APPENDIX C – Groundwater Management Plan

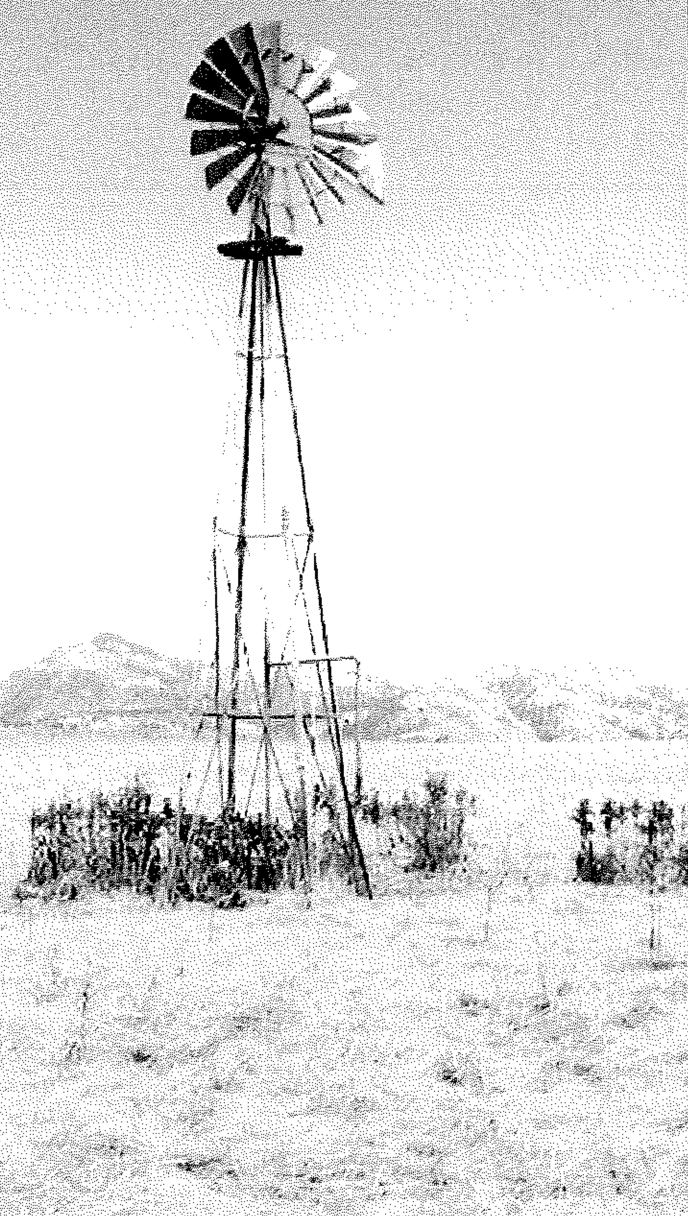
Groundwater Management Plan for the San Benito County Part of the Gilroy-Hollister Groundwater Basin

Prepared for:

Aromas Water Distict
City of Hollister
City of San Juan Bautista
San Benito County Water District
Sunnyslope County Water District
Tres Pinos County Water District

In cooperation with:

Granite Rock Company
San Benito County
San Benito County Builders and Developers Association
San Benito County Farm Bureau
Sierra Club



Prepared by:

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Groundwater Management Plan
for the San Benito County
Part of the Gilroy-Hollister
Groundwater Basin

Final

Prepared for:

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Table of Contents

List of Tables

List of Figures

Figure **Follows Page**

Introduction

PURPOSE

Northern San Benito County is fortunate to have a diverse and well-engineered water supply and distribution system. The system has numerous desirable features that are rarely found in agricultural areas in northern California, including a substantial allocation of imported surface water of high quality, a large groundwater basin available for conjunctive use, numerous river and creek channels already in use for supplemental groundwater recharge, a gravity-pressurized pipeline distribution system for imported water that minimizes leaks and saves energy, metering of groundwater pumping, and groundwater replenishment fees. These physical and institutional assets provide considerable flexibility in water resources management. Unlike other areas, where groundwater management is an unwelcome encumbrance needed to deal with water supply shortages or forestall imminent resource degradation, northern San Benito County can enjoy the luxury of implementing a groundwater management plan to reap further benefits from their water resources system, including increased yield and reliability, improved water quality, and lower cost.

Development of this plan was prompted by the realizations that groundwater plays an essential role in agricultural and urban activities, that those activities affect the availability and quality of groundwater, and that groundwater, imported water, local surface water, and wastewater are interrelated in a single, complex hydrologic system. Although the overall condition and outlook for water resources in the area is good, certain aspects of available water resources and their management have created problems in the past or could lead to problems in the future. Current or potential physical problems include local imbalances between recharge and pumping, poor water quality (i.e., salinity, nitrates, and boron), local areas of shallow groundwater or limited percolation capacity, and future increases in water demand. Institutional difficulties have included poor interagency coordination of land and water use and lack of a common understanding of the amount and quality of available groundwater. Even in the absence of physical or institutional problems, however, the groundwater and surface water systems are sufficiently complicated to benefit from a coordinated management plan.

The purpose of this groundwater management plan is to clearly state how local agencies and interest groups in northern San Benito County have agreed to manage groundwater and related water resources in the San Benito County part of the Gilroy-Hollister groundwater basin. A coordinated, interagency groundwater management plan is a desirable means of protecting groundwater quality and quantity and achieving an ample, reliable, and economical supply of water for all beneficial uses.

This groundwater management plan will necessarily evolve as issues and conditions change. For example, the information used to evaluate the condition of the groundwater basin and characterize management issues consists only of data through water year 1997. Thus, data related to the flood in February 1998 are not reflected in this plan. Similarly, the plan focuses on issues and potential management actions of greatest importance in early 1998, when the plan was first drafted. As land and water use patterns change and as the effects of management actions become apparent, new issues and management actions will emerge to the forefront. Others may become less important as a result of cost, environmental impacts, or decreased need. The loose-leaf format of this document was selected to accommodate the evolution of issues, information, and feasible management actions. Entire sections may be readily updated as needed so that the plan remains current and useful as a decision-making tool.

APPROACH

This plan is the result of a collaborative planning process that included representatives from San Benito County Water District (SBCWD), City of Hollister, Sunnyslope County Water District (SCWD), City of San Juan Bautista, Tres Pinos County Water District (TPCWD), Aromas Water District, San Benito County, San Benito County Farm Bureau, San Benito County Builders and Developers Association, and the Sierra Club. The planning process was initiated in May 1997 by means of a memorandum of understanding (MOU) endorsed by most of the participants. Key clauses in the MOU included:

- "The purpose of the Memorandum of Understanding is to establish a process between the signatory parties for developing a policy level Groundwater Management Plan (Plan). The Plan to be developed will include only information, policies, programs, and recommendations agreed upon by all signatory parties."

- "The Groundwater Management Plan is to be a policy level document developed, to the maximum extent possible, from existing county, city, and district plans, reports and documentation and directed to achieve the following goals:

  - provide for the current and future water quantity and water quality needs of water users,
  - preserve existing groundwater rights,
  - reduce overdraft,
  - protect land uses in high groundwater areas,
  - protect and maintain recharge areas,
  - protect surface and groundwater quality, and
  - integrate agency actions."

- "This Memorandum of Understanding does not address the adoption of any groundwater management."

- "The Agency Advisory Group will operate by consensus (unanimity) and shall serve as an advisory body to all signatories."
- "Meetings of the Agency Advisory Group shall be open to the public, noticed and conducted in accordance with the Brown Act..."

The planning process was funded by the first six of the aforementioned agencies through a cost-sharing agreement. The process consisted of monthly meetings of the planning group, which began in May 1997 and will continue through March 1998. A technical advisory group was convened partway through the process to advise the planning group on the importance of various issues and the feasibility of selected management actions. Jones & Stokes Associates was retained to facilitate the planning process meetings and prepare the plan document.

This plan reflects the consensus of the participants in the planning group. After the group discussed each groundwater management issue and identified potential management actions, the facilitator prepared draft text summarizing his sense of the group's opinions and conclusions. The group then revised the text as needed until all participants found the statements and proposals at least acceptable if not desirable.

Implementation of this plan will consist of voluntary, coordinated actions by the participating agencies using their existing powers and authorities. This plan is similar in scope and intent to groundwater management plans developed pursuant to AB 3030 (Water Code Section 10750 et seq.), the Groundwater Management Act passed by the legislature in 1992 (Bachman et al. 1997). This plan does not rely on authority granted by AB 3030 because local agencies in San Benito County already collectively have all of the authority needed to develop and implement a groundwater management plan.

Condition of the Basin

This management plan applies to the main groundwater basin in northern San Benito County, which is shown in Figure 1. The basin is the southern part of the Gilroy-Hollister groundwater basin, which underlies the Hollister, San Juan, and Santa Clara Valleys between Hollister and Morgan Hill. Substantial amounts of groundwater pumping associated with the development of irrigated agriculture in the valley floor areas in the first half of the 20th century greatly altered groundwater levels and flow directions. Construction of the San Felipe Project in the 1980s and the resulting importation of water from the Central Valley Project (CVP) also greatly altered groundwater conditions in the basin. This section describes the hydrogeology of the basin and current conditions regarding water use, groundwater budgets, and water quality.

HYDROGEOLOGY

Basin Boundaries

The groundwater basin is a structural trough formed by folding and faulting that has gradually filled with unconsolidated sedimentary deposits over millions of years. The basin is bounded on the southwest by the San Andreas Rift Zone and granitic and Tertiary marine and volcanic rocks of the Gabilan Range. To the north and east, the basin is bounded by the Diablo Range, which is composed of metamorphosed marine sedimentary and igneous rocks of the Franciscan Formation and Great Valley Sequence. These consolidated bedrock units store and transmit groundwater, but the amounts and rates are very small compared to those in the unconsolidated basin fill deposits. The Pajaro River forms the northwestern boundary of the planning area, but the groundwater basin extends beneath the river into the Gilroy-Morgan Hill area of Santa Clara County. The total area of groundwater basin to which this plan applies is approximately 125 square miles.

Faults that cross the basin divide it into subbasins that function somewhat independently of one another. The basin is in a tectonically active geologic region associated with the San Andreas Rift Zone. Other active faults crossing the basin are shown in Figure 1 and include the Calaveras, Ausaymas, and Tres Pinos faults. Recent geological movement along these faults has uplifted and exposed some of the deeper, more consolidated basin fill deposits, resulting in hills, such as Lomerias Muertas, the Flint Hills, the two low hills along Highway 25 northwest of the Hollister airport, and Swanson's Bluff near Tres Pinos. In the subsurface, shearing and offsetting of sediment layers along the fault planes results in relatively low permeability, and the faults form partial subsurface barriers to groundwater flow. During calibration of a groundwater model developed by Luhdorff and Scalmanini Consulting Engineers (1991), faults that had formerly been assumed to be totally impermeable were found to be semipermeable. The degree to which flow is obstructed varies with depth and location along the faults. The effect on groundwater levels is pronounced in some areas, such as along the segment of the Calaveras fault near Hollister and along the Tres Pinos fault.

Previous investigators have used various names and boundaries to identify the subbasins. This management plan uses the boundaries and names developed for the 1996 and 1997 annual groundwater reports prepared by SBCWD, as shown on Figure 1. The boundaries are generally hydrogeologic boundaries (faults) and the boundary of zone 6, which outlines the service area for delivery of imported surface water. In detail, the boundaries follow cultural features such as surface water delivery subsystem boundaries, roads, and parcel boundaries. The basin is divided into the Pacheco, Bolsa, San Juan, Hollister West, Hollister East, and Tres Pinos subbasins. The Lomerias Muertas and Flint Hills are a hilly area between the Bolsa and San Juan subbasins. The hills consist of uplifted Purisima Formation, which is an unconsolidated sedimentary formation that forms a large part of the subsurface basin fill in other parts of the basin. Although there are few wells in the hills, the hills are part of the groundwater basin. A fault and anticline pass through the northern part of the hills and probably obstruct groundwater flow. Thus, groundwater in the hilly area is connected most closely with groundwater in the San Juan subbasin.

Stratigraphy and Aquifer Characteristics

The sedimentary deposits that fill the basin consist of discontinuous layers of sand, silt, clay, and gravel deposited in stream channels, floodplains, lakes, marshes, and shallow marine environments. Although the deposits become progressively older with depth, the major geologic units are similar and therefore difficult to differentiate in well logs. Two geologic cross sections are shown in Figure 2. The surficial deposits are Quaternary alluvium, stream terrace deposits, and the San Benito Gravels of Lawson, all of which are generally quite permeable. These are underlain at a depth of 0–300 feet by the Pliocene Purisima Formation, which is lithologically similar to the overlying alluvium but generally more consolidated and less permeable. East of the Calaveras Fault, the Purisima Formation is underlain by two older, unnamed sedimentary formations (Unnamed Units 1 and 2) that also exhibit a similar range of textures but are slightly more consolidated. The Unnamed Units are exposed at the land surface in the low hills east of Fairview Road between Santa Ana Creek and Highway 25. Additional information on basin hydrogeology can be found in Kilburn (1972) and Luhdorff and Scalmanini Consulting Engineers (1991).

Groundwater is present in the small pores between the grains of sediment. Groundwater flows through these pores at a rate proportional to the slope of the water table and the permeability of the sediments. Most wells draw water from the alluvium, terrace deposits, and upper part of the Purisima Formation. Substantial additional thickness of Purisima Formation is present below this depth. An inventory of 103 wells by the U.S. Geological Survey (Farrar 1981) indicated that 84% of the wells were between 100 and 500 feet deep. Only 4% of the wells were less than 100 feet deep.

Under predevelopment conditions, groundwater flowed from southeast to northwest and naturally discharged by seeping into the Pajaro and lower San Benito Rivers. An extensive clay confining layer created artesian conditions in the Bolsa subbasin, and flowing wells were common in that area in the early twentieth century, according to the U.S. Geological Survey (Kilburn 1972).

Figure 1. Locations of Groundwater basin and Subbasins

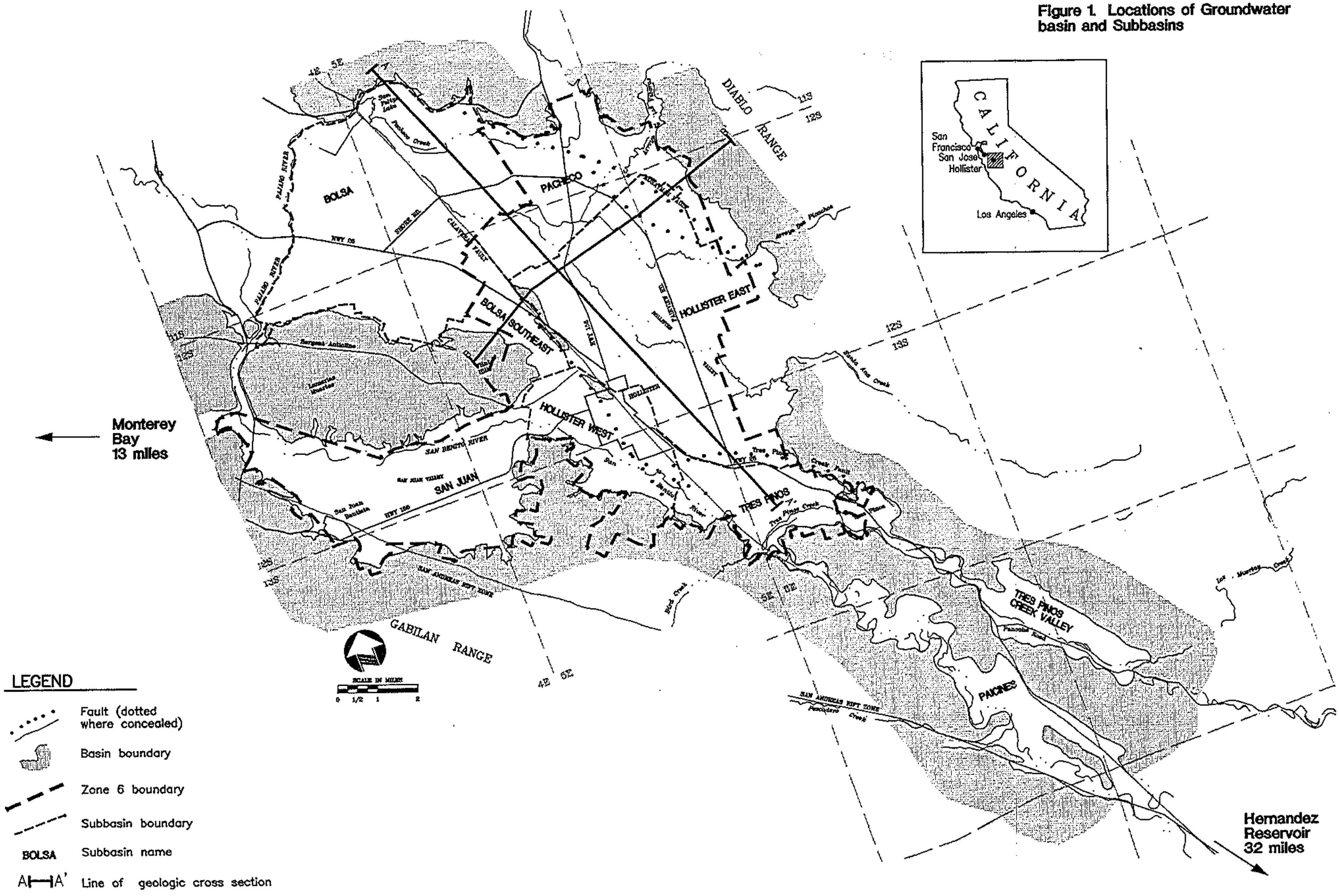
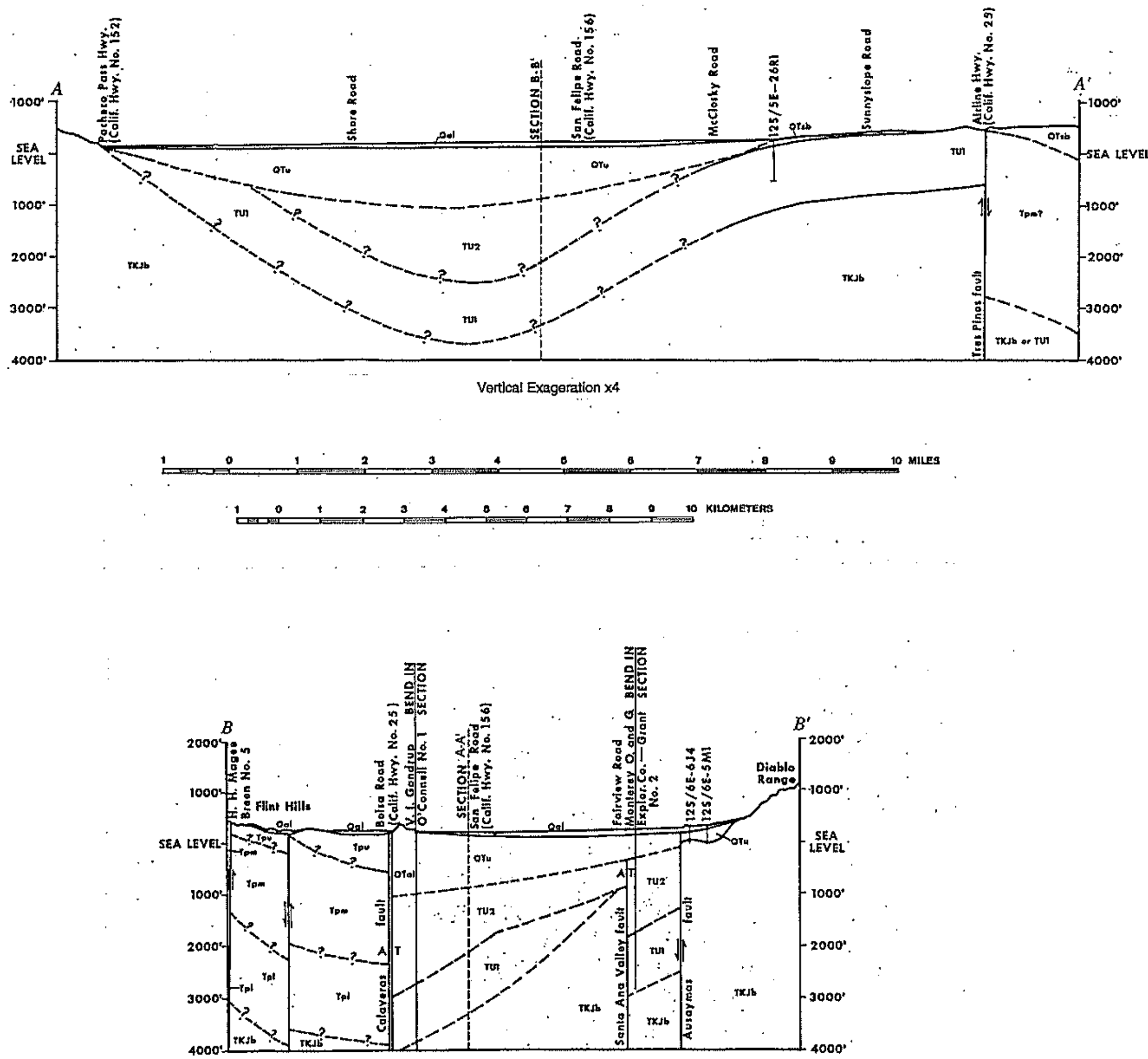


Figure 2
Geologic Cross Sections
A-A' and B-B'



Locations of geologic cross sections are shown in Figure 1.

Description of Geologic Units

- Qrc — RIVER-CHANNEL DEPOSITS Sand and gravel
- Qal — ALLUVIUM Clay, silt, sand, and gravel
- QTal — OLDER ALLUVIUM Clay, silt, sand, and gravel
- QTsb — SAN BENITO GRAVELS OF LAWSON (1893) Lenticular beds of clay, silt, sand, and gravel, locally consolidated
- QTsc — SANTA CLARA FORMATION Compact lenticular beds of clay, sand, and gravel
- QTu — UNDIFFERENTIATED UNIT (In subsurface) May include alluvial fan deposits along west side of Diablo Range

PURISIMA FORMATION

- Tpu — Upper member Predominately friable pebble gravel and sand locally containing siltstone, all of terrestrial origin
- Tpm — Middle member Poorly consolidated, mostly terrestrial, friable, massive sandstone interbedded with gypsiferous clay. Locally contains friable pebbly sandstone and pebble conglomerate. Contact with underlying unit gradational
- Tpl — Lower member Mainly friable to semifriable, bedded, fine- to medium-grained arkosic sandstone and interbedded micaceous siltstone, fossiliferous, of shallow marine to brackish marine origin
- TU1 — UNNAMED UNIT 1 Consists of thin to medium beds of clay, silt, sand, and gravel where exposed at surface. Character may be different in subsurface in northern half of valley
- TU2 — UNNAMED UNIT 2 Not known to be exposed at surface. Electrical logs indicate it is composed of thick- bedded sand or sandstone with interbedded clay, shale, and siltstone
- TKJb — CONSOLIDATED BEDROCK Sedimentary, igneous, and metamorphic rocks
- gr — GRANITE In Gabilan Range

Lithologic contact Long dash where approximately located. Short dash where inferred

Fault Dashed where approximately located. Dotted where concealed. U, upthrown side; D, downthrown side. Arrows show direction of relative horizontal movement. A, away; T, toward

Source: Kilburn 1972.

Jones & Stokes Associates, Inc.

The extent of the confining layer and contours of water levels in 1913 are shown in Figure 3. Groundwater pumping has increased steadily since the 1890s. Irrigated acreage increased from approximately 1,000 acres in 1890 to 20,000 acres in 1929 and 45,000 acres in 1997. Groundwater pumping increased in rough proportion to the increase in irrigated acreage and to a lesser extent the increase in population. In the last 10 years (1988–1997) total water use has averaged 48,000 acre-feet (af), of which 15,000–22,000 af has been supplied by imported water.

Between 1913 and the beginning of water imports in 1987, average annual groundwater extraction exceeded average annual recharge, resulting in groundwater overdraft and declining water levels. Water levels have generally been stable or rising since 1987, and long-term groundwater overdraft appears to have been eliminated in all subbasins except possibly the Bolsa Southeast subbasin (Jones & Stokes Associates 1997a, 1997b). Nevertheless, groundwater levels in most areas remain substantially below the 1913 levels. Groundwater levels in October 1997 are shown in Figure 4, and hydrographs of average water levels in each subbasin during 1976-1997 are shown in Figure 5.

Saturated soil conditions occur in several areas, but the cause of the saturation is not the same in all of the areas. Poor soil drainage is a chronic problem in the central and western parts of the San Juan Valley. The cause of the poor drainage are shallow clay layers at depths of 3-12 feet below the soil surface that impede downward percolation of infiltrated rainfall and irrigation water. Some farmers have installed tile drains in their fields, which effectively alleviates the problem. Groundwater levels in the San Juan Valley were generally more than 20 feet below the land surface even in the spring of two consecutive wet years (1996 and 1997), which indicates that a high water table is not the cause of the saturation. A different situation is present in the Pacheco and Bolsa subbasins, where soil saturation and groundwater seeps at wellheads, creek channels, and near faults were observed in spring 1997. Groundwater levels in wells are generally less than 20 feet below the ground surface in those areas, so it is more likely that the seepage is caused by high water tables and/or artesian conditions.

WATER BUDGET

Groundwater budgets are important tools for estimating the yield of the groundwater basin, investigating overdraft, and identifying opportunities for conjunctive use. Large items in the water budgets exert the greatest influence over groundwater storage and water levels and are the flow terms that should be monitored the most closely and manipulated to achieve efficient conjunctive use. The annual groundwater reports for water years 1996 and 1997 (September– October) included estimated annual water budgets for each subbasin (Jones & Stokes Associates 1997a, 1997b). The water budgets for water year 1997 are shown in Table 1. The numerous items in the water budgets were estimated independently, often from very different sets of raw data. The resulting estimate of change in groundwater storage (which equals the difference between total inflows and total outflows) in each subbasin did not exactly match the storage changes estimated from water-level changes and storage coefficients. The discrepancies between the two sets of storage change estimates reflect the net effect of errors and assumptions in both sets of calculations.

Sources and Amounts of Recharge

Percolation from streams is the largest source of recharge for the groundwater basin. By far the greatest amount of stream recharge is from the San Benito River channel, followed by Pacheco Creek, Arroyo de las Viboras, Arroyo dos Picachos, and Santa Ana Creek. Recharge in all of those creeks includes percolation from natural streamflow during winter and percolation of imported or stored local surface water during summer. Imported water from the San Felipe Project is percolated in the San Benito River and all of the creeks, and water stored in Hernandez Reservoir is released to the river for percolation. Hernandez Reservoir currently has a capacity of 17,200 af and is located on the San Benito River upstream of the groundwater basin. Locations of percolation reaches along the river and all of the creeks are shown in Figure 6.

Percolation of natural streamflow is highly variable from year to year, depending on the amount and timing of rainfall. During water year 1997, which was slightly wetter than average, percolation of natural streamflow in all subbasins combined was approximately 17,400 af, and percolation of San Felipe water amounted to 11,100 af. Hernandez Reservoir and the much smaller Paicines reregulating reservoir near Tres Pinos supply an average of approximately 10,000 af per year of percolation along the San Benito River and its tributary, Tres Pinos Creek.

Infiltration rates along all of the stream and river channels are greatest where they first enter the groundwater basin. Heavier soils or subsurface confining layers tend to limit infiltration rates toward the downstream ends of the waterways. The maximum percolation capacity along the San Benito River between Tres Pinos and Lucy Brown Road (near the midpoint of the San Juan subbasin) is approximately 38 cubic feet per second (cfs), based on measured percolation losses between stream gages. The combined maximum percolation capacity along the creeks is approximately 26 cfs, based on observed infiltration of metered releases. Thus, the river and creeks could potentially recharge the groundwater basin at a rate of 64 cfs or 127 af per day.

Infiltration is sometimes limited by high groundwater levels, particularly along the San Benito River and Pacheco Creek. If groundwater levels locally rise to the level of the water surface in the stream, further recharge is rejected for lack of subsurface storage space. Rejected recharge has been documented near the City of Hollister's municipal wastewater percolation ponds. The ponds compete with the river for percolation capacity, which is limited by a shallow subsurface confining layer. High groundwater levels along Pacheco Creek also suggest that recharge is probably rejected toward the latter part of many winter streamflow seasons, after groundwater levels have recovered to the level of the creek.

Recent shallow groundwater conditions along parts of the San Benito River are the combined result of rising groundwater levels (caused by positive water budgets) and a declining riverbed elevation (caused primarily by decades of in-channel gravel mining). Historical gravel mining along the San Benito River has lowered the thalweg elevation by 10–25 feet along most of the reach between Hospital Road and the Pajaro River, and the water table is now close to the riverbed elevation in some areas. Figure 7 shows profiles of the riverbed elevation in 1955, before most of the mining activity, and in 1987 and 1997. Profiles of groundwater levels in 1913 and 1997 are shown on the same plot. Groundwater levels in March 1997 were close to or higher than the

Table 1. Estimated Subbasin Groundwater Budgets for Water Year 1997

	Pacheco	Bolsa Southeast	San Juan	Hollister West	Hollister East	Tres Pinos	Zone 6 Subtotal	Bolsa	Paicines	Tres Pinos Creek Valley	Grand Total
Inflows											
Stream percolation											
Natural streamflow (1)	1,281	0	3,416	4,782	2,451	5,465	17,395	0	2,200	1,150	20,745
San Felipe releases	3,029	0	2,248	3,371	647	1,792	11,087	0	0	0	11,087
Hernandez/Paicines releases (1)	0	0	0	0	0	0	0	0	0	1,436	1,436
Deep percolation through soils											
Rainfall (2)	2,157	1,657	5,604	2,426	4,213	577	16,634	5,585	2,894	1,622	26,735
Irrigation (3)	1,258	745	2,823	782	2,412	274	8,294	4,370	1,000	460	14,124
Reclaimed water percolation	0	0	1,290	1,892	0	218	3,400	0	0	0	3,400
Groundwater inflow	0	1,000	0	4,000	0	1,000	6,000	4,500	0	0	10,500
Total	7,725	3,402	15,381	17,253	9,723	9,326	62,810	14,455	6,094	4,668	88,027
Outflows											
Wells											
Agricultural	2,089	2,738	8,372	3,037	2,971	1,214	20,421	12,848	5,000	2,300	40,569
Domestic and municipal and industrial (4)	120	17	1,215	4,565	907	3,406	10,230	0	0	47	10,277
Groundwater outflow	4,000	500	0	0	1,000	4,000	9,500	0	500	500	10,500
Total	6,209	3,255	9,587	7,602	4,878	8,620	40,151	12,848	5,500	2,847	61,346
Storage change											
Inflows - outflows	1,516	147	5,794	9,651	4,845	706	22,659	1,607	594	1,821	26,681
Water level change	1,810	273	8,216	10,526	5,047	1,117	26,989	1,180	n.m.	n.m.	28,169

Notes:

Entries are accurate to one or two significant digits. All digits are shown to avoid rounding small numbers to zero and to preserve correct column totals.

(1) Percolation in the San Benito River from Hernandez releases is included in natural stream percolation because the releases flow past the Willow Creek School gage. Total flow past the gage during the irrigation season (April - September 1997) was 2,200 af, none of it derived from Hernandez storage. All of it was assumed to percolate in the Paicines subbasin.

Natural stream recharge during winter in the Pacheco subbasin and the Paicines and Tres Pinos Creek Valley basins is limited to the amount of available storage capacity, estimated from the previous year's dry-season storage decline.

(2) Deep percolation of rainfall calculated by soil moisture budget model with subbasin irrigated areas calibrated so that subbasin applied water amounts and total zone 6 irrigated area equal measured values.

(3) Deep percolation of irrigation water assumed to equal 20% of applied irrigation water.

(4) Domestic and municipal and industrial groundwater use in the Bolsa and Paicines subbasins were not estimated; they are actually greater than zero but much less than agricultural pumping.

Figure 3. Contours of Groundwater Elevation, August 1913

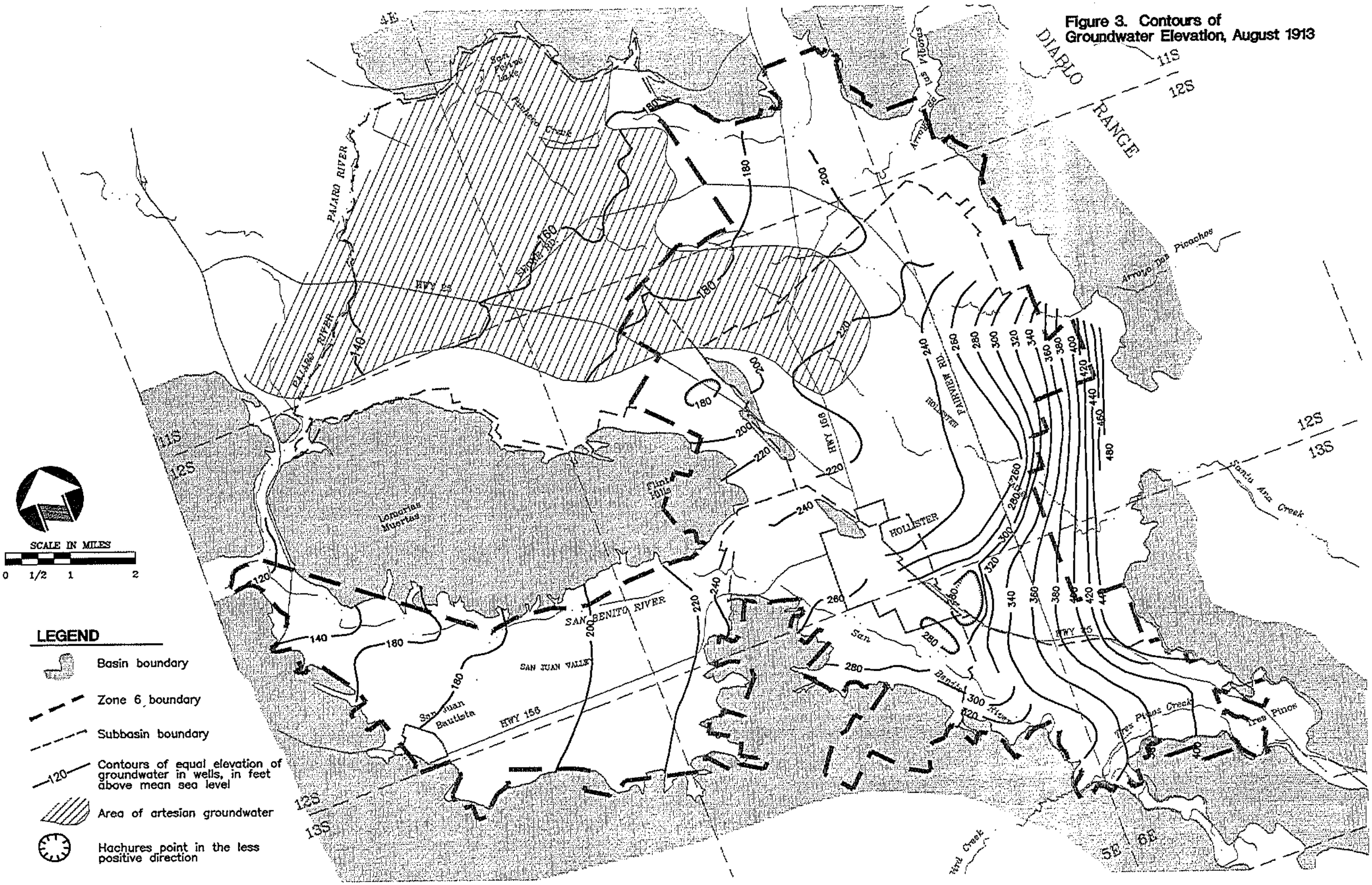
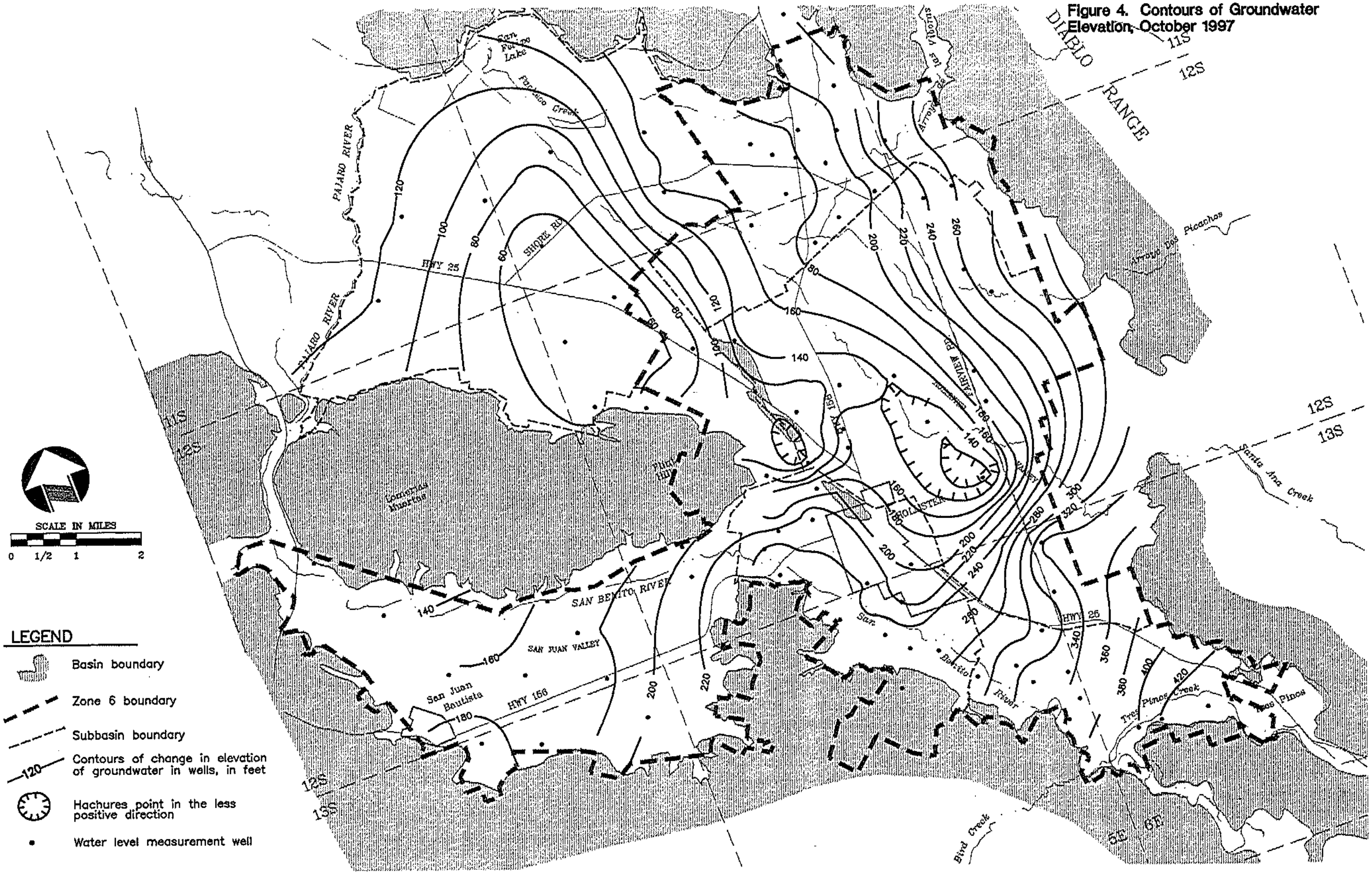


Figure 4. Contours of Groundwater Elevation, October 1997



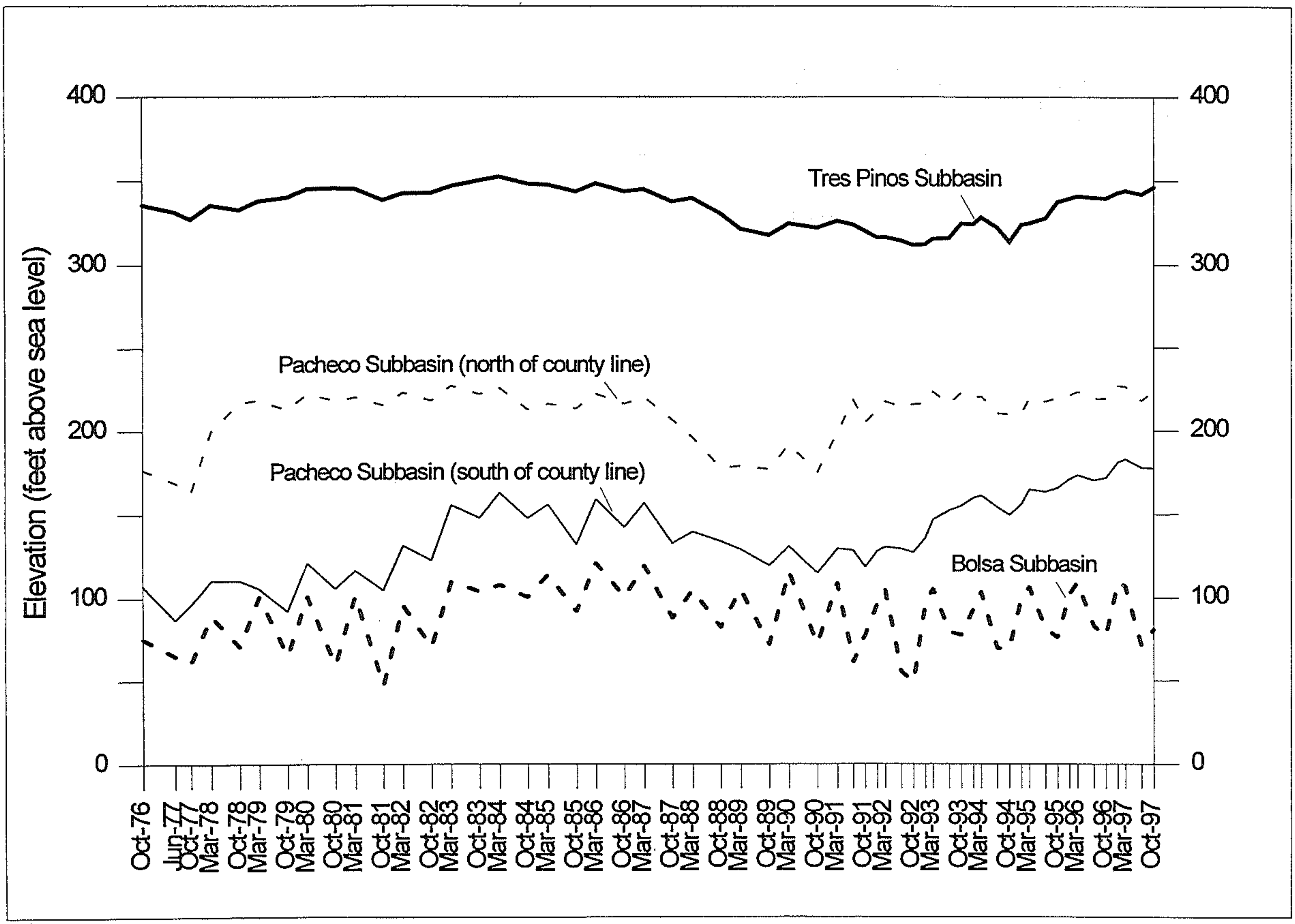


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Figure 5. Hydrographs of Average Groundwater Elevation in Each Subbasin during Water Years 1976-1997

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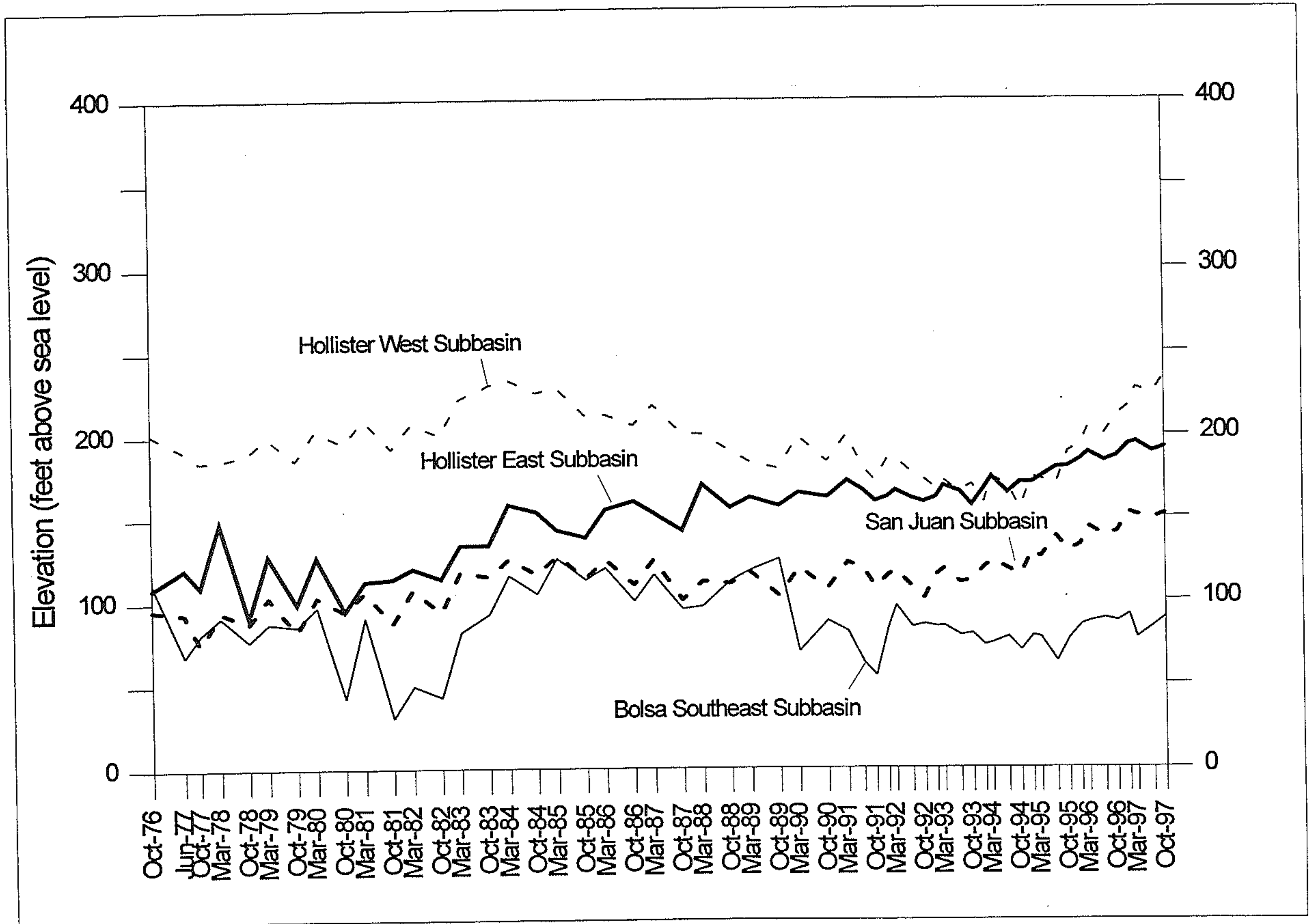

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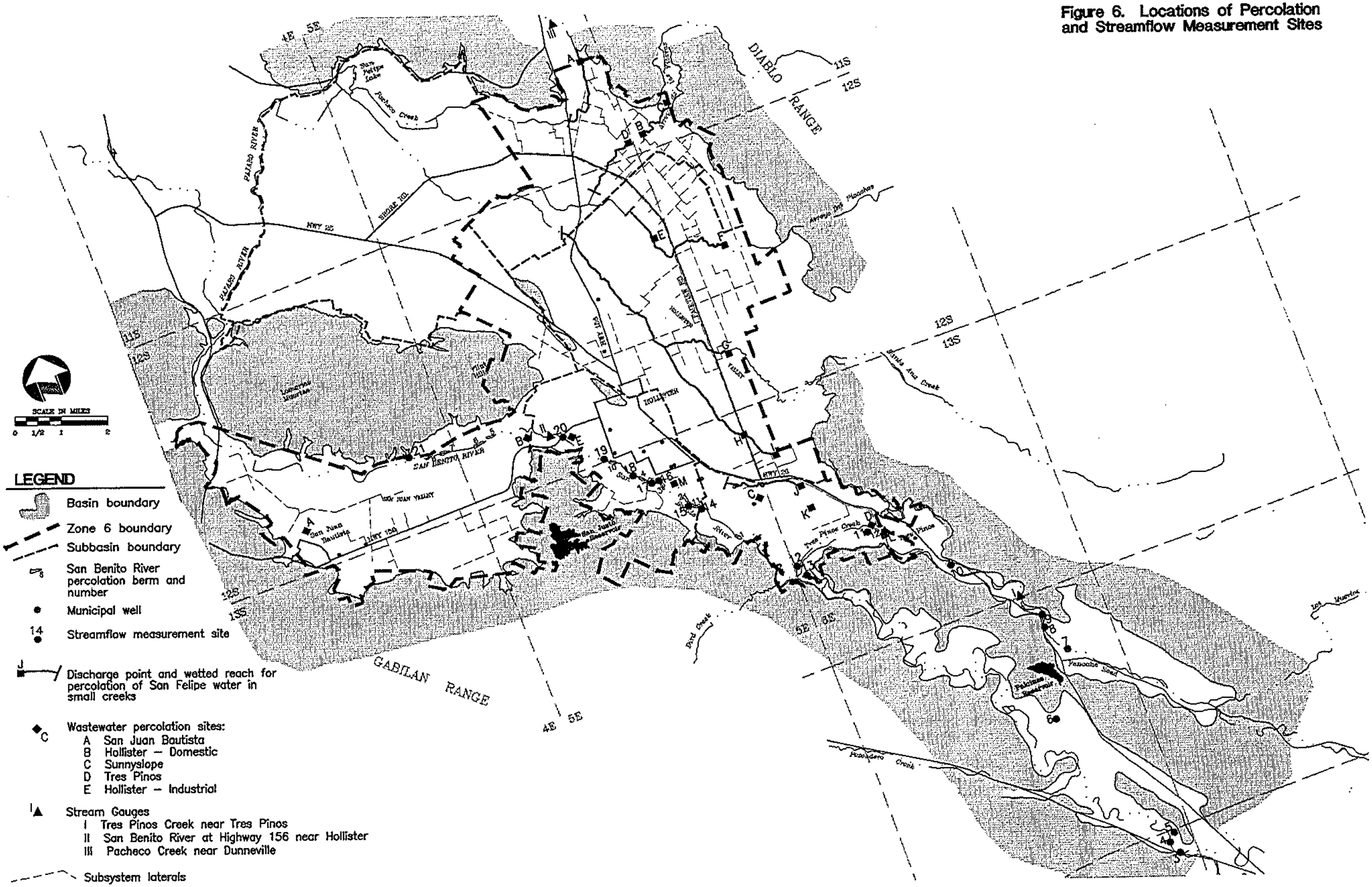
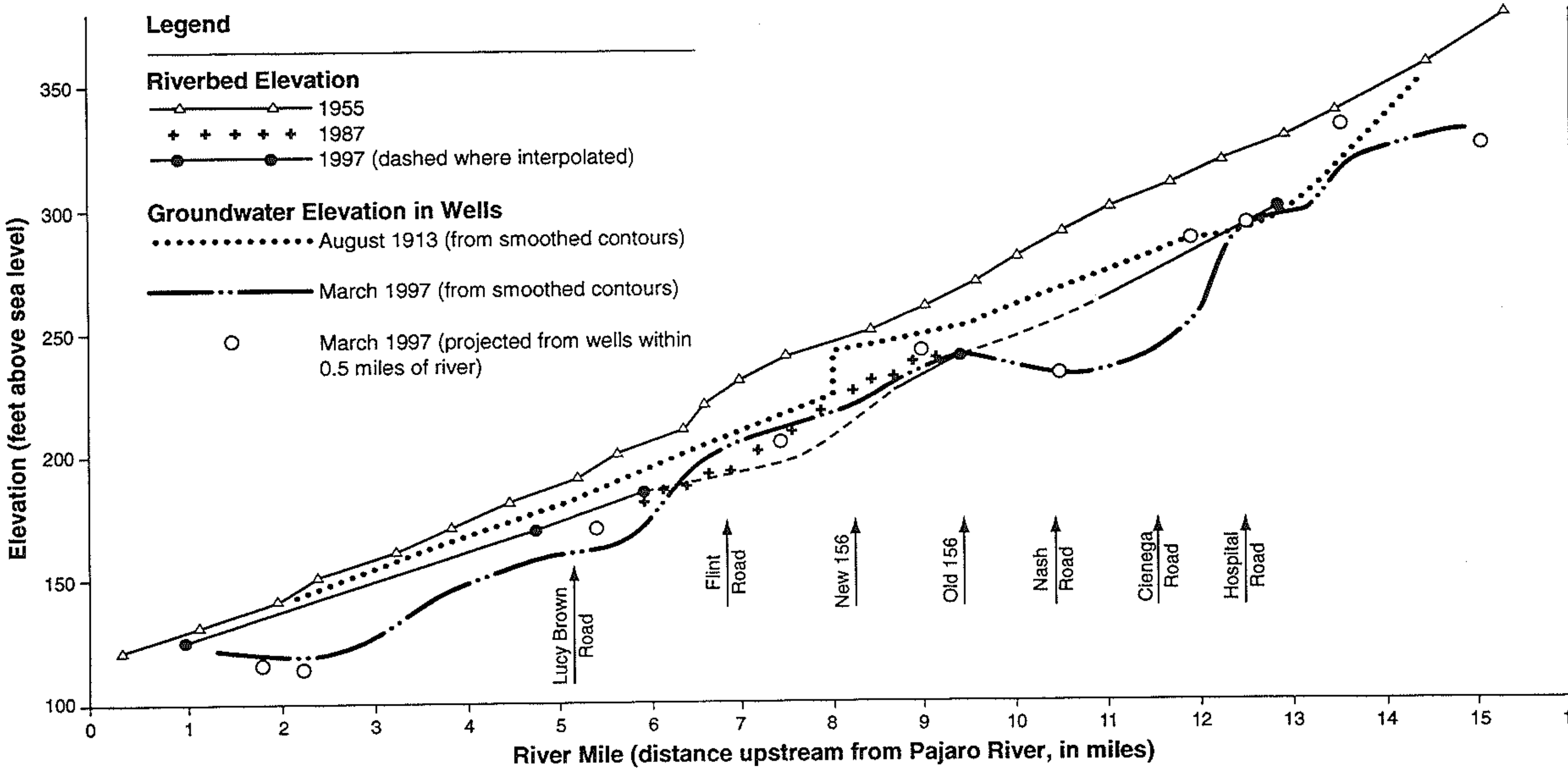
Figure 5. Continued

AVERAG2.GRF

Figure 6. Locations of Percolation and Streamflow Measurement Sites





Sources:
River thalweg: Warenski-Garcal Photogrammetry, Inc. 1987; Golder Associates 1997.
Groundwater elevations: Kilburn 1972; Jones & Stokes Associates 1997b.

Jones & Stokes Associates, Inc.

Figure 7
Longitudinal Profile along San Benito River showing Historical Riverbed Elevations and March, 1997 Groundwater Elevation

riverbed elevation upstream of Hospital Road and between the old Highway 156 bridge and approximately Flint Road. The river functions as a drain for the groundwater system when groundwater levels are high. Groundwater levels near the river cannot rise much above the thalweg elevation. If the riverbed elevation is lowered, the maximum groundwater level will also be lowered, and the storage capacity in basin materials above that level will no longer be usable. This effect is most pronounced close to the river channel. For example, the effect of riverbed lowering on groundwater levels along Cache Creek in Yolo County was found to be noticeable at only a few wells, all of which were within 1 mile of the creek (Northwest Hydraulic Consultants et al. 1995). Along the San Benito River, groundwater levels in August 1913 were higher than the present riverbed elevation along the entire length of the river below Hospital Road, and they will not be able to reach those levels again, at least near the river channel.

Infiltration and deep percolation of rainfall and applied irrigation water throughout the valley floor area is the second largest source of groundwater recharge. Even in well-managed and relatively efficient irrigation systems, some water percolates past the root zone because of inherent nonuniformities in water application and incomplete root development during early crop growth stages. Deep percolation of applied irrigation water is difficult to measure but is typically 20% of the applied water in areas with fairly efficient irrigation systems. Deep percolation of rainfall can be estimated by calculating a daily soil moisture balance and assuming that when cumulative infiltration minus evapotranspiration losses exceeds the storage capacity of the root zone, the excess becomes deep percolation that recharges groundwater. Deep percolation of winter rainfall is affected by summer irrigation practices because less rainfall is required to fill the soil moisture profile at the beginning of winter if the soil contains residual moisture from irrigation during the previous summer. Rainfall recharge is highly variable from year to year, and in relatively dry years when the root zone never becomes fully replenished, there may be no rainfall recharge.

Reclaimed municipal wastewater is disposed of by percolation at five locations overlying the groundwater basin (Figure 6). Total percolation of reclaimed water during water year 1997 was 3,400 af, most of which was at the Hollister domestic wastewater treatment facility west of Hollister. Septic systems at rural residences also contribute minor amounts of groundwater recharge.

Groundwater Withdrawals and Outflow

Historical groundwater overdraft has resulted in a reversal of groundwater flow directions in many parts of the basin and almost complete elimination of any subsurface outflow from the basin. Groundwater now flows from the perimeter of the basin toward pumping depressions in the Bolsa, Bolsa Southeast, and Hollister East subbasins. In the San Juan subbasin, groundwater levels are not substantially lower than predevelopment levels, and groundwater probably continues to discharge in limited quantities to the Pajaro and lower San Benito Rivers. The lack of groundwater outflow creates a risk of long-term increases in groundwater salinity as groundwater is repeatedly applied for irrigation and subject to evaporation. The salt buildup issues are discussed in the section on "Water Quality", below. Groundwater inflows and outflows listed in Table 1 are simply flows between subbasins; it is assumed that there is no flow across the main basin boundary.

Groundwater withdrawals by wells are the only significant outflow from the basin. Agricultural pumping within zone 6, which includes all subbasins except the Bolsa subbasin, is measured by SBCWD. The amount of pumping is measured indirectly by metering the number of hours of operation at each well and multiplying by the average measured discharge rate. Approximately 43,500 af of groundwater was pumped during water year 1997, of which 33,300 (77%) was for agricultural use. Total agricultural water use varies from year to year and has not increased noticeably during the last 10 years; however, farmers are using increasing amounts of imported San Felipe water, which has decreased the amount of groundwater use. Municipal and industrial use in Hollister and San Juan Bautista was approximately 9,400 af during water year 1997, and rural domestic water use was approximately 900 af. Municipal and industrial use has been increasing by an average of 480 af per year during the last 10 years.

Storage Capacity and Sustainable Yield

The amount of groundwater stored in a large, deep alluvial basin such as the Gilroy-Hollister basin greatly exceeds the sustainable yield. Sustainable yield is defined as the amount of groundwater that can be reliably pumped from a basin every year without causing adverse effects. The total quantity that is accessible to wells equals the volume of aquifer between the water table and the average depth of the wells multiplied by a storage coefficient, which is the amount of water yielded per foot of water level decline. The total quantity is difficult to estimate because storage coefficients are locally quite variable and also are a function of the duration of the pumping stress. The annual groundwater report for water year 1996 estimated that the difference in groundwater storage between water levels in August 1913 and October 1996 was approximately 150,000 af. The minimum groundwater storage in the basin probably occurred in 1979, and there was a net recovery of approximately 110,000 af between 1979 and 1996 (Creegan and D'Angelo 1996, Jones & Stokes Associates 1997a). Thus, the minimum storage in 1979 was approximately 260,000 af less than the storage in 1913. These estimates are based on storage coefficients calibrated from only a few years of data for use in the groundwater model and should be considered approximate.

The sustainable yield of the groundwater basin is of greater relevance to groundwater management than is the total amount of groundwater in storage. Sustainable yield is not an intrinsic characteristic of a groundwater basin; it is affected by land and water use practices and the locations of wells. For example, laser leveling of fields, tillage practices, and stormwater disposal methods affect the amount of rainfall that infiltrates into the ground. Crop root depths and irrigation practices affect the amount of cumulative infiltration required to initiate deep percolation that becomes groundwater recharge. Wells located near rivers and creeks can induce additional percolation from those surface water bodies, thereby increasing total groundwater recharge and yield. Finally, artificial recharge projects, such as percolation of San Felipe water or reclaimed water, increase groundwater recharge and basin yield.

In a basin such as the Gilroy-Hollister basin, where groundwater is used in conjunction with surface water to meet water demands, the combined yield of the groundwater and surface water supplies is of greatest importance to water management. Conjunctive use can result in a combined yield that is greater than the sum of the separate yields of the surface water and groundwater components. This is achieved by using stored groundwater to supply most of the demand during droughts, when surface water deliveries are curtailed. During wet periods, surface water is used to meet most of the demand, and groundwater storage is allowed to recover.

Groundwater overdraft is indicated by a long-term decline in groundwater levels. A decrease in storage in a single year or during a multi-year drought does not by itself indicate that the groundwater basin is experiencing overdraft. In fact, it is expected that groundwater levels would decline during a drought in a basin that is conjunctively used with surface water supplies. If groundwater levels do not recover during periods of normal or wet climatic conditions following the drought, however, the basin is in overdraft. The likely consequences of overdraft in the Gilroy-Hollister basin would be increased pumping costs, declining well yields, and possibly subsidence, increased groundwater salinity, and mortality of riparian vegetation in areas with shallow groundwater.

Groundwater levels have generally been increasing since 1976 in all subbasins except possibly the Bolsa Southeast subbasin (Figure 5). The lack of significant water-level declines during the 1987–1990 drought in subbasins that were receiving substantial quantities of imported water at that time (i.e., Pacheco, San Juan, and Hollister East) is evidence of the effectiveness of the San Felipe project in eliminating overdraft. The average annual amount of San Felipe water required in each subbasin to exactly balance the long-term water budget and prevent overdraft is not precisely known because groundwater levels also respond to other factors such as pumping, rainfall recharge, and streamflow recharge. An analysis using a groundwater model calibrated for a small number of years indicated that average annual importation of approximately 16,000 af of San Felipe water to zone 6 would prevent overdraft (Luhdorff and Scalmanini Consulting Engineers 1991). The analysis did not evaluate subbasins individually. Imports during 1991–1997 averaged 21,000 af per year (af/yr), and groundwater levels rose substantially during that time. However, annual rainfall during that period averaged 12% greater than the long-term mean, which probably also contributed to net water-level increases.

The sustainable yield of the groundwater basin is the amount of groundwater that can be pumped from the basin on an average annual basis without causing adverse effects. It is not a fixed, intrinsic characteristic of the groundwater basin; however, it is affected by the locations of wells, irrigation efficiency, and operation of surface water projects, such as Hernandez and Paicines Reservoirs and the San Felipe Project. A number of water resource studies and annual groundwater reports for the basin have indicated that the sustainable yield with the Hernandez/Paicines facilities and existing land use, irrigation efficiency, and well locations is 40,000–50,000 af/yr. This yield estimate does not include recharge from percolation or use of San Felipe water.

WATER QUALITY

Groundwater quality in the basin is marginally acceptable for potable and irrigation use. Typical quality of groundwater in the Hollister area is shown in Table 2. The water quality constituents of greatest concern are salinity, nitrate, boron, hardness, and trace elements that occasionally exceed secondary drinking water standards.

