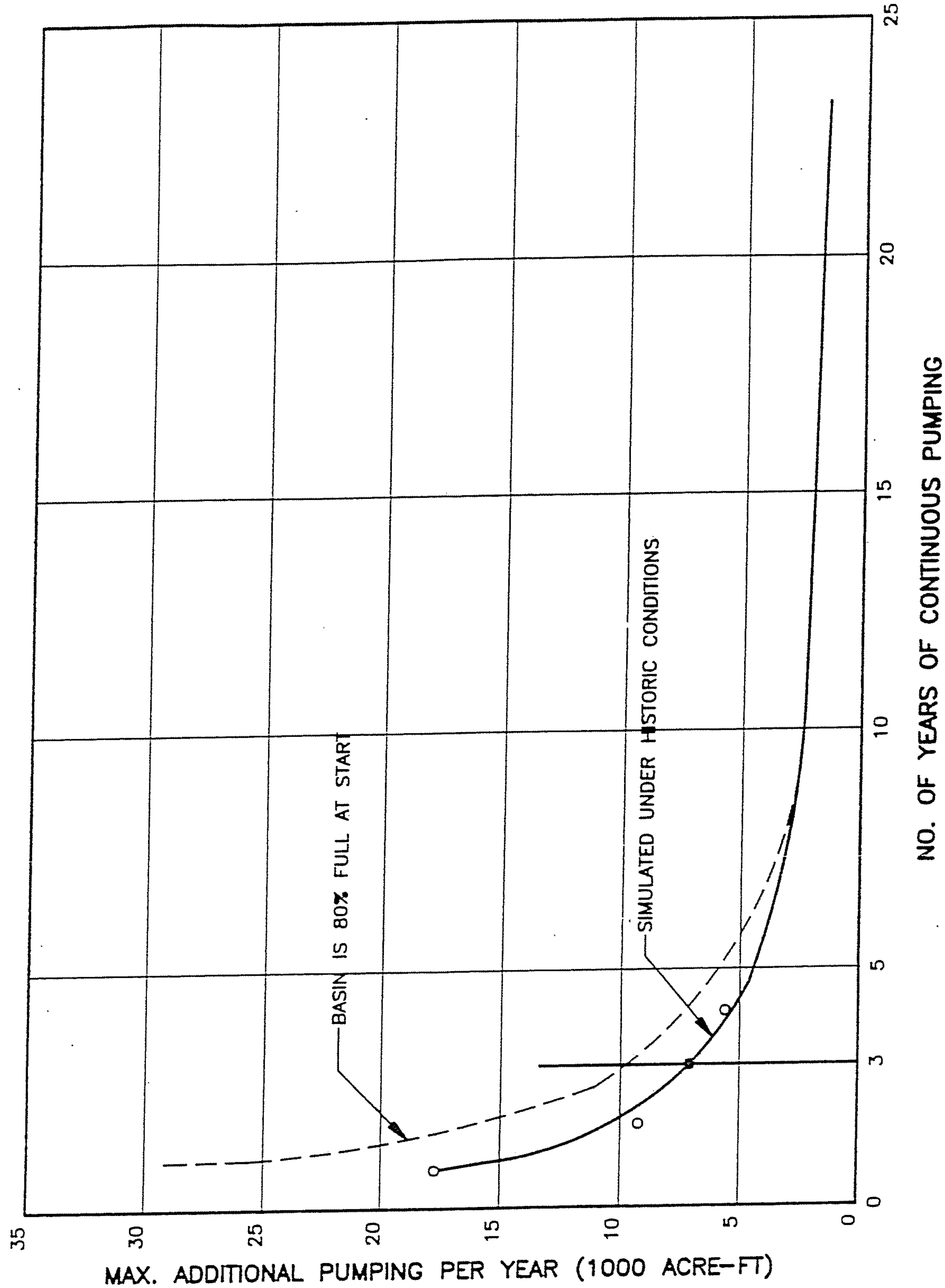
There are advantages to the timing of artificial recharge. In the various final management alternative studies artificial recharge was assumed to occur after major pumping times. This scheme tends to minimize both subsurface outflow to the ocean and outflow due to rising water.

No-Barrier Scenario

The no barrier to seawater intrusion scenario was simulated for two initial conditions: by assuming historical conditions of groundwater storage in the San Juan Basin and by assuming the basin is 80 percent full at the start of the simulation period; i.e., the basin would first be recharged by artificial means.

Figures 4-1 and 4-2 show the results of this simulation scenario. Pumping amounts are presented in terms of additional pumping over historic 1990 pumping which was assumed to continue at a constant rate into the future. Examination of Figure 4-1 shows that, for example, if pumping was to occur over a three-year period, the average annual additional pumping would be about 7,000 acre-feet per year under historic conditions of groundwater storage and about 9,000 acre-feet per year if the basin was initially 80 percent full. More dramatic benefits to having the basin 80 percent full can be achieved by shorter durations of pumping. One of the main reasons pumping rates drop off so rapidly is that the shallow alluvial sediments become partly dewatered, lowering simulated pumped volumes.

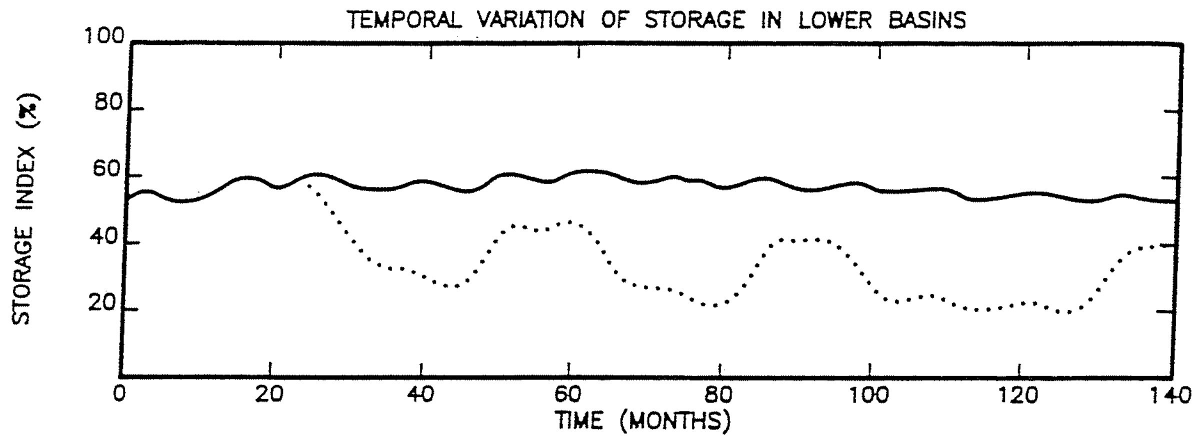
Figure 4-2 shows the simulated storage of groundwater in both the lower basins and the Upper San Juan Basin for natural historical conditions for the last 12 years of the study period. As can be seen, the Upper San Juan Basin is unaffected while pumpage and recharge markedly influence the lower basins. It will be noticed from the downward trend of the simulations (dotted line) that the basin was overdrafted somewhat.

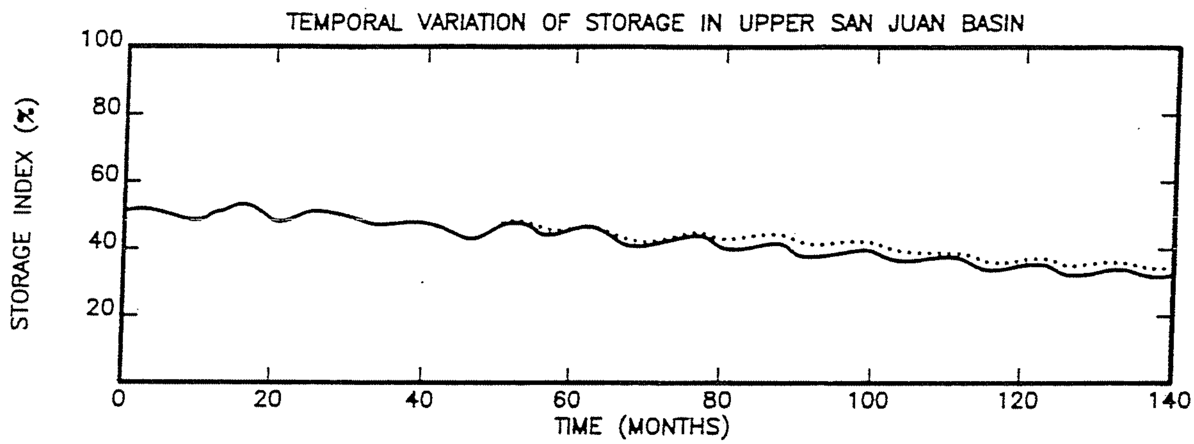


San Juan Basin Authority

SIMULATED ADDITIONAL GROUNDWATER PUMPAGE AND DURATION, NO BARRIER SCENARIO, FOR THE SAN JUAN BASIN

NBS LOWRY	SCALE: AS SHOWN	FIGURE 4-1





LEGEND

SOLID LINE: SIMULATED HISTORIC
DASH LINE: SIMULATED FUTURE

San Juan Basin Authority

SIMULATED GROUNDWATER STORAGE DUE TO ADDITIONAL PUMPAGE UNDER NATURAL CONDITIONS, NO BARRIER SCENARIO FOR THE SAN JUAN BASIN

NBS LOWRY	SCALE: AS SHOWN	FIGURE 4–2

For this particular scenario, it is estimated that the total pumped water in the lower basins would have an average TDS of about 1,500 to 2,000 mg/l.

__Pumping Barrier Scenario__

This scenario is similar to the no-barrier scenario in terms of assumptions; however, in this case seawater inflow to the main part of the Lower San Juan Basin or outflow to the ocean is controlled by an assumed series of wells near the coast that pump from the aquifer to control the water table gradient. The amount of pumping was somewhat guided by an assumption that total extractions are to be as high as possible.

Figures 4-3 and 4-4 show results for this scenario. Figure 4-3 shows results in terms for additional pumping as was previously described. For this simulation, an average annual 4,800 acre-feet per year was pumped near the coast. For a three-year withdrawal scheme, about the same amount of additional pumping can be achieved as the no-barrier scenario. For shorter periods, however, dramatically increased amounts can be achieved over the no-barrier scenario.

Figure 4-4 shows the simulated groundwater storage for this scenario assuming natural conditions of groundwater storage for the 12-year ending portion of the simulation period. This figure indicates a simulated overdraft for the basin.

Estimated groundwater quality for this scenario, assuming extracted water from the barrier project is commingled with all other lower basin-pumped groundwater, is from 11,000 to 13,000 mg/l. There is a substantial groundwater quality penalty to pay for a pumped barrier project compared to other alternatives.

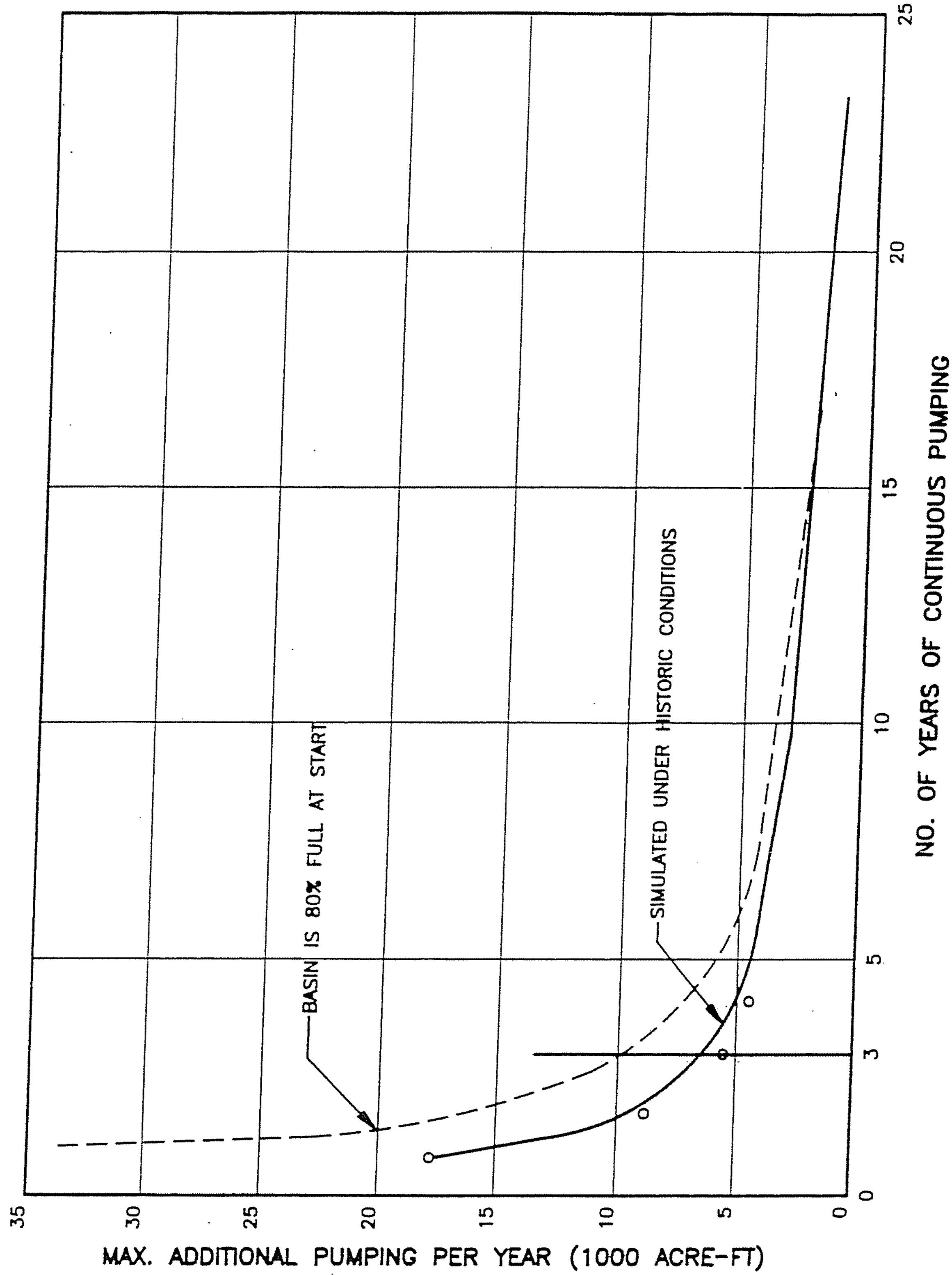
__Recharge Barrier Project__

This scenario is similar to the others except recharge is assumed near the coast to eliminate seawater intrusion. Figures 4-5 and 4-6 present the results of this simulation. As can be seen from Figure 4-5, there would be an increase of short-term pumping over the other scenarios for a three-year pumping period. For a three-year period about 9,000 acre-feet per year of additional water could be extracted under existing conditions of groundwater storage and about 11,500 acre-feet per year could be extracted if the lower basin were initially 80 percent full. Simulations include about 2,200 acre-feet of well recharge at the coast.

Figure 4-6 shows the simulated storage for the last 12-year period of the study period under natural conditions. This figure indicates an overdraft during the 12-year period. Estimated average pumped groundwater quality for this scenario is from 1,200 to 1,700 mg/l.

EVALUATION OF MANAGEMENT STRATEGIES

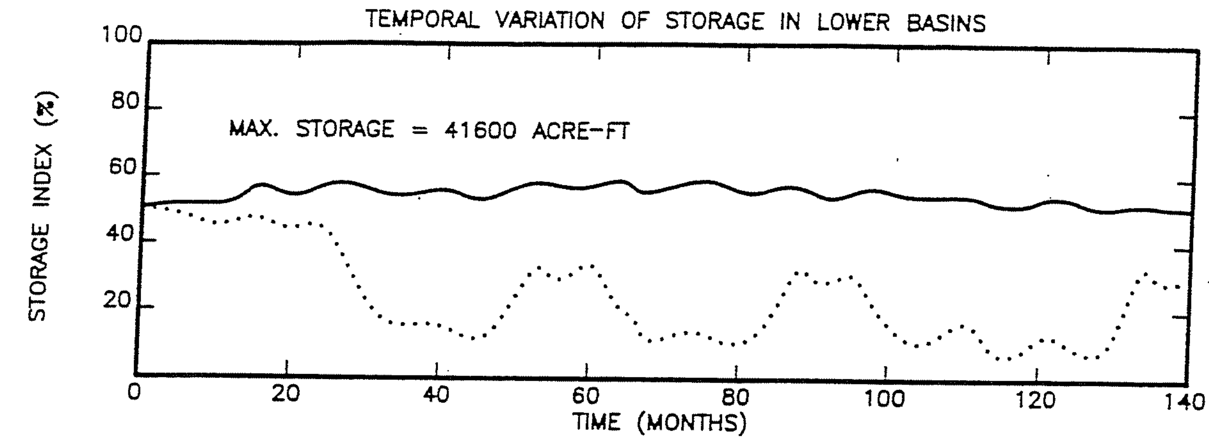
Preliminary studies suggest a strategy of using the lower basins (i.e., the Middle San Juan, Lower San Juan, and Lower Trabuco Basins) for short-term maximum groundwater withdrawals in times of drought. Additionally, based upon historical conditions, a total of about 5,200 acre-feet per year of naturally occurring groundwater can be pumped each year from the San Juan Basin without overdraft, provided the basin is managed to minimize subsurface outflow and

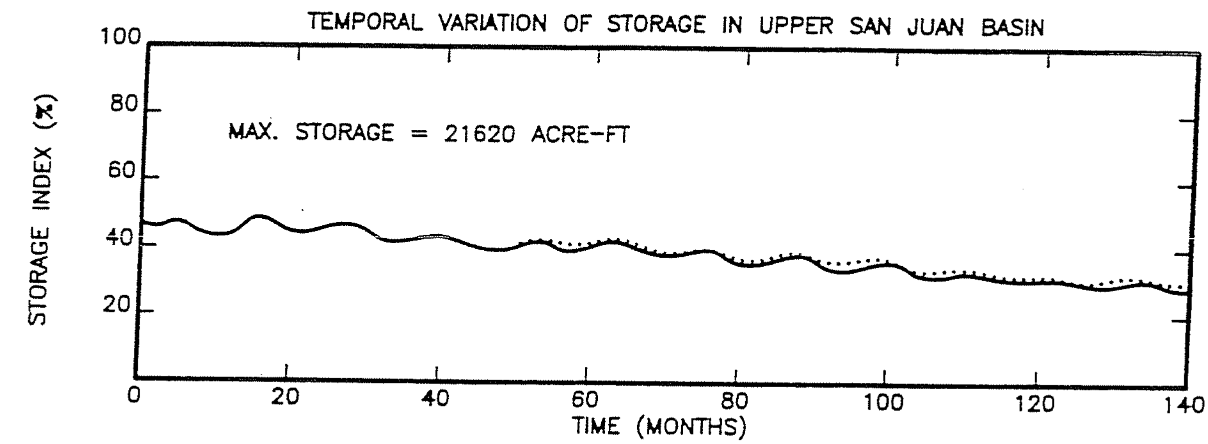


San Juan Basin Authority

SIMULATED ADDITIONAL GROUNDWATER PUMPAGE AND DURATION, PUMPING BARRIER SCENARIO, FOR THE SAN JUAN BASIN

NBS LOWRY | SCALE: AS SHOWN | FIGURE 4-3

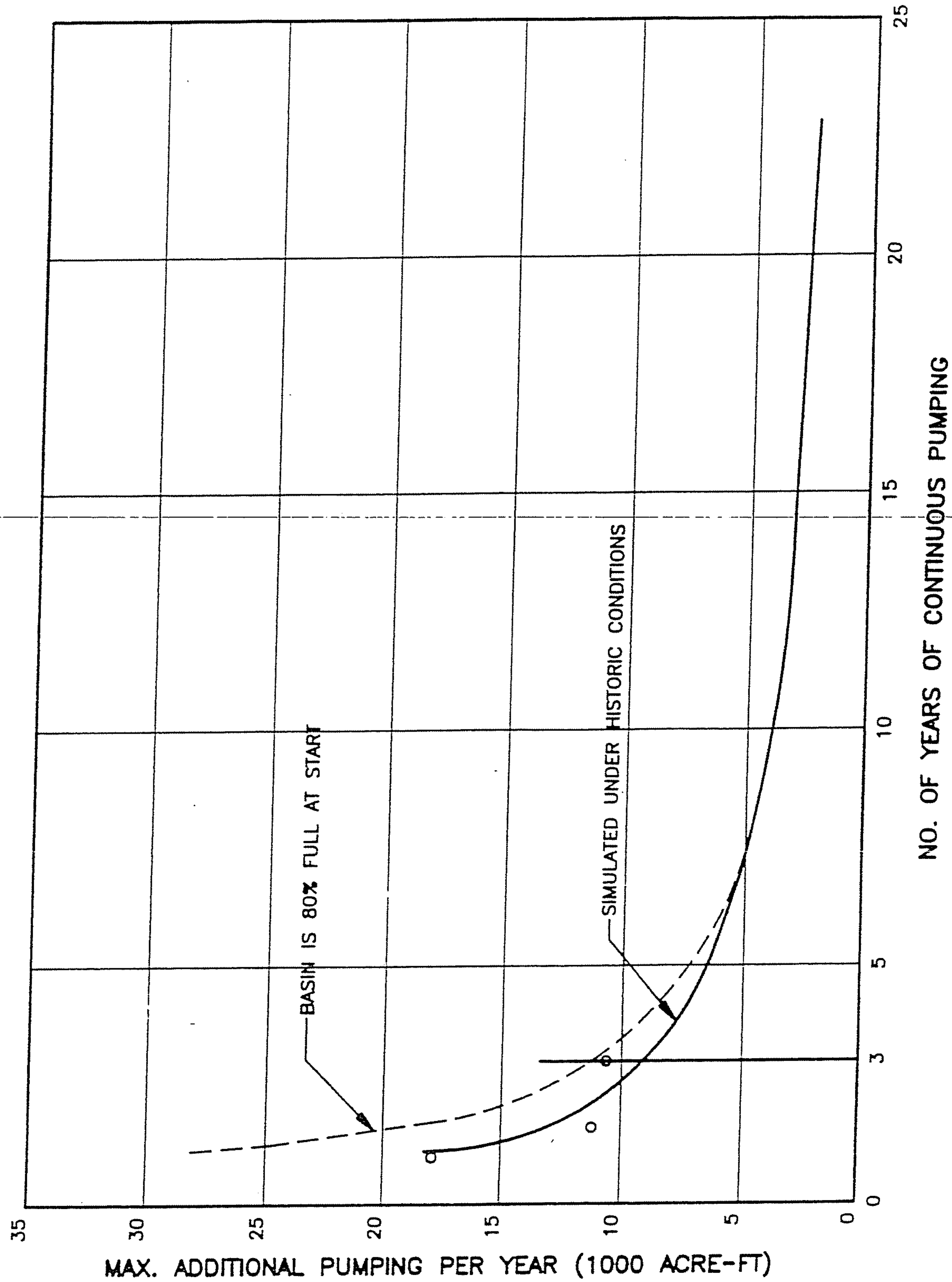




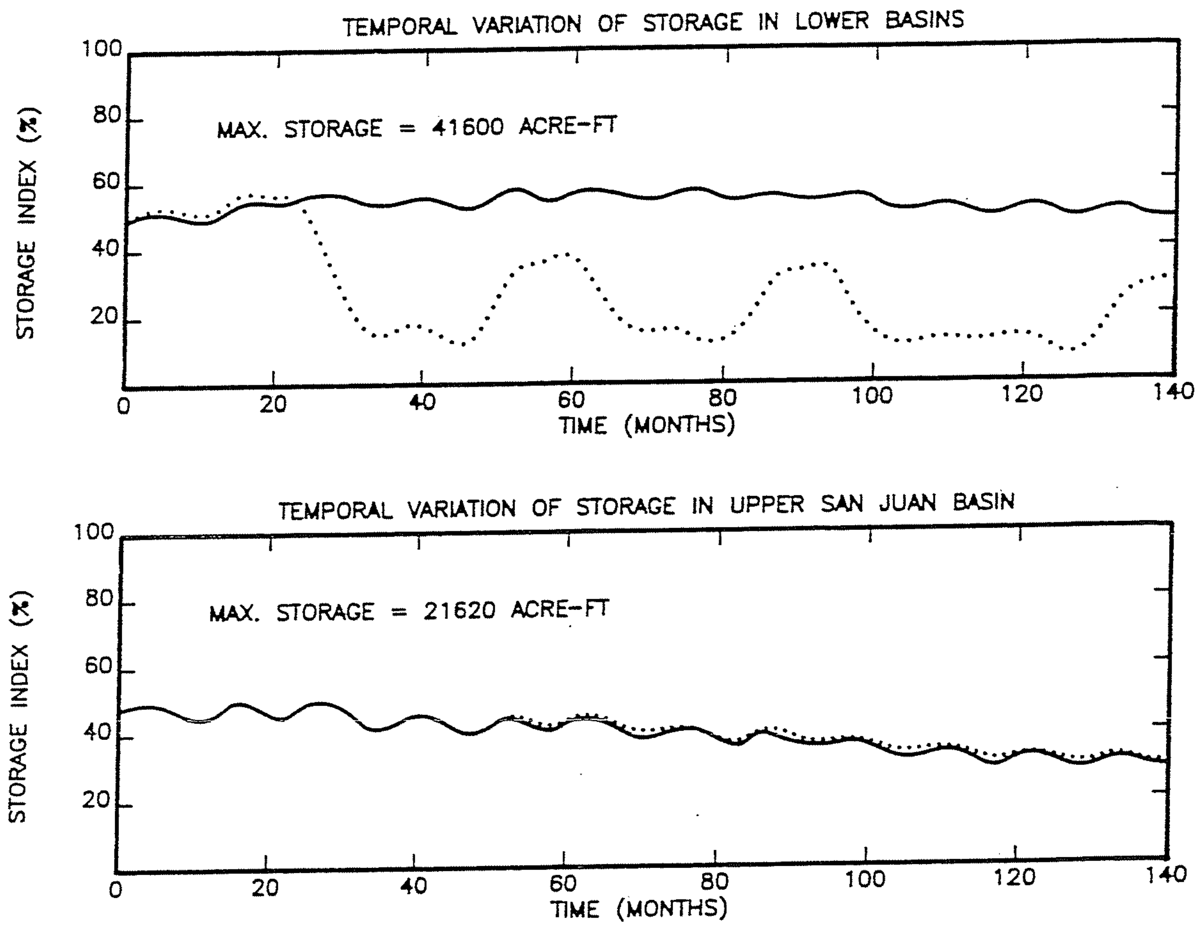
LEGEND

SOLID LINE: SIMULATED HISTORIC
DASH LINE: SIMULATED FUTURE

San Juan Basin Authority	
SIMULATED GROUNDWATER STORAGE DUE TO ADDITIONAL PUMPAGE UNDER NATURAL CONDITIONS, PUMPING BARRIER SCENARIO FOR THE SAN JUAN BASIN	
NBS LOWRY	SCALE: AS SHOWN
	FIGURE 4-4



San Juan Basin Authority		
SIMULATED ADDITIONAL GROUNDWATER PUMPAGE AND DURATION, RECHARGE BARRIER SCENARIO, FOR THE SAN JUAN BASIN		
NBS LOWRY	SCALE: AS SHOWN	FIGURE 4-5



LEGEND

SOLID LINE: SIMULATED HISTORIC
DASH LINE: SIMULATED FUTURE

San Juan Basin Authority

SIMULATED GROUNDWATER STORAGE DUE TO ADDITIONAL PUMPAGE UNDER NATURAL CONDITIONS, RECHARGE BARRIER SCENARIO FOR THE SAN JUAN BASIN

NBS LOWRY	SCALE: AS SHOWN	FIGURE 4-6

rising water (Table 2-3). In the future, sustained yield is expected to increase due to additional flows into the San Juan Basin resulting from landscape irrigation runoff from imported water used for irrigation in tributary areas.

The amount of annual water that can be withdrawn depends on the management constraints that are imposed. For example, if one-year maximum amounts are extracted, it is advantageous to partly fill the basin initially. In this study 80 percent full was assumed since it is obvious that one can not completely fill the basin without damaging surface structures. If the incremental cost per feedwater salt load of desalination is high, then a pumped barrier project may not be the best strategy. If a short-term maximum groundwater extraction scheme were adopted and it was desirable to minimize TDS while limiting subsurface outflow to the ocean, some form of control of coastal water table gradients would be implied.

The main variables in a management strategy for the San Juan Basin are:

1) Length of groundwater withdrawal period and amount of withdrawal.

2) Initial groundwater in storage in the lower basins.

3) Feedwater quality to a desalting facility which may imply some limits on permissible seawater intrusion.

4) Amounts and timing of artificial recharge which implies a limit on rising water and subsurface outflow to the ocean.

Comparisons of the results of the various scenarios under historic groundwater storage conditions suggest that the total sustained yield for the no-barrier scenario about equals the estimated historical sustained yield while the pumping barrier scenario significantly increased sustained yield. The recharge barrier scenario actually decreased sustained yield. If maximization of sustained yield of natural waters is an objective, a no-barrier or pumping barrier management technique is the best depending on the economics of treating various levels of TDS in the feed stream to a desalting facility.

Under careful management of the San Juan Basin, a sustained yield of natural <u>in situ</u> groundwater of about 5,200 acre-feet is probably available. However, should additional filling of the basin occur either naturally or through artificial recharge, there is no reason why the basin might not be overdrafted for a long period until, say, major new water supplies become available to the region. As was mentioned previously, future sustained yield will increase due to landscape irrigation return flows. This aspect will be subsequently discussed further.

A second significant use of the lower San Juan basins is short-term pumping to provide supplemental water during drought periods. The no-barrier and pumping barrier scenarios produce about the same amount of yield while the recharge barrier scenario has significantly increased amounts for short-term pumping. The main constraint on how much can be pumped is the initial groundwater in storage and the thickness of saturated sediments. It is physically impossible to pump more from fixed well sites because sediments become dewatered under prolonged pumping.

It is estimated that approximately 800 acre-feet per year are used by two golf courses and the Vermuellen agricultural areas in the lower basins. Several large groundwater pumpers are also located in the Upper San Juan Basin where superior groundwater quality is found. While it may not be possible to supply these areas in the immediate future, a long-range plan should be formulated to additionally treat existing wastewater and provide reclaimed water service to selected areas. It may also be feasible to use reclaimed water for recharge at the coast to improve water quality. The success in implementing the use of reclaimed water will depend primarily on local policy, regulatory agency approval, and the willingness of local pumpers to accept such a plan. Implementation would largely remove most pumpers from the lower basins, making it easier to manage under one authority.

The initial management strategy to conjunctively utilize the San Juan Basin should be a combination no-barrier/pumping barrier strategy to manage groundwater gradients at the coast. By combination strategy, it is meant that a formal pumping barrier would not be constructed but production wells would be located close enough to the coast so that landward groundwater gradients could be achieved. Initial facilities required would consist of a desalting facility, extraction wells and pipe manifold, and recharge facilities. These facilities would meet the following needs:

1) Provide short-term drought water supplies.

2) Provide long-term "new water" supplies for the region.

3) Provide additional summer peaking capacity.

It was shown previously in Figures 4-1 and 4-3 that about 10,000 acre-feet per year for a three-year period could be extracted from the lower San Juan basins provided it is recharged in subsequent years (i.e., a two- or three-year recharge period). Greater rates can be extracted for shorter periods.

Long-term "new water" supplies will depend upon how much seawater intrusion is induced and to what extent reclaimed water is used for current irrigation uses or recharge. The amount of seawater intrusion that may be induced depends upon the economics of treating various levels of feedwater TDS. Future sustained yield will depend upon control of rising water and outflow to the ocean. Inflow of landscape irrigation return flows will increase "new water" to the system. The benefits of replacing existing irrigation pumping with reclaimed water would be significant by increasing pumping of natural waters to blend with induced seawater intrusion.

A third use of the lower basins is for summer peak demands. Water could be recharged in the winter months and well extractions could be in the high demand summer months. The amounts of recharge and well extraction would depend on the capacity of a desalting facility and the amount of groundwater in storage at the beginning of the pumping period.

A best conjunctive use management strategy applicable to the lower basins should have the following goals:

1) Flexibility which implies staging or phasing of structural management facilities.

2) Elimination of subsurface outflow by controlling groundwater gradients at the coast to maximize sustained yield of natural in situ groundwaters.

3) Using the San Juan Basin as a storage element in the South County facilities.

4) Inducing seawater intrusion to increase water available for a desalting facility.

5) Eventual replacement of current pumping by large landscape irrigation users with reclaimed water increasing the amount of groundwater available to the project.

FUTURE SUSTAINED YIELD

As discussed previously, sustained yield of the natural groundwaters of the basin under historical conditions is on the order of 5,200 acre-feet per year, provided no subsurface outflow to the ocean or rising water occur. Historical pumping (Table 2-3), if the estimates of pumpage are correct, caused a slight overdraft of the basin, about 200 acre-feet per year. From a strategic point of view, it is probably better to overdraft the basin slightly to make additional storage available for recharge during wet years such as occurred in the 1993 winter. A slight overdraft will also facilitate minimizing rising water outflow.

Future sustained yield will be increased due to increased inflows resulting from landscape irrigation return flows, which will increase subsurface inflow from tributary areas and increase stream baseflow which will result in increased streambed percolation in the main basin. Tributary irrigation with imported water in tributary areas at ultimate buildout is estimated to be 25,339 acre-feet per year (Table 4-1). Assuming 15 percent of this value is return flow to the main San Juan Basin, 3,800 acre-feet per year of new water will be available. Add historic sustained yield of 5,200 acre-feet per year to this value and ultimate sustained yield will be about 9,000 acre-feet per year. Current sustained yield is roughly estimated by assuming 40 percent buildout in tributary areas; thus, 40 percent of the ultimate imported water irrigation in tributary areas yields 10,100 acre-feet per year. Fifteen percent of this value, or 1,500 acre-feet per year, is the estimated current return flow to the main San Juan Basin, and adding this value to historic sustained yield yields an estimated current sustained yield of 6,700 acre-feet per year. The average sustained yield over the 25-year future life of the proposed project is 7,800 acre-feet per year. Subtracting current pumpage of 5,600 acre-feet per year results in an additional average sustained yield of 2,200 acre-feet per year available to this project.

According to Nolte and Associates, future landscape irrigation in some of the tributary watersheds may be partly or wholly augmented by reclaimed water. While the use of reclaimed water will not alter predicted increased inflows to the main basin, there may be water quality effects which will subsequently be evaluated. Table 4-2 presents estimates of future water quality of inflows with and without reclamation. Non-storm estimates apply to baseflow and subsurface inflow.

TABLE 4-1

SAN JUAN BASIN AVERAGE TRIBUTARY INFLOWS ORIGINATING FROM IRRIGATION (FROM NOLTE AND ASSOCIATES)

Tributary	Irrigated Area (Ac)	Applied Irrigation Water (Ac-Ft/Yr)
Upper/Middle Trabuco	1,554	5,439
Oso Creek	3,637	12,730
Canada Gobernadora	1,810	6,335
Horno Creek	625	2,188
Canada Chiquita	1,186	4,151
Bell Canyon	773	2,707
Upper San Juan Creek	26	91
Totals	**9,611**	**25,339**

Note: Estimates are for ultimate buildout in the tributary areas.

TABLE 4-2

ESTIMATED AVERAGE WATER QUALITY FOR SAN JUAN BASIN TRIBUTARY INFLOWS (FROM NOLTE AND ASSOCIATES)

Tributary	Future with Reclamation (TDS)		Future without Reclamation (TDS)	
	Storm	Non-Storm	Storm	Non-Storm
Upper/Middle Trabuco	163	771	148	700
Oso Creek	630	1,941	NA	NA
Canada Gobernadora	242	1,191	223	1,101
Horno Creek	880	3,759	749	3,199
Canada Chiquita	203	1,312	177	1,144
Bell Canyon	228	455	NA	NA
Upper San Juan Creek	151	302	NA	NA

Note: Future implies ultimate buildout in the tributary areas. NA means non-applicable since further development of the watersheds is either not contemplated or reclamation is currently accommodated and is planned to continue in the future without change. Subsurface inflow from tributaries was assumed to have the same TDS of non-storm flows. TDS in mg/l.

IMPLEMENTATION PLAN

Based upon the above operation studies, an ultimate plan is proposed that will involve an 8 mgd desalter facility with a feedwater requirement of about 12,500 acre-feet per year. Feedwater would be provided by a number of new wells installed in the lower basins. To be conservative it is assumed that 12 wells would be constructed, of which some may be dual extraction-injection wells. Some of these wells would be to control groundwater gradients at the coast. Wells would be connected to a collection manifold. A product waterline and pump station to CVWD facilities and the South County Pipeline and a brine line would be required as part of the project. Ultimate facilities are illustrated in Figure 4-7.

There are, however, a number of uncertainties involved in an ultimate system to manage groundwaters of the San Juan Basin. These include: (1) resolution of water rights, (2) completion of the CEQA process, (3) acceptance of the concept of induced seawater inflow, (4) long-term groundwater quality that will influence the design and operation of a desalter, (5) future availability of incentive programs, and (6) the development of a management and operations infrastructure. These uncertainties can be resolved with a reasonable level of confidence by implementing a phased development program. The key concepts are flexibility, phasing and prototype demonstration.

A two-phase project is proposed. The first phase would capture natural unused groundwaters without inducing significant seawater intrusion. The second phase would expand facilities developed in the first phase depending upon experience gained during the first phase. Once preliminary management facilities are constructed, a management and institutional infrastructure begins to form, and operational experience is gained as well as more knowledge about the characteristics of the San Juan Basin. This experience will be a basis for developing and implementing an ultimate optimum management plan.

Phase I

The proposed objectives of Phase I are to:

1) Capture and desalt the unused sustained yield of the lower basins of about 2,200 acre-feet per year.

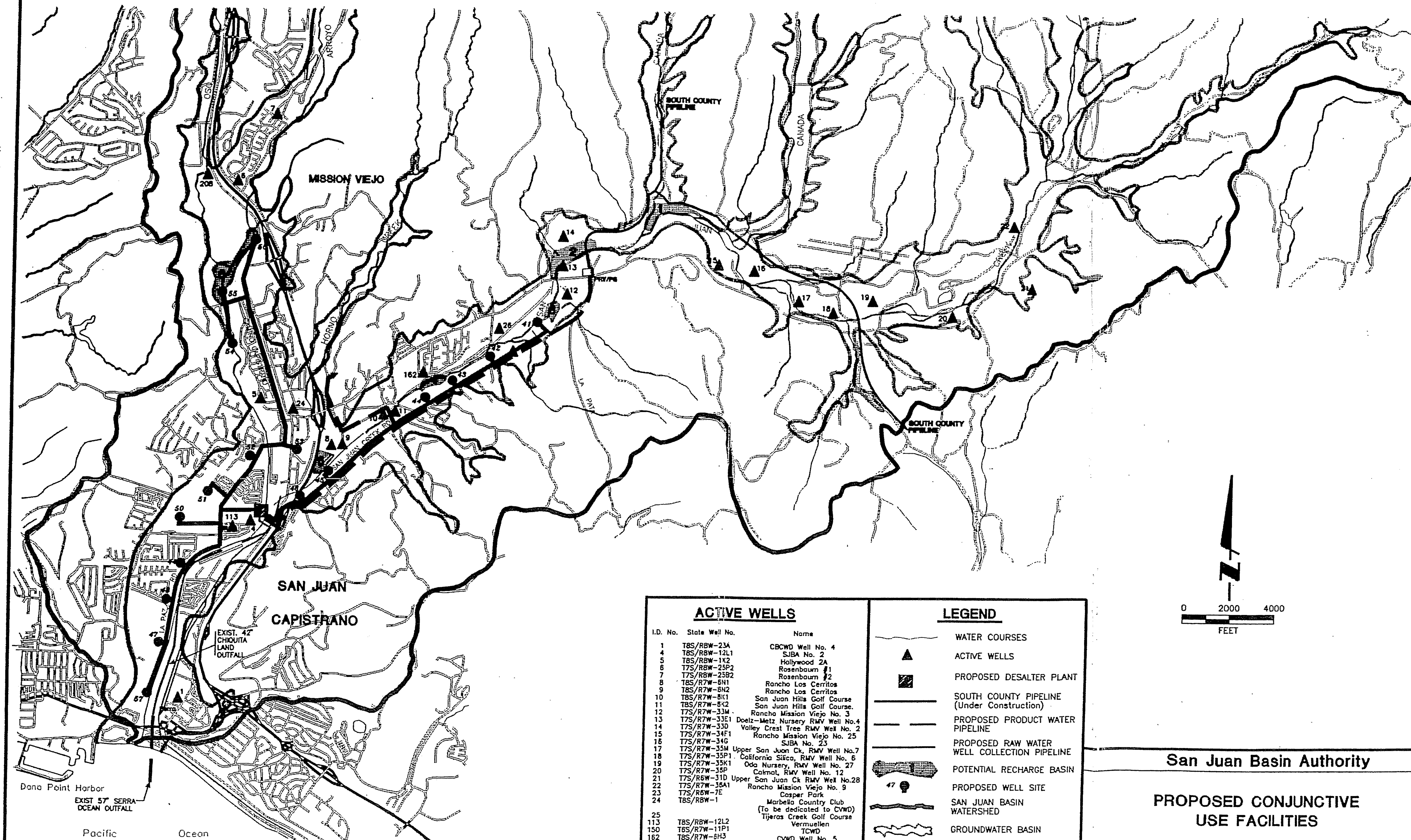
2) Provide sufficient pumping and desalting capacity to provide some drought and emergency protection.

3) Commence a limited use of the lower basins for seasonal storage and pumpage.

4) Develop a management-operations infrastructure which would include involvement in MWDSC incentive programs; and

5) Obtain and evaluate technical data to develop Phase II.

Both a resolution of water-rights issues and the CEQA process must be completed before implementing Phase I.



ACTIVE WELLS

I.D. No.	State Well No.	Name
1	T8S/R8W-23A	CBCWD Well No. 4
4	T8S/R8W-12L1	SJBA No. 2
5	T8S/R8W-1K2	Hollywood 2A
6	T7S/R8W-25P2	Rosenbaum #1
7	T7S/R8W-25B2	Rosenbaum #2
8	T8S/R7W-6N1	Rancho Los Cerritos
9	T8S/R7W-6N2	Rancho Los Cerritos
10	T8S/R7W-8K1	San Juan Hills Golf Course
11	T8S/R7W-5K2	San Juan Hills Golf Course.
12	T7S/R7W-33M	Rancho Mission Viejo No. 3
13	T7S/R7W-33E1	Doelz-Metz Nursery RMV Well No.4
14	T7S/R7W-33D	Valley Crest Tree RMV Well No. 2
15	T7S/R7W-34F1	Rancho Mission Viejo No. 25
16	T7S/R7W-34G	SJBA No. 23
17	T7S/R7W-35M	Upper San Juan Ck, RMV Well No.7
18	T7S/R7W-35P1	California Silica, RMV Well No. 6
19	T7S/R7W-35K1	Oda Nursery, RMV Well No. 27
20	T7S/R7W-35P	Calmat, RMV Well No. 12
21	T7S/R6W-31D	Upper San Juan Ck RMV Well No.28
22	T7S/R7W-36A1	Rancho Mission Viejo No. 9
23	T7S/R6W-7E	Casper Park
24	T8S/R8W-1	Marbella Country Club (To be dedicated to CVWD)
25		Tijeras Creek Golf Course
113	T8S/R8W-12L2	Vermuellen
150	T6S/R7W-11P1	TCWD
162	T8S/R7W-6H3	CVWD Well No. 5
168	T8S/R7W-5B1	Lacouague
208	T7S/R8W-25N2	Williams/Bathgate
226	T6S/R7W-11P2	TCWD
227		Sakaida nursery

LEGEND

- WATER COURSES
- ACTIVE WELLS
- PROPOSED DESALTER PLANT
- SOUTH COUNTY PIPELINE (Under Construction)
- PROPOSED PRODUCT WATER PIPELINE
- PROPOSED RAW WATER WELL COLLECTION PIPELINE
- POTENTIAL RECHARGE BASIN
- 47 PROPOSED WELL SITE
- SAN JUAN BASIN WATERSHED
- GROUNDWATER BASIN

NOTE:
Well Information is Based on Best Available Data as of July 1991

San Juan Basin Authority

PROPOSED CONJUNCTIVE USE FACILITIES

JBS LOWRY | SCALE: AS SHOWN | FIGURE 4-7

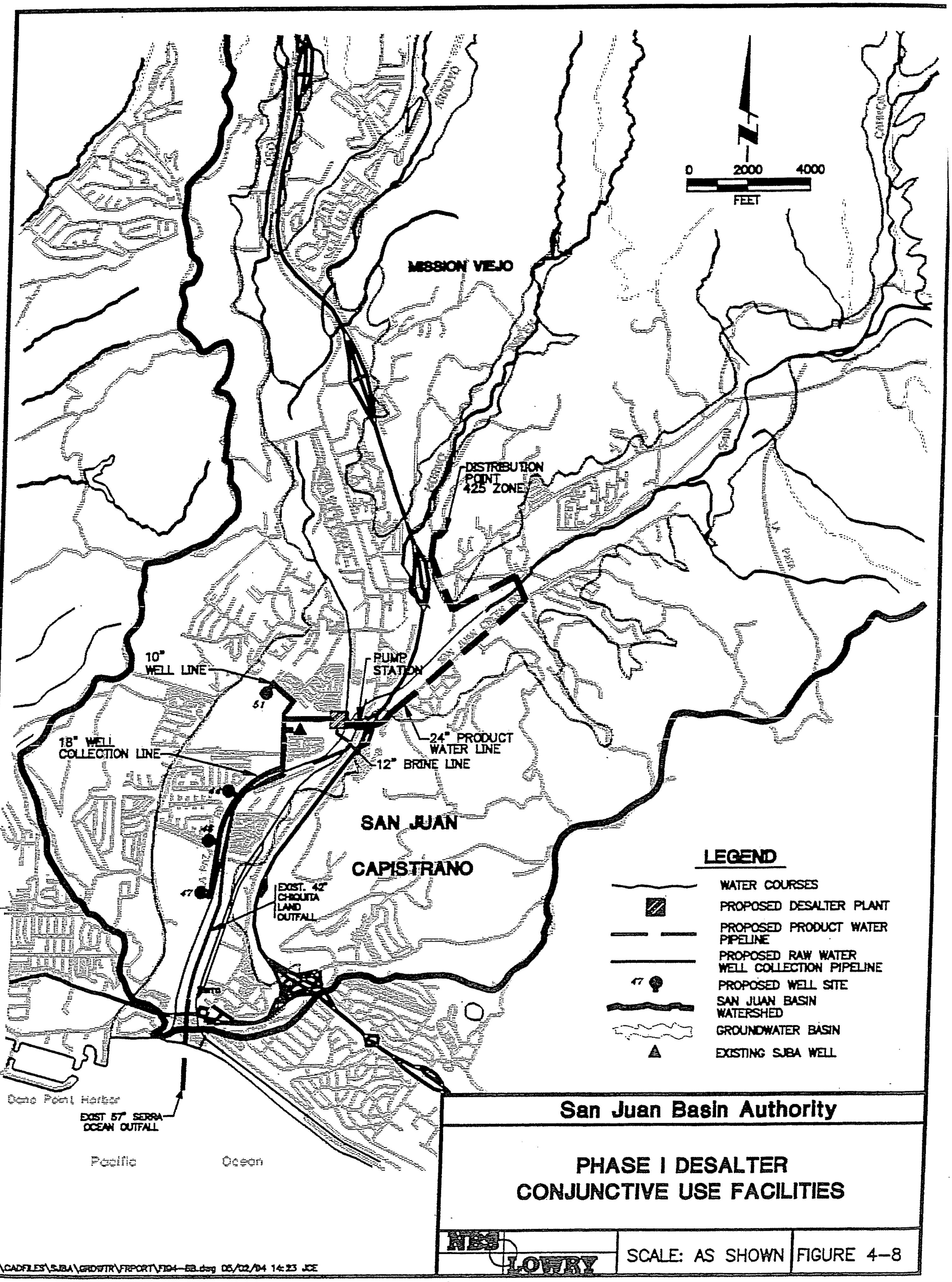
Capturing and desalting 2,200 acre-feet per year of groundwater in the Lower San Juan Basin would yield about 1,800 acre-feet per year of potable water. It is proposed that a 4 mgd desalter be constructed which would be able to produce about 4,300 acre-feet per year of potable water for drought or emergency supply. Feedwater flow pumped from groundwater would be about 5,000 acre-feet per year. Groundwater TDS would be about 2,000 mg/l when pumping 2,200 acre-feet per year and as high as 3,800 mg/l when pumping 5,000 acre-feet per year, depending upon where wells are located and pumped. Conservatively, five wells and a collection manifold would be required to do this. Several of these wells could be designed as dual extraction-injection wells to test this concept. These same wells would be used to capture the unused sustained yield and would be located to partly control groundwater gradients at the coast. Product water would be supplied to Zone 425 of the CVWD's system. Proposed Phase I facilities are illustrated in Figure 4-8.

During Phase I two modes of operation would be possible. Extract approximately 2,200 acre-feet of water during the five summer months, netting 1,800 acre-feet of potable water. This would allow maximum participation in the MWDSC seasonal storage program during the winter months. The second mode of operation would be to extract approximately 5,000 acre-feet of water over 10 to 12 months, netting 4,300 acre-feet of potable water. This second mode of operation would extract from sustained yield and stored water during drought or emergency conditions.

Recharge of extracted stored water is proposed to be through an "in-lieu" scheme. "In-lieu" imported water will be supplied to pumpers in exchange for them not pumping. This would occur in the years after a drought or other emergency to replace water pumped from storage.

During Phase I, monitoring would be conducted and further analysis will be undertaken to develop Phase II facilities and their operation and management. Figure 4-9 illustrates a project schedule for implementing Phase I.

Hypothetical simulations with the water quantity and quality models were conducted to evaluate the impacts on the San Juan Basin both for future reclamation and no reclamation in the tributary areas for Phase I operation. A 24-year future period based upon historical natural inputs and outputs similar to the 12-year period used for calibration was used. However, surface and subsurface inputs were modified to reflect increased landscape irrigation runoff from imported water in the tributary areas, Table 4-1. Historical pumping, Table 2-3, was increased by 2,200 acre-feet per year and, during two three-year drought periods, historical pumping was increased by 5,000 acre-feet per year. Of the 5,000 acre-feet per year, 2,800 is in excess of sustained yield. During the increased pumpage some minor seawater intrusion was simulated, increasing the sustained yield. The net overdraft during the three-year period of increased pumping is on the order of 2,200 acre-feet per year or a total of 6,600 acre-feet. This amount was recharged at the end of the increased pumping periods. The lumped basin inputs and outputs for this simulation are shown in Table 4-3. This table represents both future reclamation scenarios.