Salinity

Salinity refers to the dissolved solids concentration in water and is correlated with electrical conductivity, which can be easily measured with a meter in the field. Dissolved solids concentrations can be estimated from electrical conductivity measurements using the following empirical equation developed from samples of 60 wells in the Hollister Valley in 1968 (Kilburn 1972):

$$\text{Dissolved Solids} = 0.721 \times \text{Electrical Conductivity} - 125$$

Dissolved solids concentrations in recent years have typically been 750–850 milligrams per liter (mg/l) in Hollister municipal wells (with some samples as high as 1,300 mg/l) and 1,100 mg/l in San Juan Bautista municipal wells. SBCWD measured electrical conductivity at 66 wells located throughout zone 6 during 1997. Electrical conductivity ranged from 221–2,570 micromhos per centimeter (μmho/cm) and averaged 1,121 μmho/cm. The average electrical conductivity level exceeds the maximum recommended level for drinking water (900 μmho/cm) and the desirable level for avoiding yield reductions in salt-sensitive crops (1,000 μmho/cm). Using the above equation, the estimated dissolved solids concentrations in 1997 ranged from 34–1,730 mg/l and averaged 683 mg/l. This average value exceeds the recommended concentration for drinking water of 500 mg/l.

The long-term salt balance of the basin is a concern because salinity levels are already high and presently there is no pathway for accumulated salts to leave the basin. The groundwater basin functions effectively as a closed system because low groundwater levels created by decades of historical overdraft prevent groundwater from flowing out of the basin or discharging into the Pajaro and San Benito Rivers, as occurred naturally under predevelopment conditions. Groundwater outflow was the principal mechanism for removing dissolved solids from the groundwater basin. Salts are further concentrated when groundwater is used for irrigation because evaporation from soils and crops removes pure water and leaves the dissolved solids behind. Although rainfall dilutes the salts when it flushes them out of the root zone, the salinity of the percolating water probably exceeds the ambient salinity of groundwater. Percolation of municipal and rural domestic wastewater and application of fertilizers to cropland also create new sources of salts in the basin. These processes can collectively create a trend toward increasing groundwater salinity.

Historical and recent groundwater quality data for San Benito County were compiled and analyzed for this groundwater plan to determine whether long-term salinity increases are large enough to warrant aggressive management action. Although San Benito County has not had a systematic long-term program for monitoring groundwater quality, water quality surveys were done in the 1930s (Eaton et al. 1941), the 1960s (Kilburn 1972), and 1997 (SBCWD unpublished data). There are 174, 60, and 70 measurements of electrical conductivity available for these three periods, respectively. The data are listed in Table 3, and the data distributions are represented by the boxplots shown in Figure 8. The upper and lower edges of each box represent the 75th and 25th percentile values. The dashed line in the middle is the median, with the 95% confidence interval about the median indicated by the width of the indentations on the sides of the boxes. The lines above and below the box extend to 1.5 times the interquartile range, and more distant outliers are plotted

Table 2. Water Quality and Water Quality Standards

Characteristic	Units	Well Water Min	Well Water Avg	Well Water Max	San Luis Reservoir Min	San Luis Reservoir Avg	San Luis Reservoir Max	Water Limits
General								
pH	-	7.2	7.4	7.6	6.5	7.7	8.5	6.5 - 8.5 (2)
Temperature	degrees C	17	18	20	10	15.5	22	--
Turbidity	NTU	0.4	**3.8**	**14**	0.35	**2.2**	**28**	0.5 (1)
Color	PCU	3	4	5	0	10	**20**	15 (2)
Conductance	umhos/cm	**1,030**	**1,300**	**1,670**	290	450	620	900 (2)
Total Dissolved Solids	mg/L	**680**	**880**	**1,350**	188	288	395	500 (2)
Hardness	mg/L as CaCO3	295	427	524	75	110	135	--
Alkalinity	mg/L as CaCO3	210	320	444	45	80	90	--
Odor	TON	ND	1	1	0.5	**5**	**10**	3 (2)
Dissolved Oxygen	mg/L	0.5	2	4	0.65	8.3	13.1	--
Cations								
Calcium	mg/L	52	67	75	16	21	27	--
Magnesium	mg/L	40	63	82	8	14	19	--
Sodium	mg/L	100	127	158	28	55	81	--
Potassium	mg/L	2.4	2.8	3.5	2.3	3	3.8	--
Iron	mg/L	<1.10	0.15	**0.47**	ND	0.05	**0.7**	0.3 (2)
Manganese	mg/L	<0.01	**0.09**	**0.47**	ND	0.007	**0.099**	0.05 (2)
Anions								
Bicarbonate	mg/L	260	400	506	55	92	110	--
Carbonate	mg/L	<1	<1	<1	<1	<1	<1	--
Chloride	mg/L	75	99	122	31	80	114	250 (2)
Sulfate	mg/L	183	235	**266**	33	42	55	250 (2)
Nitrate	mg/L	3.4	14.5	24	0.07	0.53	3.2	45 (1)
Phosphorous	mg/L	--	--	--	0.06	0.33	4.35	--
Fluoride	mg/L	**0.3**	**0.44**	**0.54**	**ND**	**0.08**	**0.2**	1.4 - 2.4 (1)
Boron	mg/L	0.9	**1.1**	**1.17**	0.2	0.2	0.2	1 (3)
Metals								
Arsenic	ug/L	<2	<5	<10	ND	3	20	50 (1)
Cadmium	ug/L	<1	<1	<1	ND	ND	ND	5 (1)
Chromium	ug/L	1	5	14	ND	ND	ND	50 (1)
Copper	ug/L	<10	<30	<50	ND	1	10	1300 (1)
Lead	ug/L	<1	<1	<1	ND	0.2	0.9	15 (1)
Mercury	ug/L	<1	<1	<1	ND	0.2	0.9	2 (1)
Selenium	ug/L	<5	<5	<5	ND	ND	ND	50 (1)
Silver	ug/L	<10	<10	<10	ND	ND	ND	100 (2)
Zinc	ug/L	<30	40	40	ND	ND	ND	5000 (2)
Organics								
Total Organic Carbon	mg/L	--	--	--	**2.4**	**2.9**	**3.9**	2 (1)
MBAS	mg/L	ND	--	0.05	ND	ND	ND	0.5 (2)
TTHM	mg/L	--	--	--	ND	ND	ND	0.1 (1)
THMFP	mg/L	--	--	--	109	162	211	--
Bacteriological								
Total Coliform	MPN	ND	ND	**16**	<1	**20**	**1,600**	<2 (4)
Heterotrophic Plate Count	CFU/ml	--	--	--	38	**1,220**	**11,000**	500 (5)
Corrosivity/Scaling Potential								
Langelier Index @ 60 F	-	+0.1	+0.2	+0.3	**-2.4**	**-0.85**	+0.15	-0.5 to +0.5 (5)
Langelier Index @ 140 F	-	**+0.7**	**+0.8**	**+0.9**	**-1.5**	-0.05	**+85**	-0.5 to +0.5 (5)
Larsen Ratio	-	**1.1**	**1.5**	**1.8**	**1.5**	**1.7**	**2**	<0.4 (5)
Sulfate-Chloride Ratio	-	1.6	1.9	**2.2**	0.95	0.45	0.35	<2 (5)
Carbon Dioxide	mg/L	**11**	**16**	**55**	0.5	3.5	**45**	<5 (5)

Notes:
Water quality data from Kennedy/Jenks Consultants et al (1993)
Bold type indicates concentrations outside of the range of desirable water limits.
(1) = Primary (health-based) drinking water standard (California Department of Water Resources [1995])
(2) = Secondary (aesthetic) drinking water standard (California Department of Water Resources [1995])
(3) = Recommended irrigation water quality for crops sensitive to salt or boron (Ayers and Westcot [1996]; Smith pers. comm.)
(California Department of Water Resources [1995]).
(5) = Numerical limits recommended by Kennedy/Jenks Consultants et al (1993)

Table 3. Historical Groundwater Electrical Conductivity and Nitrate Concentrations

Part 1: Data from the 1930's (Eaton et al. 1941)

Pacheco

Well No.	EC	NO3
11-5-25	647	4.3
11-5-26	615	
11-5-26	768	0.6
11-5-26	1,367	1.9
11-5-27	615	
11-5-35	1,180	3.1
11-5-35	1,110	4.3
11-5-35	638	3.1
11-5-36	689	17.4
11-5-36	744	0.6
11-5-36	742	7.4
11-5-36	1,640	0.6
11-5-36	1,310	1.9
11-5-36	2,460	9.9
11-5-36	1,430	2.5
11-5-36	1,790	4.3
11-6-31	1,090	8.7
12-5-2	880	3.7
12-5-2	1,010	13.0
Minimum	615	0.6
Maximum	2,460	17.4
Average	1,091	5.1
Median	1,010	3.7

Bolsa Southeast

Well No.	EC	NO3
12-5-16	1,300	trace
12-5-17	1,280	6.8
12-5-21	1,325	5.0
12-5-9	1,330	0.0
Minimum	1,280	0.0
Maximum	1,330	6.8
Average	1,309	2.9
Median	1,313	2.5

San Juan

Well No.	EC	NO3
12-4-20	775	1.9
12-4-27	2,170	14.9
12-4-34	1,340	13.0
12-4-34	2,810	0.6
12-4-34	1,350	0.0
12-4-34	1,140	0.0
12-5-31	1,350	13.0
13-4-2	1,370	6.2
13-4-4	767	trace
Minimum	767	0.0
Maximum	2,810	14.9
Average	1,452	5.5
Median	1,350	1.9

Hollister West

Well No.	EC	NO3
12-5-27	1,120	1.2
12-5-27	1,260	6.8
12-5-28	1,630	trace
12-5-28	1,280	0.0
12-5-29	3,505	3.1
12-5-33	2,440	3.7
12-5-34	687	0.6
13-5-10	1,340	
13-5-2	1,240	
13-5-2	1,320	2.5
13-5-2	1,230	3.7
13-5-3	1,200	
13-5-3	1,260	trace
13-5-3	1,350	7.4
Minimum	687	0.0
Maximum	3,505	7.4
Average	1,490	2.6
Median	1,270	2.5

Tres Pinos

Well No.	EC	NO3
13-5-11	1,310	2.5
13-5-11	1,400	4.3
13-5-11	1,390	44.0
13-5-13	1,290	0.0
13-6-20	1,840	3.7
13-6-21	1,290	11.2
Minimum	1,290	0.0
Maximum	1,840	44.0
Average	1,420	11.0
Median	1,350	4.0

Bolsa

Well No.	EC	NO3
11-4-27	515	5.6
11-5-16	654	44.0
11-5-21	532	3.1
11-5-21	1,420	0.0
11-5-24	417	14.3
11-5-28	9,030	2.5
11-5-28	1,160	0.0
11-5-28	1,130	
11-5-29	1,070	trace
11-5-33	1,220	0.6
11-5-34	624	0.0
12-5-5	1,330	1.2
12-5-8	1,300	0.6
Minimum	417	0.0
Maximum	9,030	44.0
Average	1,569	6.0
Median	1,130	0.9

Hollister East

Well No.	EC	NO3
12-5-1	1,260	trace
12-5-1	901	2.5
12-5-1	966	14.3
12-5-1	1,220	0.0
12-5-1	843	0.0
12-5-12	742	0.0
12-5-12	638	0.0
12-5-12	631	3.4
12-5-12	898	18.0
12-5-12	872	trace
12-5-13	1,640	8.7
12-5-13	1,142	3.1
12-5-13	1,100	0.0
12-5-13	1,310	0.0
12-5-13	540	trace
12-5-13	7,690	trace
12-5-13	527	1.2
12-5-13	964	3.7
12-5-13	803	10.5

Hollister East (Continued)

Well No.	EC	NO3
12-5-13	1,300	4.3
12-5-13	1,545	
12-5-13	1,010	0.6
12-5-13	503	
12-5-13	874	3.7
12-5-14	1,340	4.3
12-5-14	1,510	3.7
12-5-22	1,310	3.7
12-5-22	1,280	0.0
12-5-22	1,260	3.7
12-5-22	1,250	0.0
12-5-23	1,090	7.4
12-5-23	1,080	1.2
12-5-24	1,190	4.3
12-5-24	1,055	0.0
12-5-24	1,010	trace
12-5-25	1,080	0.0
12-5-25	1,105	0.0
12-5-25	1,100	5.6

Hollister East (Continued)

Well No.	EC	NO3
12-5-26	1,030	1.9
12-5-26	1,190	1.2
12-5-26	1,030	0.0
12-5-26	1,050	trace
12-5-26	1,140	
12-5-35	1,510	
12-5-35	1,110	trace
12-5-35	1,250	1.2
12-5-35	1,040	5.0
12-5-36	1,090	6.8
12-5-36	1,340	4.3
12-5-36	1,150	2.5
12-5-36	1,160	3.7
12-5-36	1,100	3.7
12-5-36	1,100	4.3
12-5-36	1,050	1.9
12-5-36	1,060	4.3
12-6-18	1,160	9.3
12-6-18	893	3.7

Hollister East (Continued)

Well No.	EC	NO3
12-6-18	716	6.8
12-6-18	699	2.5
12-6-18	376	trace
12-6-18	386	trace
12-6-18	552	3.7
12-6-18	419	0.6
12-6-19	745	3.1
12-6-19	2,130	3.1
12-6-19	601	3.7
12-6-19	1,210	8.7
12-6-19	1,180	
12-6-19	604	3.7
12-6-19	1,280	2.5
12-6-19	959	7.4
12-6-19	584	2.5
12-6-19	1,350	0.6
12-6-19	1,000	5.6
12-6-19	888	trace
12-6-19	1,880	1.2

Hollister East (Continued)

Well No.	EC	NO3
12-6-19	861	2.5
12-6-30	2,360	1.2
12-6-30	1,500	4.3
12-6-30	1,980	33.5
12-6-30	2,280	1.9
12-6-30	2,335	2.5
12-6-30	2,530	3.7
12-6-30	2,870	2.5
12-6-6	608	
12-6-6	625	0.0
12-6-6	827	
12-6-6	884	1.9
12-6-7	822	31.0
12-6-7	446	4.3
12-6-7	394	3.4
12-6-7	819	0.0
12-6-7	543	0.6
12-6-7	1,080	2.5
13-5-1	1,360	2.5

Hollister East (Continued)

Well No.	EC	NO3
13-6-7	2,390	0.6
13-6-7	4,100	
Minimum	376	0.0
Maximum	7,690	33.5
Average	1,208	3.6
Median	1,080	2.5

NOTES:

Well numbers are approximate and indicate only the township (12 or 13), range (4, 5, or 6), and section (1 through 36) of the well location.

EC is electrical conductivity in micromhos per centimeter; NO3 is nitrate concentration in milligrams per liter as nitrate.

Table 3. Continued

Part 2: Data from the 1960's (Kilburn 1972)

Pacheco

Well No.	EC	NO3
11-5-34Q	650	
11-5-35B4	1,030	
11-5-35C	665	
11-5-36A2	668	
11-5-36M	1,250	
11-5-36M	1,320	
11-5-36P4	1,150	
11-6-31M	540	
12-5-2F1	1,660	
12-6-5M1	1,010	
12-6-6B1	648	
Minimum	540	NA
Maximum	1,660	NA
Average	963	NA
Median	1,010	NA

Bolsa Southeast

Well No.	EC	NO3
12-5-16F2	1,540	
12-5-16Q	1,290	
12-5-21A2	1,370	
Minimum	1,290	NA
Maximum	1,540	NA
Average	1,400	NA
Median	1,370	NA

San Juan

Well No.	EC	NO3
(no samples)		
Minimum	NA	NA
Maximum	NA	NA
Average	NA	NA
Median	NA	NA

Hollister West

Well No.	EC	NO3
12-5-21P1	1,260	
12-5-28G	1,500	
Minimum	1,260	NA
Maximum	1,500	NA
Average	1,380	NA
Median	1,380	NA

Hollister East

Well No.	EC	NO3
12-5-10R	1,460	
12-5-12A5	934	
12-5-12M	1,190	
12-5-12M	1,150	
12-5-12P3	1,220	
12-5-14M	1,000	
12-5-14R	1,610	
12-5-1H2	781	
12-5-1N2	1,200	
12-5-1Q2	934	
12-5-22C	1,790	
12-5-23P2	1,440	
12-5-24A4	652	
12-5-24N	1,060	
12-5-25F1	1,010	
12-5-36N	1,100	
12-5-9J1	1,280	
12-6-18G	404	
12-6-18P1	593	
12-6-30L5	2,140	
12-6-6P4	684	
12-6-7J1	459	
12-6-7P3	477	
Minimum	404	NA
Maximum	2,140	NA
Average	1,068	NA
Median	1,060	NA

Tres Pinos

Well No.	EC	NO3
(no samples)		
Minimum	NA	NA
Maximum	NA	NA
Average	NA	NA
Median	NA	NA

Bolsa

Well No.	EC	NO3
11-4-13A2	2,020	
11-4-23Q	570	
11-4-24C	904	
11-4-25H	1,240	
11-4-34G	838	
11-4-35R	1,160	
11-5-17R	735	
11-5-21K1	599	
11-5-21N	656	
11-5-28B1	593	
11-5-29R	762	
11-5-30H	1,090	
11-5-31F2	1,660	
11-5-31R	3,020	
11-5-33B2	551	
12-4-2J1	1,000	
12-4-3C2	780	
12-5-17D	1,290	
12-5-5A3	1,180	
12-5-7N3	1,040	
12-5-8B1	1,480	
Minimum	551	NA
Maximum	3,020	NA
Average	1,103	NA
Median	1,000	NA

NOTES:

Well numbers indicate the township (12 or 13), range (4, 5, or 6), section (1 through 36), and subsection (A through R) of the well location.

EC is electrical conductivity in micromhos per centimeter; NO3 is nitrate concentration in milligrams per liter as nitrate.

Table 3. Continued

Part 3: Data from 1997 (unpublished data from San Benito County Water District)

Pacheco

Parcel No./ Well No.	Meter No.	EC	NO3
16-9-18	1016	366	6.6
16-7-35	1020	378	6.6
16-2-44	1028	401	4.9
16-1-19	1049	415	6.6
16-12-8	1054	735	4.4
16-12-9	1055	952	8.9
16-13-16	1060	775	28.4
14-9-32	1193	608	3.1
14-9-32	1193	1,180	9.7
14-9-32	1194	519	5.8
14-9-8	1197	495	4.0
14-9-32A	1197	1,023	3.1
14-9-50	1198	673	5.3
14-10-2	1212	565	9.7
16-1-23	1532	601	4.0
	Minimum	366	3.1
	Maximum	1,180	28.4
	Average	646	7.4
	Median	601	5.8

Bolsa Southeast

Parcel No./ Well No.	Meter No.	EC	NO3
14-6-3	new	1,679	21.3
14-6-4	1181	2,430	9.7
14-6-4	1181	2,310	8.4
14-8-6	1185	2,570	24.8
19-1-8	1384	856	13.3
19-1-8	1397	863	4.9
14-8-1	1594	1,312	1.8
	Minimum	856	1.8
	Maximum	2,570	24.8
	Average	1,717	12.0
	Median	1,679	9.7

San Juan

Parcel No./ Well No.	Meter No.	EC	NO3
18-8-20	1234	1,238	3.5
	1237	1,372	4.4
18-9-13	1239	1,202	12.0
	1240	1,232	1.8
18-13-10	1251	1,125	12.8
18-14-8	1260	916	4.9
18-16-1	1266	847	4.0
18-16-22	1268	1,942	8.4
18-17-33	1271	990	6.6
	1277	2,380	16.4
18-10-33	1281	1,107	6.2
	1282	1,784	3.1
18-10-22	1285	1,291	5.3
18-18-4	1292	1,520	2.2
18-18-4	1294	2,170	4.4
12-2-13	1324	1,336	2.7
13-15-17	1600	845	4.0
12-5-6	1616	655	2.2
18-13-56	1629	1,546	3.5
	Minimum	655	1.8
	Maximum	2,380	16.4
	Average	1,342	5.7
	Median	1,238	4.4

Hollister West

Parcel No./ Well No.	Meter No.	EC	NO3
19-12-19	1406	1,032	7.1
19-11-1	1408	2,280	7.1
19-11-15	1410	1,436	7.1
19-10-13	1411	880	3.1
19-10-19	1412	1,426	8.9
19-11-22	1414	897	3.1
19-23-9	1419	741	3.1
19-23-9	1419	1,311	2.2
20-28-31	1440	1,650	29.2
21-10-8	1593	1,399	22.6
52-24-2	1609	1,166	3.1
20-28-19	1626	761	8.4
	Minimum	741	2.2
	Maximum	2,280	29.2
	Average	1,248	8.7
	Median	1,239	7.1

Hollister East

Parcel No./ Well No.	Meter No.	EC	NO3
17-10-46	1152	221	6.6
50-2-1	1204	1,203	8.4
53-36-11	1348	1,249	10.6
19-9-21	1349	2,230	18.6
19-9-24	1355	1,431	16.4
19-3-6	1356	834	7.1
19-5-3	1358	712	12.4
19-21-10	1372	1,012	3.1
	Minimum	221	3.1
	Maximum	2,230	18.6
	Average	1,112	10.4
	Median	1,108	9.5

Tres Pinos

Parcel No./ Well No.	Meter No.	EC	NO3
13-6-19J1		674	5.3
21-11-11	1463	1,304	11.5
25-20-46	1498	521	3.1
25-20-17	1500	970	4.9
25-20-16	1501	519	7.1
25-43-21	1511	739	8.4
25-41-2	1526	577	5.3
25-41-3	1623	1,505	6.6
	Minimum	519	3.1
	Maximum	1,505	11.5
	Average	851	6.5
	Median	707	6.0

Bolsa

Parcel No./ Well No.	Meter No.	EC	NO3
11-5-27P2	n.a.	565	8.0
	Minimum	565	8.0
	Maximum	565	8.0
	Average	565	8.0
	Median	565	8.0

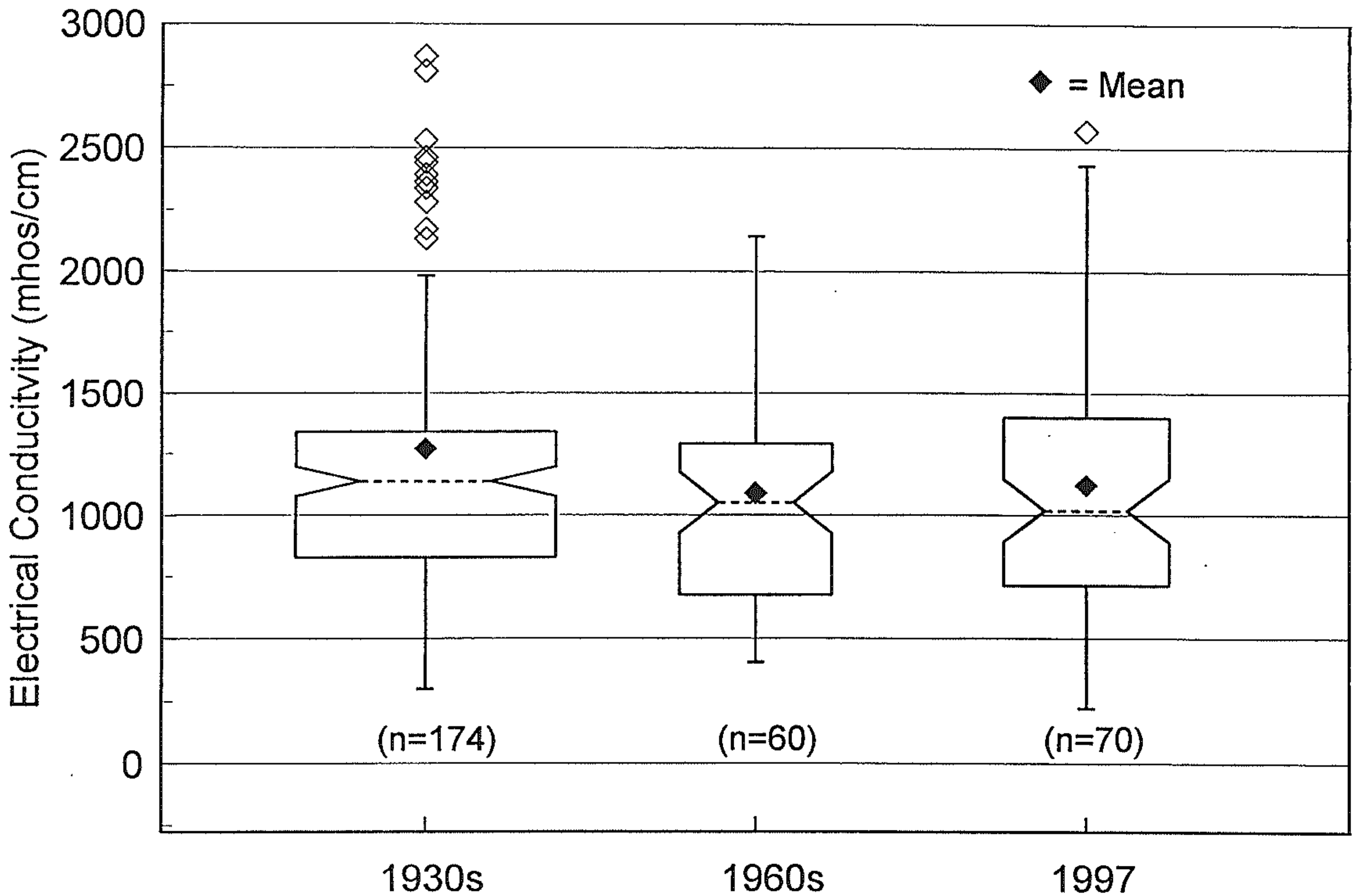
NOTES:

Well numbers indicate the township (12 or 13), range (4, 5, or 6), section (1 through 36), subsection (A through R), and sequence number (1, 2, etc.) of the well location.

Parcel numbers are San Benito County assessor's parcel numbers and indicate the parcel book, page, and lot number.

Meter numbers are numbers assigned by San Benito County Water District to wells within zone 6 (which excludes the Bolsa subbasin).

EC is electrical conductivity in micromhos per centimeter; NO3 is nitrate concentration in milligrams per liter as nitrate.



Jones & Stokes Associates, Inc.

Figure 8
Boxplots Showing Distribution of Electrical Conductivity of Groundwater Samples in the 1930s, 1960s, and 1997

individually as open diamonds. The mean is shown as a solid diamond, and the sample sizes are indicated in parenthesis.

Statistical analysis of the data was completed to determine whether the electrical conductivity of groundwater had changed significantly during the 60-year period encompassed by the data. A Shapiro-Wilk test indicated that the data are not normally distributed, even though the mean and median values are fairly similar in each data set. A nonparametric analysis of variance using the Kruskal-Wallis test revealed that the mean electrical conductivity values for the three data sets did not differ significantly from each other ($F=0.96$; $p=0.38$). Thus, the data do not reveal any significant long-term increase in groundwater salinity during the last 60 years.

The geographic distribution of samples within the basin is not the same for all three of the data sets, which might contribute to variability that obscures a long-term trend. The 1960s data included no samples from the San Juan and Tres Pinos subbasins. The number of data points is too small to rigorously investigate water quality differences among subbasins. However, a comparison of mean and median concentrations among the subbasins for each data set indicates that electrical conductivity in the Pacheco subbasin was consistently among the lowest two subbasins. The Hollister East subbasin typically ranked lower than most other subbasins. In contrast, the San Juan subbasin consistently ranked among the upper half of the subbasins.

Although historical water quality data do not reveal a long-term trend toward increasing groundwater salinity, salinity levels are already high enough to constrain municipal and irrigation use. Therefore, it is prudent to minimize any unnecessary salt loading or evaporative concentration in the basin and to encourage recharge with dilute sources of water. If salinity problems worsen, reestablishing groundwater outflow might also help minimize subsequent salinity increases.

Water softeners can indirectly increase ambient groundwater salinity because some types of softeners discharge salt to the sewer system, and municipal wastewater is used for groundwater recharge following treatment. In areas with few water softeners, municipal wastewater typically has a dissolved solids concentration 200–300 mg/l greater than the municipal supply water (Tchobanoglous and Schroeder 1985). The salt loading during municipal use in the Hollister area is much larger. A comparison of municipal supply water quality and wastewater quality at the Tres Pinos, Ridgemark, and Hollister domestic wastewater treatment plants revealed that municipal use increases the concentration of dissolved solids (salinity) by 500–1,000 mg/l (Jones & Stokes Associates 1997b).

The additional salt load of 300–700 mg/l could result from self-regenerating water softeners that discharge brine into the sewer system. Water softening is an ion-exchange process in which divalent cations (calcium and magnesium) are replaced with monovalent cations (sodium or potassium). Sodium chloride or potassium chloride are the salts typically used to provide the sodium or potassium. The average concentrations of calcium and magnesium in Hollister groundwater are approximately 67 and 63 mg/l, respectively (Walters Engineering 1996). Accounting for the differences in ion charge and molecular weight, complete softening of Hollister municipal water would require 498 mg/l of sodium chloride or 635 mg/l of potassium chloride.

These theoretical loading rates are similar to the observed excess salt loading in domestic wastewater in the Hollister area. An informal survey of local water softener service companies indicated that actual salt consumption varies considerably from house to house, depending on whether all household uses are softened and the degree of softening selected by the homeowner. One service provider reported using 16 pounds of salt per week in his 4-person household (Ray pers. comm.). Assuming a per-capita water use rate of 212 gallons per day and that 60% of this use is softened (indoor use), the salt usage rate would add 540 mg/l of dissolved solids to the household wastewater. These calculations do not prove that water softening is the only significant source of excess salt loading during municipal use, but they clearly suggest that it is a major source.

Nitrate

Nitrate concentrations exceeding the drinking water standard of 45 mg/l (as nitrate) have been found in approximately 13 wells since 1950, including two potable supply wells in 1997. A potable supply well at the Spring Grove School in the northeast corner of the Hollister East subbasin and Southside Well Number 1 operated by SCWD near the junction of the Tres Pinos, Hollister West, and Hollister East subbasins were both withdrawn from service in 1997 as a result of high nitrate concentrations (Gregg pers. comm., Miller 1997a).

Several recent efforts to investigate nitrate concentrations in groundwater have shown that:

- recent and historical nitrate concentrations are generally low, but occasionally exceed the drinking water standard;
- there is a gradual, long-term trend toward increasing nitrate concentrations; and
- high nitrate concentrations are not obviously related to a particular potential source of contamination, such as the Hollister domestic wastewater treatment plan percolation ponds.

The California Regional Water Quality Control Board (RWQCB), Central Coast Region (1995) tabulated historical water quality from 1950–1992. There are no wells at which water quality has been monitored systematically for more than a few years. As an alternative approach to identifying long-term trends, the data were grouped approximately by decade, and contour plots were prepared using all available data for each decade. Visual inspection of the plots led the regional board to conclude that nitrate concentrations had increased since the 1950s. The contour plot for the 1988–1992 period included a closed contour at 60 mg/l of nitrate (as NO_3) centered around the Hollister domestic wastewater treatment plant on the boundary between the Hollister West and San Juan subbasins. The closed contour may be an artifact of data extrapolation during the contouring process, however. The raw water quality data used to prepare the contour plots are tabulated in an appendix of the regional board report, and the only data for the treatment plant area (sections 25S/5E-28, -29, -30, and -31) are 25 measurements from 12 wells during 1961–1975. Only two measurements exceeded the drinking water standard. Both were at wells west (downgradient) of the percolation ponds, but concentrations at other downgradient wells did not exceed the standard. No data were shown for that area after 1975, and the closed contours of 30 mg/l and 60 mg/l shown in the contour plots for the 1977–1987 and 1988–1992 periods are presumably the result of incorrect data extrapolation from surrounding areas.

A separate analysis of historical groundwater quality data was completed for use in the groundwater planning process. As described in the section on "Salinity", electrical conductivity and nitrate concentration data from the 1930s, 1960s and 1997 were compiled and statistically compared. Nitrate data were available only for the data sets from the 1930s and 1997. The concentrations for both periods were not normally distributed, and the nonparametric Wilcoxon-Mann-Whitney rank sum test was used to determine whether the median nitrate concentrations were significantly different. The test revealed that the median concentration of 7.9 mg/l (as NO_3) in 1997 was significantly greater than the median concentration of 4.7 mg/l in the 1930s.

In addition to the reconnaissance survey of electrical conductivity and nitrate concentration at 66 wells throughout zone 6 in 1997, SBCWD also collected water samples from 12 domestic and irrigation wells near the boundary between the San Juan and Hollister West subbasins in 1997. Laboratory analysis of the samples found nitrate concentrations ranging from 3.6 to 170 mg/l. The median value (8.1 mg/l) was much lower than the mean value (37.1 mg/l) because of two large outliers (140 mg/l and 170 mg/l). The two wells with high nitrate concentrations were not located close to one another or closer than other wells to any known potential source of nitrate contamination.

The City of Hollister measures nitrate concentration quarterly in four monitoring wells near the domestic wastewater treatment plant percolation ponds. During 1989–1995, concentrations at Well 4 (downgradient) were sometimes higher and sometimes lower than the corresponding concentrations at Well 3 (upgradient). All measured concentrations were substantially below the drinking water standard, however, with average concentrations of 2.6 mg/l and 2.2 mg/l (as NO_3) at Wells 3 and 4, respectively. Slightly higher values (single measurements up to 21.6 mg/l) were measured during 1996 and 1997. As in prior years, the average concentration at the downgradient well was lower (7.5 mg/l) than at the upgradient well (11 mg/l). These data and the results of SBCWD's study in the same area during 1997 indicate that the domestic wastewater treatment plant percolation ponds are not an obvious point source of nitrate contamination of groundwater. Additional information regarding nitrogen removal during the treatment process is provided in the Appendix.

Trace Minerals and Organics

Agricultural use of groundwater is impaired by high boron concentrations in some areas, particularly the Pacheco and Hollister East subbasins. Boron concentrations in 60 wells in that area ranged from 0.21–9.40 mg/l, with a median value of 0.85 mg/l. Of the crops grown in that area, orchard crops are the most sensitive and can experience leaf tip burn at boron concentrations less than 1.0 mg/l (Ayers and Westcot 1976). Additional information regarding water quality standards is presented below in the section on "Water Quality Requirements for Beneficial Use".

The hardness (calcium and magnesium content) of groundwater is very high, ranging from 295–594 mg/l as calcium carbonate. Hard water accelerates corrosion of pipes and water heaters and leaves soap and salt deposits on plumbing fixtures. Residential customers generally find hardness levels greater than 180 mg/l objectionable, and most residences in northern San Benito County have water softeners.

Trace minerals that occasionally exceed secondary drinking water standards include iron, manganese, and sulfate. These minerals can stain sinks and bathtubs or give the water an unpalatable odor.

Groundwater contamination from toxic organic compounds is rare in the basin. Municipal supply wells are monitored every 3 years for a full suite of priority pollutants, which includes a large number of pesticides, fuels, solvents, metals, and other toxic pollutants. Very few priority pollutants have ever been detected, and these measurements did not exceed the maximum contaminant levels.

There are several locations in Hollister and San Juan Bautista where groundwater has been locally contaminated with hazardous compounds. A fairly large plume of trichloroethylene is moving westward from a former munitions plant on the west side of Hollister. A pump-and-treat groundwater remediation program is in operation. Leaking underground fuel tanks at gas stations have contaminated groundwater in two locations and have contaminated soils above the water table in several other locations (Packard pers. comm.).

GROUNDWATER MONITORING PROGRAMS

An ideal groundwater monitoring program would include regular measurements of groundwater levels, groundwater quality, groundwater extractions, and selected groundwater recharge flows (such as creek and wastewater percolation). SBCWD has monitored water levels in 80–100 wells located throughout the groundwater basin semiannually since 1976 and quarterly since approximately 1992. Groundwater extraction at major irrigation wells (with discharge pipes 3 inches in diameter or greater) is calculated semiannually by metering the number of hours of operation and multiplying by the average discharge rate, which is measured a few times per year using a pitot-tube device. Historically, there has been no systematic monitoring of groundwater quality in the basin. In 1997, SBCWD initiated a program of measuring nitrate concentration and electrical conductivity at major irrigation wells at the same time the well discharge rate is being measured.

Municipal water purveyors in Hollister, Tres Pinos, and San Juan Bautista measure water levels and water production at least monthly. Mineral and dissolved organic water quality at municipal wells is measured once every 3 months to once every 3 years, depending on the constituent.

Recharge from percolation of San Felipe water is measured fairly accurately by weirs at the 13 locations where water is released into creek channels during the dry season. All of the released water percolates and becomes groundwater recharge. Recharge from water released from Hernandez

Reservoir is measured with slightly less accuracy because of streamflow gains and losses along the 25-mile reach from the reservoir to the groundwater basin. The inflow to the five major municipal wastewater treatment plants is measured and provides a fairly accurate estimate of groundwater recharge from percolation of wastewater. However, flow metering devices at some of the facilities have experienced malfunctions at various times in recent years.

Recharge from natural streamflow, deep percolation of rainfall, and deep percolation of applied irrigation water are large components of the groundwater budget but are difficult to measure. These sources of recharge are not monitored and must be estimated indirectly.

Water Supply and Demand

Demand for water of adequate quality and quantity to supply beneficial uses is the ultimate reason for developing a groundwater management plan. Analysis of current demand is useful for developing water demand factors and estimating the present sustainable yield of the groundwater basin. Future demand defines the yield that the plan strives to achieve through conjunctive operation of all available water resources. Accurate quantification of future demand is also needed to define operational limitations for potential water banking agreements with external CVP water users. Also, any changes in the location or intensity of water use could alter the water balance in individual subbasins by shifting the amounts and locations of recharge and pumping.

WATER SUPPLIES AND INFRASTRUCTURE

The sources of water for agricultural, municipal, domestic, and industrial uses on lands overlying the groundwater basin are wells that draw water from the basin, imported CVP surface water purchased from the U.S. Bureau of Reclamation (Reclamation), local surface water stored in Hernandez and Paicines Reservoirs, and a minor amount of groundwater obtained from Cienega Valley, a small basin along Pescadero Creek south of Hollister.

The largest use of water is for irrigation of crops. Most of the 67,000 acres overlying the San Benito County part of the Gilroy-Hollister groundwater basin are flatlands that are cultivated to grow crops. Exceptions include urban areas around Hollister and San Juan Bautista and hilly areas in the Lomerias Muertas, Flint Hills, and along the eastern fringe of the basin. The total areas of parcels used for agricultural, domestic, and municipal purposes in each subbasin are shown in Table 4. Parcels that use imported (San Felipe) water are listed separately from parcels that use groundwater. Some areas use both San Felipe water and groundwater; therefore, the total number of irrigated acres in the service area is less than the sum of the San Felipe and groundwater areas. An analysis of SBCWD billing records cataloged by land parcel indicated that San Felipe water was used for irrigation on approximately 19,700 acres and groundwater was used on 16,300 acres in zone 6. Parcels that use both types of water are included in both totals, but parcels that are served by offsite wells are not included in either total. There are an additional 11,800 acres of cropland in the Bolsa subbasin. Cropland areas mapped by the California Department of Water Resources (DWR) in 1989 were measured separately to ascertain the completeness of SBCWD's database. A total of 25,940 acres of irrigated cropland were measured in zone 6, which approximately equals the total irrigated area in SBCWD's database. The remaining area in zone 6 consists of urban areas, nonirrigated cropland, native vegetation, and the San Benito River channel. DWR resurveyed land use in San Benito County in 1997, and digital maps of the results will be available in 1998.

Wells are distributed throughout the groundwater basin. Typically, one onsite well serves each agricultural parcel, although some wells serve multiple parcels and some large parcels have several wells. Billing records maintained by SBCWD indicate that there are 429 agricultural wells and 663 domestic, municipal, and industrial wells in zone 6, which includes all subbasins except the Bolsa subbasin. Assuming the agricultural and domestic well densities in the Bolsa subbasin are similar to the average densities for the Pacheco, Bolsa Southeast, and San Juan subbasins, there are a total of perhaps 710 irrigation wells and 870 domestic, municipal, and industrial wells in the groundwater basin. Total groundwater pumping was approximately 43,500 af during water year 1997 (Table 4) and is described in greater detail in the section on "Current Demand".

SBCWD has purchased CVP water from Reclamation every year since 1986 under the terms of a 40-year contract described in the section on "Regulatory Environment". The water is delivered to SBCWD from San Luis Reservoir (located on the eastern side of the Diablo Range, 20 miles northeast of Hollister) via the Pacheco Pumping Plant, Pacheco Tunnel, Pacheco Conduit, and Hollister Conduit, which were completed in 1986. The first three of these facilities are federally owned and collectively constitute the San Felipe Project, which serves SBCWD, Santa Clara Valley Water District (SCVWD), and Pajaro Valley Water Management Agency (PVWMA). Thus, CVP water delivered to SBCWD is referred to in this plan as San Felipe water. The Hollister Conduit is the final leg in the main supply system. It extends from the end of the Pacheco Conduit just north of the Santa Clara County line 19.5 miles to San Justo Reservoir, a reregulating reservoir located in the foothills southeast of Hollister (see Figure 6). The Hollister Conduit is a pipeline pressurized by gravity. By delivering water under pressure to the end users, the energy costs for operating sprinkler irrigation systems is greatly reduced. The Hollister Conduit and San Justo Reservoir are maintained and operated by SBCWD.

San Felipe water is delivered to individual users through a distribution system consisting of approximately 120 miles of pressurized pipeline laterals grouped into 12 subsystems (Figure 6). One or more turnouts are provided at each parcel along the laterals. The aboveground parts of the turnouts are painted blue for easy identification, and local residents often refer to San Felipe water as "blue valve" water. The distribution system reaches to most but not all parcels in zone 6. A total of 21,899 af of San Felipe water was delivered to end users for direct use during water year 1997. Except for one subdivision with an onsite treatment plant, direct use of San Felipe water is only for irrigation. Treatment is required to meet state drinking water standards and allow the water to be used for potable supply.

In addition to direct use, SBCWD releases San Felipe water to creeks at 13 locations (Figure 6) during the dry season to supplement groundwater recharge. Percolation releases during water year 1997 were approximately 11,100 af. Finally, net seepage and evaporation from San Justo Reservoir accounted for 1,100 af of San Felipe water use, which brought total use of San Felipe water during water year 1997 to approximately 34,100 af. The annual amount of San Felipe water used in San Benito County has increased substantially in the last 2 years, jumping from approximately 20,000 af/yr during 1986–1995 to more than 30,000 af/yr in 1996 and 1997.

The only major reservoirs in the watersheds on and surrounding the groundwater basin are Hernandez and Paicines Reservoirs. Hernandez Reservoir was constructed in 1961 on the San Benito River 43 miles southeast of Hollister and stores runoff from the upper San Benito River

Table 4. Subbasin Areas and Water Use During Water Year 1997

A. Area (acres)

Subbasin	San Felipe Direct Use Areas (Blue Valves) Agricultural	Domestic	Municipal	Groundwater Use Areas Agricultural	Domestic, Municipal & Industrial	Total Subbasin Area
Pacheco	4142	115	0	4241	2579	8,346
Bolsa Southeast	373	0	384	1463	565	3,122
San Juan	5003	502	169	4174	3842	11,778
Hollister West	517	39	271	1504	1493	5,727
Hollister East	8955	1701	0	3666	4867	14,649
Tres Pinos	687	497	591	1269	1562	4,716
Zone 6 subtotal	19,677	2,854	1,415	16,317	14,908	48,338
Bolsa	0	0	0	11,818	n.m.	18,565
Paicines	0	0	0	3,000	n.m.	6,876
Tres Pinos Creek Valley	0	0	0	750	n.m.	4,063
Grand total	19,677	2,854	1,415	31,885	14,908	77,842

B. Annual Water Use During Water Year 1997 (acre-feet)

Subbasin	San Felipe Direct Use Areas (Blue Valves) Agricultural	Domestic	Municipal	Groundwater Use Areas Agricultural	Domestic, Municipal & Industrial	Total Water Use
Pacheco	4,203	2	0	2,089	120	6,414
Bolsa Southeast	986	0	11	2,738	17	3,751
San Juan	5,743	8	440	8,372	1,215	15,777
Hollister West	874	0	33	3,037	4,565	8,509
Hollister East	9,100	35	0	2,971	907	13,013
Tres Pinos	156	15	295	1,214	3,406	5,086
Zone 6 subtotal	21,061	60	778	20,421	10,230	52,550
Bolsa	0	0	0	12,848	n.m.	12,848
Paicines	0	0	0	5,000	n.m.	5,000
Tres Pinos Creek Valley	0	0	0	2,300	47	2,347
Grand total	21,061	60	778	40,569	10,277	72,744

Notes:
n.m. = not measured, but much less than agricultural area and water use.

Bolsa subbasin water duty assumed to equal the average water duty for zone 6.

Most entries are significant to only two digits. All digits are retained to avoid rounding small numbers to zero and to preserve correct column totals.

watershed. The original capacity of the reservoir was 18,700 af. The capacity was resurveyed in 1997 when the reservoir was accidentally drained in 1997. Sediment accumulation in the bottom of the reservoir during 36 years of operation had decreased the reservoir capacity by 1,500 af (8%) to 17,200 af. Paicines Reservoir, with a capacity of 2,870 af, is an offstream reservoir located between the San Benito River and Tres Pinos Creek approximately 5 miles south of Tres Pinos (Figure 6). It is filled by water diverted from the San Benito River, with some of the diversions consisting of natural runoff and some consisting of "transferred" releases from Hernandez Reservoir. The stored water is released for percolation to Tres Pinos Creek and the San Benito River to provide additional groundwater recharge during the dry season. The reservoirs are owned and operated by the SBCWD under operating permits issued by DWR's Division of Safety of Dams.

SBCWD, which has jurisdiction throughout San Benito County, has formed three zones of benefit to obtain funds to support surface water management and groundwater replenishment activities. Zone 1 covers the entire county and provides the funding base for certain district administrative expenses. Zone 3 generally covers the San Benito River Valley from the Willow Creek School gaging station to San Juan Bautista and Tres Pinos Creek Valley from Paicines to the San Benito River and provides the funding base for operation of Hernandez and Paicines Reservoirs and related percolation operations. Zone 6 includes the Pacheco, Bolsa Southeast, San Juan, Hollister West, Hollister East, and Tres Pinos subbasins (Figure 1) and provides the funding base for importation and distribution of San Felipe water. Zone 6 covers a total of approximately 48,000 acres. The boundaries of zones 3 and 6 are shown in Figures 1 and 10.

SCWD, TPCWD, and the Cities of Hollister and San Juan Bautista provide potable municipal water supplies from wells. The four entities also own and operate wastewater treatment plants (see Figure 6) that dispose of treated wastewater by percolation in ponds or creeks. Percolated wastewater totaled approximately 3,400 af during water year 1997 and was one component of recharge to the groundwater basin.

WATER QUALITY REQUIREMENTS FOR BENEFICIAL USE

Drinking water quality is regulated by the California Department of Health Services. Primary drinking water standards apply to constituents that can adversely affect human health, and compliance with these standards is mandatory at all times. Secondary standards apply to constituents that affect the desirability of the water for domestic use, such as hardness, taste, and color. Water purveyors must investigate and report violations of secondary standards and take action to improve the quality of the water supply. Typical quality of groundwater in the Hollister area and San Felipe water is shown in Table 2, along with primary and secondary drinking water standards. Although municipal wells generally meet the primary standards, two public supply wells were removed from service in 1997 because of high nitrate concentrations. Nitrate contamination is clearly also a concern for rural residences served by domestic wells.

Local groundwater does not meet some of the secondary drinking water standards. The average dissolved solids concentration (683-880 mg/l reported by two recent studies) exceeds the recommended level of 500 mg/l. Iron, manganese, and sulfate also sometimes exceed the secondary standards. Hardness is not included in the drinking water standards, but a large percentage of consumers will want water softeners if hardness exceeds 180 mg/l as calcium carbonate. Local groundwater hardness greatly exceeds this threshold at 295–524 mg/l.

The constituents of greatest concern for irrigation water quality are salinity, boron, and sodium. Excessive salinity decreases the yield of all crops, but the salinity level at which this effect occurs varies substantially from crop to crop. Salt-sensitive crops grown in the Hollister area include beans, onions, peppers, and lettuce. Yield reductions in these crops can be avoided by using irrigation water with an electrical conductivity less than 1,000 μmho/cm (Richard Smith pers. comm.). SBCWD surveyed electrical conductivity at 66 wells located throughout zone 6 in 1997 and found an average value of 1,121 μmho/cm. The average conductivity of San Felipe water is 450 μmho/cm. Farmers report that some crops grow noticeably more quickly and appear healthier when grown with San Felipe water, and farmers are willing to pay a higher price for San Felipe water than for groundwater.

CURRENT DEMAND

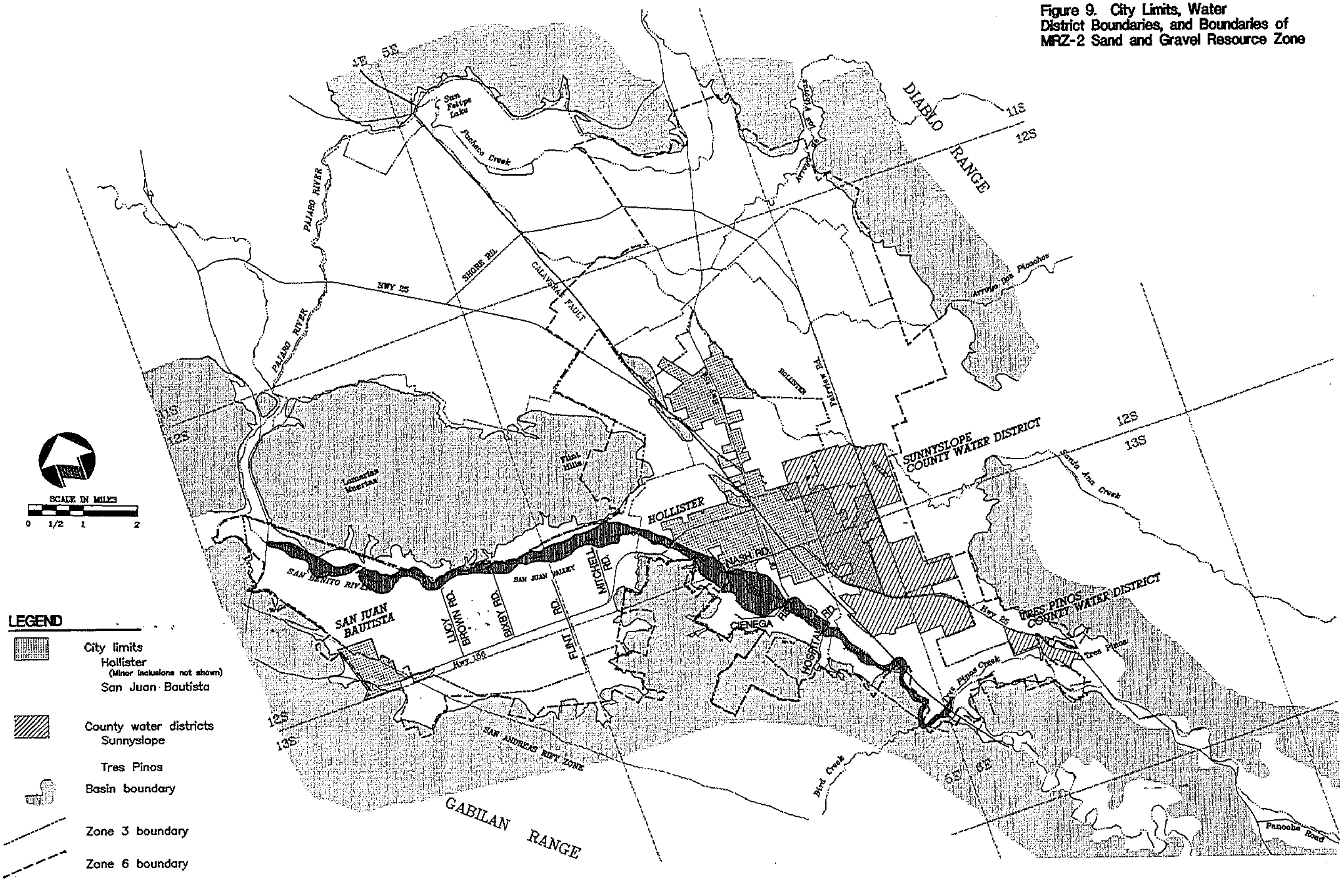
Relatively accurate estimates of agricultural, municipal, and industrial water use are available from billing records maintained by SBCWD. Unlike most rural areas in California, agricultural water use is metered in zone 6, which is the local zone of benefit for importation of San Felipe water and which covers all of the subbasins except the Bolsa subbasin (Figure 1). Groundwater users in zone 6 are charged for the amount of groundwater they pump, and SBCWD has a database of the amount of San Felipe water and groundwater used on each parcel in zone 6. Agricultural water use in the Bolsa subbasin was estimated by applying the average agricultural water use factor (water duty) to the amount of irrigated land in the Bolsa subbasin.

Agricultural

The amount of water pumped by large irrigation wells is metered by recording the number of hours of well operation and multiplying by the average discharge rate, which is periodically measured by SBCWD staff. Because the discharge rate typically fluctuates substantially as different irrigation setups are attached to the well, this metering method provides less accurate results than in-line flow meters. However, the method is probably much more accurate than water demand estimates based on regional crop water demand factors.

Agricultural water use in water year 1997 (including groundwater and San Felipe water) was approximately 41,500 af in zone 6 and 12,800 af in the Bolsa subbasin. Annual agricultural water use has fluctuated by ±20% during the last 10 years, reflecting variations in rainfall and reference evapotranspiration. There have not been large changes in cropland area in any of the subbasins during that time, and there is no indication of a long-term increase or decrease in agricultural water use.

Figure 9. City Limits, Water District Boundaries, and Boundaries of MRZ-2 Sand and Gravel Resource Zone



Agricultural water use is recorded only semi-annually, so monthly water use data are not available. However, the great majority of irrigation use occurs during the warm, dry season, which usually extends from April to October.

The average annual water demand factor for irrigation in zone 6 is 1.3–1.5 af per acre per year. This seemingly low water duty can be attributed to a large number of parcels that report no water use at all, crops that need relatively little water, efficient irrigation practices, and fallowing between crops (Jones & Stokes Associates 1997b).

Domestic, Municipal, and Industrial

Municipal water use has been increasing in recent years as a result of population growth, particularly in the Hollister area. Municipal water production in Hollister and San Juan Bautista was 7,200 af in water year 1997. Major water-using industries in the area include a cannery, a paper processing facility, golf courses, and aggregate mining operations. Water use by these industries was approximately 2,200 af in water year 1997. Domestic water use at rural residences accounted for an additional 900 af of water use. Domestic, municipal, and industrial use combined have been increasing by an average of 480 af per year during the last 10 years.

The average per capita water demand in Hollister (including the city of Hollister and SCWD service areas) during 1993–1995 was 212 gallons per capita per day (gpcd) (Walters Engineering 1996). This demand is calculated from metered water use at individual service connections and does not include losses from the main distribution system. For comparison, average water use in San Jose is 185 gpcd, and the water use factor assumed in the State Water Plan Update for urban water demand forecasting in the central coast region is 185 gpcd (California Department of Water Resources 1993).

Based on seasonal variations in municipal water use, approximately 60% of municipal water use is indoors, with 40% used for irrigation. Treatment plants processed approximately 3,400 af of municipal and industrial wastewater and percolated it for groundwater recharge during water year 1997 (Jones & Stokes Associates 1997b).

Environmental

Under natural conditions, flow in the San Benito River and the smaller creeks that cross the groundwater basin would be intermittent. In winter, rainstorms would cause brief periods of high flows separated by periods of low base flow. In summer, flow would cease in most of the channels in most years. Releases from Hernandez Dam and the San Felipe project have created nearly perennial flow in the San Benito River, especially along the reach between Cienega Road and Lucy Brown Road (see Figure 9). Similarly, releases of San Felipe water at 12 sites along the small creeks have created reaches with sustained flow in summer. Riparian vegetation such as cottonwood and willow trees and shrubs have reportedly become more abundant along the San Benito River as a result of the sustained percolation releases.

Specific instream flow levels needed to maintain aquatic and riparian habitats were not identified by the groundwater management planning group. However, several species listed as endangered or threatened under the federal or state Endangered Species Acts (ESAs) are known or expected to be present along waterways overlying the groundwater basin. The habitat needs of these species can be used as an indicator of at least part of the environmental water demand. The only listed species known to use aquatic habitats in northern San Benito County are the California red-legged frog and steelhead trout. Both were federally listed as threatened species in the last 2 years. No systematic surveys for red-legged frogs have been completed in San Benito County. A survey of creeks on the eastern side of the Santa Clara County part of the Gilroy-Hollister Valley found red-legged frogs in several of the creeks (H. T. Harvey and Associates 1997). Approximately 40 frogs were found in Tequisquita Slough near Shore Road during a pipeline repair project in December 1997, and red-legged frogs have also been found in Pacheco Creek at Highway 156, Arroyo Dos Picachos near Lone Tree Road, and in two ponds in the Ridgemark development (Myers pers. comm.). The frogs probably also inhabit other relatively permanent water bodies with vegetated shorelines, including agricultural ponds and San Felipe Lake.

Runs of steelhead trout have been documented in Pacheco Creek and Arroyo Dos Picachos, which are connected to the Pajaro River via San Felipe Lake and Miller Canal. There are no records of steelhead in Arroyo de las Viboras or Santa Ana Creek (Jerry Smith pers. comm.). Steelhead definitely spawn and rear in the Pajaro River, but their use of the San Benito River is unknown (Balance Hydrologics, Inc. 1990; Alley et al. 1990). Flow in the San Benito River may be too ephemeral or water temperatures may be too warm to allow reliable smolt emigration during March–May. Percolation releases from Hernandez Dam and the San Felipe project create nearly perennial flow along much of the San Benito River, but these releases are intentionally limited to avoid wetting the channel along the 3.5-mile reach between Lucy Brown Road and the confluence with the Pajaro River. There may be landlocked populations of steelhead in the San Benito River watershed that rarely if ever emigrate to the ocean (Alley pers. comm.).

California tiger salamander is also a listed species that might be present in moist environments in northern San Benito County, according to inventories of special-status species compiled in the San Benito County General Plan.

FUTURE DEMAND

Participants in the groundwater planning process agreed that the San Benito County General Plan and general plans for the Cities of Hollister and San Juan Bautista should be the sources for land use and population projections needed to estimate future water demands.

Agricultural

Agricultural water demand is affected by the types of crops grown, irrigation methods, and total irrigated area. There has been a gradual increase in harvested acreages of vegetable and row crops in recent years (Tognazzini 1993, 1995). Most of these crops have relatively low irrigation requirements, in part because of their short growth and maturation times. However, some of them (e.g., lettuce) are grown two or more times per year on the same field. Average irrigation efficiency has also probably improved during the last decade as a result of laser leveling of fields and more widespread use of drip irrigation and computerized irrigation demand monitoring systems. Neither of these factors has resulted in a clear trend in overall agricultural water use, however.

A change in irrigated area is the factor most likely to affect future agricultural water demands in the basin. A significant number of agricultural parcels on the valley floor were mapped by DWR as nonirrigated, and SBCWD's billing database indicated that approximately 15,000 acres of agricultural land in zone 6 (out of a total area of 48,300 acres) reported no water use in water year 1997. Some of these areas might not be suitable for irrigated agriculture because of soil type, topography, or proximity to urban areas. However, the numbers suggest that irrigation of presently nonirrigated parcels could potentially increase agricultural water demand by perhaps 20%.

A more likely cause for change in the area of irrigated cropland is urbanization. If the large increases in population expected during the next two decades result in urbanization of irrigated cropland, agricultural water demand will decrease. There has been some conversion of cropland around the perimeter of Hollister in recent years, but much of the new development has been on nonirrigated land east and south of the city center. Urbanization during 1992–1995 did not result in a discernable trend in total harvested acres (Tognazzini 1993, 1995).

The land use element of the San Benito County General Plan includes a goal of maintaining the county's rural atmosphere. Objectives associated with that and other goals include the following:

- protect prime agricultural areas in order to preserve them for present and future agricultural production vital to the county,
- direct future county growth to areas that are neither environmentally sensitive nor of substantial agricultural importance, and
- protect agriculture as a major industry in the county.

The land use map included in the general plan confirms that almost all irrigated cropland is intended to remain in its current use. Some exceptions include urbanization along the Highway 156 corridor north of Hollister and additional development along the urban fringe south of McCloskey Road. If the Board of Supervisors adheres to the goals, objectives, and maps in the current general plan, the area of irrigated cropland will decrease only slightly by 2010. However, developers continue to propose major urban developments on agricultural land and request amendments to the general plan to accommodate their proposals. For example, a proposal to develop the River Ranch project was submitted in December 1997 (Miller 1997b). The project would develop 8,000 housing units on 3,468 acres of agricultural land in the Bolsa subbasin.

None of the aforementioned trends or factors indicates that agricultural water demand is likely to change substantially within the next two decades. For the purpose of this groundwater management plan, it is reasonable to assume that agricultural water demand will remain at its present level.

Domestic, Municipal, and Industrial

The population of San Benito County doubled between 1970 and 1990 to reach a population of 37,000 residents. The growth rate during the 1980s greatly exceeded the growth rate in neighboring counties and in the State of California overall. The City of Hollister general plan projects a population of 38,000 people in the Hollister area by 2010, and unincorporated areas are expected to reach a population of approximately 29,000 people. These estimates reflect assumed growth rates of 34–46% per decade. In 1996, total water consumption for residential, commercial, and industrial uses in the Hollister area was expected to increase from 6,100 to 10,100 af (i.e., 67%) between 1997 and 2010 (Walters Engineering 1996). These estimates are for water consumption at the point of use and do not include leaks from the distribution system, which are included in the water production data cited earlier in this report. Rural domestic water use is expected to increase by a proportion similar to the increase in Hollister, which would result in a water demand of approximately 1,500 af in 2010. Population growth in San Juan Bautista has historically been much slower than in Hollister, but there have been several proposals for major new residential developments outside of either of the existing cities. Industrial water use in Hollister and rural areas is not expected to increase substantially. A rough estimate of urban water demand in 2010 can be obtained by multiplying the total population by the present average per capita water use, which results in an estimated demand of 15,900 af/yr. Per capita urban water demand would probably decrease in the future if water conservation programs recommended in this plan are implemented and if municipal water rates are increased to finance construction of a water treatment plant.

Environmental

Specific water requirements for aquatic, riparian, and wetland habitats in the groundwater basin area are not known at this time because habitat protection needs have not been identified. Phreatophytic vegetation along stream channels often suffers drought stress or mortality if surface flow is interrupted for a month or more in summer. In areas where the water table is shallow (i.e., within 10–15 feet of the land surface), mature riparian shrubs and trees can usually withstand extended periods without streamflow. In northern San Benito County, water management activities have generally increased the duration of streamflow by releasing San Felipe or Hernandez water to creek and river channels for percolation. Also, importation of San Felipe water since 1986 has tended to raise groundwater levels, which benefits phreatophytic vegetation where the elevated water table is near the ground surface. Under conjunctive use operation, percolation releases and water tables would both tend to fluctuate over periods of years, with abundant streamflow and relatively high groundwater levels during wet periods and intermittent streamflow and relatively low groundwater levels during droughts. These alternating conditions could cause fluctuations in the extent and vigor of riparian vegetation.

RELIABILITY AND SUSTAINABILITY

All water supply projects are potentially vulnerable to interruptions in deliveries caused by natural variations in hydrologic conditions, infrastructure damage or malfunction, or changes in regulations. Evaluations of water supply system reliability typically address variations in hydrologic conditions (e.g., droughts) and infrastructure malfunction (e.g., maintenance and repairs, pumps, or pipelines). These types of potential interruptions in supply can often be solved through engineering measures, such as back-up pumps and additional storage capacity.

Interruptions in supply because of changes in regulations are more difficult to predict and challenging to accommodate. The State Water Resources Control Board, for example, typically retains continuing jurisdiction over surface water rights and can alter the quantity of water authorized for diversion even for water rights that have been licensed for decades. For example, the water right held by the Los Angeles Department of Water and Power to divert water from the Mono Lake basin and Monterey Peninsula Water Management District's right to pump groundwater from the Carmel Valley were both significantly decreased in recent years. Listing of aquatic species under the federal or state Endangered Species Act can similarly affect the legal availability of water even if the user holds a valid water right. SBCWD and other CVP contractors face a decrease in long-term availability of water from the Sacramento-San Joaquin Delta as a result of endangered species listings.