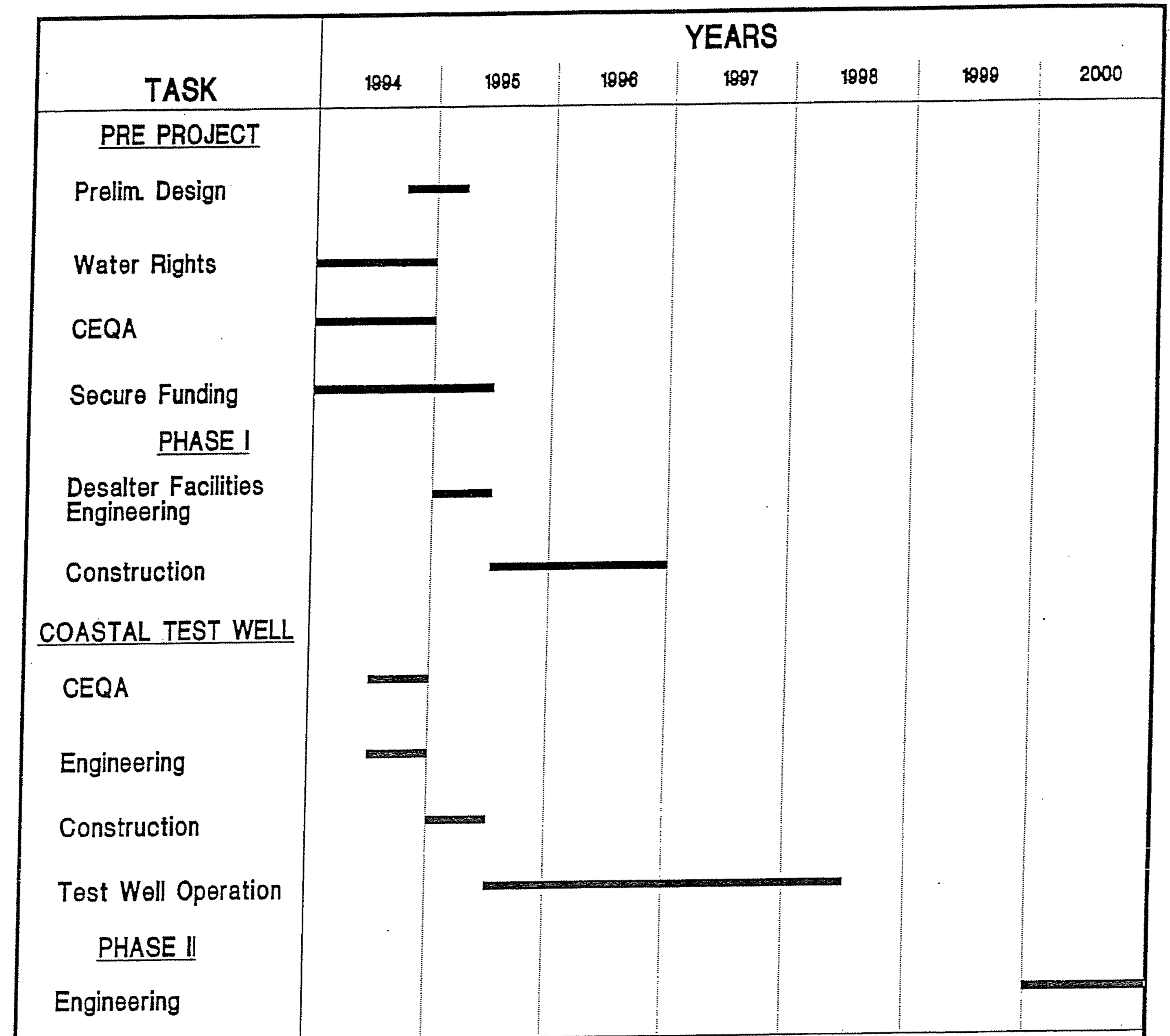


San Juan Basin Authority

PHASE I DESALTER CONJUNCTIVE USE FACILITIES

SCALE: AS SHOWN

FIGURE 4-8



PHASE I

Desalter Site Improvements
4MGD Desalter Plant
5 Lower Basin Wells
Collector Pipelines
Product Pipeline
Brine Disposal

PHASE II

Expand Desalter to 8MGD
Expand Well Field Collector Pipeline
Build S.C.P. Pump Station
and Connector Pipe

San Juan Basin Authority

DESALTER GROUNDWATER MANAGEMENT AND FACILITIES PLAN PROJECT SCHEDULE

NBS LOWRY | SCALE: AS SHOWN | FIGURE 4–9

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TABLE 4-3

SIMULATED SAN JUAN BASIN
HYDROLOGICAL COMPONENTS FOR PHASE I OPERATION
(ACRE-FEET)

Year	Percolation of Precipitation	Artificial Recharge	Percolation of Applied Water	Streambed Percolation	Subsurface Inflow	Total Input	Rising Water	Pumpage	Phreatophyte Extraction	Ocean Outflow	Total Output	Net Input
1	1295		934	2234	2459	6922	2284	7844	417	-345	10200	-3278
2	1816		934	4482	2862	10094	799	7844	417	145	9205	889
3	459		934	1809	3009	6211	461	7844	417	48	8770	-2559
4	942		934	2118	3108	7102	256	7844	417	-42	8475	-1373
5	1715		934	3781	3137	9567	359	7844	417	119	8739	828
6	729		934	1990	3162	6815	180	10644	417	-641	10600	-3785
7	833		934	2074	3207	7048	106	10644	417	-1232	9935	-2887
8	1047		934	2235	3209	7425	89	10644	417	-1507	9643	-2218
9	645		934	1932	3240	6751	58	7844	417	-1157	7162	-411
10	597	825	934	1908	3258	7522	28	7844	417	-292	7997	-475
11	983	825	934	2177	3280	8199	22	7844	417	-32	8251	-52
12	1000	825	934	2186	3279	8224	16	7844	417	105	8382	-158
13	1295	825	934	2375	3269	8698	26	7844	417	200	8487	211
14	1816	825	934	4575	3235	11385	225	7844	417	328	8814	2571
15	459	825	934	1862	3237	7317	114	7844	417	312	8687	-1370
16	942	825	934	2147	3280	8128	61	7844	417	265	8587	-459
17	1715	825	934	3801	3263	10538	207	7844	417	345	8813	1725
18	729		934	1993	3254	6910	41	10644	417	-814	10288	-3378
19	833		934	2066	3275	7108	11	10644	417	-1421	9651	-2543
20	1047		934	2221	3263	7465	8	10332	417	-1690	9067	-1602
21	645	2200	934	1921	3284	8984	134	7844	417	-66	8329	655
22	597	2200	934	1907	3292	8930	286	7844	417	143	8690	240
23	983	2200	934	2194	3307	9618	397	7844	417	221	8879	739
24	1000		934	2212	3302	7448	0	7812	417	-479	7750	-302
Mean	**1005**	**550**	**934**	**2425**	**3186**	**8100**	**257**	**8529**	**417**	**-312**	**8891**	**-791**

As can be seen, the basin was slightly overdrafted and there was a small net seawater inflow to the basin. Seawater intrusion primarily occurs during the two years of increased pumping. As can be seen in Table 4-3, during years of normal pumping (current pumping plus 2,200 acre-feet per year) there is a net outflow of groundwater to the ocean. Moreover, during years where seawater intrudes, it is limited. Increased TDS concentrations advance only a short distance into the basin along the coast (see Appendix A nodal concentrations at Node No. 113).

Table 4-4 shows comparisons of simulated water quality for reclamation and no reclamation in the tributary areas based upon the quantity inputs and outputs shown in Table 4-3 and estimated water quality boundary conditions previously described (Table 4-2). Simulated water levels and groundwater TDS concentrations at selected nodes are included in Appendix A.

As can be seen in Table 4-4 and comparing the with and without reclamation scenarios, there is no statistical difference in groundwater quality between both cases. Simulated historic no project TDS is included for comparison. In the upper reaches of the basin there is a slight increase in TDS, primarily because of future estimated increases in return flows from landscape irrigation. Phase I project pumping will increase groundwater TDS due to pumping in Zones 6 and 7 to minimize subsurface outflow to the ocean. Water quality in the upper and middle basin areas is improved by simulated artificial recharge.

Simulated water levels for a Phase I project, Appendix A, suggest there will be little impact compared to historic conditions in the Upper and Middle San Juan Basins. At the confluence of the Lower Trabuco and Lower San Juan Basins (Zone 5), simulated water levels for a Phase I project suggest a regional drawdown of about 50 feet during each of the three years of drought pumping. Otherwise, water levels are unaffected by the Phase I additional pumpage of 2,200 acre-feet per year. In the upper portion of the Lower Trabuco Basin, near the confluence of the Oso and Trabuco Creeks, simulated water levels vary cyclically due to winter recharge and summer pumpage by about 30 feet. Water levels are, however, not affected by the Phase I project because new pumping occurs well to the south of this area. Near the coast in Zones 7 and 8, simulated water levels due to Phase I operation do not vary much from historical conditions.

Phase II

Final plans for Phase II would be developed in Phase I after experience is gained in implementing and operating the facilities as previously outlined. Phase II would as a minimum have the following objectives:

1) Increase sustained yield by at least 5,000 acre-feet per year by inducing seawater intrusion.

2) Increase desalting capacity to 8 mgd to provide additional drought and emergency water.

3) Tie desalter product water into the South County Pipeline to provide increased operational flexibility.

4) Expand use of the San Juan Basin for seasonal storage and pumpage.

TABLE 4-4

SIMULATED GROUNDWATER TDS IN THE SAN JUAN BASIN FOR A PHASE I PROJECT (mg/l)

Zone*	Historic No Project			Without Reclamation			With Reclamation		
	Maximum	Minimum	Average	Maximum	Minimum	Average	Maximum	Minimum	Average
1	550	420	480	650	450	515	650	450	515
2	980	705	810	1075	875	1020	1145	915	1085
3	665	425	535	480	400	440	515	415	470
4	990	585	785	590	395	460	610	405	480
5	1080	1005	1040	2600	690	1130	2605	490	1100
6	1245	870	1055	1305	720	1050	1305	720	1050
7	1585	1490	1544	3800	1100	2450	3800	1200	2500

* See Figure 3-1 for zone locations. TDS values are representative for each zone.

5) Incorporate reclamation and reuse into the San Juan Basin management plan.

Tentative Phase II facilities are depicted in Figure 4-7. To provide about 12,500 acre-feet per year of groundwater to the desalter facility, a total of about 12 wells would be required. Some of these wells could be dual-purpose extraction-injection wells. Also shown in Figure 4-7 are potential basin recharge sites.

Similar to the hypothetical simulations conducted for Phase I operation, simulations were conducted for Phase II operation for both reclamation and no reclamation in tributary areas. Historical annual pumping, Table 2-3, was increased by 5,000 acre-feet per year, and for two three-year drought periods pumping was increased by 10,000 acre-feet per year followed by four years of recharge at 7,500 acre-feet per year. The lumped basin inputs and outputs for this simulation are shown in Table 4-5. This table represents both future reclamation scenarios. Appendix A includes simulated water levels and TDS concentrations at selected nodes.

As can be seen in Table 4-5, the basin is slightly overdrafted. There is a substantial induced seawater inflow to the basin. Overdraft could be minimized by cutting down on rising water outflow by locating more wells along rising water areas of the San Juan Creek. While some initial efforts were made to strategically locate new wells, optimization of their location was not undertaken, being left to the subsequent design phases. It will also be noticed in Table 4-5 that drought year pumpage can not be sustained with the assumed well configuration. The reason for this is that simulated pumping was restricted because wells were pumped to bedrock in some cases.

Table 4-6 shows simulated TDS levels for various zones of the basin. TDS levels in mid-zones are improved due to simulated recharge, while near the coast TDS levels are considerably increased by simulated pumping in coastal zones. There is little statistical difference between simulated reclamation and no reclamation scenarios.

Simulated water levels, Appendix A, for a Phase II project are similar to those described for a Phase I project in the Upper San Juan Basin and the upper reaches of the Lower Trabuco Basin. There is little change of historic conditions. Most of the simulated increased pumpage is in the lower basin's Zones 4, 5, 7 and 8 (Figure 3-1). During normal years of simulated increased pumpage, there is little impact on groundwater levels. However, during each of the two simulated droughts, years of substantially increased pumpage, water level drawdowns of almost 100 feet were experienced in these areas.

TABLE 4-5

SIMULATED SAN JUAN BASIN
HYDROLOGICAL COMPONENTS FOR PHASE II OPERATION
(ACRE-FEET)

Year	Percolation of Precipitation	Artificial Recharge	Percolation of Applied Water	Streambed Percolation	Subsurface Inflow	Total Input	Rising Water	Pumpage	Phreatophyte Extraction	Ocean Outflow	Total Output	Net Input
1	1295		934	2233	1966	6428	2454	10644	417	-1407	12108	-5680
2	1816		934	4473	2454	9677	793	10644	417	-1477	10377	-700
3	459		934	1779	2623	5805	488	10644	417	-1701	9848	-4043
4	942		934	2089	2730	6695	380	10644	417	-1910	9531	-2836
5	1715		934	3750	2769	9168	450	10644	417	-1879	9632	-464
6	729		934	1954	2797	6414	350	15644	417	-3062	13349	-6935
7	833		934	2039	2840	6646	299	14710	417	-3642	11784	-5138
8	1047		934	2202	2839	7022	280	13829	417	-3705	10821	-3799
9	645	7500	934	1899	2857	13835	262	10371	417	-2910	8140	5695
10	597	7500	934	1888	2848	13767	531	10644	417	-2247	9345	4422
11	983	7500	934	2236	2836	14489	1946	10644	417	-1660	11347	3142
12	1000	7500	934	2350	2796	14580	2469	10644	417	-1442	12088	2492
13	1295		934	2606	2781	7616	254	10644	417	-1525	9790	-2174
14	1816		934	4785	2776	10311	325	10644	417	-1508	9878	433
15	459		934	2055	2799	6247	263	10644	417	-1759	9565	-3318
16	942		934	2324	2857	7057	228	10644	417	-1981	9308	-2251
17	1715		934	3961	2856	9466	293	10644	417	-1953	9401	65
18	729		934	2138	2856	6657	251	15644	417	-3108	13204	-6547
19	833		934	2202	2879	6848	216	14591	417	-3647	11577	-4729
20	1047		934	2348	2869	7198	212	13680	417	-3705	10604	-3406
21	645	7500	934	2030	2881	13990	196	10368	417	-2913	8068	5922
22	597	7500	934	1997	2869	13897	458	10644	417	-2256	9263	4634
23	983	7500	934	2319	2855	14591	1896	10644	417	-1659	11298	3293
24	1000	7500	934	2421	2813	14668	2447	10644	417	-1438	12070	2598
Mean	**1005**	**2500**	**934**	**2503**	**2769**	**9711**	**739**	**11631**	**417**	**-2271**	**10516**	**-805**

TABLE 4-6

SIMULATED GROUNDWATER TDS IN THE SAN JUAN BASIN FOR A PHASE II PROJECT (mg/l)

Zone*	Historic No Project			Without Reclamation			With Reclamation		
	Maximum	Minimum	Average	Maximum	Minimum	Average	Maximum	Minimum	Average
1	550	420	480	650	450	515	650	450	515
2	980	705	810	1075	875	1020	1145	915	1085
3	665	425	535	480	400	440	515	415	470
4	990	585	785	590	395	460	610	405	480
5	1080	1005	1040	3200	450	1290	3205	450	1290
6	1245	870	1055	1280	610	940	1280	610	940
7	1585	1490	1544	17950	7050	11520	17950	7055	11525

* See Figure 3-1 for zone locations. TDS values are representative for each zone.

HYDROLOGICAL IMPACTS OF THE PROPOSED PROJECT ON STREAMFLOWS

Both of the main stream channels, the San Juan Creek and the Trabuco Creek channels, that traverse the main basin have riparian phreatophyte vegetation along them. Rising water in the San Juan Creek and the riparian vegetation probably support a variety of bird and animal species that are indigenous to the general area. Additionally, the vegetation provides a visual ambiance that is enjoyed by the numerous equestrian, bikers, and other visitors to the trails along the San Juan Creek. The question of hydrological impacts on this ecosystem by the proposed project is addressed in this section.

This is basically a groundwater management project and, consequently, impacts on the ground surface will be minimal. There are no management plans for the Upper San Juan Basin and therefore the proposed project will have no hydrological effects in this area.

Historically, rising water occurred along several reaches of the San Juan Creek, and in years of above normal groundwater storage, there was streamflow in the San Juan Creek through many reaches. This streamflow and high groundwater tables provided the water source for the riparian vegetation seen today. Although it is desirable from a water conservation standpoint to minimize rising water outflow, it is probable that in the future, stream baseflows will increase with or without the proposed project, the reason being the increased return flow to the main basin streams resulting from irrigation with imported water in the tributary areas that are being urbanized. Today, both the Trabuco and San Juan Creeks have a year-round flow in them.

Hydrological impacts of the proposed Phase I and II projects will probably increase rising water somewhat as is shown in Tables 4-3 and 4-5. Simulated average annual rising water for Phase I and Phase II is, respectively, 257 and 739 acre-feet per year and occurs in the San Juan Creek. There will be a non-project related change in the TDS of baseflows in the future. Trabuco Creek baseflow will improve, and San Juan Creek will slightly degrade because of the tributary area return flows.

Manipulation of the water table is a major part of the proposed management of the basin and, during drought years, water levels will be drawn down, particularly in the area of the basin where Trabuco Creek joins the San Juan Creek and downstream. Drawdowns for a short two- or three-year period of 100 feet or so may be achieved. Such drawdowns are not expected to have any hydrologic impacts on the stream systems because they will, for the reason stated above, have an adequate baseflow. Secondly, severe drawdowns will generally be of relatively short durations of three or less years. Assuming no baseflows, riparian vegetation would respond by lack of growth during such periods but would eventually respond as water levels returned to normal.

In conclusion, the proposed project will probably slightly improve streamflow conditions by maintaining and somewhat increasing baseflows. Riparian vegetation and the associated animal and bird species will not be impacted by hydrological modification in the ecosystem caused by this project.

CHAPTER 5

CONCEPTUAL FACILITIES TO MANAGE THE SAN JUAN BASIN

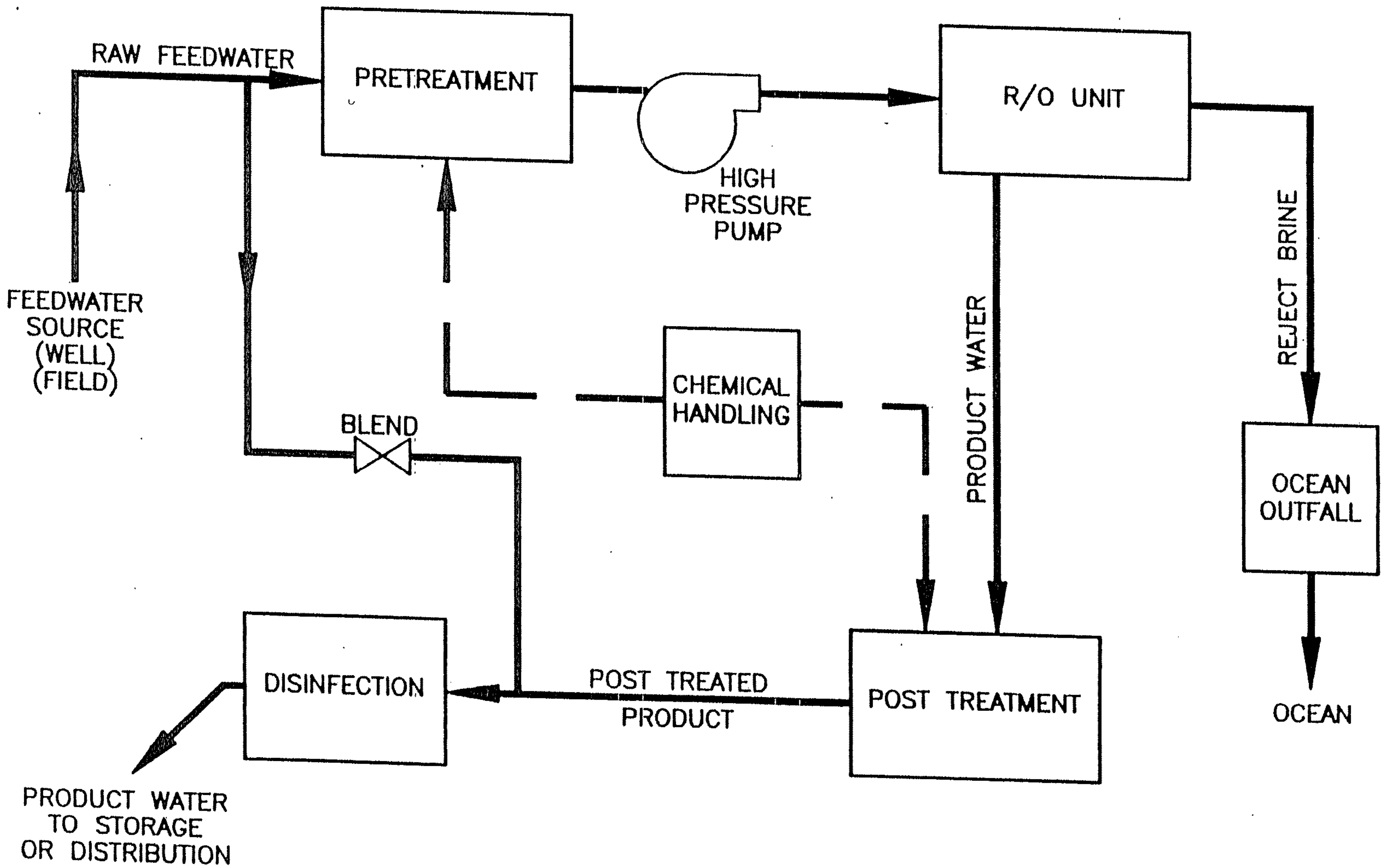
The ultimate project facilities to manage and operate the basin include wells, pipelines, artificial groundwater recharge basins, and an 8 mgd desalting water treatment plant. These facilities will have a maximum capacity to pump and treat 12,500 acre-feet per year for operation during extreme drought conditions where stored water within the basin is to be extracted. The average year extraction will be about 5,000 acre-feet per year. The facilities will include up to 12 wells to deliver water to the desalter plant. Product water from the desalter plant will be distributed into the Capistrano Valley Water District water delivery system at two points. By delivering water into CVWD's system at these points, CVWD can deliver water into all their pressure zones. It is expected that the average year project yield will be totally used by CVWD. However, by connecting at these points and with the addition of a booster pumping station, project water can be delivered into the South County Pipeline and/or Eastern Transmission Main for water distribution to other SJBA agencies. The proposed facilities are shown in Figure 4-7.

DESALTING TREATMENT PLANT

The desalting treatment plant will provide adequate water treatment to reduce salinity to a value acceptable for potable water use. Of particular concern will be the removal of iron and manganese, as well as total dissolved solids. The desalting plant will be designed to produce a total dissolved solid level of 500 mg/l. However, it will be possible to adjust this range up or down depending upon the desired finished water quality. In other words, it may be desirable to operate with slightly higher TDS to match existing imported water quality and reduce operating costs of the desalting plant.

Figure 5-1 schematically identifies the process train of the desalting plant. Inflow water will be split into two streams. One stream will be used for blending at the end of the treatment train; the second stream will be processed through the desalting plant. The blending stream will require pretreatment in the form of iron and manganese removal. The second stream will require pretreatment which may consist of iron and manganese removal, pH adjustment, and cartridge filtration in order to remove suspended matter that could plug the reverse osmosis membranes. Water will then pass through the reverse osmosis membrane racks, then through post-treatment for recarbonation and pH adjustment. The plant water will then be blended to adjust the TDS. Post-treatment of the final plant stream will also consist of disinfection through chlorination. A 1,000,000-gallon reservoir is proposed to be located on-site to provide a forebay to a pumping station to deliver water into the CVWD system and at times of emergency into the Eastern Transmission Main or South County Pipeline.

The plant will be designed with flexibility in mind, with water quality ranging from 1,500 mg/l to 7,000 mg/l. It is estimated that the maximum treated project water yield will be approximately 10,500 acre-feet per year for operation during a three-year drought period. At other times it is estimated that the plant would produce approximately 3,500 acre-feet per year.



San Juan Basin Authority

DESALTER PROCESS DIAGRAM

NBS LOWRY | SCALE: AS SHOWN | FIGURE 5–1

Appendix B contains the siting study that identifies potential desalter sites. The Forster site is the most desirable site for the project's desalting plant. Figure 5-2 presents a conceptual site layout for the desalting plant. Approximately 3.5 acres are required for the desalting treatment plant. Approximately 1.5 acres of the proposed site are currently owned by the CVWD. The remaining 2 acres must be obtained from the Forster family.

DISTRIBUTION

CVWD should be able to use project water most of the time; however, the proposed project includes facilities to deliver water to other SJBA agencies in times of emergency. An examination of CVWD projected demands indicates that they should be able to use all Phase I production and perhaps the majority of the final project production. However, it is proposed to provide connections to South County regional water transmission facilities in order to distribute water to other SJBA member agencies. These connections include a connection to the Eastern Transmission Main during Phase I and the South County Pipeline during Phase II. Figure 5-3 conceptually depicts regional project water distribution.

WELLS

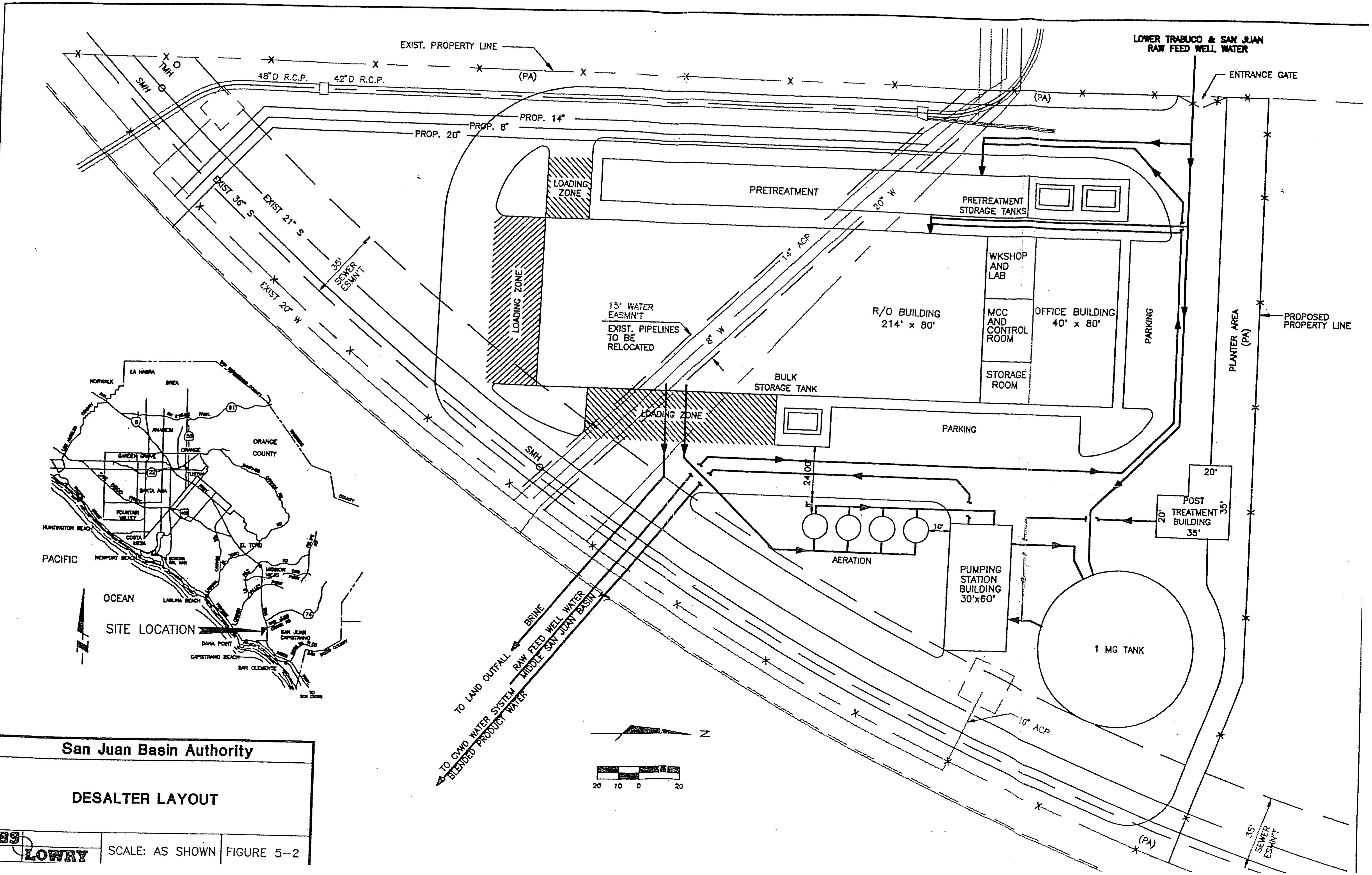
A number of wells would be required to provide feedwater to the desalting facility. The concept is that well water would be blended to provide the lowest feedwater mineral content.

To provide some redundancy and account for brine quantities and other losses associated with the desalting facility, a total well capacity of about 8,000 gpm will be required to provide feedwater to the desalting facility. Wells are anticipated to have a capacity of 1,000 gpm each in the southern end of the system and 450 gpm in the northern end of the system. Wells are spaced to account for an anticipated maximum radius of influence of about 1,500 feet for each well. Wells would discharge to a manifold pipe system with diameters ranging from 12 to 14 inches. Well pumps would be sized to provide sufficient head to move the pumped water to the desalting facility.

RECHARGE

Recharge may be by supply pumpers with "in-lieu" imported water, basins or wells, and possibly a combination of all may be required. The trade-offs between each method are the availability and cost of land for basins and the cost of well recharge. The proposed extraction wells can be designed for the dual purpose of pumping and recharge.

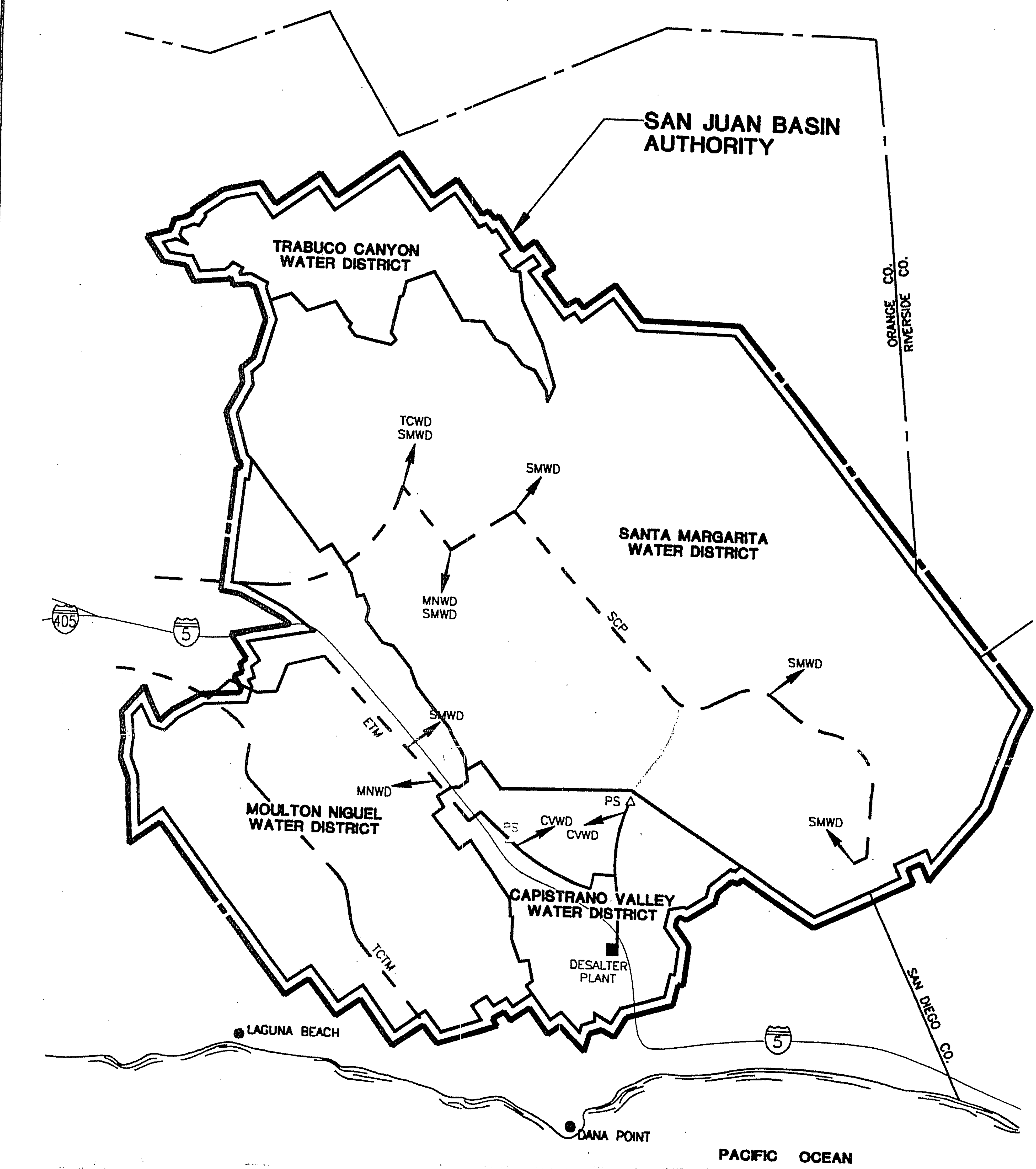
Figure 4-7 shows potential areas, primarily public land or land that is not readily developable where recharge basins may be located. It is anticipated that reasonable recharge rates may be achieved in these areas. Recharge basins are best operated in pairs; one is being used for ponding while a companion is drying and being renovated to restore recharge rates. Assuming a rather low average infiltration rate of 1 foot per day, 20 acres would be required to recharge a maximum of 7,500 acre-feet per year. Total land area required would be on the order of 25 acres.



San Juan Basin Authority

DESALTER LAYOUT

NBS LOWRY | SCALE: AS SHOWN | FIGURE 5-2



EMERGENCY WATER DISTRIBUTION

AGENCY	% PARTICAPATION (1)	PHASE I (2) AC FT/YR	PHASE I (2) CFS	ULTIMATE (2) AC FT/YR	ULTIMATE (2) CFS
SMWD	57.5	2,473	3.8	6,038	9.2
MNWD	15.1	649	1.0	1,585	2.4
CVWD	22.0	946	1.4	2,310	3.5
TCWD	5.4	232	0.4	567	0.9
TOTAL	100.0	4,300	6.6	10,500	16.0

(1) ESTIMATED BASED ON MWDOC SOUTH COUNTY STUDY (1985)
(2) ESTIMATED BASED ON 330 DAYS PER YEAR OF OPERATION

LEGEND

PHASE I
PHASE II
BY OTHERS

San Juan Basin Authority

DESALTING PROJECT
EMERGENCY WATER DISTRIBUTION

NBS LOWRY | SCALE: AS SHOWN | FIGURE 5-3

The actual amount of land required will depend upon the recharge plan. For example, if 7,500 acre-feet per year is extracted for three years and it is desirable to recharge all the water in one year, i.e., 22,500 acre-feet, 75 acres of recharge facilities would be required.

Rather than simulate a recharge plan, it is suggested that the best strategy is to acquire as much reasonably priced land as possible and develop recharge facilities on this land. Depending on the amount of land acquired and the number of wells that may be constructed as dual-purpose wells, a recharge plan can be developed.

Simulations of the basin response to pumpage and recharge did not involve specification of the source of recharge water. It was assumed that it could be imported water purchased at incentive prices offered by MWDSC or reclaimed water, providing Department of Health Services approval can be obtained. There would be considerable advantage to using reclaimed water for recharge. Costs may be less and an additional source of water would be available to the basin.

CHAPTER 6

FUNDING ALTERNATIVES

A number of local, state and federal funding incentive, loan and grant programs are available to assist the SJBA in implementing water management alternatives within the San Juan Basin. Available means for funding and/or subsidizing all or part of any selected alternatives include, but are not limited to, the following:

	Funding Mechanism	Funding Source
1.	Groundwater Storage Recovery Program (GRP)	Metropolitan Water District of Southern California (MWDSC)
2.	Small Projects Program	United States Bureau of Reclamation
3.	Local Projects Program (LPP)	MWDSC
4.	Seasonal Storage Service Program (SSS)	MWDSC
5.	State Revolving Fund (SRF) Loan Program	State of California Water Resources Control Board (SWRCB)
6.	Water Reclamation Loan Program	SWRCB
7.	Water Quality Control Fund Loan Program	SWRCB
8.	Agricultural Drainage Management Loan Program	SWRCB
9.	Water Conservation Bond Law of 1988	State of California Department of Water Resources (DWR)
10.	Special Legislation	State or Federal Government
11.	Agency (Revenue) Funding	Water Users

The funding mechanisms appropriate for assisting the SJBA will be, in part, dependent on funds available. Funding assistance from the MWDSC, Department of Water Resources and Bureau of Reclamation, however, may form the cornerstone for the implementation of brackish groundwater desalting programs. Low interest loans, agency funding or other funding mechanisms may also prove to be feasible. Available funding opportunities and mechanisms potentially applicable to the SJBA project are reviewed below.

MWDSC GROUNDWATER RECOVERY PROGRAM

The Groundwater Recovery Program (GRP), offered by MWDSC, is open to all technologies which develop and distribute new water sources for use within the MWDSC service area. MWDSC establishes the following eligibility criteria for the GRP:

1. Contaminated groundwater must be recovered.
2. The project must provide a non-interruptible supply.
3. Product water must be used within a MWDSC service area.
4. Project costs must exceed the non-interruptible rate for water.
5. Contaminated groundwater must be provided through the local safe yield of the area, recharged urban or agricultural runoff, or by groundwater replenishment by MWDSC.

The Groundwater Recovery Program provides project funding for costs of construction, design, operation and maintenance, replacement, pumping, treatment, groundwater replenishment and brine disposal. (Costs of distributing the water are not eligible for reimbursement under the GRP.) Although capital financing is not available, funding may be used towards paying off the capital cost.

Qualifying projects obtain financial benefit from the program by receiving a maximum contribution from MWDSC of $250 per acre-foot of produced water. In addition, for each acre-foot of produced water, the implementing agency avoids the cost of having to purchase one acre-foot of MWDSC water. Qualifying criteria for GRP funding include the following:

1. Each project must be developed and operated by the member agency.
2. The member agency is responsible for developing markets for the produced water.
3. The project must be capable of operating for three years under drought conditions without the need for MWDSC replenishment.
4. The product water quality must meet applicable State of California standards.
5. The participating agency must obtain all applicable permits, and adhere to applicable regulations and laws, including the California Environmental Quality Act (CEQA).

The MWDSC has established a three-step review and contracting process for seeking GRP funding:

1. A project proposal is submitted from the MWDSC member agency to MWDSC's General Manger.

2. If the project meets the qualifying criteria, the project sponsor and MWDSC meet to negotiate a contract which defines the project, the rules governing payment, the role of the member agency, liability and other related matters.

3. Approval by the MWDSC Board is required before MWDSC is committed to participate in the project. Contracting principles for the program include the following:

    - The project will be constructed, owned and operated by the sponsoring agency.

    - MWDSC will guarantee to purchase the project's new water yield at the unit rate equal to the sum of MWDSC's applicable water rate plus MWDSC's GRP contribution of $250 per acre-foot.

    - The new water yield will be sold to MWDSC's member agency at the applicable water rate for resale to the project sponsor (if the member agency is not the sponsor).

    - The net effective payment by MWDSC will be the GRP contribution.

    - All contracts will include a MWDSC member agency.

BUREAU OF RECLAMATION SMALL PROJECTS PROGRAM

The Small Projects Program is a potential federal assistance program for groundwater resource, reclaimed water reuse and quality control projects, with emphasis on agricultural, domestic and municipal water supply projects. The Small Projects Program is designed to encourage state and local participation in developing and managing groundwater aquifer systems.

Under the proposed program, the Secretary of Interior, acting through the Bureau of Reclamation, would provide federal loans and grants for projects which:

1. Maintain groundwater pumping levels and prevent long-term overdraft of aquifers.

2. Develop surface and groundwater conjunctive use facilities to conserve water for seasonal or long-term recovery that would otherwise be wasted.

3. Prevent groundwater contamination from toxic spills and pollution sources.

4. Clean up and treat contaminated groundwater.

5. Provide water supplies to agricultural, domestic and municipal water supply systems, including pumping, conveyance, distribution, storage and treatment facilities.

6. Promote and facilitate conservation through the use of reclaimed water.

7. Restore, create and enhance wetlands and other environmental resources.

Proposals for projects would be sent to the Secretary of Interior. Proposals must include a detailed report that provides the following information: plans, estimated costs and benefits, and financial and repayment terms as may be determined to be sufficient for evaluating the engineering, and financial and environmental feasibility of the proposal. If a project involves irrigation development, a statement assuring sustained production of irrigated agricultural crops must be submitted. A description of any water or soil characteristic would be required if toxic or hazardous irrigation return flows could result. Finally, a statement would be required that describes whether the organization already holds or can acquire land and water rights needed for the completed project.

MWDSC LOCAL PROJECTS PROGRAM

The Local Projects Program (LPP) is offered by the MWDSC. The program is open to all technologies which develop and distribute a new water source for use in MWDSC's service area. The program is based on the concept that the local development of water resources allows MWDSC to avoid costs for pumping imported water over the Tehachapi Mountains or developing alternate sources of supply water. The LPP passes on these avoided costs back to the agency developing the local water supply.

The program defines a "Local Project" as being a project under which a new local water supply is developed by a MWDSC member agency or subagency which currently receives water from MWDSC. The new water supply must be used within the MWDSC service area and must reduce MWDSC cost to convey, treat and distribute water. MWDSC establishes the following qualifying criteria for the program:

- Minimum Yield. Projects must deliver at least 100 acre-feet per year of new water within the MWDSC service area and replace firm water demands on the MWDSC system.

- Financial Assistance. Projects must require MWDSC financial assistance to be economically viable to the project sponsor.

- Policy Needs. Projects must be implementable under the MWDSC Enabling Act and any other pertinent legal requirements.

- Technical Development. Projects must have an approved "Facilities Plan" which presents the project layout, staging and cost. A marketing analysis must be completed for non-potable water projects.

- Regulatory Needs. Projects must demonstrate that public health and regulatory permits are obtainable.

- California Environmental Quality Act. Projects must comply with the provisions of the California Environmental Quality Act (CEQA) before the MWDSC Board of Directors can approve the project for inclusion in the LPP.

MWDSC can contribute to approved projects by providing (1) production incentives or (2) capital financing. Approved projects provide a production incentive of $154 per acre-foot of produced water. The assistance, essentially a subsidy, comes in the form of a "buy-back" agreement between the MWDSC and the local agency. The "buy-back" agreement can extend for a period of up to 25 years. The LPP incentive is subject to review every three to five years by the MWDSC Board of Directors; the incentive may be increased or decreased at the discretion of the MWDSC Board.

While the MWDSC encourages the project sponsor to secure its own capital financing, they may provide capital financing under the revised Local Projects Program. If any agency is unable to secure financing for its project, MWDSC may consider providing a capital contribution equivalent to the estimated MWDSC annual contribution to the project. In such circumstances, MWDSC would own the yield from the project and the project sponsor must then guarantee that the project would produce a minimum amount of water each year.

The review and contracting process to seek MWDSC LPP funding is similar to the process to obtain funding through GRP.

MWDSC SEASONAL STORAGE SERVICE PROGRAM

The Seasonal Storage Service (SSS) incentive program is provided by the MWDSC. In general, under this program, a local water agency enters into a purchase and pricing contract with MWDSC which, in lieu of increasing its purchases of imported water during the high demand summer months, the local agency can purchase additional MWDSC water during the months of October through April. During the months of October through April, MWDSC generally has available unallocated water supply. To encourage the off-demand seasonal purchase of MWDSC imported water supply, MWDSC provides local agencies a purchase price reduction. To qualify for the water pricing incentives, the local agency must demonstrate that its purchases of MWDSC water will be reduced correspondingly during the months of May through September. If the terms of the contract are not met by the local agency, MWDSC may impose severe water pricing penalties.

STATE REVOLVING FUND PROGRAM

The State Revolving Fund Program (RFP) provides capital financing for wastewater treatment, agricultural drainage, nonpoint source, estuary enhancement, storm drainage and water reclamation projects. The RFP, administered by the State Water Resources Control Board, provides from $150 to $240 million each year.

The RFP offers loans for up to 20 years at an interest rate equal to one-half the rate for the most recent sale of state general obligation bonds. (The February 1992 interest rate was approximately 3.5 percent.) The loans are available for planning, design and construction of publicly owned wastewater treatment works projects, construction of storm drainage projects, implementation of nonpoint source correction projects, and development and implementation of estuary conservation and management plans. Loans through the program are limited to $20 million per project.

Public wastewater agencies or organizations with authority to control nonpoint source pollution are eligible for the loans. Applications for loans under the RFP, however, often greatly exceed the available funds. As a result, the state establishes an annual priority list to direct available monies to the most worthy projects. To be placed on the priority list, applicants must receive a recommendation from the appropriate Regional Water Quality Control Board.

After completion and approval of facilities planning and design, applicants must submit a completed loan application package. Eligible projects must comply with environmental review requirements set forth in the California Environmental Quality Act (CEQA).

WATER RECLAMATION LOAN PROGRAM

The Water Reclamation Loan Program provides funds for projects which develop cost-effective water reclamation projects. The fund is administered by the State Water Resources Control Board, Office of Water Recycling. The program, established under the Clean Water Bonds Law of 1984, authorized up to $25 million for loans to municipalities to assist in the design and construction of water reclamation projects. The Clean Water and Water Reclamation Bond Law of 1988 was established to provide aid for local public agencies not included in the 1984 Bonds Law.

Funding is currently limited to $5 million maximum for each project at an interest rate equal to one-half the rate of the most recent sale of a state general obligation bond. (Currently this rate is approximately 3.5 percent.) Loan terms under the program must not exceed 20 years.

The Water Reclamation Loan Program provides funds for wastewater treatment facilities necessary to produce water for beneficial uses. Wastewater sources eligible are municipal wastewater, agricultural wastewater, polluted groundwaters or polluted surface waters. Storage and distribution systems for reclaimed water are also eligible. Water conservation projects are not funded under this program, but funding is available to projects that incorporate both reclamation and conservation features.

Eligibility requirements for the loan program include: (1) applicants must be a local public agency, (2) projects must be cost-effective compared to the development of new sources of water or alternative new fresh water supplies, and (3) project proponents must comply with requirements of the California Environmental Quality Act (CEQA). The review and contracting process for the Water Reclamation Loan Program involves the following:

1. Project proponent submits project application documents to the Office of Water Recycling. (Applications are available from the Office of Water Recycling.)

2. The State Board reviews the application and planning documents, and issues project concept approval, makes preliminary eligibility determination, and determines the availability of loan funds. (Projects are funded in the order in which the applications are received.)

3. The State Board approves the proposed project, and authorizes a loan commitment.

4. The project proponent submits project construction drawings and specifications, cost estimates, construction financing plan, revenue program, final user contracts, final CEQA documentation, and a plan for the use of remaining project capacity.

5. The submittal is reviewed by State Board staff, and approval for construction is issued.

6. The State Board issues the loan for execution with the participating agency.

WATER QUALITY CONTROL FUND LOAN PROGRAM

The Water Quality Control Fund Loan Program (WQCFLP), administered by the State Water Resources Control Board, provides loans for wastewater treatment facilities. The program provides loans at terms not to exceed 25 years at an interest rate equal to one-half the average rate paid by the state on general obligation bonds. (This rate is currently approximately 3.5 percent.)

The Water Quality Control Fund Loan Program provides loans for wastewater treatment feasibility studies, water reclamation feasibility studies, and construction of wastewater treatment facilities. Eligibility requirements for the program include the following:

1. The applicant must hold a local election in which a simple majority vote approves the loan.

2. The applicant must demonstrate that revenue or general obligation bonds cannot be sold.

3. The applicant must demonstrate financial hardship and proof that local funding is not available.

Loan applications for the Water Quality Control Fund Loan Program may be obtained through the State Board, Division of Clean Water Programs. The completed application must contain documents that demonstrate financial hardship, lack of local share, and local election results. Approximately six months are needed to process the loan application.

AGRICULTURAL DRAINAGE WATER MANAGEMENT LOAN PROGRAM

The Agricultural Drainage Water Management Loan Program, offered by the State Water Resources Control Board, provides assistance for feasibility studies, design and construction of agricultural drainage water management projects.

Loans are restricted to cities, counties, special districts, joint powers authorities, or other political subdivisions of the state involved with water management. Eligible projects must be demonstrated to remove, reduce or mitigate pollution from agricultural drainage. Projects funded through this mechanism have included evaporation ponds and deep well injection, selenium removal projects, cleanup projects for groundwater contaminated by agricultural practices, agricultural drainage management projects, and agro/forestry projects and feasibility studies.

The Agricultural Drainage Water Management Loan Program was originally funded at $75 million, and as of February 1992, the program funds were exhausted. Thus, unless additional funding is provided to the program, such agricultural drainage loans would not represent a feasible means of funding the SJBA project.

WATER CONSERVATION BOND LAW OF 1988

The Water Conservation Bond Law of 1988 (Proposition 82) provides $20 million for loans to local agencies to assist in the planning and construction of projects that develop new local water supplies. The program is administered by the Department of Water Resources (DWR) Bond Financing and Administration Office. The interest rate charged for the loans is equal to the interest rate that the state pays on the general obligation bonds sold to finance the program.

The program limits the amount loaned to $5 millon dollars for the construction of water supply facilities. To be eligible for construction loans, the engineering, hydrologic, environmental, economic, and financial viability of the project must be demonstrated in a feasibility study. Costs of such feasibility studies can be covered under the loan program. The program limits the amount loaned for feasibility studies to $500,000 per study. (Since the feasibility study is required to demonstrate the viability of project construction, separate loans are needed from the DWR for funding the feasibility study and project construction.)

The DWR provides application information both for the water supply construction loans and for water supply feasibility studies. The applications require organizational, financial and legal information, project description, feasibility study work plan, engineering and hydrologic feasibility information, economics justification analysis, state-wide interest, critical need demonstration, and environmental documentation.

For approved projects, the DWR executes a loan contract with the implementing agency. Work on project feasibility studies or construction projects, however, may begin prior to the execution of a contract with DWR. In order to receive reimbursement, however, the participating agency must contact the Bond Financing and Administration Office prior to incurring the costs.

SPECIAL LEGISLATION

If economic and other effects associated with the Southern California water shortage become sizable, the SJBA and other local agencies may wish to consider lobbying for legislate assistance at the state or federal level. If state or federal legislators can be convinced of the merits of a SJBA water resources project, it may prove possible to obtain special legislation that could provide capital funding, low interest loans, subsidies, or other financial incentives for the use of produced potable or non-potable water.

AGENCY FUNDS

The SJBA or member agencies involved in the implementation of groundwater management projects could fund capital improvements out of existing reserves or bonding capacity. Under this funding approach, the capital expenditures could be recovered through the generation of revenues received from the sale of the produced potable or non-potable water. Certificates of participation could be one of these funding mechanisms. The MWDOC has formed the Water Facilities Corporation which is available to MWDOC agencies and could provide a good vehicle for project funding.

FUNDING RECOMMENDATIONS

Financial assistance could include contributions to the capital cost of the projects needed to implement a management plan, or incentives for the pricing of the product water resulting from the implementation of the plan.

The MWDSC incentive financing programs are largely the result of the desire of the MWDSC to increase the production of local water supply sources to reduce the total dependence on the import systems of the MWDSC. The Groundwater Recovery Program encourages the development and use of local groundwater. This program basically provides a subsidy of $250 per acre-foot to bring down the cost of producing groundwater to a cost that is more equal to the cost of purchasing water from MWDSC. This program is proposed to be widely used by many agencies in the MWDSC service area that have the ability to produce groundwater, and is an important cornerstone funding mechanism for the SJBA.

The Authority has been working closely with the staff of the MWDSC and the MWDOC to ensure that the Authority's plan conforms to the criteria of the Groundwater Recovery Program. The pricing of MWDSC water is a key element in the financial incentive programs, and it will be necessary to work even more closely with the staff of MWDSC in the future as the MWDSC water pricing policies are modified because of ever-changing conditions in the water supply field.

The MWDSC Seasonal Storage Service Program encourages the expansion of local groundwater storage for reducing the peaking requirements on the MWDSC aqueduct systems. The Authority can also participate in this program that will mutually benefit both the Authority and MWDSC. This program will most likely evolve with new criteria as conditions change with new water pricing policies.

The other state and federal financial assistance programs are principally loan programs that provide low-interest funds for the construction of treatment plants and pipelines. The potential funds available from these programs vary greatly from year to year, depending on the level of activity by agencies applying for funding assistance, and the amount of funding provided by state bond issues, and/or the amount of federal funds authorized by Congress and the Office of Management and Budget. The State Water Resources Control Board each year prepares a priority ranking of projects based on recommendations from the local regional water quality control boards. The new priority list will be issued in October 1994. Funds from the federal level will be dependent upon the reenactment of the Clean Water Act (S1114 Baucus-Chafee) now being considered by Congress. State matching funds will be dependent upon a proposed bond issue for the fall of 1994. The Water Conservation Bond Law of 1988 holds the best promise for a low interest loan for up to $5 million for the proposed project. This program is administered by the State Department of Water Resources, and that agency has already performed a preliminary review of the Authority's project. Further discussions and loan application documents need to be filed to obtain final approval.

The funding programs provided by the U.S. Bureau of Reclamation are significantly different than those previously discussed. Since the early 1900's, the Bureau has constructed many large water development projects in the western states, and as an ancillary activity, has offered financial assistance to construct "small projects" to assist in the development of irrigation water to increase agricultural production. The Small Projects Program has evolved over the years to also include grants for flood control, recreation, environmental enhancement, and also loans for municipal water supply projects. However, it was also necessary to always include agricultural irrigation as a component of a proposed project. More recently, the mission of the Bureau has been redefined to focus more on "total water resources management," rather than the construction of large-scale water development projects. The recent enactment of Title 16 of PL 102-75 essentially eliminates the requirement of agricultural irrigation as an essential component of an eligible project. The law promotes new uses of reclaimed water and naturally impaired ground and surface waters. The construction of desalting plants, wells and related pipeline facilities fits very well with the goal of the new mission of the Bureau.

A number of projects similar to the Authority's proposed project are now being funded under the provisions of PL 102-75, including a desalting plant for the West Basin and Central Basin in Los Angeles County. Many other projects throughout the United States are included for funding of 25 percent to 50 percent of the capital cost of the projects. Some of the projects that are heavily oriented toward research and development are funded at the 50 percent level. Projects that are principally production-oriented are funded at the 25 percent level.

The proposed Basin Authority projects fit the criteria of PL 102-75 and should qualify for federal assistance at least at the 25 percent level. However, it will be necessary to obtain support of local Congressmen to get authorization for funding, and to provide testimony before the appropriate committees in Congress.

The recommended funding strategy is summarized as follows:

- Maximize funding opportunities from MWDSC, including Local Projects, GRP and Seasonal Storage. Try and obtain capital participation through the Local Projects Program.

- Obtain the maximum grant funds from USBR PL 102-75 program, estimated at 25 percent of project cost.

- Obtain low interest loan from DWR or SWRCB programs, i.e., Water Conservation Bond Law of 1988 - $5 million maximum.

- Fund remaining capital cost with local funding mechanisms.

- Initiate funding strategy concurrent with CEQA process.

CHAPTER 7

ECONOMIC FEASIBILITY

FACILITIES ESTIMATED COSTS

Preliminary cost estimates were prepared for the facilities proposed and described in Chapters 4 and 5. The total capital cost to develop both Phase I and Phase II facilities is about $33,812,000 (see Appendix C). Only Phase I costs will be presented and economically evaluated.

Table 7-1 presents estimated capital costs for a Phase I project involving a 4 mgd desalter, five wells, pump station, pipes and other facilities. Table 7-2 presents operation and maintenance costs for annual net potable water yields of 1,800 acre-feet per year and assumed drought year yields of 3,600 acre-feet per year. All costs are based on December 1993 dollars.

PROJECT ECONOMIC FEASIBILITY AND BENEFITS

A 25-year life is assumed although it is probable that a Phase II project will be implemented about five years after the Phase I project comes on line. Before a Phase II project is approved, an economic feasibility study will need to be developed based on the experiences of operating Phase I.

The project has two economic aspects to evaluate: its economic viability as a water supply project and, added to that, its economic viability as a water supply and storage project. A project that produces 1,800 acre-feet per year, pumping during the five summer months with no added extractions during drought or emergencies, was assumed to be the water supply case. The water storage case is a project producing as above; however, also producing an additional 1,800 acre-feet during droughts for a total of 3,600 acre-feet per year, with the additional extractions coming from storage and a modest amount of seawater intrusion.

In order to evaluate the storage case, it was necessary to develop a hypothetical annual sequence of groundwater extractions and desalter yield. This sequence includes annual potable project yields of 1,800 acre-feet with occasional drought year project yields of 3,600 acre-feet per year for an assumed maximum three-year period.

Drought recurrence was estimated by considering the 111-year (1876-1987) Lake O'Neil annual precipitation data. During this period the average annual precipitation was 13.34 inches and the standard deviation was about 7.87 inches. If drought is defined as a year where precipitation was less than the mean minus one-half a standard deviation, 10.60 inches, there were 39 years of drought during the 111-year period. Approximately 35 percent of the time is a drought condition. This means that in a future hypothetical 25-year period, approximately 8.75 years would be a drought condition. To be conservative, it was assumed that there would be two three-year drought periods to evaluate economic feasibility.

TABLE 7-1

PHASE I
CONJUNCTIVE USE FACILITIES
PRELIMINARY COST ESTIMATE

CAPITAL COST

DESCRIPTION	COST $
Well - Complete with Pump (4 Wells @ $250,000 ea & 1 Rehab @ $40,000)	1,040,000
Land - 4 sites	30,000
Coastal Monitoring Wells (3 Wells @ $20,000 ea)	60,000
Desalter Plant	
4.0 mgd R.O. Plant Complete ($1.30 per gal/day)	5,200,000
Desalter Building (10,000 sq.ft. @ $20/sq. ft.) concrete tilt-up. Includes plumbing, electrical, foundation, etc.	200,000
Site Improv. Paving, Grading, Storm Drain, Water & Sewer, etc.	500,000
Access Road - Asphalt Paving ($3/sq. ft.)	100,000
Land - 3.2 acres	512,000
Pump Stations - (Valves & Piping Included)	
@ Desalter Plant 3-200 HP @ $150,000 ea.	450,000
Building (40 ft. x 20 ft. @ $150/sq. ft.)	120,000
Brine Line - (1,000 LF - 12 in. @ $60/LF) - Installed	60,000
Product Line - (13,500 LF - 24 in. @ $140/LF) - Installed	1,890,000
Raw Water, Well Collection Pipelines - Installed	
Middle San Juan N/A	
Trabuco Creek N/A	
Lower San Juan (7,000 LF - 18 in. @ $90/LF & 1,500 LF - 10 in. @ $50/LF)	705,000
Desalter Collector (1,500 LF - 24 in. @ $120)	180,000
Brine Capacity Charge	615,000
Subtotal	11,662,000
Engineering, Surveying, Etc. -15%	1,749,000
Contingencies - 15%	1,749,000
TOTAL CAPITAL COSTS	**15,160,000**

TABLE 7-2

PHASE I
CONJUNCTIVE USE FACILITIES
PRELIMINARY COST ESTIMATE

OPERATION AND MAINTENANCE COSTS

POTABLE WATER PLANT PRODUCTION ANNUAL COST		1,800 AF/YR $/YR (4)	3,600 AF/YR $/YR (5)
DESALTER			
Fixed O&M	(1)	98,000	98,000
Variable O&M	(2)		
Chemicals, Labor, Replacement		225,000	491,000
Energy		132,000	590,000
PUMP STATION			
@ Desalter			
Fixed @ 2.5% Capital		6,000	6,000
Variable O&M			
Labor, Spare Parts, Service		0	5,500
Energy		117,000	234,000
WELLS			
Fixed O&M @ 2.5% Capital		14,200	14,200
Variable O&M			
Labor, Spare Parts, Service		0	17,100
Energy	(3)	57,000	130,000
OCEAN OUTFALL			
Fixed O&M		1,700	1,700
Variable O&M		0	2,300
Total O&M Fixed		**119,900**	**119,900**
Total O&M Variable		**531,000**	**1,469,900**
Total O&M		**650,900**	**1,589,800**
Total O&M/AF		**362**	**442**

NOTES AND ASSUMPTIONS

1. Includes labor and maintenance supply costs.
2. Includes chemical, energy, labor, maintenance supply, and membrane replacement costs.
3. Based on providing 45 psi delivery pressure at inlet to desalting plant.
4. Energy cost assumed to be $0.11/KWH, and 150 days per year operation.
5. Energy cost assumed to be $0.11/KWH, and 330 days per year operation.

Project economic feasibility is determined by comparing the cost of project water to the cost of MWDSC imported non-interruptible water delivered in South Orange County. MWDSC has made several projections of future water cost. Two MWDSC water cost scenarios were examined and are believed to "bracket" future imported water costs. Table 7-3 presents the project imported water costs used in this study.

There are numerous financial incentives and opportunities for financing Phase I, as discussed in Chapter 6. The financial analysis assumes the following financial incentives and opportunities:

- 25 percent grant from the USBR PL102-75 program.
- Low interest loan (3-1/2 percent) from DWR or SWRCB for $5,000,000.
- Remaining capital funding through local funding mechanisms.
- Maximum participation in MWDSC Groundwater Recovery and Seasonal Storage Programs.

WATER SUPPLY CASE

Tables 7-4 and 7-5 present net project cost per acre-foot for the water supply case. Included are capital, operations and maintenance costs, and MWDSC incentives. Table 7-4 compares net project cost to imported water cost Scenario 1 (Table 7-3) and Table 7-5 to Scenario 2.

A benefits and cash flow analysis was developed to further assess economic feasibility. Tables 7-6 and 7-7 analyze the financial benefits or costs of the project as a whole and to each member agency. The analysis is based on CVWD using all produced water and buying other agencies' share at MWDOC water rates. The benefits (or costs) are summed to provide a cumulative cash flow. Under both imported water cost scenarios, the water supply case project pays for itself throughout its life with a significant cumulative cash flow.

Table 7-8 summarizes the total cash flow and present worth of the Phase I water supply case. As can be seen, there is a significant economic benefit from the project. The cash flow is summarized graphically in Figure 7-1.

WATER STORAGE CASE

Tables 7-9 and 7-10 present net project cost per acre-foot for the water storage case. Included are capital, operational and maintenance costs and MWDSC incentives. Table 7-9 compares net project cost to imported water cost, Scenario 1, and Table 7-10 to Scenario 2.

A benefits and cash flow analysis was developed to further assess economic feasibility. Tables 7-11 and 7-12 analyze the financial benefits or costs of the project as a whole and to each member agency. The benefits (or costs) are summed to provide a cumulative cash flow. The project with Scenario 2 imported water cost maintains a positive cumulative cash flow. With Scenario 1 imported water cost, the cumulative becomes negative by the end of the project study

TABLE 7-3
PROJECTED IMPORTED WATER COST
$ PER ACRE FOOT

Year	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
Scenario 1 - With Constant Dollar Seasonal Differential														
MWDSC Treated	412	448	482	505	542	574	592	600	608	616	636	654	677	695
MWDSC Seasonal	280	316	350	373	410	442	460	468	476	484	503	522	545	563
MWDOC	4	4	4	4	5	5	5	5	5	5	5	5	6	6
SCPS & AMP	56	58	59	61	62	64	65							
Total MWDSC Treated	472	510	546	570	609	642	662	605	613	621	641	659	683	701
Total MWDSC Seasonal	340	378	414	438	477	510	530	473	481	489	508	527	551	569
Scenario 2 - With Constant Percentage Seasonal Differential														
MWDSC Treated	417	456	492	520	561	597	618	627	636	645	667	688	714	734
MWDSC Seasonal	275	301	325	343	370	394	408	414	420	426	440	454	471	484
MWDOC	4	4	4	4	5	5	5	5	5	5	5	5	6	6
SCPS & AMP	56	58	59	61	62	64	65							
Total MWDSC Treated	477	518	556	585	628	665	688	632	641	650	672	693	720	740
Total MWDSC Seasonal	336	363	388	408	437	462	478	419	425	431	445	459	477	490

Notes and Assumptions:

1. Sources - MWDOC December 1993
2. The effective treated water rate includes fixed charges (connection maintenance, readiness-to-serve, one-half of new demand charge, treated, peaking) calculated for MWDSC as a whole.
3. The "effective" rate increases are based upon proportionate sales of water service.
4. Rates shown are based upon MWDSC sales and revenue projections, forecasts of treated, untreated and seasonal storage sales through 2001. Rates beyond year 2001 are based upon annual "effective" increase derived from revenue projections provided by MWDSC and proportioned on the basis of 64% non-interruptible and 34% seasonal sales.
5. Scenario 1 - The treated seasonal rate is assumed to remain at $132 per acre foot less than the treated rate.
6. Scenario 2 - The treated seasonal rate is assumed to remain a constant 66% of the treated rate.
7. South County Pipeline Pump Station (SCPS) O & M and AMP surcharge included through year 2000.
8. SCPS and AMP costs inflated at the rate of 2.5 percent per year.

TABLE 7-3 Continued
PROJECTED IMPORTED WATER COST
$ PER ACRE FOOT

Year	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
Scenario 1 - With Constant Dollar Seasonal Differential														
MWDSC Treated	714	736	759	782	807	832	857	884	912	940	967	999	1,030	1,062
MWDSC Seasonal	582	604	627	650	675	700	725	752	780	808	835	867	894	922
MWDOC	6	6	6	6	6	7	7	7	7	7	7	8	8	8
SCPS &AMP														
Total MWDSC Treated	720	742	765	788	813	839	864	891	919	947	974	1,007	1,038	1,070
Total MWDSC Seasonal	588	610	633	656	681	707	732	759	787	815	842	875	902	930
Scenario 2 - With Constant Percentage Seasonal Differential														
MWDSC Treated	755	780	806	832	860	888	917	947	979	1,010	1,041	1,077	1,115	1,154
MWDSC Seasonal	498	515	532	549	568	586	605	625	646	667	687	711	736	761
MWDOC	6	6	6	6	6	7	7	7	7	7	7	8	8	8
SCPS &AMP														
Total MWDSC Treated	761	786	812	838	866	895	924	954	986	1,017	1,048	1,085	1,122	1,162
Total MWDSC Seasonal	504	521	538	555	574	593	612	632	653	674	694	718	743	769

Notes and Assumptions:

1. Sources - MWDOC December 1993
2. The effective treated water rate includes fixed charges (connection maintenance, readiness-to-serve, one-half of new demand charge, treated, peaking) calculated for MWDSC as a whole.
3. The "effective" rate increases are based upon proportionate sales of water service.
4. Rates shown are based upon MWDSC sales and revenue projections, forecasts of treated, untreated and seasonal storage sales through 2001. Rates beyond year 2001 are based upon annual "effective" increase derived from revenue projections provided by MWDSC and proportioned on the basis of 64% non-interruptible and 34% seasonal sales.
5. Scenario 1 - The treated seasonal rate is assumed to remain at $132 per acre foot less than the treated rate.
6. Scenario 2 - The treated seasonal rate is assumed to remain a constant 66% of the treated rate.
7. South County Pipeline Pump Station (SCPS) O & M and AMP surcharge included through year 2000.
8. SCPS and AMP costs inflated at the rate of 2.5 percent per year.

TABLE 7-4
PHASE I DESALTER
WITH SCENARIO 1 MWDSC WATER PRICING
CONJUNCTIVE USE PROJECT AS WATER SUPPLY
NET COST ANALYSIS
$ PER ACRE FOOT

YEAR	1995	1996		1998		2000		2002		2004		2006		2008
DESALTER PRODUCTION, af/yr (1)	0	0	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800
RECHARGE WATER/INLIEU, af/yr (2)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
PRODUCTION COST $/af (3)														
Capital (3A)	0	0	469	469	469	469	469	469	469	469	469	469	469	469
O & M														
Fixed (3B)	0	0	72	74	75	77	79	81	83	85	87	90	92	94
Variable (3C)	0	0	318	326	334	342	351	359	368	378	387	397	407	417
Recharge/inlieu (4)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Misc. Well Displacement Water Cost (4a)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Sub Total	0	0	859	869	879	889	899	910	921	932	944	956	968	980
MWDSC GRP Benefit (5)	0	0	250	250	236	227	250	250	250	250	250	250	250	250
Sub Total	0	0	609	619	642	662	649	660	671	682	694	706	718	730
MWDSC SSS Benefit (6)	0	0	66	66	66	66	66	66	66	66	66	67	66	66
NET PROJECT WATER COST (7)	0	0	543	553	576	596	583	594	605	616	628	639	652	664
MWDSC Non Interruptible to So. Co. Agencies (8)	510	546	570	609	642	662	605	613	621	641	659	683	701	720

NOTES:
(1) Estimated desalter output: 1,800 ac. ft. per year from 2,200 ac. ft per year well extraction during five summer months.
(2) Estimated amount of recharge water or inlieu water purchased to replace pumped water from storage after drought operation. None required.
(3) Estimated desalter production cost.
(3a) Annualized Capital cost facility cost of $15,160,000 with 25% grant from USBR, $5,000,000 low interest loan (3.5%) from DWR and remaining financed by local bonds (6%).
(3b) Fixed O & M costs include minimum labor, and maintance supplies costs. Costs are inflated at 2.5% per year.
(3c) Variable O & M costs include energy, chemical, membrane replacement, maintenance and variable labor costs. Costs are inflated at 2.5 % per year.
(4) Cost of recharge/inlieu water or difference in cost of water supplied to pumper "inlieu" of pumping. Based on
pumper water cost of $75/ ac. ft. (1993 $) inflated at 2.5%/yr. and cost of MWDSC recharge water.
No recharge required.
(4a) Cost of purchasing replacement water for pumpers affected by high TDS during operation of project (per acre feet of project production at150 ac. ft./yr during impacted years).
None required

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TABLE 7-4 Continued
PHASE I DESALTER
WITH SCENARIO 1 MWDSC WATER PRICING
CONJUNCTIVE USE PROJECT AS WATER SUPPLY
NET COST ANALYSIS
$ PER ACRE FOOT

YEAR		2010		2012		2014		2016		2018		2020	2021
DESALTER PRODUCTION, af/yr (1)	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800
RECHARGE WATER/INLIEU, af/yr (2)	0	0	0	0	0	0	0	0	0	0	0	0	0
PRODUCTION COST $/af (3)													
Capital (3A)	469	469	469	469	469	469	469	469	469	469	469	474	169
O & M													
Fixed (3B)	96	99	101	104	106	109	112	115	118	120	123	127	130
Variable (3C)	427	438	449	460	472	483	495	508	521	534	547	561	575
Recharge/inlieu (4)	0	0	0	0	0	0	0	0	0	0	0	0	0
Misc. Well Displacement Water Cost (4a)	0	0	0	0	0	0	0	0	0	0	0	0	0
Sub Total	993	1006	1020	1033	1048	1062	1077	1092	1108	1123	1140	1161	873
MWDSC GRP Benefit (5)	250	241	231	220	209	198	186	173	160	149	133	123	0
Sub Total	743	765	788	813	839	864	891	919	947	974	1007	1038	873
MWDSC SSS Benefit (6)	66	66	66	66	66	66	66	66	66	66	66	66	66
NET PROJECT WATER COST (7)	677	699	722	747	773	798	825	853	881	908	941	972	807
MWDSC Non Interruptible to So. Co. Agencies (8)	742	765	788	813	839	864	891	919	947	974	1007	1038	1070

NOTES Continued:

(5) MWDSC GRP Benefit is a maximum of $250 per ac. ft.

(6) MWDSC SSS Benefit is estimated at 50% project net groundwater production (1,800 ac. ft.) or 900 ac. ft. per year. Benefit is the difference in MWDSC noninterruptable water cost minus MWDSC SSS water cost.

Example: Year 2000

MWDSC Nonint:	$662/ac. ft.	Total cost differential: $132/ac. ft. times 900ac. ft. = $118,800
MWDSC SSS:	$530/ac. ft.	Total project benefit: $118,800 divided by 1,800ac ft. = $66/ac. ft.
Difference (benefit):	$132/ac. ft.	

(7) Net Project Cost is the total project cost per ac. ft.

(8) Estimated MWDSC noninterruptable treated and SSS water cost from Scenario 1 as provided by MWDOC December 1993.

TABLE 7-5
PHASE I DESALTER
WITH SCENARIO 2 MWDSC WATER PRICING
CONJUNCTIVE USE PROJECT AS WATER SUPPLY
NET COST ANALYSIS
$ PER ACRE FOOT

YEAR	1995	1996		1998		2000		2002		2004		2006		2008
DESALTER PRODUCTION, af/yr (1)	0	0	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800
RECHARGE WATER/INLIEU, af/yr (2)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
PRODUCTION COST $/af (3)														
Capital (3A)	0	0	469	469	469	469	469	469	469	469	469	469	469	469
O & M														
Fixed (3B)	0	0	72	74	75	77	79	81	83	85	87	90	92	94
Variable (3C)	0	0	318	326	334	342	351	359	368	378	387	397	407	417
Recharge/inlieu (4)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Misc. Well Displacement Water Cost (4a)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Sub Total	0	0	859	869	879	889	899	910	921	932	944	956	968	980
MWDSC GRP Benefit (5)	0	0	250	241	213	201	250	250	250	250	250	236	228	220
Sub Total	0	0	609	628	665	688	649	660	671	682	694	720	740	761
MWDSC SSS Benefit (6)	0	0	78	84	88	95	101	105	107	108	110	113	117	121
NET PROJECT WATER COST (7)	0	0	531	544	577	593	548	555	564	574	584	606	623	639
MWDSC Non Interruptible to So. Co. Agencies (8)	518	556	585	628	665	688	632	641	650	672	693	720	740	761

NOTES:

(1) Estimated desalter output: 1,800 ac. ft. per year from 2,200 ac. ft per year well extraction during five summer months.

(2) Estimated amount of recharge water or inlieu water purchased to replace pumped water from storage after drought operation. None required.

(3) Estimated desalter production cost.

(3a) Annualized Capital cost facility cost of $15,160,000 with 25% grant from USBR, $5,000,000 low interest loan (3.5%) from DWR and remaining financed by local bonds (6%).

(3b) Fixed O & M costs include minimum labor, and maintance supplies costs. Costs are inflated at 2.5% per year.

(3c) Variable O & M costs include energy, chemical, membrane replacement, maintenance and variable labor costs. Costs are inflated at 2.5 % per year.

(4) Cost of recharge/inlieu water or difference in cost of water supplied to pumper "inlieu" of pumping. Based on pumper water cost of $75/ ac. ft. (1993 $) inflated at 2.5%/yr. and cost of MWDSC recharge water. No recharge required.

(4a) Cost of purchasing replacement water for pumpers affected by high TDS during operation of project (per acre feet of project production at150 ac. ft./yr during impacted years). None required

TABLE 7-5 Continued
PHASE I DESALTER
WITH SCENARIO 2 MWDSC WATER PRICING
CONJUNCTIVE USE PROJECT AS WATER SUPPLY
NET COST ANALYSIS
$ PER ACRE FOOT

YEAR		2010		2012		2014		2016		2018		2020	2021
DESALTER PRODUCTION, af/yr (1)	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800
RECHARGE WATER/INLIEU, af/yr (2)	0	0	0	0	0	0	0	0	0	0	0	0	0
PRODUCTION COST $/af (3)													
Capital (3A)	469	469	469	469	469	469	469	469	469	469	469	474	169
O & M													
Fixed (3B)	96	99	101	104	106	109	112	115	118	120	123	127	130
Variable (3C)	427	438	449	460	472	483	495	508	521	534	547	561	575
Recharge/inlieu (4)	0	0	0	0	0	0	0	0	0	0	0	0	0
Misc. Well Displacement Water Cost (4a)	0	0	0	0	0	0	0	0	0	0	0	0	0
Sub Total	993	1006	1020	1033	1048	1062	1077	1092	1108	1123	1140	1161	873
MWDSC GRP Benefit (5)	207	194	181	167	153	138	123	106	90	75	55	38	0
Sub Total	786	812	838	866	895	924	954	986	1017	1048	1085	1122	873
MWDSC SSS Benefit (6)	125	128	133	137	141	146	151	156	161	166	172	177	183
NET PROJECT WATER COST (7)	661	684	706	729	753	778	803	830	856	882	913	946	690
MWDSC Non Interruptible to So. Co. Agencies (8)	786	812	838	866	895	924	954	986	1017	1048	1085	1122	1162

NOTES Continued:
(5) MWDSC GRP Benefit is a maximum of $250 per ac. ft.
(6) MWDSC SSS Benefit is estimated at 50% project net groundwater production (1,800 ac. ft.) or 900 ac. ft. per year.
Benefit is the difference in MWDSC noninterruptable water cost minus MWDSC SSS water cost.
Example: Year 2000

MWDSC Nonint:	$668/ac. ft.	Total cost differential: $190/ac. ft. times 900ac. ft. = $171,000
MWDSC SSS:	$478/ac. ft.	Total project benefit: $171,000 divided by 1,800ac ft. = $95/ac. ft.
Difference (benefit):	$190/ac. ft.	

(7) Net Project Cost is the total project cost per ac. ft.
(8) Estimated MWDSC noninterruptable treated and SSS water cost from Scenario 1 as provided by MWDOC December 1993.

TABLE 7-6
PHASE I DESALTER
WITH SCENARIO 1 MWDSC WATER COST
CONJUCTIVE USE PROJECT AS WATER SUPPLY
BENEFIT ANALYSIS
$ PER ACRE FOOT

YEAR	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
PROJECT YIELD. AF/YR	1,800	1,800	1,800	1,800	1,800	1,800	1,800	1,800	1,800	1,800	1,800	1,800	1,800
PROJECT NET COST, $/AF	543	553	576	596	583	594	605	616	628	639	652	664	677
MWDSC WATER COST, $/AF	570	609	642	662	605	613	621	641	659	683	701	720	742
PROJECT COST, $ (1)													
SMWD	562,049	572,128	596,824	617,232	603,906	615,032	626,437	638,126	650,108	661,872	674,978	687,881	701,107
MNWD	147,040	149,677	156,138	161,477	157,990	160,901	163,885	166,943	170,077	173,155	176,584	179,959	183,420
CVWD	215,080	218,937	228,387	236,197	231,097	235,355	239,719	244,192	248,778	253,279	258,295	263,232	268,293
TCWD	52,935	53,885	56,211	58,133	56,877	57,925	59,000	60,100	61,229	62,337	63,571	64,787	66,032
Total	977,103	994,627	1,037,559	1,073,038	1,049,871	1,069,214	1,089,040	1,109,362	1,130,192	1,150,643	1,173,428	1,195,860	1,218,852
SALE TO CVWD, $ (2)													
SMWD	590,304	630,300	665,160	685,568	626,283	634,692	643,105	663,945	682,718	706,671	725,451	745,270	768,199
MNWD	154,432	164,895	174,015	179,354	163,844	166,044	168,245	173,697	178,609	184,875	189,788	194,973	200,972
CVWD	225,892	241,197	254,538	262,347	239,660	242,878	246,097	254,073	261,256	270,423	277,609	285,193	293,967
TCWD	55,596	59,363	62,647	64,569	58,985	59,777	60,569	62,532	64,300	66,556	68,325	70,192	72,351
Total	1,026,225	1,095,756	1,156,359	1,191,838	1,088,773	1,103,392	1,118,017	1,154,247	1,186,883	1,228,525	1,261,173	1,295,628	1,335,488
BENEFIT, $ (3)													
SMWD	28,256	58,171	68,336	68,336	22,377	19,660	16,668	25,819	32,610	44,799	50,473	57,388	67,091
MNWD	7,392	15,218	17,878	17,878	5,854	5,143	4,361	6,755	8,531	11,720	13,204	15,014	17,552
CVWD	10,813	22,260	26,150	26,150	8,563	7,523	6,378	9,880	12,479	17,143	19,314	21,961	25,674
TCWD	2,661	5,479	6,436	6,436	2,108	1,852	1,570	2,432	3,071	4,219	4,754	5,405	6,319
Total	49,122	101,129	118,800	118,800	38,902	34,178	28,977	44,885	56,691	77,882	87,745	99,768	116,636
SUM OF BENEFIT CASH FLOW	49,122	150,250	269,050	387,850	426,752	460,930	489,907	534,792	591,482	669,364	757,110	856,878	973,514

NOTES:

(1) Total project cost prorated to each agency based on participation.
(2) Agency sells its prorated yeild to CVWD at the MWDSC rate.
(3) The benefit is the difference between "Sale to CVWD" and the "Project Cost".
(4) Participation is based on demands in the watershed at the start of the project estimated based on1995 projected demands.

PROJ. PARTICIPATION	% of tot
SMWD	57.52%
MNWD	15.05%
CVWD	22.01%
TCWD	5.42%
Total	100.00%

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TABLE 7-6 Continued
PHASE I DESALTER
WITH SCENARIO 1 MWDSC WATER COST
CONJUCTIVE USE PROJECT AS WATER SUPPLY
BENEFIT ANALYSIS
$ PER ACRE FOOT

YEAR	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
PROJECT YIELD. AF/YR	1,800	1,800	1,800	1,800	1,800	1,800	1,800	1,800	1,800	1,800	1,800	1,800
PROJECT NET COST, $/AF	699	722	747	773	798	825	853	881	908	941	972	807
MWDSC WATER COST, $/AF	765	788	813	839	864	891	919	947	974	1007	1038	1070
PROJECT COST, $ (1)												
SMWD	723,830	747,802	773,848	799,899	825,953	854,083	883,252	912,426	940,569	973,893	1,006,155	835,444
MNWD	189,364	195,636	202,450	209,265	216,081	223,440	231,071	238,703	246,066	254,784	263,224	218,564
CVWD	276,989	286,162	296,129	306,098	316,068	326,833	337,995	349,159	359,928	372,681	385,026	319,700
TCWD	68,172	70,430	72,883	75,337	77,791	80,440	83,187	85,935	88,585	91,724	94,762	78,684
Total	1,258,356	1,300,030	1,345,310	1,390,598	1,435,893	1,484,795	1,535,505	1,586,223	1,635,148	1,693,082	1,749,168	1,452,393
SALE TO CVWD, $ (2)												
SMWD	792,166	816,138	842,184	868,235	894,289	922,419	951,588	980,762	1,008,905	1,042,229	1,074,491	1,107,752
MNWD	207,242	213,513	220,327	227,142	233,959	241,318	248,949	256,581	263,944	272,662	281,102	289,804
CVWD	303,139	312,312	322,280	332,248	342,219	352,983	364,145	375,309	386,079	398,831	411,177	423,905
TCWD	74,608	76,866	79,319	81,773	84,227	86,876	89,623	92,371	95,021	98,160	101,198	104,331
Total	1,377,156	1,418,830	1,464,110	1,509,398	1,554,693	1,603,595	1,654,305	1,705,023	1,753,948	1,811,882	1,867,968	1,925,791
BENEFIT, $ (3)												
SMWD	68,336	68,336	68,336	68,336	68,336	68,336	68,336	68,336	68,336	68,336	68,336	272,308
MNWD	17,878	17,878	17,878	17,878	17,878	17,878	17,878	17,878	17,878	17,878	17,878	71,240
CVWD	26,150	26,150	26,150	26,150	26,150	26,150	26,150	26,150	26,150	26,150	26,150	104,204
TCWD	6,436	6,436	6,436	6,436	6,436	6,436	6,436	6,436	6,436	6,436	6,436	25,647
Total	118,800	118,800	118,800	118,800	118,800	118,800	118,800	118,800	118,800	118,800	118,800	473,398
SUM OF BENEFIT CASH FLOW	1,092,314	1,211,114	1,329,914	1,448,714	1,567,514	1,686,314	1,805,114	1,923,914	2,042,714	2,161,514	2,280,314	2,753,712

NOTES:

(1) Total project cost prorated to each agency based on participation.

(2) Agency sells its prorated yeild to CVWD at the MWDSC rate.

(3) The benefit is the difference between "Sale to CVWD" and the "Project Cost".

(4) Participation is based on demands in the watershed at the start of the project estimated based on1995 projected demands.

PROJ. PARTICIPATION	% of tot
SMWD	57.52%
MNWD	15.05%
CVWD	22.01%
TCWD	5.42%
Total	100.00%

TABLE 7-7
PHASE I DESALTER
WITH SCENARIO 2 MWDSC WATER COST
CONJUCTIVE USE PROJECT AS WATER SUPPLY
BENEFIT ANALYSIS
$ PER ACRE FOOT

YEAR	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
PROJECT YIELD. AF/YR	1,800	1,800	1,800	1,800	1,800	1,800	1,800	1,800	1,800	1,800	1,800	1,800	1,800
PROJECT NET COST, $/AF	531	544	577	593	548	555	564	574	584	606	623	639	661
MWDSC WATER COST, $/AF	585	628	665	688	632	641	650	672	693	720	740	761	786
PROJECT COST, $ (1)													
SMWD	550,121	563,372	597,445	613,743	567,160	574,590	584,410	594,516	604,913	627,577	644,732	662,045	684,559
MNWD	143,919	147,386	156,300	160,564	148,377	150,321	152,890	155,534	158,254	164,183	168,671	173,200	179,090
CVWD	210,515	215,586	228,625	234,862	217,036	219,879	223,637	227,504	231,483	240,156	246,720	253,345	261,961
TCWD	51,812	53,060	56,269	57,804	53,417	54,116	55,041	55,993	56,972	59,107	60,723	62,353	64,474
Total	956,367	979,404	1,038,639	1,066,972	985,989	998,906	1,015,978	1,033,546	1,051,622	1,091,023	1,120,845	1,150,944	1,190,084
SALE TO CVWD, $ (2)													
SMWD	605,835	649,972	688,974	712,489	654,238	663,683	673,131	696,042	717,921	744,981	765,831	787,721	813,756
MNWD	158,495	170,042	180,245	186,397	171,158	173,629	176,101	182,094	187,818	194,897	200,352	206,079	212,890
CVWD	231,836	248,725	263,650	272,649	250,358	253,972	257,588	266,355	274,728	285,083	293,062	301,438	311,401
TCWD	57,059	61,216	64,889	67,104	61,618	62,507	63,397	65,555	67,616	70,164	72,128	74,190	76,642
Total	1,053,225	1,129,956	1,197,759	1,238,638	1,137,373	1,153,792	1,170,217	1,210,047	1,248,083	1,295,125	1,331,373	1,369,428	1,414,688
BENEFIT, $ (3)													
SMWD	55,714	86,600	91,529	98,746	87,079	89,094	88,721	101,527	113,008	117,403	121,100	125,676	129,197
MNWD	14,576	22,656	23,945	25,833	22,781	23,308	23,211	26,561	29,564	30,714	31,681	32,879	33,800
CVWD	21,320	33,139	35,025	37,787	33,323	34,094	33,951	38,851	43,245	44,927	46,341	48,093	49,440
TCWD	5,247	8,156	8,620	9,300	8,201	8,391	8,356	9,562	10,643	11,057	11,406	11,837	12,168
Total	96,858	150,552	159,120	171,666	151,384	154,886	154,239	176,501	196,461	204,102	210,528	218,484	224,604
SUM OF BENEFIT CASH FLOW	96,858	247,410	406,530	578,196	729,579	884,466	1,038,704	1,215,205	1,411,666	1,615,768	1,826,296	2,044,780	2,269,384

NOTES:

(1) Total project cost prorated to each agency based on participation.
(2) Agency sells its prorated yeild to CVWD at the MWDSC rate.
(3) The benefit is the difference between "Sale to CVWD" and the "Project Cost".
(4) Participation is based on demands in the watershed at the start of the project estimated based on1995 projected demands.

PROJ. PARTICIPATION	% of tot
SMWD	57.52%
MNWD	15.05%
CVWD	22.01%
TCWD	5.42%
Total	100.00%

TABLE 7-7 Continued
PHASE I DESALTER
WITH SCENARIO 2 MWDSC WATER COST
CONJUCTIVE USE PROJECT AS WATER SUPPLY
BENEFIT ANALYSIS
$ PER ACRE FOOT

YEAR	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
PROJECT YIELD. AF/YR	1,800	1,800	1,800	1,800	1,800	1,800	1,800	1,800	1,800	1,800	1,800	1,800
PROJECT NET COST, $/AF	684	706	729	753	778	803	830	856	882	913	946	690
MWDSC WATER COST, $/AF	812	838	866	895	924	954	986	1017	1048	1085	1122	1162
PROJECT COST, $ (1)												
SMWD	707,937	730,614	755,190	779,771	805,038	831,345	859,552	886,551	913,203	945,213	978,982	714,210
MNWD	185,206	191,139	197,568	203,999	210,609	217,492	224,871	231,934	238,907	247,281	256,116	186,847
CVWD	270,907	279,585	288,990	298,396	308,065	318,132	328,926	339,257	349,456	361,706	374,628	273,308
TCWD	66,675	68,811	71,126	73,441	75,821	78,298	80,955	83,498	86,008	89,023	92,203	67,266
Total	1,230,726	1,270,150	1,312,874	1,355,606	1,399,533	1,445,267	1,494,303	1,541,241	1,587,574	1,643,222	1,701,929	1,241,631
SALE TO CVWD, $ (2)												
SMWD	840,830	867,908	897,060	926,217	956,413	987,649	1,020,959	1,053,239	1,085,524	1,122,990	1,162,216	1,202,813
MNWD	219,973	227,057	234,684	242,311	250,211	258,383	267,097	275,542	283,988	293,790	304,052	314,673
CVWD	321,761	332,123	343,279	354,436	365,991	377,945	390,692	403,044	415,399	429,736	444,746	460,282
TCWD	79,192	81,742	84,488	87,234	90,078	93,019	96,157	99,197	102,238	105,766	109,461	113,284
Total	1,461,756	1,508,830	1,559,510	1,610,198	1,662,693	1,716,995	1,774,905	1,831,023	1,887,148	1,952,282	2,020,475	2,091,052
BENEFIT, $ (3)												
SMWD	132,893	137,293	141,870	146,446	151,375	156,303	161,408	166,688	172,321	177,777	183,234	488,603
MNWD	34,767	35,918	37,115	38,312	39,602	40,891	42,227	43,608	45,082	46,509	47,937	127,825
CVWD	50,854	52,538	54,289	56,041	57,927	59,813	61,766	63,787	65,942	68,030	70,118	186,974
TCWD	12,516	12,931	13,362	13,793	14,257	14,721	15,202	15,699	16,230	16,744	17,257	46,018
Total	231,030	238,680	246,636	254,592	263,160	271,728	280,602	289,782	299,574	309,060	318,546	849,420
SUM OF BENEFIT CASH FLOW	2,500,414	2,739,094	2,985,730	3,240,322	3,503,482	3,775,210	4,055,812	4,345,594	4,645,168	4,954,228	5,272,774	6,122,194

NOTES:
(1) Total project cost prorated to each agency based on participation.
(2) Agency sells its prorated yeild to CVWD at the MWDSC rate.
(3) The benefit is the difference between "Sale to CVWD" and the "Project Cost".
(4) Participation is based on demands in the watershed at the start of the project estimated based on1995 projected demands.

PROJ. PARTICIPATION	% of tot
SMWD	57.52%
MNWD	15.05%
CVWD	22.01%
TCWD	5.42%
Total	100.00%

TABLE 7-8

PHASE I DESALTER
CONJUNCTIVE USE PROJECT AS WATER SUPPLY

BENEFIT SUMMARY

	SCENARIO 1	SCENARIO 2
CASH FLOW OF PROJECT		
Total sum of annual project cost	$32,135,293	$30,904,377
Total cost of purchasing MWDSC water without project	34,889,004	37,026,571
Total savings in water cost with the project (benefit)	2,753,712	6,122,194
Benefit-to-cost ratio	1.09	1.20
PRESENT WORTH		
Total present worth of cash flow	13,646,920	13,145,729
Total present worth of cash flow to purchase MWDSC water without the project	14,721,952	15,525,930
Net present worth of project (benefit)	1,075,032	2,380,201
Benefit-to-cost ratio	1.08	1.18

NOTES

1. Scenarios 1 and 2 as described on Table 7-3.
2. Values arrived from analysis of Tables 7-4, 7-5, 7-6 and 7-7.

FIGURE 7-1
PHASE 1 DESALTER
CONJUCTIVE USE PROJECT AS WATER SUPPLY
SUM OF NET CASH FLOW

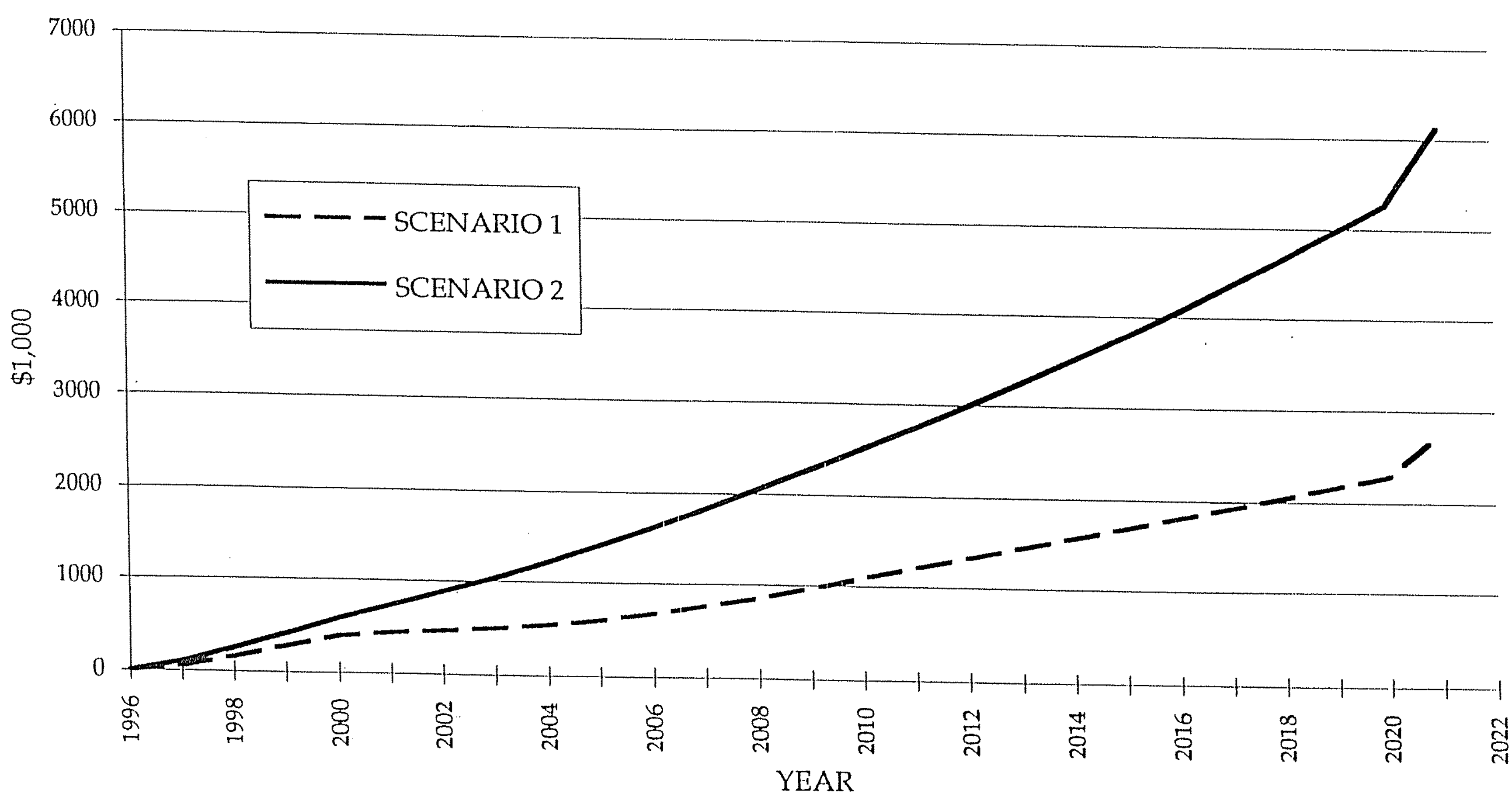


TABLE 7-9
PHASE I DESALTER
WITH SCENARIO 1 MWDSC WATER PRICING
CONJUNCTIVE USE PROJECT AS SUPPLY AND STORAGE
NET COST ANALYSIS
$ PER ACRE FOOT

YEAR	1995	1996		1998		2000		2002		2004		2006		2008
DESALTER PRODUCTION, af/yr (1)	0	0	1800	1800	1800	1800	1800	1800	3600	3600	3600	1800	1800	1800
RECHARGE WATER/INLIEU, af/yr (2)	0	0	0	0	0	0	0	0	0	0	0	825	825	825
PRODUCTION COST $/af (3)														
Capital (3A)	0	0	469	469	469	469	469	469	235	235	235	469	469	469
O & M														
Fixed (3B)	0	0	72	74	75	77	79	81	83	85	87	90	92	94
Variable (3C)	0	0	318	326	334	342	351	359	368	378	387	397	407	417
Recharge/inlieu (4)	0	0	0	0	0	0	0	0	0	0	0	206	213	221
Misc. Well Displacement Water Cost (4a)	0	0	0	0	0	0	0	0	22	23	23	48	0	0
Sub Total	0	0	859	869	879	889	899	910	708	720	733	1210	1181	1201
MWDSC GRP Benefit (5)	0	0	250	250	236	227	250	250	87	79	73	250	250	250
Sub Total	0	0	609	619	642	662	649	660	621	641	659	960	931	951
MWDSC SSS Benefit (6)	0	0	66	66	66	66	66	66	33	33	33	67	66	66
NET PROJECT WATER COST (7)	0	0	543	553	576	596	583	594	588	608	626	894	865	885
MWDSC Non Interruptible to So. Co. Agencies (8)	510	546	570	609	642	662	605	613	621	641	659	683	701	720

3 NOTES:

(1) Estimated desalter output: 1,800 ac. ft. per year from 2,200 ac. ft per year well extraction during five summer months; 3,600 ac. ft. per year from 5,000 ac. ft. per year extraction during eleven months of operation during drought. (2,200ac. ft from natural yield 2,200ac. ft. from storage and 600ac. ft. from seawater).

(2) Estimated amount of recharge water or inlieu water purchased to replace pumped water from storage after drought operation (2,200ac. ft. times 3yrs divided by 8yrs = 825ac. ft/yr.)

(3) Estimated desalter production cost.

(3a) Annualized Capital cost facility cost of $15,160,000 with 25% grant from USBR, $5,000,000 low interest loan (3.5%) from DWR and remaining financed by local bonds (6%).

(3b) Fixed O & M costs include minimum labor, and maintance supplies costs. Costs are inflated at 2.5% per year.

(3c) Variable O & M costs include energy, chemical, membrane replacement, maintenance and variable labor costs. Costs are inflated at 2.5 % per year.

(4) Cost of recharge/inlieu water or difference in cost of water supplied to pumper "inlieu" of pumping. Based on pumper water cost of $75/ ac. ft. (1993 $) inflated at 2.5%/yr. and cost of MWDSC recharge water.
Example: Year 2006 825 ac ft. recharge/inlieu water

MWDSC projected recharge water cost:	$551/ac.ft.	Total cost differential = 825ac. ft. times $450/ac. ft. = $371,250
Pumper projected water cost:	$101/ac. ft.	Project cost per ac. ft. = $371,250 divided by 1,800ac. ft. = $206/ ac. ft.
Difference:	$450/ac. ft.	

(4a) Cost of purchasing replacement water for pumpers affected by high TDS during operation of project (per acre feet of project production at150 ac. ft./yr during impacted years).