Regulatory decreases in water supply can also affect local water supplies. For example, Hernandez and Paicines Reservoirs are operated under water rights permits from the State Water Resources Control Board, and the dams must meet structural integrity and maintenance standards of the California Division of Safety of Dams. Unforseen changes in policy by these agencies could potentially restrict the yield of the reservoirs.

Sustainability refers to the local balance between water supply and demand. Increased reliance on imported water decreases the sustainability of the uses dependent on that supply because they are relying on a source that is intrinsically at greater risk of interruption than a local supply. It is prudent to consider the potential consequences of losing a supply of water for an extended period of time. For example, if San Felipe water were to become completely unavailable for a period of years, San Benito County would once again need to rely entirely on its own local water resources. Groundwater storage could sustain demand for a limited period of time, as it did before 1986, but long-term overdraft would resume. The total cumulative overdraft between 1913 and 1977, which was probably the year of maximum cumulative overdraft, was approximately 308,000 af. Approximately half of the cumulative overdraft has recovered since 1977. The expected average annual overdraft without San Felipe water is also the minimum amount of San Felipe water that needs to be imported to prevent overdraft, which has been estimated in previous water resources investigations to be 3,500–16,000 af/yr (U.S. Bureau of Reclamation 1972, Luhdorff and Scalmanini Consulting Engineers 1991). At this rate of overdraft, basin storage would decline to the 1977 level in 9–43 years.

If San Felipe water were to become permanently unavailable for some unforseen reason, the local water supply deficit could be eliminated by development of additional surface water storage, water conservation, or by decreasing local demand. Significant decreases in local demand could probably be achieved only through decreases in irrigated acreage or conversion to crops that have lower water duties.

Regulatory Environment

Management of water resources in San Benito County is influenced or constrained by the programs and regulations of numerous federal, state, and local agencies. This section describes agencies, programs, and regulations that affect current water management or could affect implementation of groundwater management actions recommended in this plan. Many of the agencies also provide funding or technical assistance that could facilitate implementation of management actions. These programs are described in the section on "Plan Implementation".

FEDERAL AGENCIES

Federal agencies that are actively involved in San Benito County water resource issues include Reclamation, the U.S. Army Corps of Engineers (Corps), the Environmental Protection Agency (EPA), the U.S. Fish and Wildlife Service (USFWS), the U.S. Natural Resources Conservation Service (NRCS), and the Monterey Bay National Marine Sanctuary (MBNMS).

U. S. Bureau of Reclamation

Reclamation owns and operates CVP, of which the San Felipe Project is a unit. The San Felipe Project consists of facilities that convey water from San Luis Reservoir in the Central Valley to SCVWD, Pajaro Valley Water Management District, and SBCWD. SBCWD obtains San Felipe water from Reclamation under a 40-year contract. Although the contract was signed in 1978, the 40-year delivery period began on the first year of actual water delivery, which was 1986. The contract specifies minimum and maximum amounts and timing of delivery of San Felipe water to SBCWD and the methods for calculating water rates. The maximum delivery under the contract is 43,800 af/yr, consisting of 8,250 af of municipal and industrial water and 35,550 af of agricultural water (which includes system losses). It also includes a schedule of minimum annual purchases of water at municipal and industrial rates that increases from 1,020 af to 8,250 af over the 40-year term of the contract. Water rates are adjusted every 5 years. The contract requires that SBCWD meter water deliveries to individual customers at a level of accuracy to be specified by Reclamation. An accuracy level has not been specified for this particular contract, but Reclamation has required a measurement accuracy of +/- 6% in similar situations. The contract allows for exchanges of water with other CVP contractors and wheeling of non-CVP water if excess conveyance capacity is available. SBCWD is responsible for operating and maintaining the Hollister Conduit and San Justo Reservoir, and SBCWD must maintain an emergency reserve fund of at least $250,000.

In response to legislation passed since 1978, Reclamation has imposed additional requirements on its contractors. The Reclamation Reform Act of 1986 increased the maximum acreage that individual contractors may hold and still qualify for water rates that do not include interest payments. The Central Valley Project Improvement Act of 1992 (CVPIA or Public Law 102-575) imposed additional fees to pay for environmental restoration activities by Reclamation to offset impacts associated with CVP construction and operation. CVPIA also established water conservation requirements for CVP contractors. In practice, these requirements are essentially the same as water conservation requirements for municipal and agricultural users developed through statewide multiagency memoranda of understanding (see Issue 8 under "Elements of the Groundwater Management Plan").

U.S. Army Corps of Engineers

The Corps has primary authority for flood protection along major streams and waterways. The floodplain of the San Benito River has been mapped and is largely undeveloped. Flood damage along the river in San Benito County has historically been small compared to flood damage near Watsonville, farther downstream along the lower Pajaro River. Although the San Benito River is the largest tributary to the Pajaro River, the Corps does not presently have plans for any dams or channel modifications along the San Benito River to improve downstream flood control. Instead, their efforts are focused on modifications to Salsipuedes and Corallitos Creeks, both of which are Pajaro River tributaries near Watsonville and within the boundaries of the federal flood control project for that area (Hernandez pers. comm.).

The Corps also has jurisdiction over wetlands. A Clean Water Act Section 404 permit is required for any activity that results in excavation or fill of waters of the United States, which includes wetlands (e.g., swamps, marshes, and vernal pools), creeks, and rivers. Filling of stream channels is regulated up to the "ordinary high water mark", which has been defined for arid climates as the water line corresponding to the flow exceeded 50% of the time. Artificial flow generated by releases of San Felipe water is not included in the flow-duration analysis. Some of the smaller creeks (e.g., Arroyo de las Viboras, Arroyo Dos Picachos, and Santa Ana Creek) would probably flow less than 50% of the time under natural conditions and would not be considered waters of the United States. More detailed analysis of streamflow records would be necessary to determine whether some reaches of the larger creeks and San Benito River might be excluded from the definition of waters of the United States. SBCWD has a Section 404 permit for installing seasonal percolation berms in the bed of the San Benito River. The permit is valid until 2000.

Normal farming practices are exempt from Section 404 regulations, and nationwide permits with simplified application procedures are available for projects that would fill small isolated water bodies. With the exception of constructing reservoirs in the foothills, none of the groundwater management actions considered in this plan would result in filling of wetlands.

U.S. Environmental Protection Agency

EPA is the federal agency responsible for protecting water quality and regulating hazardous materials that could contaminate water bodies. In California, state water quality regulations are at least as stringent as the federal regulations, and authority to implement federal regulations has been granted to various state agencies by EPA. Drinking water standards are an example of this type of transfer of authority for implementation.

The 1996 Safe Drinking Water Act amendments required EPA to develop and implement a source water protection program. Details of the program have not been finalized, but it will generally require that tributary areas for surface and groundwater supplies be identified and all sources of pollution within those areas be inventoried. After evaluating the susceptibility of potable supply wells and stream diversions to contamination from those sources, actions would be developed to minimize the risk of public exposure to contamination. The California Department of Health Services is developing a state program to implement the federal requirements by 1999 (Walker pers. comm.)

EPA also requires cities with populations greater than 50,000 to develop and implement a Stormwater Pollution Prevention Plan that identifies and implements best management practices (BMPs) to minimize nonpoint source pollution from urban runoff. The population of Hollister is not expected to exceed 50,000 until after 2010.

U. S. Fish and Wildlife Service

USFWS is responsible for implementing the federal ESA and usually comments on environmental documentation and permit applications for major water facilities. The relatively recent listings of steelhead trout and red-legged frogs as threatened species may result in increased involvement of USFWS in local water management activities.

U.S. Natural Resources Conservation Service

NRCS is part of the Department of Agriculture and has an office in Hollister. NRCS offers technical assistance to agencies and farmers for implementing more effective and efficient irrigation and land and conservation practices. The agency provides grant funds but does not enforce regulations. Programs administered by NRCS include the Environmental Quality Incentives Program (EQIP), which supplements the former Conservation Reserve Program and provides technical assistance and grants for a variety of agricultural and habitat management practices.

Monterey Bay National Marine Sanctuary

MBNMS is a region of coastal waters extending from near Half Moon Bay to near San Luis Obispo where water quality and ecological health are among the highest management priorities. A Water Quality Protection Program has been established within MBNMS that seeks to work cooperatively with state and local resource agencies and interest groups to minimize the amount of pollution that enters the sanctuary from terrestrial sources. The program has recognized the importance of nonpoint source pollution and is now developing education, assistance, and incentive programs to encourage farmers to adopt management practices that minimize nonpoint source pollution (Price and Starr 1997).

CALFED

The CALFED Bay-Delta Program (CALFED) is a consortium of federal and state agencies with responsibilities for water and habitat management in the San Francisco Bay/Sacramento-San Joaquin Delta estuary. The participating federal agencies are EPA, USFWS, Reclamation, and the National Marine Fisheries Service. The participating state agencies are the California Department of Fish and Game (DFG), DWR, and the State Water Resources Control Board (SWRCB). CALFED was established in May 1995 to implement the Bay-Delta Program, which was one of three elements of the Bay-Delta Accord signed in December 1994 by state and federal agencies after years of negotiation among agricultural, urban, and environmental water interests. The Bay-Delta Program has developed a short list of alternative sets of measures to address water quality, water supply, and habitat issues in the Bay-Delta. All of the alternatives include conjunctive use as a tool for increasing developed water supplies and operational flexibility in the CVP and State Water Project systems. The groundwater basin in northern San Benito County could potentially provide needed groundwater storage capacity for statewide conjunctive use operations. Also, the CALFED process could result in decreased availability of San Felipe water as a result of restrictions on CVP diversions from the Bay-Delta.

STATE AGENCIES

State agencies that have regulatory oversight or other programs related to water resources in San Benito County include SWRCB, RWQCB, DWR, DFG, and the California Department of Health Services (CDHS).

State Water Resources Control Board

SWRCB is responsible for protecting the state's water quality and administering water rights. The Porter-Cologne Water Quality Control Act assigns overall responsibility for water quality protection to the SWRCB and directs each of the nine RWQCBs to establish and enforce water quality standards within their respective boundaries. The authority to regulate and protect water quality extends to surface water, groundwater, and coastal waters.

The SWRCB issues appropriative water rights permits to users of surface water. Riparian water rights and rights to use groundwater stem directly from the California Constitution and common law and are not included in the permitting system. However, SWRCB retains the authority to regulate groundwater use or adjudicate groundwater rights to protect groundwater quality. The Division of Water Rights may initiate court actions (usually in cases of clearly unlawful uses of water), but more often is asked to investigate as a referee in cases referred by the Superior Court. Under this procedure, all water rights may be included.

Most of the water used in San Benito County is groundwater or imported water purchased from Reclamation. Consequently, SWRCB has not been very active in water resources issues in the County. One exception is the adjudication of water rights in the Cienega Valley along Pescadero Creek approximately 8 miles southeast of Hollister in 1985. The City of Hollister has two relatively old wells in the Cienega Valley that produce a small percentage of the city's total water supply.

Regional Water Quality Control Board

San Benito County is within the area administered by the Central Coast RWQCB, located in San Luis Obispo. Every 3 years, the RWQCB updates its basin plan, which describes existing water quality and beneficial uses of surface water and groundwater bodies in the region. If existing water quality does not meet requirements for some or all of the beneficial uses (see the section above on "Water Quality Requirements for Beneficial Use"), this deficiency is noted.

The RWQCB issues permits for waste discharges to land or surface waters pursuant to the Porter-Cologne Water Quality Control Act. These discharges are subject to Waste Discharge Requirements (WDRs), which are terms and conditions regarding discharge rates and timing, treatment levels, water quality monitoring, and reporting. The RWQCB also administers the National Pollution Discharge Elimination System (NPDES) program and incorporates NPDES requirements into state WDRs for discharges to surface water. Although WDRs for different wastewater treatment plants are usually similar to one another, permit conditions are often tailored on a case-by-case basis to reflect the treatment process and threat to water quality posed by each discharger (Kukol pers comm.).

Nonpoint source pollution is currently receiving active emphasis in the RWQCB's pollution control activities. Generally, the RWQCB has been following a strategy of developing BMPs for various types of land use and working with local agencies to encourage their implementation. In some cases, such as when developers seek County permits for new developments, the RWQCB may recommend that implementation of various BMPs to protect water quality be included as permit requirements. The RWQCB administers implementation of Stormwater Pollution Prevention Plans on behalf of EPA.

California Department of Water Resources

DWR is part of the state Resources Agency and is responsible for overall state policy regarding water resources. DWR is given authority to investigate and monitor water resources in the state, construct and manage water development projects such as the State Water Project, administer the State Water Plan, provide permit approval and inspection of dams, and conduct surveys and investigations relating to the reclamation of water from waste for beneficial purposes.

DWR is charged with statewide interagency coordination on water policy and technical aspects of water management. DWR evaluates and helps implement solutions to regional water resources management problems and has been actively promoting development of voluntary local groundwater management plans. DWR maintains a statewide water quality and quantity measurement program in the Water Data Information System. DWR coordinates closely with the RWQCBs on water quality issues. DWR does not presently have any programs or activities specifically directed toward San Benito County, but DWR's Division of Safety of Dams would have to approve any new reservoirs that might be proposed pursuant to this plan. Small impoundments with a capacity of 15 af or less or a dam height of 6 feet or less are not regulated by the Division of Safety of Dams (California Water Code Division 3, Sections 6000-6470). Also, dams up to 25 feet high are not regulated as long as the capacity is less than 50 af.

California Department of Fish and Game

DFG manages fish and wildlife and their habitats statewide. DFG is also the lead agency for implementing the California ESA, for which it coordinates closely with USFWS. DFG also commonly reviews environmental documents for major development projects and encourages the lead agency to require mitigation measures or permit restrictions that minimize adverse impacts on natural habitats.

DFG also issues Streambed Alteration Agreements, which are required for any activity that will divert or obstruct the natural flow or change the bed, channel, or bank of a river or stream, or proposes to use any material from a streambed. After reviewing a permit application, DFG will negotiate a Streambed Alteration Agreement that is designed to protect and conserve fish and wildlife resources. DFG interprets its jurisdiction to include any work within the 100-year floodplain of a stream. DFG cannot refuse to issue an agreement, but the landowner may request the involvement of an arbitrator if an impasse is reached while negotiating the terms of the agreement. The intent of the program is not to prevent landowners from undertaking essential activities to maintain flood conveyance capacity in a channel, for example, but rather to work with the landowner to perform the activities in a way that minimizes adverse effects on habitat. SBCWD has a Streambed Alteration Agreement for installing seasonal percolation berms at approximately 12 sites along the bed of the San Benito River.

California Department of Health Services

CDHS administers federal and state drinking water standards and implements regulations to protect potable water supplies. All public water suppliers must operate in accordance with primary and secondary drinking water standards specified in Title 22 of the California Environmental Health Code. Title 22 also requires water purveyors to monitor water quality, report the results to CDHS, and notify consumers if any constituent fails to meet the standards. CDHS has also developed guidelines for groundwater recharge with reclaimed water that specify horizontal and vertical setbacks from potable supply wells and the water table, dilution ratios, and subsurface residence times for percolated wastewater of various levels of treatment.

LOCAL AGENCIES

Numerous city, county, and regional agencies are engaged in activities related to water resources in San Benito County. These agencies include the Cities of Hollister and San Juan Bautista, county water districts (Tres Pinos, Sunnyslope, Pacheco Pass, and Aromas), SBCWD, San Benito County, the Association of Monterey Bay Area Governments (AMBAG), and Monterey Bay Unified Air Pollution Control District (MBUAPCD). Local agencies in adjoining counties whose activities may affect water resources in San Benito County include SCVWD, PVWMA, and Monterey County Water Resources Agency.

Cities of Hollister and San Juan Bautista

Hollister and San Juan Bautista are the only incorporated municipalities overlying the San Benito County part of the groundwater basin. The city limits of the two cities are shown in Figure 10. These municipalities regulate land use within the city limits; operate municipal water supply wells and distribute the water to residential, commercial, and industrial users; and operate sewer systems and wastewater treatment plants. The municipalities also operate stormwater management facilities and usually require developers to install those facilities when new urban development is constructed.

The City of Hollister, SBCWD, and SCWD are jointly preparing an urban water management plan to meet the requirements of California Water Code Section 10620 et seq., which calls for identification and implementation of all cost-effective urban water conservation measures and development of an urban water shortage contingency plan.

County Water Districts

County water districts near or overlying the groundwater basin include Sunnyslope County Water District, TPCWD, Aromas Water District, and Pacheco Pass County Water District. The service area boundaries of the overlying districts are indicated in Figure 9. These districts are formed with authorities granted under Division 12 (Section 30000 et seq.) of the California Water Code. They are governed by an elected board of directors and have the authority to issue revenue bonds, certificates of participation, and assessment bonds; impose property taxes; and charge user fees to fund the construction, operation, and maintenance of water supply and wastewater facilities.

San Benito County Water District

SBCWD was formed in 1953 by special state legislation that is now Appendix 70 of the California Water Code. SBCWD's boundaries are the boundaries of San Benito County. The District is governed by an elected board of directors and has the authority to form zones of benefit, impose property taxes, and charge user fees to fund the construction, operation, and maintenance of water supply projects that benefit landowners within the zone. Presently, there are three zones of benefit, the boundaries of which are shown in Figure 9. Zone 1 includes the entire county. Zone 3 includes lands along the San Benito River and is the zone of benefit for percolation releases from Hernandez Reservoir. The reservoir was constructed with funds obtained from zone 3 landowners. Property taxes are levied in zone 3, but there are no user fees for water users within the zone. Zone 6 includes all of the subbasins of the groundwater basin except the Bolsa subbasin. It is the zone of benefit for San Felipe water users within SBCWD. Property taxes and water charges are used to pay for construction, operation, and maintenance of water distribution facilities and purchases of San Felipe water from Reclamation.

San Benito County

San Benito County regulates land use in unincorporated areas within San Benito County. It is governed by the Board of Supervisors, which issues use permits for land development projects, gravel mining, landfills, and other activities that indirectly affect water resources. The county general plan includes goals and objectives to protect and conserve water resources. Individual ordinances and policies affecting water resources management include:

- Water conservation plan. Adopted in July 1992, the plan sets minimum standards for low-flow plumbing and water-conserving landscaping. The standards are similar in some respects to current statewide water conservation criteria, but they are not identical.

- Groundwater ordinance. This ordinance requires a permit for exporting groundwater from San Benito County or operating groundwater recharge facilities. It also establishes well spacing standards to minimize pumping interference between wells.

- Floodplain ordinance. Based on a model ordinance drafted by the Federal Emergency Management Agency (FEMA), this ordinance prohibits the subdivision of parcels in any designated 100-year floodplain. Construction on existing parcels may not elevate flood levels by more than 1 foot anywhere in the floodplain mapped by FEMA.

- Grading and erosion control ordinance. This ordinance is designed to protect water quality from erosion caused by poor land grading practices. It is presently being revised to address more general stormwater drainage issues.

- Stormwater detention policy. The county requires new developments to include stormwater detention facilities of sufficient capacity to prevent any increase in peak 100-year runoff from the developed property.

Association of Monterey Bay Area Governments

AMBAG is a voluntary association of local government agencies in Santa Cruz, San Benito, and Monterey Counties. It serves as a forum for discussing and making recommendations on regionally significant issues. In addition to general planning and census activities, AMBAG takes a lead role in regional transportation planning and nonpoint source water pollution control. AMBAG recently initiated development of a water quality management plan for the Pajaro River watershed. The scope of this planning effort includes collection of water quality and land use data throughout the watershed, investigation of nonpoint source contamination of surface waters, recommendation of BMPs to minimize pollutants of concern, and preparation of an implementation plan for those practices (Barron pers. comm.).

Monterey Bay Unified Air Pollution Control District

MBUAPCD issues mandatory permits for operation of domestic and industrial wastewater treatment plants. Although wastewater treatment plants can create minor odor problems, the principal reason for these permits is to ensure that urban development and its associated air pollution problems do not increase faster than the rate designated in county and city general plans and locally adopted air quality plans. Rule 216 requires new or modified wastewater treatment facilities to provide current and projected future population estimates in the service area. This information is forwarded to AMBAG for a determination of consistency with population projections in the locally adopted air quality plan.

Local Agencies in Adjoining Areas

SCVWD adjoins SBCWD to the northwest along the Pajaro River. It is also a member of the San Felipe Project and receives CVP water from Reclamation. In the past, SCVWD has entered into short-term water exchange and storage agreements with SBCWD. PVWMA manages surface and groundwater resources along the Pajaro River downstream of the Gilroy-Hollister groundwater basin. PVWMA is the third member agency of the San Felipe Project but has never taken delivery of its allocation of San Felipe water. Pursuant to a basin management plan adopted in 1994, PVWMA is proceeding with construction of a pipeline to enable San Felipe water to be delivered to PVWMA.

CALIFORNIA ENVIRONMENTAL QUALITY ACT

In addition to the regulations administered by specific agencies described above, management actions considered in this plan may require environmental review under the California Environmental Quality Act (CEQA). CEQA requires state and local government agencies to consider the environmental consequences of projects over which they have discretionary authority before taking action on those projects (Pub. Resources Code 21000 et seq.). These include projects implemented directly by an agency as well as issuance of permits and provision of funding for projects implemented by others. If state or local permits or funding are not required for a project, CEQA review is not needed.

Selected activities are exempt from CEQA review, as described in Article 19 of the State CEQA Guidelines, Sections 15300 through 15329. Examples of activities that are exempt from CEQA review and could include some groundwater management actions are:

- normal agricultural practices on private land,
- minor alterations to land,
- feasibility or planning studies, and
- educational or training programs involving no physical changes.

Changes in tillage and grazing practices would be exempt from CEQA review, as would be construction of tailwater ponds. Educational programs related to salinity and nitrates and investigations of nitrate contamination and salt balance would also be exempt from review. Installation of the drains could require county approval and CEQA review if new cropland would be brought into production.

CEQA allows a tiered approach to environmental review. A program environmental impact report (EIR) may be completed on a resources management plan such as this one that includes a variety of projects or actions. The program EIR would evaluate the individual and cumulative environmental impacts of those projects and actions to the extent that the project descriptions and locations can be defined in advance. When a specific project is proposed pursuant to this plan, no further environmental document is required if the lead agency for the program EIR finds that all project-specific impacts were adequately described in the program EIR and that no new impacts would occur or no new mitigation measures would be required. Ordinarily, project EIRs are prepared to address detailed or project-specific impacts not discussed in the program EIR. Often these relate to localized impacts at the project site, such as the presence of an endangered species at the site. State CEQA Guidelines recommend that the lead agency use a written checklist or similar device to document the evaluation of the site and the activity to determine whether the environmental effects of the activity were covered in the program EIR (Section 15168[c][4]).

Elements of the Groundwater Management Plan

OVERVIEW OF GROUNDWATER MANAGEMENT ISSUES AND ACTIONS

Importation of San Felipe water has changed the relative importance of various groundwater problems in northern San Benito County. Annual average groundwater budgets in many subbasins have become positive, and groundwater overdraft has ceased to be the overriding problem. In fact, problems associated with shallow groundwater levels have already begun to appear in some areas. The challenge now is to develop a monitoring program and set of management tools for ongoing adjustments to groundwater budgets in individual subbasins to avoid problems associated with excessively high or low groundwater levels.

Groundwater quality has also become a key issue, especially with recent increases in the amount of cropland devoted to high-value vegetable crops with low salinity tolerance. Because of the substantial differences in water quality between groundwater and San Felipe water, water quality issues and water quantity issues are inextricably linked.

The groundwater management planning group considered the following groundwater management issues to be of highest priority for immediate management action:

1. Poor groundwater quality and long-term salt buildup in the groundwater basin.
2. Rising groundwater levels and drainage problems in the San Juan and Pacheco subbasins.
3. Competition for limited percolation capacity in the upper end of the San Juan Valley.
4. Long-term nitrate buildup in the groundwater basin.
5. Future increases in water demand.
6. Residual overdraft in the Hollister West and Bolsa Southeast subbasins.
7. Coordination of land use and water supply planning.
8. Water conservation.
9. Information management.

Many of these issues are interrelated, and management actions taken to address one issue may also address other issues. All issues except Issue 6 were found to warrant implementation of specific groundwater management actions. Each of the groundwater management problems is described in the following sections along with a prioritized list of actions that could minimize or eliminate the problem. The main text of this plan includes only brief descriptions of the management actions. Additional details regarding objectives, design characteristics, costs, potential impacts, and status of each potential action are presented in the Appendix.

OVERALL GOAL AND SPECIFIC OBJECTIVES FOR GROUNDWATER MANAGEMENT

An overall goal and specific objectives for groundwater management were formulated by the groundwater planning group as the first step in the planning process. The overall goal for groundwater management is a qualitative statement that describes the desired condition of groundwater resources in northern San Benito County, while recognizing their importance as a major component of overall water resources. The goal is:

> To manage groundwater resources to help achieve a water supply that is adequate in quantity and quality for present and future water users in San Benito County in a manner that is efficient, cooperative, economical, and environmentally sound.

Groundwater management objectives are statements that provide quantitative targets for specific aspects of groundwater resources management and are consistent with the overall goal. Objectives for water supply, water quality, land use planning, and information management are listed below.

Water Supply

1. Avoid long-term overdraft in all subbasins by achieving a balanced long-term groundwater budget.

2. Create a water supply sufficient to meet present and projected future demand for agricultural, domestic, municipal, industrial, and environmental uses.

3. Integrate groundwater management with operation of the San Benito River system and San Felipe imports to achieve the overall yield and quality objectives for water supplies.

4. Include overall conjunctive use as a tool for increasing the yield of the groundwater basin.

5. Maintain and enhance groundwater recharge from rainfall and streamflow.

6. Maximize groundwater recharge rate capacity, within affordability constraints.

7. Provide water supplies adequate in quantity and quality for all reasonable, beneficial uses at the lowest possible cost.

8. Create a distribution system or systems for various sources of water (e.g., raw San Felipe water, treated San Felipe water, groundwater, reclaimed water) so that water balance and water quality objectives can be met in all subbasins.

9. Create sufficient recharge capacity, direct-use demand, or storage to receive the entire San Felipe entitlement at the times and delivery rates at which Reclamation makes the water available.

10. Avoid groundwater levels that are low enough to cause significant decreases in well yields, adverse changes in well water quality, or unaffordable pumping costs.

11. Avoid or correct groundwater levels that are high enough to adversely affect crop growth, structures, or wastewater percolation operations or to create a public nuisance.

12. Maximize interagency cooperation in planning development and managing water supplies.

13. Implement municipal and agricultural water conservation measures appropriate for conditions in San Benito County.

Water Quality

14. Provide a source of municipal water supply that meets primary and secondary drinking water standards, is palatable, and is reasonably priced when all costs and benefits are considered (including extended life of plumbing, appliances, and clothing; decreased detergent use; avoided water softener costs; and decreased wastewater treatment costs).

15. Prevent accidental contamination of groundwater from spills, leaky petrochemical or septic tanks and pipes, abandoned wells, or poorly-sealed wellheads.

16. Prevent groundwater contamination from confined animal feeding operations.

17. Prevent groundwater contamination from infiltrated stormwater runoff containing agricultural chemicals or urban pollutants.

18. Minimize long-term increases in dissolved solids concentration in the groundwater basin.

19. Prevent groundwater contamination from percolated septic system or municipal wastewater.

20. Prevent or correct groundwater contamination from commercial or industrial facilities.

Land Use Planning

21. Maximize cropland preservation in accordance with adopted general plans.

22. Minimize controversy in water resources and land use planning processes by establishing standard interagency procedures for evaluating long-term and short-term water supply availability.

Information Management

23. Collect and maintain measurements of groundwater levels, quality, and use with sufficient frequency and geographic distribution to support sound groundwater management decisions.

24. Maximize interagency cooperation and efficiency in data collection and data management activities.

Other Management Activities

25. Establish and maintain cooperative relationships with water agencies in neighboring areas whose activities could affect or be affected by this groundwater management plan.

26. To the extent feasible, avoid significant adverse impacts on water supply or water quality in areas adjoining or downstream of the management plan area.

27. Maximize efficient use of the groundwater basin by encouraging well spacing and operation that minimize well interference.

CRITERIA FOR SELECTING GROUNDWATER MANAGEMENT ACTIONS

Numerous specific actions could potentially address any given groundwater resources problem or objective. The actions would have different costs, different effects on aspects of the groundwater system, and different compatibilities with other management actions. Selection criteria are needed to systematically compare and select among a large number of potential management actions. For the purposes of this plan, a relatively high ranking will be given to actions that:

- meet many objectives or substantially meet at least one objective,
- do not adversely affect or limit other objectives,
- are relatively cost-effective,

- are equitable,
- maintain management flexibility,
- require relatively little administrative effort,
- have few permitting requirements and raise few legal issues, and
- are likely to win acceptance from an informed public.

Many of these criteria are subjective; consequently, it may not be possible to quantitatively rank or compare all potential actions. At a minimum, the criteria should be used as a checklist to identify any major drawbacks to potential management actions.

GROUNDWATER MANAGEMENT ISSUES AND ACTIONS

There are a large number of actions that could potentially help achieve one or more of the numerous groundwater management objectives. Faced with this large realm of possibility, the groundwater planning group decided to focus the plan on the most important and urgent groundwater issues. With input from the technical advisory group, nine key issues were identified. These issues are described in the following sections, along with management actions that could potentially address the issues. Actions that relate to more than one issue are cross-referenced. Unless otherwise noted, all of the actions are considered worthy of implementation based on current information. No attempt was made to rank all of the actions relative to one another, but preferences within a subset of the actions are indicated in a few cases. Further investigation during the implementation phase of this plan will provide additional cost, feasibility, and permitting information that can be used to prioritize the actions.

Issue 1: Poor Groundwater Quality and Long-Term Salt Buildup in the Basin

Groundwater quality in most parts of the San Benito County part of the Gilroy-Hollister groundwater basin is marginally acceptable for municipal and irrigation use. Municipal use is impaired by several constituents that frequently or occasionally exceed secondary (i.e., recommended) drinking water standards, including hardness and concentrations of iron, manganese, sulfate, and salinity (total dissolved solids). Hardness is very high for domestic use, and approximately two-thirds of the residential and commercial connections to the municipal water system have water softeners. Nitrate concentrations in some wells exceed the primary drinking water standard of 45 mg/l (as nitrate), and pose a threat to potable water supplies. Because the sources, chemistry, treatment, and regulations for nitrate differ in important respects from those for general salinity, nitrate issues are addressed as a separate groundwater management issue (see Issue 4).

High groundwater salinity also limits groundwater use on some crops. During the last 5 years, there has been a general increase in cropland devoted to lettuce, bell peppers, and miscellaneous field and vegetable crops and a general decrease in cropland devoted to alfalfa, green chop (forage), sugar beets, celery, garlic, and sweet corn (Tognazzini 1993, 1995). The crops that are increasing in acreage are those that are generally more sensitive to salinity. Farmers growing those crops prefer to irrigate with San Felipe water, which has an average dissolved solids concentration of approximately 288 mg/l, compared to an average of approximately 880 mg/l in groundwater (Table 2).

Any long-term trends toward increasing groundwater salinity are of particular concern because existing water quality is already marginal for irrigation and potable uses. Long-term salinity increases are expected because the groundwater basin presently functions as an essentially closed hydrologic system. However, a statistical comparison of groundwater salinity data from the 1930s, 1960s, and 1997 revealed no significant increase in the median salinity level (see the section on "Condition of the Basin"). The large local variability of groundwater salinity in the three data sets may have obscured long-term trends.

In any case, any unnecessary salt loading or evaporative concentration of groundwater should be avoided to minimize long-term salinity increases. Four actions were identified to address long-term salt buildup problems. The actions are briefly described in the following paragraphs, and additional information is provided in the Appendix.

Action 1-A: Construct a Facility to Treat San Felipe Water for Municipal Use

A municipal water treatment plant has been the subject of numerous technical studies and environmental documents in the last 10 years. Several treatment methods and plant locations have been evaluated. The treatment plant presently under consideration by the City of Hollister and SCWD would be located at the west hills site between Highway 156 and Union Road west of the San Benito River and would use a contact clarifier process and disinfection to treat raw San Felipe water to potable standards. The initial capacity of 14 million gallons per day (mgd) would be expanded to 28 mgd as future water demand increases. The plant would not normally treat groundwater (which has different treatment needs), but there would be the capability of blending treated San Felipe water with groundwater in order to meet peak demand fluctuations, maintain a balanced groundwater budget, and provide a backup water supply in case of interruptions in the San Felipe supply.

The principal purpose of constructing the water treatment plant would be to bring the Hollister municipal water supply into compliance with secondary drinking water standards and to provide aesthetic benefits to municipal water users. The treatment plant would also provide the following substantial benefits for groundwater management:

- increase the overall local water supply by increasing the ability to use San Felipe imports,
- increase the reliability of San Felipe imports because municipal users receive fewer and smaller cutbacks than agricultural users,
- diminish the cones of depression (i.e., low spots) in the groundwater surface near Hollister by decreasing groundwater pumping in that area,

- create a means of conjunctively managing local groundwater and San Felipe water to simultaneously achieve water quality and water budget objectives in the Hollister area,

- decrease the total salt load entering the groundwater system (especially in the San Juan Valley), by decreasing the salinity of raw municipal water and eliminating the need for household water softeners that presently add substantial amounts of salt to municipal wastewater, and

- increase the viability of using reclaimed municipal wastewater for nonpotable uses by improving its water quality.

An EIR for the water treatment plant was prepared and certified in 1995 (ESA, Inc. 1995). The City of Hollister and SCWD are completing additional engineering studies and exploring funding options to construct the plant. Some members of the groundwater planning group questioned whether the planned initial capacity of 14 mgd might be too large because of predictable decreases in demand that would result from higher water rates (to pay for the plant) and urban water conservation practices mandated by Reclamation for CVP contractors. Thus, municipal demand might decrease initially upon completion of the plant and in any case might increase more gradually than assumed in the planning studies for the plant. This concern does not call into question whether a plant should be built, but simply the initial size of the plant.

Concerns were also expressed that eliminating or substantially decreasing annual pumping at the existing municipal supply wells would result in positive groundwater budgets and higher water levels in the Tres Pinos and Hollister West subbasins, where water levels have already been increasing rapidly in recent years. These impacts are briefly described in the Appendix.

The water treatment plant is recommended for implementation. On balance, the benefits of a water treatment plant would outweigh the costs and risks of adverse effects, particularly if implementation of the treatment plant is linked to implementation of the following actions:

- Implement urban water conservation measures to minimize capital, operation, and maintenance costs, and minimize reliance on imported. See Issue 7, "Water Conservation".

- Avoid inducing urban growth by limiting the capacity of the plant to meet only those water demands associated with land uses projected in the San Benito County and City of Hollister general plans, corrected to reflect anticipated water conservation measures and decreases in demand resulting from higher municipal water rates. See Issue 8, "Coordination of Land Use and Water Supply Planning".

- Actively discourage use of self-regenerating water softeners to maximize the water quality benefits of the treatment plant. See Action 1-B, "Minimize Local Regeneration of Water Softeners".

- Construct new percolation ponds for the Hollister domestic wastewater treatment plant in a location away from the San Benito River channel (and preferably outside the San

Juan and Hollister West subbasins) to avoid further decreases in percolation capacity resulting from high groundwater levels. See Action 3-D, "Construct New Wastewater Percolation Ponds Away from the River".

- Maintain backup water supply capacity (i.e., wells) to ensure overall system reliability. See Appendix.

Action 1-B: Actively Discourage Local Regeneration of Water Softeners

Water softeners are a significant source of salt loading in wastewater and in groundwater where wastewater is percolated for groundwater recharge (see "Condition of the Basin" above). Water softeners function by exchanging sodium or potassium ions for calcium and magnesium ions in the water supply. Calcium and magnesium ions accumulate in the water softener and must periodically be removed. One type of water softener discharges a brine containing the calcium, magnesium, and associated anions to the sewer system, where it adds to the salinity of municipal wastewater. The homeowner regenerates this types of water softeners by adding sodium or potassium salts, which are typically purchased at a local supermarket or hardware store. Action 1-B would discourage use of this type of water softener. The other principal type of water softener retains the calcium and magnesium salts and is regenerated by periodically exchanging the salt cartridge with a fresh one. This is typically done by a water softener service company. These companies can be required to regenerate used cartridges without discharging the calcium and magnesium salts to the sewer system. Use of this latter type of water softener would continue to be permitted.

Attempts to prohibit the use of self-regenerating water softeners through municipal and county ordinances have been blocked by the courts; consequently, outright prohibition of these types of water softeners is not recommended in San Benito County. Approximately 10 years ago, the City of Escondido and Santa Barbara County passed ordinances banning self-regenerating water softeners. The ordinances were successfully challenged in two court cases by a water softener trade group (*Water Quality Association v. County of Santa Barbara* and *Water Quality Association v. City of Escondido*). The trade group was upheld on appeal, and in the mid-1990s, the California Supreme Court tacitly approved the appellate ruling by declining to hear the case (Higgins pers. comm.). Local agencies in Santa Barbara County subsequently offered financial incentives to encourage people to disconnect and turn in their water softeners. Continued compliance was difficult to enforce, and the program was abused. In contrast, public education programs aimed at convincing homeowners to switch from self-regenerating to cartridge-type water softeners can work if implemented on a continuous basis (Higgins pers. comm.).

Two minor restrictions on water softener use have been successfully implemented in the Hollister area. Cartridge-type water softeners are required through deed restrictions on homes in the Cielo Vista subdivision near Fairview Road and Airline Highway. The subdivision has its own wastewater treatment plant, and self-regenerating water softeners would have created unacceptably high wastewater salinity. The water softener restriction was identified as a water-quality mitigation measure in the EIR and incorporated into the conditions of approval for the subdivision. For homes in the Ridgemark development, SCWD prohibits self-regenerating water softeners that initiate their regeneration cycles at fixed intervals instead of in response to the volume of water used since the previous cycle. This eliminates unnecessary regeneration cycles.

It is relatively simple for homeowners to install water softeners or switch from cartridge-type to self-regenerating water softeners. Mandatory restrictions and prohibitions are consequently difficult to enforce. In contrast, public education could be effective in encouraging appropriate use of water softeners, assuming the public supports efforts to improve groundwater quality.

This management action consists of a two-phased public education effort. As long as groundwater continues to be the source of potable water supply in municipal areas, residents and businesses would be encouraged to use cartridge-type water softeners. After a treatment plant is built to provide San Felipe water for municipal use (Action 1-A), water softeners would become largely unnecessary and customers would be encouraged to disconnect their water softeners entirely.

San Felipe water has an average hardness of 110 mg/l (as calcium carbonate), which is below the maximum consumer acceptance level of 180 mg/l and much lower than the average hardness of local groundwater (430 mg/l). With a small public education effort, urban water users will presumably be eager to discontinue the expense and inconvenience of operating household water softeners when the municipal water supply reaches an acceptably low level of hardness. Water softener prohibitions would be unnecessary.

Action 1-C: Control Sources of Salt Entering the Municipal Sewer System

In addition to water softeners, other sources of salt that enter the municipal sewer system may be easier to eliminate at the source than after the salt has entered the wastewater stream. Action 1-C consists of investigating salt sources and devising salt control measures in cooperation with the individuals and businesses responsible for the salt discharges on a case-by-case basis.

Action 1-D: Investigate the Long-Term Salt Balance of the Groundwater Basin

The salt balance of the groundwater basin needs to be studied to identify the most significant sources of dissolved solids, explain the apparent lack of a long-term trend toward increasing groundwater salinity, and determine whether further actions to achieve a salt balance are warranted. This task would involve assigning dissolved solids concentrations to each of the basin inflows and outflows and quantifying any gains and losses of dissolved solutes resulting from dissolution, precipitation, adsorption, cation exchange, volatilization or other chemical processes.

Action 1-E: Maximize Recharge from Rainfall and Natural Streamflow

Rainfall is the most dilute source of groundwater recharge. Maximizing the amount of recharge from rainfall or local runoff would tend to improve the salt balance of the basin and also potentially provide additional water supplies to meet future increases in water demand (see Issue 5, "Future Increases in Water Demand"). Recharge from rainfall and natural streamflow is also desirable because it is a local water resource unaffected by policy decisions beyond the control of local agencies that could decrease the availability of San Felipe water. Thus, local water supplies are politically if not hydrologically more reliable than imported supplies.

An important element of maximizing groundwater recharge is protecting groundwater recharge areas. Land use management policies and programs to protect recharge areas are covered by Action 7-B, "Protect Critical Recharge Areas". Projects that would physically increase recharge from rainfall and natural streamflow include:

1-E-1 increasing infiltration of urban stormwater runoff through use of detention/percolation basins and dry wells;

1-E-2 increasing infiltration of rainfall and consequently increasing the duration of stream base flow in upland watersheds by implementing range management practices that prevent soil compaction and maintain adequate vegetative cover,

1-E-3 leaving a rough (chiseled) soil surface on fields that will be idle during the winter months or cross-ripping fields that are prebedded in fall,

1-E-4 constructing tailwater ponds at the low ends of fields to capture and infiltrate stormwater runoff,

1-E-5 constructing additional small, onstream reservoirs in the foothills surrounding the basin to capture runoff and release it at a slow rate that favors infiltration along downstream channels, and

1-E-6 constructing an additional offstream reservoir and diverting water to it from the San Benito River during periods of high flow.

If soil and hydrogeologic conditions at a proposed development site are not suitable for stormwater percolation, construction of offsite facilities could be funded by development mitigation fees. Also, equipment needed for vegetation maintenance in the percolation ponds could be provided by SBCWD. Actions to enhance groundwater recharge should not be implemented in areas where shallow groundwater or drainage problems are a problem or are likely to become a problem. The cost-effectiveness of these methods should be compared with the alternative of simply purchasing additional San Felipe water.

Action 1-F: Create a Salinity Education Program for Farmers

Effective long-term management of salinity (and nitrate) in the groundwater basin will require active cooperation from the agricultural community. An education program for farmers might include:

- dissemination of salinity tolerance information for crops grown in San Benito County;

- instruction in farming techniques that minimize the phytotoxic effects of high salinity, such as salinity monitoring and irrigating at night to avoid leaf burn; and

- realistic communication of expected water supply salinity, so that farmers do not become overly dependent on the high-quality but occasionally unavailable San Felipe supply.

An additional salt control measure was considered by the technical advisory group and dismissed as unlikely to be cost-effective. This measure would decrease direct evaporation of irrigation water, which concentrates salts without benefitting crops. Direct evaporation losses from aerosol mist created by sprinkler nozzles could be decreased by converting to low-energy precision applicator sprinklers or to drip irrigation. Drip irrigation would also minimize evaporation of water from bare soil between the individual plants in a field, which can be particularly substantial during early growth stages. Agricultural professionals in the technical advisory group reported that irrigation efficiency is already high in the Hollister area, and the use of drip irrigation is common. Opportunities for further decreases in direct evaporation appear to be small and are probably expensive.

Action 1-G: Increase Overall San Felipe Imports to Achieve Groundwater Outflow

Reestablishing groundwater outflow would provide a mechanism for exporting dissolved solids from the basin. One way to achieve outflow would be to increase groundwater recharge or decrease groundwater pumping until groundwater levels rise to a level high enough to initiate seepage into creeks and rivers. This action is not recommended for implementation at this time because groundwater salinity does not appear to be increasing, use of San Felipe already appears to be achieving positive groundwater budgets that will eventually result in outflow, and excessively high groundwater levels can result in drainage problems. When additional information becomes available regarding long-term water budgets, salinity patterns, and salt balance in the groundwater basin, it may be appropriate to reconsider implementing this action. A more complete description of this action and the reasons for not recommending it at the present time are presented in the Appendix.

Issue 2: Rising Groundwater Levels and Drainage Problems

Importation of San Felipe water and recent wet years have created positive groundwater balances and rising groundwater levels in most of the subbasins. When water levels rise, the water table will eventually reach the root zone of crops in topographically low areas and adversely affect crop growth. Orchard crops are adversely affected by water table depths less than approximately 8 feet. If the water table reaches the land surface, the soil becomes completely waterlogged and groundwater seeps out of the ground and into the ditches and creeks that comprise the surface drainage system. A comparison of water levels measured in wells and locations where saturated soil conditions were present within a few feet of the land surface in March 1997 indicated that different mechanisms are responsible for shallow saturation in different locations (Jones & Stokes Associates 1997b). In the San Juan Valley, poor soil drainage is caused by clay layers at depths of approximately 3–12 feet below the land surface that impede the percolation of irrigation water and infiltrated rainfall (Moss pers. comm., Salas pers. comm.). Water levels in wells in that area are 20–40 feet below the land surface, indicating that a high water table is not the cause of soil saturation. Saturated soils were also encountered 3–5 feet below the land surface while installing pipelines to extend San Felipe subsystem 10 in the western part of the San Juan Valley in spring 1997. Because water levels in wells in that area are approximately 40 feet below the land surface, the shallow saturation is the result of restricted downward percolation of soil moisture rather than a rise in the regional water table. A shallow clay layer near Fallon Road in the Hollister East subbasin has prompted at least one farmer in that area to install tile drains.

In contrast, shallow groundwater in the Pacheco and Bolsa subbasins may be the result of high water tables. Groundwater was observed discharging around well casings or seeping from hillsides and streambanks in several locations. Depths to water measured in wells are less than or equal to 20 feet in these areas, and local topographic low spots could bring the land surface down to the elevation of the regional water table. Near the Spring Grove School and monitoring well 12S/6E-6K1, the western branch of the Ausaymas Fault may obstruct groundwater flow and result in shallower water levels on the western (sic) side of the fault.

Drainage problems in northern San Benito County are indirectly linked to irrigation water quality, because the relatively low salt content of San Felipe water motivates farmers to use more imported water and less groundwater. As described above, heavy use of San Felipe water combined with relatively little groundwater use can result in rising groundwater levels and saturation of shallow strata.

Increased groundwater pumping can help alleviate drainage problems caused by a high water table, but would not alleviate soil saturation caused by a shallow clay or hardpan layer. For example, simulations of conditions in drainage problem areas in the western part of the San Joaquin Valley indicated that if groundwater pumping above the Corcoran Clay were increased by 0.5 feet per year, shallow water tables in drainage problem areas would decline by up to 3.5 feet in 2 years (Fio 1994). Localized increases in groundwater pumping could minimize soil saturation problems in the Pacheco subbasin and near the Hollister domestic wastewater treatment plant percolation ponds, but it would be ineffective in the west-central San Juan subbasin.

Saturated soil conditions can also be alleviated by installing tile drains. Tile drains are parallel lengths of horizontal, perforated drain pipe buried at a depth just above the shallow clay layer. They prevent waterlogging by providing a conduit that allows excess soil moisture to drain from the soil. The drainage problem in the west-central part of the San Juan subbasin has prompted farmers in that area to install tile drains in their fields. The drainage flow is collected in ditches that flow to San Juan Creek or the San Benito River. The drainage problems in that area are not new, and some of the drain systems were installed as long as 20 years ago.

Three management actions were identified as reasonable and feasible measures to minimize problems associated with poor soil drainage and high water tables. They are described in the following paragraphs.

Action 2-A: Expand the Use of Tile Drains to Prevent Soil Saturation

This action has the advantage of enabling farmers to use San Felipe water exclusively (with the associated water quality benefits) without incurring waterlogging problems. One disadvantage of this approach is the fairly high cost of installing drains. However, the fact that many farmers have already installed drains at their own expense indicates that the benefits can outweigh the costs. Fortunately, problems associated with shallow water tables are likely to be somewhat localized, even if groundwater levels rise in all subbasins. Thus, drains would not be necessary throughout the groundwater basin. Also, if conjunctive use of surface water and groundwater is increased (see Issue 5 and Action 5-B), high water tables would probably not be a chronic problem in most areas but would occur only during those years when groundwater storage is at a high level.

Action 2-B: Blend San Felipe Water and Groundwater

By blending San Felipe water with local groundwater, the salinity of the irrigation water could be adjusted to meet the specific requirements of the crop type and growth stage. As described in the section on "Water Quality Requirements for Beneficial Use", even the most salt-sensitive crops commonly grown in San Benito County would be unaffected by a salinity less than 1,000 μmho/cm. This is between the average salinity of San Felipe water (450 μmho/cm) and groundwater (1,121 μmho/cm). Groundwater could be blended with San Felipe water in various proportions to achieve a salinity tailored to the salt tolerance of each crop type and growth stage. Blending would allow increased use of local groundwater while still achieving the agronomic benefits of high-quality San Felipe water. Three methods could be used to combine groundwater and surface water:

- Blending at the wellhead. San Felipe water and well water could be directed to a mixing valve the proportions of each source could be adjusted manually or automatically to achieve a desired salinity level. This approach has the advantage of maintaining the maximum amount of flexibility for individual users. The principal drawback is the potentially high cost of plumbing modifications at each well, possibly including installation of a variable-speed pump motor.

- Blending in the distribution system. SBCWD could install and operate its own wells (or contract for use of existing wells) in areas where groundwater levels are undesirably high and pump water from those wells into the San Felipe distribution system. Users downstream of the blending point would receive a mixture of San Felipe water and groundwater at their blue valves. This approach has the advantages of having a lower overall cost than blending at individual wellheads and of providing additional groundwater management benefits by increasing groundwater extractions in high water table areas. It has the disadvantage of decreased water quality flexibility for individual users. Users downstream of the blending point would no longer be able to obtain pure San Felipe water, and individual farmers would not be able to select different salinity levels unless they installed their own onsite blending facilities for additional mixing with groundwater.

- Alternating between irrigation sources. For each successive irrigation cycle, farmers could alternate between groundwater and San Felipe water. In the long run, this would achieve balanced use of the two sources. However, adverse effects of high salinity would reportedly continue to be problematic after each irrigation with groundwater.

Agricultural members of the technical advisory group thought that either of the first two blending methods would be acceptable to most farmers. They did not recommend the third method because of the residual agronomic impacts. Implementation of Action 2-B would probably require a detailed study of salinity tolerances of crops grown in San Benito County, a salinity education program for farmers (see Action 2-C), and a pilot program for testing one or both of the first two methods of blending water sources.

Action 2-C: Encourage Use of Groundwater for Purposes Not Sensitive to Water Quality

In addition to agricultural crops that may not require the high quality of San Felipe water, some municipal and industrial uses might be able to continue using groundwater if the municipal supply converts to San Felipe water. For example, irrigation of large turf areas at schools and parks could be supplied by onsite wells.

Several additional measures for maintaining a balance between groundwater use and surface water use were considered by the technical advisory group. The following actions would probably be less effective, more expensive, or less popular than Actions 2-A, 2-B, and 2-C but may be worthy of future consideration if the recommended actions prove to be insufficient to achieve groundwater management objectives:

2-D institute economic incentives to promote increased use of groundwater in drainage problem areas,

2-E decrease deliveries of San Felipe water to drainage problem areas and implement an allocation scheme for San Felipe water, and

2-F increase irrigation efficiency.

Descriptions of these actions and the reasons for not recommending them at this time are provided in the Appendix.

Issue 3: Competition for Limited Percolation Capacity in the Upper End of the San Juan Valley

Infiltration rates at the percolation ponds used to dispose of effluent from the Hollister municipal wastewater treatment plant have been decreasing. The ponds are located along the south bank of the San Benito River, downstream of the old Highway 156 bridge. An investigation of subsurface hydrogeologic conditions and historical percolation rates concluded that the principal cause of decreased infiltration is a clay layer that underlies most of the pond area at a depth of 15–20 feet (Kenneth D. Schmidt and Associates 1997). The ability of the aquifer layer above the clay to absorb infiltration from the ponds and from the adjacent San Benito River channel is limited. Relatively sustained natural streamflow during the past 2 years (both of which were wetter than average) combined with record releases of San Felipe water for percolation in the riverbed during the dry season and gradually increasing volumes of municipal wastewater overwhelmed the capacity of the aquifer to receive and transmit recharge. In effect, the ponds and the river are competing for recharge capacity in that location. Although the problem is fairly localized, it has undoubtedly been exacerbated by general increases in groundwater levels resulting from use of San Felipe water (see Issue 2) and from a series of recent wet years.

Implementation of Actions 2-A through 2-F would address the general problem of shallow groundwater levels and would undoubtedly ameliorate percolation capacity problems near the wastewater ponds. Possible remedial actions that would specifically address the upper end of the San Juan Valley include the following.

Action 3-A: Deliver Reclaimed Water for Golf Course Irrigation

The San Juan Oaks golf course is located approximately 2 miles from the wastewater percolation ponds and has a dual-plumbed irrigation system that can accept reclaimed water. The golf course operators are willing to receive and use reclaimed water for irrigation, but deliveries have never been made for lack of a pipeline from the ponds to the golf course and lack of adequate wastewater disinfection (Fuller pers. comm.).

Diverting wastewater to the golf course would decrease the amount that needs to be percolated at the ponds. The irrigation demand at the golf course is approximately 400 af/yr, and this demand could increase substantially if a planned second golf course is built adjacent to the existing one. For agronomic reasons, golf course personnel prefer not to use reclaimed water exclusively, although a high percentage of reclaimed water would be acceptable if the municipal water supply converts to San Felipe water (see Action 1-A, "Construct a Facility to Treat San Felipe Water for Municipal Use"). The present golf course irrigation demand equals 20% of the annual discharge to the wastewater percolation ponds. Unfortunately, the irrigation demand is relatively small during the winter months, when rainfall, river recharge, and high groundwater levels create the greatest competition for percolation capacity at the wastewater ponds. Nevertheless, Action 3-A would be an effective incremental step toward alleviating the percolation capacity problem.

Action 3-B: Increase Groundwater Pumping in the Upper End of the San Juan Valley

Increasing the amount of groundwater pumping in the vicinity of the wastewater percolation ponds could substantially relieve the percolation capacity problem. One strategy for increasing the amount of pumping would be to offer economic incentives to nearby farmers to use groundwater instead of San Felipe water for crop irrigation (Action 2-D). Another strategy would be for SBCWD to install and operate pumps in that area and inject the pumped water into the San Felipe distribution system. This would be an example of implementing Action 2-B, described above. The well locations and pumping rates would need to meet the guidelines issued by the California Department of Health Services for use of groundwater recharged with reclaimed water.

Action 3-C: Modify Percolation Releases from Hernandez Reservoir and the Hollister Conduit to Avoid Competition for Percolation Capacity

In addition to Actions 3-A and 3-B, it may be desirable to decrease the Hernandez and San Felipe percolation releases to the San Benito River in order to diminish the amount of flow in the reach adjacent to the percolation ponds during periods when groundwater levels are particularly high and percolation rates are impaired. Percolation cutbacks would probably be needed only during certain seasons in most years and might not be needed at all in dry years. Under this action, releases would be managed to minimize flow in the river downstream of the Highway 156 bridge. This would decrease the length of river channel used for percolation by approximately 25%. It may be possible to increase Hernandez and San Felipe percolation releases at other times to compensate for the temporary decrease in reach length. Alternatively, direct delivery of San Felipe deliveries to water-deficient areas could be increased. This action would also help achieve a balanced overall water budget in the San Juan subbasin (and the Hollister West subbasin following conversion of municipal supply from groundwater to San Felipe water), thereby helping to solve problems associated with rising groundwater levels (see Issue 2).

This action could have adverse effects on groundwater quality in the San Juan and Hollister West subbasins because the salinity of Hernandez and San Felipe percolation releases is relatively low. Consequently, this action should be implemented on an interim basis until the quality of municipal wastewater is improved by converting the municipal supply to San Felipe water (Action 1-A) or the wastewater percolation ponds are relocated to a different area (Action 3-D).

Action 3-D: Construct New Wastewater Percolation Ponds Away from the River

By relocating the percolation ponds to a site farther from the river, there would be less competition between the ponds and the river for percolation capacity. The full percolation capacity of the river could then be used to rapidly recharge groundwater with Hernandez or San Felipe water under a conjunctive use management program (see Action 5-B). Also, percolation capacity problems will become worse in the future as population growth increases the amount of municipal wastewater flows. Finally, percolation capacity would be further decreased by conversion of the municipal water supply from groundwater to treated San Felipe water because municipal groundwater pumping will decrease substantially in the Hollister West subbasin. The water table will rise to a level near the elevation of the riverbed, which will further decrease percolation rates from the river and the ponds.

This action was recommended in the independent study of the percolation problems (Kenneth D. Schmidt and Associates 1997). Soils information useful for selecting an additional location for percolation of some or all of the municipal wastewater is presented in the Appendix. No further technical analysis of alternative percolation sites has been completed. Because percolation capacity is a shared resource needed for water supply and wastewater disposal operations, there was sentiment within the groundwater planning group that the cost of relocating wastewater percolation facilities should be shared among several water resource agencies.

The following two groundwater management actions were also considered by the technical advisory group as potential solutions to the percolation capacity problem:

- deliver reclaimed municipal wastewater to fields for irrigation, and
- discharge treated municipal wastewater to the San Benito River.

For reasons explained in the Appendix, these actions are considered of secondary priority for refinement and implementation.

Issue 4: Long-Term Nitrate Buildup in the Groundwater Basin

Two recent studies of historical groundwater quality in the San Benito County part of the Gilroy-Hollister groundwater basin have concluded that nitrate concentrations have increased in recent decades. Details of the study by the Central Coast RWQCB (1995) and the study completed for this groundwater management plan are described in the section "Condition of the Basin". Although the median nitrate concentration in both studies was well below the drinking water standard, the variability of nitrate concentrations is high and both studies included wells with nitrate concentrations exceeding the standard. Localized high nitrate concentrations are a problem if they affect potable supply wells, as occurred at two wells in 1997. These well closures, combined with a historical trend toward higher nitrate concentrations, clearly indicate that a program to minimize future nitrate contamination of groundwater is warranted.

The problem of increasing nitrate concentration in groundwater is similar in some respects to the problem of salt buildup, but in other respects it is different. Unlike mineral salts, nitrate is a nutrient that is actively taken up by plants and can be converted to a gas by soil microbes. Unlike most salts, it is also intentionally applied to soils as a fertilizer. Potential sources of nitrate in this basin include naturally occurring soil organic matter, agricultural and residential fertilizers, percolation of municipal wastewater, percolation from septic systems in rural areas, percolation beneath confined animal feeding operations, and spills or discharges from industrial facilities such as munitions plants. Where multiple potential sources are present, it is sometimes possible (but often difficult) to determine the relative contributions from each source based on chemical typing. Following are three recommended actions that could decrease nitrate concentrations in groundwater.

Action 4-A: Investigate Sources of Nitrate in Groundwater

Identifying the principal sources of nitrate in groundwater would allow funds for remedial activities to be targeted more effectively. An investigation of nitrate contamination could include further groundwater sampling and hydrogeologic characterization near wells that have experienced high nitrate concentrations, identification of all potential nitrogen sources, and estimation of the maximum potential loading rates from each of those sources. Nitrogen isotope ratios have also been successfully used in some areas to differentiate between fertilizer and wastewater sources of nitrogen. The inventory of potential nitrogen sources could include a survey of farmers, homeowners, and landscaping contractors to identify typical fertilization practices, and mapping of existing and historical feedlots.

Action 4-B: Educate Farmers, Homeowners, and Landscape Contractors in Nitrogen Management

Farmers may not be adjusting their fertilizer applications to allow for the amount of "free" nitrate already present in their irrigation water. Fertilizer applications in fall for crops that will not grow until spring can also contribute significant amounts of nitrate to groundwater. Total nitrogen application for a given crop can be minimized by adjusting the timing and amount of application to reflect actual crop need (based on foliar analysis) rather than applying according to a fixed schedule. Homeowners and landscape contractors may be unaware of appropriate fertilizer types and application rates and seasons, and they may tend to overirrigate following application, which tends to increase deep percolation and groundwater contamination.

The technical advisory group considered several other actions for addressing nitrate contamination. Action 3-E, "Deliver Reclaimed Municipal Wastewater to Agricultural Fields for Irrigation Use", could be an effective means of nitrogen removal. As explained in the discussion of Action 3-E, however, the cost-effectiveness may be low and there may be substantial resistance among farmers to using the reclaimed water. If the results of Action 4-A indicate that the municipal wastewater treatment plant or septic systems at urban or rural residences are significant sources of nitrate contamination, the following actions should be considered:

- Action 4-C: add a nitrate removal process to the Hollister domestic wastewater treatment plant,
- Action 4-D: Connect septic systems in urban areas to the municipal sewer system, and
- Action 4-E: install sewers in rural areas.

Details of these contingent management actions are provided in the Appendix.

Issue 5: Expected Increases in Future Water Demand

As described above in the section on "Future Demand", average annual agricultural water demand is expected to remain approximately constant until 2010. Nonirrigated cropland may become irrigated while other cropland is converted to urban use, with no net change in overall agricultural water demand. Urban water demand is expected to increase by approximately 8,000 af/yr by 2010. If urban expansion is onto existing irrigated cropland, most or all of the increased urban water demand would be offset by decreased agricultural demand. If the zone 6 and San Felipe service area boundaries are expanded to allow delivery of San Felipe water to new urban areas that no not displace agriculture (see Action 5-C), new water supplies would have to be found for the entire increase in total demand.

Existing San Felipe Project contract entitlements could supply the expected increases in urban water demand. San Benito County has not historically used its entire allocation of San Felipe water. In some years, SBCWD has not been able to find agricultural buyers for all of the San Felipe water it has ordered, and in recent years, farmers have been using only approximately 20,000 af/yr of the 35,550 af/yr of San Felipe water allocated for agricultural use. Thus, although irrigation water demand is not expected to increase substantially, increases of up to 15,000 af/yr could be supplied simply by purchasing additional San Felipe water.

Presently, 8,250 af/yr of San Felipe water is allocated for municipal use. Only one small, isolated residential development (Stonegate) treats San Felipe water for potable supply. If Action 1-A is implemented ("Construct a Facility to Treat San Felipe Water for Municipal Use"), San Felipe imports could abruptly increase by approximately 8,000 af/yr, which equals the entire municipal allotment and also approximately equals the present municipal water demand in Hollister. Conversion of the municipal supply to San Felipe water would free up 8,000 af/yr of groundwater yield, which could be used to meet future increases in agricultural or municipal use or other purposes.

If future increases in urban water demand are to be met with San Felipe water, some of the agricultural allotment of San Felipe water will need to be converted to municipal use. Reclamation allows conversion of agricultural allotments to municipal use, but not vice versa. Because approximately 15,000 af/yr of agricultural allotment is presently unused, all of the expected increase in municipal water demand until the year 2010 could be met by converting agricultural allotments without jeopardizing the agricultural supply. Approximately 7,000 af/yr of allotment would remain available for increased agricultural demand.

Future increases in total water demand may have to be met by local water resources if San Felipe water is not available for municipal use (because a water treatment plant is not built), urban growth is outside the zone 6 and San Felipe Project service area boundaries (and boundary expansion proves to be politically unachievable), or the San Felipe supply is decreased by water rights proceedings related to CALFED and Delta water requirements. Actions specifically aimed at increasing groundwater yield are described below. Related actions that would preserve and augment local water supplies include measures to maximize recharge from rainfall and natural streamflow (see Action 1-E).

Action 5-A: Increase Conjunctive Use of Surface Water and Groundwater

The storage capacity of the groundwater basin could be used more actively to achieve increased yield. Increased yield could be used to meet future increases in water demand, increase the reliability of existing supplies, or—if a water banking agreement is established with another CVP contractor (see Action 5-B)—decrease the cost of San Felipe water. Because of a long history of overdraft, the focus of surface water operations (Hernandez and San Felipe) has historically been to maximize direct use of surface water and percolation of surface water for groundwater recharge.

Water level trends during the past 11 years have shown that these efforts have succeeded in achieving balanced or positive long-term groundwater budgets in most subbasins. An appropriate conjunctive use program at this point would have the objective of maximizing the overall yield or water quality of the combined surface water-groundwater system without incurring problems associated with excessively low or high groundwater levels.

Action 5-B: Negotiate a Conjunctive Use Agreement with Another CVP Contractor

A potential source of revenue for financing infrastructure improvements or partially defraying the cost of imported water would be a water banking contract with another CVP contractor, similar to contracts that the Metropolitan Water District of Southern California and the Los Angeles Department of Water and Power have negotiated with Semitropic Water Storage District and Arvin-Edison Water District in the San Joaquin Valley. Implementation of this action would be appropriate as long as the water banking arrangement does not create overdraft in any subbasin, and it should be conditioned on maintaining sufficient local use of San Felipe water to meet minimum water quality requirements. A banking agreement would also need to distinguish between water supply derived directly from SBCWD's contractual entitlement to San Felipe water and water supply derived from conjunctive use operation of local groundwater storage.

Action 5-C: Expand the Zone 6 and San Felipe Service Area Boundaries

If future urban growth is directed toward areas around the periphery of the groundwater basin in an effort to preserve agricultural land, it may be desirable to expand zone 6 and the San Felipe Service Area boundaries to include the areas slated for development. This would allow those areas to be served by San Felipe water or by a conjunctively managed combination of San Felipe water and groundwater without raising questions regarding the legality of supplying water outside the basin or assessing fees for the use of the water. Changes in the zone 6 and San Felipe service area boundaries would require actions by the state legislature, Reclamation, and possibly by Congress. Given that the underlying purpose of the expansions is to preserve agricultural land, this action may be viewed favorably by those decision-making bodies.

Issue 6: Residual Overdraft in the Bolsa Southeast Subbasin

Until recently, groundwater overdraft has been the central groundwater management issue in northern San Benito County. Importation of San Felipe water appears to have solved the overdraft problem in most parts of the groundwater basin, as indicated by long-term rising trends in groundwater levels. However, long-term water level trends in the Bolsa Southeast subbasin have had level or slightly declining trends.

Members of the technical advisory group expect that the water budget in the Bolsa Southeast subbasin will become positive as a result of recent or future expansions of subsystem 7 and implementation of some of the groundwater management actions recommended elsewhere in this plan. One of the suggested methods for increasing conjunctive use of the groundwater basin (Action 5-B) is to increase the extent of the San Felipe distribution system within zone 6. Extending subsystem 7 to serve a larger part of the Bolsa Southeast subbasin could eliminate local overdraft in addition to increasing conjunctive use capacity. Furthermore, construction of a municipal water treatment plant (Action 1-A) would decrease groundwater pumping and consequently elevate groundwater levels in the Hollister East and Hollister West subbasins. Both of these subbasins adjoin the Bolsa Southeast subbasin, and groundwater flow from those subbasins into the Bolsa Southeast subbasin would increase. Although faults restrict groundwater flow between subbasins, the increase might be large enough to eliminate the small amount of residual overdraft. No special action is considered necessary to correct the small amount of possible residual overdraft.

Issue 7: Coordination of Land Use and Water Supply Planning

For many decades, northern San Benito County was primarily rural. The City of Hollister was compact, and the population of Hollister and the nearby rural communities grew slowly. The rate of suburban residential development has increased during the past 10–15 years, largely because of growth pressure from San Jose and the San Francisco Bay area. In some instances, the local review process for proposed development projects was characterized by misunderstandings and lack of coordination between agencies. Lack of a common perception of water supply availability and lack of standard procedures for soliciting and coordinating input from various agencies were two factors that contributed to difficulties during the review process.

All local agencies agree that land use planning is the responsibility of the County Board of Supervisors, the city councils, and their respective planning commissions and staff. In addition, all local agencies agree that cooperative interagency coordination and a common understanding of local water resources are essential for successful and efficient land use and water supply planning. San Benito County and SBCWD recently signed a memorandum of agreement to jointly fund, oversee, and use a groundwater model of the San Benito County part of the Gilroy-Hollister groundwater basin. The model is recognized as the best available tool for evaluating the yield of the groundwater basin and the potential effects of new urban development and proposed groundwater management actions. The cooperative modeling effort will largely fulfill the need for establishing a common understanding of local water resources.

Generally, county and local land use planning agencies notify local water agencies of pending development proposals and solicit their comments and recommendations. In some instances, notices and replies have not been made in a timely manner. Reliable consultation among agencies early in the project approval process would be the most efficient way to avoid undesirable project features or approvals. The following action will help achieve this objective.

Action 7-A: Establish Standard Interagency Procedures for Evaluating Long-Term and Short-Term Water Supply Availability

Elected officials and staff of local land use planning agencies (i.e., San Benito County, City of Hollister, and City of San Juan Bautista) should negotiate standard interagency consultation procedures with local water agencies (i.e., SBCWD, SCWD, TPCWD, Aromas Water District, and Pacheco Pass Water District). Procedures should include joint long-range planning activities in addition to approvals of specific projects. The procedures should be documented in a memorandum of agreement. The memorandum of agreement may address points of contact, sequences of communication and decision making, and expected response time for commenting agencies.

Action 7-B: Protect Critical Recharge Areas

Land use management policies can assist water resources management by encouraging or requiring that important groundwater recharge areas be protected from urban development or other land uses that would decrease the amount of recharge or potentially introduce contaminants into the recharge. Percolation from streams provided approximately 45% of the annual groundwater recharge in water year 1997 (Table 1), and deep percolation of rainfall and irrigation water through soils contributed approximately 40%. Creek and river channels occupy only a small fraction of the area overlying the groundwater basin and consequently are the most critical recharge areas on a per-acre basis. Stream reaches where percolation rates are relatively high should be protected by adopting policies that discourage or prohibit fill, realignment, dumping, sedimentation, and other activities that could decrease the percolation capacity or jeopardize groundwater quality. Permit conditions, plans, and ordinances regarding sand and gravel mining along Tres Pinos Creek and the San Benito River are also examples of land use management policies that can serve to protect groundwater recharge and storage capacity.

The best approach to protecting recharge capacity along the San Benito River would be to develop a comprehensive resource management plan for the river corridor. Numerous resources that are interrelated and potentially conflicting must be managed simultaneously along the river channel, including flood control, water supply, water quality, wastewater disposal, gravel mining, habitat, recreation, and open space. Development of a comprehensive river plan was attempted in the late 1980s, but the plan was not fully supported or implemented by all of the agencies and groups with interests in resources along the river.

Deep percolation through soils occurs throughout the area overlying the groundwater basin, but percolation rates are greater in some areas than others. Deep percolation is very difficult to measure, but would tend to be relatively high in areas where land slopes are small, soils are relatively permeable, and root depths are shallow.

A preliminary description of stream reaches and land areas where recharge rates are relatively high is presented in the Appendix. Potential adverse and beneficial water resources impacts associated with in-stream sand and gravel mining are also described in the Appendix.

Issue 8: Water Conservation

Water conservation is generally considered a desirable objective among urban and agricultural water users throughout California. In particular, it is reasonable to expect that areas dependent on imported water use that water as efficiently as possible. Even if water that is inefficiently used is subsequently available for reuse (by contributing to groundwater recharge, for example), conserving water minimizes impacts on regions that export water and minimizes costs associated with pumping and treating water. These expectations have been formally articulated in statewide MOUs regarding urban and agricultural water conservation. The urban water conservation MOU was developed in 1991 and now has 176 signatories, including the City of Hollister. The MOU prompted the creation of the California Urban Water Conservation Council, which develops and endorses BMPs for urban water conservation. Urban water conservation is also required by California Water Code Section 10620 et seq., which mandates the preparation of urban water management plans and references the statewide urban water conservation MOU. Agencies applying for low-interest loans from the state must comply with the MOU, and Reclamation requires urban CVP contractors to comply.

An analogous agricultural water conservation MOU was finalized in 1996 pursuant to the Agricultural Water Suppliers Efficient Water Management Practices Act of 1990 (AB 3616). The MOU established the Agricultural Water Management Council, which develops and endorses efficient water management practices for agriculture. The efficient water management practices recommended in the MOU are similar to the procedures and practices required by Reclamation for CVP contractors. Failure to prepare an adequate water management plan that includes appropriate conservation measures may jeopardize renewal of a CVP contract and exclude a contractor from receiving allocations of surplus CVP water or participating in water transfers involving CVP water.

Because SBCWD is a CVP contractor and the groundwater basin depends on CVP (San Felipe) water to prevent overdraft, a water conservation program is essential. One of the first steps in developing such a program will be to evaluate urban and agricultural water management practices recommended in the MOUs and determine whether they are appropriate for implementation in northern San Benito County. Fortunately, the existing water delivery infrastructure, metering, and irrigation practices already meet many of the standards set forth in the MOUs. A preliminary assessment of the recommended practices is given in the Appendix, but a thorough analysis is beyond the scope of this groundwater management plan.

Several local agencies have adopted water conservation plans, but the plans are quite different from one another and do not necessarily conform with state and federal requirements for water conservation plans. San Benito County adopted a water conservation plan in 1992 (Resolution 92-82) to meet the requirements of the Water Conservation in Landscaping Act (Government Code Section 65591). It prohibits water waste, requires low-flow plumbing fixtures in new and remodeled buildings, requires public or developer-installed residential landscaping to meet prescribed maximum allowable water budget standards, and recommends three generalized water conservation principles that "should be considered by the agricultural community". SBCWD submitted a water conservation plan to DWR in 1993, but the plan may not meet current standards and has not been actively implemented (Gregg pers. comm.). The City of Hollister is a signatory to the California Urban

Water Conservation MOU and thereby endorses and plans to implement all of the BMPs currently recommended by the California Urban Water Conservation Council. SCWD prohibits water waste (Ordinance 45) and requires all applicants for water service contracts to submit water conservation and landscaping plans for approval (Ordinance 95-2). Finally, SBCWD, City of Hollister, and SCWD are jointly preparing an urban water management plan to meet the requirements of Water Code Section 10620 et seq., which calls for identification and implementation of all cost-effective urban water conservation measures and development of an urban water shortage contingency plan.

Implementation of effective urban and agricultural water conservation programs will require ongoing efforts by local agency personnel. After reviewing the benefits and practicality of various water conservation practices under conditions found in San Benito County and selecting the most beneficial practices, local agencies will need to promote and facilitate their implementation. Public education and technical assistance are typically major components of successful water conservation programs and require ongoing effort by trained personnel. At an agency planning level, the key action required to implement a water conservation program is to budget for sufficient staff resources to design the conservation program and work with water users in implementing it.

Action 8-A: Implement an Agricultural Water Conservation Program

One of the agencies participating in development of this groundwater plan should designate a water conservation coordinator to develop and implement an agricultural water conservation program consistent with the statewide MOU. SBCWD would be an appropriate agency to house this program. Implementation of the program would probably require at least a half-time position and possibly a full-time position if water use audits of individual farm operations are included in the program.

Action 8-B: Implement an Urban Water Conservation Program

Municipal water purveyors should jointly fund an urban water conservation coordinator to develop and implement an urban water conservation program consistent with the statewide MOU. The City of Hollister would be an appropriate agency to house this program. Implementation of the program would probably require at least a half-time position.

Issue 9: Information Management

In its annual groundwater report for water year 1996, SBCWD identified several areas of weakness in its data collection, storage, and dissemination procedures. Certain types of data needed for effective groundwater management, such as groundwater quality and small stream flow, are not routinely collected. Other types of data, such as groundwater pumping totals, may not be measured accurately. Some types of data, such as parcel-based water use data, are difficult to use in hydrologic analyses because of a lack of geographic coordinate information. Information collected by other local agencies is also uneven in quality and availability. The following action would eliminate many of these shortcomings.

Action 9-A: Develop a Strategic Data Collection and Management Program

Technical staff from all local agencies involved in water-related data collection and management should jointly develop a strategic program for data collection and management. The program should be designed to efficiently provide information identified as necessary to support groundwater management decisions. The program should specify the types of data to be collected and the frequency of measurement; evaluate the accuracy of data collection procedures; outline the structure, format, and units to be used in computerized databases; and indicate procedures to ensure data consistency and transfer among agencies.

Plan Implementation

IMPLEMENTATION GROUP

Implementation of this groundwater management plan will be overseen by the Water Resources Association of San Benito County (Association), which will be a mutual benefit corporation formed under California nonprofit corporation law (Corporations Code Sections 7110-8910). Membership in the Association will be voluntary and will be open to local agencies involved in land and water management that have elected governing boards. The Board of Directors of the Association will consist of one representative from each member agency. The Association will not constitute a new agency or joint powers authority and will not have authority over any of its members. Actions will not be implemented within the geographical boundaries of any member agency without the consent of that agency. Decisions will be made by consensus, or if necessary, by majority vote of the members. Membership dues will be structured by the Board of Directors so that the Association's operating budget is shared among member agencies in approximate proportion to their respective budgets for water resources and/or land use planning activities.

Associate membership will be open to any other agencies, businesses, or interest groups that wish to actively participate in Association meetings and activities and support the goals and functions of the Association. Associate members will not have voting privileges and will pay a flat annual dues sufficient to cover copying and mailing costs for agenda packets.

The main purposes of the Association are to:

- refine, select, and coordinate implementation of management actions identified in this plan;
- coordinate the planning and management of local programs and projects involving water resources such as supply, drainage, flood control, water quality, conservation, wastewater disposal and reuse, and environmental protection;
- coordinate the management of surface water and groundwater supplies available to San Benito County to avoid potential adverse impacts from surface water use and groundwater extraction, such as overdraft, water quality deterioration, and environmental degradation;
- provide a forum for addressing proposals for water banking and transfers; and
- ensure open and frequent communications with the public.

The Association will meet at least quarterly. Meetings will be open to the public and will be advertised and recorded in accordance with the Brown Act.

Activities to be funded directly and collectively by the Association may include:

- administrative activities;
- preparing and mailing meeting agendas and minutes;
- preparing and mailing newsletters, press releases, and educational and public information materials;
- organizing conferences and workshops;
- organizing and attending interagency meetings;
- interacting with other local, state, and national water resources groups and agencies;
- investigating general questions or proposed actions related to water resources in San Benito County;
- commenting on policies, programs, and projects proposed by member agencies (e.g., general plan revisions and amendments, development projects, and conditional use permits involving activities that affect water resources);
- preparing and disseminating an annual report on the Associations's activities; and
- periodically updating this groundwater management plan (see "Future Plan Revisions" below).

The Association may employ a staff or hire consultants to perform the above activities. Implementation of specific groundwater management actions will be undertaken by individual agencies or groups of agencies interested in those actions. The implementing agencies will decide among themselves how best to obtain funds for implementing the actions. Implementation of an action requiring the authority of a particular member agency will be done through that agency.

In addition to the agency advisory group, one or more staff members from each participating agency shall be designated as the contact person for day-to-day activities and decisions related to implementing the plan or specific management actions. These individuals will collectively form the staff-level coordinating team.

SCHEDULE

A summary list of the recommended groundwater management actions is presented in Table 5, along with target dates for implementing them. The target dates reflect the relative urgency, long-term importance, and ease of implementation of the various actions. The schedule is not driven by any mandated regulatory compliance deadlines. Rather, it represents a realistic estimate of the minimum amount of time needed to implement the complete suite of actions, assuming all of the participating agencies and groups make a concerted effort toward that goal. The implementation lead time includes time to complete environmental documentation.

FUNDING

The groundwater management actions recommended for implementation vary widely in cost. Some consist of capital improvement projects that would incur a large one-time expense, while others are more programmatic in nature and would require renewed funding on an annual basis. Estimated order-of-magnitude costs associated with each recommended action are listed in Table 6.

Funding arrangements for each management action will be voluntarily negotiated among agencies directly involved in implementing the action. Each participating agency would then be responsible for raising the funds to meet its share of the cost. Possible sources of funding include state and federal grants and loans, county and municipal general funds, municipal water and sewer charges, San Felipe water charges, groundwater charges, and benefit assessments. Several assistance programs that could potentially support implementation of the groundwater management actions are described below.

Clean Water Act Section 205 (j) Funds

SWRCB administers Clean Water Act Section 205 (j) grant funds for watershed management planning and implementation projects. Eligible activities include development of watershed plans or other planning functions designed to resolve actual or potential water quality issues. Applicants must show that a coordinated approach with relevant agencies and stakeholders will be employed. Only local public agencies are eligible to receive grant funds. Grants must be matched with at least 25% nonfederal funds. The statewide funding level for the 205 (j) program is $400,000–$750,000. These funds could potentially support development of detailed management plans related to stormwater quality and nitrate contamination in the groundwater basin area.

Clean Water Act Section 319 (h) Funds

The SWRCB also administers the Clean Water Act Section 319 (h) grant program, which is intended to support implementation of BMPs for agricultural drainage, physical habitat alteration, channel stabilization, sediment control, hydrologic modification, dredging, livestock grazing, and other activities. Projects involving technology transfer, pollution prevention, citizen monitoring, and education are all eligible for funding. Applicants may be nonprofit organizations, government agencies, or educational institutions. Grants must be matched with at least 40% nonfederal funds. Actions recommended in this groundwater management plan that could be eligible for 319 (h) funding include salinity and nitrate education programs, use of reclaimed water for crop irrigation, tillage practices to enhance infiltration, and stormwater management measures.

Proposition 204 Funds

Proposition 204 (SB 900) was a major state bond measure passed in November 1996. The Water Conservation and Groundwater Recharge Loan Programs created under Proposition 204 provide loans to acquire land and develop facilities for groundwater recharge and for capital investments in water conservation facilities. The groundwater recharge funds are targeted for basins that are overdrafted and can demonstrate a "critical need". Groundwater recharge projects to achieve increased conjunctive use capacity may be eligible. Applications will be considered on a case-by-case basis, and the cost/benefit ratio of the proposed project will be evaluated (Rolph pers. comm.). Water conservation projects will be subjected to a similar cost-benefit evaluation. Actions recommended in this management plan that may be eligible for funding under these programs include construction of stormwater percolation facilities, investigation of conjunctive use opportunities, construction of a pipeline to deliver reclaimed water to San Juan Oaks Golf Course, relocation of the Hollister domestic wastewater percolation ponds, installation of wellhead blending facilities, and measures developed under the proposed urban and agricultural water conservation programs.

Proposition 204 also includes a Local Projects Loan and Grant Program designed to provide funds for projects to increase water supplies in rural counties (including San Benito County). Grants of up to $500,000 are available for feasibility studies, and loans of up to $5 million are available for construction. Public agencies in rural counties are eligible to apply. To be eligible for funding, projects should develop new water supplies. The Hollister water treatment plant might qualify if it is presented as increasing the conjunctive yield of the groundwater basin and improving the quality of municipal wastewater to the point that is directly usable for irrigation. Additional reservoirs that further develop local water resources would also be eligible for funding. Mitigation and enhancement of fish and wildlife habitat associated with the water supply project are also eligible for funding.

Table 5. Schedule for Implementation of Recommended Groundwater Management Actions

Groundwater Management Action	Implementation Date 1998	1999	2000	2001	2002
1-A: Construct water treatment plant	Design	Permits	Funding	Construct	On-line
1-B: Discourage water softener regeneration	New				Existing
1-C: Control sources of salt in wastewater					
1-D: Study groundwater salt balance					
1-E: Maximize rainfall recharge					>
1-F : Implement a salinity education program					
2-A: Expand use of tile drains	As	needed			>
2-B: Blend San Felipe water and groundwater					>
2-C: Use groundwater where quality not a problem					>
3-A: Irrigate golf course with reclaimed water				Design	Construct
3-B: Increase pumping in upper San Juan Valley					>
3-C: Modify percolation releases	As	needed			
3-D: Construct new wastewater percolation ponds			Design	EIR	Construct
4-A: Investigate nitrate sources					
4-B: Implement a nitrate education program					
5-A: Increase conjunctive use	Model	Implement			>
5-B: Negotiate water banking agreement					
5-C: Expand zone 6 boundaries					
7-A: Establish interagency procedures	MOU				
7-B: Protect critical recharge areas	Policy				
8-A: Implement agricultural water conservation					>
8-B: Implement urban water conservation					>
9-A: Develop information management program					

Note: Actions with significant ongoing activities are indicated by right-pointing arrows.

Table 6. Estimated Costs of Recommended Groundwater Management Actions

Groundwater Management Action	Estimated Cost
1-A: Construct water treatment plant	$22 million
1-B: Discourage water softener regeneration	$23,000
1-C: Control sources of salt in wastewater	$20,000
1-D: Study groundwater salt balance	$15,000
1-E: Maximize rainfall recharge	Varies (see Appendix)
1-F: Implement a salinity education program	$35,000 per year
2-A: Expand use of tile drains	$1,000-$2,000 per acre
2-B: Blend San Felipe water and groundwater	$35,000 per well
2-C: Use groundwater where quality not a problem	N/A
3-A: Irrigate golf course with reclaimed water	$440,000
3-B: Increase pumping in upper San Juan Valley	N/A
3-C: Modify percolation releases	$0
3-D: Construct new wastewater percolation ponds	$2-$4 million
4-A: Investigate nitrate sources	$50,000
4-B: Implement a nitrate education program	$15,000
5-A: Increase conjunctive use	Varies (see Appendix)
5-B: Negotiate water banking agreement	N/A
5-C: Expand zone 6 boundaries	N/A
7-A: Establish interagency procedures	$0
7-B: Protect recharge areas	N/A
8-A: Agricultural water conservation coordinator	$50,000 per year
8-B: Urban water conservation coordinator	$60,000 per year
9-A: Develop information management program	$15,000

N/A = not available until actions and implementation sites are specified in greater detail.

Environmental Quality Incentive Program

The 1996 Farm Bill established EQIP, which provides funding for local natural resource conservation needs. The program is administered by the Natural Resource Conservation Service (NRCS) in cooperation with local resource conservation districts and the RWQCBs. Farm conservation practices that are actively being encouraged by NRCS include: planting vegetation on highly erodible areas, constructing water diversions on long slopes to reduce sheet and rill erosion, planting filter strips of vegetation to remove sediment and pollutants from runoff, constructing water and sediment detention basins, and vegetating streambanks. Management actions considered in this plan that could fall within the scope of the EQIP practices include protecting critical recharge areas along streams and constructing stormwater infiltration basins to maximize rainfall recharge.

Conservation Reserve Program

The Conservation Reserve Program (CRP) is also administered by NRCS and predates EQIP. CRP provides rental payments and cost-share funding to farmers for reducing soil erosion and sedimentation, improving water quality, and maintaining fish and wildlife habitat. The program was developed to provide payments to farmers who remove highly erodible or otherwise environmentally sensitive terrain (such as wetlands) from production. Rental payments may be up to $50,000 per individual per year or up to a maximum of 50% of the cost of establishing permanent vegetative cover. CRP could potentially fund actions that prevent sediment deposition in local creeks and the San Benito River.

California Riparian Habitat Conservation Program

The California Riparian Habitat Conservation Program is administered by the state Wildlife Conservation Board and provides up to 50% of the cost of conservation easements, land exchanges, and land acquisition for protection and restoration of riparian habitat. Grants may be awarded to non-profit organizations, municipalities, counties, and other local, state, and federal agencies. Conservation easements are purchased directly from landowners. This program could potentially help acquire land along the San Benito River channel for use as integrated percolation and wetland habitat areas.

Fertilizer Research and Education Program

The Fertilizer Research and Education Program (FREP) is administered by the California Department of Food and Agriculture. FREP coordinates and funds research and demonstration projects related to environmentally safe and agronomically sound use of fertilizer materials. Most of the work presently funded by FREP is related to nitrate contamination of groundwater. Recipients of FREP support include growers, agricultural supply and service professionals, extension personnel, public agencies, and other interested parties. The program presently supports 61 projects at a cost of $3 million (plus $2.5 million in matching funds). The program publishes the results of the research projects it supports. FREP is a potential source of funding for the investigation of nitrate sources and the nitrate education program recommended in this plan.

Gravel Mining Extraction Fees

Extraction or tonnage fees imposed on gravel mining operations are another potential source of funds for habitat restoration or development of groundwater recharge facilities along Tres Pinos Creek and the San Benito River. None of the areas that have been mined or are presently being mined have been fully restored. Mined areas that are ready for restoration could be restored to provide groundwater recharge ponds combined with wetland and riparian habitats. For example, the mined area on the right bank of the San Benito River just upstream of Hospital Road will probably not be mined again in the future and is in a location suitable for restoration for groundwater recharge and/or habitat purposes.

Extraction fees have been used to support habitat restoration in other counties. For example, the Cache Creek Resource Management Plan in Yolo County is shifting essentially all gravel mining to off-channel deposits and using funds generated by extraction fees to pay for restoration along the Creek (Yolo County 1996). Although extraction fees are not used for these types of purposes in San Benito County, some mining companies may be willing to accept fees as a condition of permit approval (West pers. comm.).

Local Revolving Fund

Implementation of some management actions, such as installation of tile drains, plumbing modifications to blend groundwater and San Felipe water, and construction of tailwater ponds would require investments by private landowners. It would be desirable to create a local, low-interest revolving loan fund to assist landowners in implementing those measures.

FUTURE PLAN REVISIONS

This groundwater management plan will need to be updated periodically to reflect new information regarding the groundwater basin, changes in land and water use patterns, and the effects of successful implementation of groundwater management actions. Revisions and updates to this plan will be made by the Association using a consensus-based process similar to the process used to develop this initial plan. Substantive changes in the plan, such as major new issues or actions, will be ratified by the governing boards of member agencies. Minor changes to implementation details and schedules may be made by the Association without updating the plan or seeking ratification. A complete review and update of this plan will be done at least every 5 years.

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Table of Contents

Appendix. Detailed Descriptions and Status of Groundwater Management Actions

INTRODUCTION

All implementation actions that have been considered by the groundwater management planning group are described in this Appendix, including actions that are not recommended for implementation at this time. Each action is described on separate pages, so that revised descriptions can be substituted as information, analysis, and implementation plans evolve and improve. Revised descriptions can be identified by the date included in the footer on each page.

The descriptions all follow the same outline. The "Objective" section describes the groundwater management issues that the action is intended to address. The "Design Details and Implementation Issues" section describes any design work that has already been completed and any project features, operational strategies, contingencies, or site-specific details that need to be addressed in future design work. The "Estimated Cost" section includes the best available cost information, which ranges from broad estimates to itemized estimates developed by engineering firms. The "Key Participating Agencies" section lists local agencies that have expressed an interest in refining and implementing the management action or that logically would need to be involved because of their jurisdictions and responsibilities. Regional, state, and federal agencies that could be involved in reviewing, permitting, or funding the action are not listed.

The section on "Potential Effects on Groundwater, Water Users, and the Environment" discusses potential adverse or beneficial side effects of the action that should be considered in the project design and environmental documentation. The "Status" section indicatės whether the action is recommended for implementation and, if so, its present state of development. Finally, the "References Cited and Sources of Information" section lists sources of addition information, including printed references, internet sites, and personal contacts.

Management Action 1-A: Construct a Facility to Treat San Felipe Water for Municipal Use

Objective

To improve groundwater quality by increasing the use of San Felipe water, increase the reliability of water supplies, make groundwater budgets more positive, and thereby promote groundwater outflow for salt balance and decrease salt loading from water softener use.

Design Details and Implementation Issues

To ensure short-term water supply reliability, sufficient well capacity (in gallons per minute) should remain connected to the water distribution system at all times to meet peak day demand. System reliability is a greater concern with San Felipe water than with local groundwater because the San Felipe supply is subject to unforseen changes or interruptions resulting from unusual climatic conditions in distant locations, changes in state or federal laws and policies governing operation of the Central Valley Project (CVP), and accidental or malicious damage to CVP infrastructure. Because of anticipated increases in urban water demand, additional wells will need to be installed from time to time to maintain backup capacity. Additional local water storage tanks will also be needed to meet firefighting demands and peak hourly demands.

Estimated Cost

Capital cost of plant and associated pipelines: $22 million (Walters Engineering 1996).

Annualized unit cost: $1.69 per 1,000 gallons or $1.26 per billing unit (748 gallons) (Walters Engineering 1996).

Key Participating Agencies

San Benito County Water District (SBCWD), Sunnyslope County Water District (SCWD), City of Hollister.

Potential Effects on Groundwater, Water Users, and the Environment

A water treatment plant will increase the rate at which groundwater storage can be increased in the Tres Pinos, Hollister West, and Hollister East subbasins, but it may decrease the long-term average amount of recharge from the San Benito River. Groundwater pumping at municipal wells represents 51% of the outflows from the Tres Pinos and Hollister West subbasins combined. This pumping would largely or entirely cease if Action 1-A is implemented. Water levels in those subbasins would rapidly rise to the level of the San Benito River bed, and much of the potential recharge from the river would be rejected. Substantial decreases in the amount of Hernandez and San Felipe water that can be percolated in the river would occur within 1–3 years (assuming normal or wet climate conditions). Alternative uses or percolation sites would need to be found for some of the San Felipe water, Hernandez water, and wastewater that is currently percolated in those subbasins.

Any action that increases the amount of imported water used to meet local demand raises questions regarding reliability of the supply and sustainability of the use that depends on that supply. These issues are discussed in the section on "Reliability and Sustainability" in the body of the plan.

Status

Recommended for prompt implementation.

SBCWD, City of Hollister, and SCWD need to develop a cost-sharing and plant operation agreement.

References Cited and Sources of Information

Walters Engineering. 1996. City of Hollister water master plan update. September. San Jose, CA. Prepared for Hollister City Council, Hollister, CA.

Management Action 1-B: Actively Discourage Local Regeneration of Water Softeners

Objective

Decrease salt loading in municipal wastewater and groundwater.

Design Details and Implementation Issues

The first phase of this management action would be implemented as long as groundwater remains the source of municipal supply. Homeowners and businesses in urban areas would be encouraged to use cartridge-type rather than self-regenerating water softeners. The media for this public education effort could include inserts in utility bills, special mailings to customers, and newspaper advertisements and articles. Cartridge-type water softeners could be required in all new construction, although compliance may be difficult to enforce. Water softening service companies would be contacted and encouraged to recommend cartridge-type softeners to their customers.

The second phase of this management action would be a public education campaign at the time a water treatment plant is built to convert the municipal supply to San Felipe water (Action 1-A). All urban water customers would be encouraged to disconnect their water softeners, which will no longer be needed. A short-term public education program following completion of the water treatment plant should be sufficient to remind and instruct homeowners and businesses to disconnect their water softeners.

There is a small risk that customers will want to reactivate their water softeners during periods when groundwater is blended into the municipal supply. In general, CVP deliveries to municipal users are not cut more than 25% during drought periods. The hardness of a 75–25% blend of San Felipe water and local groundwater (assuming hardnesses of 110 and 430 milligrams per liter [mg/l] as $CaCO_3$, respectively) would be 190 mg/l, which only slightly exceeds the threshold at which most consumers prefer water softeners (180 mg/l). It is unlikely that large numbers of homeowners would switch back to water softeners in response to a transient increase in hardness to 190 mg/l. If the Hollister Conduit were damaged and the entire municipal water supply had to revert to groundwater, consumers would definitely notice and object to the sudden increase in hardness. Assuming that the normal San Felipe supply would be quickly restored, however, it is unlikely that many homeowners would go to the trouble and expense of reactivating their water softeners.

This management action does not include pick-up and disposal of disconnected water softeners. A water softener turn-in event could be organized by local water agencies, although cost of hauling and disposing of the softeners would need to be considered.

Estimated Cost

For the first phase, the cost of preparing and disseminating educational billing inserts and press releases once a year, and answering telephone inquiries from customers over a period of 5 years might be on the order of $13,000. A similar, but more concentrated 1-year effort, following completion of the water treatment plant might cost $10,000 for a total cost of $23,000.

Key Participating Agencies

The logical participants in implementing this action are SBCWD, City of Hollister, and SCWD.

Potential Effects on Groundwater, Water Users, and the Environment

This action would ensure that construction of a municipal water treatment plant would achieve the maximum possible reduction in salt loading at the wastewater treatment plant.

Status

Recommended for implementation immediately following implementation of Action 1-A (construction the water treatment plant for San Felipe water).

References Cited and Sources of Information

Management Action 1-C: Control Sources of Salt Entering the Municipal Sewer System

Objective

Decrease salt loading in municipal wastewater and groundwater

Design Details and Implementation Issues

This action would include sampling the conductivity of wastewater at various points in the municipal sewer system to identify any concentrated sources of salt entering the sewer system. Additionally, local industries that are likely to use salt in their processing activities would be contacted to jointly identify opportunities for source load reduction or pretreatment of wastewater at the point of use.

Sunnyslope County Water District surveyed pH and chloride at various points in the sewer system for the Ridgemark development to investigate salt loading from water softeners. The data indicated a large amount of short-term fluctuation in concentrations. Frequent or continuous monitoring during a 24-hour period may be necessary to accurately characterize salinity levels and identify salinity sources.

Estimated Cost

This action could be implemented by existing agency personnel. Labor costs would be on the order of $20,000.

Key Participating Agencies

The logical participants in implementing this action are the City of Hollister, SCWD, City of San Juan Bautista, and Tres Pinos County Water District (TPCWD).

Potential Effects on Groundwater, Water Users, and the Environment

Status

Recommended for implementation.

References Cited and Sources of Information

Management Action 1-D: Investigate the Long-Term Salt Balance of the Groundwater Basin

Objective

Prevent long-term salt buildup in the groundwater basin by understanding salt balance and determining which, if any, salt management measures are warranted.

Design Details and Implementation Issues

This action consists of a salt balance study that would combine water budget information for each subbasin obtained from the updated and recalibrated groundwater model with the estimated salinity of each flow term in the water budget. Water budgets would be obtained from simulations of existing and several hypothetical future conditions assuming various levels of implementation of groundwater management actions. The flow and salinity data would be combined in a spreadsheet mixing model to calculate long-term salinity trends under each scenario. Additional salinity measurements may be needed to more accurately characterize some of the basin inflows and outflows.

Estimated Cost

Assuming the groundwater model is updated, recalibrated, and ready for use, the cost of completing additional model simulations and developing the water quality mixing model would be approximately $15,000.

Key Participating Agencies

The logical participants in implementing this action are SBCWD and San Benito County.

Potential Effects on Groundwater, Water Users, and the Environment

By itself, this action would have no direct effect on the groundwater system. Indirect effects would depend on management recommendations that might emerge from the study.

Status

Recommended for implementation.

References Cited and Sources of Information

Management Action 1-E: Maximize Rainfall Recharge

Objective

Maintain high potential recharge rate to increase conjunctive use capacity of the basin, prevent long-term salt buildup by maximizing groundwater recharge and throughflow in the basin, and minimize dependence on imported water supplies.

Design Details and Implementation Issues

Specific structures, water management practices, and policies that can be used to maximize rainfall recharge are listed below and described in the following paragraphs:

1-E-1 increasing infiltration of urban stormwater runoff through use of detention/ percolation basins and dry wells,

1-E-2 increasing infiltration of rainfall in upland watersheds by implementing range management practices that prevent soil compaction and maintain adequate vegetative cover,

1-E-3 leaving a rough (chiseled) soil surface on fields that will be idle during the winter months or cross-ripping fields that are prebedded in fall,

1-E-4 constructing tailwater ponds at the low ends of fields to capture and infiltrate stormwater runoff,

1-E-5 constructing additional small, onstream reservoirs in the foothills surrounding the basin to capture runoff and release it at a slow rate that favors infiltration along downstream channels,

1-E-6 constructing an offstream reservoir and diverting water to it from the San Benito River during periods of high flow, and

1-E-7 constructing additional percolation berms in the San Benito River bed.

Some stormwater detention and retention ponds are already present in Hollister. Detention ponds intercept runoff before it reaches a creek or river and release it gradually after the peak flows have subsided. Retention ponds do not eventually release the stored runoff to the waterway. Instead, the water is percolated to augment groundwater recharge. New residential and commercial developments are required to include facilities that delay or contain stormwater runoff so that flood risk is not increased in downstream waterways. Sufficient detention capacity must be provided to achieve a peak runoff rate during a 100-year storm event that is no larger than the peak runoff rate during a 10-year storm event under existing conditions. There is no requirement that stormwater detention basins percolate the stored water to increase groundwater recharge, and suitable soils for percolation are not present in every proposed development area. Percolation can be enhanced by selecting pond sites with relatively permeable soils or by including a dry well in the pond design. Stormwater detention ponds can also be designed to serve as parks or playing fields during the dry season. A map showing the distribution of relatively permeable soils in the Hollister area is presented in the discussion of Action 3-D in this appendix.

San Benito County prepared a drainage plan to address flooding problems in the San Felipe Lake area in 1988. A drainage impact fee of $890 (1997 dollars) is added to the charge for every building permit to construct or modify any building in the area that drains into San Felipe Lake, which includes the Arroyo de las Viboras, Arroyo Dos Picachos, and Santa Ana Creek watersheds plus all valley floor areas north and east of a line between Hollister and San Felipe Lake. The county also has a revised drainage study in progress.

Dry wells are large-diameter gravel-packed wells that allow stormwater to be infiltrated into the ground at a faster rate. They are particularly useful in areas where permeable sediments are located at a shallow depth below relatively impermeable surface soils. A diagram and description of the dry well design offered by one vendor is shown in Figure 1-E-1.2. Typically, one of these wells is needed for every 1–3 acres of urban development. Two dry wells are located in the bottom of the municipal stormwater retention pond at the north end of Rustic Street in Hollister. The dry wells accelerate the rate of percolation of stormwater from the pond into an underlying 50-foot-thick sequence of sand and gravel strata. The wells were intended to serve as an interim method of stormwater disposal until an outlet pipeline could be constructed from the pond to Santa Ana Creek. The wells have performed so successfully, however, that plans for the pipeline have been abandoned (Perrine pers. comm.).

Range management practices in the upper watershed and foothills areas of the creeks that enter the groundwater basin can increase the infiltration of rainfall and prolong the duration of base flow in the creeks. Numerous studies since the 1940s have documented the effects of grazing on rainfall infiltration and runoff and demonstrated that decreased grazing intensity is associated with increased rainfall infiltration, decreased runoff, and decreased erosion. A key variable in all of the grazing studies was grazing intensity, as measured by the number of animal units per acre. An animal unit equals 1,000 pounds of grazing animal, which could consist, for example, of two steers, a cow-calf pair, one bull, or a number of sheep. Some of the earlier studies (Rhoades et al. 1964, Rauzi and Hanson 1966, Wood and Blackburn 1981) measured the effects of continuous grazing at various intensities. The results of these studies are summarized in Figure 1-E-2.1, which shows that rainfall infiltration is inversely correlated with animal density and runoff is directly correlated with animal density. Most of the studies measured infiltration and runoff during short periods of relatively intense rainfall generated using rainfall simulators. One study found that the relationships were also evident in annual runoff, however. More recent studies (McCalla et al. 1984, Warren et al. 1986, Pluhar et al. 1987, Takar et al. 1990) have focused on the effects of grazing systems involving rotational grazing at various intensities and frequencies. The results were less consistent but generally indicated that heavy grazing with high animal densities resulted in significantly decreased infiltration, regardless of whether it occurred on an intermittent or continuous basis.

Specific factors found to contribute significantly to changes in infiltration and runoff included soil compaction by trampling, percent vegetative cover, and total aboveground biomass, all of which were directly or inversely correlated with grazing intensity. Range condition was also found to correlate with runoff rates during experiments with intense (i.e., 4 inches in 30 minutes) simulated rainfall (Knight 1993). Only 2% of the rainfall became runoff on ranges in good condition, whereas 14% and 73% became runoff on ranges in fair and poor condition, respectively.

A recent U.S. Natural Resources Conservation Service study in three rangeland locations in California found that soil compaction and vegetative cover both influenced runoff rates and sediment yield under intense (i.e., 4 to 6 inches per hour) artificial rainfall conditions (Spaeth et al. 1995). There was a negligible difference in runoff rates between ungrazed and lightly grazed areas on loamy soils that did not tend to compact. On heavier soils with a greater tendency toward compaction, however, differences were substantial. The infiltration rate after 1 hour of rainfall in a moderately grazed area with greater residual aboveground cover (2,000–2,500 pounds per acre residue) was over three times greater than the infiltration rate in a heavily grazed area with the same soil type. In the upper Stony Creek watershed west of Colusa, perennial grassland had a much higher infiltration rate (3.8 inches per hour) than annual grassland on the same soil type (0.009 inch per hour) after one hour of intense (i.e., 4 inches per hour) artificial rainfall.

The results of the rainfall simulation experiments indicate that grazing intensity and range condition have a large effect on rainfall runoff processes and probably have a significant effect on peak runoff rates during major storms in the creeks that flow across the groundwater basin. The results also indicate that range condition affects the seasonal distribution of runoff. Decreased grazing intensity and improved range condition tend to increase infiltration and allow the infiltrated water to later emerge as base flow in nearby creeks. Thus, managing the intensity of grazing would have the double benefit of decreasing floodflows while increasing summer base flow. Both of these effects have been observed on ranges in the Stony Creek watershed, where decreased animal densities and rotational grazing were implemented in the early 1990s. The timing and duration of grazing was managed to favor perennial rather than annual grasses. Beginning in 1993, small creeks in the affected areas began flowing year round, which had not occurred during the previous several decades of intense grazing. Runoff during storms simultaneously decreased. On January 6, 1995, after the first several days of a major storm event, the creeks were barely starting to flow and stockpond impoundments on the creeks were still almost empty. Similar creeks on neighboring ranches where grazing was not managed were flowing in torrents and water was spilling from the impoundments (Gilgerd pers. comm.).

Tillage practices on fields overlying the groundwater basin can also be used to enhance rainfall recharge. If fields that will be idle during the winter are left with a rough, chiseled surface or if prebedded fields are cross-ripped, rainfall runoff will be retarded and infiltration increased relative to smooth or prebedded fields. Cross-ripping a field (dragging a single-toothed, deep-penetrating plow behind a light tread-type tractor) creates small checks in the furrows that allow rain to pond rather than run off immediately, as shown in Figure 1-E-3.1.

Tailwater ponds at the downhill ends of fields can also collect rainfall runoff and irrigation tailwater and allow it to percolate into the ground. If percolation rates are relatively low, the ponds can also be designed to provide wildlife habitat. If the ponds are equipped with gated outlet pipes and pumping plants, they can be operated for flood control and tailwater recirculation. A diagram of a multipurpose tailwater pond is shown in Figure 1-E-4.1 and examples from the Sacramento Valley are shown in Figure 1-E-4.2

Foothills reservoirs that provide water supply, flood control, and habitat benefits could range in size from small stockponds to reservoirs with capacities of several thousand acre-feet (af). No specific locations have been identified for ponds and small reservoirs, but the rolling terrain in the creek watersheds east of the groundwater basin would be well suited for small impoundments. Impoundments that store more than 5 af of runoff or streamflow for more than 30 days require an appropriative water right permit from the State Water Resources Control Board.

No locations for offstream reservoirs to store water diverted from the San Benito River have been identified at this time. Conceptually, the reservoirs would be similar to the existing Paicines Reservoir near Tres Pinos. Paicines is filled by diversions from the San Benito River that are conveyed by canal from a diversion structure several miles upstream of the reservoir. During the dry season, water in the reservoir is gradually released for percolation in Tres Pinos Creek and the San Benito River. An appropriative water rights permit would be required, and the dam would need to meet California dam safety requirements if the reservoir capacity exceeds 50 af.

Additional berms in the San Benito River bed could increase the total percolation capacity and focus it along reaches where there is no competition with wastewater percolation facilities. Additional percolation capacity along the San Benito River might not be needed given that groundwater budgets in the Hollister West and San Juan subbasins already appear to be generally positive and are likely to become more so following construction of a water treatment plant. The need for additional percolation capacity should be evaluated with respect to water treatment plant effects and conjunctive use requirements.

Various types of activities can protect creek channels for use as groundwater recharge facilities. Using grant funds, SBCWD and other local agencies organized and implemented a creek cleanup program in 1997 that removed several tons of rubbish from approximately 19 miles of local creeks. Local agencies could also contact, educate, and work with riparian landowners to discourage grading, filling, and bank protection measures that would decrease percolation capacity and promote vegetation management practices that retain conveyance capacity while retaining habitat value.

Estimated Cost

1-E-1: Stormwater percolation ponds and dry wells. CH2M HILL completed two projects in 1991 that provide an indication of typical costs. For the Diamond Oaks project in Roseville, a pond holding 50 af of stormwater was constructed for a cost of $300,000. The development site served by the pond covered 640 acres of land. An escalated cost value in 1997 dollars is $335,000. For another 3450-acre project in Roseville, the required detention pond cost $155,000 in 1991. In 1997 dollars, this would be $175,000.

On a cost-per-developed-acre basis, these ponds cost $523 per acre and $515 per acre, respectively, in 1997 dollars. As with reservoirs, detention basin costs are site-dependent because of different rainfall patterns and land slope and texture. Therefore, the costs given for the two cited projects can be used to compare with other projects in relative terms, but site-specific studies are required to develop reliable costs for San Benito County.

A typical dry well 4 feet in diameter and 40 feet deep serving 1–3 acres of commercial or residential development costs approximately $5,000. This assumes that the contractor is installing a number of wells in the same area at one time (Hustead pers. comm.).

1-E-2: Range management. Costs associated with this action include installation and maintenance of fencing, labor to rotate livestock among fenced grazing areas, and possibly a decrease in harvested animal weight. Actual costs would be site-specific and have not been estimated.

1-E-3: Tillage practices. The only cost associated with this practice is the potential loss of market opportunity resulting from delaying spring planting until the ground is dry enough to cultivate.

1-E-4: Tailwater ponds. Ponds can often be constructed with equipment and labor already available on the farm in 1–2 days. Culverts and gate valves for regulating the water level would cost several hundred dollars. There would also be a cost associated with a decrease in harvested area by perhaps 5%.

1-E-5 and 6: Reservoirs. Dam and reservoir costs and yields per af of storage capacity are very site-specific. Consequently, the examples described here provide general order-of-magnitude costs that may have no direct applicability to potential pond or reservoir sites in northern San Benito County. The examples include onstream reservoirs, offstream reservoirs, and onstream reservoirs with supplemental inflow. Onstream reservoirs consist of dams built on an existing stream that collect water only from the stream. Offstream reservoirs are typically constructed on a small drainage and receive water that is pumped from a larger nearby stream. The third category includes reservoirs that receive significant amounts of inflow from the drainage they impound and from another nearby stream. Costs for the selected projects are shown in Table 1-E-5.1, with project descriptions given below.

TABLE 1-E-5.1
Project Costs per Acre-Foot for Reservoirs

Type of Reservoir	Project Name	Location	Yield, Acre-Feet per Year	Cost per Acre-Foot of Yield
1. Onstream	Arroyo Seco River Reservoir	"Pools Site" near Carmel	10,000	$700
2. Offstream	Soquel Creek	Near Soquel	1,000	$240
	Bolsa de San Cayetano	Watsonville	3,500	$660
3. Onstream with supplemental supply	Pescadero Creek	Watsonville	7,600	$570
	College Lake	Watsonville	3,400	$640

The costs shown are only for design and construction of the reservoir itself and do not include any costs for conveyance, treatment, or distribution facilities that may be needed to use the water. Treatment and distribution costs for injection or potable supply uses could add another $2,000 per af to the storage costs, as estimated for the Soquel Creek project.

The Monterey County Water Resources Agency studied Arroyo Seco River Reservoir sites in 1994 and concluded that a 100,000-af reservoir at the Pools site would cost approximately $90 million.

The Soquel Creek Water District investigated the Soquel Creek Project in 1996. It included a 50-af offstream reservoir with water diverted and pumped from Soquel Creek. Although the reservoir capacity is small, the ability to directly divert water from Soquel Creek in winter brings the total project yield to approximately 1,000 af.

The Bolsa de San Cayetano Reservoir is a proposed offstream reservoir that would be filled with water diverted and pumped from the Pajaro River. An approximately 90-foot-high dam would create a reservoir of approximately 4,000 af. Water would be pumped from the Pajaro River at Thurwachter bridge at rates of up to 40 cubic feet per second (cfs) and conveyed through a 10,500-foot pipeline. The anticipated average annual yield of the reservoir is approximately 3,500 af. Costs were estimated in 1984 by Brown and Caldwell Consulting Engineers at $21.5 million in capital costs and $110,000 in operation and maintenance (O&M) costs. Escalating those costs to 1997 dollars results in capital costs of $28.6 million and annual O&M costs of $146,000.

The Pescadero Creek Reservoir would be located approximately 1,500 feet upstream of the creek's confluence with the Pajaro River. The yield of the 10.5-square mile Pescadero Creek watershed would be supplemented by winter diversions from the Pajaro River. The average annual yield of a 20,000-af reservoir with a 75 cfs supplemental Pajaro River diversion is estimated to be approximately 7,600 af. This reservoir was also included in the 1984 Brown and Caldwell study. Capital costs are estimated to be $40.1 million and O&M costs are estimated to be $309,000 per year in 1997 dollars.

The College Lake Reservoir would increase the capacity of a natural depression located on Salsipudes Creek near Watsonville with supplemental flows diverted from Corralitos Creek. The average annual yield of a 10,000-af reservoir with a supplemental diversion of 25 cfs from Corralitos Creek is estimated to be 3,400 af. Updating the cost estimate from the 1984 Brown and Caldwell study to 1997 dollars results in an estimated capital cost of $22.5 million and an annual O&M cost of $136,000.

1-E-7: Constructing additional percolation berms. The average cost of constructing two percolation berms in the San Benito River in 1996 was $3,700, including permits, earthwork, and outlet culverts.

Key Participating Agencies

Participating agencies would vary depending on the specific implementation measure involved.

Potential Effects on Groundwater, Water Users, and the Environment

The measures considered under this action would all result in increased groundwater recharge. Some of them would also provide water quality, flood control, and wildlife habitat benefits.

Status

It is recommended that recharge capacity needs be evaluated for each subbasin in light of the effects of San Felipe imports during the past 11 years and the effects of other recommended actions such as construction of a municipal water treatment plan (Action 1-A) and increased conjunctive use of the basin (Action 5-A). If increased rainfall and streamflow recharge is found to be desirable, then the measures described under this action should be evaluated for cost-effectiveness and environmental impact.

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Figure 1-E-1.2. Description and Diagram of a Dry Well

The MaxWell® DRAINAGE SYSTEM

Design Suggestions for Retention and Drainage Systems

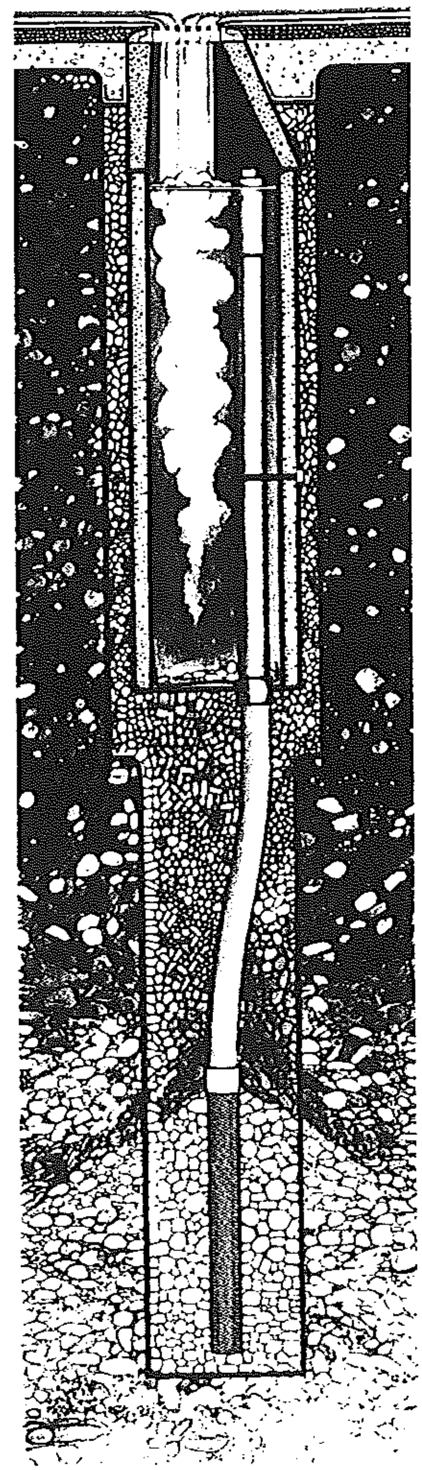
The MaxWell® Concept

Since 1974, over 24,000 MaxWell® Systems have proven their value as a cost-effective solution in a wide variety of drainage applications. Earlier experience had shown that the silt and debris that flow into a conventional storm water drywell could quickly cut short its life by clogging the soils meant to transmit water. Pavement sediment could contribute to these problems by further restricting long-term performance.

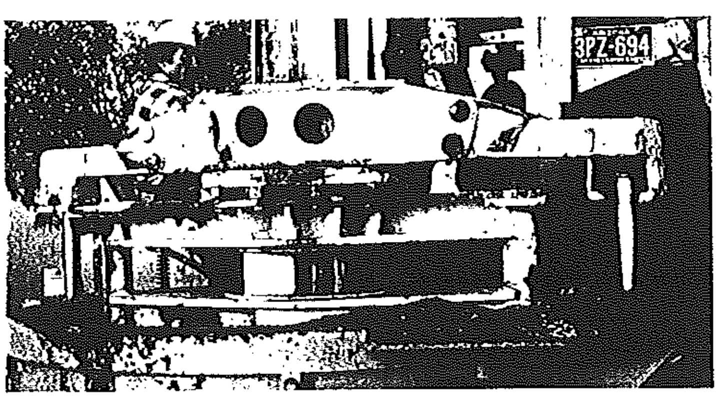
As a result, engineers have been specifying MaxWell® Systems to bring an end to these life-expectancy problems and provide a practical solution to drainage requirements.

Common to all MaxWells is a large settling basin in its upper section combined with a carefully designed and constructed drainage assembly below. The drawing shown here of a Type IV MaxWell illustrates the patented overflow process on which the settling basin works. Silt and other heavy particles settle to the bottom of the basin. Floating trash, paper and other debris are effectively stopped by the PureFlo® Debris Shield on top of the overflow pipe. An internal screen then filters fine suspended particles while a floating absorbent pillow wicks residual pavement oils and compounds from the water. The drainage assembly then returns the cleaned water from storms or sprinklers to the surrounding permeable soils through the FloFast® drainage screen.

Equally important to long life is the care taken in drilling the drywell and installing the components. At least ten feet of penetration with a large, 4-foot diameter hole into the permeable, clay-free sand, gravel and cobbles is vital. McGuckin Drilling's specially designed, "crowd"-equipped rigs get through difficult cemented soils to reach clean drainage soils at depths up to 180 feet. Additionally, the firm's proprietary techniques assure that soils will stay clean from the drilling operation through initial well use.



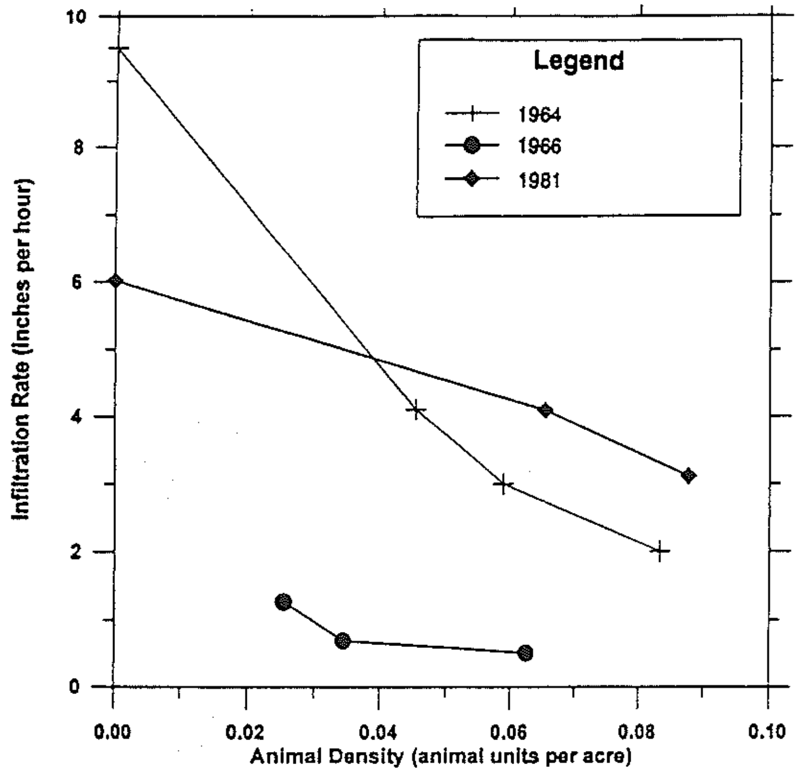
The MaxWell® IV



McGuckin Drilling "Crowd"-equipped Drill Rig

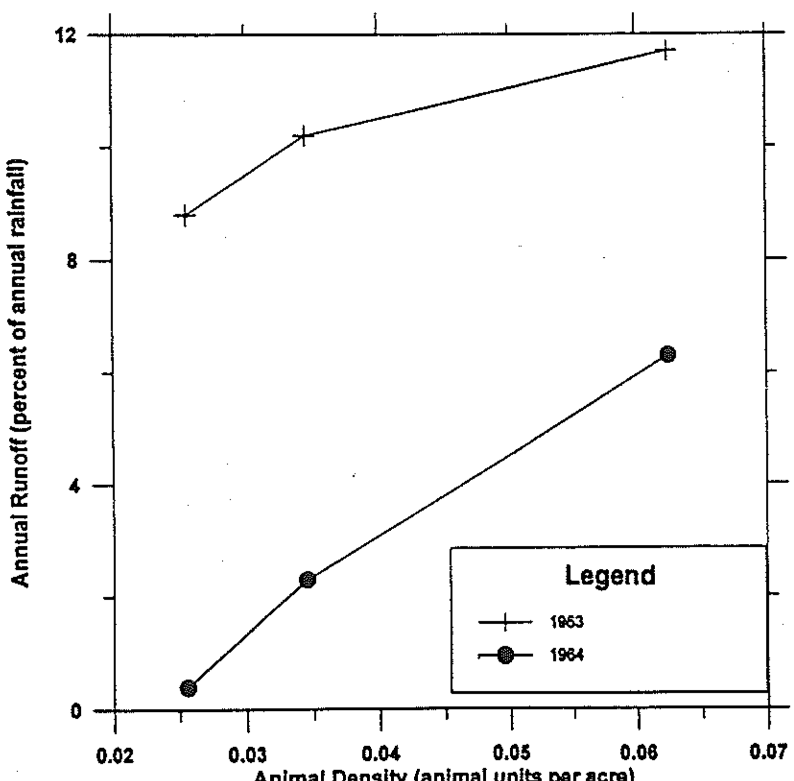
Manufactured and Installed Exclusively by McGuckin Drilling, Inc.

Please see reverse side for additional information. ▼



Effect of Grazing Intensity on Rainfall Infiltration Rate

Sources: Rhoades et al. 1964, Rauzi and Hanson 1966, Wood and Blackburn 1981.



Effect of Grazing Intensity on Annual Rainfall Runoff

Source: Rauzi and Hanson 1966.

Jones & Stokes Associates, Inc.