TABLE 7-9 Continued
PHASE I DESALTER
WITH SCENARIO 1 MWDSC WATER PRICING
CONJUNCTIVE USE PROJECT AS SUPPLY AND STORAGE
NET COST ANALYSIS
$ PER ACRE FOOT

YEAR		2010		2012		2014		2016		2018		2020	2021
DESALTER PRODUCTION, af/yr (1)	1800	1800	1800	1800	1800	3600	3600	3600	1800	1800	1800	1800	1800
RECHARGE WATER/INLIEU, af/yr (2)	825	825	825	825	825	0	0	0	825	825	825	825	825
PRODUCTION COST $/af (3)													
Capital (3A)	469	469	469	469	469	235	235	235	469	469	469	474	169
O & M													
Fixed (3B)	96	99	101	104	106	109	112	115	118	120	123	127	130
Variable (3C)	427	438	449	460	472	483	495	508	521	534	547	561	575
Recharge/inlieu (4)	230	239	248	259	269	0	0	0	313	324	337	348	359
Misc. Well Displacement Water Cost (4a)	0	0	0	0	0	0	0	0	68	70	72	75	0
Sub Total	1223	1245	1268	1292	1316	827	842	857	1488	1517	1549	1583	1232
MWDSC GRP Benefit (5)	250	250	250	250	250	0	0	0	250	250	250	250	162
Sub Total	973	995	1018	1042	1066	827	842	857	1238	1267	1299	1333	1070
MWDSC SSS Benefit (6)	66	66	66	66	66	33	33	33	66	66	66	66	66
NET PROJECT WATER COST (7)	907	929	952	976	1000	794	809	824	1172	1201	1233	1267	1004
MWDSC Non Interruptible to So. Co. Agencies (8)	742	765	788	813	839	864	891	919	947	974	1007	1038	1070

3 NOTES Continued:
(5) MWDSC GRP Benefit is a maximum of $250 per ac. ft.
(6) MWDSC SSS Benefit is estimated at 50% project net groundwater production (1,800 ac. ft.) or 900 ac. ft. per year.
Benefit is the difference in MWDSC noninterruptable water cost minus MWDSC SSS water cost.
Example: Year 2000

MWDSC Nonint:	$662/ac. ft.	Total cost differential: $132/ac. ft. times 900ac. ft. = $118,800
MWDSC SSS:	$530/ac. ft.	Total project benefit: $118,800 divided by 1,800ac ft. = $66/ac. ft.
Difference (benefit):	$132/ac. ft.	

(7) Net Project Cost is the total project cost per ac. ft.
(8) Estimated MWDSC noninterruptable treated and SSS water cost from Scenario 1 as provided by MWDOC December 1993.

TABLE 7-10
PHASE I DESALTER
WITH SCENARIO 2 MWDSC WATER PRICING
CONJUNCTIVE USE PROJECT AS SUPPLY AND STORAGE
NET COST ANALYSIS
$ PER ACRE FOOT

EAR	1995	1996		1998		2000		2002		2004		2006		2008
ESALTER PRODUCTION, af/yr (1)	0	0	1800	1800	1800	1800	1800	1800	3600	3600	3600	1800	1800	1800
ECHARGE WATER/INLIEU, af/yr (2)	0	0	0	0	0	0	0	0	0	0	0	825	825	825
RODUCTION COST $/af (3)														
Capital (3A)	0	0	469	469	469	469	469	469	235	235	235	469	469	469
O & M														
Fixed (3B)	0	0	72	74	75	77	79	81	83	85	87	90	92	94
Variable (3C)	0	0	318	326	334	342	351	359	368	378	387	397	407	417
Recharge/Inlieu (4)	0	0	0	0	0	0	0	0	0	0	0	172	177	182
Misc. Well Displacement Water Cost (4a)	0	0	0	0	0	0	0	0	23	24	25	52	0	0
Sub Total	0	0	859	869	879	889	899	910	709	722	734	1180	1145	1163
MWDSC GRP Benefit (5)	0	0	250	241	213	201	250	250	59	49	41	250	250	250
Sub Total	0	0	609	628	665	688	649	660	650	672	693	930	895	913
MWDSC SSS Benefit (6)	0	0	78	84	88	95	101	105	53	54	55	113	117	121
NET PROJECT WATER COST (7)	0	0	531	544	577	593	548	555	597	618	639	816	778	791
MWDSC Non Interruptible to So. Co. Agencies (8)	518	556	585	628	665	688	632	641	650	672	693	720	740	761

NOTES:

(1) Estimated desalter output: 1,800 ac. ft. per year from 2,200 ac. ft per year well extraction during five summer months; 3,600 ac. ft. per year from 5,000 ac. ft. per year extraction during eleven months of operation during drought. (2,200ac. ft from natural yield 2,200ac. ft. from storage and 600ac. ft. from seawater):

(2) Estimated amount of recharge water or inlieu water purchased to replace pumped water from storage after drought operation (2,200ac. ft. times 3yrs divided by 8yrs = 825ac. ft/yr.)

(3) Estimated desalter production cost.

(3a) Annualized Capital cost facility cost of $15,160,000 with 25% grant from USBR, $5,000,000 low interest loan (3.5%) from DWR and remaining financed by local bonds (6%).

(3b) Fixed O & M costs include minimum labor, and maintance supplies costs. Costs are inflated at 2.5% per year.

(3c) Variable O & M costs include energy, chemical, membrane replacement, maintenance and variable labor costs. Costs are inflated at 2.5 % per year.

(4) Cost of recharge/inlieu water or difference in cost of water supplied to pumper "inlieu" of pumping. Based on pumper water cost of $75/ ac. ft. (1993 $) inflated at 2.5%/yr. and cost of MWDSC recharge water.

Example: Year 2006: 825 ac ft. recharge/inlieu water

MWDSC projected recharge water cost:	$478/ac.ft.	Total cost differential = 825ac. ft. times $377/ac. ft. = $311,025
Pumper projected water cost:	$101/ac. ft.	Project cost per ac. ft. = $311,025 divided by 1,800ac. ft. = $172/ ac. ft.
Difference:	$377/ac. ft.	

(4a) Cost of purchasing replacement water for pumpers affected by high TDS during operation of project (per acre feet of project production at150 ac. ft./yr during impacted years).

TABLE 7-10 Continued
PHASE I DESALTER
WITH SCENARIO 2 MWDSC WATER PRICING
CONJUNCTIVE USE PROJECT AS SUPPLY AND STORAGE
NET COST ANALYSIS
$ PER ACRE FOOT

YEAR		2010		2012		2014		2016		2018		2020	2021
DESALTER PRODUCTION, af/yr (1)	1800	1800	1800	1800	1800	3600	3600	3600	1800	1800	1800	1800	1800
RECHARGE WATER/INLIEU, af/yr (2)	825	825	825	825	825	0	0	0	825	825	825	825	825
PRODUCTION COST $/af (3)													
Capital (3A)	469	469	469	469	469	235	235	235	469	469	469	474	169
O & M													
Fixed (3B)	96	99	101	104	106	109	112	115	118	120	123	127	130
Variable (3C)	427	438	449	460	472	483	495	508	521	534	547	561	575
Recharge/inlieu (4)	189	196	202	209	217	0	0	0	248	256	266	275	286
Misc. Well Displacement Water Cost (4a)	0	0	0	0	0	0	0	0	74	76	79	82	0
Sub Total	1182	1202	1222	1243	1264	827	842	857	1429	1456	1484	1518	1159
MWDSC GRP Benefit (5)	250	250	250	250	250	0	0	0	250	250	250	250	0
Sub Total	932	952	972	993	1014	827	842	857	1179	1206	1234	1268	1159
MWDSC SSS Benefit (6)	125	128	133	137	141	73	75	78	161	166	172	177	183
NET PROJECT WATER COST (7)	807	823	839	856	873	754	767	779	1018	1039	1062	1091	975
MWDSC Non Interruptible to So. Co. Agencies (8)	786	812	838	866	895	924	954	986	1017	1048	1085	1122	1162

NOTES Continued:

(5) MWDSC GRP Benefit is a maximum of $250 per ac. ft.

(6) MWDSC SSS Benefit is estimated at 50% project net groundwater production (1,800 ac. ft.) or 900 ac. ft. per year.
Benefit is the difference in MWDSC noninterruptable water cost minus MWDSC SSS water cost.

Example: Year 2000

MWDSC Nonint:	$688/ac. ft.	Total cost differential: $190/ac. ft. times 900ac. ft. = $17100
MWDSC SSS:	$478/ac. ft.	Total project benefit: $171,000 divided by 1,800ac ft. = $95/ac. ft.
Difference (benefit):	$190/ac. ft.	

(7) Net Project Cost is the total project cost per ac. ft.

(8) Estimated MWDSC noninterruptable treated and SSS water cost from Scenario 1 as provided by MWDOC December 1993.

TABLE 7-11
PHASE I DESALTER
WITH SCENARIO 1 MWDSC WATER COST
CONJUCTIVE USE PROJECT AS SUPPLY AND STORAGE
BENEFIT ANALYSIS

$ PER ACRE FOOT

YEAR	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
PROJECT YIELD. AF/YR	1,800	1,800	1,800	1,800	1,800	1,800	3,600	3,600	3,600	1,800	1,800	1,800	1,800
PROJECT NET COST, $/AF	543	553	576	596	583	594	588	608	626	894	865	885	907
MWDSC WATER COST, $/AF	570	609	642	662	605	613	621	641	659	683	701	720	742
PROJECT COST, $ (1)													
SMWD	562,049	572,128	596,824	617,232	603,906	615,032	1,217,873	1,259,554	1,297,100	925,441	895,772	916,532	939,010
MNWD	147,040	149,677	156,138	161,477	157,990	160,901	318,613	329,517	339,340	242,108	234,347	239,778	245,658
CVWD	215,080	218,937	228,387	236,197	231,097	235,355	466,045	481,995	496,363	354,139	342,786	350,730	359,332
TCWD	52,935	53,885	56,211	58,133	56,877	57,925	114,703	118,628	122,164	87,161	84,366	86,321	88,438
Total	977,103	994,627	1,037,559	1,073,038	1,049,871	1,069,214	2,117,233	2,189,694	2,254,966	1,608,850	1,557,270	1,593,361	1,632,438
SALE TO CVWD, $ (2)													
SMWD	590,304	630,300	665,160	685,568	626,283	634,692	1,286,209	1,327,890	1,365,436	706,671	725,451	745,270	768,199
MNWD	154,432	164,895	174,015	179,354	163,844	166,044	336,490	347,395	357,217	184,875	189,788	194,973	200,972
CVWD	225,892	241,197	254,538	262,347	239,660	242,878	492,195	508,145	522,513	270,423	277,609	285,193	293,967
TCWD	55,596	59,363	62,647	64,569	58,985	59,777	121,139	125,064	128,600	66,556	68,325	70,192	72,351
Total	1,026,225	1,095,756	1,156,359	1,191,838	1,088,773	1,103,392	2,236,033	2,308,494	2,373,766	1,228,525	1,261,173	1,295,628	1,335,488
BENEFIT, $ (3)													
SMWD	28,256	58,171	68,336	68,336	22,377	19,660	68,336	68,336	68,336	(218,770)	(170,321)	(171,262)	(170,811)
MNWD	7,392	15,218	17,878	17,878	5,854	5,143	17,878	17,878	17,878	(57,233)	(44,558)	(44,805)	(44,687)
CVWD	10,813	22,260	26,150	26,150	8,563	7,523	26,150	26,150	26,150	(83,717)	(65,177)	(65,537)	(65,364)
TCWD	2,661	5,479	6,436	6,436	2,108	1,852	6,436	6,436	6,436	(20,604)	(16,041)	(16,130)	(16,087)
Total	49,122	101,129	118,800	118,800	38,902	34,178	118,800	118,800	118,800	(380,324)	(296,097)	(297,734)	(296,949)
SUM OF BENEFIT CASH FLOW	49,122	150,250	269,050	387,850	426,752	460,930	579,730	698,530	817,330	437,006	140,909	(156,825)	(453,774)

NOTES:

(1) Total project cost prorated to each agency based on participation.
(2) Agency sells its prorated yeild to CVWD at the MWDSC rate.
(3) The benefit is the difference between "Sale to CVWD" and the "Project Cost".
(4) Participation is based on demands in the watershed at the start of the project estimated based on1995 projected demands.

PROJ. PARTICIPATION	% of tot
SMWD	57.52%
MNWD	15.05%
CVWD	22.01%
TCWD	5.42%
Total	100.00%

TABLE 7-11 Continued
PHASE I DESALTER
WITH SCENARIO 1 MWDSC WATER COST
CONJUCTIVE USE PROJECT AS SUPPLY AND STORAGE
BENEFIT ANALYSIS
$ PER ACRE FOOT

YEAR	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
PROJECT YIELD. AF/YR	1,800	1,800	1,800	1,800	3,600	3,600	3,600	1,800	1,800	1,800	1,800	1,800
PROJECT NET COST, $/AF	929	952	976	1000	794	809	824	1172	1201	1233	1267	1004
MWDSC WATER COST, $/AF	765	788	813	839	864	891	919	947	974	1007	1038	1070
PROJECT COST, $ (1)												
SMWD	962,263	985,824	1,010,651	1,035,801	1,644,728	1,675,403	1,706,846	1,213,918	1,243,824	1,276,902	1,312,271	1,039,416
MNWD	251,741	257,905	264,400	270,980	430,284	438,309	446,535	317,578	325,402	334,056	343,308	271,926
CVWD	368,230	377,246	386,747	396,371	629,390	641,128	653,161	464,531	475,975	488,634	502,168	397,754
TCWD	90,628	92,848	95,186	97,555	154,905	157,794	160,755	114,330	117,147	120,262	123,593	97,895
Total	1,672,862	1,713,823	1,756,984	1,800,708	2,859,306	2,912,635	2,967,297	2,110,357	2,162,347	2,219,854	2,281,340	1,806,991
SALE TO CVWD, $ (2)												
SMWD	792,166	816,138	842,184	868,235	1,788,578	1,844,837	1,903,176	980,762	1,008,905	1,042,229	1,074,491	1,107,752
MNWD	207,242	213,513	220,327	227,142	467,917	482,635	497,898	256,581	263,944	272,662	281,102	289,804
CVWD	303,139	312,312	322,280	332,248	684,437	705,966	728,290	375,309	386,079	398,831	411,177	423,905
TCWD	74,608	76,866	79,319	81,773	168,453	173,752	179,246	92,371	95,021	98,160	101,198	104,331
Total	1,377,156	1,418,830	1,464,110	1,509,398	3,109,386	3,207,191	3,308,610	1,705,023	1,753,948	1,811,882	1,867,968	1,925,791
BENEFIT, $ (3)												
SMWD	(170,096)	(169,686)	(168,466)	(167,567)	143,851	169,434	196,330	(233,156)	(234,919)	(234,673)	(237,779)	68,336
MNWD	(44,500)	(44,392)	(44,073)	(43,838)	37,633	44,326	51,363	(60,997)	(61,458)	(61,394)	(62,206)	17,878
CVWD	(65,091)	(64,934)	(64,467)	(64,123)	55,048	64,838	75,130	(89,222)	(89,897)	(89,803)	(90,991)	26,150
TCWD	(16,020)	(15,981)	(15,867)	(15,782)	13,548	15,958	18,491	(21,959)	(22,125)	(22,102)	(22,395)	6,436
Total	(295,707)	(294,994)	(292,873)	(291,309)	250,080	294,556	341,314	(405,334)	(408,399)	(407,972)	(413,372)	118,800
SUM OF BENEFIT CASH FLOW	(749,481)	(1,044,475)	(1,337,348)	(1,628,658)	(1,378,578)	(1,084,022)	(742,708)	(1,148,043)	(1,556,442)	(1,964,413)	(2,377,785)	(2,258,985)

NOTES:

(1) Total project cost prorated to each agency based on participation.
(2) Agency sells its prorated yeild to CVWD at the MWDSC rate.
(3) The benefit is the difference between "Sale to CVWD" and the "Project Cost".
(4) Participation is based on demands in the watershed at the start of the project estimated based on1995 projected demands.

PROJ. PARTICIPATION	% of tot
SMWD	57.52%
MNWD	15.05%
CVWD	22.01%
TCWD	5.42%
Total	100.00%

TABLE 7-12
PHASE I DESALTER
WITH SCENARIO 2 MWDSC WATER PRICING
CONJUNCTIVE USE PROJECT AS SUPPLY AND STORAGE
BENEFIT ANALYSIS
$ PER ACRE FOOT

YEAR	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
PROJECT YIELD. AF/YR	1,800	1,800	1,800	1,800	1,800	1,800	3,600	3,600	3,600	1,800	1,800	1,800	1,800
PROJECT NET COST, $/AF	531	544	577	593	548	555	597	618	639	816	778	791	807
MWDSC WATER COST, $/AF	585	628	665	688	632	641	650	672	693	720	740	761	786
PROJECT COST, $ (1)													
SMWD	550,121	563,372	597,445	613,743	567,160	574,590	1,235,899	1,280,138	1,322,312	845,081	805,727	819,472	835,819
MNWD	143,919	147,386	156,300	160,564	148,377	150,321	323,329	334,902	345,935	221,085	210,790	214,385	218,662
CVWD	210,515	215,586	228,625	234,862	217,036	219,879	472,943	489,872	506,010	323,388	308,328	313,588	319,844
TCWD	51,812	53,060	56,269	57,804	53,417	54,116	116,400	120,567	124,539	79,592	75,886	77,180	78,720
Total	956,367	979,404	1,038,639	1,066,972	985,989	998,906	2,148,571	2,225,478	2,298,796	1,469,146	1,400,730	1,424,625	1,453,044
SALE TO CVWD, $ (2)													
SMWD	605,835	649,972	688,974	712,489	654,238	663,683	1,346,262	1,392,084	1,435,843	744,981	765,831	787,721	813,756
MNWD	158,495	170,042	180,245	186,397	171,158	173,629	352,201	364,189	375,637	194,897	200,352	206,079	212,890
CVWD	231,836	248,725	263,650	272,649	250,358	253,972	515,175	532,710	549,455	285,083	293,062	301,438	311,401
TCWD	57,059	61,216	64,889	67,104	61,618	62,507	126,795	131,110	135,232	70,164	72,128	74,190	76,642
Total	1,053,225	1,129,956	1,197,759	1,238,638	1,137,373	1,153,792	2,340,433	2,420,094	2,496,166	1,295,125	1,331,373	1,369,428	1,414,688
BENEFIT, $ (3)													
SMWD	55,714	86,600	91,529	98,746	87,079	89,094	110,363	111,947	113,531	(100,100)	(39,896)	(31,750)	(22,063)
MNWD	14,576	22,656	23,945	25,833	22,781	23,308	28,872	29,287	29,701	(26,188)	(10,437)	(8,306)	(5,772)
CVWD	21,320	33,139	35,025	37,787	33,323	34,094	42,233	42,839	43,445	(38,305)	(15,267)	(12,150)	(8,443)
TCWD	5,247	8,156	8,620	9,300	8,201	8,391	10,394	10,543	10,693	(9,428)	(3,757)	(2,990)	(2,078)
Total	96,858	150,552	159,120	171,666	151,384	154,886	191,862	194,616	197,370	(174,020)	(69,357)	(55,197)	(38,355)
SUM OF BENEFIT CASH FLOW	96,858	247,410	406,530	578,196	729,579	884,466	1,076,328	1,270,944	1,468,314	1,294,293	1,224,936	1,169,739	1,131,384

NOTES:

(1) Total project cost prorated to each agency based on participation.
(2) Agency sells its prorated yeild to CVWD at the MWDSC rate.
(3) The benefit is the difference between "Sale to CVWD" and the "Project Cost".
(4) Participation is based on demands in the watershed at the start of the project estimated based on1995 projected demands.

PROJ. PARTICIPATION	% of tot
SMWD	57.52%
MNWD	15.05%
CVWD	22.01%
TCWD	5.42%
Total	100.00%

TABLE 7-12 Continued
PHASE I DESALTER
WITH SCENARIO 2 MWDSC WATER PRICING
CONJUNCTIVE USE PROJECT AS SUPPLY AND STORAGE
BENEFIT ANALYSIS
$ PER ACRE FOOT

YEAR	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
PROJECT YIELD. AF/YR	1,800	1,800	1,800	1,800	3,600	3,600	3,600	1,800	1,800	1,800	1,800	1,800
PROJECT NET COST, $/AF	823	839	856	873	754	767	779	1018	1039	1062	1091	975
MWDSC WATER COST, $/AF	812	838	866	895	924	954	986	1017	1048	1085	1122	1162
PROJECT COST, $ (1)												
SMWD	852,604	868,993	886,150	903,630	1,561,689	1,587,436	1,613,774	1,054,503	1,076,018	1,100,075	1,129,619	1,010,024
MNWD	223,053	227,341	231,829	236,402	408,560	415,296	422,186	275,873	281,501	287,795	295,524	264,237
CVWD	326,267	332,539	339,104	345,793	597,613	607,466	617,545	403,528	411,761	420,967	432,272	386,507
TCWD	80,301	81,844	83,460	85,106	147,084	149,509	151,990	99,316	101,342	103,608	106,391	95,127
Total	1,482,224	1,510,717	1,540,543	1,570,932	2,714,946	2,759,707	2,805,495	1,833,220	1,870,623	1,912,445	1,963,806	1,755,894
SALE TO CVWD, $ (2)												
SMWD	840,830	867,908	897,060	926,217	1,912,826	1,975,297	2,041,919	1,053,239	1,085,524	1,122,990	1,162,216	1,202,813
MNWD	219,973	227,057	234,684	242,311	500,422	516,766	534,195	275,542	283,988	293,790	304,052	314,673
CVWD	321,761	332,123	343,279	354,436	731,983	755,889	781,383	403,044	415,399	429,736	444,746	460,282
TCWD	79,192	81,742	84,488	87,234	180,155	186,039	192,313	99,197	102,238	105,766	109,461	113,284
Total	1,461,756	1,508,830	1,559,510	1,610,198	3,325,386	3,433,991	3,549,810	1,831,023	1,887,148	1,952,282	2,020,475	2,091,052
BENEFIT, $ (3)												
SMWD	(11,774)	(1,086)	10,911	22,587	351,137	387,861	428,145	(1,264)	9,506	22,915	32,597	192,789
MNWD	(3,080)	(284)	2,854	5,909	91,862	101,470	112,009	(331)	2,487	5,995	8,528	50,436
CVWD	(4,506)	(416)	4,175	8,643	134,370	148,423	163,839	(484)	3,638	8,769	12,474	73,775
TCWD	(1,109)	(102)	1,028	2,127	33,071	36,530	40,324	(119)	895	2,158	3,070	18,157
Total	(20,469)	(1,888)	18,968	39,267	610,440	674,284	744,316	(2,197)	16,526	39,837	56,669	335,157
SUM OF BENEFIT CASH FLOW	1,110,915	1,109,027	1,127,995	1,167,261	1,777,701	2,451,985	3,196,301	3,194,103	3,210,629	3,250,466	3,307,135	3,642,292

NOTES:
(1) Total project cost prorated to each agency based on participation.
(2) Agency sells its prorated yeild to CVWD at the MWDSC rate.
(3) The benefit is the difference between "Sale to CVWD" and the "Project Cost".
(4) Participation is based on demands in the watershed at the start of the project estimated based on1995 projected demands.

PROJ. PARTICIPATION	% of tot
SMWD	57.52%
MNWD	15.05%
CVWD	22.01%
TCWD	5.42%
Total	100.00%

period (25 years). This is primarily due to the impacts of buying recharge water at the MWDSC seasonal storage rate.

Table 7-13 summarizes the total cash flow and present worth of the Phase I water storage case. The cash flow is summarized graphically in Figure 7-2.

NON-QUANTIFIABLE BENEFITS OF SJBA DESALTER PROJECT

Many of the benefits of the SJBA desalter project are not fully quantifiable at present, either due to the nature of the benefit, or the lack of complete documentation on the MWDSC's new rate structure. The current non-quantifiable benefits include:

1. Storage

2. Reliability

3. Local control

4. MWDSC Rate Impacts
   a. New demand charge
   b. Readiness to serve charge
   c. Treated water peaking charge
   d. Connection maintenance charge

The following discussions of these benefits are presented to assist the SJBA member agencies in further analyzing the project.

STORAGE

Southern Orange County is short of storage, based upon MWDSC's recommended criteria of seven average days' demand. The San Juan Basin presents an opportunity to access approximately 30,000 acre-feet of useable storage. The utilization of this storage is restricted by both water quality constraints and production facilities at present. Full development of the desalter project will provide for accessing 10,000 acre-feet of storage per year from the San Juan Basin at a withdrawal rate of 10 mgd. The current full development plan provides facilities to enable all SJBA members to benefit from this storage. Access to the storage will decrease the need for local reservoirs for emergency storage.

RELIABILITY

A major concern with respect to Southern California water supplies is the issue of reliability. Recently, the California Urban Water Agency (CUWA) sponsored a study developing procedures for quantifying the reliability of California's water supply. MWDOC, a member of CUWA, has integrated these procedures into an Orange County Water Reliability Study, produced jointly with the Orange County Water District. The results of the study show that Southern Orange County, because of its high dependence on imported MWDSC supplies, has a very poor reliability, compared to the MWDSC's recently established goals, and particularly when

TABLE 7-13

PHASE I DESALTER
CONJUNCTIVE USE PROJECT AS SUPPLY AND STORAGE

BENEFIT SUMMARY

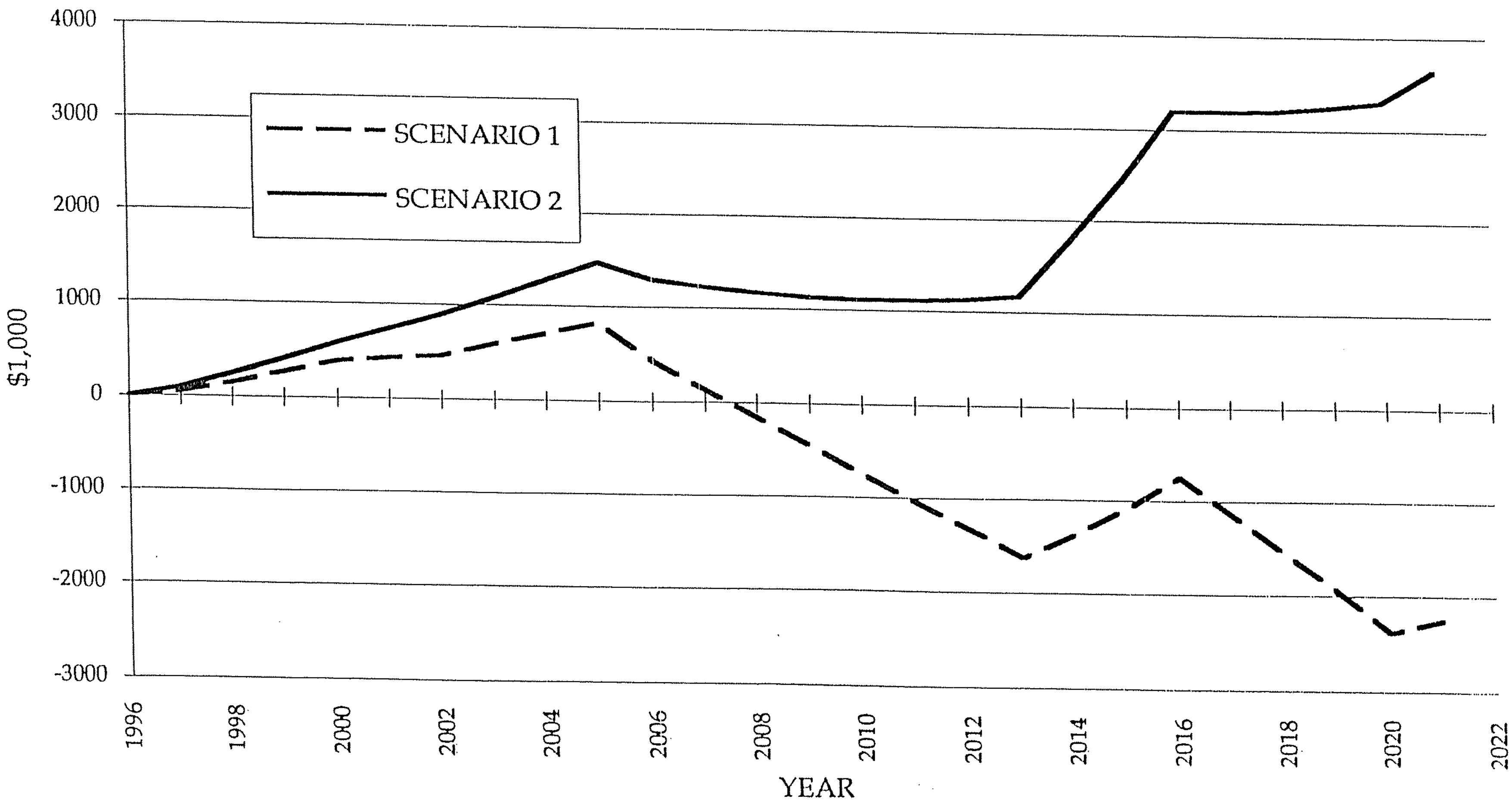
	SCENARIO 1	SCENARIO 2
CASH FLOW OF PROJECT		
Total sum of annual project cost	$45,419,730	$42,167,219
Total cost of purchasing MWDSC water without project	43,160,745	45,809,512
Total savings in water cost with the project (benefit)	-2,258,985	3,642,292
Benefit-to-cost ratio	0.95	1.09
PRESENT WORTH		
Total present worth of cash flow	18,788,013	17,749,293
Total present worth of cash flow to purchase MWDSC water without the project	18,069,010	19,444,525
Net present worth of project (benefit)	-719,003	1,695,232
Benefit-to-cost ratio	0.96	1.10

NOTES

1. Scenarios 1 and 2 as described on Table 7-3.
2. Values arrived from analysis of Tables 7-9, 7-10, 7-11 and 7-12.

File: Bene Graph 3600 Rev 1 Chart 1

FIGURE 7-2
PHASE 1 DESALTER
CONJUCTIVE USE PROJECT AS SUPPLY AND STORAGE
SUM OF NET CASH FLOW



compared to Northern Orange County with its large Lower Santa Ana Groundwater Basin. Currently, Southern Orange County can expect water shortages of 15 percent or more 10 percent of the time, with shortages as large as 30 percent occurring 4 percent of the time. MWDSC's goal for retail agencies is a 2 percent probability of a shortage of 10 percent and a 10 percent probability of any shortage. Upon full implementation of the San Juan Basin desalter, San Mateo Basin project and proposed wastewater recycling, reliability approaching the MWDSC's retail agency goal can be achieved. The San Juan Basin desalter is particularly valuable because it is the largest Southern Orange County potable water project proposed.

LOCAL CONTROL

A key factor in the ability of retail water agencies to develop long-range plans with any degree of financial certainty is the degree to which local control is asserted over the sources of supply. An area highly dependent on imported MWDSC supplies can be severely impacted financially by changes in MWDSC's rate structure, water allocation policies, or delivery criteria. Development of the SJBA desalter project will help to manage the potential for disruptive change.

MWDSC NEW WATER RATE STRUCTURE

MWDSC, in December 1993, adopted a new rate structure which significantly affects potential water costs in Southern Orange County. The new rate structure includes:

- A basic commodity rate.
- Continuation of the existing Seasonal Storage Rate.
- A new demand charge of between $1,000 per acre-foot and $2,000 per acre-foot of new demand, based upon a four-year rolling average. This is called a "Capacity Acquisition Charge" and would be financed over 15 years.
- A treated water peaking charge for peaking over 130 percent of an average week.
- A readiness to serve charge allocated based upon an average of water purchased.
- A connection maintenance charge based upon the capacity of connections to MWDSC system.

These new rates would be implemented in 1995/96. Currently, MWDOC has not decided how it will pass these charges on to its member agencies. Consequently, the economic analysis for the SJBA desalter project is based upon a rate representing all of MWDSC's proposed water sales revenues divided by projected MWDSC water sales in acre-feet. In actuality, the proposed capacity acquisition charge and treated water peaking charge, if passed through directly, would severely impact Southern Orange County, due to projected growth and the need to peak off of the MWDSC water supplies. The savings from developing a firm water supply of 1,800 acre-feet per year in Phase I would be at least $2.0 million, while the completed project of 5,000 acre-feet per year would save over $6.0 million in capacity acquisition and treated water peaking charges. The proposed readiness to serve charge will also be reduced. Development of the firm water supplies would eventually result in a reduced need for connected MWDSC capacity and a small annual savings on the service connection maintenance charge.

SUMMARY

The Phase I project is economically feasible as a water supply project as demonstrated with a benefit-to-cost ratio greater than one and net positive cash flow. The quantifiable economics of the storage elements are marginal and heavily dependant on imported water costs scenarios.

Many of the potential benefits to the SJBA cannot be fully quantified at this time. However, factors such as basin storage access, increased overall supply reliability, local control and ability to reduce proposed MWDSC charges all contribute to a more reliable and economical regional water system.

CHAPTER 8

CONCLUSIONS AND RECOMMENDATIONS

CONCLUSIONS

Comprehensive mathematical modeling studies were conducted of the San Juan Basin to develop management strategies so that the basin can be integrated into the potable water supply systems of the San Juan Basin Authority member agencies. Considerable benefits may be possible for these agencies particularly in times of drought as has been experienced between 1986 and 1993.

Based upon studies conducted herein and previous studies, it is concluded that the San Juan Basin acts as two subsystems separated by the Cristianitos Fault: The Upper San Juan Basin and the lower basins: Middle and Lower San Juan Basins and Lower Trabuco Basin. The Upper San Juan Basin was included in all phases of the operational studies; however, specific management schemes were not studied for this basin. It is shallow and has less storage capacity. This basin may be effectively used to increase in situ pumping of several hundred acre-feet per year. Depending on future conditions, the SJBA may want to consider incorporating this basin into a management plan. The main area that is useful for comprehensive management at this time is the lower basins, the focus of this report.

Historic sustained yield in the San Juan Basin was about 5,200 acre-feet per year. Sustained yield will gradually increase in the future due to development of the tributary watershed areas that will see increased irrigation with imported water. Return flows from this irrigation will increase subsurface inflow to the main basin and increased stream baseflows which will percolate in the main basin. As a consequence, current (1993) sustained yield is estimated to be 7,800 acre-feet per year, and under ultimate buildout of the tributary areas, sustained yield is estimated to be 9,000 acre-feet per year in the main San Juan Basin. The average additional sustained yield available to this project over its assumed 25-year life is at least 2,200 acre-feet per year and will probably be more once operational experience is gained in managing the basin.

Unless subsurface outflow to the ocean is controlled, the use of the San Juan Basin for long-term storage would have a penalty in lost water to subsurface outflow. The best use of the basin is short-term drought storage involving heavy pumping for a one- to three-year period. Depending upon the initial storage in the lower basins and duration of pumping, 6,500 to 34,000 acre-feet per year of additional water may be withdrawn from the groundwater. Recharge of water to replace short-term pumpage should follow withdrawal and be accomplished in such a way that rising water losses are minimized. Recharge could be accomplished by a combination of artificial recharge of imported water, reclaimed water, or in-lieu water exchange. The advantages of using reclaimed water have been previously discussed in this report. A pattern of extractions in the Lower San Juan Basin should be implemented to minimize subsurface outflow to the ocean and induce limited seawater intrusion. Limited seawater intrusion can substantially enhance the yield of the project in times of emergency such as drought or catastrophe when imported supplies are limited. This can be accomplished with limited pumping near the ocean in areas already affected with seawater intrusion.

The key strategy in developing a management plan for the San Juan Basin is flexibility, phasing and prototype demonstration. To be successful in implementing an ultimate optimal plan, management and operations infrastructure needs to be constructed.

Based upon studies conducted with the mathematical model, it appears that an ultimate plan would include an 8 mgd desalter for drought or emergency supplies, 12 extraction wells and a supply manifold, product waterline, pump station to the South County Pipeline, and direct connections to CVWD. This would provide the most flexible operating system. An ultimate system may have a capital cost of about $34,000,000 (1993 dollars). However, due to the many uncertainties of how the basin will respond to such a project, due to the limited current hydrologic information, MWDSC future water pricing and current financial climate, a phased approach is suggested. A Phase I project is proposed that would include a 4 mgd desalter, five extraction wells, supply manifold and a product pipeline to CVWD. In addition, a basin monitoring plan would be developed and reviewed each year to assist in the development and implementation of the final project.

The Phase I facilities would produce an annual additional potable supply of 1,800 acre-feet per year, control groundwater gradients to minimize subsurface outflow to the ocean, and provide seasonal storage capacity. During times of drought or catastrophic emergencies, 3,600 acre-feet of potable supply could be produced by extracting water from storage within the basin and the inducing of a modest amount of seawater into the lowest reach of the Lower Basin.

The capital cost for the proposed Phase I facilities is estimated to be $15,160,000 (1993 dollars). The economic feasibility of the project is complex. In a strict financial analysis, the Phase I project has a benefit-to-cost ratio, based on present worth, ranging from 0.96 as a water supply and storage project, to 1.18 as a water supply project only. However, there are numerous other benefits which must be considered which are difficult to assign a dollar value to. Primarily these include the increased water supply reliability for the project area by providing water from a local water resource. This project also helps offset the impact of MWDSC's projected shortfalls. MWDSC's water pricing concepts are rapidly changing. The same is true with their incentive to develop local water. It is anticipated that additional incentives may be available in the near future that may enhance the financial aspects of this project.

RECOMMENDATIONS

The following specific recommendations are proposed:

1) Continue with the water rights appropriation with the goal to appropriate all unappropriated waters of the San Juan Creek for the project.

2) Develop and implement a cooperative strategy with MWDOC to request MWDSC funding assistance by applying for participation in their Groundwater Recovery, Seasonal Storage and Local Projects programs. Explore the possibility of MWDSC participation in capital funding participation.

3) Initiate the CEQA process for the entire project.

4) File application for financial aid from State of California in the form of a low-interest loan.

5) Initiate the process to obtain a 25 percent grant from USBR.

6) Develop and implement a local funding plan for the portion of the project not funded by State loan or USBR grant.

7) Acquire rights-of-way or easements for the necessary facilities which include: desalting facility, well sites and pipelines.

8) Initiate design of Phase I facilities and develop a construction phasing plan.

9) Develop and initiate a monitoring and data reporting program that includes: measurement of groundwater levels, metering of pumped water, and groundwater quality sampling programs.

10) Develop a basin management program that includes the evaluation of the monitoring program and integration into the mathematical model to develop a projected annual water balance for the basin each year.

11) Initiate studies to explore the use and integration of reclaimed water into the basin. In particular, explore the use of recharged reclaimed water to increase sustained yield and recharged reclaimed water near the coast to aid in the control of water quality in the Lower San Juan Basin.

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APPENDIX A

SIMULATED WATER LEVELS AND TDS CONCENTRATIONS AT SELECTED NODES FOR THE SAN JUAN BASIN

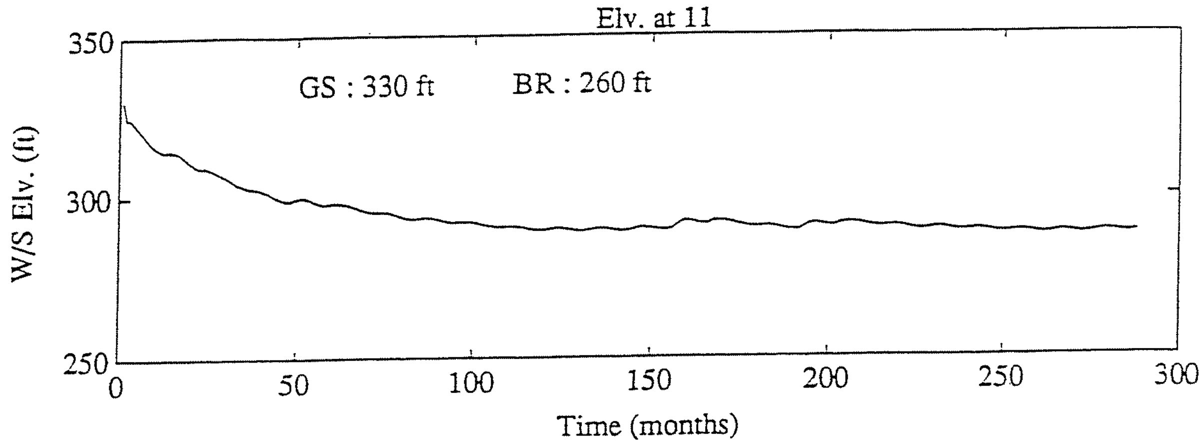
TABLE A-1

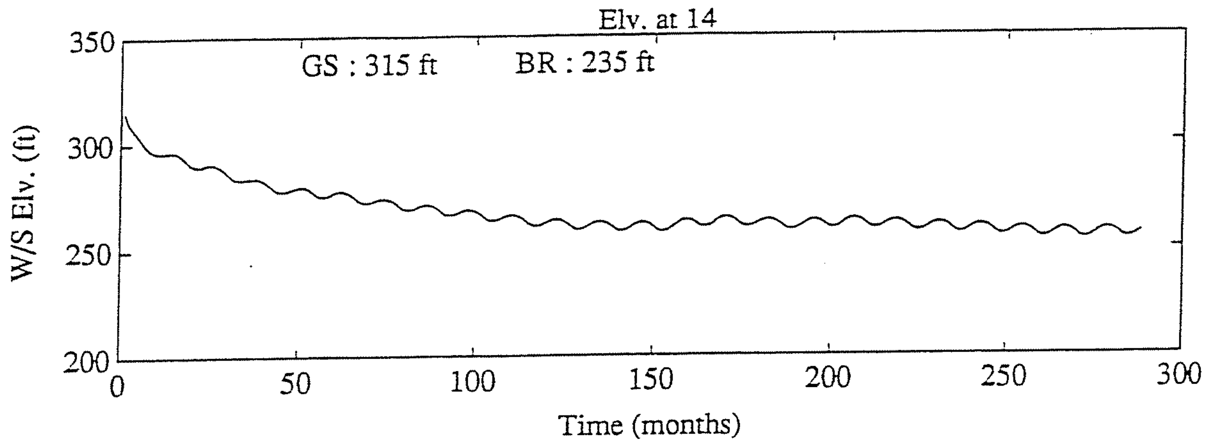
SAN JUAN BASIN PRECIPITATION AND PAN EVAPORATION FOR THE SIMULATION PERIOD

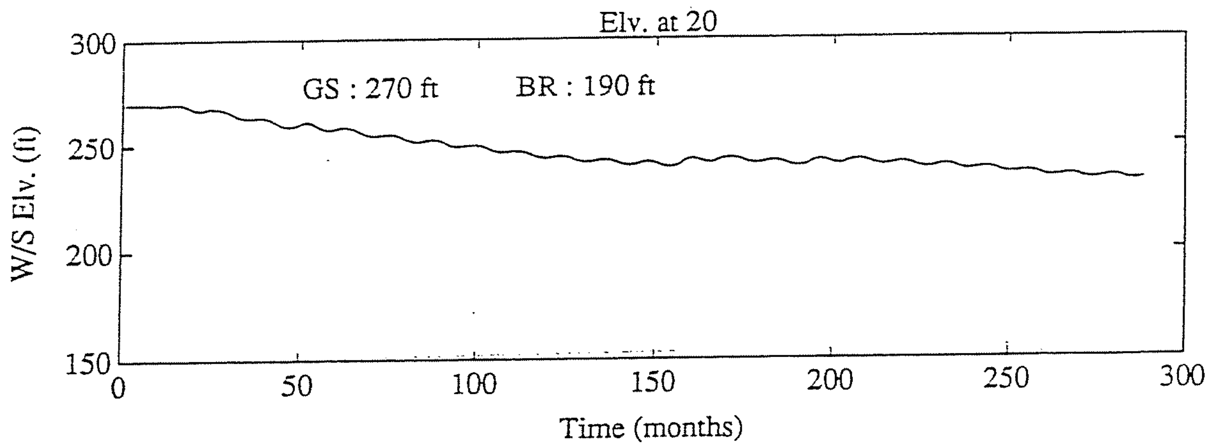
Year	Precipitation (in)	Pan Evaporation (in)
1	20.37	51.75
2	28.55	51.75
3	7.22	51.75
4	14.82	51.75
5	26.97	51.75
6	11.47	51.75
7	13.1	51.75
8	16.47	51.75
9	10.15	51.75
10	9.38	51.75
11	15.46	51.75
12	15.73	51.75

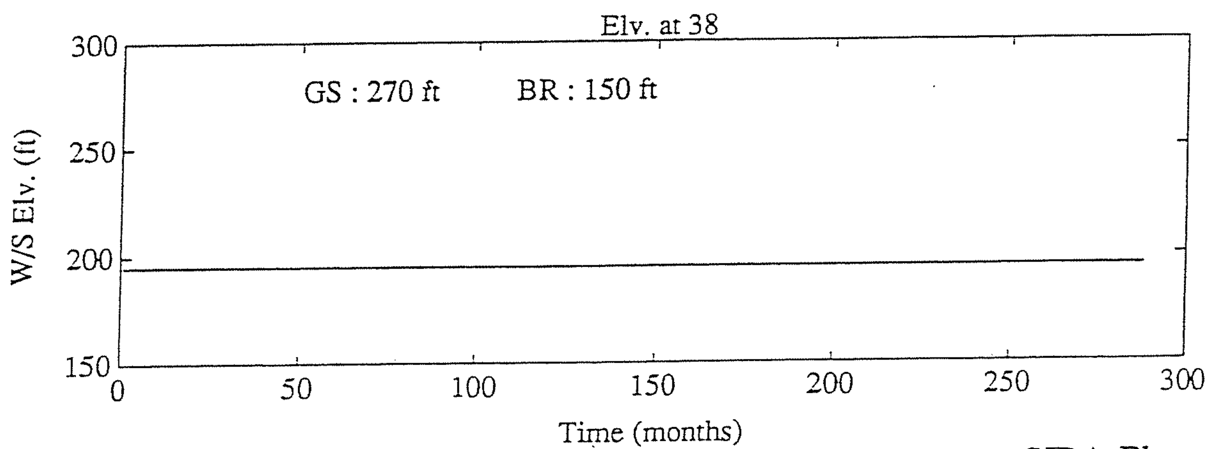
PHASE I OPERATION
SIMULATED WATER LEVELS
AT SELECTED NODES

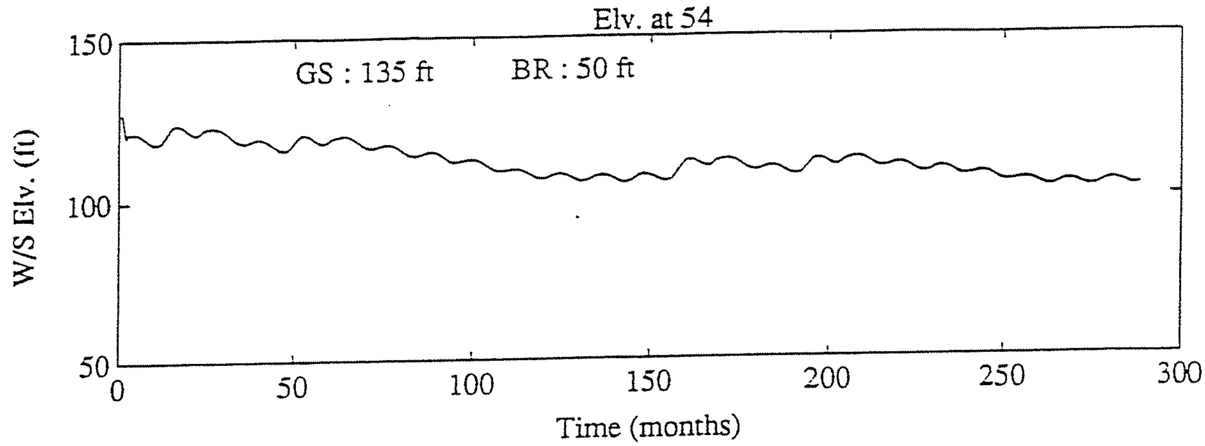
See Figure 3-1 for node locations

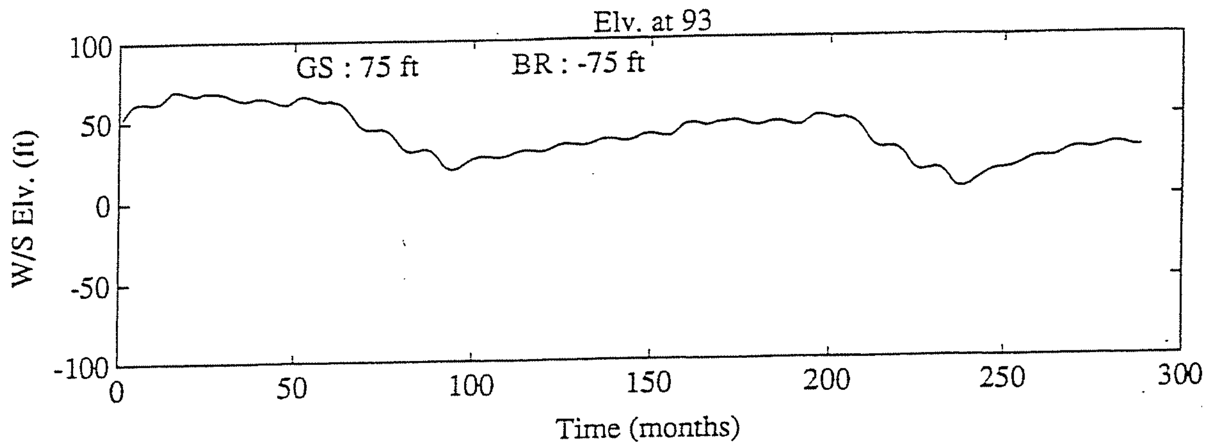

Elv. at 11
GS : 330 ft
BR : 260 ft
W/S Elv. (ft)
350
300
250
0
50
100
150
200
250
300
Time (months)