Figure 1-E-2.1
Effect of Grazing Intensity on Infiltration and Rainfall Runoff

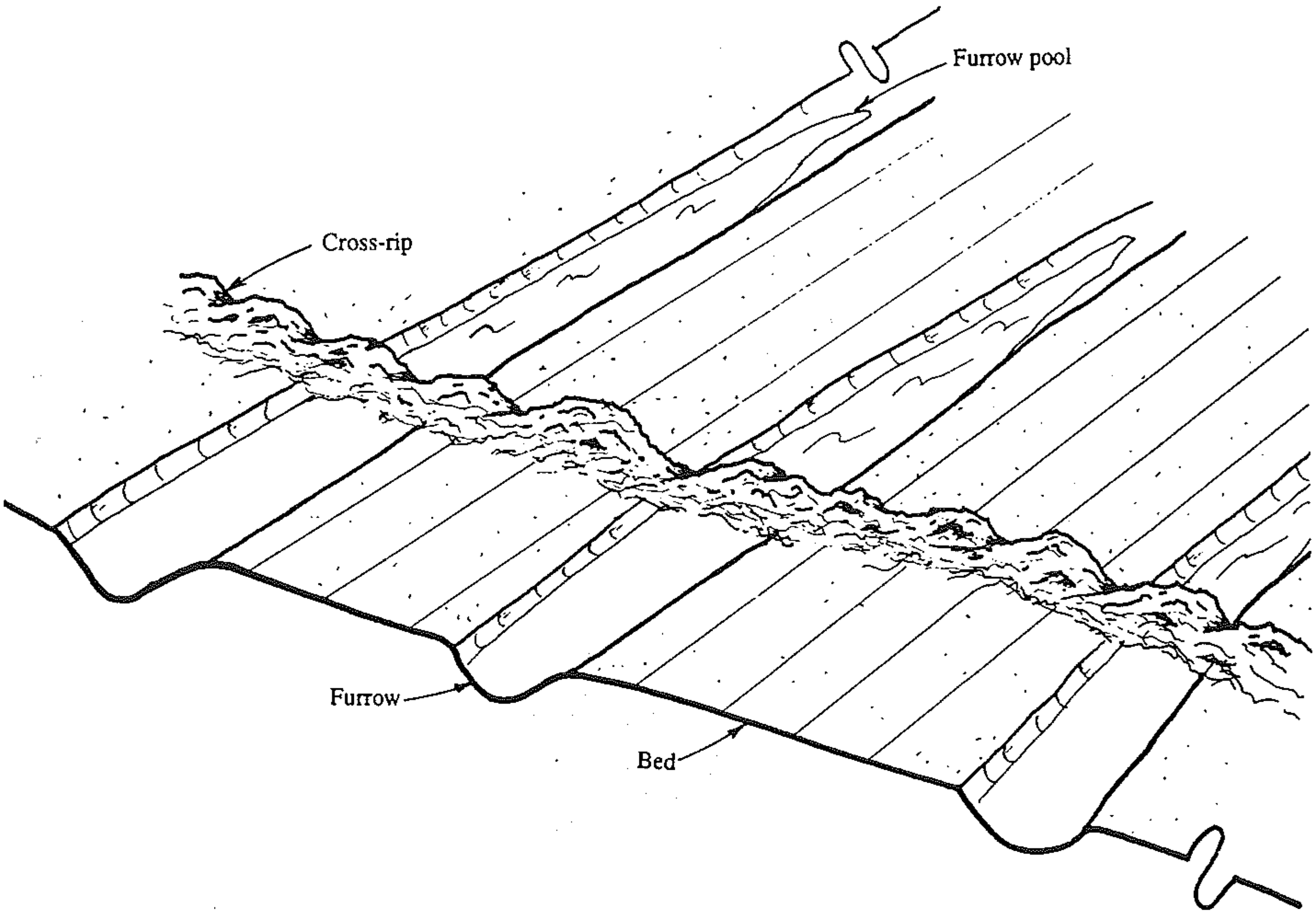


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Figure 1-E-3.1
Ponding and Infiltration of Field Runoff behind Furrow Checks Created by Cross-Ripping

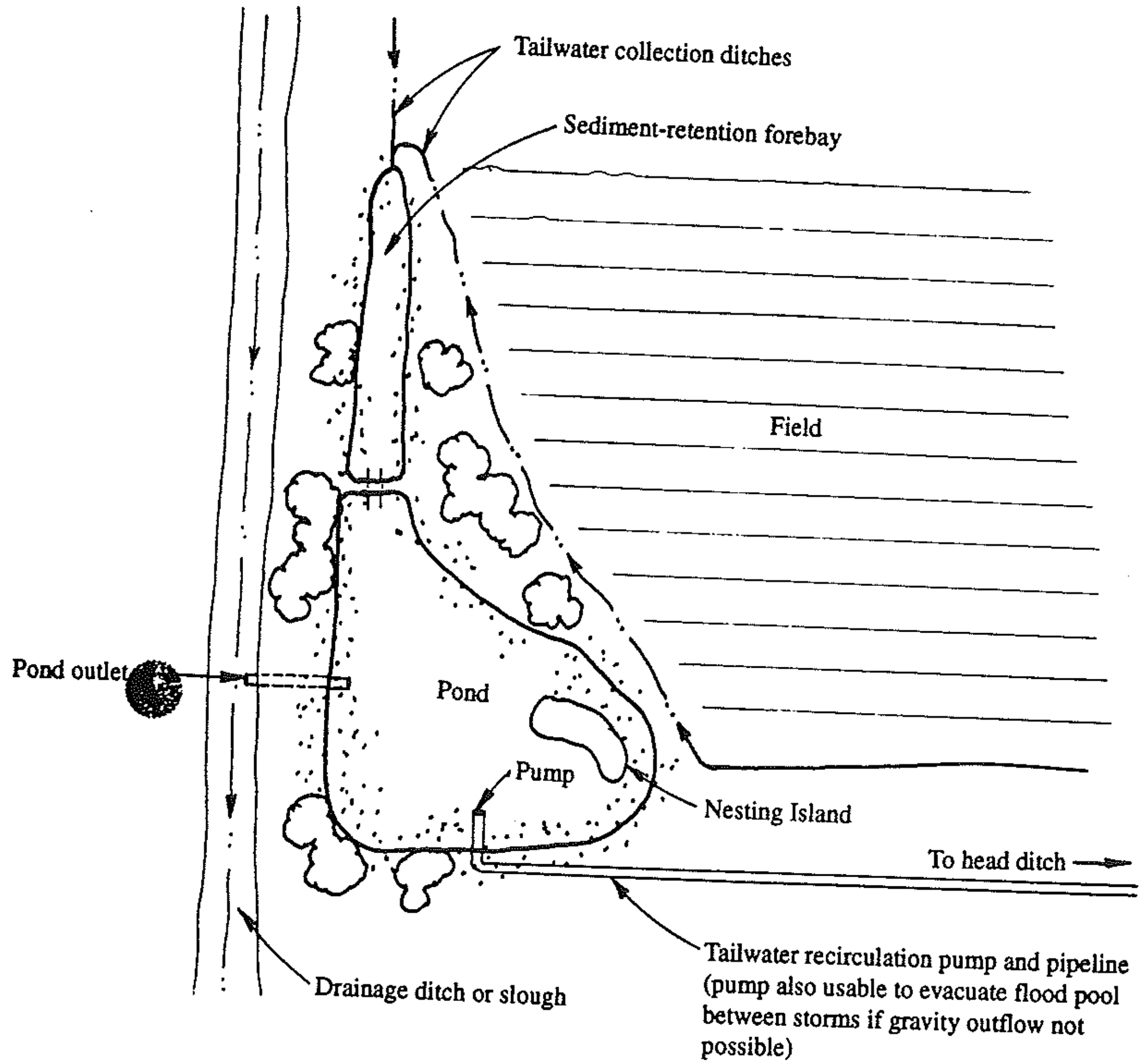

Figure 1-E-4.
Design Features of a Typical Tailwater Pond and Return System

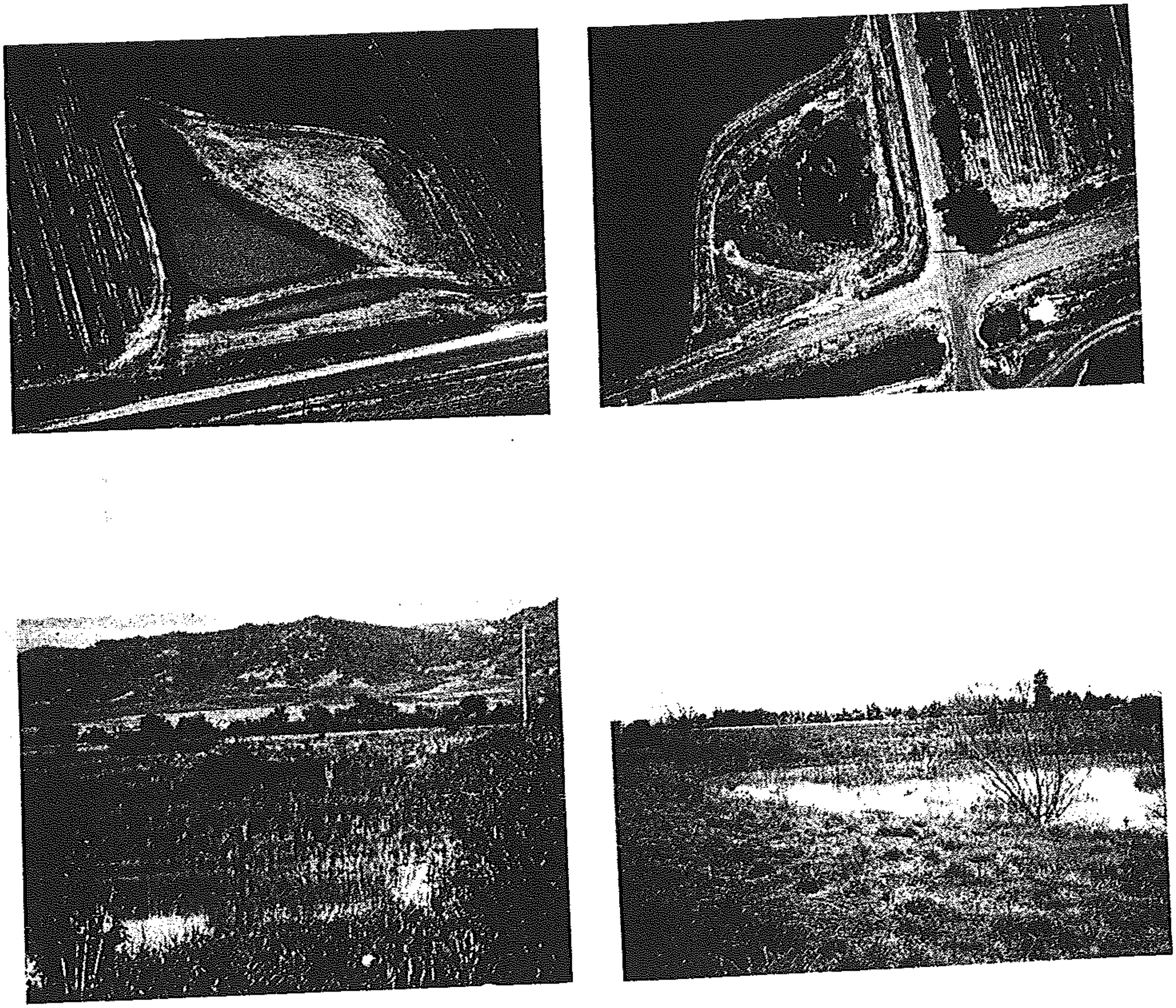

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Figure 1-E-4.2
Examples of Tailwater Ponds

Management Action 1-F: Create a Salinity Education Program for Farmers

Objective

Maximize conjunctive use flexibility by enabling farmers to effectively use various proportions of San Felipe water and groundwater for irrigation.

Design Details and Implementation Issues

Working with the California Department of Water Resources, the U.S. Natural Resources Conservation Service, the University of California Cooperative Extension, and the San Benito County Agricultural Commissioner, local agencies would develop an education and technical assistance program for salt management in agriculture. The program could include preparation of pamphlets, demonstration field days for growers, individual farm evaluations, and on-call technical assistance for growers.

Estimated Cost

The principal cost associated with this action is staff time. Some of the involved agencies may already have staff assigned to implement educational and technical assistance programs of this nature. Assuming that hosting special educational events and providing individual assistance to farmers would require approximately a half-time position (collectively among the participating agencies), the approximate annual cost of this action would be $35,000.

Key Participating Agencies

The logical participants for implementing this action are SBCWD and the San Benito County Farm Bureau.

Potential Effects on Groundwater, Water Users, and the Environment

This would result in larger annual variations in agricultural use of San Felipe water and enable the long-term average annual agricultural use of San Felipe water to be adjusted to meet water balance, water quality, and agronomic objectives.

Status

Recommended for implementation.

References Cited and Sources of Information

Management Action 1-G: Increase Overall San Felipe Imports to Achieve Groundwater Outflow

Objective

Prevent long-term salt buildup in the groundwater basin by increasing groundwater outflow from the basin.

Design Details and Implementation Issues

Reestablishing groundwater outflow from the basin is a possible means of flushing salts from the groundwater basin and avoiding large long-term increases in groundwater salinity. Potential mechanisms of groundwater outflow include subsurface outflow (e.g., beneath the Pajaro River toward Gilroy), groundwater discharge into the San Benito and Pajaro Rivers, discharge of agricultural tile drains to the rivers, and discharge of treated municipal wastewater to rivers and creeks. Increased use of San Felipe water would create a positive shift in the groundwater budget that would initially result in rising groundwater levels and eventually cause an increase in groundwater outflow.

Construction of a municipal water treatment plant (Action 1-A) could increase imports by approximately 8,000 af per year (af/yr) (the present municipal water demand), and in recent years farmers have been using only approximately 20,000 af/yr of the 35,250 af/yr of San Felipe water allocated for agricultural use. The maximum amount of San Felipe water available to San Benito County under its contract with the U.S. Bureau of Reclamation (Reclamation) is 43,800 af/yr, which would be more than enough to establish a positive water balance leading to increased groundwater outflow. Simulations of the groundwater system have indicated that imports of 16,000 af/yr would be sufficient to eliminate overdraft (Luhdorff and Scalmanini Consulting Engineers 1991), and any additional imports would presumably result in water level increases and groundwater outflow. More recent analysis of water level hydrographs (Jones & Stokes Associates 1997) indicates that San Felipe imports during water years 1987–1996 appear to have created level or rising water level trends in most subbasins. Imports averaged 17,800 af/yr during that 10-year period and averaged 23,400 af/yr during the last 4 years of that period.

Estimated Cost

No specific additional costs are associated with promoting and coordinating the implementation of other actions recommended in this plan. Interagency planning and coordinating costs are assumed to be covered by existing budgeting procedures and funding sources.

Based on costs incurred during 1996–1997 to expand subsystem 10, the cost of extending the San Felipe distribution system to new areas is approximately $600 per acre.

Key Participating Agencies

None identified at this time.

Potential Effects on Groundwater, Water Users, and the Environment

Importation of additional San Felipe water has some drawbacks, although they may be acceptable ones. Increased imports will result in rising groundwater levels that can become high enough in some areas to cause waterlogging of soils. For example, soil saturation that appeared to be caused by high groundwater levels was observed in several areas in the Pacheco and Bolsa subbasins in spring 1997. Saturation that continues into the growing season may force farmers to install tile drains in their fields to avoid waterlogged soils (see Issue 2 and Action 2-A, below). Although the cost of installing tile drains is fairly high, the costs have willingly been borne by a number of farmers in the San Juan subbasin, where waterlogging results from a shallow clay layer that impedes downward percolation of rainfall and irrigation water. Another drawback to groundwater outflow and drain discharges as a method of removing salts is the potential for adverse effects on downstream water users, freshwater aquatic habitat in the Pajaro River, and marine biota in the Monterey Bay National Marine Sanctuary. These effects would be highly dependent on the concentration of dissolved solids in the outflow, which could be manipulated somewhat by groundwater management policies. Finally, groundwater discharge to rivers has the drawback that the water leaves the basin as surface flow and is no longer available for beneficial reuse in San Benito County.

Status

This action is not recommended for implementation at this time because groundwater salinity is not increasing at a significant rate, use of San Felipe already appears to be achieving positive groundwater budgets that will eventually result in outflow, and excessively positive groundwater budgets can result in drainage problems. When additional information becomes available regarding long-term water budgets, salinity patterns, and salt balance in the groundwater basin, it may be appropriate to reconsider implementing this action.

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Management Action 2-A: Expand the Use of Tile Drains to Prevent Soil Saturation

Objective

Avoid drainage problems associated with high water table conditions resulting from positive groundwater budgets or conjunctive use cycles.

Design Details and Implementation Issues

Implementation of this action would consist of individual landowners installing tile drains in their fields if high water table conditions become frequent or severe enough to substantially impair agricultural productivity. This action would only be effective in areas where drainage problems are the result of a high water table rather than the presence of shallow clay layers that impede downward percolation of water. The existing drainage problems in the central and western parts of the San Juan Valley, for example, result from shallow clay layers.

Estimated Cost

The total cost for this action depends on the number of acres of land that need tile drains. The cost per acre depends on the depth and spacing of individual drain lines but typically is in the range of $1,000–2,000 per acre (Salas pers. comm.).

Key Participating Agencies

SBCWD could promote this action by providing establishing a low-interest revolving loan fund or by assisting farmers in obtaining financial assistance from other sources.

Potential Effects on Groundwater, Water Users, and the Environment

Depending on its quality, drainage water discharged to creeks can have adverse impacts on aquatic wildlife. The water quality of existing drain discharges has not been thoroughly investigated.

Status

Recommended for implementation as needed on a site-specific basis.

References Cited and Sources of Information

Salas, Gene. President, Salas, Inc., Santa Maria, CA. January 8, 1997 -telephone conversation. Telephone: (805) 937-6169.

Management Action 2-B: Blend San Felipe Water and Groundwater

Objective

Maximize conjunctive use flexibility by enabling farmers to use varying proportions of groundwater and San Felipe water.

Design Details and Implementation Issues

To implement this action, individual farmers would install wellhead plumbing appurtenances that would enable San Felipe water to be blended in any proportion with groundwater to achieve a desired salinity level. The plumbing would consist of a pipeline extending from the San Felipe turnout valve to the well serving the same parcel, valves, and pressure regulators. The blend and salinity level would be selected by the farmer based on crop salinity tolerance, water cost, and the current groundwater use objectives of SBCWD. Under conjunctive use management, SBCWD would request that relatively large amounts of San Felipe water be used in some years and relatively little in other years.

Estimated Cost

The cost estimate for blending San Felipe water and groundwater at individual wells and blue valves assumes that farms use sprinkler systems and that connection of two pressurized pipelines would require check valves on the San Felipe supply line and the well discharge pipe to prevent backflow in either direction. A pressure regulating valve on the well water line would also be needed to provide consistent mixing when water pressures fluctuate in the San Felipe supply line. Calculated sizes of pipelines are as follows:

- Well discharge = 1,500 gallons per minute (typical)
- Well discharge pipe size = 12 inches
- Desired blended dissolved solids concentration = 700 mg/l
- Required San Felipe flow rate = 3,000 gallons per minute
- Required San Felipe pipe size = 16 inches

Assuming an average distance from San Felipe pipeline to farm well of 200 feet, costs would be approximately as follows:

■ 16-inch piping and fittings	$ 13,000
■ 16-inch butterfly valve	$ 3,000
■ 16-inch check valve	$ 5,600
■ 16-inch meter	$ 4,300
■ 12-inch pressure sustaining valve	$ 7,000
Subtotal	$ 33,000
Contingency at 20%	$ 2,000
Total	$ 35,000

Actual sizing of pipe and meter would depend on the desired delivery rates, so actual costs could vary significantly from the value shown. For distances other than 200 feet from the well to the San Felipe blue valve, costs can be adjusted upward or downward by $35 per foot for buried 16-inch PVC pipe. A variable speed well pump motor might also be needed to achieve a full range of blending proportions.

Operation of this system would most likely be manual. When the new plumbing is first put into operation, an empirical relationship between the San Felipe valve setting and the salinity and discharge rate of the blended water could be developed by testing several combinations of wellhead and San Felipe valve settings. This relationship could be used to select valve settings for subsequent irrigations, and the salinity of the blended flow could be confirmed with a conductivity meter.

Key Participating Agencies

SBCWD is the logical agency to coordinate and assist with implementing this action.

Potential Effects on Groundwater, Water Users, and the Environment

This action would result in larger annual variations in agricultural use of San Felipe water by allowing farmers to vary the amount of San Felipe water used without incurring adverse agronomic impacts. At the subbasin scale, it would enable the long-term average annual agricultural use of San Felipe water to be adjusted to meet water balance and groundwater quality objectives.

Status

Recommended for implementation.

References Cited and Sources of Information

Management Action 2-C: Encourage Use of Groundwater for Purposes Not Sensitive to Water Quality

Objective

Avoid high water table problems by maintaining reasonable amounts of groundwater pumping in subbasins where many users prefer San Felipe water.

Design Details and Implementation Issues

This action consists of identifying large agricultural water users in high water table areas who do not require the higher quality of San Felipe water and encouraging them to continue using groundwater. For agricultural users who already have access to both groundwater and San Felipe water, this action could include incentives to continue using groundwater. For urban users (selected industrial users and turf irrigation at parks, schools, and cemeteries), this action may include construction of onsite wells to enable continued use of groundwater in the event that the municipal water supply converts to treated San Felipe water (Action 1-A). Hollister High School and the Ridgemark golf course already use onsite wells and could continue to do so. Municipal water in the City of Hollister and SCWD service areas is used to irrigate 31 other large turf areas that could potentially be supplied by onsite wells. The average annual water use for these areas during water years 1996–1997 was 220 af, or approximately 2.7% of municipal water production.

Estimated Cost

The cost of implementing this action depends on the extent of high water table conditions, the number and types of users that could continue using groundwater, and the site-specific costs of installing additional wells or providing financial incentives.

Key Participating Agencies

SBCWD would be the logical agency to implement this action for agricultural users. The City of Hollister, SCWD, and possibly the City of San Juan Bautista would need to be involved for urban users.

Potential Effects on Groundwater, Water Users, and the Environment

The principal effect would be a beneficial balancing of local groundwater budgets to prevent or minimize high water table conditions.

Status

If high water table conditions spread to new areas, large water users in that area should be inventoried. The cost-effectiveness of providing financial incentives or new wells to promote groundwater use should be considered on a case-by-case basis.

References Cited and Sources of Information

Management Action 2-D: Institute Economic Incentives to Promote Increased Use of Groundwater in Drainage Problem Areas

Objective

Prevent shallow water table conditions by encouraging groundwater use and thereby decreasing use of San Felipe water in selected areas

Design Details and Implementation Issues

A system of tiered pricing for incremental allocations of San Felipe water could be instituted to adjust the overall amount of surface and groundwater use in the basin. Present pricing rules in SBCWD's formation act require that prices be geographically uniform throughout zone 6, so tiered pricing could not achieve locally variable results. An alternative method for creating economic incentives to use more groundwater would be to offer subsidies or rebates to farmers who choose to forego use of San Felipe water in favor of using local groundwater. These incentives could be offered only in drainage problem areas to achieve locally variable results.

Estimated Cost

Presumably, tiered pricing could be structured to be revenue-neutral overall.

Key Participating Agencies

SBCWD.

Potential Effects on Groundwater, Water Users, and the Environment

This action would have the beneficial effect of providing a means of balancing local groundwater budgets. It could potentially create financial uncertainty or hardship for farmers who require the higher quality of San Felipe water, depending on the amount and annual variation in water charges.

Status

Not recommended for implementation at this time, pending evaluation of the effectiveness of other actions.

References Cited and Sources of Information

Management Action 2-E: Decrease Deliveries of San Felipe Water to Drainage Problem Areas and Implement an Allocation Scheme for San Felipe Water

Objective

Prevent shallow water table conditions by limiting San Felipe imports and thereby increasing groundwater use in selected areas

Design Details and Implementation Issues

SBCWD could limit deliveries of San Felipe water to drainage problem areas until local groundwater pumping increases to a level that prevents rising groundwater levels and drainage problems. For example, the allocation scheme could consist simply of decreasing the normal San Felipe allocation of 1.2 af per acre to some lower number that achieves a balance between imported and local water use. SBCWD already has an allocation program that it uses in years when the amount of water available from Reclamation is less than enough to provide 1.2 af per acre throughout zone 6. The program consists basically of across-the-board cuts in the allocation, with special allowances for perennial crops if the cuts are large.

Estimated Cost

There would be a small administrative cost associated with implementing this action. A specific cost has not been estimated.

Key Participating Agencies

SBCWD.

Potential Effects on Groundwater, Water Users, and the Environment

This action would have the beneficial effect of providing a means of balancing local groundwater budgets. It could potentially create financial uncertainty or hardship for farmers who require the higher quality of San Felipe water, depending on the amount and annual variation in water charges.

Status

Not recommended for implementation at this time, pending evaluation of the effectiveness of other actions.

References Cited and Sources of Information

Management Action 2-F: Improve Irrigation Efficiency

Objective

Decrease soil saturation by decreasing deep percolation of irrigation water.

Design Details and Implementation Issues

Drainage problems can be minimized by maximizing irrigation efficiency. Careful monitoring of soil moisture status and improvements in application uniformity (e.g., through drip or low energy precision applicator systems) can decrease the amount of deep percolation below the root zone. These approaches have been successfully used in Westlands Water District to substantially decrease the amount of agricultural drainage water. Agricultural members of the technical advisory group asserted that irrigation efficiency is already quite high and that additional opportunities to decrease deep percolation of irrigation water without adversely affecting crop growth are limited.

Estimated Cost

The equipment and techniques needed to improve irrigation efficiency are site-specific. A range of costs has not been estimated for this action.

Key Participating Agencies

SBCWD, San Benito County Farm Bureau, and the San Benito County Agricultural Commissioner would be logical participants in implementing this action.

Potential Effects on Groundwater, Water Users, and the Environment

Implementation of this action would result in decreased groundwater pumping and/or decreased purchases of San Felipe water. Discharge from tile drains would be minimized and drains may not be needed in some areas where they would otherwise have been necessary.

Status

Not recommended at this time.

References Cited and Sources of Information

Management Action 3-A: Deliver Reclaimed Water for Golf Course Irrigation

Objective

Alleviate percolation capacity problems in the upper end of the San Juan subbasin.

Design Details and Implementation Issues

The San Juan Oaks golf course is located in the southeast corner of the San Juan subbasin approximately 2 miles from the Hollister domestic wastewater treatment plant percolation ponds. The golf course already has dual plumbing for irrigation and can partially substitute reclaimed water for its existing use of San Felipe water. This action would consist of installing a pipeline from the ponds to the golf course and delivering approximately 440 af/yr of reclaimed water.

The California Department of Health Services regulates use of reclaimed water on golf courses to protect public health. Golf courses that are not surrounded by residences, such as the San Juan Oaks golf course, may irrigate with reclaimed water treated to a secondary level and disinfected. If there are residences adjacent to the golf course, the wastewater must receive tertiary treatment, which involves an additional filtration step. In 1997, the City of Hollister evaluated several options to upgrade the wastewater treatment process. The City elected to proceed with implementing a Facultative Aerobic Pond Series process (a secondary level of treatment) without disinfection. A tertiary treatment process was also evaluated but the 10-year life cycle cost was 26% more expensive (i.e., $5.8 million versus $4.6 million).

During water year 1997, the golf course used 440 af of San Felipe water in amounts ranging from less than 10 af per month during October–January to approximately 70 af per month during June–August. Groundwater use was minimal. The amount of reclaimed water discharged to the domestic wastewater ponds ranged from 98 af in May to 256 af in September and thus exceeded the irrigation demand at the golf course in all months. On an annual basis, the golf course irrigation demand equals approximately 20% of the available reclaimed water.

The golf course operators are willing to use reclaimed water but would not want to use it exclusively because of its high salinity (Fuller pers. comm.). An agronomically acceptable percentage of reclaimed water in the irrigation supply has not yet been determined. Implementation of Action 1-A, "Construct a Facility to Treat San Felipe Water for Municipal Use", would substantially decrease the salinity of wastewater and would allow reclaimed water to supply a larger percentage of the irrigation demand at the golf course. If the golf course could replace only a small percentage of its existing supply with reclaimed water because of salinity constraints, it might be more cost-effective to postpone implementation of this action until the municipal water treatment plant has been built (Action 1-A).

Estimated Cost

A cost was estimated for a pipeline sized to carry 440 af/yr from the City of Hollister domestic wastewater percolation ponds to the San Juan Oaks golf course 2 miles away. The peak monthly irrigation requirement for turf in the Hollister area is approximately 16% of the annual requirement (California Department of Water Resources 1975), which in this case equates to 70 af in the month of July. Assuming that this water is pumped 24 hours per day during the peak month to fill a small storage pond at the golf course, the required pipeline diameter is 8 inches. Assuming the pipeline material is PVC and installed in existing road rights-of-way, the unit cost to install the pipeline would be approximately $25 per linear foot. The total cost would be approximately:

Cost = (10,600 L.F. x $25) (1.20 contingency) = $320,000

If a pump station is also required, an additional cost of approximately $240,000 should be anticipated ($200,000 base cost plus 20% contingency).

Note that if no pond is available at the golf course, and water is pumped directly to the sprinklers over an 8-hour watering period (instead of the 24 hour period assumed above), the required pipeline diameter would be 12 inches. The cost would be $35 per linear foot or a total of $440,000, including contingency.

The cost of upgrading the wastewater treatment plant to provide tertiary-treated, disinfected water would be $1.2 million over a 10-year period or approximately $120,000 per year (Perrine pers. comm.). The cost of simply disinfecting the existing or proposed secondary-treated water has not been calculated.

Key Participating Agencies

The City of Hollister, San Juan Oaks golf course, and SBCWD would be logical participants for implementing this action.

Potential Effects on Groundwater, Water Users, and the Environment

This action would decrease use of San Felipe water by approximately 440 af and decrease net recharge to the Hollister West and San Juan subbasins by 220 af each. The groundwater budgets for both of the subbasins have been substantially positive in recent years and groundwater levels have been rising rapidly. Total recharge to the two basins in water year 1997 was approximately 33,000 af and exceeded total outflow by 15,000 af. This action would decrease that imbalance by 400 af, or 2.6%. If Action 1-A, "Construct a Water Treatment Plant", is implemented, the groundwater budget in the Hollister West subbasin will become even more positive. Therefore, irrigating the golf course with reclaimed water would have a beneficial effect on water budgets.

SBCWD is required to purchase a minimum amount of San Felipe water at the municipal rate each year, and the amount increases according to a schedule in the CVP contract from 1,020 af in 1986 to 8,250 af in 2021. The minimum purchase in 1997 was 3,100 af. SBCWD was able to sell only 778 af of this water for direct use, and the San Juan Oaks golf course was one of the largest customers. Thus, if the golf course substantially decreases its use of San Felipe water, SBCWD will have to compensate for the lost income through other sources of revenue. If Action 1-A, "Construct a Water Treatment Plant", is implemented, achieving the minimum required purchase of San Felipe water will no longer be an issue.

Status

Recommended for implementation if an economic analysis shows that this action is at least as cost-effective as other actions that would help alleviate the percolation capacity problem.

References Cited and Sources of Information

California Department of Water Resources. 1975. Vegetative water use in California, 1974. April. Bulletin 113-3. Sacramento, CA.

Fuller, Scott. General manager, San Juan Oaks golf course, San Juan Bautista, CA. September 22, 1997 -telephone conversation with Gus Yates.

Perrine, Jim. Capital projects manager, City of Hollister Public Works Department, Hollister, CA. July 1997 -transmittal of written summary of wastewater treatment plant master plan update.

Management Action 3-B: Increase Groundwater Pumping in the Upper End of the San Juan Valley

Objective

Improve percolation capacity and minimize shallow groundwater conditions in the upper end of the San Juan Valley.

Design Details and Implementation Issues

Implementation of this action could include:

- offering financial incentives for farmers in the upper end of the San Juan Valley to use groundwater in preference to San Felipe water,
- installation and operation of wells by SBCWD to extract groundwater and blend it with San Felipe water in the main San Felipe distribution system, and
- consolidation of municipal pumping for the Hollister area in wells near the boundary between the San Juan and Hollister West subbasins.

The quality of the extracted groundwater is of concern for irrigation and municipal users. In particular, the California Department of Health Services has guidelines regarding minimum dilution ratios, travel times, and well setbacks for wells located near facilities that recharge groundwater with reclaimed water, such as the Hollister domestic wastewater treatment plant.

Estimated Cost

The amount of financial incentive required to motivate farmers to use groundwater in lieu of San Felipe water is unknown. The cost of constructing large irrigation or municipal supply wells commonly exceeds $100,000.

Key Participating Agencies

Agencies that might logically participate in implementing this action include SBCWD and the City of Hollister.

Potential Effects on Groundwater, Water Users, and the Environment

Potential effects of implementing this action include lower groundwater levels in the upper end of the San Juan Valley and correspondingly higher percolation rates from the river and wastewater ponds, increased salinity of irrigation water for farmers who use groundwater in preference to San Felipe water, a slight increase in the salinity of San Felipe water to customers throughout the southwestern part of the groundwater basin if groundwater is injected into the San Felipe distribution system for blending, and increased costs to SBCWD and/or the City of Hollister.

Status

Recommended for implementation subject to evaluation of cost-effectiveness and water quality impacts.

References Cited and Sources of Information

Management Action 3-C: Modify Percolation Releases from Hernandez Reservoir and the Hollister Conduit to Avoid Competition for Percolation Capacity

Objective

Minimize competition for percolation capacity in the upper end of the San Juan subbasin and avoid rising groundwater levels and drainage problems.

Design Details and Implementation Issues

The percolation capacity at the Hollister domestic wastewater treatment plant percolation ponds decreased for extended periods in 1996 and 1997. A geotechnical investigation concluded that the decrease in percolation rate was the result of high groundwater levels near the ponds rather than clogging of the pond surface (Kenneth D. Schmidt and Associates 1997). The ponds are located immediately adjacent to the San Benito River between the old and new Highway 156 bridges, which is a reach that also receives percolation releases from the Hernandez Reservoir and the San Felipe distribution system.

This action consists of decreasing Hernandez and San Felipe releases so that percolation flows do not extend beyond the old Highway 156 bridge during periods when percolation rates noticeably decline at the wastewater ponds.

This action is considered an interim measure to be implemented only until a long-term solution to wastewater disposal capacity is implemented (e.g., by implementing Action 3-D, "Construct New Wastewater Percolation Ponds Away from the River").

Estimated Cost

There is no direct cost associated with implementing this action.

Key Participating Agencies

The agencies that would logically be involved in implementing this action are SBCWD and the City of Hollister.

Potential Effects on Groundwater, Water Users, and the Environment

Decreasing Hernandez and San Felipe percolation releases could adversely affect groundwater quality in the San Juan and Hollister West subbasins because the salinity of the percolation water is much lower than the salinity of wastewater. The water quality impact would probably be noticeable primarily in the immediate vicinity of the percolation ponds because wastewater constitutes only approximately 8% of the overall inflow to the two subbasins. The water quality impacts would also become negligible if the municipal water supply is converted to San Felipe water and the widespread use of self-regenerating water softeners is eliminated (Actions 1-A and 1-B).

Decreasing percolation releases to the San Benito River could effectively create a surplus of Hernandez water because presently the only means of using it is by percolation in the river and in Tres Pinos Creek. Similarly, purchases of San Felipe water for percolation would probably also need to be decreased because of the overall decrease in available sites for percolation that would result from this action.

Status

Recommended for implementation on an interim basis provided that impacts on groundwater quality near the wastewater percolation ponds would not be significant.

References Cited and Sources of Information

Kenneth D. Schmidt and Associates. 1997. Groundwater conditions and infiltration rates for the City of Hollister domestic wastewater treatment plant. September. Phoenix, AZ. Prepared for City of Hollister Public Works Department, Hollister, CA.

Management Action 3-D: Construct New Wastewater Percolation Ponds Away from the River

Objective

Minimize competition for percolation capacity in the upper San Juan Valley, maintain balanced groundwater budgets, and avoid problems associated with high water tables.

Design Details and Implementation Issues

Relocating the Hollister domestic wastewater treatment plant percolation ponds to a site farther away from the San Benito River channel would avoid the present competition with river seepage for percolation capacity in the shallow aquifer system near the pond site. Percolation capacity is affected by soil type, the presence of shallow subsurface clay layers, and groundwater levels. Areas of relatively permeable soils are shown in Figure 3-D.1. The existing ponds are located in an area with the second highest level of soil permeability, and this level of permeability is found only in locations within approximately 0.5 mile of the San Benito River channel. Thus, to eliminate competition with the river for percolation capacity, it would probably be necessary to move the wastewater percolation to an area with less permeable soils than are present at the existing site. A larger pond area would be needed to offset a decrease in permeability. Areas of moderate soil permeability are present in the Bolsa Southeast and Hollister East subbasins at distances of 1.5–4.0 miles from the existing ponds. A reconnaissance survey of potential sites for stormwater percolation facilities in the northern part of Hollister failed to identify any locations where soil conditions would allow adequate percolation rates (Earth Systems Consultants 1996).

Information regarding shallow subsurface stratigraphy is not documented in soil survey reports, but information from scattered locations may be available from water well drillers' logs. Conversely, shallow sandy deposits could be present in various locations and could potentially compensate for lower permeability of the surface soils. For example, a large urban stormwater percolation pond at the north end of Rustic Street uses two dry wells to accelerate percolation into a fairly thick sequence of underlying sand and gravel strata. The presence of shallow subsurface clay layers or sand deposits can only be determined by drilling at prospective pond sites.

It would be desirable from a water balance standpoint to relocate the wastewater percolation site to a subbasin with a large amount of vacant storage capacity or a less positive groundwater budget. For example, the Bolsa Southeast and Hollister East subbasins would be preferable to the Hollister West or San Juan subbasins in this regard.

Most of the alternative percolation pond sites would be uphill from the existing site, and the wastewater conveyance facilities would need to include a pumping plant in addition to a pipeline.

Estimated Cost

The cost of relocating the wastewater percolation ponds cannot be calculated without a specific proposed site. However, it is reasonable to assume that land acquisition, pipeline, pumping plant, and pond construction costs would reach several million dollars.

Key Participating Agencies

City of Hollister.

Potential Effects on Groundwater, Water Users, and the Environment

This action would tend to decrease groundwater levels near the existing ponds and increase water levels near the new pond location. The existing salinity of the wastewater (1,300–1,900 mg/l dissolved solids) is slightly higher than average groundwater salinity in zone 6 (683 mg/l dissolved solids) and could potentially cause a small long-term increase in groundwater salinity if percolated wastewater becomes a large part of the groundwater budget. This might be a concern for percolation in the Bolsa Southeast subbasin but is probably not a concern in the Hollister East subbasin. In any case, groundwater quality would be beneficially affected by wastewater percolation if the municipal water supply for Hollister converts to San Felipe water (Action 1-A).

If the new percolation ponds are constructed on cropland, there may be a decrease of 100–200 acres of cultivated land in northern San Benito County.

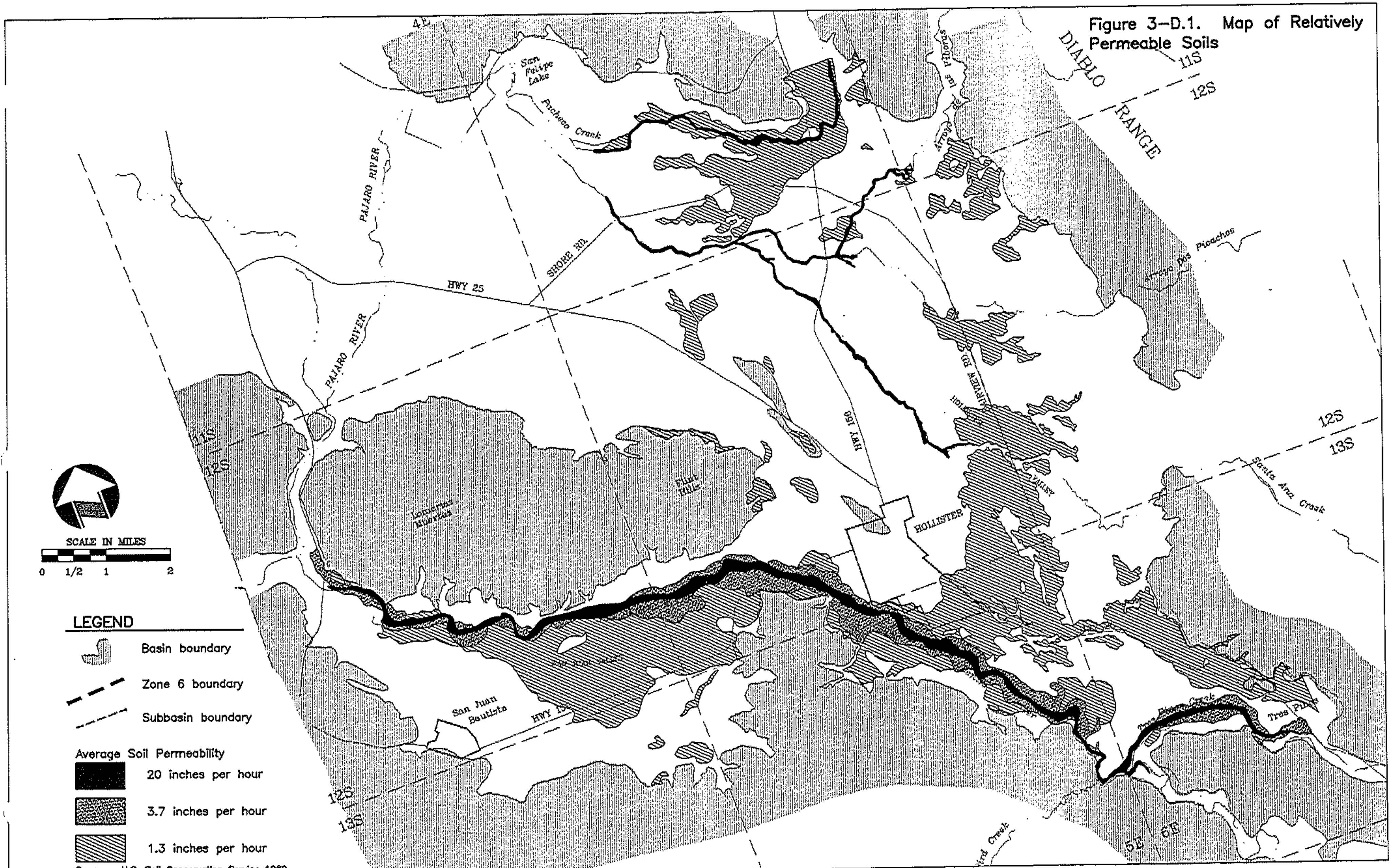
Status

Recommended for implementation.

References Cited and Sources of Information

Earth System Consultants. 1996. Percolation and permeability test results, Santa Ana Creek Master Storm Drain Plan. December 6, 1996. Hollister, CA. Prepared for Schaaf & Wheeler, Consulting Civil Engineers, Marina, CA.

Figure 3–D.1. Map of Relatively Permeable Soils



Management Action 3-E: Deliver Reclaimed Municipal Wastewater to Fields for Irrigation Use

Objective

Minimize competition for percolation capacity in the upper end of the San Juan Valley and decrease nitrate loading of the groundwater basin.

Design Details and Implementation Issues

Delivering some or all of the municipal wastewater to nearby fields for irrigation use would help alleviate the percolation capacity problem. Irrigation use would also tend to remove nitrogen, which would help prevent nitrate contamination of groundwater near the wastewater percolation ponds (see Issue 4). If the water were delivered to fields in the Bolsa Southeast subbasin, the deliveries would also help balance the water budget in that subbasin. This action would probably not relieve percolation capacity limitations during wet weather periods, when there would be no demand for irrigation water and the San Benito River would be flowing naturally and competing with the ponds for recharge capacity.

Agricultural members of the technical advisory group asserted that farmers would object to using reclaimed water for irrigation. Without a higher level of treatment, its use may be limited to fodder crops, which often are grown in rotation with more valuable vegetable crops. Consequently, distribution pipelines to particular fields might be used only intermittently and would not likely be cost-effective. Even if the reclaimed water were permitted for use on vegetable crops, there is a risk of sudden public panic based on the perception that the produce is unsafe. This type of panic can abruptly render crops unmarketable, which would have severe financial impacts on farmers. Finally, if groundwater continues to be the sole source of municipal water supply, the salinity of the reclaimed water may be too high for use on many of the vegetable crops commonly grown in the area.

Estimated Cost

No cost estimate was developed for this action.

Key Participating Agencies

To be identified if this action is reconsidered at a future date.

Potential Effects on Groundwater, Water Users, and the Environment

If the reclaimed water used for irrigation replaces San Felipe water, total groundwater recharge will be decreased by the amount of reclaimed water used and will be distributed over a larger area than presently occurs at the percolation ponds. A decrease in recharge in the San Juan and Hollister West subbasins may be beneficial, particularly if the Hollister municipal water supply converts from groundwater to San Felipe water.

If the reclaimed water used for irrigation replaces groundwater from the same subbasin, there would be no change in the net groundwater budget. However, the local water balance would become less positive near the percolation ponds and more positive near the point of use.

Status

Not recommended for implementation at this time.

References Cited and Sources of Information

Pettygrove, G.S., and T. Asano. (eds.) 1985. Irrigation with reclaimed municipal wastewater: a guidance manual. Department of Land, Air and Water Resources, University of California, Davis, CA. Prepared for California State Water Resources Control Board, Sacramento, CA. Reprinted by Lewis Publishers, Inc., Chelsea, MI.

Management Action 3-F: Discharge Treated Municipal Wastewater to the San Benito River

Objective

Decrease percolation capacity problems at the existing Hollister domestic wastewater treatment plant percolation ponds.

Design Details and Implementation Issues

With supplemental disinfection, the proposed conversion of the treatment process at the municipal wastewater treatment plant from an algae-based process to a facultative aerated pond system process would produce a high-quality effluent potentially acceptable for direct discharge into the San Benito River. This discharge option could be used during wet weather conditions when the percolation capacity of the existing disposal ponds is exceeded. Water discharged to the San Benito River during wet weather conditions would flow out of the basin, thereby eliminating the possibility of beneficial reuse of the water in San Benito County. If the municipal supply is converted to San Felipe water (Action 1-A), however, the effluent would be less saline than ambient groundwater and would be desirable for recharge or irrigation use.

Estimated Cost

The incremental cost for upgrading the secondary treatment process at the existing wastewater treatment plant to a tertiary process with disinfection would be approximately $1.2 million over a 10-year life cycle, or $120,000 per year. The costs of completing environmental documents and obtaining permits is not known but could be substantial, based on the example of the Gilroy plant.

Key Participating Agencies

City of Hollister.

Potential Effects on Groundwater, Water Users, and the Environment

Significant regulatory hurdles would need to be overcome to implement this option because of water quality concerns in the Monterey Bay National Marine Sanctuary. These concerns have delayed construction of a large wastewater treatment plant serving Morgan Hill and Gilroy that would also discharge into the Pajaro River and Monterey Bay. Personnel at the Monterey Bay National Marine Sanctuary have developed a water quality protection program that emphasizes collaborative partnerships with agencies and interest groups that manage water quality in rivers and streams that flow into the sanctuary (Price and Starr 1997). Nevertheless, substantial opposition to wastewater discharge into the San Benito River can reasonably be anticipated.

Status

Not recommended for implementation at this time.

References Cited and Sources of Information

Price, H. and R. M. Starr. 1997. Partnerships preserve water quality of Monterey Bay National Marine Sanctuary. July–August. California Agriculture 54(4):12.

Management Action 4-A: Investigate Sources of Nitrate in Groundwater

Objective

Identify significant sources of nitrate contamination of groundwater and identify actions to minimize those sources and prevent long-term increases in nitrate concentration.

Design Details and Implementation Issues

The work plan for an investigation of nitrate sources would include the following elements:

- Identify all wells that have recently or historically experienced high nitrate concentrations, as indicated by data in the 1995 report by the Central Coast Region of the California Regional Water Quality Control Board, data collected by SBCWD in 1997, and water supplier self-monitoring reports. Conduct reconnaissance sampling of additional wells in 1998 to further delineate the spatial variability of nitrate concentration and potentially identify additional wells with high nitrate concentrations.

- Determine the geographic extent of each local area where high nitrate concentrations have occurred by obtaining new water samples from the contaminated wells and all nearby wells and analyzing the samples for general minerals and nitrate.

- Obtain geologic logs and well construction information for as many of the sampled wells as possible.

- Characterize subsurface hydrogeology and groundwater flow conditions near the contaminated wells based on the above information plus regional groundwater information obtained from SBCWD's annual groundwater reports and simulation results from the basinwide groundwater model.

- Document current and historical land uses near the contaminated wells, emphasizing uses that could potentially result in nitrate contamination (e.g., feedlots, fertilizer storage or handling areas, wastewater disposal, septic systems, fertilized landscapes or cropland, and industrial activities).

- For each potential source of nitrate, estimate the maximum conceivable nitrate loading rate and eliminate any obviously minor sources from further investigation.

- If the foregoing steps do not clearly indicate the major source or sources of nitrate contamination, design and conduct more intensive investigations that may include installation and sampling of monitoring wells in the unsaturated zone or shallow groundwater zone and measurement of nitrogen isotopes in groundwater and various source waters.

Estimated Cost

The cost for a reconnaissance investigation of the extent and sources of nitrate contamination (excluding installation of new monitoring wells and analysis of nitrogen isotope data) would be on the order of $50,000. Some or all of the work could be done by local agency personnel.

Key Participating Agencies

SBCWD, with assistance and cooperation from local wastewater treatment plant operators, farm advisors, well owners, San Benito County Planning Department, and the regional water quality control board.

Potential Effects on Groundwater, Water Users, and the Environment

Implementation of this action would have no direct effect on groundwater, water users, or the environment because it is investigatory in nature.

Status

Recommended for implementation.

References Cited and Sources of Information

California Regional Water Quality Control Board. Central Coast Region. 1995. Assessment of nitrate contamination in ground water basins of the central coast region. Preliminary working draft. December. San Luis Obispo, CA.

Fogg, G., and D. E. Rolston. 1994. Identification and evaluation of methods for determining sources of nitrate contamination in ground water: guidance manual and final project report. June 30. Department of Land, Air and Water Resources, University of California, Davis, CA. Prepared for Central Coast Regional Water Quality Control Board, San Luis Obispo, CA.

Tanji, K., G. Helfand, and D. Larson. 1994. BMP assessment model for agricultural nonpoint source pollution. August. Department of Land, Air and Water Resources, University of California, Davis, CA.

Zidar, M. 1995. Wellhead protection for rural communities facing threats from nonpoint source nitrate contamination, Case study: King City, Salinas Valley, California. October. Monterey County Water Resources Agency, Salinas, CA.

Management Action 4-B: Educate Farmers, Homeowners, and Landscape Contractors in Nitrogen Management

Objective

Minimize potential nitrate contamination of groundwater from fertilizers.

Design Details and Implementation Issues

This action would consist of holding periodic local workshops on nitrogen management in agricultural fields and urban landscapes and providing on-call advising service for fertilizer users. Local farm advisors may already provide technical advice regarding fertilizer use on request from individual farmers, homeowners, and landscape managers.

The Fertilizer Research and Education Program of the California Department of Food and Agriculture organizes conferences on fertilizer use and research, disseminates written and videotaped instructional materials on nitrogen management in various agricultural settings, and supports local education and public information efforts. Grants for research and education projects are awarded on an annual basis, with project suggestions due in early March and complete proposals due in late April.

Estimated Cost

A 1-year effort to increase public and farmer awareness of nitrate contamination issues and host a local workshop in nitrogen management and fertilizer use might cost on the order of $15,000. The effort would qualify for support from the Fertilizer Research and Education Program.

Key Participating Agencies

Agencies that might logically participate in implementing this action include SBCWD and the San Benito County Farm Bureau, with assistance from the San Benito County Agricultural Commissioner and the University of California Cooperative Extension.

Potential Effects on Groundwater, Water Users, and the Environment

Assuming that the educational program results in voluntary improvements in nitrogen management by individual fertilizer users, this action could decrease future nitrate contamination of groundwater.

Status

Recommended for implementation.

References Cited and Sources of Information

Fertilizer Research and Education Program, California Department of Food and Agriculture, Sacramento, CA. Telephone: (916) 653-5340. Internet web site: http://www.cdfa.ca.gov/inspection/frep/index.html.

Management Action 4-C: Add a Nitrogen Removal Process to the Hollister Domestic Wastewater Treatment Plant

Objective

Decrease nitrate contamination of groundwater.

Design Details and Implementation Issues

If water quality investigations completed under Action 4-A indicate that percolation of municipal wastewater is a significant source of nitrate in groundwater, a denitrification step could be added to the wastewater treatment process. The master plan for the Hollister domestic wastewater treatment plant was updated in July 1997 (Perrine pers. comm.). A modified sequencing batch reactor process, which removes nitrate, was considered but not recommended for implementation in the near future. The emphasis of the update was on achieving sufficient processing and disposal capacity.

Estimated Cost

Nitrate removal is usually a relatively expensive process to add to a wastewater treatment plant. The 10-year life cycle cost of the modified sequencing batch reactor process was listed in the master plan update as $5.8 million, or $1.2 million more than the selected alternative (i.e., the facultative aerated pond system).

Key Participating Agencies

City of Hollister.

Potential Effects on Groundwater, Water Users, and the Environment

Under normal operation, the existing wastewater treatment and percolation process appears to remove almost all nitrogen from the wastewater before it reaches the water table. Nitrogen concentrations in the influent wastewater, the processed effluent piped to the percolation ponds, and groundwater near the percolation ponds have been monitored since 1980. The data are tabulated in the master plan update for the domestic wastewater treatment plant (Bracewell Engineering, Inc. 1997). Total nitrogen (measured as Kjeldahl nitrogen) in the influent ranged from 17 to 78 mg/l and averaged 40 mg/l during 1980–1995. This is a typical value for "medium strength" raw domestic wastewater (Tchobanoglous and Burton 1991). Typically, approximately 15 mg/l of the nitrogen in solids is in solid organic material and is removed during the primary and secondary treatment processes. Measurements at the Hollister plant since 1990 show an average nitrogen removal rate of 28% during the primary treatment process. Additional removal occurs during secondary treatment and percolation. The U.S. Environmental Protection Agency (EPA) (1981) found average total nitrogen removal rates of 50% at plants with rapid infiltration systems. The City of Hollister plant was included in the EPA study, and a total removal rate of 93% was reported.

These high rates of nitrogen removal are consistent with the groundwater monitoring data described in the section on "Water Quality" in the body of the plan. Nitrate concentrations in monitoring wells near the percolation ponds (Well 3 and Well 4) were substantially below the drinking water standard (2.2–2.6 mg/l as NO_3 versus a standard of 45 mg/l) during 1988–1995. Average concentrations at the downgradient well (Well 4) have also been slightly lower than average concentrations at the upgradient well (Well 3), indicating that the percolated wastewater might dilute ambient nitrate concentrations.

Average nitrate concentrations at Wells 3 and 4 were higher during 1996–1997 (7.5–11 mg/l), although all measurements were still substantially below the drinking water standard. The increase in nitrate concentration could have been related to high groundwater levels during that period. A high water table decreases the thickness of the unsaturated zone between the bottom of the ponds and the water table and may eliminate it entirely. Although nitrogen removal by denitrification (conversion to nitrogen gas) is an anaerobic process, the denitrifying bacteria are more abundant in the unsaturated zone than in the saturated zone below the water table. Thus, the opportunity for nitrogen removal during percolation is diminished when groundwater levels are high.

Water quality samples collected from 12 wells near the percolation ponds in 1997 also showed no apparent relationship between nitrate concentration and proximity to or direction from the percolation ponds. These data are described in the "Water Quality" section in the main body of the plan.

Status

Not recommended for implementation unless the results of the nitrate source investigation (Action 4-A) indicate that the Hollister domestic wastewater treatment plant is a significant source of nitrate contamination.

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Management Action 4-D: Connect Septic Systems in Urban Areas to the Municipal Sewer System

Objective

Decrease nitrate contamination of groundwater.

Design Details and Implementation Issues

Several small residential areas in Hollister are not connected to the municipal sewer system and use onsite septic systems for domestic wastewater disposal. Connecting these residences to the municipal system would require an expansion of the sewer service area, which requires approval from the local agency formation commission, and installation of sewer mains and laterals.

Estimated Cost

A cost estimate for this action has not been developed.

Key Participating Agencies

City of Hollister.

Potential Effects on Groundwater, Water Users, and the Environment

This action would displace the location of nitrate contamination from the residential area to the municipal wastewater percolation ponds. Unless the municipal wastewater treatment plant were also upgraded to achieve tertiary treatment and nitrogen removal (Action 4-D), there would not be a significant decrease in total nitrate loading of the groundwater basin.

This action would increase municipal wastewater flows and exacerbate percolation capacity problems at the wastewater percolation ponds until a long-term solution to the capacity problem is implemented (e.g., Action 3-D, "Construct New Wastewater Percolation Ponds Away from the River").

Status

Not recommended for implementation unless: 1) the investigation of nitrate contamination (Action 4-A) determines that residential septic systems are a significant source of nitrate and 2) the Hollister domestic wastewater treatment plant is upgraded to provide nitrogen removal (Action 4-D).

References Cited and Sources of Information

Management Action 4-E: Install Sewers in Rural Areas

Objective

Decrease nitrate contamination of groundwater.

Design Details and Implementation Issues

If the Hollister wastewater treatment plant is upgraded to remove nitrogen, nitrate contamination from private septic systems could be eliminated by connecting rural residences to the municipal sewer system. A disadvantage of this action is that it may induce expansion of urban growth into rural agricultural areas. An alternative approach could be to provide a septic system pump-out service to rural residences in areas with high nitrate levels.

Estimated Cost

A specific cost estimate for this action has not been developed. The cost would depend on the location and size of the area to be served and the method chosen for wastewater collection.

Key Participating Agencies

Not yet identified.

Potential Effects on Groundwater, Water Users, and the Environment

This action would move a small amount of groundwater recharge from the rural residential areas to the Hollister domestic wastewater percolation ponds. Assuming the wastewater plant is upgraded to remove nitrogen, total nitrate loading of the groundwater basin would decrease.

Status

Not recommended for implementation at this time. Implementation should be reconsidered if: 1) the investigation of nitrate contamination (Action 4-A) indicates that rural residential systems are a significant source of nitrate contamination, 2) the wastewater treatment plant is upgraded to remove nitrogen, and 3) this action appears to be a cost-effective means of decreasing nitrate loading on the groundwater basin.

References Cited and Sources of Information

Management Action 5-A: Increase Conjunctive Use of Surface Water and Groundwater

Objective

Increase future water supplies, increase supply reliability, and possibly decrease the cost of San Felipe water.

Design Details and Implementation Issues

A key requirement for increasing the ability to dynamically operate the storage capacity of the groundwater basin is to increase the rate at which water can be stored in the basin. This maximizes the capacity to obtain and store surplus surface water supplies, which are often only available for short periods of time. Presently, the capacity to rapidly extract water with wells is large compared to the ability to rapidly recharge the basin. Possibilities for increasing the recharge rate capacity include:

- applying a slight excess of San Felipe irrigation water to fields in areas with well-drained soils;
- extending the San Felipe distribution system to achieve more complete coverage of zone 6, thereby increasing the maximum in-lieu recharge rate;
- relocating the Hollister wastewater percolation ponds to a site farther from the San Benito River, thereby allowing increased recharge from the river (see Action 3-D);
- increasing groundwater pumping in the Pacheco Creek area (possibly pumping the water into the Hollister Conduit for use elsewhere) to increase stream percolation during natural streamflow events;
- negotiating an agreement with Pacheco Water District under which SBCWD would either buy excess water from their storage reservoir or pump groundwater from the Pacheco Creek valley in exchange for providing greater supply reliability (i.e., San Felipe water) to Pacheco Water District;
- increasing infiltration of urban stormwater runoff through use of stormwater detention/percolation ponds and dry wells (Action 1-E-1);
- delivering San Felipe water to urban stormwater percolation ponds in summer to increase dry-season groundwater recharge capacity;
- developing a municipal water supply that can use variable amounts of groundwater by blending groundwater with treated San Felipe water (see Action 1-A); and
- developing an aquifer storage and recovery (ASR) program to inject treated surface water directly into the groundwater basin.

A conjunctive use program would involve large variations in the relative amounts of groundwater and surface water used from year to year. Mechanisms would need to be developed to avoid cash flow problems for SBCWD in years of low San Felipe imports, and it may be desirable to limit the amount of annual variation in San Felipe use so that municipal and agricultural water quality objectives are met in all years. To maintain a hardness level of less than 180 mg/l as CaCO3, it would be desirable to import enough San Felipe water to meet 75% of the urban demand every year. Because Reclamation provides firm delivery of 75% of the contract amount to municipal users, urban water quality objectives could be met in all years. To the extent that urban use continues to be supplied by San Felipe water during droughts, however, there is less opportunity for conjunctive use.

Irrigation water quality objectives for all crops could be met with a blend of San Felipe water and groundwater containing up to approximately 50% groundwater (depending on water quality at the particular well), and many crops grow perfectly well on 100% groundwater. Many agricultural users could accommodate large fluctuations in the amount of San Felipe water they use from year to year, but many may also prefer to maintain at least some blend of groundwater and San Felipe water. Again, the greater the willingness of farmers to vary the amount of San Felipe water they buy from year to year, the greater the opportunity for conjunctive use.

The groundwater model jointly managed by San Benito County and SBCWD is an essential tool for developing optimal conjunctive use strategies and evaluating the impacts of conjunctive use on various aspects of the hydrologic system.

Estimated Cost

The cost of future expansions of the San Felipe distribution system can be estimated from the cost of extending subsystem 10 in 1996–1997. The cost for serving 1,835 additional acres was $1,063,000. The average per-acre cost of this expansion was $580.

SBCWD plans to have a test ASR well installed by Fugro-West, Inc. in January 1998. Until tests are completed and analyzed, site-specific costs are not available from Fugro-West. However, CH2M HILL estimated costs for an ASR program in Watsonville in 1994, followed by a pilot test in 1995. The project was studied for the Pajaro Valley Water Management Agency. Estimated costs for storing and recovering 1,800 af of water per year from nine wells are as follows (in December 1997 dollars):

■ Construction cost for wells, treatment plant, and connecting piping	$5,500,000
■ Construction and engineering costs for pilot test program	400,000
■ Annual operation and maintenance costs	120,000

The construction costs included pumping water from a lake adjacent to the wellfield, a solids removal facility (treatment plant) to remove sediment from the lake water, and nine wells of 150 to 200 foot depth, spaced 800 feet apart. The pilot program included drilling and temporary operation of the first of nine wells.

Amortizing the capital costs for 30 years at 6% yields a total cost of $306 per af/yr for the proposed Watsonville wellfield. Costs in San Benito County would be expected to vary from this number based on geologic properties (depth of wells and spacing between wells) and level of treatment required for the recharge water.

Key Participating Agencies

SBCWD is the logical agency to design and implement a basinwide conjunctive use program. San Benito County will need to be involved at least to the extent of participating in groundwater modeling efforts. Municipal and agricultural water users will need to contribute to the design process by clarifying their flexibility in using variable proportions of San Felipe water and groundwater.

Potential Effects on Groundwater, Water Users, and the Environment

Conjunctive use would result in large, multi-year fluctuations in groundwater levels and storage, but a balanced long-term average groundwater budget. Because groundwater levels have historically been drawn down to low levels, it is unlikely that low water levels during the drawdown phase of each conjunctive use cycle would cause subsidence or cause shallow wells to go dry. If phreatophytic vegetation becomes established in areas of shallow groundwater during the recovery phase of a conjunctive use cycle, the vegetation could suffer drought stress and mortality during the next drawdown cycle.

Total yield of the water supply system in northern San Benito County would increase. This yield could be used to decrease imports of San Felipe water or sold to another CVP contractor.

Status

Recommended for implementation. Many of the actions considered in this plan would contribute toward increased conjunctive use of the groundwater basin. The potential for excessively high or low water levels or unacceptable fluctuations in water quality should be considered when implementing any element of conjunctive use.

References Cited and Sources of Information

Management Action 5-B: Negotiate a Conjunctive Use Agreement with Another CVP Contractor

Objective

Develop a source of funding to design and construct facilities needed for water resources management and potentially to decrease the local cost of San Felipe water.

Design Details and Implementation Issues

Various California Water Code sections and SBCWD's contract with Reclamation authorize transfers of water among water users. One strategy would be to sell water to the state water bank in dry years. This strategy would not require a long-term commitment, and the amount transferred could be adjusted annually to reflect local needs. A second strategy would be to negotiate a long-term agreement with another CVP contractor for water storage and exchanges. Examples of this type of agreement include the water transfer agreements between the Metropolitan Water District of Southern California and two water districts in the southern San Joaquin Valley (Arvin-Edison Water Storage District and Semitropic Water Storage District).

In either case, conjunctive use would probably be implemented by decreasing the amount of San Felipe water purchased in dry years and having Reclamation deliver the water that would have been purchased to the water transfer recipient. Groundwater use in zone 6 would increase during those years, and groundwater levels would decline. In normal and wet years, relatively large amounts of San Felipe water would be purchased for direct use and percolation. Groundwater use would decrease, and groundwater levels would rise.

Designing and implementing a successful conjunctive use program might include the following steps:

- identify the range of water quality flexibility of existing users (i.e., tabulate the minimum annual water volume required for each of several salinity levels, by subbasin);
- define the water delivery schedule desired by the prospective exchange partner;
- quantify the minimum, maximum, and current groundwater storage levels in each subbasin and the recharge rate capacity during recovery periods;
- simulate proposed water operations over a long hydrologic period (greater than 50 years) using a preliminary spreadsheet mass balance model followed by the groundwater model;
- evaluate the yield, water levels, and impacts on well users, water quality, and habitat based on simulation results (refining the operating rules and resimulating as necessary until an acceptable program is identified);

- create a system of guidelines, rules, and incentives to motivate individual users to adjust their water supply mix each year in accordance with the overall operating plan (including a water rate structure and range of financial incentives that will achieve the desired water use patterns and equitably share the proceeds from the exchange agreement among local water users);

- negotiate the precise terms of the water transfer agreement with the receiving agency and Reclamation; and

- prepare and certify environmental documentation for the project.

Each subbasin has a different capacity for conjunctive use operation. Subbasins that are now relatively "full" and/or have high recharge rate capacities (e.g., Pacheco, Tres Pinos, and soon probably Hollister West) are best suited for immediate conjunctive use operation. Subbasins that are now relatively "empty" and/or have low recharge rate capacities (e.g., Hollister East and Bolsa Southeast) are less well suited for conjunctive use operation in the near future. Increasing the recharge rate capacity and current groundwater storage in those subbasins will increase their suitability for conjunctive use.

Estimated Cost

Significant costs will be incurred for the technical analysis of conjunctive use operation, possible construction of infrastructure (e.g., San Felipe subsystem extensions or aquifer storage and recovery injection wells), environmental documentation, negotiation of contract details, developing public support for the concept and the implementation details, and administering a more complex system of water charges and incentives. The technical analysis and environmental documentation would probably cost on the order of $100,000 each, infrastructure costs are unknown, and developing, promoting, and administering the conjunctive use plan would require local agency staff time. Revenue received from the conjunctive use contract would presumably equal or exceed the amount of these costs.

Key Participating Agencies

SBCWD would be the logical lead agency for developing a conjunctive use program, although all local agencies and water users would need to provide information and recommendations during the program development process.

Potential Effects on Groundwater, Water Users, and the Environment

The general effects of a conjunctive use program are described under Action 5-A, "Increase Conjunctive Use of Surface Water and Groundwater".

Status

Recommended for implementation. SBCWD has already been approached by agencies outside of San Benito County seeking to contract for use of groundwater storage capacity.

References Cited and Sources of Information

Management Action 5-C: Expand the Zone 6 and San Felipe Service Area Boundaries

Objective

Avoid large decreases in cropland area and groundwater recharge by allowing San Felipe water to be legally delivered to new urban areas around the perimeter of the groundwater basin (outside the present zone 6 and San Felipe service area boundaries).

Design Details and Implementation Issues

Changing the boundaries of zone 6 would require state legislation to modify SBCWD's district act (Appendix 70 of the California Water Code). This act has been amended for various other purposes in the past. Changing the boundaries of the San Felipe service area would require the approval of Reclamation and could require congressional action.