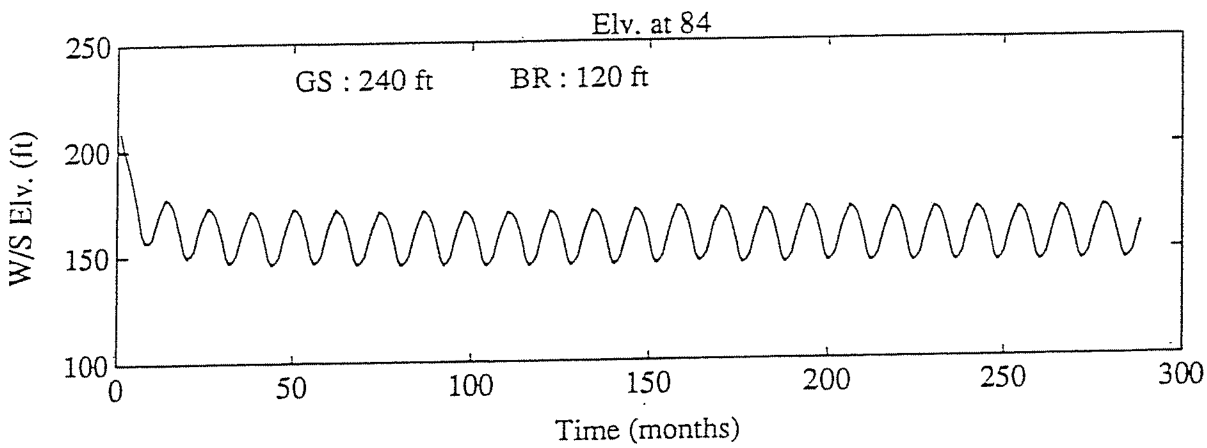

Elv. at 14
GS : 315 ft
BR : 235 ft
W/S Elv. (ft)
350
300
250
200
0
50
100
150
200
250
300
Time (months)

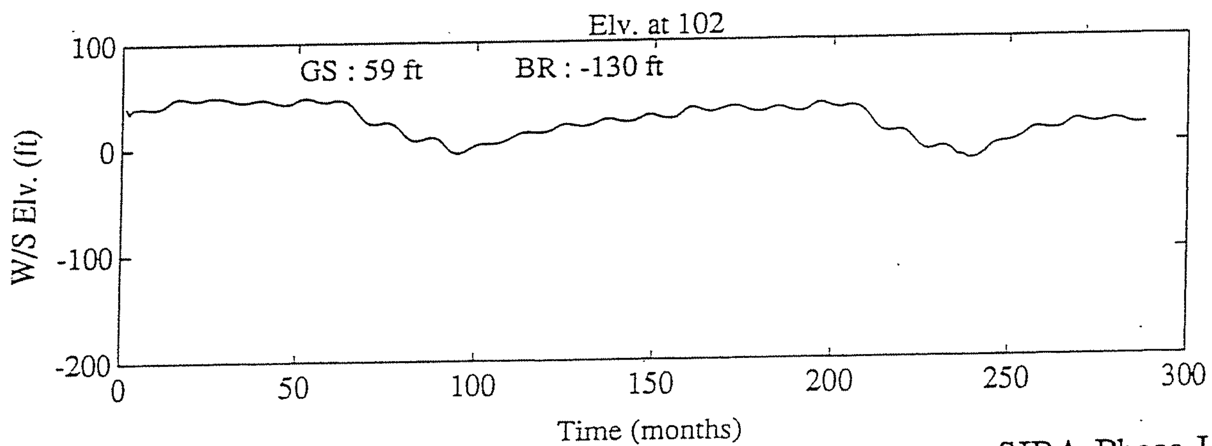

Elv. at 20
GS : 270 ft
BR : 190 ft
W/S Elv. (ft)
300
250
200
150
0
50
100
150
200
250
300
Time (months)

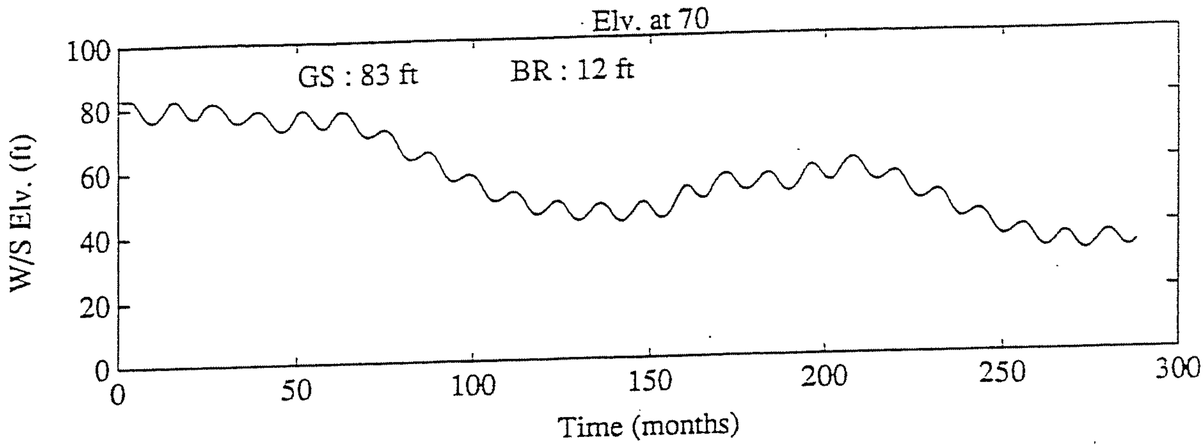

Elv. at 38
GS : 270 ft
BR : 150 ft
W/S Elv. (ft)
300
250
200
150
0
50
100
150
200
250
300
Time (months)

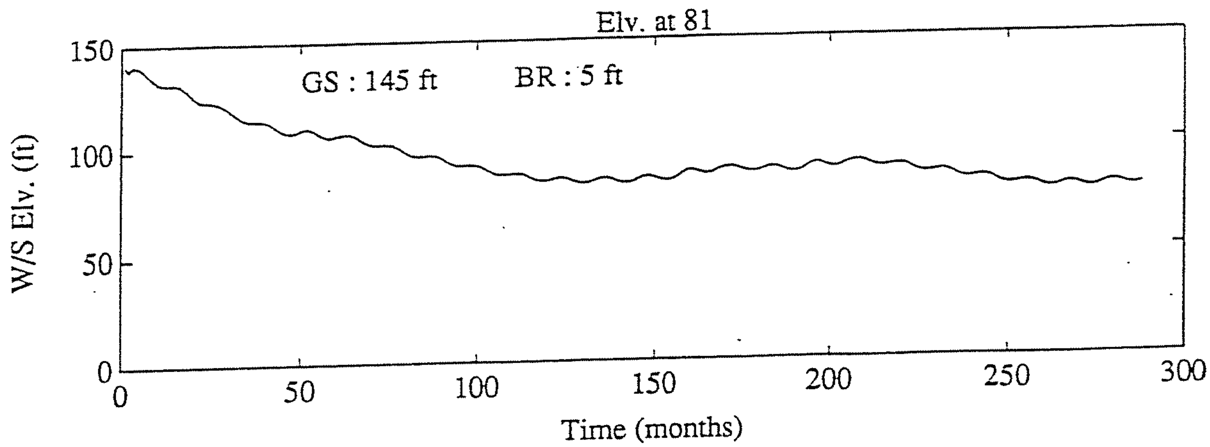

Elv. at 54
GS : 135 ft
BR : 50 ft
W/S Elv. (ft)
Time (months)

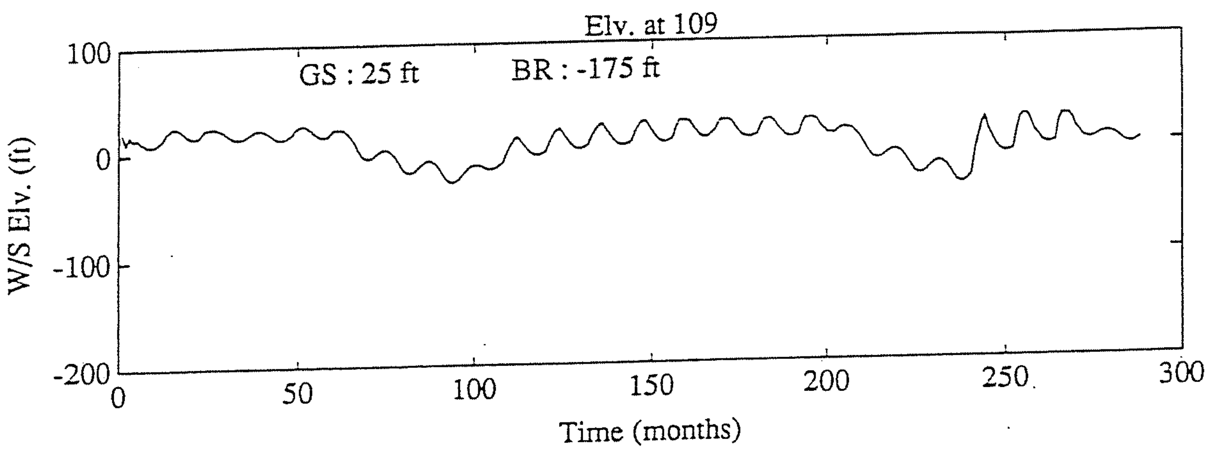

Elv. at 93
GS : 75 ft
BR : -75 ft
W/S Elv. (ft)
Time (months)


Elv. at 84
GS : 240 ft
BR : 120 ft
W/S Elv. (ft)
Time (months)


Elv. at 102
GS : 59 ft
BR : -130 ft
W/S Elv. (ft)
Time (months)


Elv. at 70
GS : 83 ft
BR : 12 ft
W/S Elv. (ft)
Time (months)
0
20
40
60
80
100
0
50
100
150
200
250
300


Elv. at 81
GS : 145 ft
BR : 5 ft
W/S Elv. (ft)
Time (months)
0
50
100
150
0
50
100
150
200
250
300


Elv. at 109
GS : 25 ft
BR : -175 ft
W/S Elv. (ft)
Time (months)
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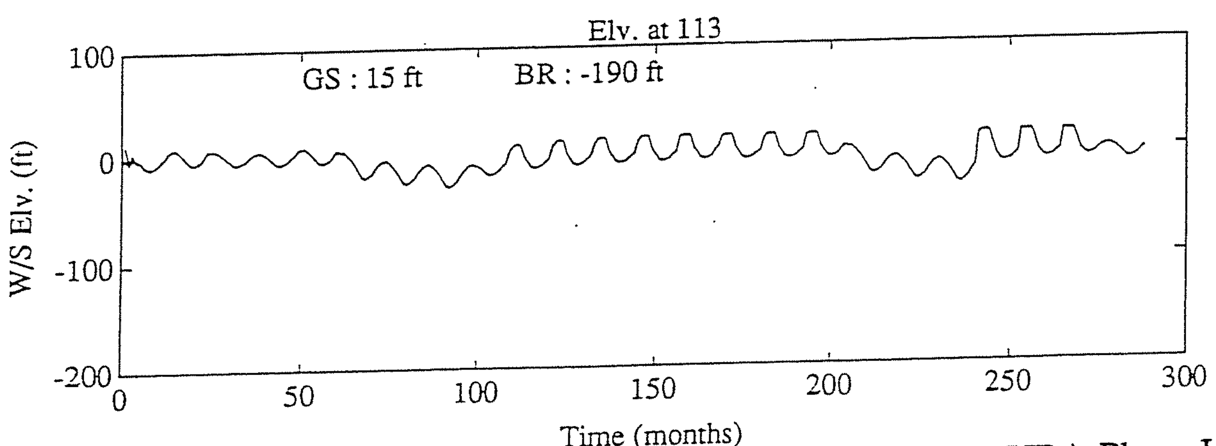
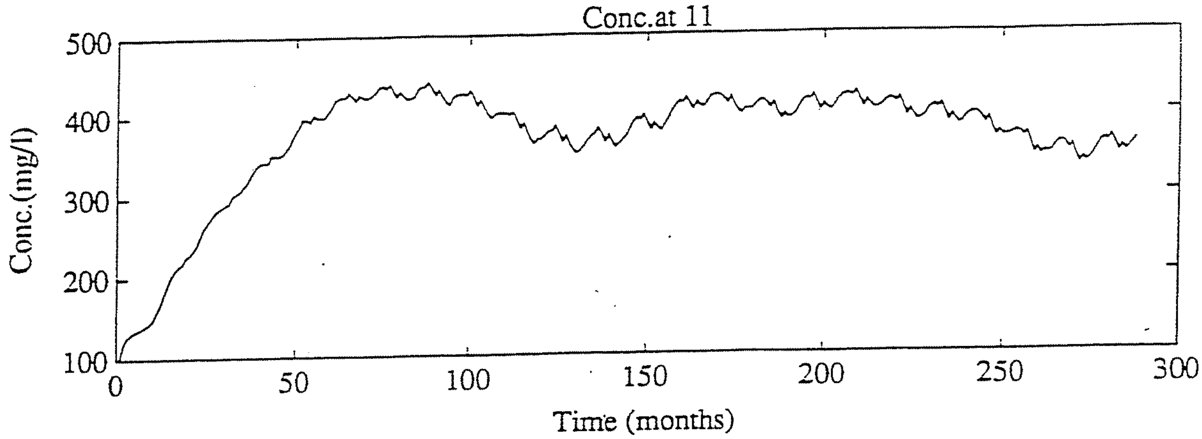
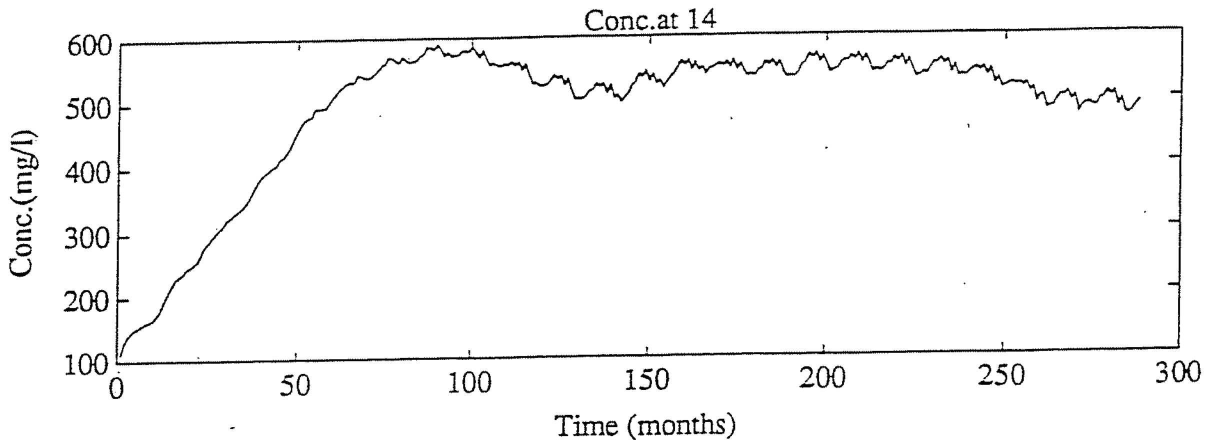
-100
0
100
0
50
100
150
200
250
300

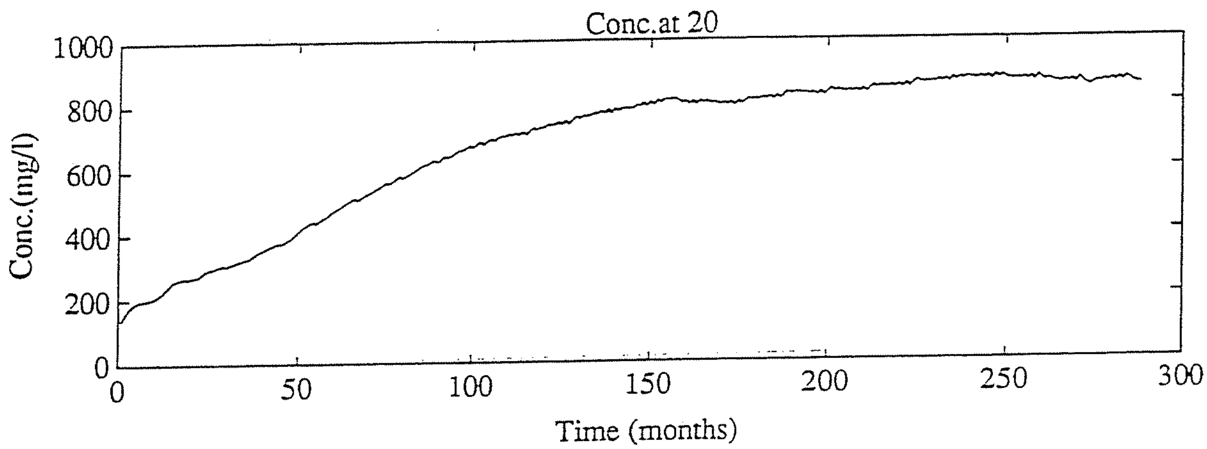

Elv. at 113
GS : 15 ft
BR : -190 ft
W/S Elv. (ft)
Time (months)
-200
-100
0
100
0
50
100
150
200
250
300

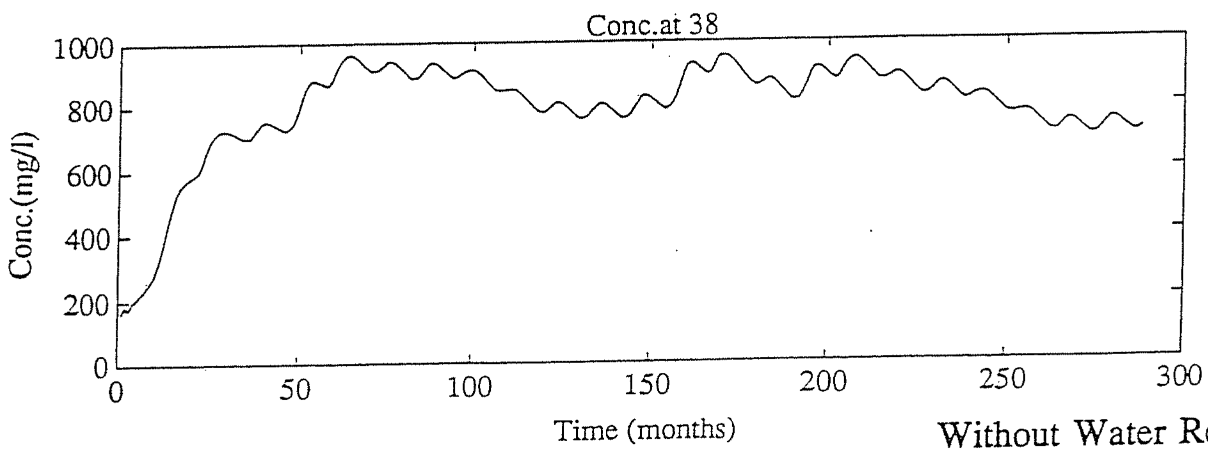
PHASE I OPERATION
SIMULATED TDS CONCENTRATIONS
AT SELECTED NODES
WITHOUT RECLAMATION

See Figure 3-1 for node locations

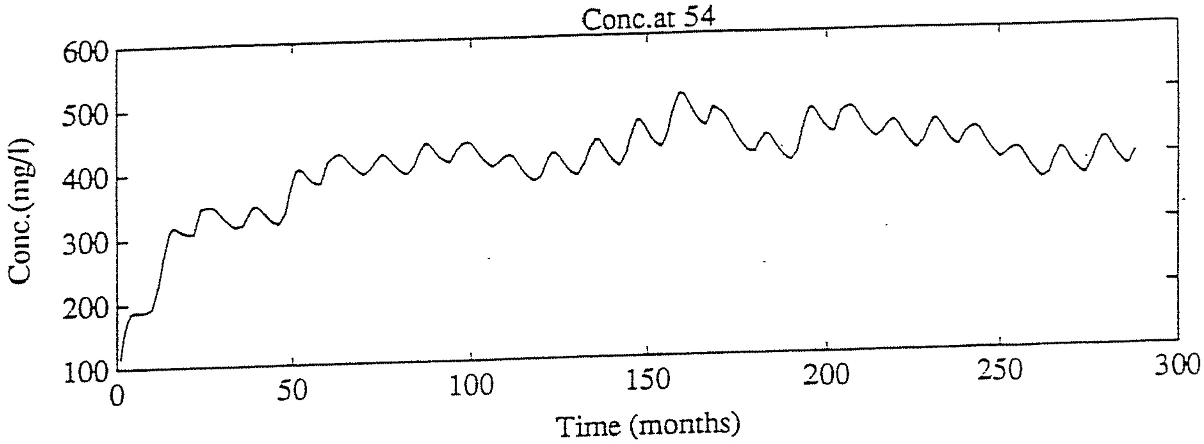


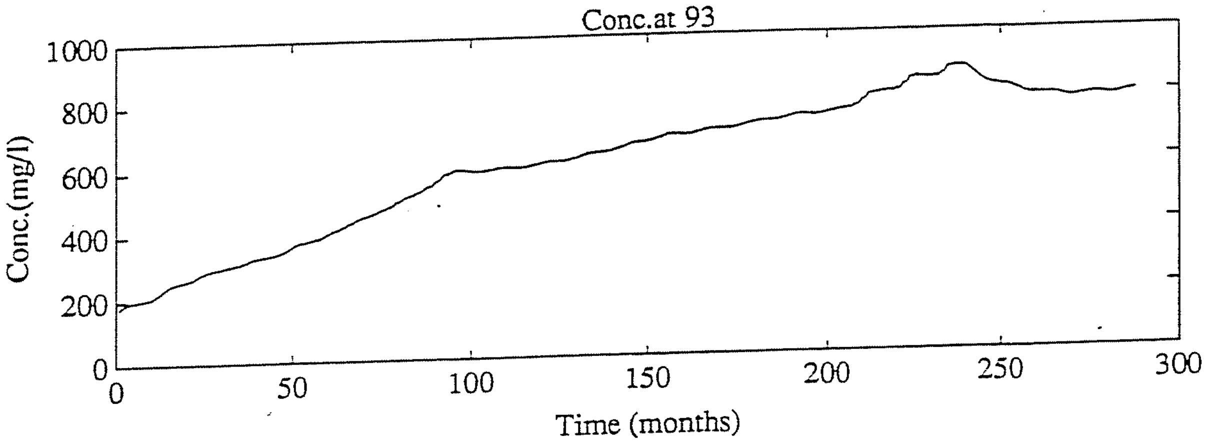


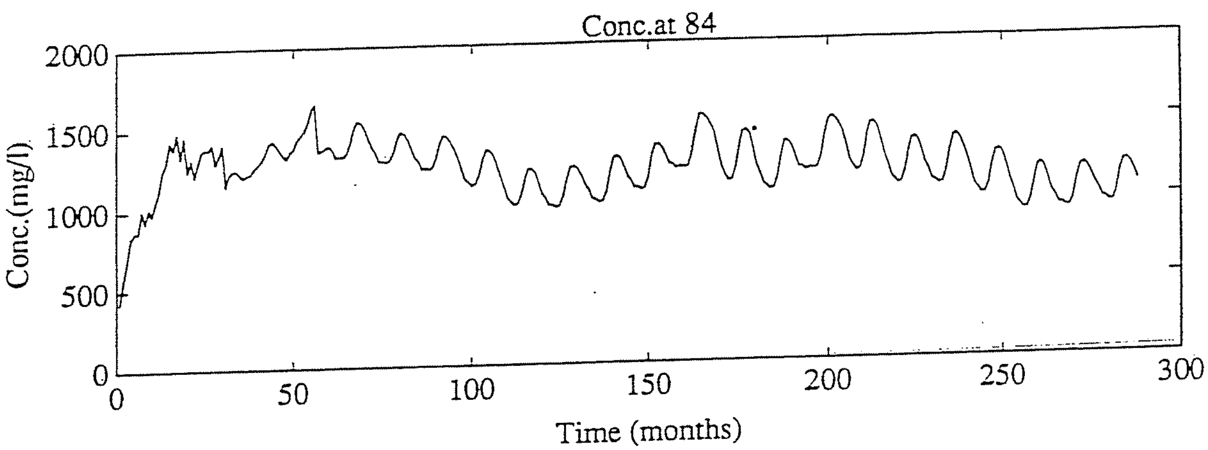


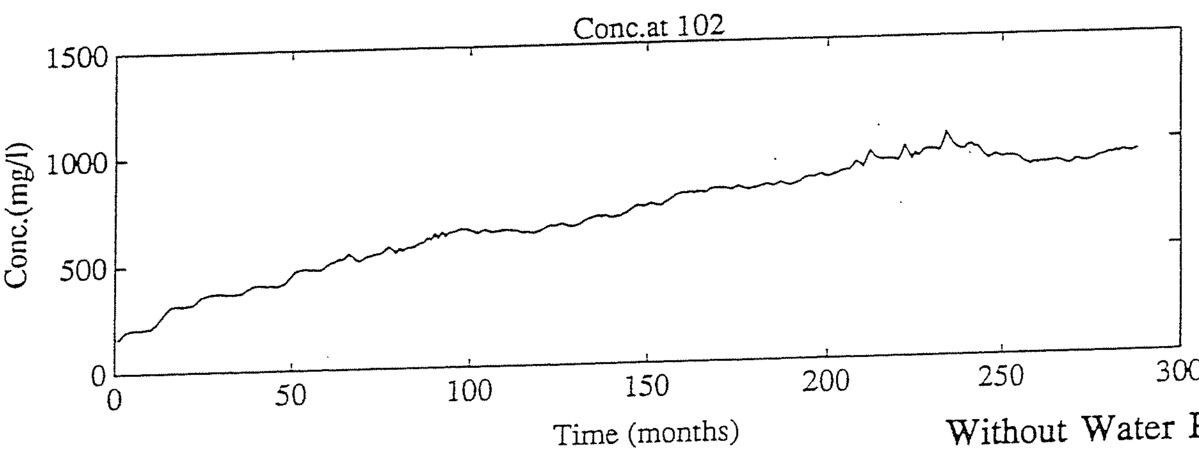


Without Water Reclamation
Plus SJBA Phase I Project

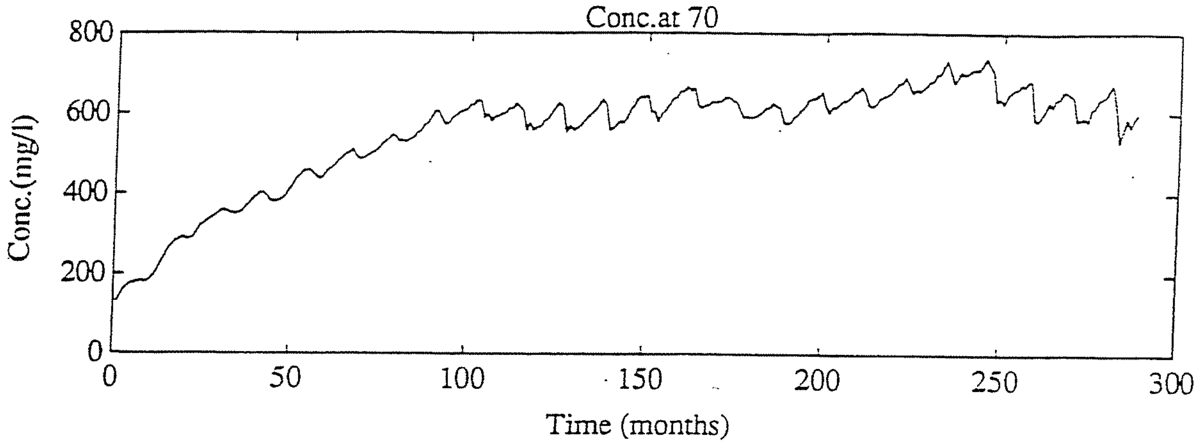


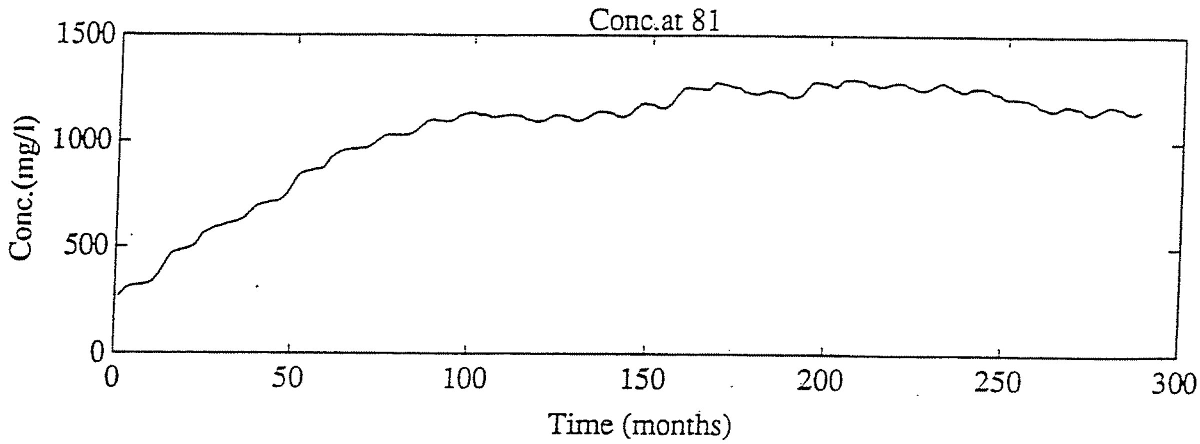


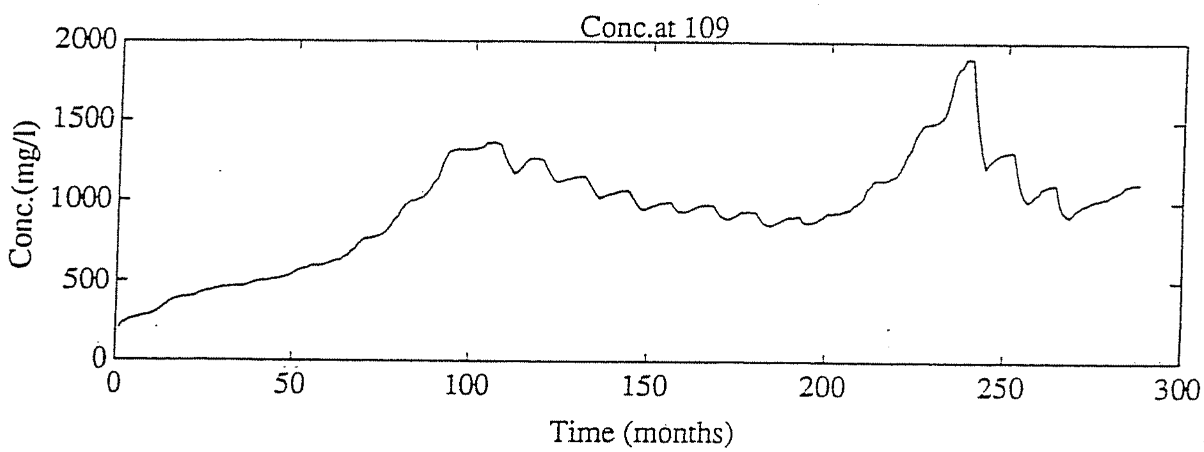


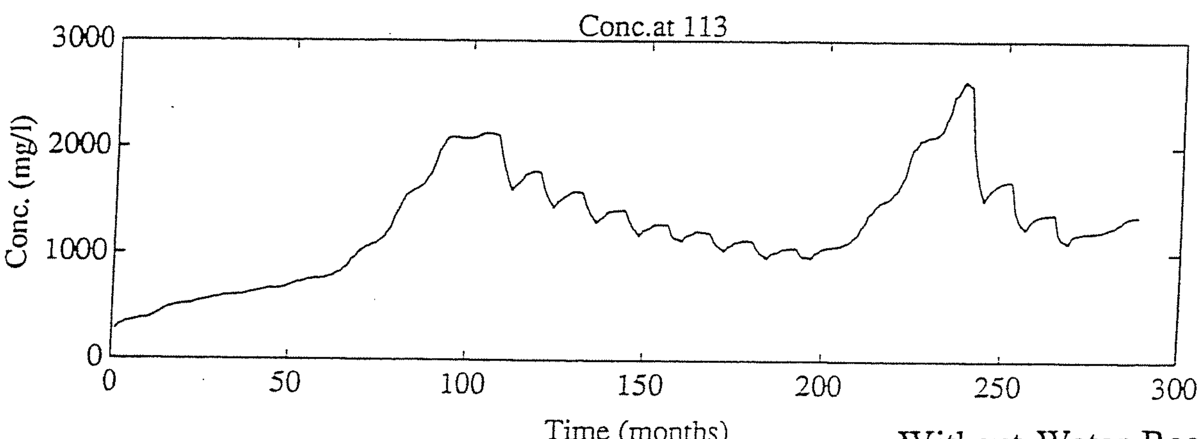


Without Water Reclamation
Plus SJBA Phase I Project





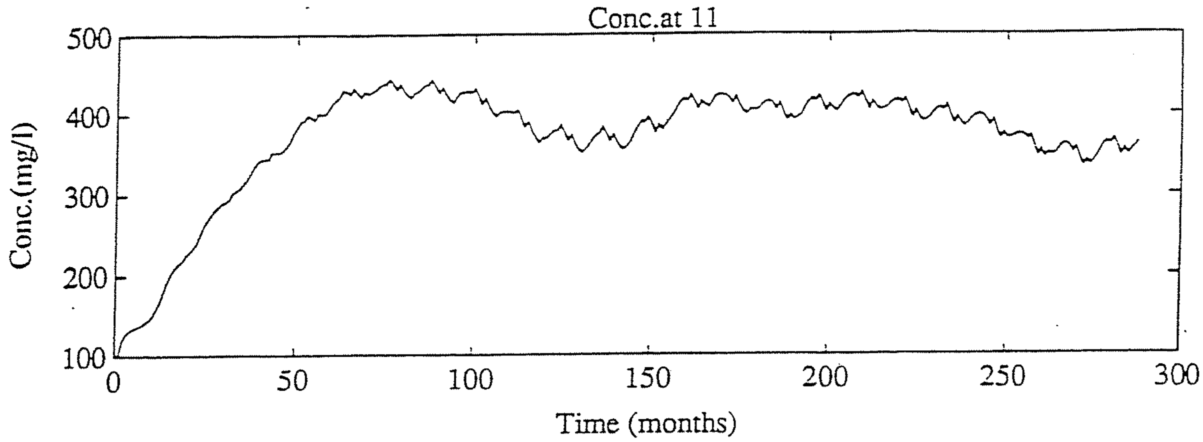


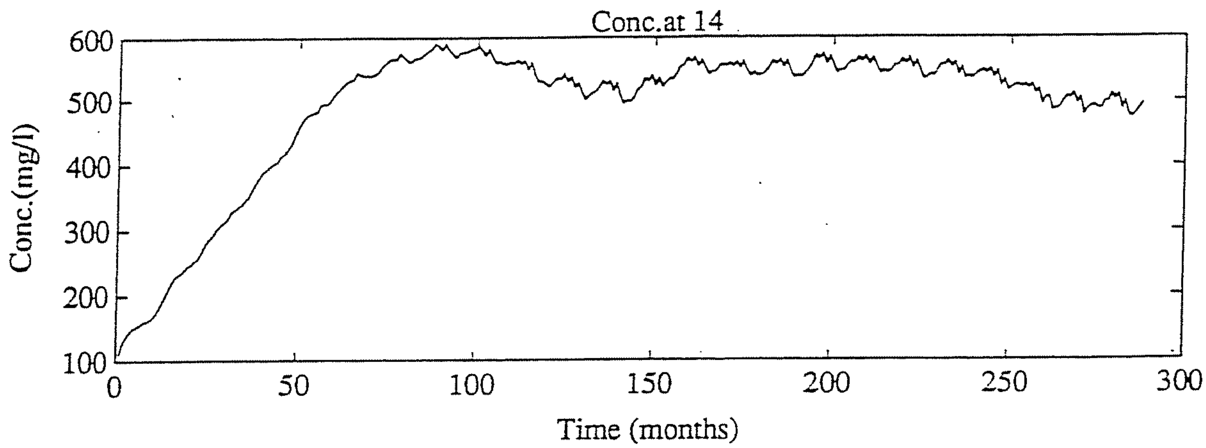


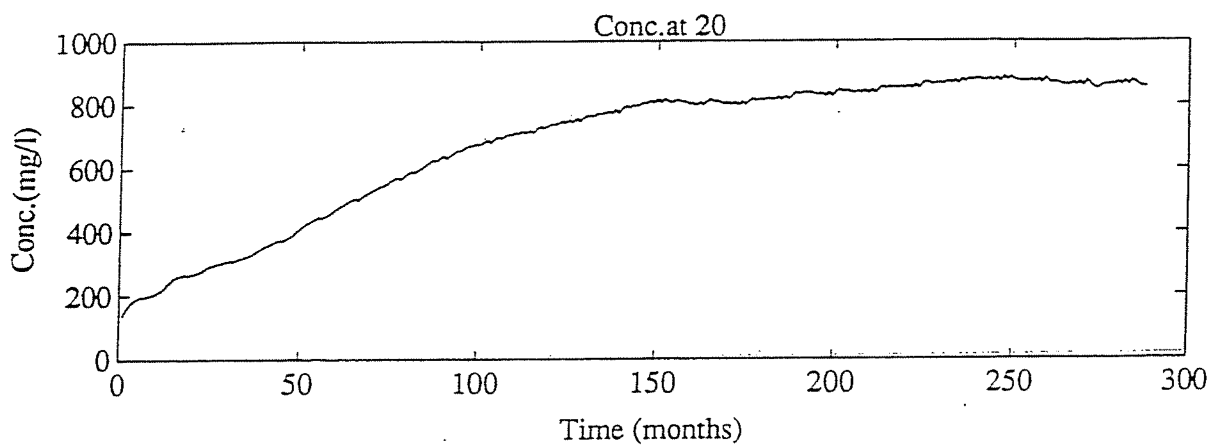
Without Water Reclamation
Plus SJBA Phase I Project

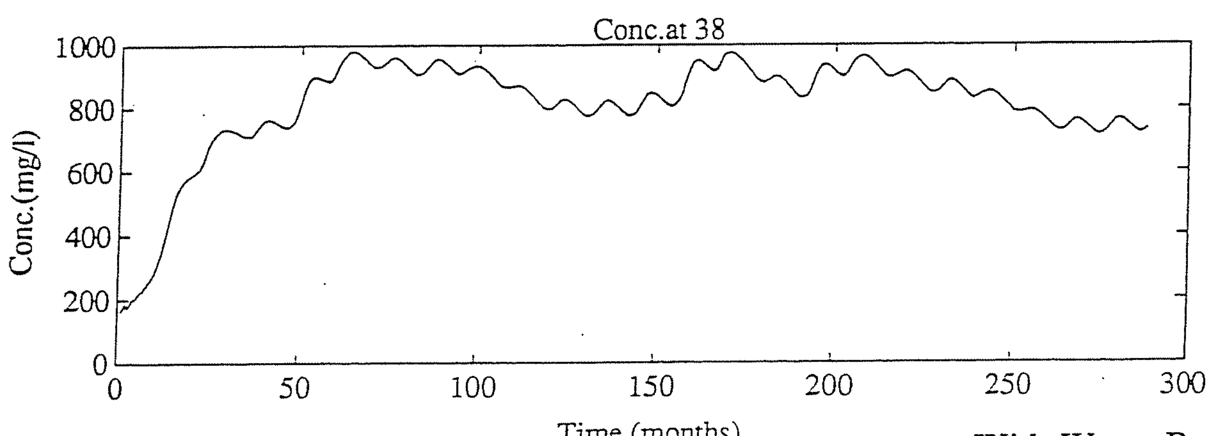
PHASE I OPERATION
SIMULATED TDS CONCENTRATIONS
AT SELECTED NODES
WITH RECLAMATION

See Figure 3-1 for node locations

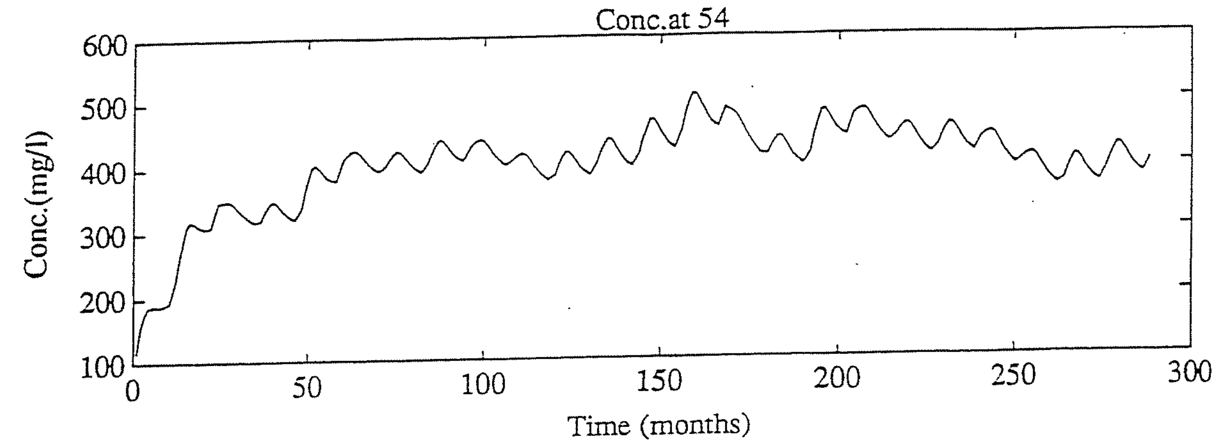


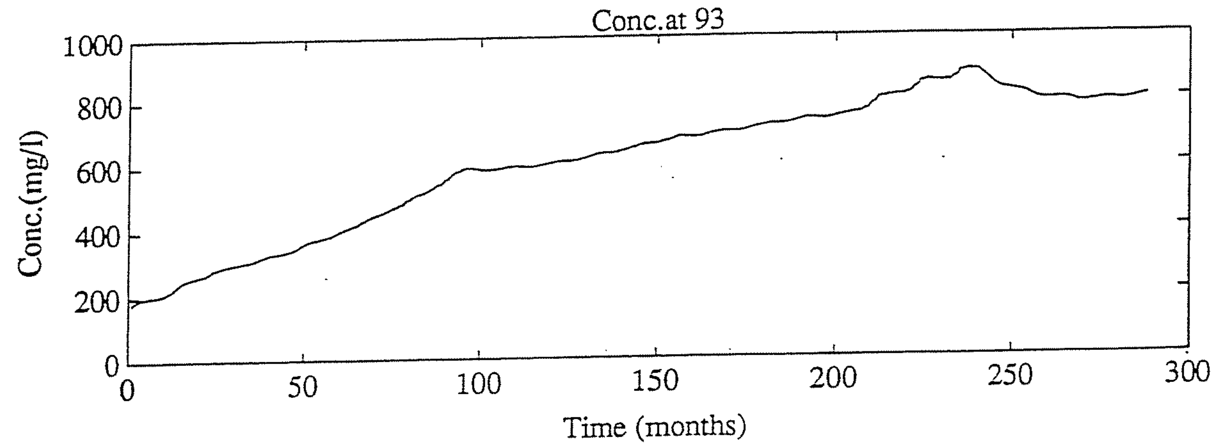


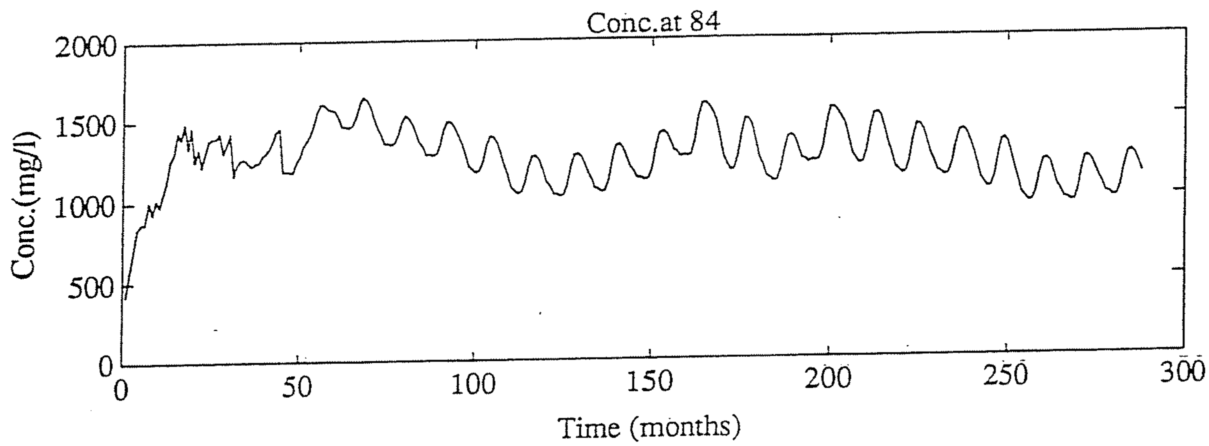


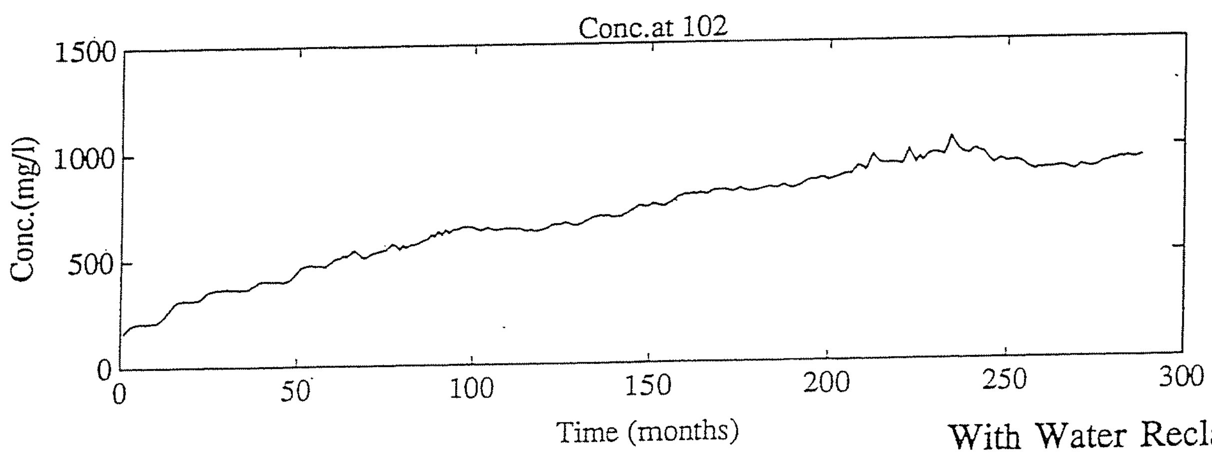


With Water Reclamation

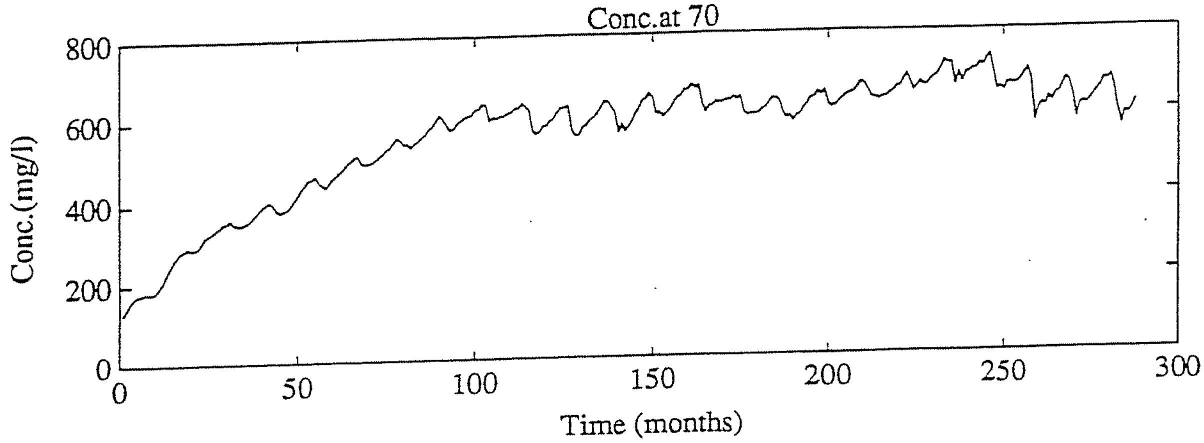


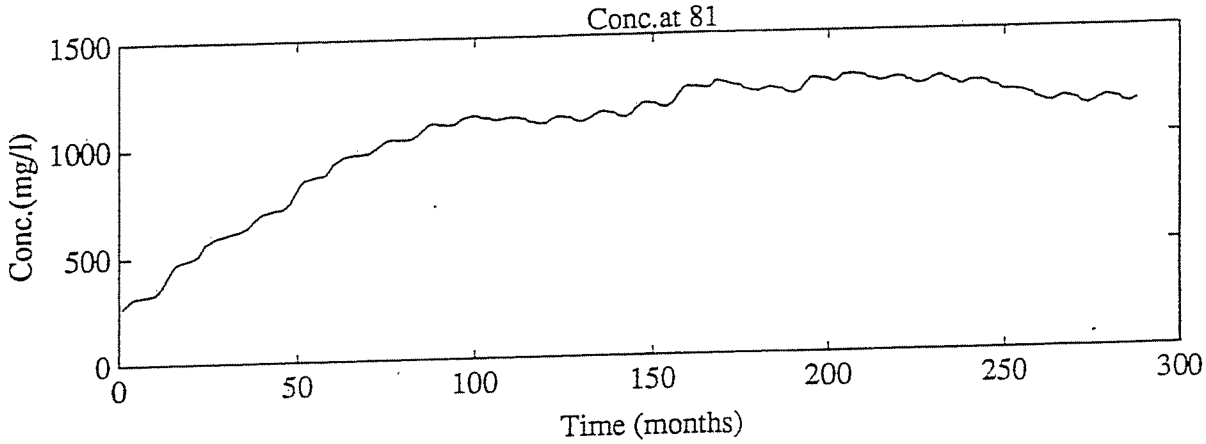


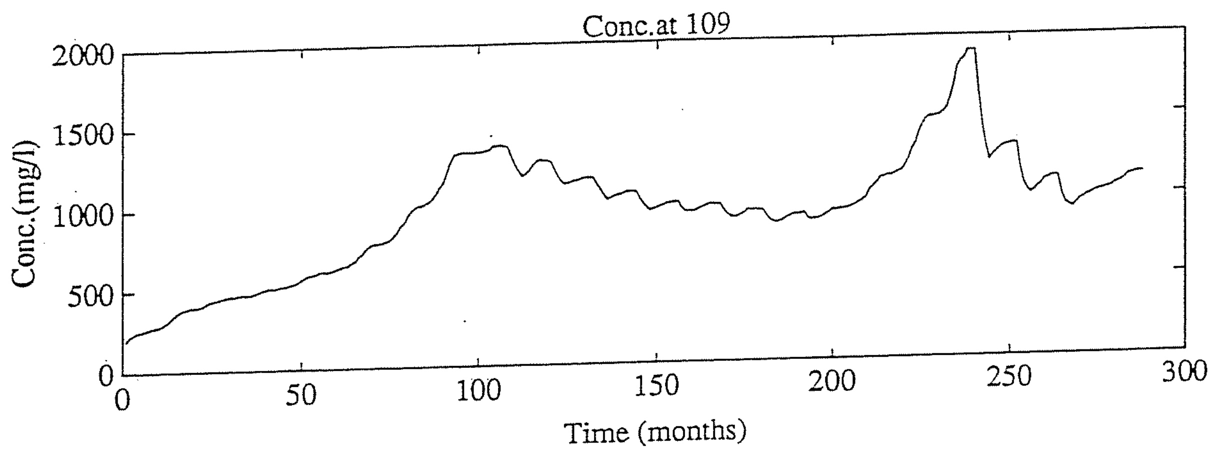


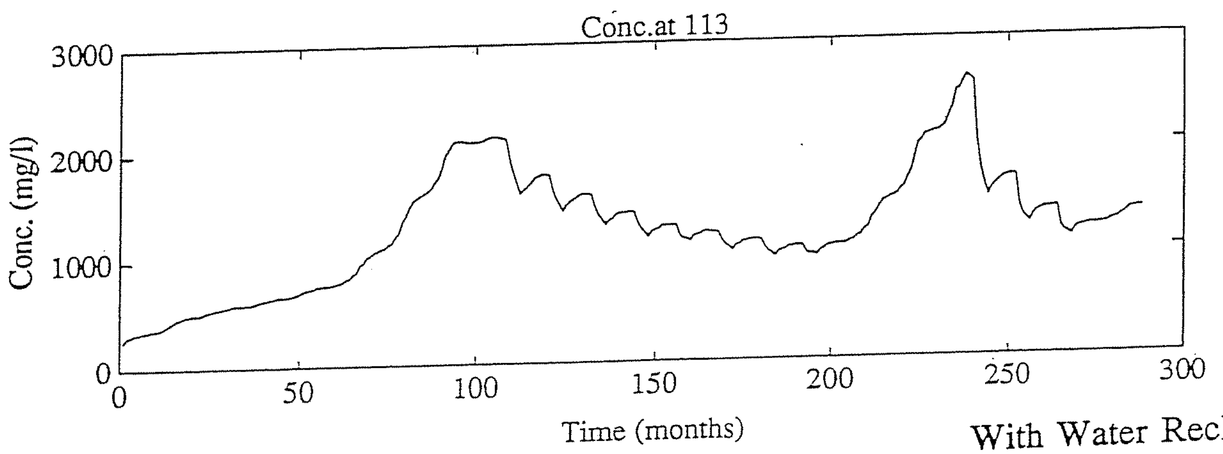


With Water Reclamation
Plus SJBA Phase I Project





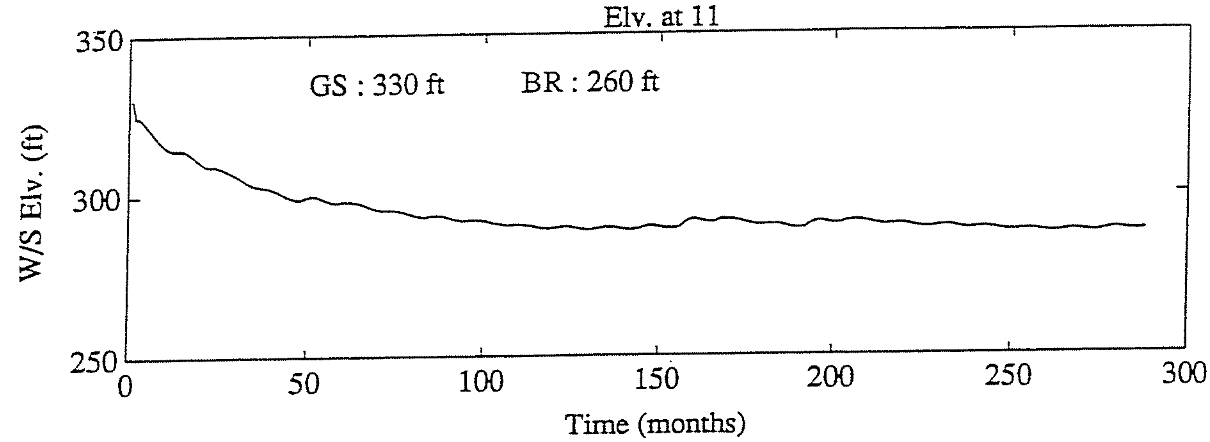


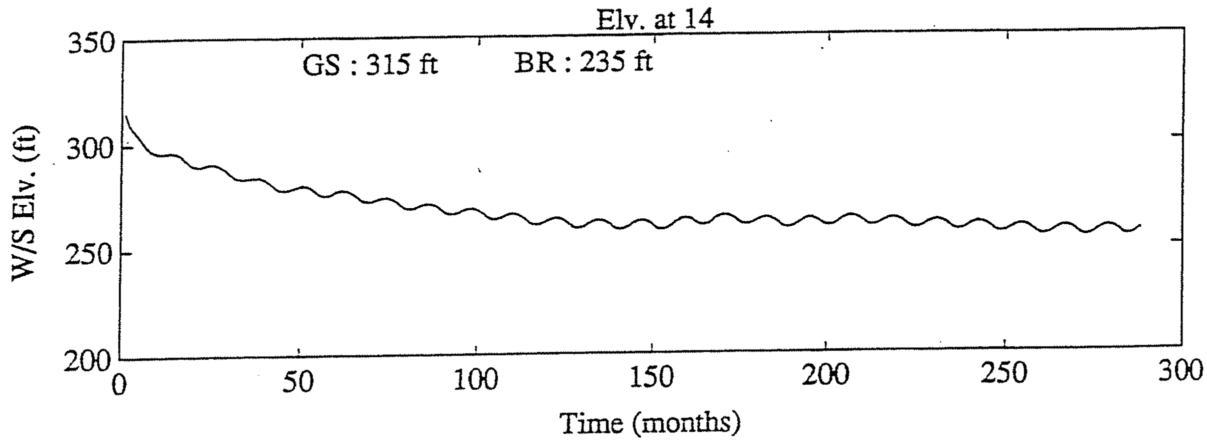


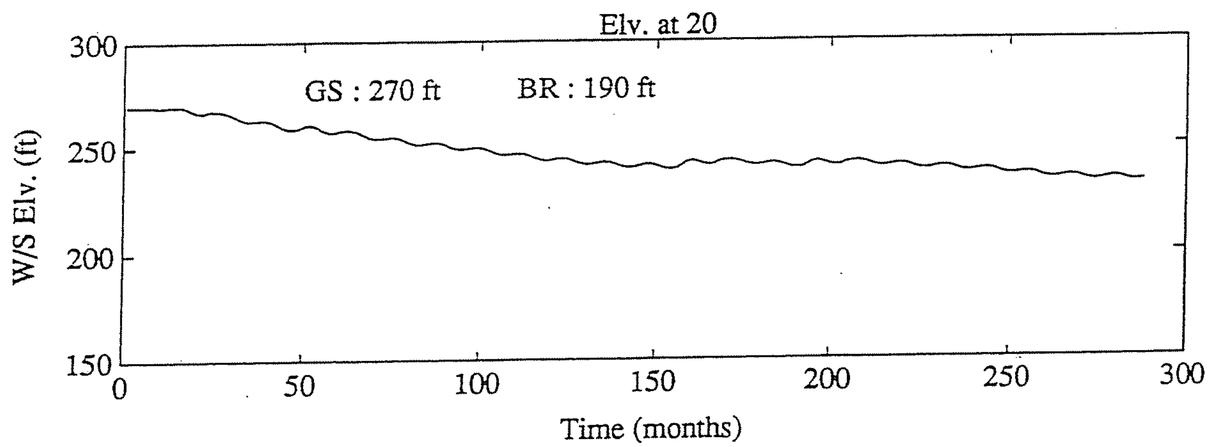
With Water Reclamation
Plus SJBA Phase I Project

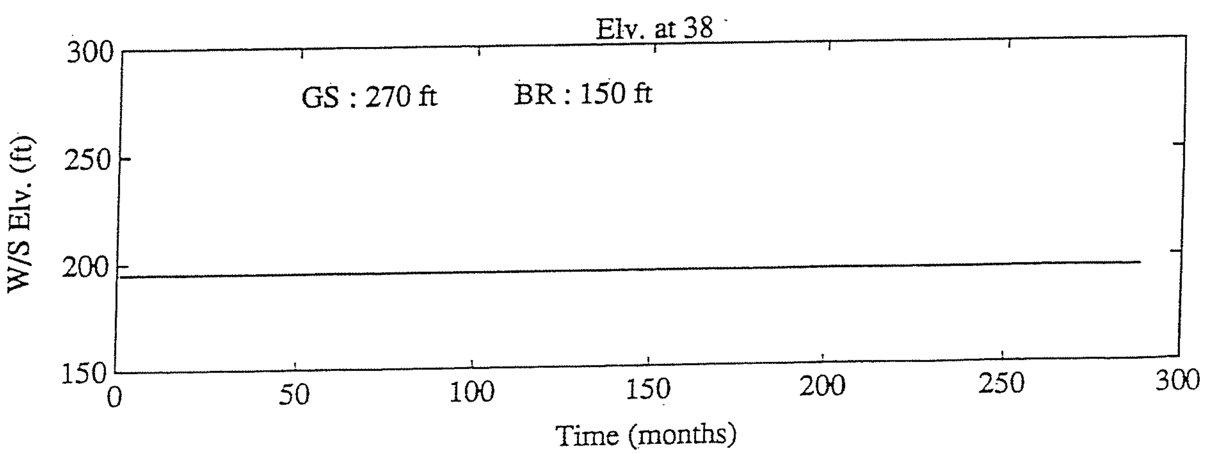
PHASE II OPERATION
SIMULATED WATER LEVELS
AT SELECTED NODES

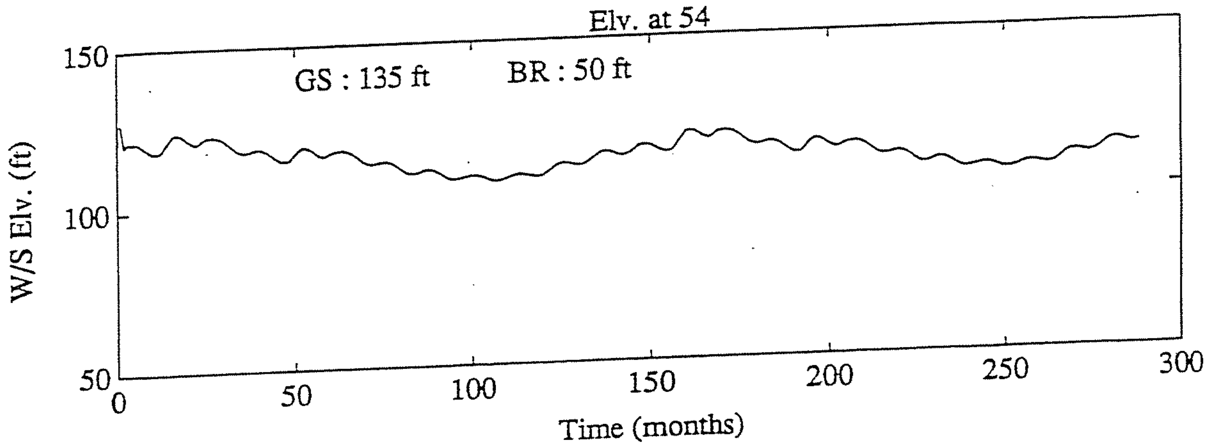
See Figure 3-1 for node locations

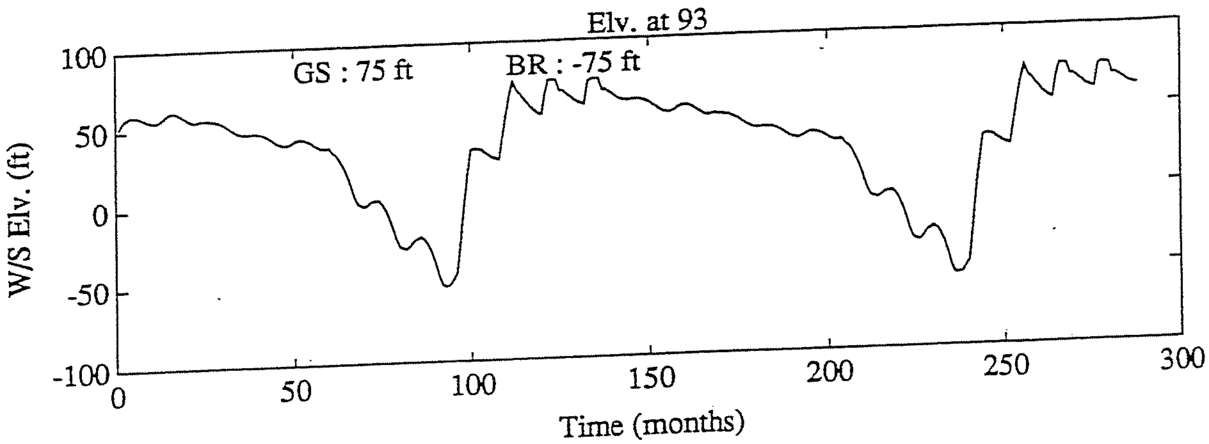

Elv. at 11
GS : 330 ft
BR : 260 ft
W/S Elv. (ft)
350
300
250
0
50
100
150
200
250
300
Time (months)

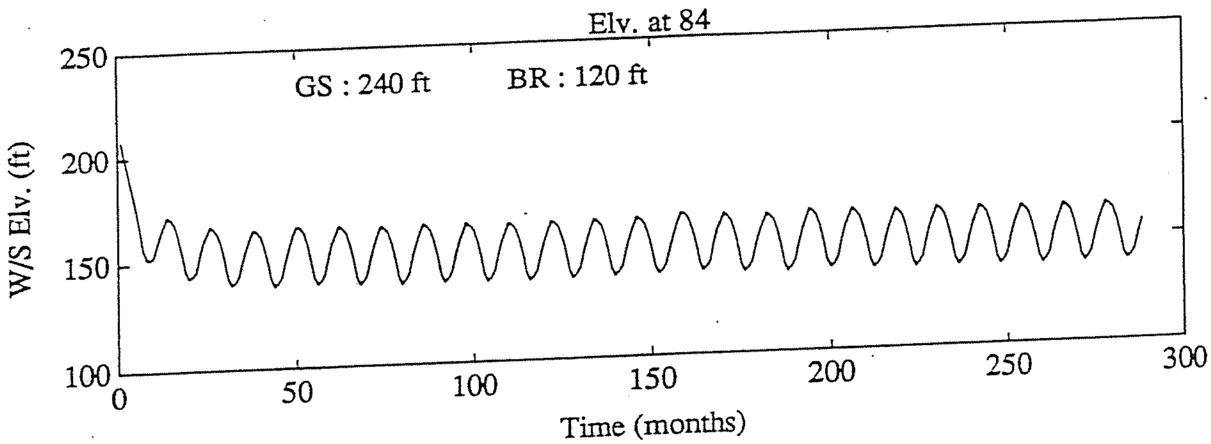

Elv. at 14
GS : 315 ft
BR : 235 ft
W/S Elv. (ft)
350
300
250
200
0
50
100
150
200
250
300
Time (months)

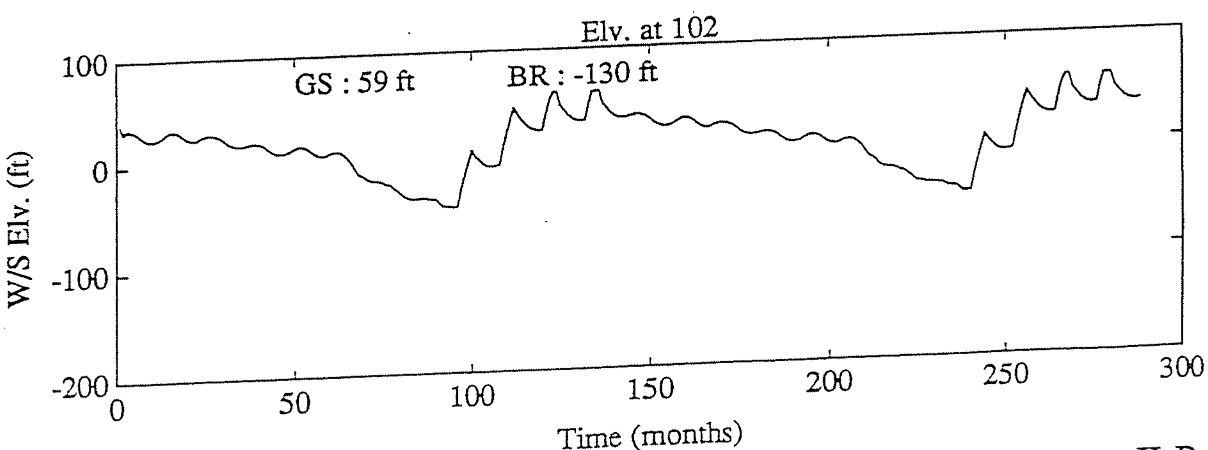

Elv. at 20
GS : 270 ft
BR : 190 ft
W/S Elv. (ft)
300
250
200
150
0
50
100
150
200
250
300
Time (months)

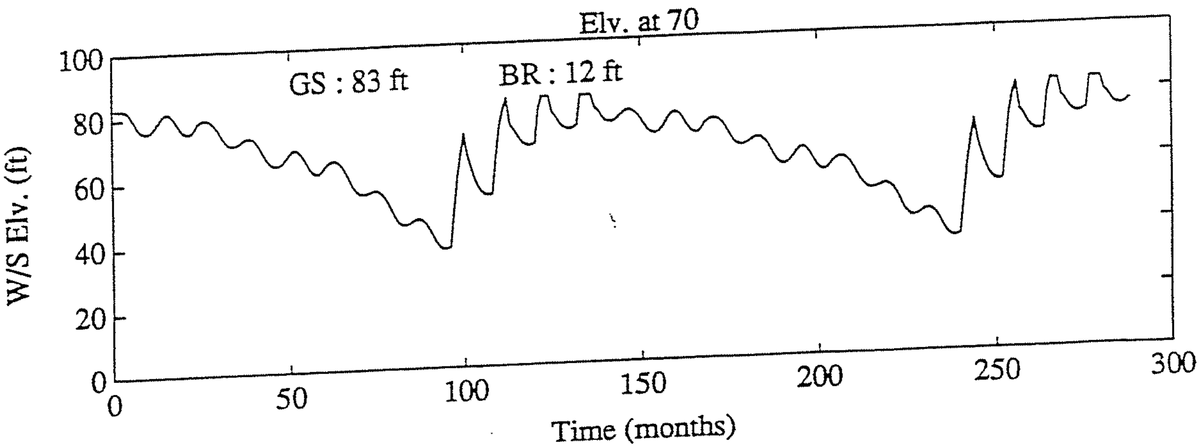

Elv. at 38
GS : 270 ft
BR : 150 ft
W/S Elv. (ft)
300
250
200
150
0
50
100
150
200
250
300
Time (months)


Elv. at 54
GS : 135 ft
BR : 50 ft
W/S Elv. (ft)
150
100
50
0
50
100
150
200
250
300
Time (months)

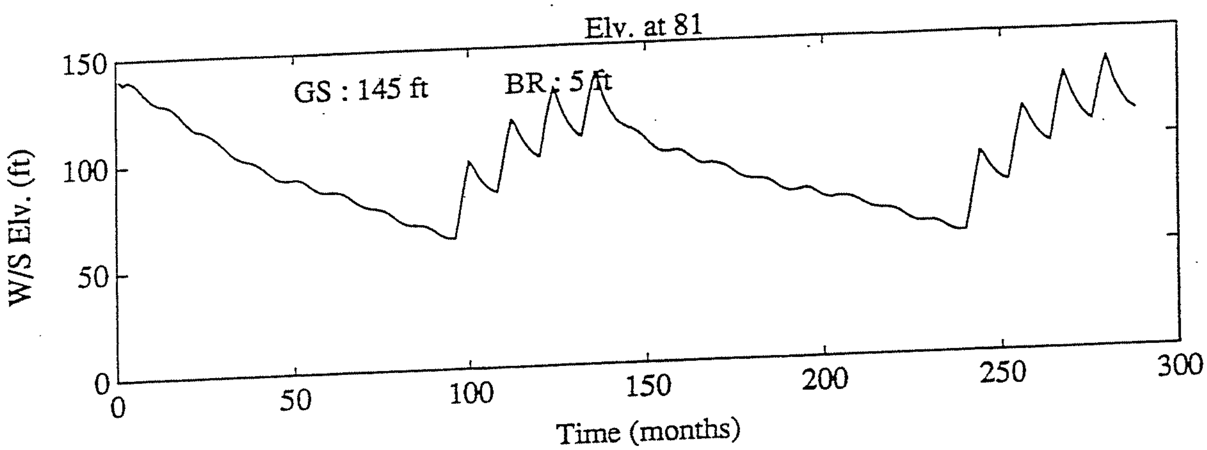

Elv. at 93
GS : 75 ft
BR : -75 ft
W/S Elv. (ft)
100
50
0
-50
-100
0
50
100
150
200
250
300
Time (months)


Elv. at 84
GS : 240 ft
BR : 120 ft
W/S Elv. (ft)
250
200
150
100
0
50
100
150
200
250
300
Time (months)

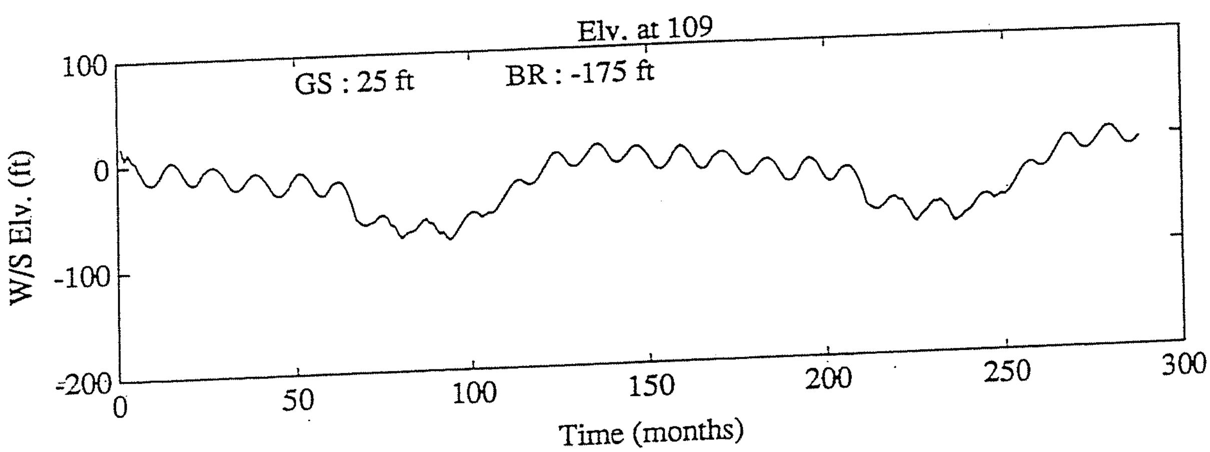

Elv. at 102
GS : 59 ft
BR : -130 ft
W/S Elv. (ft)
100
0
-100
-200
0
50
100
150
200
250
300
Time (months)



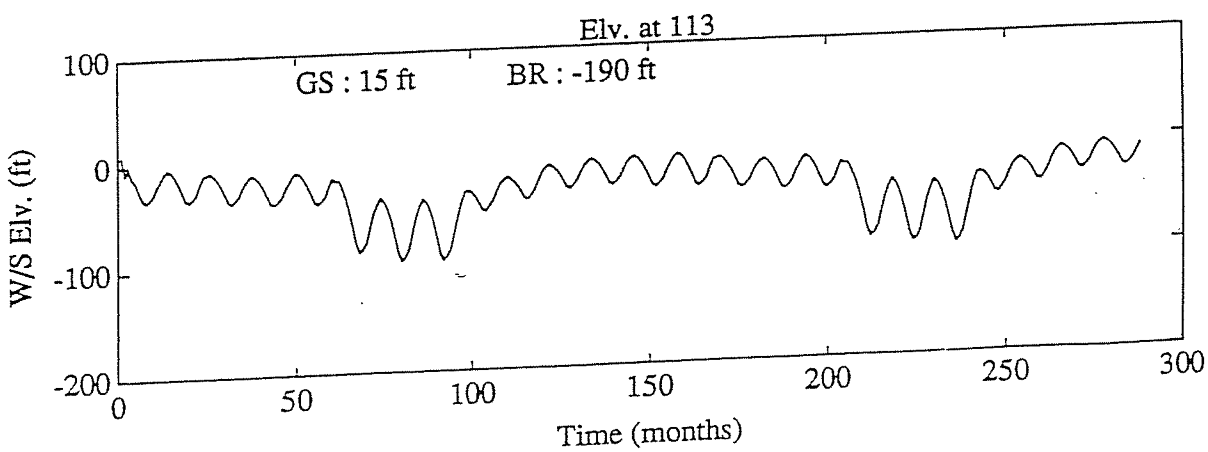
Elv. at 70
GS : 83 ft
BR : 12 ft
W/S Elv. (ft)
0
20
40
60
80
100
0
50
100
150
200
250
300
Time (months)



Elv. at 81
GS : 145 ft
BR : 5 ft
W/S Elv. (ft)
0
50
100
150
0
50
100
150
200
250
300
Time (months)



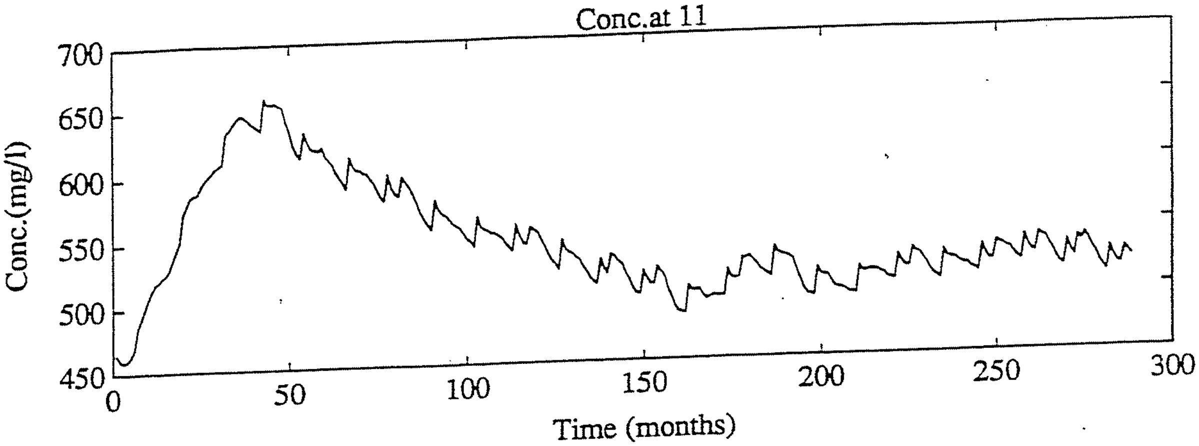
Elv. at 109
GS : 25 ft
BR : -175 ft
W/S Elv. (ft)
-200
-100
0
100
0
50
100
150
200
250
300
Time (months)

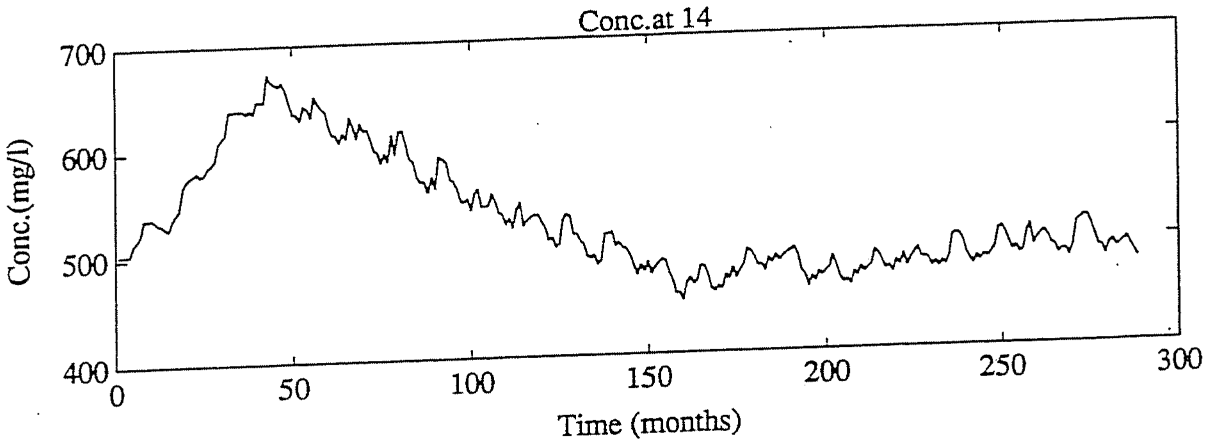


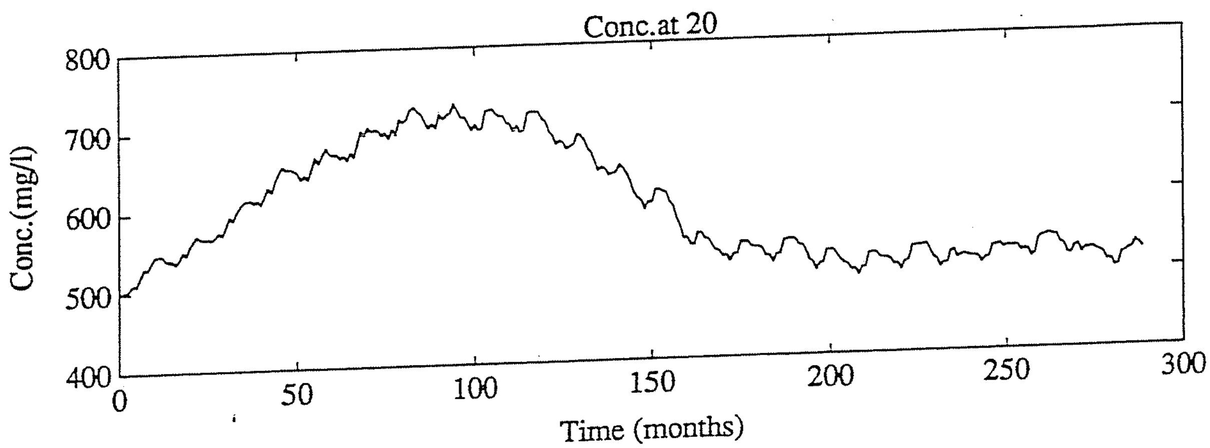
Elv. at 113
GS : 15 ft
BR : -190 ft
W/S Elv. (ft)
-200
-100
0
100
0
50
100
150
200
250
300
Time (months)

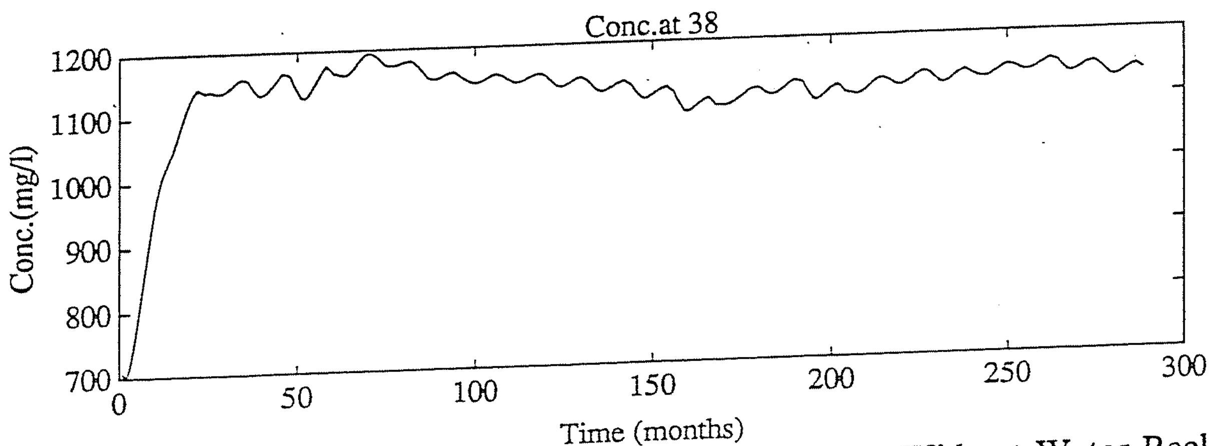
**PHASE II OPERATION
SIMULATED TDS CONCENTRATIONS
AT SELECTED NODES
WITHOUT RECLAMATION**

See Figure 3-1 for node locations

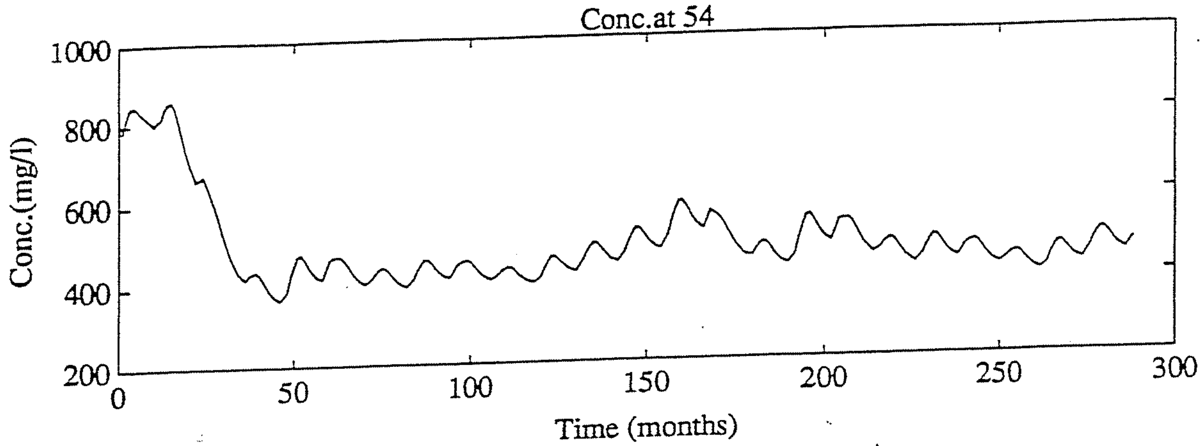


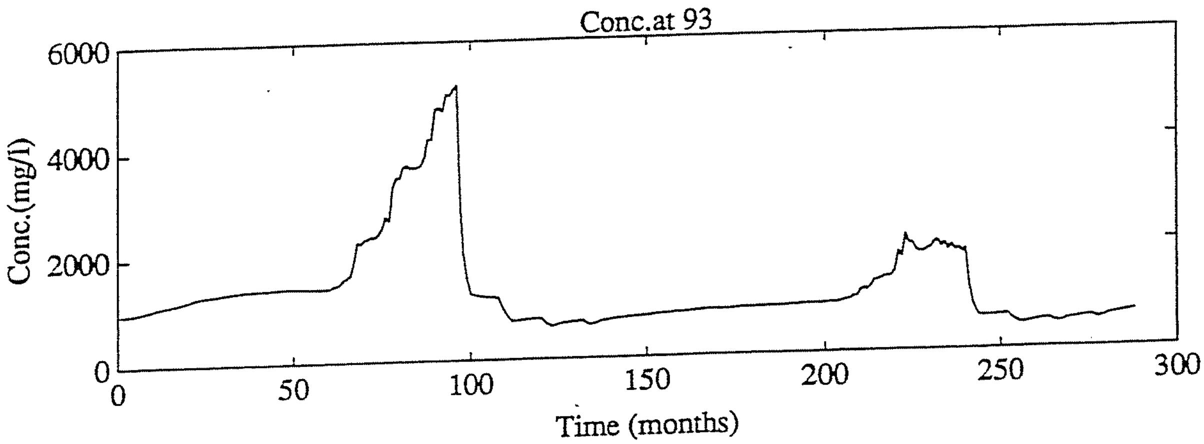


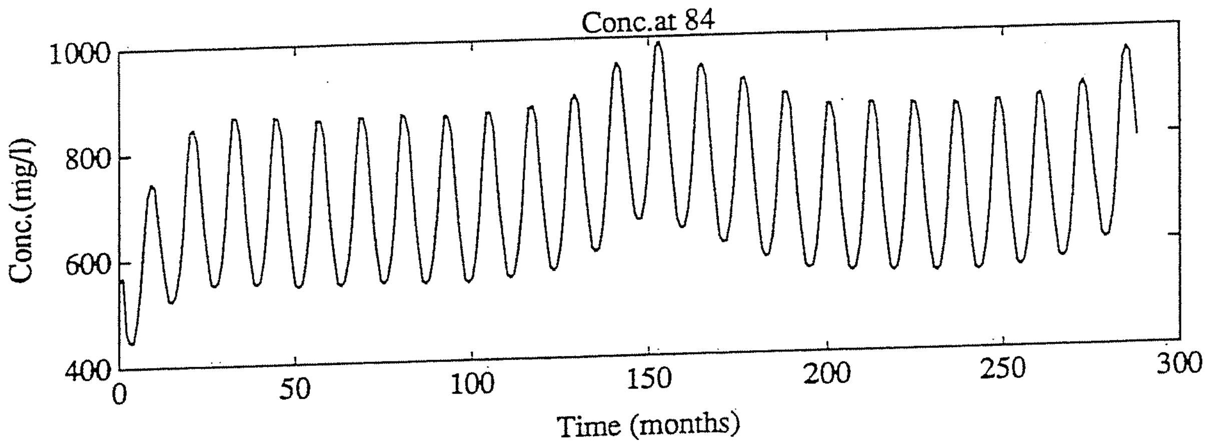


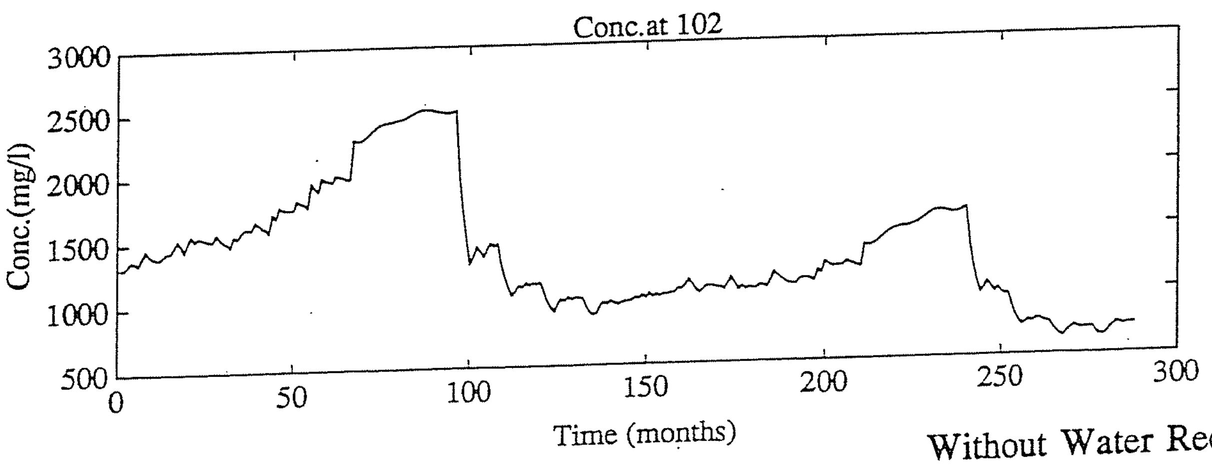


Without Water Reclamation

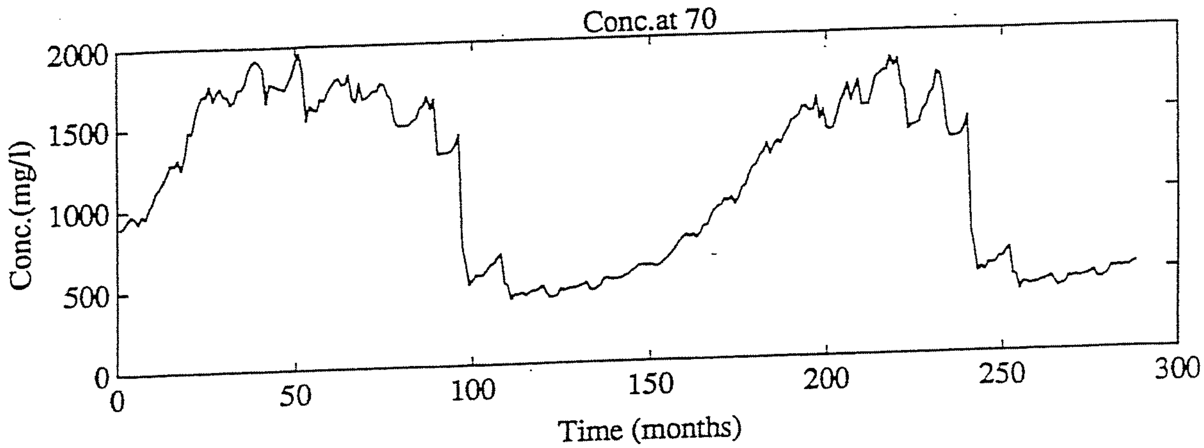


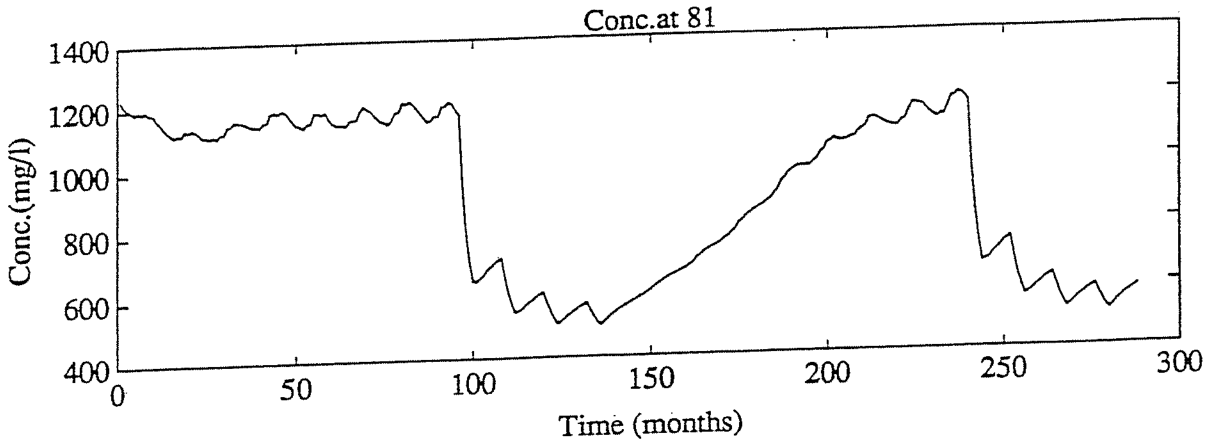


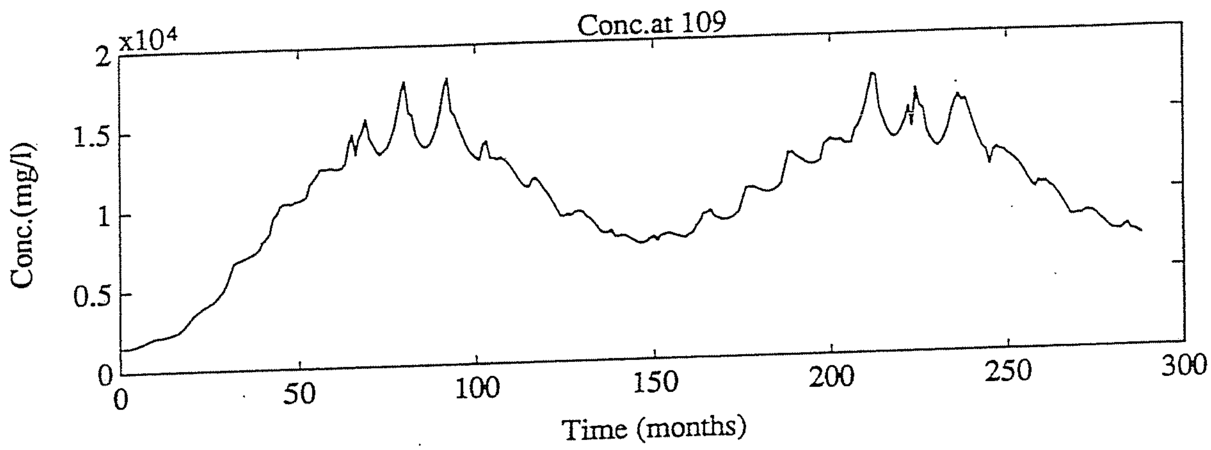


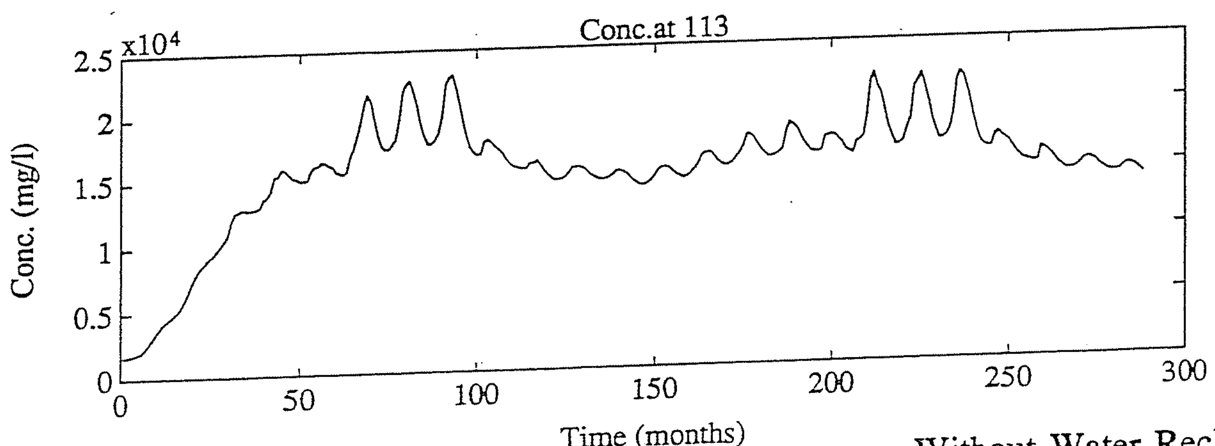


Without Water Reclamation
Plus SIRA Phase II Project





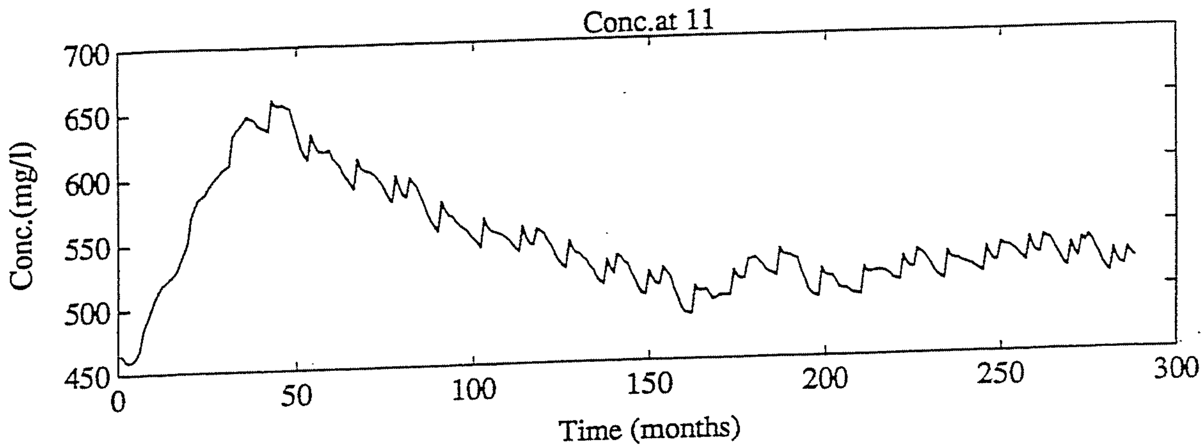


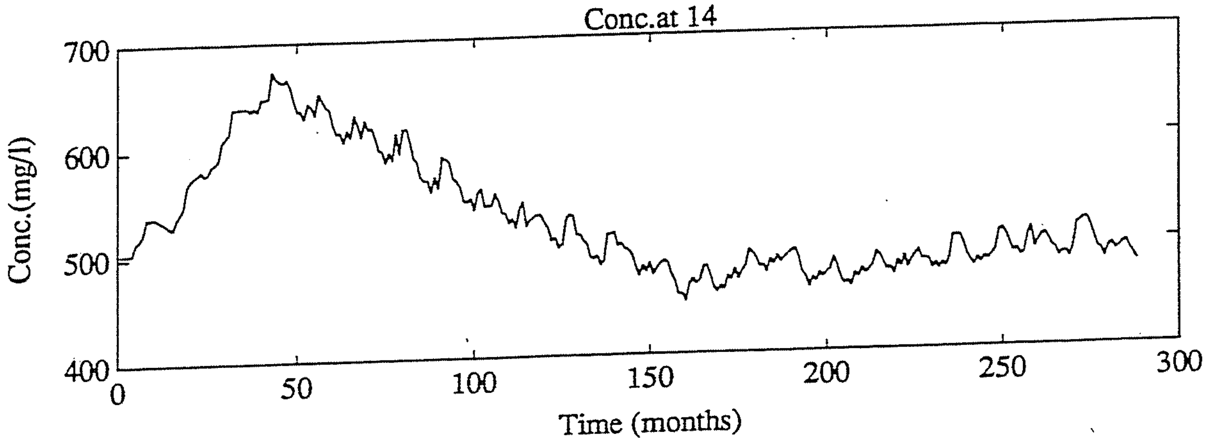


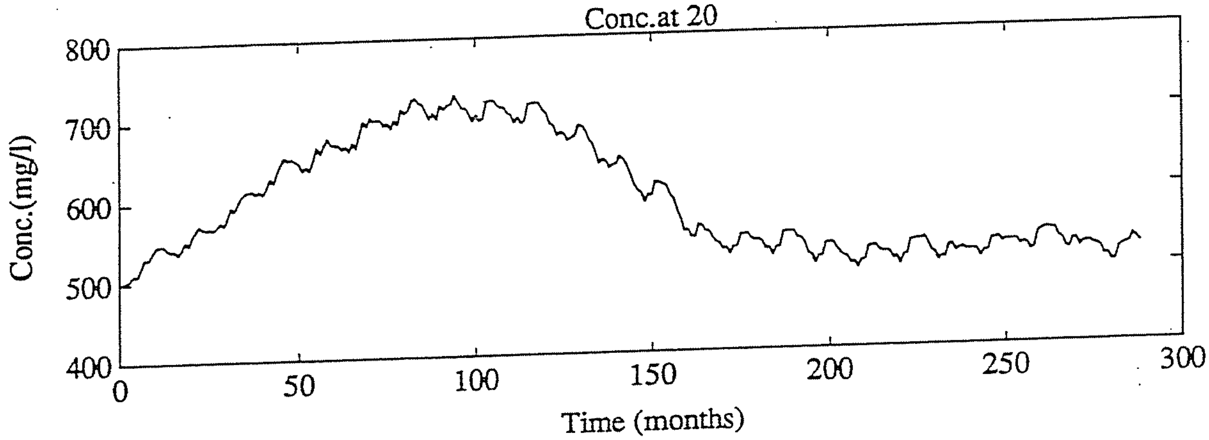
Without Water Reclamation
Plus SIRA Phase II Project