Estimated Cost

Implementing this action would require an unknown but probably substantial amount of SBCWD and San Benito County staff time. A cost estimate has not been developed.

Key Participating Agencies

SBCWD and San Benito County would be the key agencies for implementing this action.

Potential Effects on Groundwater, Water Users, and the Environment

This action has implications for future urban growth in San Benito County. It would create a water supply that would enable expansion of urban development into areas around the perimeter of the groundwater basin. This would increase total water demand in the area, and all of this demand would need to rely on available local water resources in the event of cutbacks or unforseen interruptions in the San Felipe supply. If future urban development is restricted to areas within zone 6 and/or overlying the groundwater basin, the development will displace agriculture and there will be only a small change in total water use. In the latter case, there may be a decrease in groundwater recharge, depending on stormwater management practices in future developed areas.

Status

This action is recommended for implementation if the county's general planning process seeks to accommodate urban growth while retaining as much productive agricultural land as possible.

References Cited and Sources of Information

Management Action 7-A: Establish Standard Interagency Procedures for Evaluating Long-Term and Short-Term Water Supply Availability

Objective

Minimize conflicts among local agencies regarding land and water use issues and create more efficient government by coordinating local agency resource planning and project permitting activities.

Design Details and Implementation Issues

Over the course of several meetings, a committee consisting of local water and land use management agencies would:

- identify activities for which interagency cooperation is needed,
- evaluate past problems and successes in achieving cooperation,
- develop standard interagency cooperation procedures (e.g., points of contact, review needs and turnaround times, information needs),
- prepare a memorandum of understanding (MOU) documenting these procedures, and
- train the staff members of their respective agency to understand and implement the procedures.

Estimated Cost

Each participating agency would need to allocate staff time for attending meetings, drafting and reviewing the MOU, and training. The combined agency staff time investment might cost on the order of $12,000.

Key Participating Agencies

San Benito County, City of Hollister, City of San Juan Bautista, SBCWD, SCWD, TPCWD, Aromas Water District, and Pacheco Water District.

Potential Effects on Groundwater, Water Users, and the Environment

No direct effects.

Status

Recommended for implementation.

References Cited and Sources of Information

Management Action 7-B: Protect Critical Recharge Areas

Objective

Maintain and increase groundwater recharge to increase water supply reliability (by decreasing dependence on imported water supplies), provide additional yield to meet future increases in water demand, increase the feasibility of conjunctive use, prevent groundwater contamination, and minimize long-term salt buildup in the groundwater basin (by promoting recharge from dilute sources).

Design Details and Implementation Issues

This action consists of identifying critical recharge areas; reviewing existing land use policies implemented by San Benito County, the City of Hollister and the City of San Juan Bautista; developing a comprehensive resource management plan for the San Benito River and developing additional policies and regulations as needed to ensure protection of groundwater recharge quantity and quality.

Stream recharge. The channels of Tres Pinos Creek and the San Benito River from the groundwater basin boundary near Tres Pinos to approximately Lucy Brown Road near San Juan Bautista provide more recharge than any other stream reaches because of the high permeability of the streambed materials, the large wetted area (natural and supplemented by percolation berms), and the availability of stored surface water for percolation (Hernandez and San Felipe water). Percolation rates reportedly decrease downstream of Lucy Brown Road, but there are no recent data confirming this.

The small stream reaches that also contribute significant amounts of groundwater recharge include the reaches of Pacheco Creek, Arroyo de las Viboras, Arroyo Dos Picachos, and Santa Ana Creek between the groundwater basin boundary and the downstream end of the reach normally used for percolation of San Felipe water (see Figure 5 in the body of this plan). This includes branches of those creeks used for artificial percolation, such as the Lone Tree Road branch of Arroyo Dos Picachos and the John Smith Road branch of Santa Ana Creek. By experimenting with release rates, SBCWD staff have found that percolation rates are relatively low in the reaches downstream of the normal percolation reaches.

The combined percolation capacity of the creek and river reaches used for artificial percolation is approximately 64 cfs, based on typical observed percolation rates during the dry season (Jones & Stokes Associates 1997b). If all of the reaches were utilized throughout a 6-month dry season, a total of 23,000 af of recharge could be contributed to the groundwater basin. The combined percolation capacity during natural flow events is larger because the wetted reaches are longer and wider.

The comprehensive resource management plan for the San Benito River that would be developed as part of this action would simultaneously consider issues related to flood control, water supply, water quality, wastewater disposal, gravel mining, habitat, recreation, and open space. To the extent possible, the plan would reflect a reasonable balance in managing those resources and reflect the input and consensus of all local agencies and interest groups that represent those issues. The planning area should extend from the Paicines Reservoir diversion structure to the Pajaro River and extend laterally from the center of the river to the edge of the 100-year floodplain or the edge of the Quaternary alluvial deposits, whichever is farther.

Percolation through soils. Groundwater recharge from deep percolation through soils is affected by land slope, soil permeability, and root depth. Low slopes (laser-leveled fields in particular) provide greater opportunity for infiltration of rainfall. The percentage of rainfall that can infiltrate into the soil is also greater in areas with relatively permeable soils. Deep percolation below the root zone depends on the available water capacity of the root zone, which is a function of soil texture and root depth. Permeable soils generally have a coarse texture and relatively low available water capacity, which is a second reason why recharge rates probably correlate with soil permeability. Areas of bare (fallow) soils or shallow-rooted vegetation (grass or vegetable crops) have a relatively small amount of soil moisture storage capacity in the root zone, which increases the frequency and amount of deep percolation. The locations of areas with relatively permeable soils are shown in Figure 3-D.1.

Groundwater recharge from deep percolation can be obstructed by shallow clay layers, which can cause soil saturation when infiltration of rainfall or irrigation water at the land surface exceeds the percolation capacity of the clay layer. Shallow clay layers are fairly common in the central and western parts of the San Juan subbasin and in a few places in the Hollister East subbasin. Also, much of the Bolsa subbasin is underlain by a clay confining layer that created artesian conditions (flowing wells) under predevelopment conditions. Although some recharge water may be able to percolate through the clay layer, areas overlying the confining layer do not provide substantial amounts of recharge. The extent of the confining layer is approximately indicated by the area where artesian groundwater conditions were present in 1913, which is shown in Figure 3 in the body of this plan.

Gravel mining. Sand and gravel deposits along the San Benito River between Tres Pinos Creek and the Pajaro River have been classified as "designated" deposits of regional significance by the State Mining and Geology Board (California Division of Mines and Geology 1987). Designated deposits are a subset of the broader MRZ-2 category of lands that contain mineral resources. Designated deposits are economically recoverable deposits unobstructed by incompatible overlying land uses and are ranked of greatest value within a production-consumption region by virtue of their quality, size, and accessibility to transportation and markets. The State Mining and Reclamation Act requires local land use planning agencies to recognize the designated areas in the process of developing land use plans. The boundaries of the designated deposits along the San Benito River are shown in Figure 9 in the body of this plan. Tres Pinos Creek was outside the study area for the original California Division of Mines and Geology mineral resource evaluation but will be shown as MRZ-2 areas in an updated analysis currently in progress (Kohler-Antablin pers. comm.). The State Mining and Geology Board no longer routinely "designates" mineral resource deposits, so it is unlikely that the Tres Pinos Creek sand and gravel deposits will be included in that classification.

Most of the sand and gravel deposits along the San Benito River are in or adjacent to the active channel and range from approximately 15 feet above to more than 50 feet below the riverbed elevation. The lack of substantial off-channel deposits or deposits situated well above the riverbed elevation means that most of the harvested material must come from excavations in the river channel that extend to depths below the existing riverbed (thalweg) elevation. These pits may or may not be isolated from the river by berms placed around the perimeters of the pits, and the pits may extend to depths below the water table (wet pits). In-channel gravel mining can have significant adverse impacts on water resources, habitat, and land use. These are described below in the section on "Potential Effects on Groundwater, Water Users, and the Environment". With respect to gravel mining, this action consists of developing plans and permit conditions that avoid or minimize those impacts.

Estimated Cost

A specific cost for this management action has not been calculated. The principal cost is for an unknown amount of local agency staff time, which could be funded through budget augmentations or reprogramming of existing funds. If gravel mining is restricted or prohibited along the San Benito River and Tres Pinos Creek, the public would face higher costs as a result of higher prices for sand and gravel imported from other areas, decreased local agency revenue from gravel extraction fees, and possibly compensation payments to gravel companies for a public taking of private property.

Key Participating Agencies

Not yet identified.

Potential Effects on Groundwater, Water Users, and the Environment

The impacts of gravel mining in or adjacent to streams or overlying groundwater basins have been investigated in numerous locations in California and documented in technical studies and environmental impact reports (Yolo County 1996; Jones & Stokes Associates 1991, 1995, 1997a). Water-related impacts commonly considered in other areas and the significance and mitigation associated with those impacts include the following:

Groundwater Recharge and Storage

- **Recharge rate capacity.** If the riverbed is excavated down to a clay layer, the percolation capacity of the riverbed can decrease. This impact can be minimized with site-specific excavation depth limits. Recharge capacity can increase if gravel pits are reclaimed for use as artificial recharge ponds, which has been successfully done in many areas. Ponds are most effective in locations where the bottom of the pond is above the water table.

- **Groundwater storage capacity.** If gravel mining results in a lowering of the riverbed to an elevation that is lower than historical high water table elevation, the river will function as a drain for the groundwater system. Groundwater levels near the river will no longer be able to rise much above the thalweg elevation, and the storage capacity in basin materials above that elevation will no longer be usable. This effect has been demonstrated along Cache Creek in Yolo County, but was found to be noticeable at only a few wells, all of which were within 1 mile of the creek (Northwest Hydraulic Consultants et al. 1995). Historical gravel mining along the San Benito River has lowered the thalweg elevation by 10–25 feet along most of the reach between Hospital Road and the Pajaro River (see Figure 7 in the body of this plan). Groundwater levels in August 1913 were higher than the present thalweg elevation and will not be able to reach those levels again, at least near the river channel.

This impact can be significant and difficult to mitigate. Granite Rock Company is considering installing grade control structures in the river to prevent bed lowering upstream and downstream of a proposed excavation and possibly to serve as a dam to prevent or regulate groundwater drainage (West pers. comm.). Such structures could simply displace channel erosion to downstream reaches, and their effectiveness, reliability, and environmental impacts would need to be carefully considered before implementation.

Isolated gravel pits in the river channel can increase groundwater storage if they penetrate the water table, forming lakes. To successfully achieve this increase in storage, however, the pits must remain isolated from the river at high flows. Otherwise, the river will tend to fill the pit with sediment scoured from upstream reaches (headcutting) and create a smooth riverbed profile that is lower than the premining profile and that will tend to drain the aquifer. The usual approach to isolating the pits from the river is to surround the pits with berms or levees that are higher than the 100-year flood elevation. This approach has two liabilities: it requires ongoing levee maintenance in perpetuity and it decreases the flood conveyance capacity of the river channel.

Water Quality

- **Channel and bank erosion.** When sand and gravel are removed from an active river channel, the river tends to replace the removed material by eroding the banks (channel widening) or scouring the channel bottom upstream (headcutting) and downstream of the excavation. Clay and silt material thus mobilized during high flows can settle out when flows recede or in areas of low flow velocity and create a layer of reduced permeability on the riverbed. High suspended sediment loads can also have adverse effects on organisms in the river or in the Monterey Bay National Marine Sanctuary. This impact is difficult to quantify but can be significant and difficult to avoid or mitigate.

  One method commonly used to prevent riverbed erosion near an in-channel excavation is to surround the excavation with a berm that prevents the river from flowing into the pit even during floods. However, this strategy relies on proper design, construction, and long-term maintenance of the berms. For example, the San Benito River briefly overtopped the berm surrounding a former excavation upstream of Hospital Road in the

January 1997 flood and caused noticeable erosion of the back side of the berm. Also, bermed pits encroach on the floodplain of the river and can increase river stage (water level) or cause erosion of the opposite bank or other nearby parts of the channel during floods.

- **Silt discharge from mining operations.** Sand and gravel are processed by washing to remove fine clay and silt material. The muddy wash water would have an adverse water quality impact if it were discharged directly to a creek or river. However, settling basins are routinely used to remove and contain the fine materials, and the wash water is then recycled. This impact is typically less than significant.

- **Contamination from mining operations.** The only hazardous materials used in significant quantities during gravel mining operations are diesel fuel and crankcase oil for heavy equipment and solvents and lubricants for maintaining the equipment. State and local regulations regarding storage, handling, and disposal of hazardous materials are effective in preventing surface water or groundwater contamination from these materials.

- **Loss of aquifer filtration capacity.** Surface water often contains pollutants that must be removed to render the water potable. Groundwater is normally free of these pollutants because they are removed during the recharge process. Pathogens and organic compounds are removed through filtration, absorption, biodegradation, and other processes as streamflow percolates into the ground and moves through the aquifer. The unsaturated zone (the zone between the ground surface and the water table where soil, water, and air are all present) is particularly effective in removing pollutants. Gravel mining can decrease the thickness of the unsaturated zone and the total flow distance between the creek and a nearby potable supply well. In the case of wet pits (where the excavation extends below the water table), the unsaturated zone is removed entirely and the groundwater is directly exposed to potential contamination. Regulation of post-mining land use can prevent contamination from normal land use activities. The risk of contamination from accidental or deliberate spills of hazardous materials in mined areas is also negligible except perhaps for wells within a few hundred feet of the excavation because pollutants continue to be removed over relatively short distances (Luhdorff and Scalmanini Consulting Engineers and Todd Engineers, Inc. 1996).

Structures, Habitat, and Land Use

- **Bridge scour.** Lowering of the streambed from scour and erosion upstream and downstream of an in-channel excavation can undermine bridge piers or expose utility structures such as pipelines and cables buried under the riverbed. This impact can be difficult to distinguish from natural sediment transport processes, but the effects can be significant and costly to mitigate.

- **Loss of farmland.** Lateral bank erosion can wash out low stream terraces, converting them from usable farmland to unfarmable riverwash areas. Again, this impact can be difficult to differentiate from natural channel meander processes, but the effects are significant and difficult to avoid or mitigate.

- **Loss of riparian habitat.** Riparian habitat can be lost if riverbed erosion increases in the vicinity of excavations. With proper design, in-channel mined areas can often be reclaimed to riparian, wetland, or aquatic habitats of excellent quality.

Status

Recommended for implementation.

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Management Action 8-A: Implement an Agricultural Water Conservation Program

Objective

Meet current state and Reclamation standards for agricultural water conservation and minimize dependence on imported water supplies.

Design Details and Implementation Issues

The actual water savings associated with various water conservation practices depends strongly on whether the conserved water would have been available for reuse anyway. In northern San Benito County, for example, overapplication of irrigation water is not necessarily wasteful because it results in deep percolation below the root zone of the crops and thereby increases groundwater recharge. Conversely, increased irrigation efficiency does not necessarily save water because it decreases the amount of groundwater recharge from deep percolation of irrigation water.

Although most of the "wasted" water in northern San Benito County is actually captured in the groundwater basin and reused, certain types of water conservation practices can result in real water savings. Furthermore, most water conservation practices result in decreased water acquisition and treatment costs, decreased wastewater treatment costs, or improved water quality. To understand these benefits, it is necessary to distinguish between gross and consumptive water use. Gross water use is the total amount of water produced by wells or purchased from Reclamation. Consumptive use is the fraction of gross use that is lost to evaporation or outflow from the basin. It is no longer available for reuse. Consumptive use is generally a large percentage of total use for irrigation but is a very small percentage of indoor residential use.

The benefits of agricultural water conservation in northern San Benito County include:

- decreased groundwater pumping costs (applies to decreases in gross groundwater use),
- decreased water purchase costs for San Felipe water (applies to decreases in gross San Felipe water use),
- decreased long-term salt buildup in the groundwater basin (applies to decreases in direct evaporation from sprinkler spray and bare soil),
- decreased water lost to drain outflow (applies only to decreases irrigation applications in areas with tile drains),
- decreased risk of groundwater contamination from agricultural chemicals and fertilizers (if increased irrigation efficiency decreases deep percolation below the root zone), and
- increased availability of San Felipe water to other users (applies to decreases in gross San Felipe water use).

AB 3616, Agricultural Efficient Water Management Act of 1990, required the California Department of Water Resources to establish a technical advisory committee to develop a list of efficient water management practices (EWMPs) for agricultural water users. Governor Wilson further directed the committee to develop a statewide MOU between the agricultural and environmental communities to further address efficient use of agricultural water in California. An MOU was completed in November 1996 and lists numerous EWMPs that are recommended or required for signatory agencies. It is likely that Reclamation will adopt the state guidelines as requirements for its contractors, or vice versa (U. S. Bureau of Reclamation 1997). The MOU states that some of the EWMPs are required of all agencies, and some are subject to exemptions because they do not apply to the local water supply system or because they do not meet net benefit criteria. The EWMPs are listed below along with a preliminary assessment of the extent to which they are already implemented in northern San Benito County.

List A: Required EWMPs

1. **Prepare and adopt a water management plan in accordance with the MOU.** With a few exceptions, this practice could be met by consolidating elements of existing water conservation plans, this groundwater management plan, and the water supply and demand study currently being prepared by SBCWD.

2. **Designate a water conservation coordinator.** Reclamation already requires its contractors to designate a water conservation coordinator. SBCWD does not presently have a designated water conservation coordinator.

3. **Support the availability of water management services to water users.** The two existing CIMIS microclimate stations, SBCWD's water quality monitoring program, and farmer education programs included in this plan (Actions 1-F and 4-B) largely fulfill this EWMP.

4. **Where appropriate, improve communication and cooperative work among water suppliers, water users, and other agencies.** Interagency communication is or will be achieved by the planning process used to develop this groundwater management plan, the ongoing plan implementation group, and Action 7-A, "Establish Standard Interagency Procedures for Evaluating Long-Term and Short-Term Water Supply Availability".

5. **Evaluate the need, if any, for changes in policies of the institutions to which the water supplier is subject.** This EWMP is directed toward increasing the flexibility of water deliveries and storage. Actions 5-A, "Increase Conjunctive Use of Surface Water and Groundwater", and 5-C, "Expand Zone 6 Boundaries", would demonstrate fulfillment of this EWMP.

6. **Evaluate and improve efficiencies of water supplier's pumps.** This EWMP would need to be implemented by SBCWD.

List B: Conditionally Applicable EWMPs Subject to Net Benefit Analysis

1. **Facilitate alternative land use.** This EWMP consists of facilitating voluntary compensated alternative uses of farmland that generates poor-quality drainage water. The discharges from tile drains in northern San Benito County is probably not of poor enough quality to warrant an alternative land use.

2. **Facilitate use of available recycled water that otherwise would not be used beneficially, meets all health and safety criteria, and does not cause harm to crops or soils.** Actions 3-A, "Deliver Reclaimed Water or Golf Course Irrigation", and 3-E, "Deliver Reclaimed Municipal Wastewater to Fields for Irrigation", would fulfill this EWMP, although Action 3-E is not presently recommended.

3. **Facilitate the financing of capital improvements for on-farm irrigation systems.** The "Plan Implementation" section of the main body of this plan identifies external sources of funding for on-farm irrigation improvements and recommends that a local low-interest revolving fund be established to assist private landowners with on-farm irrigation improvements.

4. **Facilitate voluntary water transfers that do not unreasonably affect the water supplier, the environment, or third parties.** SBCWD already participates in temporary water storage and exchange agreements with Santa Clara Valley Water District. Action 5-B, "Negotiate a Conjunctive Use Agreement with Another CVP Contractor", would also facilitate water transfers at a more statewide level.

5. **Line or pipe ditches and canals.** San Felipe water is already delivered via pipelines.

6. **Increase flexibility in water ordering by, and delivery to, the water users within operational limits.** San Felipe users are already able to use San Felipe water according to their own individual irrigation schedules.

7. **Construct and operate water supplier spill and tailwater recovery systems to reduce operational losses.** There are no spills or tailwater associated with the San Felipe distribution system because it consists entirely of pressurized pipelines with valved delivery turnouts.

8. **Optimize conjunctive use.** Actions 5-A, "Increase Conjunctive Use of Surface Water and Groundwater", and 5-B, "Negotiate a Conjunctive Use Agreement with Another CVP Contractor", would fulfill this EWMP.

9. **Automate canal structures.** This EWMP does not apply to northern San Benito County because the San Felipe distribution system consists of pressurized pipelines that already offer unlimited delivery scheduling flexibility to individual users.

List C: Other EWMPs Subject to Detailed Net Benefit Analysis

1. **Water measurement and water use report.** San Felipe deliveries are already metered, users receive monthly statements, and annual water use is already reported in SBCWD's annual groundwater report.

2. **Pricing or other incentives.** This EWMP strives to improve agricultural water use efficiency through retail water price structures. Action 2-D, "Institute Economic Incentives to Adjust Balance between Use of Groundwater and San Felipe Water", is an example of this EWMP. However, the groundwater management planning group recommended that this action be deferred until the efficacy of other more desirable actions could be determined.

Estimated Cost

Implementation of a water conservation program will require ongoing investment of SBCWD staff resources, educational materials, and possibly financial assistance or incentives to encourage individual farmers to invest in water conservation measures. Assuming a half-time position is dedicated to the program, the agency budget allocation would be on the order of $50,000 per year.

Key Participating Agencies

SBCWD.

Potential Effects on Groundwater, Water Users, and the Environment

Agricultural water conservation measures could help prevent excessively positive groundwater budgets and high water table conditions in subbasins where San Felipe water use substantially exceeds groundwater use. Overall agricultural water use would decrease to the extent that nonbeneficial consumptive use (e.g., direct evaporation of sprinkler mist) is decreased. Energy use and environmental impacts associated with energy production would decrease if gross water use is decreased.

Status

Recommended for implementation.

References Cited and Sources of Information

U. S. Bureau of Reclamation, Water Conservation Center. 1997. AB 3616 council ready to go. Conservation Connection 4(1):1. April.

Prillwitz, Marsha. Water conservation specialist, U.S. Bureau of Reclamation, Sacramento, CA. Telephone: (916) 979-2379. E-mail: mprillwitz@mp.usbr.gov

Management Action 8-B: Implement an Urban Water Conservation Program

Objective

Meet current statewide standards for urban water conservation and minimize dependence on imported water supplies.

Design Details and Implementation Issues

The actual water savings associated with various water conservation practices depends strongly on whether the conserved water would have been available for reuse anyway. In San Benito County, for example, all municipal wastewater is percolated into the ground and contributes to the yield of the groundwater basin. Thus, urban water conservation measures that decrease the amount of wastewater generated also decrease the available groundwater yield by a similar amount and consequently do not result in a net overall water savings. Leaking water pipes also contribute to groundwater recharge, so the water that leaves the pipes is still available for use.

Although most of the "wasted" water in northern San Benito County is actually captured in the groundwater basin and reused, certain types of water conservation practices can result in real water savings. Furthermore, most water conservation practices result in decreased water acquisition and treatment costs, decreased wastewater treatment costs, or improved water quality. To understand these benefits, it is necessary to distinguish between gross and consumptive water use. Gross water use is the total amount of water produced by wells or purchased from Reclamation. Consumptive use is the fraction of gross use that is lost to evaporation or outflow from the basin. It is no longer available for reuse. Consumptive use is generally a large percentage of total use for irrigation but is a very small percentage of indoor residential use.

The benefits of urban water conservation in northern San Benito County include:

- decreased groundwater pumping costs (applies to decreases in gross water use),
- decreased water treatment costs (applies to decreases in gross water use if San Felipe water is used for municipal supply),
- decreased wastewater treatment costs (applies to decreases in indoor water use only),
- decreased competition for percolation capacity at the upper end of the San Juan Valley (applies to decreases in indoor water use only), and
- decreased long-term salt buildup in the groundwater basin (applies to decreases in urban irrigation use).

A statewide MOU regarding best management practices (BMPs) for urban water conservation was signed in 1991 by urban water agencies and public interest groups. Currently, there are 176 signatories, including the City of Hollister. Signatory water suppliers agree to develop and implement BMPs using sound economic criteria. BMPs are continually developed, refined, and evaluated by the California Urban Water Conservation Council, which was created by the MOU.

The BMPs presently required by the California Urban Water Conservation Council are:

1. Provide interior and exterior water audits and incentive programs for residential and governmental/institutional customers.

2. a) Enforce water conserving plumbing fixture standards, including the requirement for ultra low flush toilets in all new construction.

   b) Support state and federal legislation prohibiting sale of toilets using more than 1.6 gallons per flush.

   c) Provide plumbing retrofit kits and installation assistance for homes built before 1980.

3. Complete water audits, leak detection, and repairs of water distribution system.

4. Install meters on new and existing connections and bill by water usage.

5. Provide water audits and conservation incentives for large tracts of irrigated landscape.

6. Implement water conservation requirements for new and existing commercial, industrial, institutional, governmental, and multifamily developments.

7. Provide public information on water conservation practices.

8. Provide educational materials and instructional assistance for teaching water conservation in schools.

9. Provide water audits and conservation incentives to large commercial and industrial water users.

10. Review proposed water uses for new commercial and industrial users.

11. Adopt water pricing structures that promote conservation.

12. Promote and require landscape water conservation for new and existing single family homes.

13. Prohibit water waste.

14. Designate a water conservation coordinator.

15. Provide financial incentives to facilitate implementation of water conservation BMPs.

16. Implement toilet replacement program to eliminate high water use toilets in older homes.

The MOU includes performance standards and implementation schedules for the BMPs. Each MOU signatory is expected to implement all of the BMPs within 3 years of signing the MOU. The status of the City of Hollister's implementation of the BMPs was not investigated for this plan.

Estimated Cost

The cost of implementing an urban water conservation program would include agency staff time (assuming a half-time position, possibly divided among agencies), educational materials, financial incentives for conservation measures (e.g., rebates for replacing large-tank toilets), and do-it-yourself plumbing retrofit kits. The cost of an ongoing program would be on the order of $60,000 per year.

Key Participating Agencies

City of Hollister and possibly SCWD and the City of San Juan Bautista

Potential Effects on Groundwater, Water Users, and the Environment

Water conservation decreases water production, water treatment, and wastewater treatment and disposal costs. Given the current percolation capacity limitations at the Hollister domestic wastewater treatment plant ponds, any decreases in indoor water use would be clearly beneficial. Landscape water conservation decreases consumptive water use and results in more positive groundwater budgets in the Tres Pinos and Hollister West subbasins, which are presently the source of most municipal water. If a water treatment plant is constructed to use San Felipe water for municipal purposes (Action 1-A), water conservation would decrease the amount of imported water that needs to be purchased and would decrease the amount of agricultural CVP water that ultimately might need to be converted to municipal use.

Status

Recommended for implementation.

References Cited and Sources of Information

California Urban Water Conservation Council internet web page (includes current list of best management practices): http://www.cuwcc.com

Management Action 9-A: Develop a Strategic Data Collection and Management Program

Objective

Efficiently obtain and store high-quality water resources data of direct relevance to water resources management decisions.

Design Details and Implementation Issues

This task consists of reviewing the accuracy and efficiency of data collection methods and data storage systems presently used by local agencies in northern San Benito County. Information needs for water resources management will be identified based on management issues and actions in this plan and other local water management plans. Specific types of data will be recommended for collection, such as streamflow, water levels, surface and groundwater quality, drainage flows, and irrigated acreage. Locations will be specified in moderate detail (for example, a stream gage on Santa Ana Creek near Fairview Road, or five irrigation wells distributed throughout the Tres Pinos Creek Valley). Measurement frequency will be recommended (for example, continuous recording of streamflow or annual water quality measurements). The constituents to be measured and the measurement method will be recommended for water quality data (for example, nitrate measured with a portable titration-type meter).

The accuracy of the present method of measuring water production at large private wells could be verified by installing in-line flow meters on a few of the wells and rotating the meters among a subset of the largest wells. There are presently 429 irrigation wells in SBCWD's billing database. The present method of measuring water production at these wells is to install a meter that records the number of hours of well operation and multiply the hours by the average discharge rate. Discharge rates of large wells are periodically measured by SBCWD staff. The weakness of this approach stems from variations in well discharge that result from the type and size of irrigation system attached to the well. Irrigation setups frequently change, and switching from a high-pressure sprinkler setup to a low-pressure drip or furrow setup greatly alters the discharge rate. Repeated measurements at individual wells confirm that discharge rates often vary substantially throughout the irrigation season.

Although in-line flow meters are fairly expensive, rotating a small number of them among the largest wells would be a reasonable means of obtaining accurate estimates of average discharge rate over a period of a year. The 38 largest irrigation wells pumped 50% of all irrigation water produced during 1996, and the 138 largest wells pumped 90% of the total water produced that year. Thus, purchasing 28 in-line flow meters and rotating them among the 138 wells on a 5-year cycle could greatly improve the accuracy of groundwater pumping data at a much lower cost than providing flow meters at all wells.

Estimated Cost

The cost of reviewing existing data collection and management practices and developing recommendations for improvements would be approximately $15,000, of which approximately two-thirds is for engineering consultants to SBCWD and one-third is for SBCWD staff. No cost is included for incidental meeting and data documentation time by other local water agencies. The cost of revising or expanding computer databases; purchasing and using new field equipment; or increasing the number, type, and frequency of field measurements cannot be estimated until the recommended program has been developed.

Key Participating Agencies

SBCWD, City of Hollister, City of San Juan Bautista, SCWD, TPCWD, Aromas Water District, and Pacheco Water District.

Potential Effects on Groundwater, Water Users, and the Environment

Measurement of hydrologic conditions would not alter or adversely affect water resources or the environment.

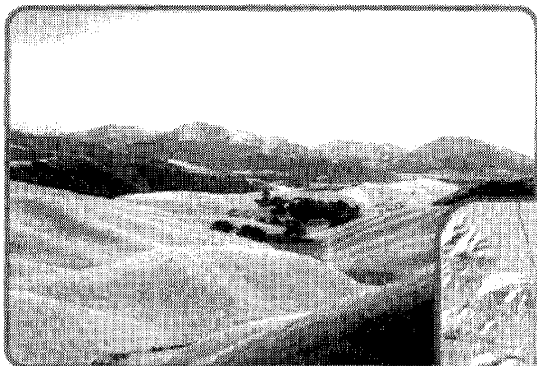
Status

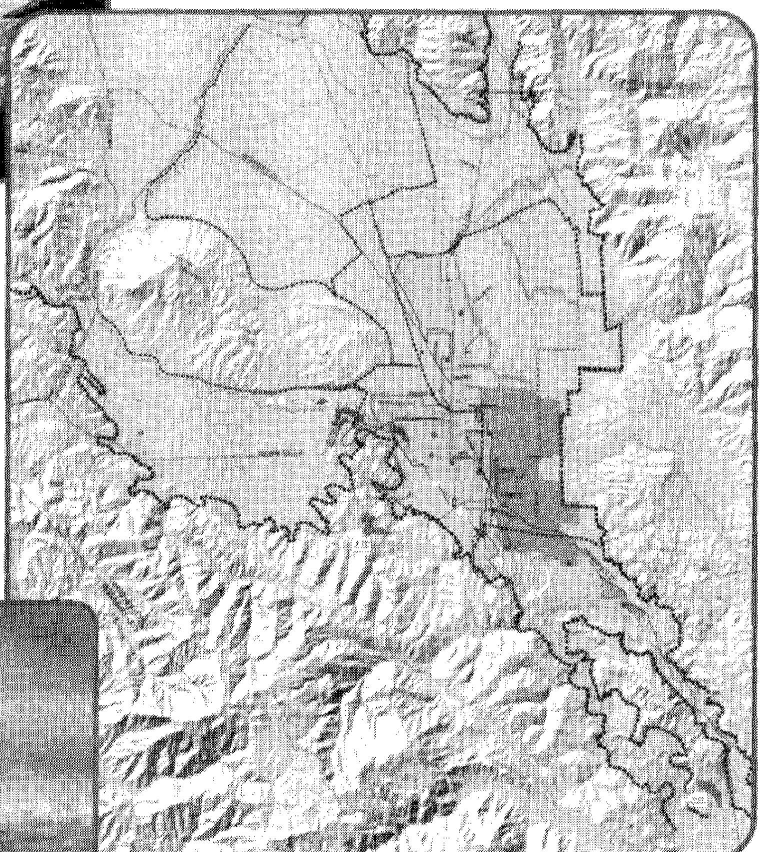
Recommended for implementation. SBCWD has already commenced a review of currently available hydrologic data and is designing a more systematic, scientifically-based program of monitoring, data compilation, and data analysis.

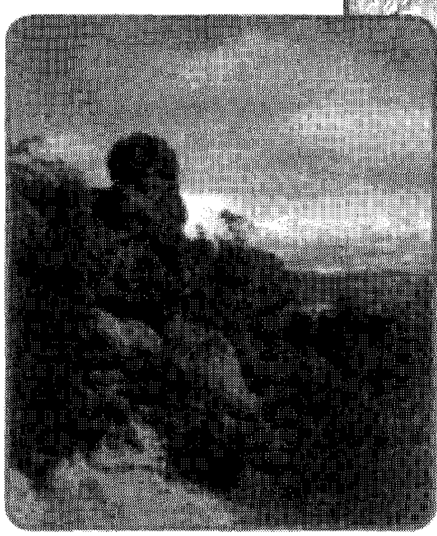
References Cited and Sources of Information

Revised Administrative
Final Report

Groundwater Management Plan Update for the San Benito County Part of the Gilroy-Hollister Groundwater Basin







Water Resources Association
of San Benito County

K\J 025007.05
April 2004

Kennedy/Jenks Consultants
Engineers & Scientists

Table of Contents

List of Tables

List of Figures

Section 1: Introduction

The Groundwater Management Plan for the San Benito County Part of the Gilroy-Hollister Groundwater Basin (1998 GMP) was prepared in 1998 for a consortium of agencies including the Aromas Water District, the City of Hollister, the City of San Juan Bautista, San Benito County Water District, Sunnyslope County Water District, and Tres Pinos County Water District.

Since the preparation of the 1998 GMP, the Water Resources Association of San Benito County (WRA) was formed by the City of Hollister, the City of San Juan Bautista, San Benito County Water District (SBCWD), and the Sunnyslope County Water District. This plan is intended to be an update to the 1998 GMP. Alternatives for groundwater management were developed for this update of the 1998 GMP in the Draft Report Evaluation of Project Alternatives to Implement Groundwater Management Plan in San Benito County (June 2002 Draft Report). The July 2002 Draft Report was preceded by an earlier effort in 2001 by EDAW and Todd Engineers documenting existing conditions and the end-points of the range of groundwater management options (2001 existing condition). Detailed information regarding hydrogeology, water quality and water levels are found in the 1998 GMP and the Annual Groundwater Reports prepared by the SBCWD.

1.1 Purpose

The following problem statements regarding the quantity and quality of water in San Benito County are addressed in this Groundwater Management Plan Update (GMP Update):

Water Quantity

- Existing imbalance of areas of high and low groundwater
- Pending imbalance of supply and demand due to planned growth
- Existing and pending inability to adequately dispose of wastewater
- Frequent reduction of long-term imported water supplies and lower quality local supplies

Water Quality

- Increasing total dissolved solids (TDS) – salts are accumulating in the basin and constrain beneficial uses
- Hardness affects urban supplies and leads to water softeners that further add salts to the basin
- Nitrates have accumulated in some groundwater sub-basins, affecting beneficial uses
- Effective water quality protection is lacking

The purpose of this GMP Update is to build on the previous work in the further identification and evaluation of alternatives that will define coordinated basin-wide approaches to groundwater management and serve as the basis for the upcoming Program Environmental Impact Report (PEIR).

1.2 Approach

Keeping in mind these problems in the Gilroy-Hollister portion of the San Benito County groundwater basin, the approach that has been taken in this report is to:

- Further develop objectives and criteria by which alternatives will be evaluated.
- Further develop the toolbox of project elements identified in the 2001 Phase 1 Existing Conditions effort.
- Use the toolbox of project elements to develop additional alternatives that bridge the 100% Local Supply and 100% Imported Supply alternatives developed in the 2001 Phase 1 Existing conditions effort.
- Evaluate the alternatives against the objectives and criteria that were developed.
- Estimate water supplies and water demands for present and future conditions for municipal/industrial and agricultural uses using existing analyses
- Using estimated water needs, identify potential projects that could be used to manage the groundwater basin in accordance with the identified alternatives.
- Prioritize and phase projects for implementation and develop planning-level estimates of the probable cost of construction for the projects.
- As part of the preparation of PEIR, identify mitigation measures for these projects that may cause or result in impacts through use or construction to air quality, biological resources, cultural resources, energy, geology or seismicity, hydrology and water quality, land-use, noise or visual and aesthetic resources.

Section 2: Condition of the Basin

2.1 Summary

The SBCWD has jurisdiction throughout San Benito County to support surface water management and groundwater replenishment activities as well as collecting and evaluating data related to water management. The SBCWD annually prepares a Groundwater Report that documents and evaluates surface water and groundwater use for the previous water year.

SBCWD operates and maintains facilities to import, distribute, and recharge surface water from the CVP's San Felipe Project (San Felipe) into the groundwater basin as well as to impound and percolate water from the Hernandez and Paicines Reservoirs. SBCWD has formed three zones of benefit to generate the necessary funds for the facilities:

- Zone 1 covers the entire county and provides the funding base for certain District administrative expenses.
- Zone 3, which covers the San Benito River Valley from the Willow Creek School gauging station to San Juan Bautista and Tres Pinos Creek Valley from Paicines to the San Benito River, provides the funding base for operation of Hernandez and Paicines Reservoirs and related percolation activities.
- Zone 6 includes the Pacheco, Bolsa Southeast, San Juan, Hollister West, Hollister East, and Tres Pinos groundwater sub-basins and provides the funding base for importation and distribution of San Felipe water. Zone 6 covers approximately 48,000 acres.

The groundwater sub-basin boundaries are shown on Figure 2-1. The physical characteristics have been detailed in many previous reports, and recent sub-basin water balance and water quality issues are summarized in this document.

As discussed in the 1998 GMP and other previous reports, prior to the introduction of imported San Felipe water, more groundwater was being extracted from the basin than was being recharged, resulting in overdraft over the long term. Since the first deliveries of imported San Felipe Water in 1987, most areas of the groundwater basin became full in as few as 4 to 5 years, and many sub-basins experience localized areas of high groundwater. Reductions and increases of water in storage within groundwater sub-basins occur annually, concurrent with hydrologic variability and each sub-basin's management practices. Overdraft could occur in a sub-basin if a net decrease in water levels takes place over the long term, as occurred prior to the delivery of San Felipe Water. Evaluation of overdraft within each sub-basin is beyond the scope of this report.

It has been estimated that the basin's groundwater storage capacity is approximately 500,000 AF within the first 200 feet of the ground surface. The basin's approximate average annual safe groundwater yield is estimated to be between 40,000 to 50,000 AF/yr (1998 GMP); for the purposes of this analysis, the yield is estimated at 54,000 AF. (J. Gregg, personal communication).

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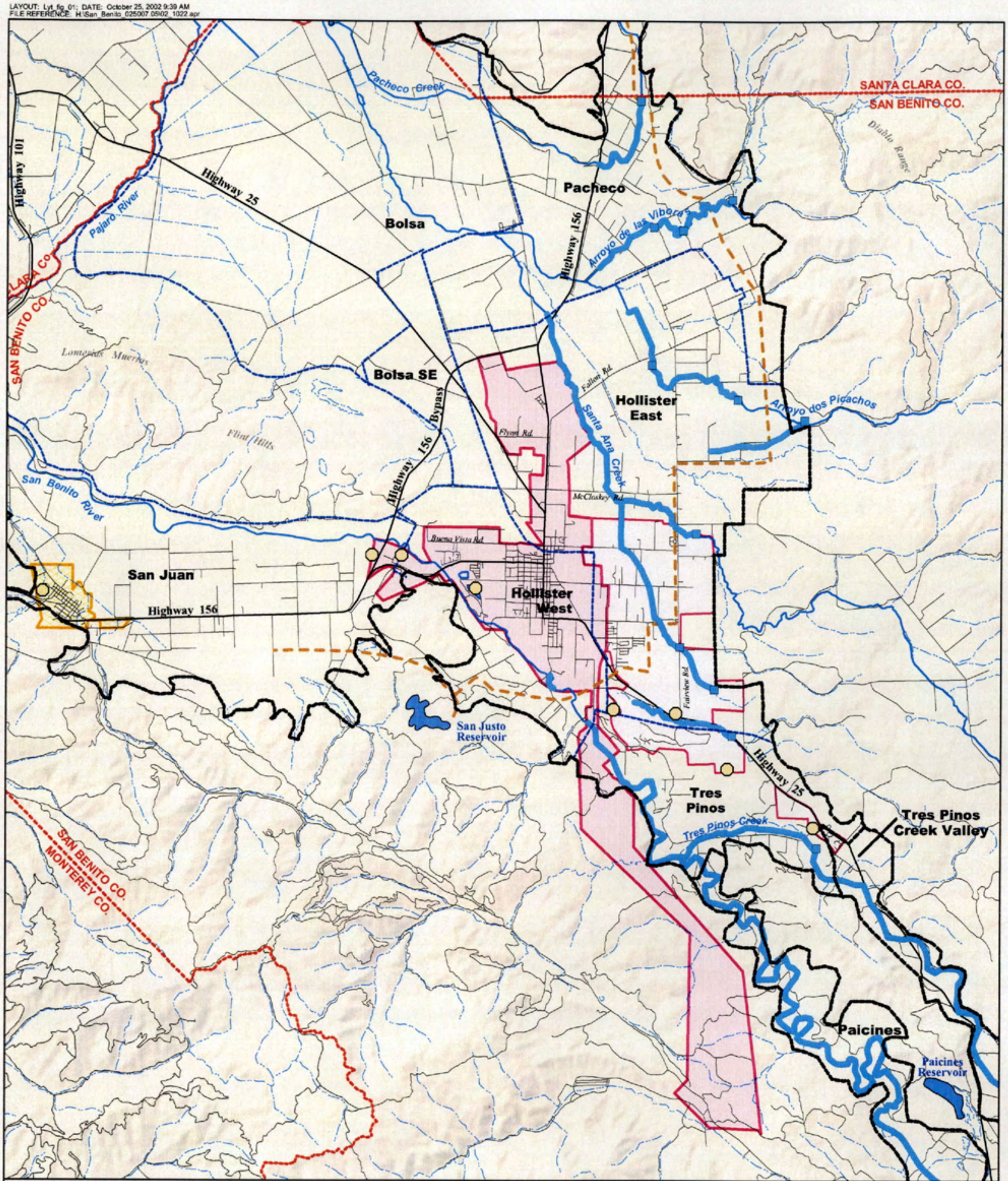

Basemap reference: EDAW/TODD Engineers, 2001

LEGEND

- Existing Wastewater Percolation Sites
- City of San Juan Bautista
- City of Hollister Water Service
- Sunnyslope County Water District
- Tres Pinos County Water District
- Hollister Conduit San Felipe Water System
- Discharge Point and Wetted Reach for Percolation of San Felipe/Local Surface Water
- Groundwater Basin Boundary
- Groundwater Subbasin Boundary

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GROUNDWATER MANAGEMENT PLAN UPDATE PROJECT AREA

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Figure 2-1

Sub-basin Conditions

More detailed information regarding individual sub-basins is found in the 1998 GMP and the Annual Groundwater Reports. The information below is a summary of current conditions for each sub-basin and is derived from information in the Water Year 2001 Annual Groundwater Report.

2.2.1 San Juan

High groundwater level is characteristic of the San Juan sub-basin. As imported CVP water was introduced and used in this sub-basin, percolation continued from applied water, and well pumping was insufficient to keep groundwater levels from rising. Soil structure in the sub-basin is another factor influencing groundwater level. Clay layers, existing at 3 to 12 feet below the ground surface in some areas, result in poor soil drainage. As a result, perched high groundwater saturated the root zone in some locations.

According to the Water Year 2001 Annual Groundwater Report, the San Juan sub-basin showed stable groundwater storage levels in the recent past. This appears to be the result of normal or below-normal rainfall and streamflow and the suspension of percolation of Zone 3 and Zone 6 water in the Hollister West and San Juan sub-basins. A review of the water balance indicates that land uses overlying the San Juan sub-basin are predominantly agricultural, with water supplies provided by both groundwater and imported surface water, depending on the location.

The groundwater quality in the San Juan sub-basin typically has an average TDS concentration of 1,200 parts per million (ppm), among the highest within the San Benito County groundwater basin.

2.2.2 Hollister West

A review of groundwater levels in the Hollister West sub-basin indicates that localized high groundwater levels occur adjacent to areas of the San Benito River. The SBCWD has discharged less surface water for percolation over the past 2 years to manage the high water levels. The water balance for the Hollister West sub-basin indicates a 1,300 AF reduction of water in storage in Water Year 2001, even though 2001 was considered a normal rainfall year. Inspection of the groundwater hydrograph over the last 2 years seems to confirm a gradual decline in groundwater levels, which are being monitored as part of the SBCWD's annual groundwater report. Land uses overlying the Hollister West sub-basin are predominantly M&I.

The 3 million gallons per day (MGD) Lessalt surface water treatment plant completed in November 2002 will reduce groundwater pumping between an estimated 2,300 –2,800 AF/yr for some of the M&I uses in the City of Hollister and Sunnyslope County Water District service areas. The Lessalt plant is expected to result in a net increase in in-lieu banking, which should moderate the overdraft previously experienced.

The groundwater in the Hollister West sub-basin has an average TDS concentration of 800 ppm and a hardness in excess of 400 ppm. The Lessalt plant should reduce the use of brine softeners used by many water customers to reduce the mineral hardness of the groundwater. Brine softeners contribute salt to the wastewater stream during regeneration of the ion exchange membranes.

2.2.3 Hollister East

Hollister East is generally considered to be a "full" sub-basin. The hydrographs for the sub-basin indicate that its groundwater level is generally increasing over time. Although the amount of imported San Felipe surface water percolation was reduced in 2001 by changing water system management measures, groundwater in storage still increased by 3,000 AF. This sub-basin experiences high agricultural water use in rural areas and high M&I use in the urban areas.

The average concentration of TDS for the Hollister East sub-basin groundwater is approximately the same as the Hollister West sub-basin groundwater. Similar to Hollister West, the groundwater in this area also contains high mineral hardness. As a result, urban water customers use water softeners extensively. In addition to TDS and hardness in Hollister East, boron can be found in the 2 to 3 ppm range. For agricultural purposes, boron levels of less than 0.5 ppm are desirable.

2.2.4 Bolsa

Groundwater levels vary throughout the Bolsa sub-basin. High groundwater levels are present in the northeast, and an area of low groundwater exists in the south. During Water Year 2001, the water balance showed a net loss of water in storage of 2,000 AF/yr. The Bolsa sub-basin has experienced consistent reductions of water in storage, indicating that it is in overdraft. The Bolsa area is predominantly agricultural and does not receive imported surface water.

The average boron concentration in the Bolsa sub-basin is 2-3 ppm, with accompanying issues the same as those in the Hollister East sub-basin. The average TDS concentration is approximately 800 ppm.

2.2.5 Pacheco

In the Pacheco sub-basin, groundwater levels were stable for 2 years before Water Year 2001. Then in 2001, the water balance showed a slight increase of 400 AF per year of groundwater in storage. It appears that the Pacheco sub-basin has significant potential for groundwater banking. Similar to the Hollister East area, the SBCWD instituted water level management measures, and San Felipe water percolation was reduced.

TDS concentrations for the Pacheco sub-basin are on the order of 600 ppm, which is lower than the other sub-basins. This groundwater quality is adequate to support the mainly agricultural water usage in the Pacheco area.

2.2.6 Bolsa Southeast

Groundwater storage in the Bolsa Southeast sub-basin increased by 250 AF in 2001. Inspection of the hydrograph of average groundwater levels in this sub-basin indicates that they are rising due to the delivery of imported surface water. Based on a groundwater modeling analyses, groundwater levels are starting to rise in the groundwater depression identified in the report *Groundwater Management Plan: Existing Conditions and Alternatives* (December, 2001).

2.2.7 Tres Pinos

In Water Year 2001, the Tres Pinos sub-basin water storage increased by an estimated 150 AF. Analysis of this sub-basin shows that the groundwater level is slightly higher than in the other sub-basins and that there are localized areas of even higher groundwater near the San Benito River. There may be some opportunities for groundwater banking in this sub-basin in areas away from the San Benito River.

2.3 Groundwater Monitoring Programs

The SBCWD has taken and maintained data related to groundwater levels and surface water flow measurements since the early 1920's for the San Benito County Portion of the Gilroy-Hollister Groundwater Basin and its principle tributaries, Pacheco Creek, Tres Pinos Creek and the San Benito River.

The early data was instrumental in supporting U.S. Geological Survey (USGS) and U.S. Bureau of Reclamation (USBR) studies which led to design and construction of the Hernandez Dam and Reservoir together with the necessary water rights for Hernandez and Paicines reservoirs and the eventual development of the San Felipe Project. The SBCWD has continued that early monitoring by measuring groundwater levels from a network of 80 to 100 wells. Levels have been measured on a semi-annual basis since 1976 and on a quarterly basis since 1991/92. The SBCWD has a cooperative agreement with the USGS for water measurement at a gauging station on Tres Pinos Creek and two gauging stations on the San Benito River. In addition, SBCWD personnel, and USGS personnel on a special study basis, conduct periodic surface water flow measurements to determine stream flows along the San Benito River and Tres Pinos Creek.

Since the 1991/92 time period the SBCWD has measured groundwater extraction at major wells (with discharge pipes) three (3) inches in diameter or greater and has assessed groundwater extraction from minor wells through a system of annual groundwater extraction reports. Groundwater extraction at major wells is measured directly or calculated semiannually by metering the number of hours of pump operation and multiplying by the average discharge rate. The pump discharge rate is measured and periodically updated using a velocity measurement device inserted into the discharge pipeline. Discharges from the San Felipe Distribution System for percolation in area streams are all directly metered.

Historically, there has not been systematic monitoring of groundwater quality in the basin. However, in 1997, the SBCWD initiated a Groundwater Monitoring Program. That program began with the measurement of nitrate concentrations and electrical conductivity at major irrigation wells and has expanded to include quarterly sampling for mineral content and inorganic chemicals from a network of 18 wells.

Potable water systems under the jurisdiction of the California Department of Health Services and/or the Department of Environmental Health Services of San Benito County must monitor and report certain water quality parameters to fulfill regulatory requirements.

The SBCWD seeks to expand and improve its Groundwater Quality Monitoring System for the basin, and has been awarded a $200,000 grant from the California Department of Water Resources (DWR) toward the development of a Basin Wide Groundwater Quality Monitoring Program. This program will include measurement of water quality directly, the collection of water quality data gathered by other agencies, and a system for data maintenance and presentation. The time schedule for the development of a basin wide Groundwater Quality Monitoring Program is fourteen months, beginning on November 1, 2002.

The SBCWD is systematically improving its groundwater and surface water measurement and water quality monitoring efforts and recently completed the installation of shallow groundwater monitoring wells in the San Juan and Hollister West sub basins.

The results of the SBCWD's water monitoring activities are presented and summarized in the Annual Groundwater Reports prepared by the SBCWD for the San Benito County Portion of Gilroy-Hollister Groundwater Basin and the Tres Pinos and Paicines Groundwater Basins.

Section 3: Current and Estimated Future Water Supplies and Demands

In order to estimate the order-of-magnitude size of future water management facilities, it is necessary to estimate demands and supplies. These demands and supply estimates are based on information provided in previous reports as well as by the SBCWD.

3.1 Water Supplies and Infrastructure

The majority of the information used to estimate water supplies potentially available to the County was derived from the Annual Groundwater Reports prepared by the San Benito County Water District. Additional information used to augment these reports is identified in the text below.

3.1.1 Water Year Classifications

The analysis of available water sources in this section required classification of water years into wet, normal, dry, and critically dry years. Long-term annual precipitation data from 1875 to 2001 for gages at Hollister and the SBCWD offices were evaluated to classify water year types based on deviations from average annual precipitation. Reliable groundwater water balance data were limited to water balances estimated from 1997 to the present. The review of average annual precipitation from water year 1997 through water year 2001 indicated that 1998 could be classified as a wet year, and 2001 could be classified as normal.

No dry or critically dry water years occurred in the 1997-2001 water year time period; therefore, estimates were calculated as described below. All supply values are shown in Table 3-2: Estimated Supply Availability. The supply components are further described in the following Sections 3.1.2 and 3.1.3. The water year classifications are used in developing the 20-year supply demand simulation in Section 3.3.

3.1.1.1 Wet Year

Supply values for the wet year summarized in Table 3-2 are taken from Table 9 of the Annual Groundwater Report for Water Year 1998. Although the value of 450 AF of Local Surface Water (Paicines and Hernandes percolation) appears low when compared to the value for a normal year (Water Year 2001), it is considered sufficient for the purposes of developing the illustrative example in Section 3.3.

3.1.1.2 Normal Year

Supply values for the normal year summarized in Table 3-2 are taken from Table 9 of the Annual Groundwater Report for Water Year 2001. The total local supply minus the Other Local Surface Supplies and Cienega is approximately 54,000 AF/yr which is consistent with the value for the average annual yield of the groundwater basin (J. Gregg, Personal Communication, July 2002).

3.1.1.3 Dry Year and Critically Dry Year

Because no reliable water balances were available using the methods used in water year 1998 and water year 2001 to estimate dry year and critically dry year supplies, it was assumed that all values, with the exception of deep percolation and recycled water, would be considerably less than normal years and were adjusted based on direction from SBCWD staff.

3.1.2 Local Supplies

Using Table 9 from the Annual Groundwater Reports, natural supplies from rainfall and stream percolation were calculated separately for Zone 6 only and the Bolsa, Paicines, and Tres Pinos Creek Valley by summing the components of: (1) total stream percolation from natural streamflow, (2) San Felipe releases, and (3) total deep percolation through the soils from rainfall for each area.

Local surface water supply represents stream percolation from Hernandez and Paicines releases summed with values for: (1) Zone 6 only and (2) the combined Bolsa, Paicines, and Tres Pinos Creek Valley area. Although there may be inconsistencies in local surface water values (Paicines and Hernandez percolation) between the 1998 and 2001 water years, the estimate of water sources remains valid for the purposes of developing the illustrative example in Section 3.3.

Potentially available water supplies from Pacheco Creek, Arroyo de Las Viboras and Arroyo dos Picachos were estimated using stream gauging data when available and otherwise using streamflow predictions prepared for the San Benito County Water District as part of the water balance analysis for the Annual Groundwater Reports. Gauged and predicted daily streamflow data were available for the 3 creeks from Water Year 1984 to Water Year 2001. Based on measured and predicted streamflow data, the estimated quantities of water that could be available are summarized below. These figures need to be corroborated with additional field measurements.

Table 3-1: Summary of Gauged/Predicted Streamflow from WY 1984 – WY 2001

	Pacheco Creek (AF/yr)	Arroyo de Las Viboras (AF/yr)	Arroyo dos Picachos (AF/yr)	Total (AF/yr)
Average	25,550	3,160	2,100	30,810
Minimum	800	150	100	1,050
Maximum	92,900	11,580	7,720	112,200

There are some existing water rights for the SBCWD and other rights holders for the Pacheco Creek, Arroyo de Las Viboras and Arroyo dos Picachos, therefore the availability of streamflows for diversion will be less than the predicted flows. A more detailed discussion of water rights occurs later in Section 5.5.

Cienega groundwater is another local supply that could be available the supply pipeline is repaired. The City of Hollister has a water rights decision for up to 489.41 AF/yr with a maximum of up to 40.78 AF/month. It is assumed that the maximum 489.41 AF/yr is available during wet and most normal years but will be reduced during dry and critically dry years, as shown in Table 3-2.

The values in Table 3-2 for deep percolation of domestic/irrigation water are derived from Table 9 of the Annual Groundwater Reports and are for: (1) Zone 6 only, and (2) the combined Bolsa, Paicines, and Tres Pinos Creek Valley area.

The groundwater inflow value in Table 3-2 is extracted from Table 9 of the Annual Groundwater Reports. This value represents the total groundwater inflow for (1) Zone 6 only and (2) the combined Bolsa, Paicines, and Tres Pinos Creek Valley area.

The recycled water supply estimates shown in Table 3-2 are derived from the recycled water estimate in Table 9 of the Annual Groundwater Report. Where recycled water estimates were not available, a base-line estimate of 3,000 AF/yr was used. It should be noted that the recycled water supply is a function of population, and that additional recycled water will be available in the future. The recycled water could be percolated and indirectly reused, or, in the future, could be directly reused for irrigation of parks and golf courses.

3.1.3 Imported San Felipe Water

As shown in Table 3-2, both M&I and agricultural imported water supply estimates are based on recent evaluations of U.S. Bureau of Reclamation CVP contract entitlements compared to actual deliveries. The San Benito County imported San Felipe Water contract is for a total supply of 8,250 AF/yr for M&I supply and 35,550 AF/yr for agriculture. However, recent actions have resulted in reallocation of CVP supplies for legal and institutional purposes, such as meeting Bay-Delta Standards, minimum instream flows and those required under the CVP Improvement Act (CVPIA), and they have effectively reduced CVP contract allocations.

It is estimated that full contract entitlements will be delivered only in a "wet" year, as defined by rainfall and runoff in the Central Valley for the CVP. Even in "normal" years, CVP deliveries are only expected to be 85% of M&I contract entitlements and 65% of agricultural contract entitlements. In "dry" and "critically dry" years, the deliveries are expected to be less. In "dry" years, CVP M&I deliveries are expected to be 75% of contract entitlements and 50% of agricultural contract entitlements. In "critically dry" years, CVP M&I deliveries are expected to be 35% of contract entitlements and 0% of agricultural contract entitlements. The resulting quantities of expected imported water deliveries are shown in Table 3-2.

3.1.4 Summary of Potential Water Supply Availability

Table 3-2 summarizes the various sources of water supply that could be available to San Benito County.

Table 3-2: Potential Supply Availability in Wet, Normal, Dry, and Critically Dry Years (AF)

	Wet Year (WY 1998)	Normal Year (WY 2001)	Estimated Dry Year	Estimated Critically Dry Year
Local Supplies				
Zone 6: Natural from Rainfall, Stream Percolation, and San Felipe Releases	36,685 (1)	15,444 (1)	10,000	0
Bolsa, Paicines, Tres Pinos Natural from Rainfall and Stream Percolation	11,536 (1)	4,791 (1)	4,000	0
Local Surface Water (Paicines and Hernandes Percolation)	450 (1)	6,917 (1)	350	0
Deep Percolation of Domestic/Irrigation Water in Zone 6, Bolsa, Paicines and Tres Pinos	9,438 (1)	10,403 (1)	10,400	10,400
Groundwater Influent Flow	10,000 (1)	12,500 (1)	7,000	5,000
Recycled Water Recharge/Reuse	3,557 (1)	3,338 (1)	3,000	3,000
Other Local Surface Water (2)	112,200	30,810	1,050	0
Cienega Groundwater (3)	489	489	350	200
Total Local Supplies	**184,355**	**84,692**	**36,150**	**18,600**
Imported Surface Water Availability				
Imported M&I (% of Contract Entitlement)	8,250 (100%)	7,012 (85%)	6,188 (75%)	2,888 (35%)
Imported Ag (% of Contract Entitlement)	35,550 (100%)	23,108 (65%)	17,775 (50%)	0
Total Imported Surface Water	**43,800**	**30,120**	**23,963**	**2,888**
Combined Total				
Total Potential Local and Imported Supplies	228,155	114,812	60,113	21,488

(1) Estimates are based on Table 9 – Groundwater Balances from Annual Groundwater Reports for Water Year 1998 and Water Year 2001.

(2) Estimates are based on gauged/predicted stream flows for Pacheco Creek, Arroyo de Las Viboras, and Arroyo dos Picachos and will not be available until diversion facilities are constructed and water rights are resolved. Dry Years are assumed to have minimum flow, critically dry areas are assumed to have zero flow while wet and normal years correspond to maximum and average flows respectively.

(3) Cienega availability is contingent on construction/repair of the pipeline.

3.1.5 Water Delivery Infrastructure

A detailed discussion of existing water delivery infrastructure can be found in the 1998 Groundwater Management Plan Report and the Annual Groundwater Reports.

3.2 Current and Future Demand Projection

Future water demand projections for both M&I and agricultural uses were developed as described below. First, available information on past water usage was used to estimate demands for current conditions. Future M&I demand was estimated based on the Growth Management Ordinances currently in place in the cities and county. These ordinances are discussed in detail below. Future agricultural demand was estimated by SBCWD staff, and a report prepared for the District on Zone 6 irrigation.

3.2.1 Past Water Usage

Table 3-3 contains information regarding water usage in the past. The data summarize information contained in the Annual Groundwater Reports prepared by the SBCWD.

Table 3-3: Water Use in Hollister Groundwater Basin-Water Years 1991 - 2001

Water Year	Agricultural Imported SW Use [c](AF/year)	M&I Imported SW Use [c] (AF/year)	Sub-total SW Use (AF/year)	Agricultural GW Use (AF/year)	M&I GW Use (AF/year)	Sub-total GW Use (AF/year)	Total SW + GW Use (AF/year)	Annual Rainfall (in)[e]
1991[a]	SW not available	SW not available	SW not available	46,640	7,631	54,271	54,271	10.94
1992[a]	SW not available	SW not available	SW not available	32,210	6,912	39,122	39,122	12.31
1993[a]	SW not available	SW not available	SW not available	38,878	5,066	43,944	43,944	18.29
1994[a]	SW not available	SW not available	SW not available	41,854	7,186	49,040	49,040	10.5
1995[a]	SW not available	SW not available	SW not available	36,744	5,895	42,639	42,639	22.42
1996[b]	18,325 52%	759 9%	19,084 44%	42,523	7,415	49,938	69,022	15.46
1997[b]	21,061 59%	838 10%	21,899 50%	40,569	10,277	50,846	72,745	15.47
1998[b]	12,335 35%	459 6%	12,794 29%	28,843	8,191	37,034	49,828	28.61
1999[b]	17,343 49%	695 8%	18,038 41%	38,717	9,415	48,132	66,170	10.61
2000[b]	17,656 50%	1,017 12%	18,673 43%	37,263	9,794	47,057	65,730	11.44
2001[b]	18,281 51%	1,254 15%	19,535 45%	33,715	9,433	43,148	62,683	14.09
Average[d]	17,500 49%	837 10%	18,337 42%	37,996	7,929	45,925	55,927	15.47
Maximum[d]	21,061 50%	1,254 15%	21,899 50%	46,640	10,277	54,271	72,745	28.61
Minimum[d]	12,335 35%	459 6%	12,794 29%	28,843	5,066	37,034	39,122	10.5

(a) Data were extracted from Water Year 1995 Annual Groundwater Report
(b) Data were extracted from the Annual Groundwater Reports for the Water Year reported
(c) 100% CVP Contract Entitlement for Agricultural Uses is 35,550 AF/yr, 100% CVP Contract Entitlement for M&I Uses is 8,250 AF/yr for a total of 43,800 AF/yr. M&I Entitlement has not been fully exercised.
(d) Average, Maximum, and Minimum of all surface water data for 1996 – 2001 and groundwater and precipitation for 1991 – 2001
(e) Hollister Station

3.2.2 M&I – Current and Future Demands

3.2.2.1 Estimated 2002 Demands

Information regarding 2002 M&I water demand for the incorporated cities of Hollister and San Juan Bautista and the unincorporated portions of the County were estimated as follows. Sunnyslope CWD serves customers in both the City of Hollister and in unincorporated San Benito County. Approximately 60% of Sunnyslope CWD's customers are in the City of Hollister; the remaining 40% are in unincorporated San Benito County.

However, because the California Department of Finance's information, which was used for developing the residential portion of the demand estimate, does not specifically subdivide Sunnyslope CWD's population between the incorporated and unincorporated portions of the County, it was assumed that Sunnyslope County Water District customers would fall under the City of Hollister, and that San Benito County Water District customers would be considered to be located in unincorporated areas. This assumption has limited impact on the total demands estimated and is considered valid for this estimate.

The 2002 demands were based on the Department of Finance population and persons per dwelling unit information for January 1, 2002. Population was divided by persons per dwelling unit to estimate the number of dwelling units. The number of dwelling units were then multiplied by an average demand of 420 gallons per day per dwelling unit which is consistent with the demands estimated for a relatively new residential development west of Fairview Road (Northeast Fairview Specific Plan draft EIR, April 1998).

The estimated demands were consistent with those in the 1999 Urban Water Management Plan (UWMP), Table 1-15, Hollister Urban Area – Projected Population and Water Demands With Implementation of Conservation Program and the City of San Juan Bautista General Plan, P. III-J.4.

Based on these sources, the total residential water demand for 2002 is 5,108 AF/year in urban areas and 2,789 AF/year in the unincorporated County. Non-residential demand of 2,790 AF/year for schools, parks, golf courses, industry, etc. was estimated by subtracting the residential demand of 5,108 AF/yr and 2,789 AF/yr from the total Domestic and Municipal water use of 10,687 AF for Water Year 2001 (Annual Groundwater Report, Table 1).

3.2.2.2 Estimated 2022 Demands

The following method was used to evaluate the effects on water demand of the Growth Management Ordinances in the Cities of Hollister and San Juan Bautista and the unincorporated portions of San Benito County.

- California Department of Finance (CDOF) population estimates for 2002 were used as the current condition and as the base for estimating future populations for the urban and unincorporated portions of the County.

- Estimated future water demand for the existing population was based on the assumption that for the 20 years from 2002 to 2022, conservation measures will result in a 1% annual decrease in water demand from each existing residential dwelling unit. Demand is expected to decrease from 420 gpd/du in 2002 to 344 gpd/du in 2022 for this sector of the urban service areas.

- Population increases in the City of Hollister/Sunnyslope County Water District were based on Ordinance 959, which limits growth to 244 residential units per year. An assumed density of 3.537 persons per household was used, based on CDOF estimates for City of Hollister for 1 January 2002.

- Population increases in the City of San Juan Bautista were based on the current ordinance that limits growth to 1% per year as set by the City of San Juan Bautista City Council in August 2002. An assumed density of 2.739 persons per household was used, based on CDOF estimates for City of San Juan Bautista for 1 January 2002.

- Population increases in the unincorporated County areas were based on Ordinance 751, which limits population increases to 1% per year. An assumed density of 3.034 persons per household was used, based on CDOF estimates for unincorporated San Benito County for 1 January 2002.

- Water demand associated with new growth is assumed to be 312 gpd/du which is consistent with the estimates used in the West of Fairview Water Supply Assessment. This assumes an interior demand of 230 gpd/du and exterior demand on a single family home of 92 gpd/du.

M&I demands and population are summarized in Table 3-4: Estimated Population and M&I and Agricultural Demands 2002-2022.

The estimated total residential demand for 2022 is estimated to be 8,675 AF/yr. The non-residential demand was assumed to continue to be 2,790 AF/yr since there is insufficient information available to predict future non-residential demands. The total M&I Demand is 11,465 AF/yr and is the sum of the residential and non-residential demands as shown in Table 3-4.

3.2.3 Agricultural – Current and Future Demands

The estimated total agricultural demand for 2002 is derived from the Annual Groundwater Report WY2001, Table 9, work done for the SBCWD by Ken Henneman, and from SBCWD staff. The 2001 Annual Groundwater Report estimated agricultural demand for 2000 to be 51,996 AF/yr. The GWPM update estimates that by the year 2022, up to 17,000 additional acres of land in the project area could be converted to irrigated agriculture. Currently, grazing land (annual grassland) and unirrigated hay fields with good soil characteristics are being converted to irrigated row crops and, to a lesser extent, orchards. This trend is likely to continue to occur in the future and is independent of implication of any of the groundwater management project elements in the proposed GWMP Update.

These agricultural demands assume an increase from 36,000 irrigable acres in 2002 to about 53,000 irrigable acres in 2022. They are also based on the assumption of 1.8 feet/year water duty, 0.4 feet of effective precipitation (ep) and 85% irrigation efficiency. The estimated 85% agricultural irrigation efficiency is consistent with the CVP guidelines for its water supply contractors. The increase in agricultural irrigation is based on estimates of available acreage not currently irrigated that could be irrigated in the future.

25-year agricultural demand estimates were calculated assuming an evenly-distributed linear increase from a 2000 demand of 51,996 AF/yr to a 2025 demand of 78,000 AF/yr. The total agricultural demand is estimated at 66,000 AF/yr for 2002 and 74,880 AF/yr for 2022.

3.2.4 Other Demands

All other estimated water demands are taken and adjusted from Henneman (2000). These water demands include conveyance losses and other minor uses. For 2002 through 2022, this estimated demand is expected to remain at 3,000 AF/yr.

3.2.5 Summary of 2002 – 2022 M&I and Agricultural Demands

Table 3-4 summarizes the estimated 2002 and 2022 populations and water demand estimates. It should be noted that the agricultural demands far outweigh the M&I demands and changes in assumptions for in agricultural demands can greatly influence the water supply that is needed to meet future demands.

Table 3-4: Estimated Population and M&I and Agricultural Demands 2002-2022

	Demands 2002 (AF/yr)[a]	Population 2002[b]	Estimated Demands 2022 (AF/yr)[c]	Estimated Population 2022[d]
Municipal & Industrial				
City of Hollister	4,834	36,338	5,665	53,600
City of San Juan Bautista	274	1,597	270	1,949
Total M&I Urban Areas	5,108	37,935	5,934	55,549
Other Unincorporated County	2,789	17,986	2,741	21,946
Non-Residential Demand	2,790		2,790	
Total Municipal and Industrial Demands/Population	10,687	55,921	11,465	77,495
Agricultural				
Zone 6, Bolsa, Paicines and Tres Pinos Creek Valley	Estimate based on acres under irrigation		Estimate based on all irrigable acres	
Total Agricultural Demands	54,076		74,880	
Other				
Other Demands	3,000		3,000	
Total				
Total Municipal and Industrial and Agricultural	67,763		89,345	

(a) 2002 Estimated Demands were based on the assumption that the demand per dwelling unit is 420 gallons per day per dwelling unit. The number of persons per dwelling unit was adopted from California Department of Finance Table 1: County and State Population and Housing Estimate, Official State Estimates as of January 1, 2002 for San Benito County.
(b) Population data for 2002 were adopted from California Department of Finance Table 2: City and County Population and Housing Estimates, Official State Estimates as of January 1, 2002.
(c) Estimated Demands for 2022 are based on Estimated Demand for existing population and Estimated Demand for new growth. Further details are in the report.
(d) Estimated Population for 2022 are based on current Growth Management Ordinances and are described in the report.

3.3 Reliability and Sustainability

As discussed in the 1998 Groundwater Management Plan, the inherent variability of hydrologic cycles and the potential changes in regulation can reduce the reliability and hence the availability of many water supplies. However, through managed development and careful use of all of the potential supplies, the dry period demands should be able to be met reliably.

The sustainability of the local supplies needs to also be considered such that environmental needs are met in surface waterways, groundwater levels are managed to minimize groundwater overdraft, and high groundwater is lowered to acceptable levels. Diversity in supply through the development and prudent use of both local and imported water supplies provides both reliability and sustainability.

The following section describes the manner in which various supplies can be managed and used conjunctively to provide both a reliable and sustainable supply for San Benito County.

3.3.1 20-year Simulation of Groundwater Basin Operation

Using the demand estimates from Growth Management assumptions and water source availability estimates assembled above, an illustrative 20-year simulation of groundwater basin operation was prepared. By carefully using the range of supply sources available and the projected demands, a 3-year dry period can be bridged by using groundwater banking.

For the purposes of this illustrative example, a 3-year dry period was assumed to be sufficient, although dry periods can obviously extend beyond 3 years. A 3-year dry period is consistent with the multiple-dry-year analyses prepared for the Hollister area Urban Water Management Plan.

A 20-year period was selected for the illustrative example because it is the projected planning horizon for this groundwater management plan and 20-years will contain many normal, wet, dry, and critically dry years to illustrate groundwater banking operations. For the purposes of the simulation, the 20 years included 8 normal years, 6 wet years, 4 dry years, and 2 critically dry years. The distribution of types of years was randomly selected within the 20-year period, and the dry-critically dry years were placed in sequence.

Using the assumptions for M&I, agricultural and other demands from Section 3.2, future demands were calculated for the 20-year simulation period. Total demands for dry and critically dry years were decreased by 10% on the assumption that some additional conservation can be achieved in a drought.

Total imported surface water supplies available for the different types of years are shown in Table 3-2: Potential Supply Availability in Wet, Normal, Dry and Critically Dry Years.

For the simulation, the amount of local supply used to meet demand depended on the amount of imported surface water available. When imported surface water could not meet demand, increased amounts of local supply were used. Supplies from the Cienega and Arroyo dos Picachos projects were assumed to be available in 2005, and supplies from the Pacheco Creek and Arroyo Las Viboras were assumed to be available in 2017. The amount of available local water included in the simulation was reduced from the figures in Table 3-2 to reflect meeting existing water rights.

When the total available supply was not sufficient to meet demand, the deficit was "withdrawn" from the groundwater/water bank. Conversely, when supplies were greater than demand, the excess supply was "deposited" into the bank. This assumption may overstate the true physical ability to bank excess water.

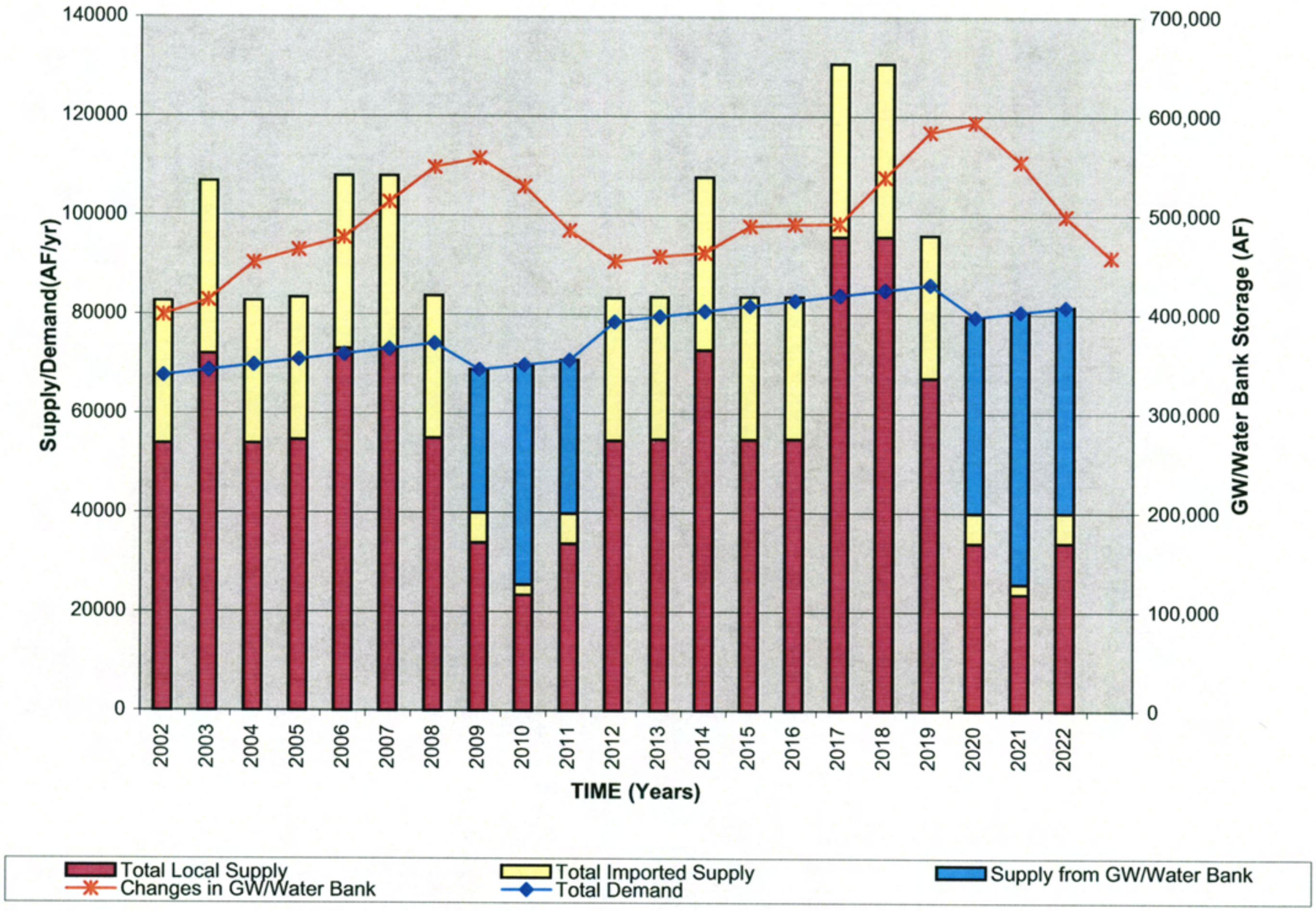
However, this assumption is sufficient for illustrative purposes and should be refined when developing a more detailed operations model and after further hydrogeologic studies. Calculations for the groundwater/water bank were based on the initial assumption that the beginning storage is 400,000 AF/yr.

Values for total demand, imported supply, local supply, supply from groundwater and surface water bank, and changes in groundwater/water bank are shown on Figure 3-1.

The 20-year simulation illustrates how a bank contributes to the reliability of a water supply system. Whether the bank occurs in a local groundwater bank, or a regional groundwater bank, the concept remains the same: when supplies are low, the bank will be used to make up shortfalls in demand.

The critical element of the bank is that contributions must be made to the bank when the water is available; otherwise, overdraft will result when too many withdrawals are made during times of low supply. It should also be noted that demand projections beyond 2025 may flatten and stabilize if land use plans and growth ordinances do not change significantly.

Figure 3 - 1 : Simulated Supply and Demand from 2002-2022 for San Benito County Groundwater Basin



Section 4: Objectives and Criteria for Groundwater Management Plan Implementation

The overall objective of the GWMP effort is to maintain and enhance the agricultural and economic productivity of San Benito County in an environmentally responsible manner. The objectives and criteria were initially developed in the 2001 Existing Conditions Report, and were expanded during the process of the preparation of the alternatives analysis presented in the Evaluation of Project Alternatives to Implement Groundwater Management Plan in San Benito County – Draft Report, June 2002 (June 2002 Draft Report). Specific criteria to achieve the overall goal are presented below.

4.1 Water Quantity Objectives and Criteria

- **Water Quantity Objective 1**: Maintain a reliable water supply for present and future users.

  Water Quantity Criterion 1-1: Deliver 100% of agricultural and M&I supply in normal and dry years, and in the first critically dry year of a drought.

  Water Quantity Criterion 1-2: Deliver at least 85% of M&I demands and 75% of agricultural demands in the second and subsequent critically dry years of a drought.

- **Water Quantity Objective 2:** Integrate the management of groundwater, surface water, and imported water, according to the following criteria:

  Water Quantity Criterion 2-1: Maximize efficient use of water supply by implementing water conservation programs for both M&I and agricultural uses. For existing M&I uses, it is assumed that over the next 20 years, water demand will decrease by 1% percent per year for existing residential dwelling units. Conservation will reduce demand from an estimated 420 gpd/du to 344 gpd/du. New development is assumed to have a demand of 312 gpd/du. Based on CVP guidelines, agricultural irrigation is assumed to be at 85% efficiency.

  Water Quantity Criterion 2-2: Provide new M&I water supplies to support planned growth within established urban (service) areas, in accordance with approved growth projections contained in the General Plans for San Benito County and the cities of Hollister and San Juan Bautista.

  Water Quantity Criterion 2-3: Manage groundwater levels to maintain groundwater storage for the protection of the water rights of the overlaying landowners and for emergency storage, limiting drawdown to the historic low levels of about 1977 to preclude and/or minimize the potential for ground settlement.

  Maintain groundwater levels, where practical, no higher than 20-30 feet below ground surface. In portions of the Bolsa, Pacheco, Hollister East and San Juan subbasins it will be impractical to achieve these groundwater levels and subsurface drainage systems and other means of providing improved drainage conditions for the overlying uses will be required. In addition, higher groundwater levels will occur in areas adjacent to streams and where artificial percolation occurs outside of natural streams, such as in the vicinity of the percolation ponds of wastewater treatment plants, septic systems, and off stream groundwater recharge ponds.

Water Quantity Criterion 2-4: Optimize the use of groundwater storage.

4.2 Water Quality Objectives and Criteria

- **Water Quality Objective 1:** Provide water quality to meet both the needs of end users and the established objectives as described in the criteria below .

  Water Quality Criterion 1-1: Manage water resources to minimize imported salts and long-term levels of groundwater salinity to protect beneficial uses as set forth in the applicable revisions of the Regional Water Quality Control Board Basin Plan.

  Water Quality Criterion 1-2: Protect groundwater resources from infiltration of nitrates and salts, as well as other substances that could adversely affect groundwater quality.

  Water Quality Criterion 1-3: Deliver M&I water meeting primary and secondary drinking water quality objectives, with emphasis on achieving the "DHS's Recommended Limit for Consumer Acceptance" of not more than 500 mg/l of TDS and hardness of no greater than 120 mg/l as CaCO3. {It should be noted that there are no secondary standards for hardness; soft waters are typically considered to have 0-60 mg/l of hardness, moderately hard waters have 61-120 mg/l, hard waters have 121 - 180 mg/l, and very hard waters have over 180 mg/l of hardness.}

  Water Quality Criterion 1-4: Deliver agricultural water meeting established quality parameters. In order to optimize crop yield based on the available water sources, salinity (as measured by TDS), sodium hazard (as measured by Sodium Adsorption Ratio, or SAR); and boron have been selected as key indicator parameters. The following water quality objectives for these three water quality parameters have been developed.

    Salinity: <700 mg/L TDS

    SAR: <6.5

    Boron: <0.5 mg/L

    TDS: Levels that range from 480 - 1920 mg/L are considered marginal for irrigation, per Regional Water Quality Control Board Basin Plan.

- **Water Quality Objective 2:** Manage water resources to meet Regional Water Quality Control Board Basin Plan and Department of Health Services water quality objectives.

4.3 Other Objectives and Criteria

Additional criteria were developed to assist in evaluating other aspects of the implementation of groundwater management programs and projects.

4.3.1 Regional Criterion

The following regional criterion has been developed:

- **Regional Criterion 1**: The programs and projects of the groundwater management plan should be coordinated with regional water supply planning and projects to the extent that it is practical and feasible to do so.

- **Regional Criterion 2:** The major programs and projects of the groundwater management plan related to water quality and stream flows of the San Benito and Pajaro Rivers should be coordinated with local government and resources agencies in adjacent and downstream areas of the Pajaro River Watershed in Santa Clara, Monterey and Santa Cruz Counties and with the California Department of Fish and Game, National Marine Fisheries Service and U.S. Fish and Wildlife Service.

4.3.2 Environmental Resources Objectives

The following environmental resources criteria have been considered in the selection of toolbox elements for the GMP Update.

- **Environmental Resources Objective 1:** Minimize adverse effects on biological and cultural resources, including riparian habitats, habitats supporting sensitive plant or animal species, and archaeological/historic sites.

- **Environmental Resources Objective 2:** Avoid or minimize construction impacts from the various projects contained in the GMP Update.

- **Environmental Resources Objective 3:** Minimize operational energy requirements for the projects contained in the GMP Update.

- **Environmental Resources Objective 4:** The environmental impacts of each element should, to the maximum extent practicable, be mitigable to acceptable levels. Project elements should maintain and, to the extent practical, enhance the local environment and contribute to the long-term sustainability of agricultural, commercial, industrial and urban land uses and activity within the basin.

4.3.3 Institutional/Jurisdictional Objective

The following institutional/jurisdictional criterion has been developed.

- **Institutional/jurisdictional Objective 1**: The projects and programs in the groundwater management plan should be permittable and implementable, and shall be consistent with local and regional institutional constraints.

4.3.4 Cost Effectiveness/Affordability Objectives

The following cost effectiveness/affordability criteria have been developed:

- **Cost Effectiveness/Affordability Objective 1:** The programs and projects in the groundwater management plan should be affordable and financially feasible for urban and agricultural interests to implement over a predictable time period consistent with plan objectives. One measure of affordability will be the impact on water costs to urban and agricultural users over current and future baseline estimates.

- **Cost Effectiveness/Affordability Objective 2:** The programs and projects in the groundwater management plan should maximize the use of existing facilities.

Section 5: Elements of the Groundwater Management Plan Update

5.1 Development of the Project Elements

The Water Resources Association of San Benito County acknowledges the need to undertake programs and projects that improve the reliability and quality of the water available to its users. Many of these programs and projects are required to meet regulatory requirements, such as the primary and secondary drinking water standards, as well as wastewater effluent limits.

The programs and projects selected for the GMP Update have been derived from the preliminary evaluation of alternatives (June 2002 Draft Report) that compared the Project Toolbox Elements to the objectives and criteria. This comparison has resulted in the selection of Project Toolbox Elements that:

- Are practical and feasible (i.e. have no apparent fatal flaws and avoid sensitive environmental resources).
- Offer operational flexibility in the use of the various water resources available.
- Make creative use of opportunities/resources.
- Are cost-effective when compared to other Project Toolbox Elements that accomplish the same goal.

The selected Project Toolbox Elements are described below and include those in Alternative 4, with refinements as well as some additional project elements. Development of the programs and projects of the GMP Update are based on the following assumptions:

- Municipal and Industrial (M&I) water demands in the year 2022 are estimated to be 11,465 AF/yr.
- Agricultural and other water demands in the year 2022 are estimated to be 74,880 AF/yr.

5.2 Overview of Project Elements

The GWMP Update includes several types of water resource management programs that address:

- M&I Water Supply
- Agricultural Water Supply
- Groundwater Level Management

- Water Quality Management
- Agricultural
- M&I
- Wastewater Disposal

The following Project Toolbox Elements (Management Measures) have been selected for inclusion in the GMP Update. The Project Toolbox Elements can be divided into programs and projects/activities. Programs address issues such as water conservation, salt and nitrate education, ordinances, and economic incentives for water use. Projects/Activities will most likely result in capital infrastructure projects that will transport San Benito County water.

The programs and projects/activities contained in the Project Toolbox Elements have been divided into three general categories: 1) Institutional Programs; 2) Continuation of Existing Projects/Activities; and 3) New Projects/Activities.

1) Institutional Programs

- M&I Water Conservation
- Agricultural Water Conservation
- Salinity Education Program
- Water Softener Ordinance
- Industrial Salt Control in Municipal Wastewater Program
- Nitrate Education Program
- Well Construction and Abandonment Ordinance
- Maintain and Enhance Strategic Data Collection and Management Program
- Continue and Expand Economic/Regulatory Water Level Management Tools

These elements are ongoing, basin-wide programs that are the cornerstones of the GMP Update.

2) Continuation of Existing Projects/Activities

- Existing Groundwater Extraction Facilities
- Surface Water Importation
- Surface Water Treatment

- M&I Wastewater Effluent Percolation
- Water Transfers
- In-Basin Water Banking
- Natural Direct Percolation
- Artificial Direct Percolation of Imported Surface Water
- In-lieu Banking of Imported Surface Water

3) New Projects/Activities

- Development/Improvement of High Quality Local Groundwater and Surface Water Supplies
- Regional and Local Conveyance Facilities For Multiple Water Supply
- Out-of-Basin Water Banking
- In-Basin Water Banking
- Natural Direct Percolation
- Artificial Direct Percolation of Local Surface Water
- In-Lieu Banking of Local Surface Water
- Aquifer Storage and Recovery of Imported and/or Local Surface Water
- Groundwater Treatment and Concentrate* Disposal
- Groundwater/Surface Water Blending
- Recycled M&I Wastewater Effluent for Direct Reuse
- Tile Drains for Localized Groundwater Level Management
- Tree Belt Evapotranspiration for Localized Groundwater Level Management/Wastewater Disposal
- Groundwater Pumping for Water Level Management

* Concentrate is the minerals/salts that remain after treatment of water through demineralization or desalting processes

- Constructed Wetlands for Treatment/Polishing of Agricultural Runoff
- Future Study of New Water Management Tools

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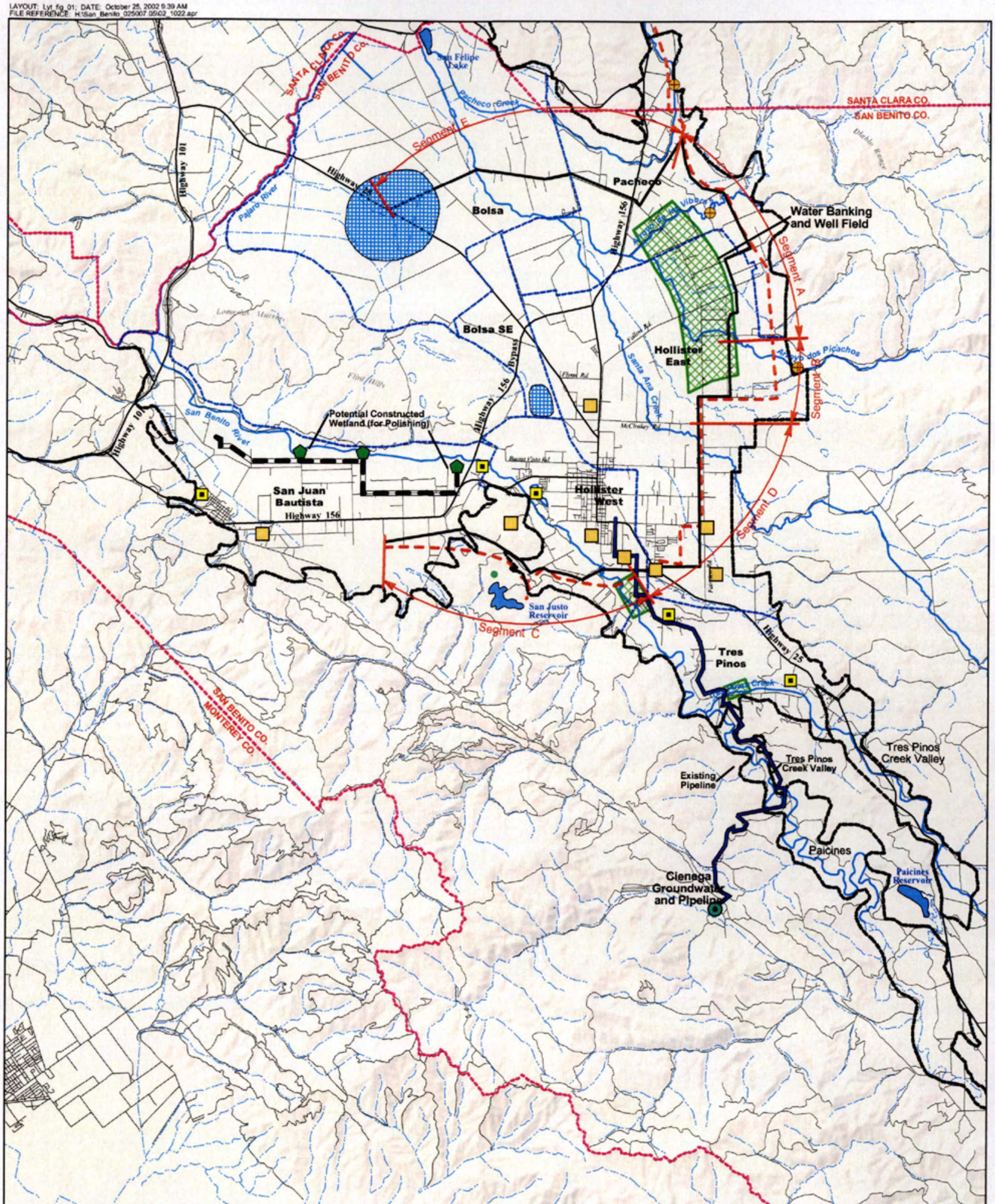

Basemap reference: EDAW/TODD Engineers, 2001

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- Proposed Effluent for Direct Reuse
- Proposed Groundwater/Surface Water Treatment Facilities
- Proposed Seasonal Local Surface Water Development
- Potential Constructed Wetland
- Proposed/on-going In-lieu Percolation
- In Basin Water Banking and Well Field
- Proposed Local Conveyance Pipeline
- Proposed Cienega Groundwater Pipeline
- Proposed Agricultural Drain to Wetlands
- Hollister Conduit San Felipe Water System
- Groundwater Basin Boundary
- Groundwater Subbasin Boundary

Kennedy / Jenks Consultants

Water Resources Association of San Benito County

GROUNDWATER MANAGEMENT PLAN UPDATE PROJECT ELEMENTS

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April, 2004

Figure 5-1

Table 5-1: GMP Update Project Toolbox Elements and Program Matrix

Project Toolbox Element	M&I Water Supply	Agricultural Water Supply	GW Level Management	Water Quality Management		Wastewater Disposal
				Ag.	M&I	
Institutional Programs						
M&I Water Conservation	✓		✓			
Agricultural Water Conservation		✓	✓			
Salinity Education Program				✓	✓	
Water Softener Ordinance					✓	✓
Industrial Salt Control in Municipal Wastewater Program					✓	
Nitrate Education Program	✓	✓		✓	✓	
Well Construction and Abandonment Ordinance				✓	✓	
Maintain and Enhance Strategic Data Collection and Management Program	✓	✓	✓	✓	✓	✓
Continue and Expand Economic/Regulatory Water Level Management Tools	✓	✓	✓	✓	✓	
Continuation of Existing Projects/Activities						
Existing Groundwater Extraction Facilities	✓	✓	✓			
Surface Water Importation	✓	✓				
Surface Water Treatment	✓				✓	

Table 5-1: GMP Update Project Toolbox Elements and Program Matrix

Project Toolbox Element	M&I Water Supply	Agricultural Water Supply	GW Level Management	Water Quality Management		Wastewater Disposal
				Ag.	M&I	
Continuation of Existing Projects/Activities						
M&I Wastewater Effluent Percolation		✓		✓	✓	✓
Water Transfers	✓	✓	✓			
In-Basin Water Banking – Natural Direct Percolation[1]	✓	✓				
In-Basin Water Banking – Artificial Percolation of Imported and/or Local Surface Water[1]	✓	✓	✓	✓		
In-Basin Water Banking – In-lieu Banking of Imported and/or Local Surface Water[1]		✓	✓	✓		
New Projects/Activities						
Development/Improvement of High Quality Local Ground and Surface Water Supplies	✓	✓		✓	✓	✓
Regional and Local Conveyance Facilities for Multiple Water Supply Distribution	✓	✓	✓	✓	✓	
Out-of-Basin Water Banking	✓	✓	✓			
In-Basin Water Banking – Aquifer Storage and Recovery of Imported and/or Local Surface Water	✓	✓	✓	✓		
Groundwater Treatment and Concentrate Disposal	✓				✓	
Groundwater/Surface Water Blending	✓	✓	✓	✓	✓	
Recycled M&I Wastewater Effluent for Direct Reuse		✓	✓			✓
Tile Drains for Localized Groundwater Level Management			✓	✓		

Table 5-1: GMP Update Project Toolbox Elements and Program Matrix

Project Toolbox Element	M&I Water Supply	Agricultural Water Supply	GW Level Management	Water Quality Management		Wastewater Disposal
				Ag.	M&I	
New Projects/Activities						
Tree Belt Evapotranspiration for Localized Groundwater Level Management/Wastewater Disposal			✓	✓		
Groundwater Pumping for Water Level Management			✓			
Constructed Wetlands for Treatment/Polishing of Stormwater/Agricultural Runoff				✓	✓	

(a) Also applies to New Projects/Activities for Local Surface Water

Each Project Toolbox Element is described in further detail below and major issues and major benefits for each Element are identified. Those projects that can be identified with a general location are shown on Figure 5-1.

Table 5-2 shows the project toolbox elements and their applicability to the various sub-basins.

Table 5–2: Project Toolbox Elements and Sub-basin Applicability.

Project Toolbox Elements	Bolsa	Pacheco	Hollister East	Hollister West	Bolsa SE	San Juan	Tres Pinos
Institutional Programs							
M&I Water Conservation	✓	✓	✓	✓	✓	✓	✓
Agricultural Water Conservation	✓	✓	✓	✓	✓	✓	✓
Salinity Education Program	✓	✓	✓	✓	✓	✓	✓
Water Softener Ordinance			✓	✓		✓	
Industrial Salt Control in Municipal Wastewater Program			✓	✓		✓	
Nitrate Education Program	✓	✓	✓	✓	✓	✓	✓
Well Construction and Abandonment Ordinance	✓	✓	✓	✓	✓	✓	✓
Maintain and Enhance Strategic Data Collection and Management Program	✓	✓	✓	✓	✓	✓	✓
Continue and Expand Economic/Regulatory Water Level Management Tools		✓	✓	✓			
Continuation of Existing Projects Activities							
Existing Groundwater Extraction Facilities	✓	✓	✓	✓	✓	✓	✓
Surface Water Importation		✓	✓	✓	✓	✓	✓
Surface Water Treatment			✓	✓		✓	
M&I Wastewater Effluent Percolation			✓	✓		✓	✓
Water Transfers	✓	✓	✓	✓	✓	✓	✓
In-Basin Water Banking – Natural Direct Percolation[1]	✓	✓	✓	✓	✓	✓	✓
In-Basin Water Banking – Artificial Percolation of Imported and/or Local Surface Water[1]	✓		✓				✓
In-Basin Water Banking – In-lieu Banking of Imported and/or Local Surface Water[1]		✓			✓		

New Projects/Activities							
Development/Improvement of High Quality Local Ground and Surface Water Supplies	✓		✓				✓
Regional and Local Conveyance Facilities for Multiple Water Supply Distribution	✓	✓	✓	✓		✓	
Out-of-Basin Water Banking	✓	✓	✓	✓	✓	✓	✓
In-Basin Water Banking – Aquifer Storage and Recovery of Imported and/or Local Surface Water	✓		✓				
Groundwater Treatment and Concentrate Disposal			✓	✓		✓	
Groundwater/Surface Water Blending			✓	✓		✓	
Recycled M&I Wastewater Effluent for Direct Reuse			✓	✓		✓	
Tile Drains for Localized Groundwater Level Management						✓	
Tree Belt Evapotranspiration for Localized Groundwater Level Management / Wastewater Disposal						✓	
Groundwater Pumping for Water Level/ Management		✓	✓			✓	
Constructed Wetlands for Treatment/Polishing of Stormwater/Agricultural Runoff			✓	✓		✓	

(1) Also applies to New Projects/Activities for Local Surface Water

5.3 Institutional Programs

5.3.1 M&I Water Conservation

Description: The WRA members have joined to implement M&I Water Conservation by hiring an individual as a shared resource among the WRA members. For existing M&I uses, it is assumed that, over the next 20 years, water demand from existing residential units will decrease by 1% per year (J. Gregg, Personal Communication, 3 June 2002). At this rate of decrease of water demand, demands are expected to reduce from an estimated 420 gpd/du at present to 344 gpd/du in the future in existing residential units. Current ordinances for new residences in the city and county will restrict water use to approximately 312 gpd/du by using xeriscape landscaping and other water conservation measures. (Draft Environmental Impact Report for Northeast Fairview Specific Plan, October 1999).

Major Issues: The most important issue associated with this element is the implementation of water conservation programs and quantifying demand reductions over time.

Major Benefits: The most important benefit of this element is that it is an efficient use of the water supplies and represents a low-cost way to stretch water supplies.

5.3.2 Agricultural Water Conservation

Description: The conservation goal is to achieve 85% irrigation efficiency consistent with CVP water supply contract expectations. Agencies such as the Resource Conservation District and the San Benito County Farm Bureau assist agricultural water users in improving efficiency. It is expected that the efficiency improvements needed to meet the CVP guidelines for 85% efficiency will be achieved primarily by reducing evaporative losses during irrigation (J. Gregg, Personal Communication on 3 June 2002).

The SBCWD has developed a Water Management Program for M&I and agricultural supplies that is subject to review and approval by the USBR for all imported CVP water. The Best Management Practices identified under the Water Management Program include:

- Measurement of water to plus or minus 6% as required by the USBR.
- Designation of a water conservation coordinator. At present the SBCWD District Manager serves as the water conservation coordinator and for FY 02/03, the SBCWD Board has approved the addition of an agricultural/urban irrigation specialist.
- Provide or support water management services to water users. Services include providing:10 on-farm surveys per year and timely crop and water use information to each user; Irrigation scheduling and evapotranspiration information to water users; surface, ground, and drainage water quality data; and agricultural water management education programs and materials for farmers, staff, and the general public.
- Evaluation and improvement of SBCWD pump efficiencies.

- Other relevant items from the Best Management Practices include: facilitating use of recycled urban wastewater for crop use; facilitation of financing of capital improvements for on-farm irrigation systems; and optimize conjunctive use of surface and groundwater.

At present, the SBCWD does not have sufficiently detailed information (such as acreage by crop, including multi-cropping) to accurately estimate agricultural water use efficiency.

Major Issues: The most important issue associated with this element is implementation of the water conservation programs and tracking demand reductions over time.

Major Benefits: The most important benefit of this element is that it is an efficient use of the water supplies and represents a low-cost way to stretch water supplies.

5.3.3 Salinity Education Program

Description: Implementation of salinity education for both agricultural and M&I users will be crucial to managing salt loads to the groundwater basin. A preliminary salt balance that has been prepared as part of the San Benito County Water District's Annual Groundwater Report for Water Year 2001 indicates that imported CVP water, fertilizers from agricultural and urban users, and concentrate from water softeners from M&I users account for 20,941 tons per year or 53% of all of the salts entering the groundwater basin. Of the salts contributed, agricultural users account for 17,541 tons per year and urban users 3,400 tons per year.

Ongoing programs by agencies such as the Resource Conservation District and the San Benito County Farm Bureau assist agricultural water users in managing salt additions from fertilizers and other products to reduce salt infiltration to the local groundwater basin. Management of salinity, particularly from agricultural users, also reduces nitrate build-up in the groundwater. Salinity education of M&I users will occur primarily through implementation of the water softener ordinance described below.

Major Issues: The most important issue associated with this element is implementation of the salinity education program and tracking reductions in salt contributions over time.

Major Benefits: The most important benefit of this element is that it reduces salt input to the groundwater basin.

5.3.4 Water Softener Ordinance

Description: The salt balance in the Annual Groundwater Report for Water Year 2001 estimates that water softeners add 2,270 tons per year or 6 % of the total salt inputs to the groundwater basin. Although this source is small in comparison to other sources, it is a relatively easily controllable source of salts.

The urban water purveyors have implemented ordinances requiring new home water softeners to be the type that is regenerated offsite to prevent the introduction of salts into the sewer system. In addition, public education is ongoing regarding the need to regenerate softeners only when required. A retrofit ordinance applicable to resale of homes, and a grant program to assist existing homeowners in achieving conversion at lower cost is also under consideration.

Introduction of lower hardness water sources to the municipal water systems, such as the recently completed Lessalt Water Treatment Plant, will reduce the need for home water softeners.

Major Issues: The most important issue associated with this element is enforcement of the ordinance and implementation of the education program. Reductions in salt contributions over time will most easily be tracked in wastewater effluent samples.

Major Benefits: The most important benefit of this program is that it reduces a salt input that is relatively easy to control to the groundwater basin.

5.3.5 Industrial Salt Control in Municipal Wastewater Program

This program is intended to work cooperatively with food processors and other industrial dischargers whose operations contribute elevated levels of salts to municipal wastewater treatment plants.

5.3.6 Nitrate Education Program

This program is intended to work cooperatively with agricultural and municipal users on the use of soil amendments, fertilizers and other compounds that are applied to fields and landscaping to improve soil conditions and plant productivity.

5.3.7 Well Construction and Abandonment Ordinance

There are many wells in San Benito County that were not constructed to current standards and may be providing a means for vertical migration of poor quality water to deeper aquifers. These wells were most likely constructed with gravel pack seals to the ground surface and have not been properly abandoned so remain a threat to groundwater quality.

This program would include review of applicable current County well ordinances. The review would evaluate whether sufficient resources, processes, and procedures are available for enforcement of the ordinance. If necessary, additional ordinances or modifications to existing ordinances would be developed to be consistent with Department of Health Services and other standards for well construction and abandonment.

5.3.8 Maintain and Enhance Strategic Data Collection and Management Program

The San Benito County Water District currently gathers groundwater level and quality information and prepares an annual groundwater report. As practices such as groundwater banking and in-lieu percolation are expected to be practiced more intensively in the future, the need for groundwater data collection and analysis on a more frequent seasonal basis is expected to increase. This program is intended to further develop data collection and management so that timely decisions can be made regarding which water source can be used in each area.

More detailed information regarding data collection and management is found in Section 2.2

5.3.9 Continue and Expand Economic/Regulatory Water Level Management Tools

The SBCWD has developed a regulation that limits transfer of additional imported water into the San Juan sub-basin. This regulation was established to manage the current high groundwater levels in the San Juan. At the present time, the regulation is reviewed on an annual basis and decisions are made regarding the need to implement the regulation based on groundwater level data.

The SBCWD envisions development of additional regulations, policies, and economic incentives/disincentives to better distribute water to the areas in overdraft and to encourage the use of wells in those areas of high groundwater.

5.4 Continuation of Existing Projects and Activities

5.4.1 Existing Groundwater Extraction Facilities

Description: There are approximately 1,000 wells currently in the County that serve agriculture, community water systems in San Juan Bautista and Hollister area, and rural home users. Groundwater is readily available and is considered to be the predominant supply in the basin as shown in Section 3.2.1. For community water systems that use groundwater for M&I supply, additional treatment to remove hardness and salts will be required in the future as described further in Section 5.5.5. For agricultural users that have access to surface water, groundwater can be blended with surface water to improve the quality of the delivered water.

Major Issues: Declining water quality is the most important issue associated with the continued use of existing groundwater extraction facilities for M&I and agricultural supply. The water quality can be improved through the treatment and/or blending described below.

Major Benefits: Continued use of groundwater serves as an important element in the prevention of elevated groundwater levels that can negatively impact agricultural and residential areas. The facilities to extract groundwater are already in place and will not require significant additional capital expenditures other than possible treatment to remove salts.

5.4.2 Surface Water Importation

Description: Existing CVP surface water contracts allow up to 43,800 AF/yr of contract entitlement to the SBCWD of which 8,250 AF/yr is for M&I and 35,550 AF/yr is for agriculture deliveries. However, the levels for M&I supplies are often reduced to 75% of entitlement, and agricultural supplies are often reduced to less than 60% and as low as 0% of entitlement in severe drought conditions. The long-term average annual delivery is expected to be closer to 30,000 AF of which 7,000 AF/yr is for M&I deliveries and 23,000 AF/yr is for agriculture deliveries. CVP deliveries of 2,100 AF/yr are estimated for M&I during critically dry years.

Actual CVP deliveries to San Benito County are shown in Table 3-2 above and have averaged about 18,400 AF/yr. However, only a small fraction of M&I use of CVP water has been realized.

Draft CVP reliability guidelines for M&I indicate that if agricultural supplies are converted to M&I supplies, they still maintain the lower reliability of an agricultural supply. For example, in severe drought conditions, no water may be delivered if the entitlement has been converted from agricultural to M&I uses. The GMP Update assumes that the available CVP surface water for M&I uses can range from 1.9 MGD (2,100 AF/yr) to 7.4 MGD (8,250 AF/yr). Delivery of CVP water for M&I uses will require treatment in a surface water treatment plant as described below.

Major Issues: Importation of surface water for M&I uses instead of use of local groundwater can result in higher groundwater levels. Wastewater effluent disposal issues associated with percolation of effluent are exacerbated in areas of high groundwater. Therefore, continued long-term use of imported surface water for M&I will require careful management of groundwater levels. The relatively low reliability of this supply and the insufficient supply to meet 2022 M&I demands will require additional sources of water to be developed for M&I uses.

Major Benefits: The high quality of the CVP water with respect to hardness and TDS will result in reduced use of water softeners and the resulting reduction in salt concentration in wastewater effluent. Reduced salts in wastewater effluent will make the recycled water more attractive for direct reuse.

5.4.3 Surface Water Treatment

Description: As described earlier, the availability of imported CVP water for M&I uses is likely to range from an average flow of 1.9 MGD (2,100 AF/yr) to 7.4 MGD (8,250 AF/yr) while the total average demand is up to 10.2 MGD (11,465 AF/yr). Since there is a high probability that local surface water to make up the 2.8 MGD (3,215 AF/yr) difference between the total M&I demand and the available CVP water is available, it has been assumed for the GMP Update that up to 10.2 MGD of surface water treatment capacity will be required on an average basis.

Providing sufficient capacity for peak summertime demands will require distribution storage. Some distribution storage already exists within the City of Hollister, Sunnyslope County Water District, and City of San Juan Bautista systems. The Water Master Plan Update for the City of Hollister (September 1996) recommended the addition of 7 MG of storage to the existing 6 MG of storage already in the Hollister and Sunnyslope system. Construction of distribution storage is a requirement of operations of the water distribution system and will be the responsibility of each individual water purveyor.

In those dry and critically dry years when surface water may not be available for treatment, more groundwater will be required to make up the difference.

Surface water must be treated by filtration and disinfection processes to remove particles and pathogens from the water and to meet Federal and State drinking water requirements. Filtration alternatives for surface water treatment include conventional granular media filtration and microfiltration (MF) or ultrafiltration (UF) membrane filtration processes. Disinfection alternatives include the use of chlorine, ozone, or ultraviolet light (UV) to inactivate pathogens.

The recommended surface water treatment for San Luis Reservoir CVP water is MF or UF membrane filtration with chlorine or UV disinfection. This cost-effective process provides higher water quality, uses fewer chemicals, is easier to operate, and provides greater flexibility in meeting future water quality regulations than does the conventional treatment process.

The 3 MGD capacity Lessalt membrane filtration plant went into operation in November 2002 for the City of Hollister and Sunnyslope County Water District to deliver treated imported surface water in a portion of their service area. The Lessalt plant is expected to operate at full capacity most of the year. The City of San Juan Bautista has completed its California Environmental Quality Act (CEQA) document for a 1-MGD capacity membrane filtration plant. It is expected that it will take several years for the San Juan Bautista plant to have demands near full operational capacity.

Therefore, it is assumed for the GMP Update that up to 6.2 MGD, on average, of additional surface water treatment capacity would be required in the future to meet the projected M&I demands. Currently, Sunnyslope County Water District is in the early planning and design process for a 2 MGD capacity membrane filtration plant. If Sunnyslope's plant goes forward, then up to 4.2 MGD, on average, of additional treatment capacity will be required. The additional treatment capacity could be possibly economically achieved by expanding existing treatment plants with additional treatment units. However, in some cases, it may be desirable to locate a treatment plant in an area of development rather than constructing additional transmission pipelines. Up to five locations for surface water treatment plants have been identified and are shown conceptually on Figure 5-1. It should be noted that some of this capacity may not be required if groundwater demineralization facilities are constructed to meet the M&I demand.

Major Issues: The major issues associated with surface water treatment plants are with potential increases in water levels in the Hollister East and Hollister West sub-basins. The higher groundwater will be the result of: a) reduced groundwater pumping in the sub-basins because of the increased use of imported surface water and/or local surface water from another sub-basin and b) the additional wastewater effluent that is generated and disposed of in the wastewater percolation ponds.

Therefore, careful monitoring and management of groundwater levels in the Hollister East and Hollister West sub-basins will be required during the implementation of this Project Toolbox Element. It should be noted that the additional groundwater which will likely be developed to meet future M&I demands will offset, to some degree, the water level impacts of the use of imported water.

Major Benefits: The major benefits associated with the use of surface water and treatment through surface water treatment plants is the high quality of the CVP and/or local surface water with respect to hardness and TDS. The higher quality water will result in reduced use of water softeners and a resulting reduction in salt concentration in wastewater effluent. The reduced salt loading in the wastewater effluent will make it more attractive for direct reuse. In addition, the use of local surface water for M&I uses will result in even further reductions in salt inputs to the groundwater basin when compared to the salt inputs from imported surface water.

5.4.4 M&I Wastewater Effluent Percolation

Description: This Project Toolbox Element involves disposing of and/or storing M&I wastewater effluent through existing or new percolation ponds. M&I wastewater effluent disposed of and/or stored in percolation ponds must be treated to a sufficiently high quality to meet local groundwater quality objectives mandated by the Regional Water Quality Control Board. Increased percolation capacity can be achieved through redevelopment of existing ponds to increase rate of percolation, creation of additional ponds, development of ponds in other locations with higher capacity, and/or reduction of local groundwater levels to improve vertical groundwater gradients and therefore increase percolation rates.

M&I wastewater effluent percolation is now the primary mechanism for wastewater effluent disposal. Even as water recycling becomes more widespread, it is expected that use of percolation ponds will continue to serve as an alternative wastewater disposal method to address seasonal variations in recycled water demand and the expected need for wastewater disposal in wintertime. For the purposes of the GMP Update, it is assumed that M&I wastewater effluent percolation will continue to serve as a method of wastewater disposal in the groundwater basin area.

Major Issues: One of the major issues of this Project Toolbox Element is the ongoing concern for groundwater quality degradation and localized high groundwater associated with M&I wastewater effluent percolation.

Major Benefits: One of the major benefits of this Project Toolbox Element is that as source water quality improves, so will the M&I wastewater effluent and therefore will improve the water quality of the groundwater.

5.4.5 Water Transfers

Description: Assuming that water management activities free some of the imported water, then short-term or long-term water transfers of the imported water from the basin to outside users could generate revenue to help implement the programs of the GMP Update. It is assumed that execution of short-term water transfers to other entities or to Out-of-Basin water banks as discussed in Section 5.5.3 has already been reviewed for environmental impacts through on-going Federal and State permitting and review processes.

Major Issues: One of the major issues associated with water transfers is the need to obtain buy-in from current users of imported water to take delivery of groundwater and/or blended water of higher TDS than the imported water alone. Only when users accept groundwater or blended water will the imported water become available for transfer. In addition, depending on the length and degree of permanence of the water transfer, the negotiations to complete a water transfer could be complex and protracted.

Major Benefits: Some of the major benefits associated with transferring the use of imported water out of the groundwater basin are: the generation of revenue that can be used to help implement programs; the lowering of high groundwater levels that will occur with decreased application of imported water and increased groundwater pumping; and the reduction in imported salts that results from importing less surface water.

5.4.6 In-basin Water Banking

Description: Local water banking in the groundwater aquifer is an important component of managing water resources in the basin and storing water to improve the reliability of the water supply.

As described in earlier sections, there are a number of sources that could be banked in the groundwater basin including imported surface water and/or high winter flows in local streams. The potential mechanisms for banking include:

- Natural direct percolation,
- Artificial direct percolation of imported and/or local surface water,
- In-lieu banking of imported and/or local surface water, and
- Injection of imported and/or local surface water into groundwater storage and extraction of water from Aquifer Storage and Recovery (ASR) wells.

These mechanisms are discussed in greater detail below.

Use of percolated water in river channels or recharge basins would require extraction wells, while ASR would provide injection and extraction in a single facility. In-basin water banking will also require Regional and Local Conveyance Facilities for Multiple Water Supply Distribution to effectively distribute the banked water.

Natural direct percolation is an on-going natural process and is discussed briefly below.

At the present time, the greatest opportunity for artificial direct percolation appears to be in the Pacheco and northern portion of the Hollister East Sub-basins where percolation of imported surface water has historically occurred. Some in-stream percolation sites along the San Benito River in the Hollister West and San Juan sub-basins have also been studied. Although percolation sites have been identified in the San Juan sub-basin, the sub-basin has limited hydraulic capacity for water banking because of existing high water levels, and is further limited by poor ambient groundwater quality.

Southern Bolsa sub-basin has capacity for in-lieu banking because of the presence of a large groundwater depression and the availability of imported water. In-lieu banking is currently occurring in the Bolsa Southeast sub-basin where imported surface water is now used for irrigation, thus allowing natural direct percolation to refill a groundwater depression that had previously been overdrafted.

ASR could occur in any number of locations depending on the availability of storage capacity in the aquifer.

Major Issues: The major issue associated with water banking in general is ensuring that there is sufficient information regarding water levels, water quality, available storage capacity of aquifers, etc. to be able to make informed decisions about where and when to recharge water.

Major Benefits: The major benefit of groundwater banking is the ability to store a variety of source waters with relatively few environmental impacts when compared to surface water reservoirs. Water in storage will increase the reliability of the overall water supply system during dry years when groundwater can be used to offset reductions in imported water.

A more detailed discussion of the various in-basin water banking options follows:

5.4.6.1 Natural Direct Percolation

Natural direct percolation is an on-going process in the existing fields and waterways. The high proportion of agricultural land uses in San Benito County result in high levels of natural direct percolation, especially when compared to more urbanized areas with higher proportions of impervious surfaces. As long as the agricultural land uses, which are highly valued in San Benito County remain, natural direct percolation will also continue to occur at levels close to current levels.

5.4.6.2 Artificial Direct Percolation of Imported and/or Local Surface Water

Description: Similar to the Project Toolbox Element of Development/Improvement of High Quality Local Ground and Surface Water Supplies, if sufficient groundwater storage space and unused imported and/or local surface water is available, then water could be percolated in high permeability river/drainage channels for storage in the groundwater basin. The SBCWD currently stores excess imported water in the groundwater basin through percolation in highly permeable channels. However, rising groundwater levels in some areas have required the SBCWD to curtail percolation in an effort to better manage groundwater levels.

The Pacheco and northern Hollister East sub-basins, as shown on Figure 5-1, have been identified as areas for potential banking and withdrawals. At the present time this area has high groundwater levels that would have to be pumped down to allow water to be stored. It is expected that extraction of water banked in these areas can occur primarily through existing wells. There are over a thousand wells in San Benito County; it is expected that wells that are in good condition close to use areas and/or regional and local conveyance pipelines can be identified and arrangements made with the well owners to lease the wells.

The Hollister Conduit and/or the proposed regional and local conveyance facility could be used to convey the pumped water to either the southern Bolsa sub-basin or to other potential use areas that could be accessed by SBCWD's extensive CVP water delivery system.

In the Hollister West and San Juan sub-basins, eight in-stream percolation sites were studied along the San Benito River as shown on Figure 5-1 (Zone 3 and Zone 6 Annual Percolation and Groundwater Recharge Program, San Benito River Detention Basins, March 1995). The percolation facilities consisted of simple berms with culvert spillways and slide gates to control the flow. The berms reduce the flow rate, increase water depth, and allow more percolation than occurs through the natural river channel.

Although not specifically studied, there may be off-stream percolation facilities that can be constructed close to the in-stream percolation sites that would increase the area of percolation, and hence the volumes of water that could be percolated. Studies conducted by the SBCWD in cooperation with Granite Rock Incorporated indicate that in some locations, sustained percolation rates as high as 1 foot/day were observed (J. Gregg, Personal Communication, 28 August 2002). Off-stream percolation may also extend the length of time that percolation can occur and therefore the volume of water that could be percolated.

The San Benito River percolation sites would also benefit from development of a dedicated shallow well-field to extract the water. It is expected that water would be pumped out of the San Benito River gravels and into the Hollister Conduit and/or the regional and local conveyance pipelines to the use areas. Some existing deeper wells could also be used for extraction.

Major Issues: The major issue associated with artificial direct percolation is that all of the proposed artificial direct recharge locations have high groundwater levels as a result of the use of imported water in the area. In addition, Hollister West has the additional consideration of treated wastewater effluent percolation that impacts groundwater levels . Therefore, artificial direct recharge will require careful selection of recharge areas and monitoring and management of water levels.

SBCWD has been awarded an AB 303 grant to further develop and automate their on-going groundwater level and quality monitoring. Improved data will assist the SBCWD in identifying areas appropriate for groundwater banking and withdrawal and in evaluating local water quality. In addition, careful evaluation of the quality of the source and native waters will be required to minimize the potential for aquifer plugging and other negative impacts.

Major Benefits: The major benefit associated with imported surface water percolation is that it allows for the storage of high quality water when the water is available thus increasing the reliability of water supply to the San Benito County users.

5.4.6.3 In-lieu Banking of Imported and/or Local Surface Water

Description: As described earlier, in-lieu banking is currently occurring in the Bolsa Southeast sub-basin through the extension of the delivery system for imported water to the sub-basin. By using the imported water, groundwater is not being pumped and the groundwater recharge that is occurring remains in storage. Therefore, by providing imported water in-lieu of pumping groundwater, water banking is occurring.

It is expected that the in-lieu banking effort will result in mitigation of the groundwater depression that has formed by allowing direct natural percolation to recharge the sub-basin. Evidence of the decrease in the size and depth of the groundwater depression has been documented in the recent Annual Groundwater Reports.

In-lieu banking in Bolsa Sub-basin is described below in the New Projects/Activities section.

Major Issues: The major issues associated with in-lieu banking through the delivery of alternative water supplies is that careful monitoring of the water levels must occur. Prior to delivery of imported surface water to San Benito County, the entire groundwater basin was in overdraft. Since imported surface water deliveries began in 1997, the overdraft condition in those areas receiving imported surface water has largely been mitigated. In some cases, deliveries have resulted in oversupply and corresponding high groundwater levels.

Major Benefits: The major benefit associated with in-lieu banking is that it offers opportunities to increase the quantity of banked water, and thus increases the reliability of the overall groundwater system for use during droughts.

5.5 New Projects/Activities

5.5.1 Development/Improvement of High Quality Local Ground and Surface Water Supplies

Description: This Project Toolbox Element addresses underutilized, high-quality water resources in the groundwater basin. These consist either of previously-developed resources with facilities that have fallen into disrepair, or of resources with unexercised water rights. These water sources include:

- Redevelopment of City of Hollister's water right for additional local groundwater extraction at Cienega Valley.
- Development of groundwater resources in the Pacheco sub-basin for transfer to other sub-basins.
- Development of SBCWD's Arroyo Dos Picachos surface water right.
- Development of new surface water rights on Arroyo Los Viboras.
- Development of unused surface water on Pacheco Creek.

With the exception of the Cienega and Pacheco sub-basin groundwater supplies which are available year-round, most of the surface waters are only available in the winter and late spring. These surface water sources could be developed further using seasonal diversion dams. The water could then be percolated in-place if in-stream percolation and aquifer storage capacity are available, directed into surface water pipeline systems for conveyance to a banking area, or delivered directly to agricultural or M&I users.

Major Issues: The major issue associated with this Project Toolbox Element is the need to have sufficient storage available for use during the summer months. Banking of the surface waters in the groundwater aquifer will require careful management of the basin. Potential environmental impacts to riparian areas may be associated with seasonal diversion dams and the provision of adequate flows for possible fish passage.

Major Benefits: One of the major benefits associated with this Project Toolbox Element is that it provides a relatively low-cost, high quality water source. Also, use of local surface waters reduces importation of salts, and use of wet weather diversion may offer some measure of flood control. The Pajaro River Watershed Flood Management Authority has identified potential flood control opportunities on the San Benito River as it passes through Hollister; diversion on upstream waterways may offer similar benefits.

These specific proposed water sources are discussed in greater detail below.

5.5.1.1 Cienega Valley Groundwater Source

Description: The Cienega Valley water source, located to the south of the City of Hollister as shown on Figure 5-1, is the historic water source for the City. However, landslides in 1983 damaged the pipeline that delivered the water and water rights adjudication that occurred soon thereafter reduced the quantity of water that the City could deliver. As a result, the project to rehabilitate and replace the damaged pipeline (shown on Figure 5-1) was economically infeasible and not pursued. The City made pipeline repairs to serve a limited number of customers close to the Cienega Valley source and continues to make pipeline repairs needed to serve those existing customers. Cienega Valley water is not currently delivered to customers within Hollister's city limits because that portion of the pipeline has not been repaired.

The water quality of Cienega Valley is excellent with TDS less than 200 mg/l. Extraction of Cienega Valley waters occurs through either of two shallow wells constructed adjacent to Pescadero Creek. The City's adjudicated water right No. 14797 from 1988 in Cienega Valley is for a maximum diversion of 489.41 AF/year with a monthly maximum diversion of 40.78 AF. In the past, water had been available from the Cienega Valley on a year-round basis. The proposed capacity of the pipeline from the Cienega Valley is 1.5 MGD (1,050 gpm or 1,679 AF/yr) (Cienega Pipeline – 1983 Damage Assessments, April 1983).

Because the wells are shallow and adjacent to Pescadero Creek, the water may be considered groundwater under the direct influence of surface water according to current drinking water regulations. As a result, use of Cienega Valley water for M&I supply may require treatment under the Surface Water Treatment Rule as a opposed to the disinfection-only that occurred previously. If the water is delivered to the Hollister Conduit as envisioned, the water could be treated at one of the existing or proposed surface water treatment plants.

It is envisioned that the Cienega Valley water could be brought to and commingled with CVP water at the downstream end of the CVP System in Tres Pinos. Connection of the San Felipe and Cienega systems would require about one mile of pipeline between the proposed Cienega Valley replacement pipeline and the Hollister Conduit. It appears that there would be sufficient head in the Cienega Valley pipeline such that a booster pump station would not be required.

The City's allocation of Cienega Valley water could then be exchanged with the SBCWD's CVP water and the City could take its allocation as CVP Water further upstream. The commingled Cienega Valley/CVP water would be delivered by SBCWD to downstream users.

Major Issues: The major issues with this source of water are the relatively low quantities available, and the potential costs of delivery.

Major Benefits: The major benefits of this source of water are its high quality and high reliability. Also, the presence of additional supply sources offers operational flexibility in serving water users.

5.5.1.2 Pacheco/Northern Hollister East Sub-basins Groundwater Pumping

Description: As a result of the delivery of CVP water, the Pacheco and Northern Hollister East sub-basins have an estimated surplus of 4,000 AF/yr of water that is banked in the local groundwater sub-basin (U.S.B.R., 1972). This surplus is in direct proportion to the amount of water that is imported. SBCWD is currently managing groundwater levels in the Pacheco and Northern Hollister East Sub-basins by limiting the amount of summertime percolation releases of CVP Water.

Banked water, which is discussed later in Section 5.5.4, could be pumped to the Hollister conduit and/or the proposed regional and local conveyance pipelines, as shown on Figure 5-1, for delivery either to the southern portion of Bolsa sub-basin where there is a historic overdraft, or to San Juan or other sub-basins.

The expected water quality from the Pacheco/Northern Hollister East sub-basins is on the order of 700 – 800 mg/l TDS and 2-3 ppm boron. It is likely that blending with local or imported water sources will be required to reduce boron concentrations to levels acceptable to agricultural and other users. Pacheco/Northern Hollister East sub-basin water could also be blended with the native San Juan groundwater to reduce local groundwater TDS concentrations.

Major Issues: The major issues with this source of water are the potential costs of delivery and the need for blending to reduce boron levels.

Major Benefits: The major benefits of this source of water are its high reliability and relatively high quality. Also, the presence of an additional supply source offers operational flexibility in serving water users.

5.5.1.3 Arroyo Dos Picachos Water Supply Development

Description: The SBCWD holds an existing water right to divert up to 4.75 cfs from 1 December of one year to 1 May of the subsequent year. If the 4.75 cfs were available for the full 151 day period, a total of up to 1,422 AF/yr may be available on Arroyo Dos Picachos. The water right is structured such that diversions from Arroyo Dos Picachos can occur when there is active flow from Arroyo Dos Picachos into Arroyo Los Viboras that occurs during the wet season. In the past, the water was percolated over 2 miles of the Arroyo Dos Picachos channel bed. More recently, much less channel length has been available for percolation as a result of changes in local land uses. The SBCWD considers this water right to be underutilized. Review of water rights Decision No. 409 indicates that the Pacheco Pass Irrigation District may also have the right to divert up to 45.25 cfs from Arroyo Dos Picachos.