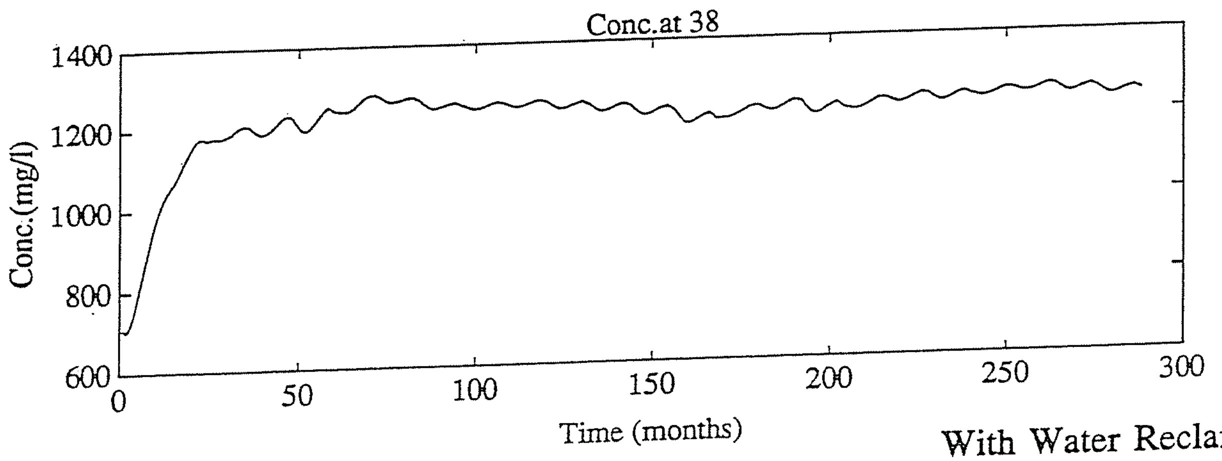
PHASE II OPERATION
SIMULATED TDS CONCENTRATIONS
AT SELECTED NODES
WITH RECLAMATION

See Figure 3-1 for node locations

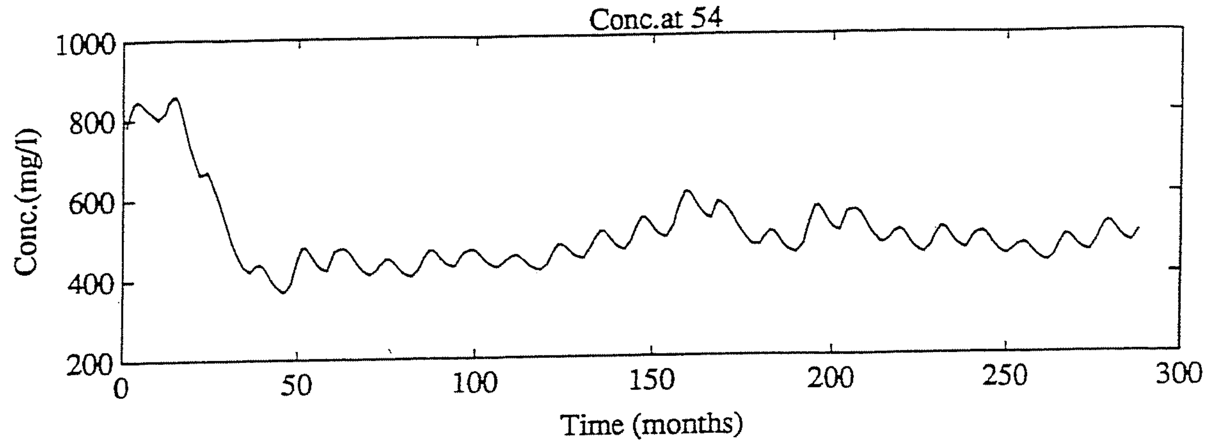


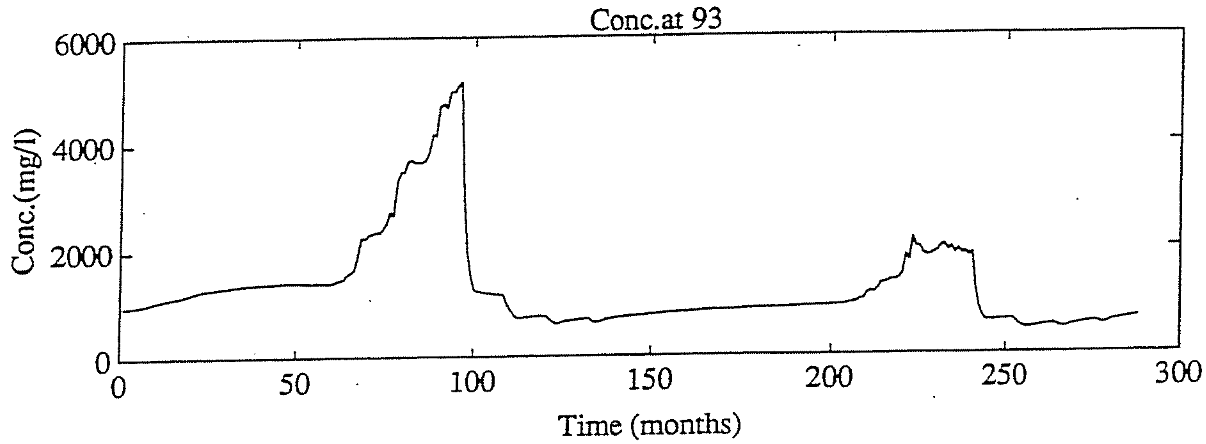


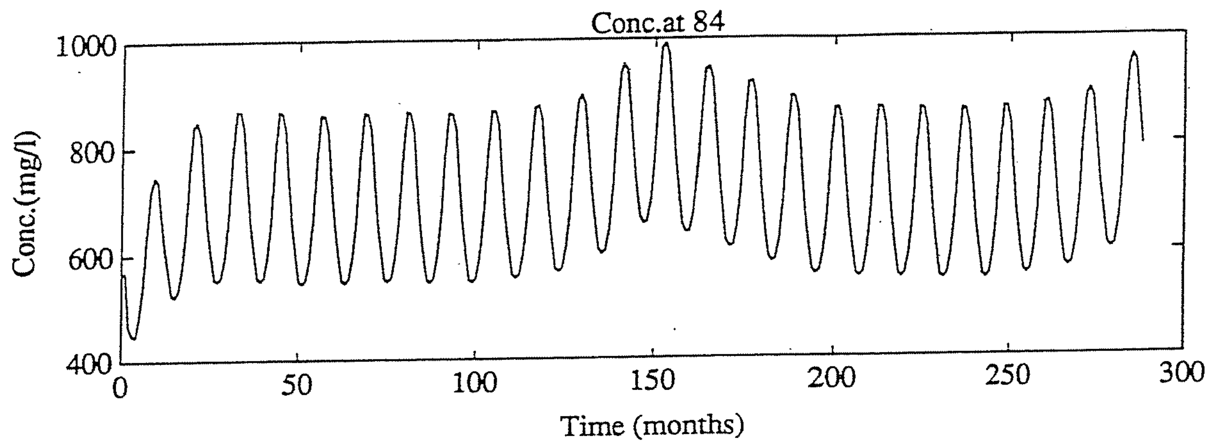


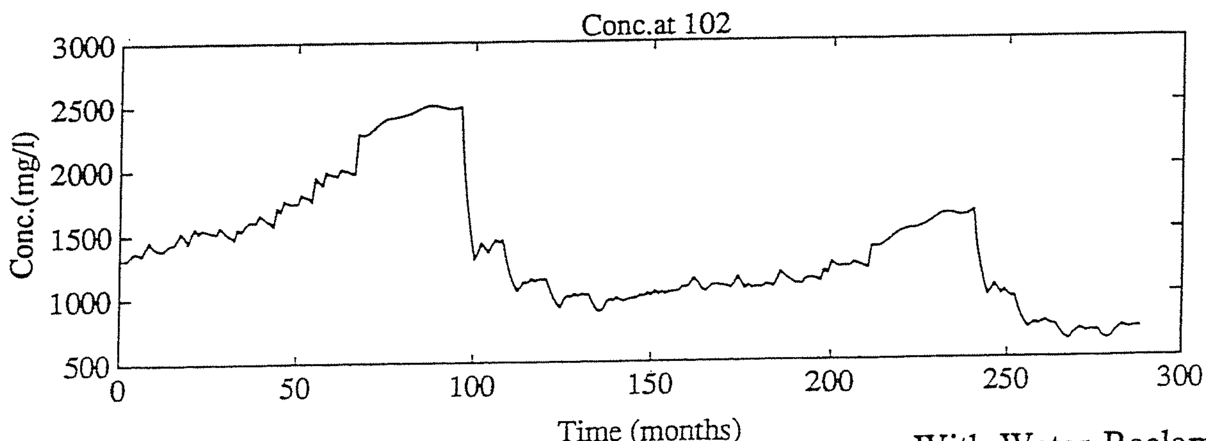


With Water Reclamation

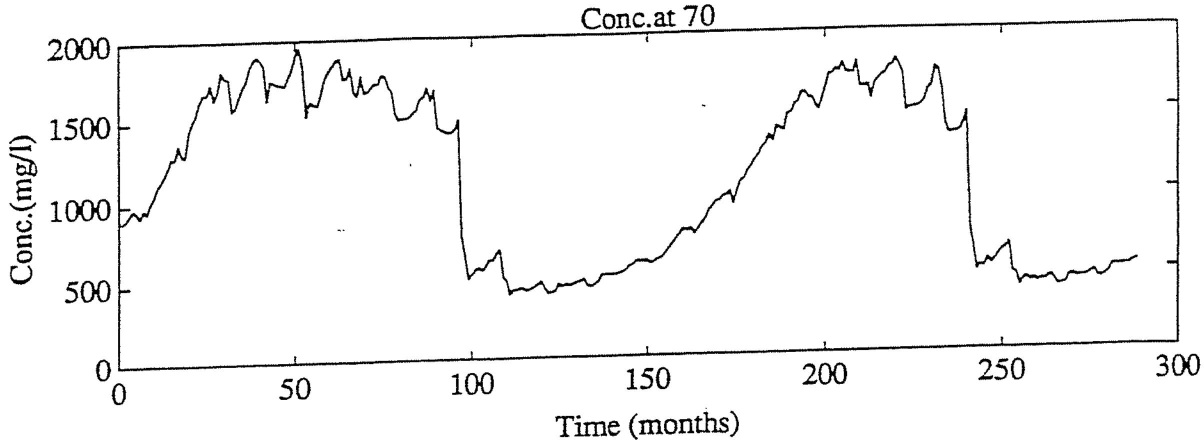


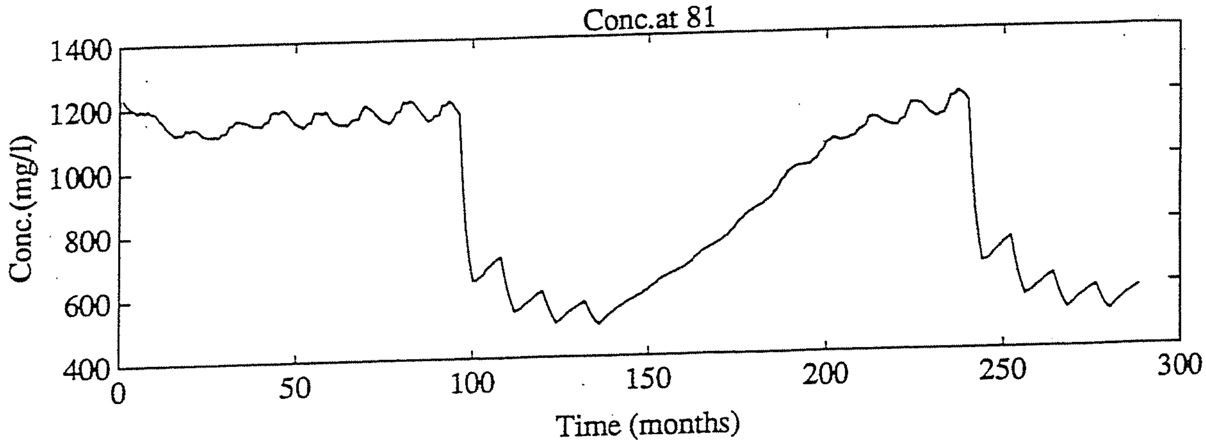


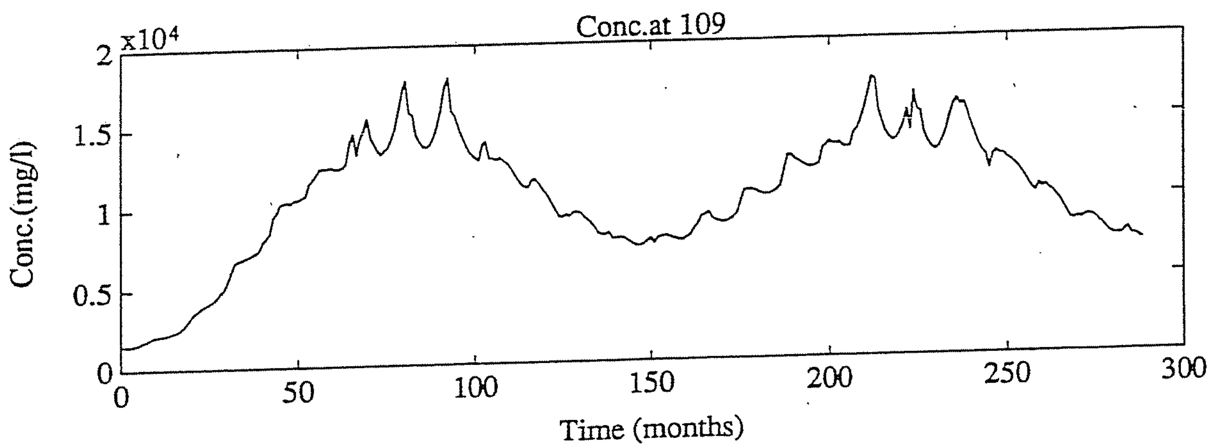


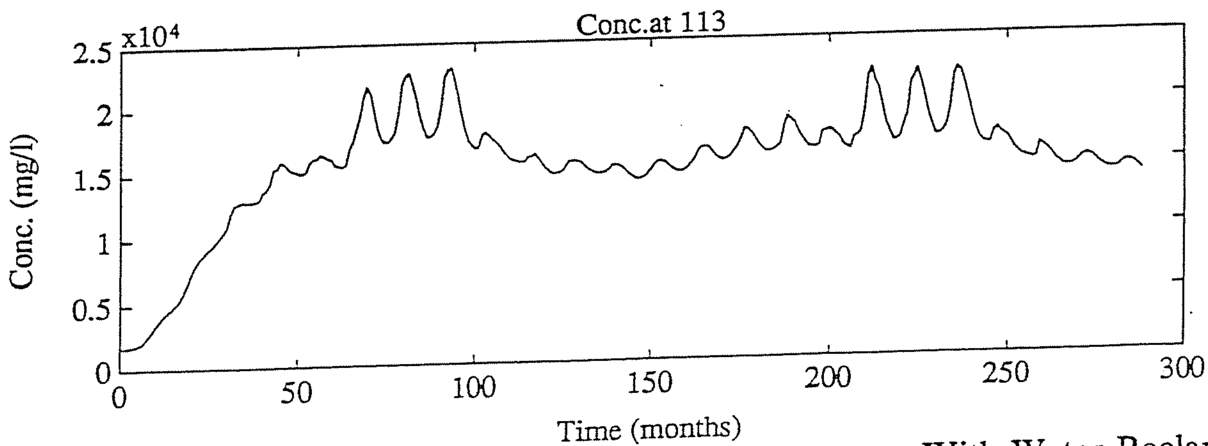


With Water Reclamation
Plus SIRA Phase II Project









With Water Reclamation

APPENDIX B

CONJUNCTIVE USE FACILITIES SITE EVALUATIONS

APPENDIX B

CONJUNCTIVE USE FACILITIES SITE EVALUATIONS

INTRODUCTION

The purpose of this section is to summarize the findings of the desalter facilities siting study within the San Juan Basin area. It involves a desalter plant siting in which five candidate sites are identified and selected for evaluation, wells siting which includes 17 potential sites and recharge basins siting which resulted in the selection of six potential sites.

These potential sites were identified based on visual inspection of the area. Review of the ownership records in the County Recorder's office indicated that some of the potential sites were listed as publicly owned, others owned by private parties. Land use, land ownership and parcel size for all the potential sites are documented and included at the end of this section. Each of the desalter sites identified is rated with reference to each of the criteria described in subsequent paragraphs. Those sites are shown in Figure B-1. The locations of San Juan Creek as well as the existing Chiquita land outfall are also depicted, Figure B-1.

A recommendation of the best alternative potential desalter site, as well as conceptual pipeline routing connecting the desalter plant with the proposed new wells, is also presented in this section and shown on Figure 5-1.

DESALTER SITES' LAND OWNERSHIP AND LAND USE

A summary of land ownership, land use and parcel size for the selected desalter sites is presented in Table B-1.

The ownership of the identified sites as well as the land use and zoning were verified based on data collected from the County of Orange and the City of San Juan Capistrano. Figures B-2 through B-6, as well as Tables B-3 through B-7, identify location and land ownership of the five selected desalter sites along with their adjacent parcels.

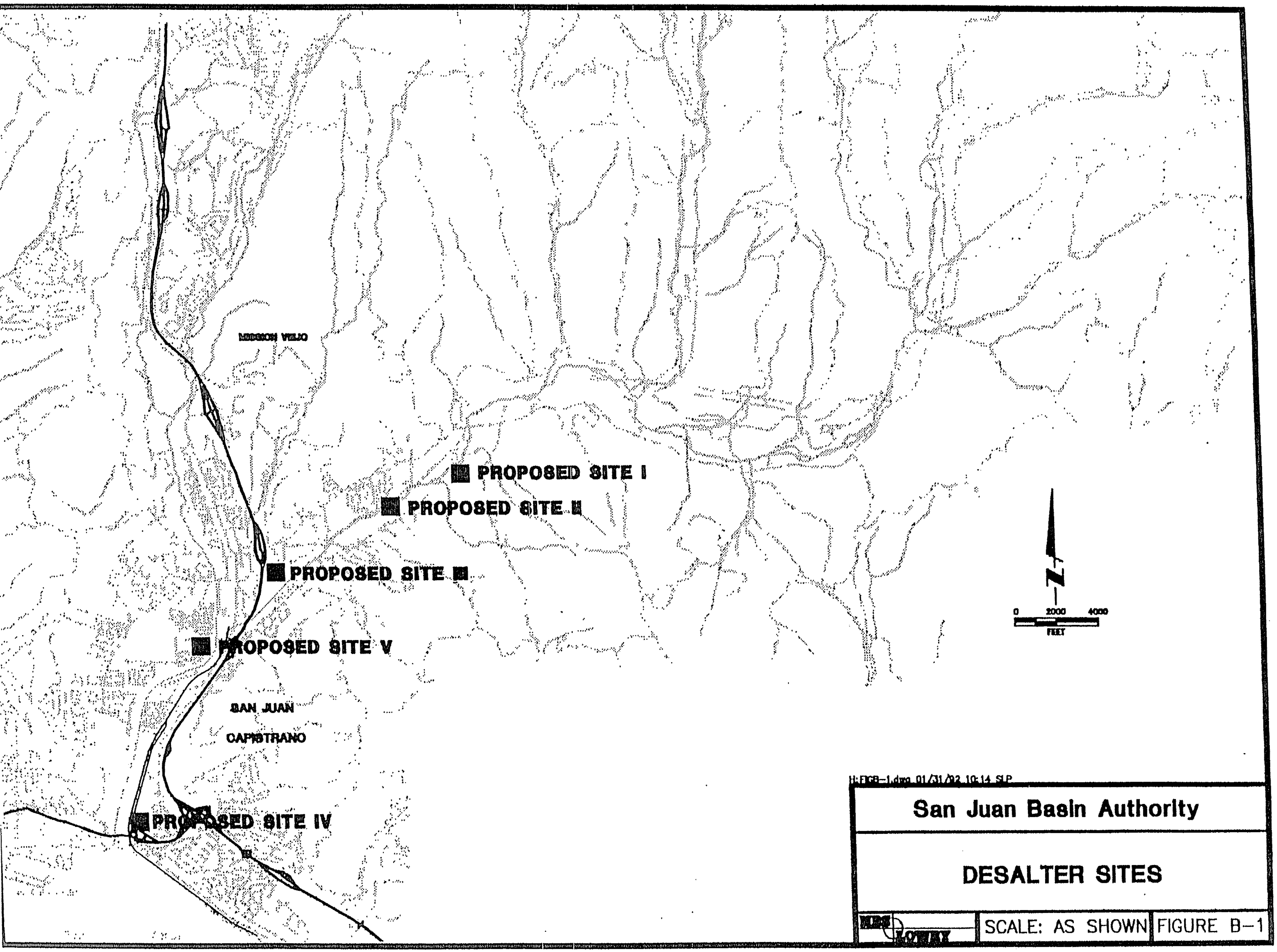

PROPOSED SITE I
PROPOSED SITE II
PROPOSED SITE III
PROPOSED SITE V
SAN JUAN
CAPISTRANO
PROPOSED SITE IV
N
0 2000 4000
FEET
H:FIGB-1.dwg 01/31/92 10:14 SLP
San Juan Basin Authority
DESALTER SITES
NBS LOWRY
SCALE: AS SHOWN
FIGURE B-1

TABLE B-1

POTENTIAL DESALTER SITES

Desalter Site No.	Parcel Size (acres)	Current Land Use	Current Ownership
I	118.58	Very Low Density/ Open Space 1 du/ac max.	Santa Margarita Co. % Viejo Management Co. P.O. Box 9 San Juan Capistrano, CA 92693
II	6.367	General Open Space	Creekside Equestrian Ltd. 27252 Cable Arroyo San Juan Capistrano, CA 92675
III	10.826	Industrial Park	Real Estate Holdings, Inc. Newco. Mgmt. Co. 6320 Canoga Ave., Ste. 1430 Woodland Hills, CA 91367
IV	4.14	Industrial	Capistrano Beach Sanitary Dist. P. O. Box 2008 Capistrano Beach, CA 92624
V	1.49	Mobile Home Park 8 du's/ac. max.	CVWD P. O. Box 967 San Juan Capistrano, CA 92675
	7.40	Spec. Study Area R. V. Storage	Forster, Thomas A TR P. O. Box 146 San Juan Capistrano, CA 92692

DESALTER SITING CRITERIA

Sites were identified and chosen to satisfy a siting criteria for best desalter site location.

The basis for identifying potential desalter sites was established and summarized as follows:

- Pipeline Constraints: Refers to a site being close to a point of connection to deliver desalted product water into the potable water distribution system.

- Land Availability: Refers to a site being located on a parcel or parcels of land that are large enough to handle the facility (approximately 2 acres). Also refers to the potential ease to deal with a land owner to acquire the land for the facility.

- Flood Constraints: Refers to the site being located in or out of a flood plain as shown on Federal Emergency Management Association (FEMA) maps.

- Brine Disposal: Refers to the ease of construction of a pipeline to dispose of brine into the nearest viable land outfall pipeline (costs, land right-of-way considered).

- Public Impact: Refers to how a facility is located to lessen the effect on the public with respect to noise, traffic and visual considerations.

- Minimize Sitework: Refers to how a site rates with respect to the need to develop the finished grades for the facility (minimizing cut and fill).

- Site Accessibility: Refers to how readily accessible the site is to public roads, thereby minimizing costs to develop access roads and/or improvements to the facility.

- Power and Sewer Availability: Refers to how a site rates with respect to the ability to bring power and to hook up sewer to a desalter facility (costs and constructibility considered).

- Proximity to Well Field: Refers to how a site is located with respect to well field to allow the desalter system as a whole take advantage of elevations to reduce pumping costs.

- Institutional Constraints: Refers to how a site with a desalter facility will be impacted by regulatory agencies.

DESALTER SITE RATING

The selected potential desalter sites are located in the City of San Juan Capistrano and in unincorporated areas of Orange County. Each site has been carefully examined. Sites were rated as "excellent", "good", "fair" or "poor" with regard to the siting criteria established earlier. Table B-7 identifies each site and its rating relative to the other sites. The site description, as well as distinguishing features that contribute to the selection and rating of the site, is summarized in subsequent sections.

Site I - La Pata

- o Site is located in a large parcel about 118 acres.

- o Site is privately owned. This could create a problem as far as land availability is concerned.

- o The site is located outside the flood plain shown on the FEMA maps.

- o Desalted product water can be distributed into CVWD upper zone system due to new pipelines to be constructed in the area.

- o Brine disposal can easily be realized due to close proximity to Chiquita Land outfall line that passes adjacent to the site.

- Site is located in area zoned for low residential, which currently has residential development to the west of the site. Visual and noise impacts will need to be mitigated.

- Site work is at a minimal level. Finished grade can easily be developed due to the flat nature of this particular site.

- The site can be accessed by extending San Juan Creek Road. An Edison easement would be crossed with this extension of the road.

- Power is obtainable from SDG&E.

- Site is located at an elevation that contributes to the reduction in costs of pumping. This is due to the fact that product water can be distributed into district water system (upper zone) through future pipelines.

- On the negative side, raw water from the field wells has to be pumped up through a long raw water supply pipeline to the desalter plant site at a higher elevation, thus increasing pumpage cost.

- The site is located outside the City limit and within the County; this minimizes the institutional and regulatory constraints.

Site II - Camino Lacouague

- Site is located adjacent to a residential development area along San Juan Creek Road. It is zoned for general open space. To the south of this site is a proposed public park. To obtain the land for this type of facility would be difficult from a regulatory viewpoint.

- The site is within a 1- to 3-foot flood plain zone.

- Desalted product water can be distributed into the CVWD upper zone system.

- Site location is ideal for brine disposal since the land outfall passes in San Juan Creek Road adjacent to the site.

- Public impact is not favorable since it is located in a residential area as well as adjacent to a public park. Noise and visual impacts would require mitigation.

- Site work will require floodproofing, possibly raising finished grades due to the site being within a FEMA flood area.

- Site is readily accessible since it lies immediately north of San Juan Creek Road.

- Power can be brought to this site by SDG&E. Sewer mains exist within San Juan Creek Road.

- Raw water from field wells has to be pumped through a long pipeline to this site.

- o This site is located within the City near residential and park land. Also the land is zoned open space. Approvals from regulatory agencies would be difficult to obtain.

Site III - Paseo Tirador

- o Site is located adjacent to Interstate 5, Ortega Highway and San Juan Creek Road. Zoned as industrial, this site is an ideal location for a desalter facility.
- o Land availability could be an issue since more than one parcel would have to be purchased to handle the facility (about 2 acres). More than one owner would be included in the property acquisition.
- o Another site alternative, a 10.8-acre adjacent parcel zoned as industrial, would have to be subdivided into two parcels, one of which is to be used as a site. This is better since negotiations would only be with one owner.
- o Site is located in a 1- to 3-foot flood plain according to the FEMA maps. Floodproofing is required.
- o Product water can be distributed into the lower zone of the CVWD system.
- o Brine disposal can be achieved by the construction of a 1,000-foot pipeline across San Juan Creek and the connection to Chiquita land outfall in San Juan Creek Road. Creek crossings are difficult to get approved for construction from a regulatory point of view.
- o Public impact is minimal since this site is zoned industrial and is adjacent to the freeway. Noise and visual impacts would require less mitigation.
- o Site area is close to the San Juan Creek bed as well as a large storm drain outlet. Fill for finished grades would need to be elevated as floodproofing for a facility.
- o Site can be accessed by using Paseo Tirador Street.
- o Power can be made available by SDG&E. Sewer mains exists within close proximity to the site.
- o Site is in close proximity to the well fields. Reduction in cost of raw water pumpage is achieved due to lower elevations, and reduced piping.
- o Constraints related to institutional and regulatory agencies are low.

Site IV - CBSD

- o Site is zoned industrial and owned by Capistrano Beach Sanitary District. It can be located within an area of land that has 30 acres available. It is adjacent to the SERRA Wastewater Treatment Plant.
- o Site is located in a flood plain. Site would require floodproofing.

- o Distribution of desalted product water into the CVWD system is not favorably achieved due to the point of connection being owned by Tri-Cities Municipal Water District. Water paper trades could get complicated.

- o Brine disposal is ideal at this site location since it is very close to the SERRA ocean outfall.

- o Since this parcel along with the adjacent parcels is zoned industrial, as well as the closeness to the Serra plant and San Juan Creek Channel, public impact is at the low level. Noise and visual impacts would require less mitigation.

- o Sitework will require floodproofing, possibly raising finished grades by filling.

- o Site is not readily accessible to public roads; therefore access road improvement is required.

- o Power can be obtained from SDG&E.

- o Site is located in the lower San Juan Basin area, a far distance south of the well fields. Reduction in cost of raw water pumpage is achieved because of the lower elevation of the site relative to the well field elevations.

- o More piping is required due to the long raw water pipeline which will be constructed from the well fields to the site.

- o Institutional as well as regulatory constraints are minimal since positive feedback from General Manager of CBSD was obtained regarding the construction of a desalter plant in that location.

Site V - Forster

- o Site includes a small parcel about 1.49 acres adjacent to San Juan Creek flood control channel, owned by CVWD; remaining portion of site is owned by Thomas Forster.

- o Site is zoned as a Mobile Home Park and R.V. storage area.

- o Site is located within a 1-foot flood plain zone according to FEMA maps. Floodproofing is required.

- o Desalted product water can be distributed into CVWD lower zone system. Site is adjacent to 12-inch water pipeline.

- o Brine disposal can be achieved by the construction of an approximately 300-foot pipeline across San Juan Creek and the connection to Chiquita Land Outfall in San Juan Creek Road.

- o Site is located adjacent to residential area (density 8 DU's/AC); therefore public impact is high. Noise as well as visual impacts would require appropriate mitigation.

- o Site work will require floodproofing, possibly raising finished grades.

- o Site can be accessed by using a dirt road off Alipaz Street. Road improvement is required.
- o Power is obtainable from SDG&E. Sewer mains are adjacent to the site.
- o Site is located at a short distance from the well fields. Cost of raw water pumpage as well as piping is minimal.
- o Constraints related to institutional and regulatory agencies are low.

DISCUSSION AND DESALTER SITE RECOMMENDATION

Five potential desalter sites were identified to meet the siting criteria established earlier. These sites were rated and evaluated earlier in this section based on their environmental, economic and feasibility aspects. Using the rating criteria for each location, the five sites, shown on Table B-2, have an overall rating as follows:

La Pata - Site 1 - Fair
Camino Lacouague - Site II - Fair
Paseo Tirador - Site III - Good
CBSD - Site IV - Fair
Forster - Site V - Good

It is recommended that the desalter plant be located on Site III or V. These two sites will require further investigation to identify their overall suitability for construction of the desalter plant. The owners of Site V have expressed interest in negotiating with the SJBA. It is recommended that negotiations commence as soon as possible. Figure B-2 illustrates conceptually the desalter plant at this site as well as approximate acreage requirements.

WELLS AND PIPELINES

New potential well sites are identified based on their proximity to the center of the basin, land use, availability of the site parcel and accessibility. Wells are spaced to account for an anticipated maximum radius of influence of about 1,500 feet for each well. Table B-8 presents land ownership, land use and size for the well sites.

A well collection system will be constructed to convey well water to the desalter. A conceptual well water collection system is shown on Figure 5-1. The collection pipelines are proposed to be constructed in existing roads.

Potential recharge basins are identified and chosen based on land use, location and availability, Figure 5-1. Table B-9 presents land ownership, land use and site size for the recharge basin sites. Hydrogeological studies will need to be completed before the feasibility of using the proposed recharge site can be determined.

TABLE B-2
SAN JUAN BASIN
DESALTER SITE RATING

Site	Site No.	Pipeline Constraints	Land Availability	Flood Constraints	Brine Disposal	Public Impact	Minimize Sitework	Site Accessability	Power Sewer Availability	Proximity To Well Field	Institutional Constraints	Total Rating
La Pata	I	4	2	4	4	3	4	2	3	1	3	30
Camino Lacoungue	II	3	1	2	4	2	3	4	3	2	1	25
Paseo Tirador	III	3	3	2	4	4	3	4	3	3	3	32
CBSD	IV	2	4	2	4	4	3	2	3	3	1	28
Forster	V	4	4	2	4	2	3	3	3	4	3	32

Notes:

E=Excellent highly recommended=4

G=Good recommended=3

F=fair acceptable=2

P=Poor not recommended=1

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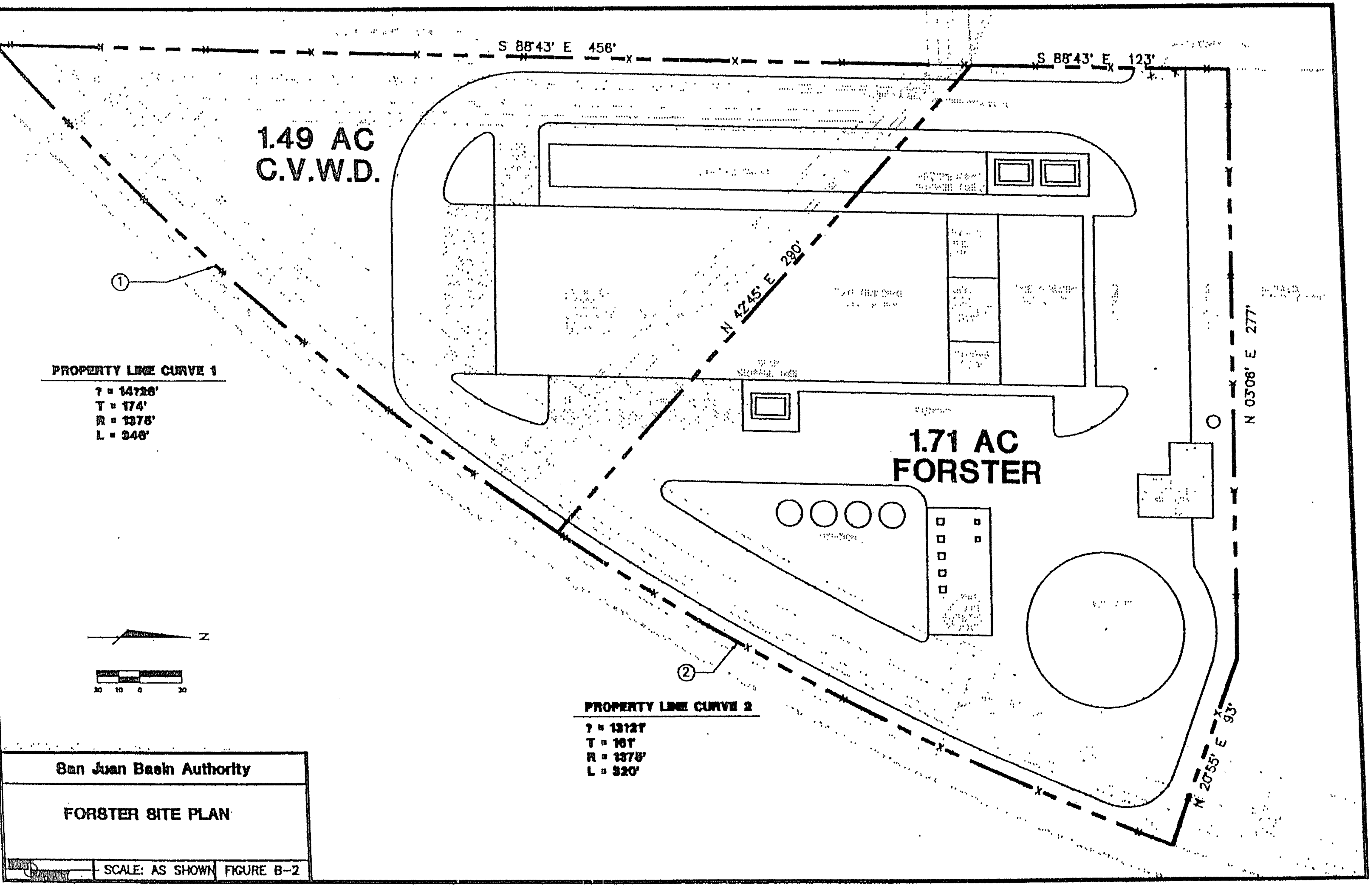
Date:12\15\91



S 88°43' E 456'
S 88°43' E 123'
1.49 AC
C.V.W.D.
N 42°45' E 290'
N 03°08' E 277'
1.71 AC
FORSTER
N 20°55' E 93'
PROPERTY LINE CURVE 1
T = 174'
R = 1375'
L = 346'
PROPERTY LINE CURVE 2
T = 161'
R = 1375'
L = 320'
N
San Juan Basin Authority
FORSTER SITE PLAN
SCALE: AS SHOWN
FIGURE B-2

Brine Disposal Pipeline

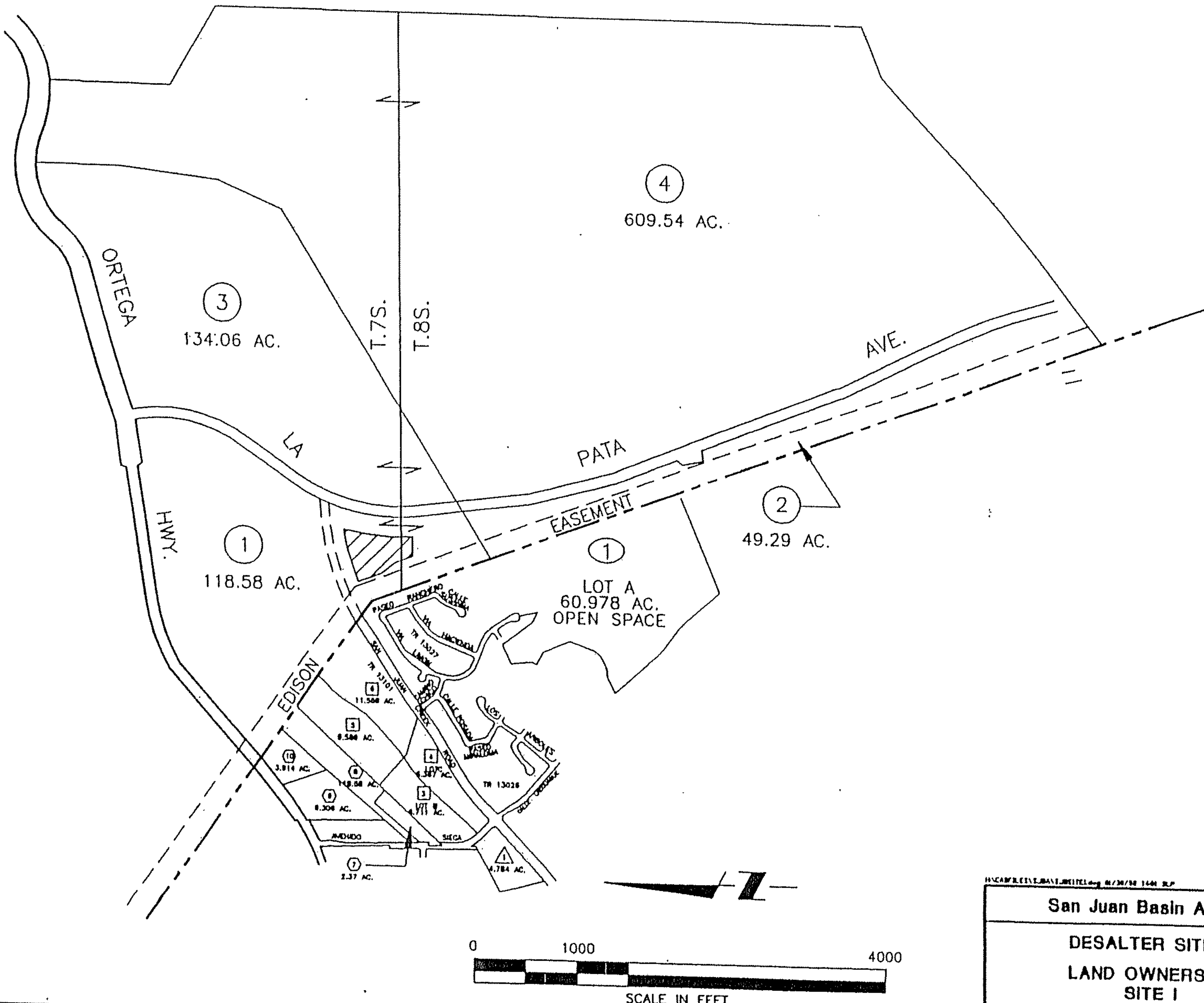
Reclamation of the saline groundwater will produce a brine waste stream. A brine disposal pipeline will transport waste flows from the desalter site to the existing Chiquita land outfall pipeline, adjacent to San Juan Creek.

Product Water Pipeline

The product water pipeline will be constructed having the capacity to carry the maximum capacity of the desalter. The best proposed route for this pipeline is through San Juan Creek Road running parallel to the existing Chiquita Wastewater Treatment Plant land outfall. It will be connected to the upper zone of the Capistrano Valley Water District water system at a PRV location adjacent to La Pata and Ortega Highway and ultimately connected to the South County Pipeline at Chiquita Canyon.

LAND USE

LAND OWNERSHIP



LEGEND

SITE I

PARCEL NO.	BOOK	PAGE
2	125	172
1	664	041
3	664	172
4	664	181
5	664	111

San Juan Basin Authority

DESALTER SITING

LAND OWNERSHIP
SITE I

SCALE: AS SHOWN | FIGURE B-3

TABLE B-3
LAND OWNERSHIP
SAN JUAN BASIN
R/O SITING
SITE #1 AND ADJACENT PARCELS

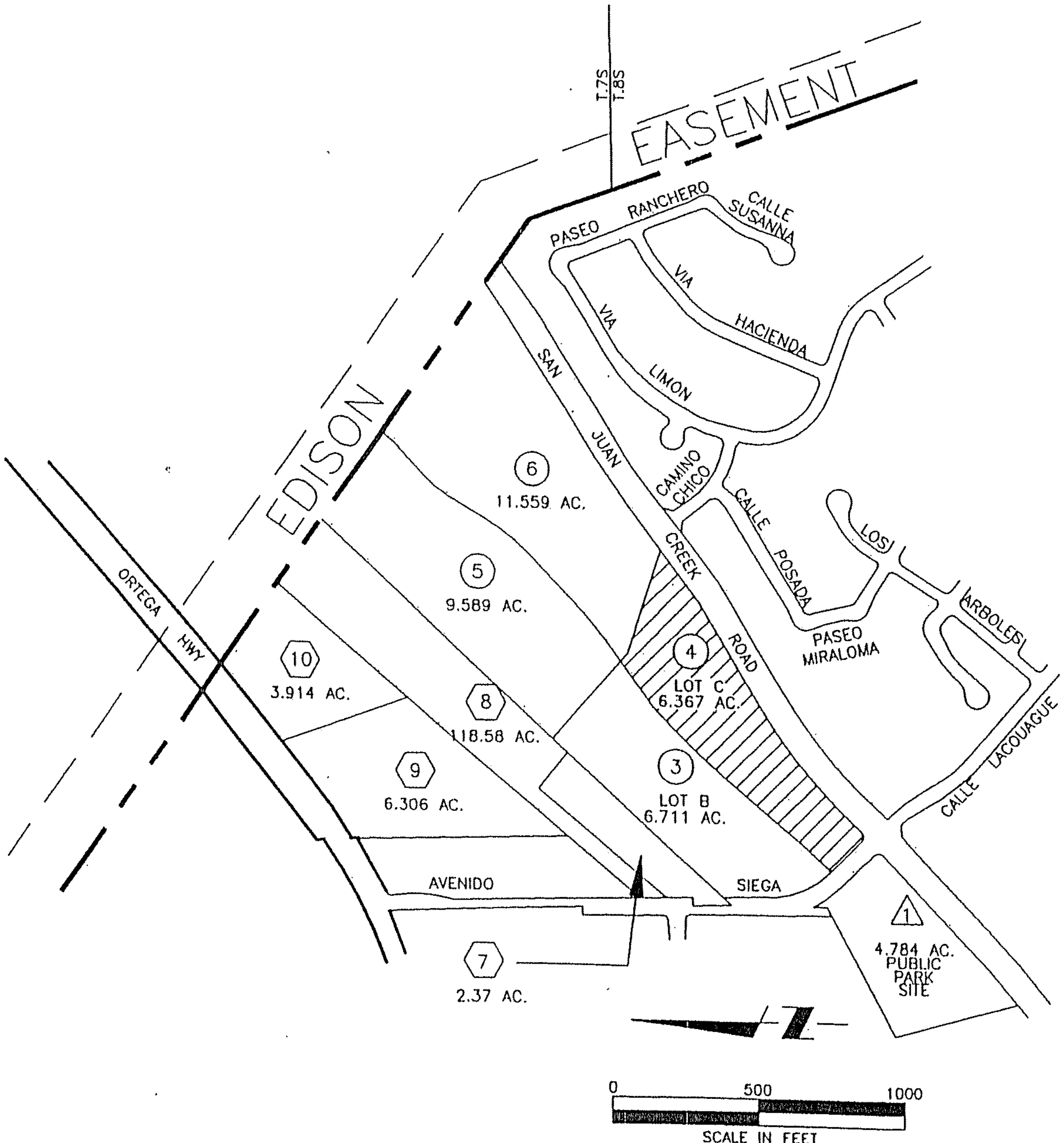
ASSESSOR'S PARCEL NO.	MAP PARCEL NO	AREA (acres)	LAND USE	OWNER AND ADDRESS
125-172-01 SITE 1	01	118.58	VERY LOW DENSITY 1 DU'S/AC MAX. OPEN SPACE	SANTA MARGARITA COMPANY VIEJO MANAGEMENT CO P O BOX 9 SAN JUAN CAPISTRANO, CA. 92693 RECDR DOC # 83/000462887
125-172-03	03	134.06	VERY LOW DENSITY 1 DU'S/AC MAX.	SANTA MARGARITA COMPANY VIEJO MANAGEMENT CO P O BOX 9 SAN JUAN CAPISTRANO CA. 92693 RECDR DOC # 83/000462887
125-172-04	04	609.54	VERY LOW DENSITY 1 DU'S/AC MAX. GENERAL OPEN SPACE	SAN JUAN PARTNERSHIP # 4 VIEJO MANAGEMENT CO P O BOX 9 SAN JUAN CAPISTRANO, CA 92693 RECDR DOC # 014343/00607
125-172-02	02	49.29	VERY LOW DENSITY 1 DU'S/AC MAX.	SAN JUAN PARTNERSHIP # 4 VIEJO MANAGEMENT CO P O BOX 9 SAN JUAN CAPISTRANO, CA 92693 RECDR DOC # 014343/00607
664-172-01	01 LOT A	60.978	VERY LOW DENSITY 1 DU'S/AC MAX.	CITY OF SAN JUAN CAPISTRANO 32400 PASEO ADELANTO SAN JUAN CAPISTRANO,CA 92675
664-111-03	03 LOT B	6.711	GENERAL OPEN SPACE SAN JUAN CREEK	CITY OF SAN JUAN CAPISTRANO ATTN CITY ATTY 32400 PASEO ADELANTO
664-111-04	04 LOT C	6.367	GENERAL OPEN SPACE	SAN JUAN CAPISTRANO, CA 92675 RECDR DOC # 88/445030 CREEKSIDE EQUESTRIAN LTD 27252 CALLE ARROYO SAN JUAN CAPISTRANO,CA 92675 RECDR DOC # 87/000664846
664-111-05	05	9.589	GENERAL OPEN SPACE SAN JUAN CREEK	CITY OF SAN-JUAN CAPISTRANO ATTN CITY ATTY 32400 PASEO ADELANTO SAN JUAN CAPISTRANO, CA 92675 RECDR DOC # 88/445030
664-111-06	06	11.559	GENERAL OPEN SPACE	CREEKSIDE EQUESTRIAN LTD 27252 CALLE ARROYO SAN JUAN CAPISTRANO,CA 92675 RECDR DOC # 87/000664846
664-041-08	08	7.64	GENERAL OPEN SPACE	ANDERSON, KERRI JO TR 610 NEWPORT CENTER DR STE 690 NEWPORT BEACH, CA 92660 RECDR DOC # 89/307661

TABLE B-3
(CONTINUED)
LAND OWNERSHIP
SAN JUAN BASIN
R/O SITING
SITE #1 AND ADJACENT PARCELS

ASSESSOR'S PARCEL NO.	MAP PARCEL NO	AREA (acres)	LAND USE	OWNER AND ADDRESS
664-041-09	09	6.306	MEDIUM-LOW 3.5 DU'S/AC MAX	CLARKE, ATHALIE R TR 61 BELCOURT RD NORTH NEWPORT BEACH, CA 92660 RECDR DOC # 86/000427856
664-041-10	10	3.914	MEDIUM-LOW 3.5 DU'S/AC MAX	ANDERSON, KERRI JO TR SUITE 690 610 NEWPORT CENTER DR NEWPORT BEACH, CA 92660 RECDR DOC # 89/307660

SITE I

View from La Pata Avenue towards the West



LEGEND

SITE II

PARCEL NO.	BOOK	PAGE
2 (circle)	664	111
1 (hexagon)	664	041
4 (triangle)	664	181

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San Juan Basin Authority

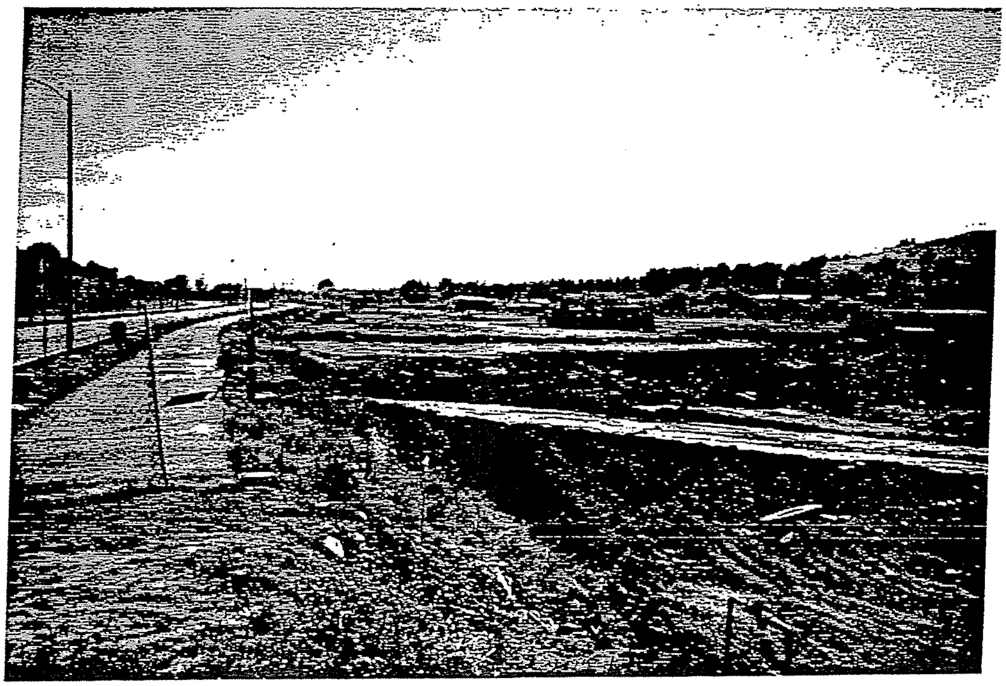
DESALTER SITING

LAND OWNERSHIP SITE II

HEI LOWRY | SCALE: AS SHOWN | FIGURE B-4

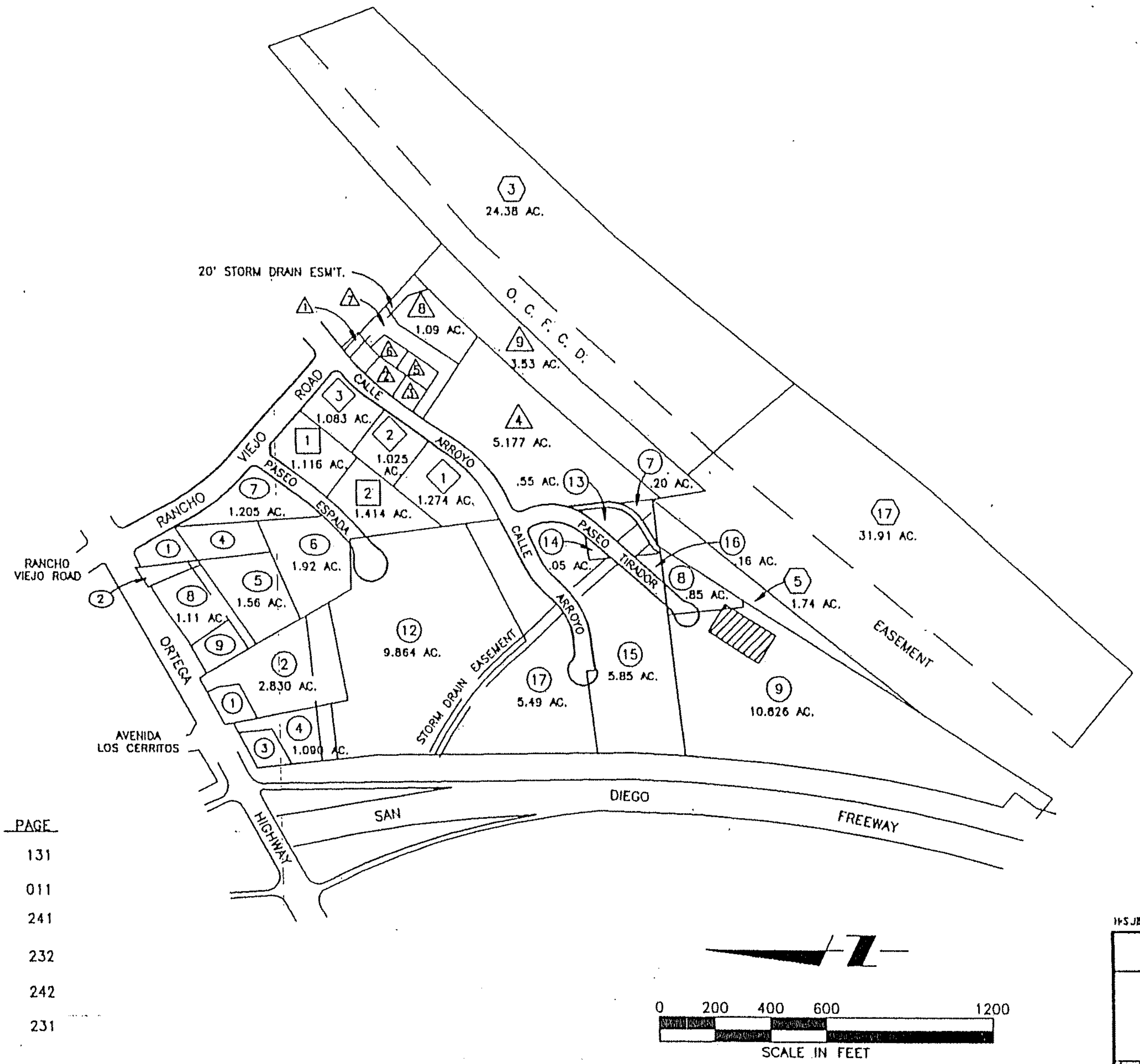
TABLE B-4
LAND OWNERSHIP
SAN JUAN BASIN
R/O SITING
SITE #2 AND ADJACENT PARCELS

ASSESSSOR'S PARCEL NO.	MAP PARCEL NO.	AREA (acres)	LAND USE	OWNER AND ADDRESS
664-111-06	06	11.559	GENERAL OPEN SPACE	CREEKSIDE EQUESTRIAN LTD 27252 CALLE ARROYO SAN JUAN CAPISTRANO, CA 92675 RECDR DOC # 87/000664846
664-111-05	05	9.589	GENERAL OPEN SPACE	CITY OF SAN JUAN CAPISTRANO ATTN CITY ATTY 32400 PASEO ADELANTO SAN JUAN CAPISTRANO, CA 92675 RECDR DOC # 88/445030
664-111-04 SITE 2	04	6.367	GENERAL OPEN SPACE	CREEKSIDE EQUESTRIAN LTD 27252 CALLE ARROYO SAN JUAN CAPISTRANO, CA 92675 RECDR DOC # 87/000664846
664-111-03	03	6.711	GENERAL OPEN SPACE SAN JUAN CREEK	CITY OF SAN JUAN CAPISTRANO ATTN CITY ATTY 32400 PASEO ADELANTO SAN JUAN CAPISTRANO, CA 92675 RECDR DOC # 88/445030
664-181-01	01	4.784	OPEN SPACE PUBLIC PARK SITE	CITY OF SAN JUAN CAPISTRANO 32400 PASEO ADELANTO SAN JUAN CAPISTRANO, CA 92675
664-041-07	07	2.37	GENERAL OPEN SPACE	ANDERSON DERRI JO IR MICHAEL, J CHRISTIANSON 610 NEWPORT CENTER DR STE 690 NEWPORT BEACH, CA 92660 RECDR DOC # 89/307662
664-041-08	08	7.64	GENERAL OPEN SPACE	ANDERSON DERRI JO IR 610 NEWPORT CENTER DR STE 690 NEWPORT BEACH, CA 92660 RECDR DOC # 89/307661
664-041-09	09	6.306	MEDIUM-LOW 3.5 DU'S/AC MAX	CLARKE, ATHALIE R TR 61 BELCOURT RD NORTH NEWPORT BEACH, CA 92660 RECDR DOC # 86/000427856
664-041-10	10	3.914	MEDIUM-LOW 3.5 DU'S/AC MAX	ANDERSON DERRI JO IR 610 NEWPORT CENTER DR STE 690 NEWPORT BEACH, CA 92660 RECDR DOC # 89/307660



SITE II

Future equestrian center - View towards the Southwest - San Juan Creek Road shown on left



LEGEND

SITE III

PARCEL NO.	BOOK	PAGE
2	666	131
1	666	011
3	666	241
4	666	232
7	666	242
6	666	231

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San Juan Basin Authority

DESALTER SITING

LAND OWNERSHIP SITE III

HDR LOWRY | SCALE: AS SHOWN | FIGURE B-5

TABLE B-5
LAND OWNERSHIP
SAN JUAN BASIN
R/O SITING
SITE #3 AND ADJACENT PARCELS

ASSESSOR'S PARCEL NO.	MAP PARCEL NO.	AREA (acres)	LAND USE	OWNER AND ADDRESS
666-131-12	12	9.864	INDUSTRIAL PARK	CAPISTRANO ENTERPRISES SELIGMAN, FRED 5100 E. LA PALMA #202 ANAHEIM, CA 92807 RECDR DOC # 87/000563252
666-131-15	15	5.85	INDUSTRIAL PARK	REAL ESTATE HOLDINGS INC NEWCO MGNT CO 6320 CANOGA AVE. STE 1430 WOODLAND HILLS, CA 91367 RECDR DOC # 89/227980
666-131-09 SITE 3	09	10.826	INDUSTRIAL PARK	REAL ESTATE HOLDINGS INC NEWCO MGNT CO 6320 CANOGA AVE. STE 1430 WOODLAND HILLS, CA 91367 RECDR DOC # 89/227980
666-131-08	08	0.85	INDUSTRIAL PARK	COUNTY OF ORANGE
666-131-16	16	0.17	INDUSTRIAL PARK	REAL ESTATE HOLDINGS INC NEWCO MGNT CO 6320 CANOGA AVE. STE 1430 WOODLAND HILLS, CA 91367 RECDR DOC # 89/227980
666-131-13	13	0.55	INDUSTRIAL PARK	CAPISTRANO ACRES MUTUAL WATER CO P O BOX 607 SAN JUAN CAPISTRANO, CA 92675
666-131-14	14	0.05	INDUSTRIAL PARK	CAPISTRANO ACRES MUTUAL WATER CO P O BOX 607 SAN JUAN CAPISTRANO, CA 92675
666-131-07	07	0.2	INDUSTRIAL PARK	CAPISTRANO ACRES MUTUAL WATER CO P O BOX 607 SAN JUAN CAPISTRANO, CA 92675

TABLE B-5
(CONTINUED)
LAND OWNERSHIP
SAN JUAN BASIN
R/O SITING
SITE #3 AND ADJACENT PARCELS

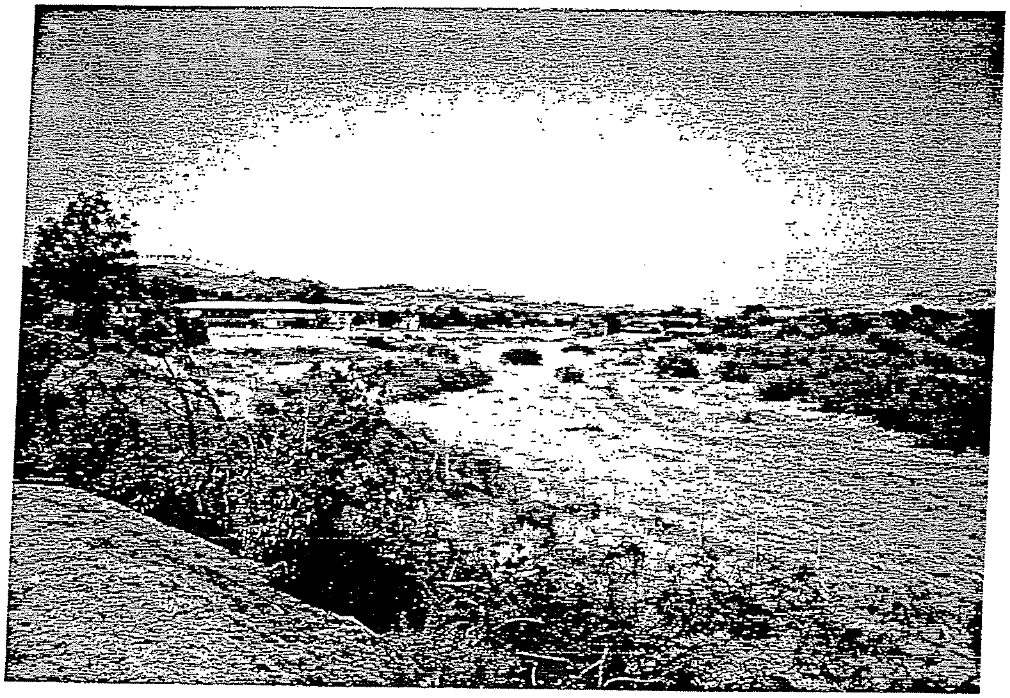
ASSESSOR'S PARCEL NO.	MAP PARCEL NO.	AREA (acres)	LAND USE	OWNER AND ADDRESS
666-232-04	04	5.177	GENERAL OPEN SPACE	REAL ESTATE HOLDINGS INC NEWCO MGNT CO 6320 CANOGA AVE. STE 1430 WOODLAND HILLS, CA 91367 RECDR DOC # 89/227980
666-232-09	09	3.53	GENERAL OPEN SPACE	CITY OF SAN JUAN CAPISTRANO 100 AVENIDA PRESIDIO SAN CLEMENTE, CA 92672
666-232-08	08	1.09	GENERAL OPEN SPACE	ORTEGA PROPERTIES 1 BROOKHOLLOW DR SANTA ANA, CA 92705
666-232-07	07		GENERAL OPEN SPACE	REAL ESTATE HOLDINGS INC NEWCO MGNT CO 6320 CANOGA AVE. STE 1430 WOODLAND HILLS, CA 91367 RECDR DOC # 89/227980
666-232-05	05		GENERAL OPEN SPACE	REAL ESTATE HOLDINGS INC NEWCO MGNT CO 6320 CANOGA AVE. STE 1430 WOODLAND HILLS, CA 91367 RECDR DOC # 89/227980
666-232-06	06		GENERAL OPEN SPACE	REAL ESTATE HOLDINGS INC NEWCO MGNT CO 6320 CANOGA AVE. STE 1430 WOODLAND HILLS, CA 91367 RECDR DOC # 89/227980
666-232-01	01		GENERAL OPEN SPACE	REAL ESTATE HOLDINGS INC NEWCO MGNT CO 6320 CANOGA AVE. STE 1430 WOODLAND HILLS, CA 91367 RECDR DOC # 89/227980

TABLE B-5
(CONTINUED)
LAND OWNERSHIP
SAN JUAN BASIN
R/O SITING
SITE #3 AND ADJACENT PARCELS

ASSESSOR'S PARCEL NO.	MAP PARCEL NO.	AREA (acres)	LAND USE	OWNER AND ADDRESS
666-232-02	02		GENERAL OPEN SPACE	REAL ESTATE HOLDINGS INC NEWCO MGNT CO 6320 CANOGA AVE. STE 1430 WOODLAND HILLS, CA 91367 RECDR DOC # 89/227980
666-232-03	03		GENERAL OPEN SPACE	REAL ESTATE HOLDINGS INC NEWCO MGNT CO 6320 CANOGA AVE. STE 1430 WOODLAND HILLS, CA 91367 RECDR DOC # 89/227980
666-011-05	05	1.74	GENERAL OPEN SPACE	CITY OF SAN JUAN CAPISTRANO 32400 PASEO ADELANTO SAN JUAN CAPISTRANO, CA 92675 RECDR DOC # 013973/01750
666-011-17	17	31.91	OPEN SPACE RECREATION	GLENDALE FEDERAL SAVINGS &LOAN ASS. 401 N. BRAND BLVD GLENDALE, CA 91209 RECDR DOC # 009756/00217
666-011-03	03	24.38	OPEN SPACE RECREATION	GLENDALE FEDERAL SAVINGS &LOAN ASS. 401 N. BRAND BLVD GLENDALE, CA 91209 RECDR DOC # 009756/00217
666-241-01	01		GENERAL COMMERCIAL	ROMER, FRANCIS C P O BOX 520 SAN JUAN CAPISTRANO, CA 92675 RECDR DOC # 011142/00275
666-241-02	02		GENERAL COMMERCIAL	ROMER, FRANCIS C P O BOX 520 SAN JUAN CAPISTRANO, CA 92675 RECDR DOC # 011142/00275

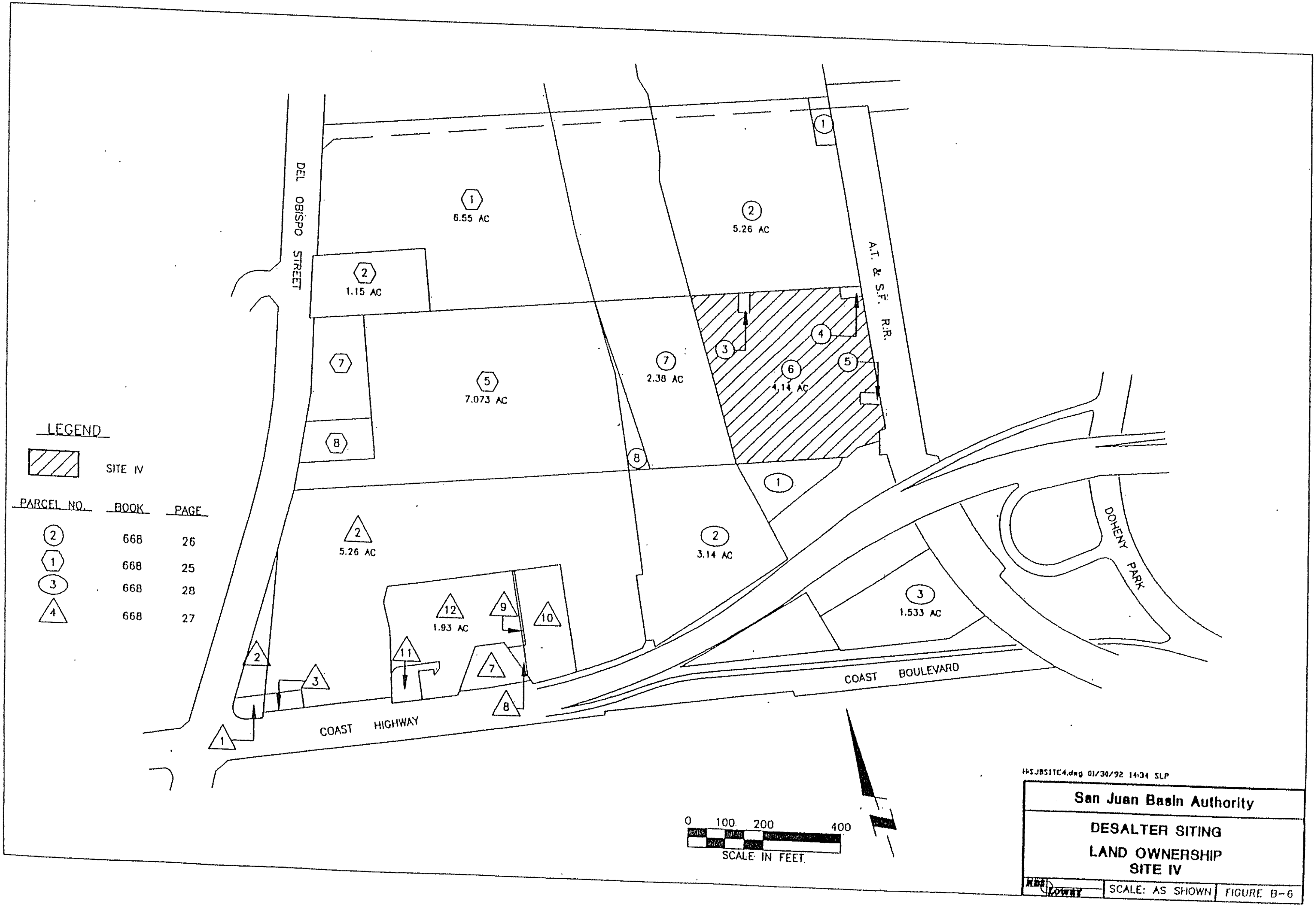
TABLE B-5
(CONTINUED)
LAND OWNERSHIP
SAN JUAN BASIN
R/O SITING
SITE #3 AND ADJACENT PARCELS

ASSESSOR'S PARCEL NO.	MAP PARCEL NO.	AREA (acres)	LAND USE	OWNER AND ADDRESS
666-241-04	04		GENERAL COMMERCIAL	ROMER, FRANCIS C P O BOX 520 SAN JUAN CAPISTRANO, CA 92675 RECDR DOC # 82/000244950
666-241-05	05	1.56	GENERAL COMMERCIAL	ROMER, FRANCIS C P O BOX 520 SAN JUAN CAPISTRANO, CA 92675 RECDR DOC # 012902/01065
666-241-06	06	1.92	GENERAL COMMERCIAL	GOYA, PAUL Y P O BOX 278 27232 GANADO DR SAN JUAN CAPISTRANO, CA 92675 RECDR DOC # 008408/00360
666-241-07	07	1.205	GENERAL COMMERCIAL	REAL ESTATE HOLDINGS INC NEWCO MGNT CO 6320 CANOGA AVE STE 1430 WOODLAND HILLS, CA 91367 RECDR DOC # 89/227980
666-241-08	08	1.11	GENERAL COMMERCIAL	CAPISTRANO COLLECTION ASSOC LTD 1400 QUAIL ST STE 270 NEWPORT BEACH, CA 92660 RECDR DOC # 89/124611
666-241-09	09		GENERAL COMMERCIAL	GRESHAM, RICHARD HART TR 18 TERRAZA DEL MAR DANA POINT, CA 92629 RECDR DOC # 86/000379276



<u>SITE III</u>

View towards the Northeast, taken from I-5 just south of Ortega Highway


DEL OBISPO STREET
A.T. & S.F. R.R.
DOHENY PARK
COAST HIGHWAY
COAST BOULEVARD
1
6.55 AC
2
5.26 AC
2
1.15 AC
5
7.073 AC
7
2.38 AC
6
1.14 AC
2
3.14 AC
3
1.533 AC
2
5.26 AC
12
1.93 AC
LEGEND
SITE IV
PARCEL NO. BOOK PAGE
2 668 26
1 668 25
3 668 28
4 668 27
0 100 200 400
SCALE IN FEET
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San Juan Basin Authority
DESALTER SITING
LAND OWNERSHIP
SITE IV
SCALE: AS SHOWN
FIGURE B-6

TABLE B-6
LAND OWNERSHIP
SAN JUAN BASIN
R/O SITING
SITE #4 AND ADJACENT PARCELS

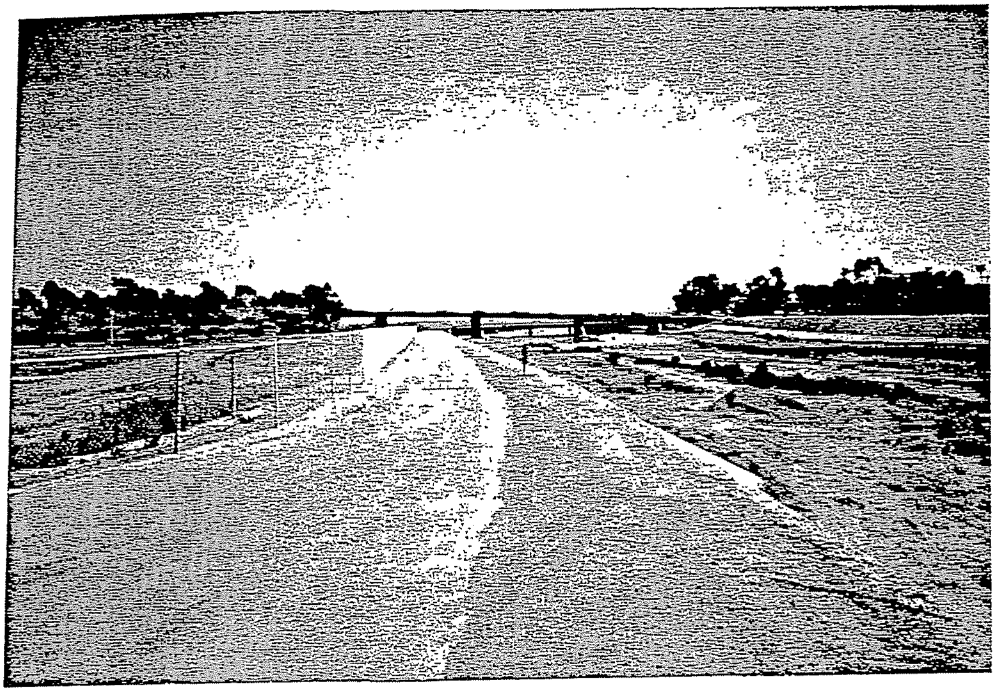
ASSESSOR'S PARCEL NO.	MAP PARCEL NO.	AREA (acres)	LAND USE	OWNER AND ADDRESS
668-261-05	05	.034	INDUSTRIAL	CAPISTRANO BEACH SANITARY DIST. P O BOX 8 CAPSTRANO BCH, CA 92672 RECDR DOC # 007309/00204
668-261-06 SITE 4	06	4.14	INDUSTRIAL	CAPISTRANO BEACH SANITARY DIST P O BOX 2008 CAPSTRANO BCH, CA 92624
668-261-04	04	0.034	INDUSTRIAL	CAPISTRANO BEACH SANITARY DIST. P O BOX 8 CAPSTRANO BCH, CA 92672 RECDR DOC # 007309/00204
668-261-03	03	0.034	INDUSTRIAL	CAPISTRANO BEACH COUNTY WATER DIST P O BOX 515 CAPSTRANO BCH, CA 92624
668-261-02	02	5.26	INDUSTRIAL	CAPISTRANO BEACH SANITARY DIST P O BOX 8 CAPSTRANO BCH, CA 92672
668-261-01	01		INDUSTRIAL	CAPISTRANO BEACH SANITARY DIST P O BOX 8 CAPSTRANO BCH, CA 92672
668-261-07	07	2.38	SJC CHANNEL	ORANGE COUNTY FLOOD CONTROL DIST
668-261-08	08			ORANGE COUNTY FLOOD CONTROL DIST
668-271-04	04	8.82		DANA POINT MARINA-THREE 3187-H AIRWAY AVE COSTA MESA, CA 92626 RECDR DOC # 89/043875
668-271-10	10			VARDAKOSTAS, EVANGELOS VARDAKOSTAS, MAHEEN 27046 CALLE DOLORES CAPISTRANO BEACH, CA 92675 RECDR DOC # 86/000393467

TABLE B-6
(CONTINUED)
LAND OWNERSHIP
SAN JUAN BASIN
R/O SITING
SITE #4 AND ADJACENT PARCELS

ASSESSOR'S PARCEL NO.	MAP PARCEL NO.	AREA (acres)	LAND USE	OWNER AND ADDRESS
668-271-08	08			VARDAKOSTAS, EVANGELOS VARDAKOSTAS, MAHEEN 34344 PACIFIC COAST HWY DANA POINT, CA 92629 RECDR DOC # 86/000393467
668-271-09	09			DOHENY PARK PLAZA P O BOX 10187 NEWPORT BEACH, CA 92658 RECDR DOC # 012304/01877
668-271-07	07			ATLANTIC RICHFIELD CO PS&T TAX DEPT SS#00447-11 P O BOX 2485 LOS ANGELES, CA 90051 RECDR DOC # 008064/00ENG
668-271-12	12	1.93	PARK	DOHENY PARK PLAZA P O BOX 10187 NEWPORT BEACH, CA 92658
668-271-11	11		PARK	DOHENY PARK PLAZA CARL KARCHER ENTRPS INC P O BOX 10187 NEWPORT BEACH, CA 92658
668-251-05	05	7.073	INDUSTRIAL	SOUTH EAST REGIONAL RECLAMATION AUTHORITY 25411 CABOT RD SUITE 209 LAGUNA HILLS, CA 92655
668-251-01	01	6.55	DEL OBISPO PARK	CAPISTRANO BAY PARK & RECREATION DIST P O BOX 2217 CAPSTRANO BCH, CA 92624 RECDR DOC # 011565/01860
668-251-02	02	1.15	INDUSTRIAL	COUNTY OF ORANGE
668-251-07	07		INDUSTRIAL	SOUTH EAST REGIONAL RECLAMATION AUTHORITY SUITE 209 25411 CABOT RD LAGUNA HILLS, CA 92653 RECDR DOC # 87/000096007

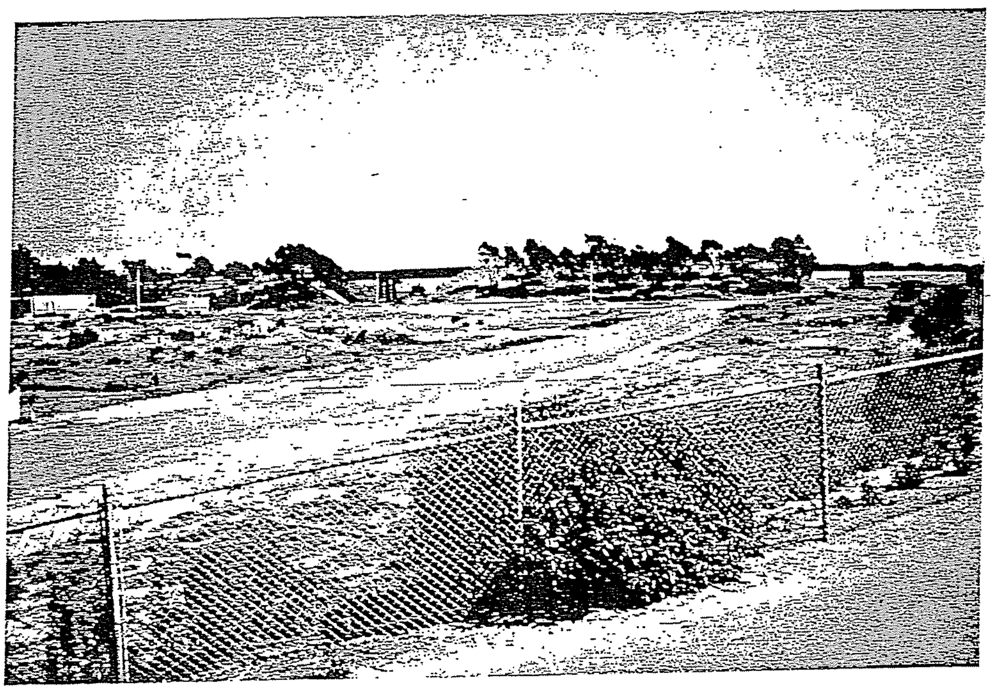
TABLE B-6
(CONTINUED)
LAND OWNERSHIP
SAN JUAN BASIN
R/O SITING
SITE #4 AND ADJACENT PARCELS

ASSESSOR'S PARCEL NO.	MAP PARCEL NO.	AREA (acres)	LAND USE	OWNER AND ADDRESS
668-251-08	08		INDUSTRIAL	DANA POINT SANITARY DIST 34152 DEL OBISPO ST DANA POINT, CA 92629
668-281-01	01		INDUSTRIAL	CAPISTRANO BEACH SANITARY DIST. P O BOX 571 DANA POINT, CA 92629
668-281-02	02	3.14	SJC CHANNEL	ORANGE COUNTY FLOOD CONTROL DIST.
668-282-03	03	1.533		PATEL, CHANDULAL K PATEL, GEETA C 17595 ALMAHURST RD #208 CITY OF INDUSTRY, CA 91748 RECDR DOC # 85/000244030



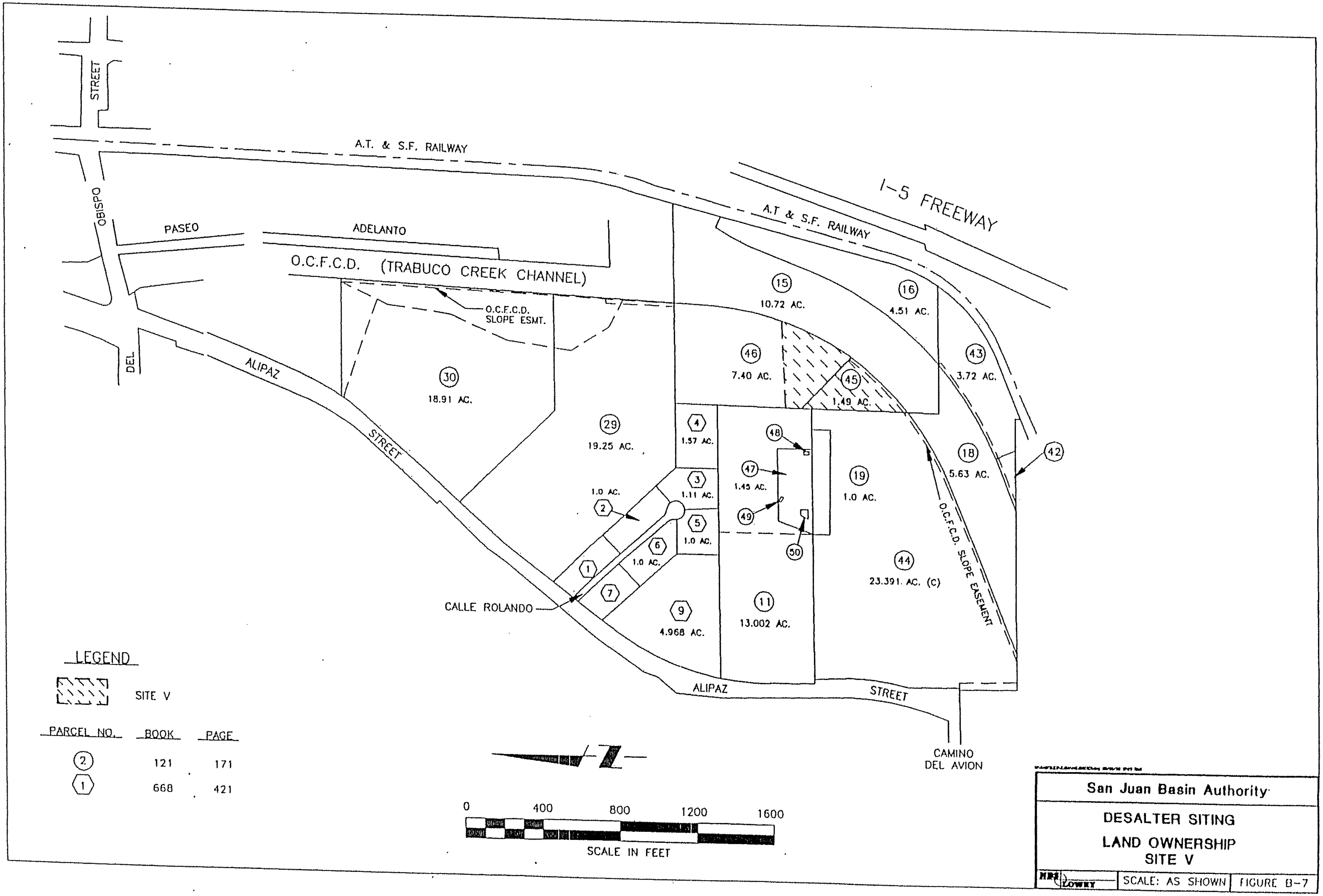
SITE IV

View towards the South with San Juan Creek on the right approximately 1000 feet north of Pacific Coast Highway



SITE IV

View towards the Southeast



San Juan Basin Authority

DESALTER SITING

LAND OWNERSHIP SITE V

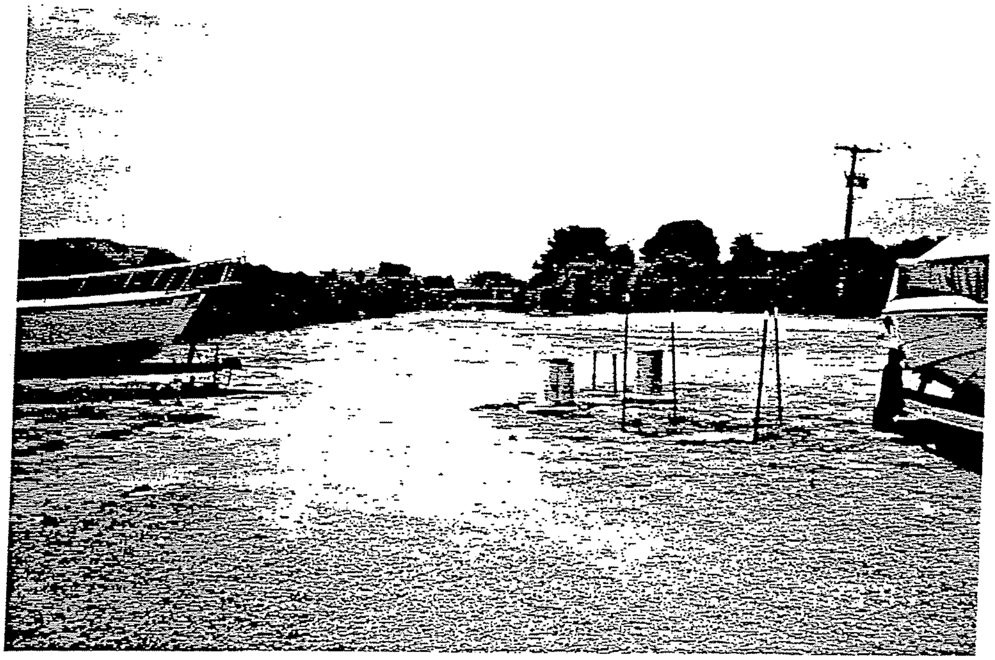
NBS LOWRY | SCALE: AS SHOWN | FIGURE B-7

TABLE B-7
LAND OWNERSHIP
SAN JUAN BASIN
R/O SITING
SITE #5 AND ADJACENT PARCELS

ASSESSSOR'S PARCEL NO.	MAP ARCE NO.	AREA (acres)	LAND USE	OWNER AND ADDRESS
121-171-44	44	23.391	MOBILE HOME PARK MED.HIGH DENSITY 8 DU'S/AC MAX	SEE CONDOMINIUM PROJECT LISTED UNDER 931-98-251 THRU 421
121-171-45 SITE 5	45	1.49	MOBILE HOME PARK MED.HIGH DENSITY 8 DU'S/AC MAX	CAPISTRANO VALLEY WATER DISTRICT P.O BOX 967 SAN JUAN CAPISTRANO, CA 92675 RECDR DOC # 87/000084702
121-171-46 SITE 5	46	7.4	SPEC. STUDY AREA R.V STORAGE	FORSTER, THOMAS A TR P.O BOX 146 SAN JUAN CAPISTRANO, CA 92693
121-171-19	19	1	SPEC. STUDY AREA	OSTERMILLER, DONNA M TR 522 S EL CAMINO REAL SAN CLEMENTE, CA 92672 RECDR DOC # 87/000152171
121-171-47	47	1.45	SPEC. STUDY AREA	FORSTER, THOMAS A TR P.O BOX 146 SAN JUAN CAPISTRANO, CA 92693 RECDR DOC # 87/000084703
121-171-48	48		SPEC. STUDY AREA WELL LOCATION	CAPISTRANO VALLEY WATER DISTRICT P.O BOX 967 SAN JUAN CAPISTRANO, CA 92675
121-171-49	49		SPEC. STUDY AREA	CAPISTRANO VALLEY WATER DISTRICT P.O BOX 967 SAN JUAN CAPISTRANO, CA 92675
121-171-50	50		SPEC. STUDY AREA	CAPISTRANO VALLEY WATER DISTRICT P.O BOX 967 SAN JUAN CAPISTRANO, CA 92675
121-171-11	11	13.002	SPEC. STUDY AREA/ MED.HIGH DENSITY 8 DU'S/AC MAX	FORSTER,ELIZABETH M ET AL P.O BOX 146 SAN JUAN CAPISTRANO, CA 92693
121-171-29	29	19.25	MOBILE HOME PARK MED.HIGH DENSITY 8 DU'S/AC MAX	OYHARZABAL, CARMEN TR %DPH INVESTMENT CO 1050 ROSECRANS ST STE M-1 SAN DIEGO, CA 92106 RECDR DOC # 011261/00496

TABLE B-7
(CONTINUED)
LAND OWNERSHIP
SAN JUAN BASIN
R/O SITING
SITE #5 AND ADJACENT PARCELS

ASSESSSOR'S PARCEL NO.	MAP ARCE NO.	AREA (acres)	LAND USE	OWNER AND ADDRESS
668-421-01	01		MED.HIGH DENSITY 8 DU'S/AC MAX	SINES, JEFFREY M SINES, ELIZABETH D 226 VISTA MARINA SAN CLEMENTE, CA 92672 RECDR DOC # 89/615918
668-421-02	02	1	MED.HIGH DENSITY 8 DU'S/AC MAX	MEYER, GRANT B JR MEYER, HELEN J MICRO PRECISION SWISS INC 26401 CALLE ROLANDO SAN JUAN CAPISTRANO,CA 92675 RECDR DOC # 89/190339
668-421-03	03	1.11	MED.HIGH DENSITY 8 DU'S/AC MAX	PITIS, ROGER R 34031 EL CONTENTO DR. DANA POINT, CA 92629 RECDR DOC # 013939/01321
668-421-04	04	1.57	MED.HIGH DENSITY 8 DU'S/AC MAX	PITIS, ROGER R 34031 EL CONTENTO DR. DANA POINT, CA 92629 RECDR DOC # 013939/01321
668-421-05	05	1	MED.HIGH DENSITY 8 DU'S/AC MAX	CAPISTRANO PROPERTIES 31508 MAR VISTA SOUTH LAGUNA, CA 92677 RECDR DOC # 87/000706208
668-421-06	06	1	MED.HIGH DENSITY 8 DU'S/AC MAX	CAPISTRANO PROPERTIES 31508 MAR VISTA SOUTH LAGUNA, CA 92677 RECDR DOC # 87/000706208
668-421-07	07		MED.HIGH DENSITY 8 DU'S/AC MAX	ALIPAZ INDUSTRIAL PARK P.O BOX 945 SAN JUAN CAPISTRANO, CA 92675 RECDR DOC # 011837/01080
668-421-09	09	4.968	MED.HIGH DENSITY 8 DU'S/AC MAX	SEE CONDOMINIUM PROJECT LISTED UNDER 939-61-001 THRU 40



SITE V

View towards the Southwest, taken from R.V. storage area

SITE V

View towards the Southeast, taken from R.V. storage area

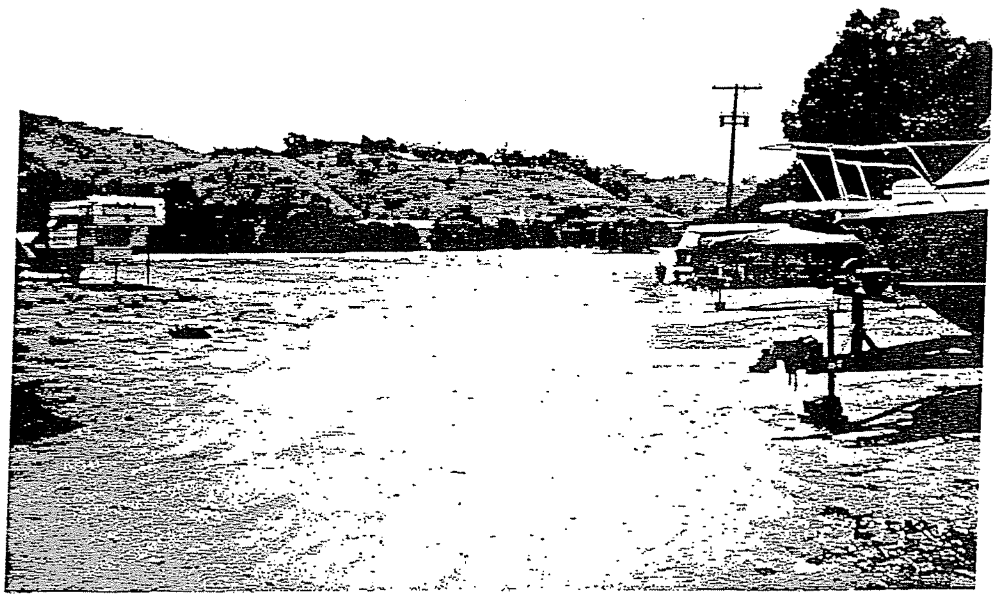


TABLE B-8
SAN JUAN BASIN AUTHORITY
POTENTIAL WELL SITES

Well Site	Land Use	Ownership	Site Area
41	General Open Space	Anderson, Derri 610 Newport Ct. Dr. Suite 690 Newport Beach, CA 92660 Recdr Doc #89/307661	30'x40'
42	Open Space Public Park Site	City of San Juan Capistrano 32400 Paseo Adelanto San Juan Capistrano, CA 92675	30'x40'
43	General Open Space	Hoffman, Walter TR 35821 Beach Road Capistrano Beach, CA 92624 APN 124-223-74	40'x50'
44	General Open Space	Hoffman, Walter TR 35821 Beach Road Capistrano Beach, CA 92624	40'x50'
45	Open Space Recreational	Glendale Federal Savings & Loan Assn. 401 N. Brand Blvd. Glendale, CA 91209 Recdr Doc #009756/00217 APN 666-011-17	30'x40'
46	Public and Institutional Uses	Huish, John M. TR 33208 Paseo Cervaza, Suite O San Juan Capistrano, CA 92675 APN 666-011-16 Recdr Doc #90/045102	30'x40'
47	Open Space	Harrison, Lorrin C TR Gordon, Alan P. 27451 Ortega Highway San Juan Capistrano, CA 92675 APN 121-253-04	30'x40'
48	Open Space	City of San Juan Capistrano 32400 Paseo Adelanto San Juan Capistrano, CA 92675 APN 668-211-19/21	30'x40'
49	Single Family	Mariners Village Owners Assoc. % Turn-Key Assoc. 31706 Coast Highway, Suite 302 South Laguna, CA 92677 APN 668-232-27	30'x40'

TABLE B-8
SAN JUAN BASIN AUTHORITY
POTENTIAL WELL SITES
(CONTINUED)

Well Site	Land Use	Ownership	Site Area
50	General Agricultural	Kinoshita Properties P. O. Box 201 San Juan Capistrano, CA 92675 APN 121-190-56	30'x40'
51	General Agricultural	Vermeulen, Charles I. 11591 Cielo Place Santa Ana, CA 92705 APN 121-182-53	30'x40'
52	General Commercial	Blazer, Betty Jean % Capistrano Capital 32107 Alipaz Street San Juan Capistrano, CA 92675 APN 668-151-05	30'x40'
53	General Commercial	Seaside Ranchos P. O. Box 444 Tustin, CA 92680 APN 668-241-24	30'x40'
54	General Open Space	J. F. Shea Company, Inc. 655 Brea Canyon Road Walnut, CA 91789 APN 121-070-30	40'x50'
55	General Open Space	Oso Ranch Company P. O. Box 936 San Juan Capistrano, CA 92675 APN 121-070-57	40'x50'
56	General Open Space	Daniel, Oren Mathew TR 9450 Adelaida Road Paseo Robles, CA 93446 APN 121-050-21	40'x50'

TABLE B-9
SAN JUAN BASIN AUTHORITY
POTENTIAL RECHARGE SITES

Recharge Site	Land Use	Ownership	Site Area
1	General Open Space	San Juan Partnership No. 2 % Viejo Management Company P. O Box 9 San Juan Capistrano, CA 92693 APN 125-161-07/06	20 AC
2	General Open Space	Santa Margarita Company % Viejo Management Company P. O Box 9 San Juan Capistrano, CA 92693 APN 125-171-08/10	28 AC
3	Very Low Density/General Open Space	Santa Margarita Company % Viejo Management Company P. O Box 9 San Juan Capistrano, CA 92693 APN 125-172-01	11 AC
4	Open Space Preservation	Glendale Federal Savings & Loan 401 N. Brand Blvd. Glendale, CA 91209 APN 124-223-51	6.5 AC
5	Industrial Park	Real Estate Holdings, Inc. Newco Management Company 6320 Canoga Ave., Suite 1430 Woodland Hills, CA 91367 APN 666-131-09	10 AC
6	General Open Space	Oso Ranch Company P. O. Box 936 San Juan Capistrano, CA 92675 APN 121-070-55/57 Daniel, Oren Mathew TR 9450 Adelaida Road Paseo Rubles, CA 93446 APN 121-050-21	35 AC

APPENDIX C

PRELIMINARY COST ESTIMATE
ULTIMATE CONJUNCTIVE USE FACILITIES

TABLE C-2

ULTIMATE CONJUNCTIVE USE FACILITIES
PRELIMINARY COST ESTIMATE

OPERATION AND MAINTENANCE COSTS

POTABLE WATER PLANT PRODUCTION ANNUAL COST		3,500 AF/YR $/YR (4)	10,500 AF/YR $/YR (5)
DESALTER			
Fixed O&M	(1)	133,000	133,000
Variable 0&M	(2)		
Chemicals, Labor, Replacement		348,300	916,200
Energy		419,800	787,200
PUMP STATION			
@ Desalter			
Fixed		7,300	7,300
Variable O&M			
Labor, Spare Parts, Service		0	25,000
Energy		287,800	863,300
CVWD PRV			
Fixed 0&M		N/A	12,500
Variable 0&M			
Energy		N/A	444,400
WELLS			
Fixed O&M @ 2.5% Capital		24,800	24,800
Variable O&M			
Labor, Spare Parts, Service		0	8,300
Energy	(3)	129,800	324,600
OCEAN OUTFALL			
Fixed O&M		3,300	3,300
Variable O&M		0	6,600
Total O&M Fixed		**168,400**	**180,900**
Total O&M Variable		**1,185,7000**	**3,375,600**
Total O&M		**1,354,100**	**3,556,500**
Total O&M/AF		**387**	**339**

TABLE C-2

ULTIMATE CONJUNCTIVE USE FACILITIES
PRELIMINARY COST ESTIMATE

OPERATION AND MAINTENANCE COSTS
(Cont'd)

NOTES AND ASSUMPTIONS

1. Includes labor and maintenance supply costs.
2. Includes chemical, energy, labor, maintenance supply, and membrane replacement costs.
3. Based on providing 45 psi delivery pressure at inlet to desalting plant.
4. Energy cost assumed to be $0.11/KWH, and 150 days per year operation.
5. Energy cost assumed to be $0.11/KWH, and 330 days per year operation.