As described earlier in Section 3.1.2, Arroyo Dos Picachos water supply availability estimates were made based on simulated stream flows as part of the preparation of the SBCWD Annual Groundwater Reports. Using the simulated stream flows for a period from water year 1984 through water year 2001, the average availability on Arroyo Dos Picachos ranges from a minimum of 100 AF/yr to a maximum of 7,720 AF/yr with an average availability of 2,100 AF/yr. Based on a simulated stream flow, it appears that the 1,422 AF/yr water right held by the SBCWD could be available during most wet and normal years, provided that the Pacheco Pass Irrigation District does not exercise its water rights.

The water rights Decision No. 409 that apparently appropriate an additional 45.25 cfs to the Pacheco Pass Irrigation District should be reviewed carefully. It does not appear that an additional 45.25 cfs from Arroyo Dos Picachos would be available at any time.

An existing diversion structure that is sufficient for two 5'-wide slide gates is located on the Arroyo, as shown on Figure 5-1. It is envisioned that the existing diversion structure will require rehabilitation and improvement, and that some of the existing upstream channel will have to be reshaped to create a small impoundment. A small pump station would need to be constructed adjacent to the impoundment. The pump station would be used to pump water out of the impoundment and into a proposed 1.3 mile pipeline to the Hollister Conduit and/or proposed regional and local conveyance pipeline for delivery to either M&I or agricultural users or to water banking sites for percolation or ASR.

During the time that the Arroyo Dos Picachos water is available for M&I use, it would replace CVP water. If it is anticipated that the full CVP water allocation will not be used during a given water year, then the unused CVP water could be put onto the open market for a short-term sale or transfer, thus generating revenues to help fund projects.

The water quality of the Arroyo Dos Picachos is estimated to have electrical conductance of 30 (Kx 10^5 at 25C), 25 percent sodium, and boron at 0.15 ppm (Reconnaissance Report, Hollister Project, Pajaro River Basin, California, January 1954). This is approximately a TDS of 500 mg/l and/or EC of 800 umhos/cm and would be characterized as good quality water.

Major Issues: The major issues with this source of water are the potential costs of delivery facilities and the need for some construction in the channel of the arroyo and the associated environmental impacts that would require additional documentation and permitting. Maintaining adequate late spring and winter flows to allow for possible steelhead passage in Arroyo Dos Picachos is also a concern.

Major Benefits: The major benefits of this source of water are its relatively high reliability and quality. In addition, having additional supply sources offers operational flexibility in serving the water users.

5.5.1.4 Arroyo Los Viboras Water Supply Development

Description: The Pacheco Pass Water District (PPWD) has an existing diversion on the Arroyo Los Viboras downstream of where the Hollister Conduit crosses the arroyo as shown on Figure 5-1. The PPWD diverts approximately 1.5 cfs to a small percolation pond nearby.

A review of water rights decisions for Arroyo Los Viboras indicates that up to 13.685 cfs or up to 1,781.7 AF/yr of water has been allocated. The estimate of water supply availability made in Section 3.1.2 indicates that a minimum of 149 AF/yr, a maximum of 11,583 AF/yr and an average of 3,159 AF/yr may be available from Arroyo Los Viboras. Accordingly, there may be up to 1,377 AF/yr of unadjudicated seasonal water rights available during an average year. It is anticipated that additional diversions of excess flow would only occur after the Arroyo Las Viboras and downstream water ways have reached a predetermined level of flow.

In order to utilize the 1.9 cfs or 1,377 AF/yr water that is unajudicated, the diversion structure may have to be modified such that a small impoundment can be formed. A small pump station would be constructed adjacent to the impoundment. The pump station would be used to pump water out of the impoundment and into a proposed 3/4 mile pipeline to the Hollister Conduit and/or proposed regional and local conveyance pipeline for delivery to either M&I or agricultural users or to water banking sites for percolation or ASR.

As in the Arroyo Dos Picachos, during the time that the Arroyo los Viboras water is available for M&I use, it would replace CVP water. If the full CVP water allocation is anticipated not to be used during that wet year, then the unused CVP water could be put onto the open market for a short-term sale or transfer thus generating revenues to help fund projects.

The water quality of the Arroyo Los Viboras is estimated to have electrical conductance of 51 (Kx 10^5 at 25C), 24 percent sodium, and boron at 0.52 ppm (Reconnaissance Report, Hollister Project, Pajaro River Basin, California, January 1954). This is approximately a TDS of 360 mg/l and/or EC of 510 umhos/cm and would be characterized as good quality water.

Use of the unadjudicated wet season water would require coordination with PPWD and development of any institutional arrangements for the use of the existing diversion structure. A water right filing for the remaining 1.9 cfs or more will have to be filed.

Major Issues: The major issues with this source of water are the need to develop an institutional arrangement with PPWD, the potential costs of delivery facilities, and the need for some construction in the channel of the arroyo and the associated environmental documentation and permitting. As Arroyo De Las Viboras is apparently too dry to support stream fishes (Dr. Jerry Smith, May 2002), fish passage is not a major concern on this arroyo.

Major Benefits: The major benefits of this source of water are its relatively high reliability and quality. In addition, having additional supply sources offers operational flexibility in serving the water users.

5.5.1.5 Pacheco Creek Water Supply Development

Description: Pacheco Creek is estimated to have up to 7,200 AF/yr of safe yield for surface delivery based on a 61,000 AF storage reservoir after 6,800 AF/yr of percolation releases have been made (Reconnaissance Report, Hollister Project, Pajaro River Basin, California, January 1954). Although this quantity is not equivalent to the excess wet weather flows that may be available, it does provide an order of magnitude estimate of the available flows from Pacheco Creek. Water rights Decision No. 187 from 1928 indicates that the Hollister Irrigation District may have a water right for up to 11,000 AF/yr (15.19 cfs for 365 days) and the Pacheco Pass Irrigation District may have a water right to up to 16,000 AF/yr (22.10 cfs for 365 days).

The estimated water supply availability prepared as part of Section 3.1.2 indicates that Pacheco Creek may have a minimum of 800 AF/yr, a maximum of 92,887 AF/yr , and an average of 25,551 AF/yr water supply available.

There is an existing small dam on Pacheco Creek as shown on Figure 5-1. The ownership of the dam has not been determined at this time. It is envisioned that the dam could be modified, perhaps with an inflatable dam, resulting in the creation of a larger impoundment. A small pump station and approximately 1,000 feet of pipeline would be required to convey water from Pacheco Creek to the Hollister Conduit and/or the proposed regional and local conveyance pipeline for delivery to either M&I or agricultural users or to water banking sites for percolation or ASR.

As in the other surface water diversion locations, during the time that the Pacheco Creek water is available for M&I use, it would replace CVP water. If the full CVP water allocation is anticipated not to be used, then the unused CVP water could be put onto the open market for a short-term sale or transfer, thus generating revenues to help fund projects.

In the summertime, the PPWD releases water from Pacheco Dam for percolation. However, it is possible that these releases may be exacerbating high groundwater levels in San Benito County. Institutional arrangements could be made between San Benito County and PPWD to better manage those releases such that lower groundwater levels can be maintained.

The water quality of Pacheco Creek is estimated to have electrical conductance of 33.7 (K x 10^5 at 25C), 22 percent sodium, and boron at 0.09 ppm (Reconnaissance Report, Hollister Project, Pajaro River Basin, California, January 1954). This is approximately a TDS of 235 mg/l and/or EC of 337 umhos/cm and would be characterized as good quality water.

Some institutional arrangements with PPWD should be made regarding releases. The Hollister Irrigation District water right will need to be reviewed and evaluated for transferability to the SBCWD. Based on review and analysis of the and estimated records for flows on Pacheco Creek, it appears that some additional wet weather flows could be recovered.

Major Issues: The major issues with this source of water are the need to develop an operational plan for summertime releases with PPWD, the potential costs of delivery facilities and the need for some construction in the channel of the creek and the associated environmental documentation and permitting. Maintaining adequate late spring and winter flows to allow for possible steelhead passage in Pacheco Creek is also a concern.

Major Benefits: The major benefits of this source of water are its relatively high reliability and quality. In addition, having additional supply sources offers operational flexibility in serving the water users.

5.5.2 Regional and Local Conveyance Facilities for Multiple Water Supply Distribution

Description: Regional and local conveyance pipelines increase the operational flexibility of the water system by allowing movement of water either: a) to and from groundwater banking areas or b) from local surface water sources to use areas. Regional conveyance pipelines traverse longer distances and would be of larger diameter while local conveyance pipelines would be to connect facilities such as wells and surface water sources and would be of smaller diameter. For the purposes of the GMP Update, it is assumed that the backbone regional conveyance would include:

- Approximately 13.8-miles of 18-inch pipeline located approximately 10 – 15 feet away from and parallel to the existing Hollister Conduit or along existing County roads. The pipeline would extend from the Pacheco Sub-basin to the eastern edge of the San Juan

Sub-basin. This pipeline could deliver a range of source waters including imported and/or local surface water and pumped groundwater or a blend of the above to users in Hollister East, Hollister West, and San Juan sub-basins.

- Approximately 7.5 miles of 18-inch pipeline extending from the northern end of the pipeline described above to the east along Shore Road and other county roads to the junction of Highway 25. This pipeline could deliver a range of source waters including imported and/or local surface water and pumped groundwater or a blend of the above to the areas in the Bolsa sub-basin where groundwater overdraft is currently occurring.

The pipeline segments are shown on Figure 5-1 and have been further sub-divided to facilitate phased construction for the purposes of preparing estimates of probable costs of construction (Section 6). Additional conveyance pipelines may be required in the future as source, use, and storage areas are further developed. Pump stations will also most likely be required, but they have not been sized or located at this time. Pump stations would be located adjacent to the pipeline. The first segment of the Regional and Local Conveyance Facilities for Multiple Water Supply Distribution will parallel the Hollister Conduit or along existing County roads and will be able to intertie, if desired, with the extensive imported water delivery system operated by the SBCWD. An intertie would allow delivery of a range of water to many users.

Major Issues: The major issue associated with development of Regional and Local Conveyance Facilities for Multiple Water Supply Distribution is to locate the facilities so that they have minimal impact to environmental resources such as wetlands and habitat areas. Most of the environmental impacts associated with Regional and Local Conveyance Facilities for Multiple Water Supply Distribution would likely be short-term during construction of the pipeline and appurtenant facilities, and should be mitigable.

Major Benefits: Operational flexibility is the primary benefit of regional and local conveyance pipelines. Other benefits include:

- Will allow efficient use of groundwater banking of either local or imported surface water.
- Can be used to move the higher quality groundwater found in the northern portions of the groundwater basin to the southern portions where water quality is not as good.
- Can be used to move groundwater for blending with surface water to improve water quality.
- Can be used to move local surface water available during wet weather periods to areas of groundwater banking or to M&I surface water treatment plant.
- Can be used to move recycled water to agricultural use areas

5.5.3 Out-of-basin Water Banking

Description: Water banking can occur in a regional/statewide bank that would be under a contractual arrangement with a water bank operator such as the Kern Water Bank or the Semi-Tropic Water Bank. Excess CVP contract water from San Benito County, generated when other local surface waters such as described in Section 5.5.1 above are developed, could be stored in a regional/statewide bank; conversely, water owned by the regional/statewide water bank could be purchased by San Benito County agencies for delivery during dry years.

Major Issues: The major issues associated with out-of-basin water banking are the institutional arrangements that need to be made to store, extract and deliver the water when needed and the costs of water banking.

Major Benefits: The major benefits associated with out-of-basin water banking are that it offers additional operational flexibility and reliability. If excess CVP water is available but cannot be used or banked within San Benito County, then out-of-basin water banking allows San Benito County to retain the water for use in the future.

5.5.4 In-basin Water Banking

Description: As described above in the Continuation of Existing Projects/Activities section, local water banking in the groundwater basin is an important component of managing water resources in the basin and storing water to improve the reliability of the water supply.

The only difference with the activities that occurred as described above are:

- In-lieu banking would be added to the Bolsa sub-basin.
- ASR, which is not currently being practiced, is added as a project toolbox element.
- Local surface water could be added as a water source.

In-basin water banking will also require Regional and Local Conveyance Facilities for Multiple Water Supply Distribution to effectively distribute the banked water.

Natural direct percolation is an on-going natural process that has been previously discussed.

At the present time, the greatest opportunity for artificial direct percolation appears to be in the Pacheco and northern portion of the Hollister East Sub-basins where percolation of imported surface water has historically occurred. Some in-stream percolation sites along the San Benito River, in the Hollister West and San Juan sub-basins, have also been studied. Although percolation sites have been identified in the San Juan sub-basin, the sub-basin has limited hydraulic capacity for water banking because of its high water levels and is further limited by the poor quality of the groundwater that may be stored there.

Southern Bolsa sub-basin has capacity for in-lieu banking because of the presence of a large groundwater depression. Through the delivery of imported surface water, natural direct percolation would refill the groundwater depression that has historically occurred.

ASR could occur in any number of locations depending on the availability of storage capacity in the aquifer.

Major Issues: The major issue associated with water banking in general is ensuring that there is sufficient information regarding water levels, water quality, available aquifer storage capacity, etc. to be able to make informed decisions about where and when to recharge water.

Major Benefits: The major benefit of groundwater banking is the ability to store a variety of source waters with relatively few environmental impacts when compared to surface water reservoirs. Water in storage will increase the reliability of the overall water supply system during dry years.

A more detailed discussion of the various in-basin water banking options follows:

5.5.4.1 In-lieu Banking of Imported and/or Local Surface Water

Description: As described earlier, in-lieu banking has been practiced in the Bolsa Southeast sub-basin since construction of the extension of the delivery system for imported water to the sub-basin. By using the imported water, groundwater is not being pumped and the groundwater recharge that is occurring remains in storage. Therefore, by providing imported water in-lieu of pumping groundwater, water banking is occurring.

There is also potential for in-lieu banking in the southern portion of the Bolsa sub-basin where a large groundwater depression has developed. The Bolsa sub-basin is not currently a part of Zone 6 of San Benito County that receives imported surface water. However, the proposed regional and local conveyance pipeline to the southern portion of the Bolsa sub-basin would allow delivery of local surface water or pumped groundwater to the area of groundwater depression for agricultural use, thus allowing direct natural percolation to recharge the sub-basin.

Major Issues: The major issues associated with in-lieu banking through the delivery of alternative water supplies is that careful monitoring of the water levels must occur. Prior to delivery of imported surface water to San Benito County, the entire groundwater basin was in overdraft. Since imported surface water deliveries were initiated in 1997, the overdraft condition in areas receiving imported surface water has largely been eliminated; in some cases, the practice has resulted in oversupply and correspondent high groundwater levels.

Major Benefits: The major benefit associated with in-lieu banking is that it offers opportunities to increase the quantity of banked water and thus increases the reliability of the overall groundwater system for use during drought periods.

5.5.4.2 Aquifer Storage and Recovery of Imported and/or Local Surface Water

Description: Aquifer storage and recovery (ASR) facilities are specially designed wells that operate as both injection wells and extraction wells. Potential well locations must be studied through evaluation of hydrogeologic data and field testing, so that appropriate locations with aquifer conditions allowing for injection and extraction can be selected.

In general, regardless of whether an imported or a local surface water is used for ASR, either coagulation or filtration of the source water is required so that large particles can be removed prior to injection. Failure to remove large particles can result in plugging of the well screen and even the aquifer; both of which will reduce injection and extraction rates. It is expected that local surface waters may be particularly high in particulates because they will be wet weather flows that result in higher rates of soil erosion than base flows. Therefore treatment of local surface waters prior to injection will be particularly critical.

A study conducted by SBCWD indicated that levels of suspended materials in San Felipe water are high enough that filtration is necessary prior to injection. As a result, it does not appear that ASR is practical/cost-effective for general purposes. However, if excess treated San Felipe water is available, it could be injected. ASR is most practical in an area close to planned surface water treatment facilities.

For the purposes of the groundwater management plan, ASR remains an option that could be used. However, alternative methods of recharge may prove more cost-effective at this time. If ASR facilities are to be developed, they will likely be located near the proposed regional and local conveyance pipeline or the imported surface water distribution system assuming that sites with the appropriate hydrogeology can be identified.

Major Issues: As with the other methods of water banking, one of the major issues is selection of appropriate sites for ASR based on water levels and aquifer characteristics. Careful evaluation of the quality of the source and native waters will be required to minimize the potential for aquifer plugging and other negative impacts. ASR is likely to be more energy intensive than other water banking methods because of a commonly occurring need to pump water into the aquifer. In some cases, ASR sites that allow gravity percolation may be found. However, if gravity percolation cannot occur, then pumping will be required. ASR may prove to be less cost-effective than other water banking methods because of the extensive investigation required and the extensive capital facilities including pumping, well, and treatment facilities required.

Major Benefits: One of the major benefits of ASR is that it requires a smaller footprint than percolation facilities. In addition, the same facility can be used for both injection and extraction and will be located close to conveyance facilities to be able to deliver the pumped water.

5.5.5 Groundwater Treatment and Concentrate Disposal

Description: As described in the June 2002 draft report, there are a number of alternative treatment methods for demineralization and softening to remove hardness and TDS from the groundwater to improve its quality for delivery to M&I users. Centralized demineralization or softening facilities would result in reduced salt loads to the basin; up to 2,270 tons/year of salt or 6% of the overall salt input.

For the purposes of the GMP Update, it is assumed that up to 7.5 MGD (8,365 AF/yr) of groundwater will require demineralization/softening. This assumes that:

- The M&I demand can be reduced from 11,465 to 10,465 AF/yr in a critically dry year, and that
- 2,100 AF/yr of imported/local surface water is available.

Initial estimates indicate that a demineralization/softening process would require approximately 9.0 MGD (10,100 AF/yr) of 800 mg/l TDS groundwater to be able to deliver 7.5 MGD (8,365 AF/yr) of 500 mg/l TDS water. The remaining 1.5 MGD (1050 gpm, 1,680 AF/yr) would be concentrate, or brine, with 2,600 mg/l of TDS which would require disposal.

Disposal of concentrate from groundwater treatment is a major consideration in groundwater treatment and can be accomplished in several ways. This discussion focuses on evaporation methods which include:

- Fueled evaporation that can be located near the treatment facilities, takes a relatively small area, but will require significant energy resources to implement.
- Land evaporation can be a relatively cost-effective option if a large, inexpensive area of suitable land is available for creation of evaporation ponds.

For either option, it is expected that the remaining salts would be in either a solid form or a highly concentrated brine. Brine solids could easily be trucked out of the basin and disposed of at a landfill or sold to a salt processor. Highly concentrated brines could be conveyed by a tanker truck to the City of Watsonville Wastewater Treatment Plant for discharge through their outfall.

For the purposes of the GMP Update, it is assumed that two to five groundwater demineralization/softening facilities would be required to serve the M&I users efficiently. The groundwater would be extracted from existing wells and the treatment facilities would most likely be located close to existing groundwater wells.

Major Issues: There are several major issues associated with groundwater treatment. The first is that demineralization has high energy costs as compared to development of other water sources. However, the relative energy use and comparative costs of the various water supplies including the true cost of imported CVP water should be developed and evaluated further.

Another major issue associated with groundwater demineralization/softening is the need for concentrate disposal. The concentrate from groundwater treatment would be concentrated prior to disposal so that the remaining concentrate can be easily disposed of. Land evaporation of concentrate from groundwater treatment requires a large land area. It is estimated that up to 300 acres may be required for evaporating 1,250 AF/yr of concentrate alone at an estimated evapotranspiration (ETo) rate of 50"/year (California Irrigation Management Information System database). The additional 12" – 16" of rainfall that falls annually in the area would also need to be accounted for in sizing evaporation ponds.

As discussed in the June 2002 Draft Report, there are several additional options for concentrate disposal that were considered including:

- Export pipeline for concentrate and other waters for disposal such as wastewater effluent, or pumped groundwater for water level management and salt removal. (See Section 8.0 for a description of future studies needed for the export pipeline as a new project element.)

- Deep well injection of concentrate in depths in excess of 1,500 feet that also takes a relatively small area but requires additional permitting and other elements of uncertainty. This alternative for concentrate disposal is probably the least likely option to be used.

Major Benefits: The major benefit of groundwater treatment for M&I use is that it adds a high measure of reliability to the water supply. In addition, use of the local groundwater will be an important part of the effort to manage groundwater levels and quality.

The use of local, treated groundwater will serve to limit the amount of CVP water that is imported. This will assist with the management of groundwater levels and reduce the salt load imported into the basin.

Disposal of concentrate at a sanitary landfill or a salt/mineral company if in a solid form, or to the City of Watsonville ocean outfall if in a concentrated liquid form that meets Watsonville's requirements has the added benefit of removing salts from the groundwater basin.

5.5.6 Groundwater/Surface Water Blending Facilities for Agricultural/M&I Water Users

Description: Blending of high quality imported or local surface water with local groundwater to adjust the TDS of the applied water is one way to achieve overall water quality suitable for agriculture or M&I supply. This type of project is most practical for locations where both sources of groundwater and surface water supplies are readily available.

This Project Toolbox Element would require development of operational criteria on timing, quality, and quantity of deliveries to customers. In addition, the physical facilities that would be required for agricultural users would include some additional piping metering and controls to connect to groundwater wells. Automatic controls could be connected to a telemetry system for remote operation. The facilities could be located on a concrete pad approximately 20' x 20' in size. Additional piping of blended water may be desirable so that the blended and unblended water can be segregated. Facilities for M&I users would be similar but would have to be carefully located so that surface water is filtered before being combined with groundwater.

The system could be operated by using flow meter information from the higher quality water to pace the pumping of groundwater into the pipeline at a rate appropriate for the desired TDS. If the distance from where the water sources are blended to the turnouts are short, a static, in-line mixer could be installed to facilitate full blending.

Since the groundwater quality is poorest in the San Juan sub-basin, it is likely that this Project Toolbox Element will be implemented mostly in the San Juan sub-basin and most likely for agricultural users. A review of the locations of wells and distribution pipelines and use areas would be required to evaluate the most cost-effective locations for blending stations. It is anticipated that no more than 2 – 3 blending stations will be required assuming that locations where groundwater and surface water facilities can be identified that are close together. Other agricultural and M&I blending locations can be developed relatively easily as it becomes practical to do so.

Major Issues: The major issue with groundwater/surface water blending facilities for agricultural water users may be with gaining acceptance by those agricultural users that are currently receiving imported water. The major issue with groundwater/surface water blending facilities for M&I users is locating the facilities so that groundwater is not filtered unnecessarily.

Major Benefits: The major benefits associated with groundwater/surface water blending facilities for agricultural users will be to those users who are currently irrigating with higher TDS groundwater since it will improve the water quality to those users. M&I users would derive the same benefits. In addition, by using less imported surface water, the overall salt input to the groundwater basin will be reduced. By pumping groundwater, this Project Toolbox Element can also function to manage water levels.

5.5.7 Recycled M&I Wastewater Effluent for Direct Reuse

Description: Reuse of recycled effluent from wastewater plants is practiced widely within California. Title 22 recycled water criteria govern the level of treatment and largely determine the acceptable uses for recycled water. Several studies have been conducted regarding the markets for recycled water for direct reuse in San Juan Bautista and Sunnyslope. An evaluation for recycled water use is planned for Hollister. The studies also evaluated the wastewater treatment plant improvements and distribution systems necessary to deliver the recycled water to the potential users.

With regard to the potential supply of recycled water, at the present time there is approximately 3,300 AF/yr of wastewater effluent produced and indirectly reused through percolation in the entire groundwater basin (Water Year 2001 Annual Groundwater Report).

In the San Juan Bautista area, there is far more demand for recycled water than supply (San Juan Bautista Area Water Reclamation Study – Final, May 2002). In the Ridgemark area of the Sunnyslope County Water District service area, there appears to be sufficient demand for recycled water at the Ridgemark golf course to use the estimated 280,000 gpd (0.28 MGD, 314 AF/yr) of recycled water that could be produced. A recent study of recycled water for Ridgemark indicates that there is far more demand for recycled water than supply. (Sunnyslope County Water District – Recycled Water Study, Final- November 2001)

The estimated 2010 wastewater flows to the Hollister domestic wastewater treatment plant is 3.8 MGD (4,200 AF/yr) of average dry weather flow in the peak month. Although a specific recycled water demand analysis has not been prepared, the City of Hollister anticipates conducting a recycled water study in the near future.

Major Issues: The greatest limiting factor on the use of recycled water for direct reuse is the high levels of TDS in the recycled water. For example, the recycled water study for San Juan Bautista assumes a 1:1 blending ratio of imported surface water to recycled water to achieve a 700 mg/l TDS level. The availability of higher quality imported water has reduced the demand for the recycled water. As the quality of the potable water improves, so will the quality of the recycled water that will then improve the marketability of the recycled water.

Implementation of the programs and projects in this GWMP Update will improve the quality of the effluent such that direct reuse may be more practical. However, seasonal fluctuations in the demand for recycled water will require alternative wastewater disposal methods such as percolation and land application of effluent on unirrigated rangelands and other potentially available lands.

The sites that may be appropriate for land application will require consideration of short-term and long-term factors such as water balance; water level; water quality; application methods (such as spray irrigation); percolation; timing of application; proximity to wastewater treatment plants; land-ownership; and necessity for environmental documentation and monitoring.

Another major issue associated with direct reuse of recycled water is the imbalance between when the recycled water would be used, which is the late spring, summer, and early fall, and when most of the recycled water is available, which is in the winter. To be able to maximize the use of recycled water, storage of recycled water and/or land application will be required.

Major Benefits: There are several benefits associated with direct reuse of recycled water which are that it is a beneficial use of a valuable water supply and it provides a disposal mechanism for recycled water, thereby reducing the impact on groundwater levels of effluent percolation.

5.5.8 Tile Drains for Localized Groundwater Level Management

Description: This Project Toolbox Element may be required if agricultural fields contain localized high water levels. As occurs in the San Juan sub-basin, shallow, impermeable clay layers produce localized perched high groundwater in some areas. Tile drains are perforated pipes that are installed above the shallow clay layer to allow the perched groundwater to flow into the perforated pipe, which typically drains to the surface, to a ditch, and possibly to the ocean.

In the northern portions of the Bolsa and Pacheco sub-basins, there are areas where groundwater surfaces near wellheads, creek channels, and faults. This is most likely caused by artesian conditions and/or high water tables. (Groundwater Management Plan for the San Benito County Part of the Gilroy-Hollister Groundwater Basin, 1998). Localized high groundwater conditions also occur in the northern portion of the Hollister East sub-basin. (Water Year 2001 Annual Groundwater Report)

The areas where this Project Toolbox Element will most likely be implemented is in the San Juan sub-basin, where tile drains have already been installed in some areas, and in the Bolsa, Pacheco and northern Hollister East sub-basins. For the most part, tile drains solve a localized problem by moving high groundwater into a ditch or creek, which then percolates into the groundwater, and can create a problem for downstream users.

In the San Juan sub-basin, where the high groundwater levels are most problematic, the SBCWD is initiating a study to develop of a master collection pipeline, as shown on Figure 5-1, to centralize collection of the agriculture drain water. As proposed, the pipeline could terminate in a constructed wetland for polishing that could overflow into the river; as described later in Section 5.5.12.

Major Issues: The major issues associated with the use of tile drains for water level management are the expenses associated with remedying the localized high groundwater condition and the poor quality of the agricultural drainage. It is likely that the water is high in nutrients and TDS, some of which is from the high TDS of the local groundwater, and potentially high in herbicides and/or pesticides.

In addition, if river discharges were to occur, NPDES permits may be required for a point-source discharge from constructed wetlands. Without a master collection pipeline, agricultural discharges are considered non-point sources that are often regulated through best management practices.

Major Benefits: The major benefit associated with the use of tile drains for agricultural effluent collection is that it will result in lower localized groundwater levels, making some land with poor soil drainage and high groundwater levels more viable for agriculture. This can result in the net export of salt, if the agricultural effluent reaches a flowing stream or river.

5.5.9 Tree Belt Evapotranspiration for Localized Groundwater Level Management

Description: This Project Toolbox Element could be used to reduce localized high water levels in agricultural fields. Experimental research in Australia has indicated that high water-use trees such as eucalyptus can use up to 24 inches of water per year and generally lower local water levels. No work has been conducted to translate this water consumption to an AF-per-plant basis. Other high water-consuming vegetation may serve the same purpose. Within the Bay Area, eucalyptus and redwoods have been used on a small scale to take up wastewater effluent.

Similar to the use of tile drains, this Project Toolbox Element could be used in the areas of localized high groundwater described above. It is most likely to be used in conjunction with the constructed wetlands, described in 5.4.21 where trees could be planted with minimal encroachment on agricultural lands.

Major Issues: The major issues associated with this Project Toolbox Element is the highly experimental nature of this approach and the difficulty with quantifying the amount of water that could be removed and the resulting lowering of the water table. In addition, there are concerns with the use of eucalyptus trees, which are not native to the area, for this purpose. Finally, the costs of implementing a program with the accompanying lowering of the water table have not been quantified.

Major Benefits: The major benefit associated with this Project Toolbox Element is that if it can be demonstrated that vegetation is a effective means of managing water levels, the use of vegetation is arguably less intrusive than other more mechanical means of managing local high groundwater levels.

5.5.10 Groundwater Pumping for Water Level Management

Description: This Project Toolbox Element could help manage groundwater levels and salt balances in the San Juan, Pacheco, and northern portion of the Hollister East sub-basins where groundwater levels are particularly high. This Project Toolbox Element would use existing wells to the greatest extent possible. The water from the groundwater basin; depending on the location and quality of the pumped water; could be used in another portion of the sub-basin by using the proposed regional and local conveyance pipeline. Discharge to a surface water such as the San Benito River is possible, but would require obtaining a National Pollutant Discharge Elimination System (NPDES) permit from the Regional Board and compliance with the Program Mitigation Measures found in Section 7.

A groundwater basin-wide water balance that evaluated the amount of groundwater in storage with and without imported surface water indicated from between water years 1990 – 1999, there was an estimated basin-wide increase of groundwater in storage of 11,466 AF/yr. (Groundwater Management Plan: Existing Conditions and Alternatives, December 2001.)

Further analysis of the groundwater budget in the Water Year 2001 Annual Groundwater Report indicates that there was a net increase of about 2,400 AF/yr of groundwater in storage from 2000 - 2001. This net increase of water in storage has occurred even after the percolation of imported surface water by SBCWD was significantly reduced. This net increase is most likely the result of deep percolation of surface water applied for irrigation.

It should be noted that on a sub-basin basis in Water Year 2001, the Pacheco sub-basin was essentially in balance with an estimated net increase of 475 AF/yr in storage; the San Juan sub-basin was also essentially in balance with a net decrease of 11 AF/yr in storage; the Hollister East sub-basin had a net increase of 3,150 AF/yr of groundwater in storage; and the Bolsa sub-basin had a net decrease of 1,896 AF/yr. (Water Year 2001 Annual Groundwater Report). Therefore, the necessity to manage groundwater levels varies widely between sub-basins and is further localized within each sub-basin.

For the purposes of the GMP Update, it is assumed that 2,500 AF/yr of groundwater would need to be removed from the problem areas of the selected sub-basins to manage high groundwater levels. Removal of 2,500 AF/yr would require pumping of 2.25 MGD or 1,560 gallons per minute (gpm) for 365 days a year. At an average production rate of 750 gpm per well, it could take as few as two wells to pump the entire amount. However, more wells at lower pumping rates could be required to effectively remove the groundwater.

Major Issues: There are energy costs associated with pumping groundwater. Groundwater level management may be more cost-effectively achieved by managing the inputs to the groundwater system rather than removing water that has already entered the groundwater system. In addition, any discharge to the Pajaro River would have to be timed to minimize the potential for flooding and impact to important downstream habitat. At some locations, groundwater pumping potentially could impact established wetlands where groundwater is artesian.

Major Benefits: Some of the major benefits of pumping groundwater are that it can help to quickly lower high groundwater levels.

Lower groundwater levels can be beneficial where groundwater interferes with overlying land uses, such as the growth of orchards, operation of septic wastewater systems, creates nuisance conditions from artisian flows, or necessitates the installation and/or operation of subsurface drainage systems. In addition, high groundwater levels can contribute to the potential for liquefaction during seismic events.

5.5.11 Constructed Wetlands Treatment/Polishing of Agricultural Runoff and Stormwater

Description: This Project Toolbox Element includes construction of wetlands for treatment of agricultural runoff and stormwater,. Constructed wetlands have demonstrated capacity to remove sediments and solids that are found in agricultural and stormwater runoff as well as providing for nutrient removal and denitrification of agricultural runoff.

The level of treatment or polishing that can be achieved in a constructed wetlands depends on factors such as the configuration of the ponds and the detention time that is achieved, the hydraulic loading, and the plant species that populate the wetlands.

For the purposes of the GMP Update, it has been assumed that constructed wetlands would be generally developed in areas where there would be minimal negative environmental impacts and where the potential for water quality improvement is great. One proposed area for a constructed wetland is adjacent to the San Benito River as shown on Figure 5-1 where there is an excavation from a gravel mining operation that could be the terminus for an agricultural drainage pipeline. The constructed wetland would offer polishing to potential source waters by removing nutrients, in general, and nitrogen through denitrification if the appropriate species of plants are planted and sufficient detention time can be provided. Another potential area that would offer a similar benefit is in an area to the west of the City of Hollister Domestic Wastewater Treatment Plant.

Major Issues: One of the major issues associated with construction of wetlands is the need to purchase land that is both close to the water source to be treated and of sufficient area to achieve the treatment required. Depending on the level and type of treatment, considerable acreage can be required. In addition, constructed wetlands will percolate water and therefore should not be located in areas of high groundwater or permeability.

The potential concentration of contaminants, such as persistent pesticides and metals in sediment and waters of constructed wetlands and possible effects on wildlife that use the constructed wetlands is a concern of resources agencies.

Major Benefits: Some of the major benefits associated with constructed wetlands are their relatively low construction cost; their low maintenance for treatment and polishing; the seasonal habitat that they provide for migratory birds; and the resulting aesthetic and recreational benefits for the public.

5.5.11.1 Future Study of New Water Management Tools

Description: Several water management issues and possible projects that warrant study in the future have been identified during the preparation of this GMP. These topics of future study are discussed in Section 8.0. The strategies and projects described in Section 8.0 may be studied in the future, but are not currently included as management tools in the GWP Update.

One broad area for future study is the Out-of-Basin Export of wastewater effluent, groundwater treatment concentrate, agricultural drainage runoff, and/or pumped groundwater for salt management. Two different options for Out-of-Basin Export that have been identified for further study are: discharge to the San Benito River or Pajaro River; and an export pipeline to the City of Watsonville's ocean outfall.

Other areas of future study include strategies for disposal of concentrate from groundwater treatment/demineralization and options for percolation and land application of treated wastewater effluent.

Section 6: Plan Implementation

6.1 Basis for Prioritization

The Groundwater Management Plan includes 36 different types of programs and projects for implementation. Some of the programs and projects have been further divided into sub-projects located in different parts of San Benito County. Based on current conditions, some the general locations for sub-projects such as the surface water treatment plants and pipeline segments have been identified while locations for others may not be identified for several years.

In order to implement the programs, projects and sub-projects, the 36 programs/projects have been placed into four categories as follows:

1. **Ongoing:** Programs/Projects that are currently in place that will need to be maintained and may require enhancement/modification
2. **High Priority:** Programs/Projects that most benefit the current Water Resource Associations members and/or are of relatively low complexity such that the project can be implemented within 3 – 5 years (i.e. by 2007)
3. **Medium Priority:** Programs/Projects that are of a moderate benefit to the current WRA members and/or are of moderate complexity such that the project can be implemented within 6 – 10 years (i.e. by 2012)
4. **Low Priority:** Programs/Projects that may be a more general benefit to San Benito County and/or are of a high complexity such that the project can be implemented within 11 – 20 years (i.e. by 2022).

The categorization of the programs/projects is based primarily on the steps that are necessary to implement the program/project which is also a function of the size and complexity of the program/project. Typical project timelines are discussed in more detail later in Section 6.2.

Those programs/projects that are smaller, less complex, and less controversial are more likely to be implemented in a shorter time frame than those that are larger, are more complex, and require more planning prior to implementation.

6.2 Typical Project Timelines

As indicated above, programs/projects can be categorized into smaller, less complex projects and larger, more complex projects. An example of a smaller, less complex project might be a groundwater/surface water blending station or development of the Cienega groundwater or Arroyo Dos Picachos surface water source.

An example of a larger, more complex project might be the development of the Pacheco Creek local water supply or an effluent/concentrate/groundwater pumping/agricultural drainage discharge pipeline. The following Tables 6-1 and 6-2 present a comparison of the relative timeframes for implementation of the two types of projects and the steps that may be required for implementation.

Table 6-1: Small Project Implementation Schedule

Arroyo Dos Picachos Water Supply Development Example

Task	Estimated Time for Completion
Conceptual Planning/Feasibility Study	9 months – 1 year
Water Rights Acquisition	2 years
Environmental Documentation (CEQA/NEPA)/Permitting	1 year – 15 months
Pre-Design/Design	6 months
Construction	3 months
Total Elapsed Time (Some tasks may overlap)	**4 – 5 years**

Table 6-2: Large Project Implementation Schedule

Pacheco Creek Water Supply Development Example

Task	Estimated Time for Completion
Conceptual Planning	6 - 9 months
Feasibility Study	6 – 9 months
Environmental Documentation (CEQA/NEPA)	12 – 24 months
Negotiation with Other Agencies	12 – 24 months
Water Rights	3 years
Permitting	12 – 18 months
Pre-Design	6 months
Design	12 months
Construction	9 months
Total Elapsed Time (Some tasks may overlap)	**10 -12 years**

6.3 Projects and Priorities

Using the list of 36 programs and projects and the basis for prioritization above, the following tables have been developed. Table 6–3 shows the programs and projects in order presented in Section 5, while Table 6-4 shows the programs and projects in order of priority.

The priorities are based on the facts and circumstances that were available at the time of the GMP Update and are expected to be reviewed and revised during future updates to the GMP.

Table 6-3: Groundwater Management Plan Programs and Projects in Section 5 Order

Priority	Project Toolbox Elements
Institutional Programs	
A- On-going	M&I Water Conservation
A- On-going	Agricultural Water Conservation
A- On-going	Salinity Education Program
B- High Priority	Water Softener Ordinance
A- On-going	Industrial Salt Control in Municipal Wastewater Program
A- On-going	Nitrate Education Program
B- High Priority	Well Construction and Abandonment Ordinance
A- On-going	Maintain and Enhance Strategic Data Collection and Management Program
A- On-going	Continue and Expand Economic/Regulatory Water Level Management Tools
Continuation of Existing Projects Activities	
A- On-going	Existing Groundwater Extraction Facilities
A- On-going	Surface Water Importation
A- On-going	Surface Water Treatment Site A - Lessalt - 3 MGD
B- High Priority	Surface Water Treatment Site B - San Juan Bautista - 1 MGD
C- Medium Priority	Surface Water Treatment Site C - Location not determined at this time – Estimated Capacity 2 MGD
C- Medium Priority	Surface Water Treatment Site D - Location not determined at this time – Estimated Capacity 1.3 MGD
D- Low Priority	Surface Water Treatment Site E - Location not determined at this time – Estimated Capacity 1.2 MGD
A- On-going	M&I Wastewater Effluent Percolation
A- On-going	Water Transfers
A- On-going	In-Basin Water Banking - Natural Direct Percolation[1]
A- On-going	In-Basin Water Banking - Artificial Percolation of Imported and/or Local Surface Water[1] - San Benito River Wellfield
A- On-going	In-Basin Water Banking - In-lieu Banking of Imported and/or Local Surface Water[1]
New Projects/Activities	
B- High Priority	Development/Improvement of High Quality Local Ground and Surface Water Supplies – Cienega
B- High Priority	Development/Improvement of High Quality Local Ground and Surface Water Supplies - Pacheco/Northern Hollister East Sub-basins Groundwater Pumping

Table 6-3: Groundwater Management Plan Programs and Projects in Section 5 Order

Priority	Project Toolbox Elements
New Projects/Activities (cont.)	
B- High Priority	Development/Improvement of High Quality Local Ground and Surface Water Supplies - Arroyo Dos Picachos
D- Low Priority	Development/Improvement of High Quality Local Ground and Surface Water Supplies - Pacheco Creek
D- Low Priority	Development/Improvement of High Quality Local Ground and Surface Water Supplies - Arroyo Las Viboras
B- High Priority	Regional and Local Conveyance Facilities for Multiple Water Supply Distribution - Pipeline Segment A
B- High Priority	Regional and Local Conveyance Facilities for Multiple Water Supply Distribution - Pipeline Segment B
C- Medium Priority	Regional and Local Conveyance Facilities for Multiple Water Supply Distribution - Pipeline Segment C
C- Medium Priority	Regional and Local Conveyance Facilities for Multiple Water Supply Distribution - Pipeline Segment D
D- Low Priority	Regional and Local Conveyance Facilities for Multiple Water Supply Distribution - Pipeline Segment E
B- High Priority	Out-of-Basin Water Banking
C- Medium Priority	In-Basin Water Banking - Aquifer Storage and Recovery of Imported and/or Local Surface Water
B- High Priority	Groundwater Treatment and Concentrate Disposal Site A - Hollister/Sunnyslope Area
B- High Priority	Groundwater Treatment and Concentrate Disposal Site B - Hollister/Sunnyslope Area
D- Low Priority	Groundwater Treatment and Concentrate Disposal Site C - Location not determined at this time
D- Low Priority	Groundwater Treatment and Concentrate Disposal Site D - Location not determined at this time
D- Low Priority	Groundwater Treatment and Concentrate Disposal Site E - Location not determined at this time
B- High Priority	Groundwater/Surface Water Blending w/ Pipeline A and B
B- High Priority	Recycled M&I Wastewater Effluent for Direct Reuse - SJB Recycled M&I Wastewater Effluent Project
C- Medium Priority	Recycled M&I Wastewater Effluent for Direct Reuse - Sunnyslope Ridgemark
C- Medium Priority	Recycled M&I Wastewater Effluent for Direct Reuse - Hollister Domestic
C- Medium Priority	Recycled M&I Wastewater Effluent for Direct Reuse - Hollister Industrial
B- High Priority	Tile Drains for Localized Groundwater Level Management
B- High Priority	Tree Belt Evapotranspiration for Localized Groundwater Level Management
B- High Priority	Groundwater Pumping for Water Level/Water Quality Management
B- High Priority	Constructed Wetlands for Treatment/Polishing of Stormwater/Agricultural Runoff

(1) Also applies to New Projects/Activities for Local Surface Water

Table 6-4: Groundwater Management Plan Programs and Projects in Priority Order

Priority	Program Type	Project Toolbox Elements
A - On-going	Institutional	M&I Water Conservation
A - On-going	Institutional	Agricultural Water Conservation
A - On-going	Institutional	Salinity Education Program
A - On-going	Institutional	Industrial Salt Control in Municipal Wastewater Program
A - On-going	Institutional	Nitrate Education Program
A - On-going	Institutional	Maintain and Enhance Strategic Data Collection and Management Program
A - On-going	Institutional	Continue and Expand Economic/Regulatory Water Level Management Tools
A - On-going	Existing	Existing Groundwater Extraction Facilities
A - On-going	Existing	Surface Water Importation
A - On-going	Existing	Surface Water Treatment Site A – Lessalt – 3 MGD
A - On-going	Existing	M&I Wastewater Effluent Percolation
A - On-going	Existing	Water Transfers
A - On-going	Existing	In-Basin Water Banking - Natural Direct Percolation[1]
A - On-going	Existing	In-Basin Water Banking - Artificial Percolation of Imported and/or Local Surface Water[1] - San Benito River Wellfield
A - On-going	Existing	In-Basin Water Banking - In-lieu Banking of Imported and/or Local Surface Water[1]
B - High Priority	Institutional	Water Softener Ordinance
B - High Priority	Institutional	Well Construction and Abandonment Ordinance
B - High Priority	Existing	Surface Water Treatment Site B - San Juan Bautista – 1 MGD
B - High Priority	New	Development/Improvement of High Quality Local Ground and Surface Water Supplies – Cienega
B - High Priority	New	Development/Improvement of High Quality Local Ground and Surface Water Supplies - Pacheco/Northern Hollister East Sub-basins Groundwater Pumping
B - High Priority	New	Development/Improvement of High Quality Local Ground and Surface Water Supplies - Arroyo Dos Picachos
B - High Priority	New	Regional and Local Conveyance Facilities for Multiple Water Supply Distribution - Pipeline Segment A
B - High Priority	New	Regional and Local Conveyance Facilities for Multiple Water Supply Distribution - Pipeline Segment B

Table 6-4: Groundwater Management Plan Programs and Projects in Priority Order

Priority	Program Type	Project Toolbox Elements
B - High Priority	New	Out-of-Basin Water Banking
B - High Priority	New	Groundwater Treatment and Concentrate Disposal Site A - Hollister/Sunnyslope Area
B - High Priority	New	Groundwater Treatment and Concentrate Disposal Site B - Hollister/Sunnyslope Area
B - High Priority	New	Groundwater/Surface Water Blending w/ Pipeline A and B
B - High Priority	New	Recycled M&I Wastewater Effluent for Direct Reuse - SJB Recycled M&I Wastewater Effluent Project
B - High Priority	New	Tile Drains for Localized Groundwater Level Management
B - High Priority	New	Tree Belt Evapotranspiration for Localized Groundwater Level Management
B - High Priority	New	Groundwater Pumping for Water Level Management
B - High Priority	New	Constructed Wetlands for Treatment/Polishing of Stormwater/Agricultural Runoff
C - Medium Priority	Existing	Surface Water Treatment Site C - Location not determined at this time – Expected Capacity 2 MGD
C - Medium Priority	Existing	Surface Water Treatment Site D - Location not determined at this time – Expected Capacity 1.8 MGD
C - Medium Priority	New	Regional and Local Conveyance Facilities for Multiple Water Supply Distribution - Pipeline Segment C
C - Medium Priority	New	Regional and Local Conveyance Facilities for Multiple Water Supply Distribution - Pipeline Segment D
C - Medium Priority	New	In-Basin Water Banking - Aquifer Storage and Recovery of Imported and/or local Surface Water
C - Medium Priority	New	Recycled M&I Wastewater Effluent for Direct Reuse - Sunnyslope Ridgemark
C - Medium Priority	New	Recycled M&I Wastewater Effluent for Direct Reuse - Hollister Domestic
C - Medium Priority	New	Recycled M&I Wastewater Effluent for Direct Reuse - Hollister Industrial
D - Low Priority	Existing	Surface Water Treatment Site E - Location not determined at this time
D - Low Priority	New	Development/Improvement of High Quality Local Ground and Surface Water Supplies - Pacheco Creek
D- Low Priority	New	Development/Improvement of High Quality Local Ground and Surface Water Supplies - Arroyo Las Viboras
D- Low Priority	New	Regional and Local Conveyance Facilities for Multiple Water Supply Distribution - Pipeline Segment E

Table 6-4: Groundwater Management Plan Programs and Projects in Priority Order

Priority	Program Type	Project Toolbox Elements
D- Low Priority	New	Groundwater Treatment and Concentrate Disposal Site C - Location not determined at this time
D- Low Priority	New	Groundwater Treatment and Concentrate Disposal Site D - Location not determined at this time
D- Low Priority	New	Groundwater Treatment and Concentrate Disposal Site E - Location not determined at this time

(a) [1] Also applies to New Projects/Activities for Local Surface Water

6.4 Project Cost Estimation Method

Very preliminary, conceptual-level cost estimates are provided for those infrastructure programs/projects/sub-projects that have been sufficiently defined at this time. However, not all facilities required to implement this plan have been identified, sized, or costed at this time. These other facilities include: pump stations for pipelines, and new wells, including pumping facilities and local conveyance pipelines.

As defined by the American Association of Cost Engineers, conceptual level (order of magnitude) estimates typically have an accuracy of plus 50% to minus 30%. For those projects for which studies have been conducted, cost estimates have been provided.

Costs for on-going programs and projects are indicated with 'Not Applicable" while those projects where there is insufficient information, or where information is in the process of being developed, the costs are indicated with "Not Available". A summary of the costs that have been developed is provided in Section 6.5.

These conceptual level probable costs of capital, operations and maintenance provided a starting point for evaluating funding needs. More detailed costs of capital and operations and maintenance should be prepared as more project details become known.

6.4.1 Capital Cost Components

The capital costs of the sub-projects have been grouped into broad categories of project construction, engineering and management, land acquisition, and specialty costs. The cost components for capital cost are as follows:

6.4.1.1 Project Construction Costs

The project construction cost includes the capital cost of constructing the project The construction costs will be based on cost curves and typical "rules of thumb", such as unit cost per gallon capacity for tanks or treatment plants, cost per diameter-inch/lineal foot for pipelines, cost per Acre-foot of water for reservoir projects, and are assumed to include contractor overhead and profit and contingency. etc.

6.4.1.2 Engineering, Construction Management Costs

These costs include the engineering design, construction management, administrative, legal, and simple environmental documentation (negative declarations) costs. This cost component is estimated at twenty-five percent of the construction cost.

6.4.1.3 Land Acquisition / Right-of-Way Acquisition Costs

This cost includes buying land and access to specific areas. For this conceptual level work, the cost of land will be based on a cost per acre for an urban or rural area. Urban Land is assumed to cost $100,000 per acre, smaller tracts of rural land is assumed to cost $10,000 per acre while larger tracts are assumed to cost $1,500 per acre.

These land costs have been corroborated with review of commercial land costs available on the Multiple Listings Service for San Benito County.

6.4.1.4 Special Environmental Documentation and Site Consideration Costs

This cost component includes preparing more detailed Environmental Impact Reports for special project circumstances such as work in a riparian corridor. This cost also accounts for any special site or location costs. Since these costs are project and site-specific, the project team will develop the cost on a per-project basis.

6.4.2 Annual O&M Cost Components

The annual O&M costs of the projects have been grouped into broad categories of water purchase cost, power cost, chemical cost, personnel cost and specialty costs. Not all O&M cost components will be applicable to each sub-project. Where other reports estimated annual O&M costs, those O&M costs were used. The general cost components for O&M include:

6.4.2.1 Water Purchase Costs

The cost of purchasing water for agricultural use or municipal treatment will be based on current and or foreseeable future water costs.

6.4.2.2 Power Costs

The cost of power for the project will be based on the kilowatts per unit of capacity required for pumping, desalting, etc. The systems will be assumed to operate year round. The cost of power is assumed to be $0.15 per kilowatt-hr.

6.4.2.3 Facility Maintenance Costs

Costs for maintenance for the sub-projects will be calculated as a percentage of the construction capital cost. The annual O&M cost will be estimated as a percentage of the construction cost as follows: 2% for treatment facilities, 1% of well facilities, 0.05% for pipelines, storage reservoirs, etc.

6.4.2.4 Chemical Costs

This cost will include the chemicals necessary for water treatment. The cost will be based on a unit cost per capacity of the specific sub-project.

6.4.2.5 Personnel Costs

The cost will be determined as a salary of $50,000 per year (including benefits) per person times the number of people necessary for the sub-project.

6.4.2.6 Specialty Costs

These costs are unique to the specific projects, such as membrane replacement for a water treatment plant, or special monitoring costs for discharge of agricultural runoff from constructed wetlands to the San Benito River.

6.4.2.7 Present Worth of 20-year Annual O&M Cost

The present worth of the annual O&M Costs has been calculated for 20-years using a 6% interest rate. The 6% interest rate is consistent with the rate that California Department of Water Resources uses in its Proposition 13 Grant Applications.

6.4.3 Capital Costs in the Future

Since many of the projects may not be constructed for many years in the future, the impact of inflation on capital costs has been calculated by estimating the capital costs 5 years in the future in 2007, 10 years in the future in 2012, and 20 years in the future in 2022. An inflation rate of 2.5% has been used to escalate the costs.

6.5 Estimated Costs of Implementation

Using the method of estimating costs described in Section 6.4 above, estimates of the probable cost of construction on a planning basis have been developed for the projects and sub-projects. The cost tables have been divided using the prioritization developed in Section 6.3 above and are presented in summary below.

6.5.1 On-Going Programs/Projects

Programs/projects that are on-going are shown in Table 6-5 as follows.

Table 6-5: Ongoing Programs/Projects

Program Type	Project Toolbox Elements	2002 Capital Costs	20-Year O&M Costs (2002 $)	2007 Capital Costs	2012 Capital Costs	2022 Capital Costs	Notes
Institutional	M&I Water Conservation	Not Applicable	Not Applicable	Not Applicable	Not Applicable	Not Applicable	Current WRA Program
Institutional	Agricultural Water Conservation	Not Applicable	Not Applicable	Not Applicable	Not Applicable	Not Applicable	Current SBCWD Program
Institutional	Salinity Education Program	Not Applicable	Not Applicable	Not Applicable	Not Applicable	Not Applicable	Current SBCWD Program
Institutional	Industrial Salt Control in Municipal Wastewater Program	Not Applicable	Not Applicable	Not Applicable	Not Applicable	Not Applicable	Current SBCWD Program
Institutional	Nitrate Education Program	Not Applicable	Not Applicable	Not Applicable	Not Applicable	Not Applicable	Current SBCWD Program
Institutional	Maintain and Enhance Strategic Data Collection and Management Program	Not Applicable	Not Applicable	Not Applicable	Not Applicable	Not Applicable	Current SBCWD Program
Institutional	Continue and Expand Economic/Regulatory Water Level Management Tools	Not Applicable	Not Applicable	Not Applicable	Not Applicable	Not Applicable	Current SBCWD Program
Existing	Existing Groundwater Extraction Facilities	Not Applicable	Not Applicable	Not Applicable	Not Applicable	Not Applicable	
Existing	Surface Water Importation	Not Applicable	Not Applicable	Not Applicable	Not Applicable	Not Applicable	
Existing	Surface Water Treatment Site A - Lessalt - 3 MGD	$4,300,000	$10,552,400	Not Applicable	Not Applicable	Not Applicable	Capital Cost Based on 95% Cost Estimate, In Operation November 2002, O&M Costs Estimated

Table 6-5: Ongoing Programs/Projects

Program Type	Project Toolbox Elements	2002 Capital Costs	20-Year O&M Costs (2002 $)	2007 Capital Costs	2012 Capital Costs	2022 Capital Costs	Notes
Existing	M&I Effluent Percolation	Not Applicable	Not Applicable	Not Applicable	Not Applicable	Not Applicable	
Existing	Water Transfers	Not Applicable	Not Applicable	Not Applicable	Not Applicable	Not Applicable	
Existing	In-Basin Water Banking - Natural Direct Percolation	Not Applicable	Not Applicable	Not Applicable	Not Applicable	Not Applicable	
Existing	In-Basin Water Banking - In-lieu Banking of Imported and/or Local Surface SWater	Not Applicable	Not Applicable	Not Applicable	Not Applicable	Not Applicable	Additional In-lieu Banking Will Require Additional Pipeline Facilities.

6.5.2 High Priority Programs/ Projects: 3 – 5 Years to Implementation

Estimated probable costs for construction and operations and maintenance for High Priority programs/projects that are expected to be implemented within a 3-5 year timeframe are shown in Table 6-6 as follows.

Table 6-6: High Priority Programs/Projects: 3-5 Years to Implementation

Program Type	Project Toolbox Elements	2002 Capital Costs	20-Year O&M Costs (2002$)	2007 Capital Costs	2012 Capital Costs	2022 Capital Costs	Notes
Existing	In-Basin Water Banking - Artificial Percolation of Imported and/or Local Surface Water1 - San Benito River Wellfield	Not Available	Not Available	Not Available	Not Available	Not Available	Under Study by SBCWD in 2002 - 2003
Institutional	Water Softener Ordinance	Not Available	Not Applicable	Not Available	Not Available	Not Available	Will Require WRA and County Approval
Institutional	Well Construction and Abandonment Ordinance	Not Available	Not Applicable	Not Available	Not Available	Not Available	Under Development by SBCWD
Existing	Surface Water Treatment Site B - San Juan Bautista - 1 MGD	$1,600,000	$4,014,500	$1,800,000	$2,000,000	$2,600,000	
New	Development/Improvement of High Quality Local Ground and Surface Water Supplies - Cienega	$2,900,000	$344,100	$3,300,000	$3,700,000	$4,800,000	From 1983 Walters Engineering Report
New	Development/Improvement of High Quality Local Ground and Surface Water Supplies - Pacheco/Northern Hollister East Sub-basins Groundwater Pumping	Not Available	Not Available	Not Available	Not Available	Not Available	Under Study by SBCWD in 2002 - 2003
New	Development/Improvement of High Quality Local Ground and Surface Water Supplies - Arroyo Dos Picachos	$4,500,000	$802,900	$5,100,000	$5,800,000	$7,400,000	Assumed to be 40-foot Long Inflatable Diversion Dam, Includes Pump Station
New	Regional and Local Conveyance Facilities for Multiple Water Supply Distribution - Pipeline Segment A	$4,800,000	$114,700	$5,400,000	$6,100,000	$7,900,000	Estimated Length -3.7 Miles Conveyance and 1.6 Miles Collection Pipeline

Table 6-6: High Priority Programs/Projects: 3-5 Years to Implementation

Program Type	Project Toolbox Elements	2002 Capital Costs	20-Year O&M Costs (2002$)	2007 Capital Costs	2012 Capital Costs	2022 Capital Costs	Notes
New	Regional and Local Conveyance Facilities for Multiple Water Supply Distribution - Pipeline Segment B	$2,100,000	$114,700	$2,400,000	$2,700,000	$3,400,000	Estimated Length -2.2 Miles Conveyance and 0.24 Miles Collection Pipeline
New	Out-of-Basin Water Banking	Not Available	Not Available	Not Available	Not Available	Not Available	
New	Groundwater Treatment and Concentrate Disposal Site A - Hollister/Sunnyslope Area	$5,800,000	$5,505,600	$6,600,000	$7,400,000	$9,500,000	Estimated Capacity 2.5 MGD. Costs Estimated Assuming Concentrate Disposal through an Export Pipeline. Costs for Alternate Concentrate Disposal will be Equal to or Greater than the Costs Estimated.
New	Groundwater Treatment and Concentrate Disposal Site B - Hollister/Sunnyslope Area	$5,800,000	$5,505,600	$6,600,000	$7,400,000	$9,500,000	Estimated Capacity 2.5 MGD. Costs estimated assuming concentrate disposal through an export pipeline. Costs for alternate concentrate disposal will be equal to or greater than the costs estimated.
New	Groundwater/Surface Water Blending w/ Pipeline A and B	$180,000	$206,460	$204,000	$230,000	$295,000	Assumed 6 Stations Constructed
New	Recycled M&I Effluent for Direct Reuse - SJB Recycled M&I Effluent Project	$6,200,000	Not Provided	$7,000,000	$7,900,000	$10,200,000	Most Expensive Alternative 2 Selected for Inclusion from SJB Recycled Water Study
New	Tile Drains for Localized Groundwater Level Management	Not Available	Not Available	Not Available	Not Available	Not Available	Under Study by SBCWD in 2002 - 2003
New	Tree Belt Evapotranspiration for Localized Groundwater Level Management	Not Available	Not Available	Not Available	Not Available	Not Available	

Table 6-6: High Priority Programs/Projects: 3-5 Years to Implementation

Program Type	Project Toolbox Elements	2002 Capital Costs	20-Year O&M Costs (2002$)	2007 Capital Costs	2012 Capital Costs	2022 Capital Costs	Notes
New	Groundwater Pumping for Water Level Management	Not Applicable	Not Available	Not Applicable	Not Applicable	Not Applicable	Implementation Expected Through Existing Facilities
New	Constructed Wetlands for Treatment/Polishing of Stormwater/Agricultural Runoff	$1,900,000	$802,900	$2,100,000	$2,400,000	$3,100,000	For 11 Acre Wetlands for Municipal Polishing
Subtotal	High Priority Projects with Estimates	$15,799,000	$6,079,100	$17,700,000	$20,000,000	$25,800,000	

6.5.3 Medium Priority Programs/Projects: 6 – 10 Years to Implementation

Estimated probable costs for construction and operations and maintenance for Medium Priority programs/projects that are expected to be implemented within a 6-10 year timeframe are shown in Table 6-7 as follows.

Table 6-7: Medium Priority Programs/Projects: 6-10 Years to Implementation

Program Type	Project Toolbox Elements	2002 Capital Costs	20-Year O&M Costs (2002$)	2007 Capital Costs	2012 Capital Costs	2022 Capital Costs	Notes
Existing	Surface Water Treatment Site C - Location not determined at this time	$3,100,000	$6,996,700	$3,500,000	$4,000,000	$5,100,000	Estimated Capacity 2 MGD
Existing	Surface Water Treatment Site D - Location not determined at this time	$4,500,000	$10,093,600	$5,100,000	$5,800,000	$7,400,000	Estimated Capacity 3 MGD
New	Regional and Local Conveyance Facilities for Multiple Water Supply Distribution - Pipeline Segment C	$4,100,000	$114,700	$4,600,000	$5,200,000	$6,700,000	Estimated Length -5.5 Miles
New	Regional and Local Conveyance Facilities for Multiple Water Supply Distribution - Pipeline Segment D	$3,100,000	$114,700	$3,500,000	$4,000,000	$5,100,000	Estimated Length -3.5 Miles
New	In-Basin Water Banking - Aquifer Storage and Recovery of Imported and/or Local Surface Water	Not Available	Not Available	Not Available	Not Available	Not Available	
New	Recycled M&I Effluent for Direct Reuse - Sunnyslope Ridgemark	$4,600,000	$2,294,000	$5,200,000	$5,900,000	$7,500,000	Based on Most Expensive Alternative from SCWD Recycled Water Study - Golf Course w/ Storage
New	Recycled M&I Effluent for Direct Reuse - Hollister Domestic	$21,700,000	$14,222,800	$24,600,000	$27,800,000	$35,600,000	Based on Most Expensive Alternative from HSE May 2002 Report

Table 6-7: Medium Priority Programs/Projects: 6-10 Years to Implementation

Program Type	Project Toolbox Elements	2002 Capital Costs	20-Year O&M Costs (2002$)	2007 Capital Costs	2012 Capital Costs	2022 Capital Costs	Notes
New	Recycled M&I Effluent for Direct Reuse - Hollister Industrial	Not Available	Not Available	Not Available	Not Available	Not Available	
Subtotal - Medium Priority Projects with Estimates		$41,100,000	$33,836,500	$46,500,000	$52,700,000	$67,400,000	
							Capital Cost Based on 95% Cost Estimate, In Operation November 2002

6.5.4 Low Priority Programs/Projects -11 – 20 Years to Implementation

Estimated probable costs for construction and operations and maintenance for Low Priority programs/projects that are expected to be implemented within a 11-20 year timeframe are shown in Table 6-8 as follows.

Table 6-8: Low Priority Programs/Projects: 11 to 20 Years to Implementation

Program Type	Project Toolbox Elements	2002 Capital Costs	20-Year O&M Costs (2002 $)	2007 Capital Costs	2012 Capital Costs	2022 Capital Costs	Notes
Existing	Surface Water Treatment Site E - Location not determined at this time	$1,900,000	$4,588,000	$2,100,000	$2,400,000	$3,100,000	Estimated Capacity 1.2 MGD
New	Development/Improvement of High Quality Local Ground and Surface Water Supplies - Pacheco Creek	$5,000,000	$802,900	$5,700,000	$6,400,000	$8,200,000	Assumed to be 75-foot Long Inflatable Diversion Dam, Includes Pump Station
New	Development/Improvement of High Quality Local Ground and Surface Water Supplies - Arroyo Las Viboras	$4,500,000	$802,900	$5,100,000	$5,800,000	$7,400,000	Assumed to be 40-foot Long Inflatable Diversion Dam, Includes Pump Station
New	Regional and Local Conveyance Facilities for Multiple Water Supply Distribution - Pipeline Segment E	$5,100,000	$114,700	$5,800,000	$6,500,000	$8,400,000	Estimated Length -6.1 Miles, Necessary for In-lieu Banking in Bolsa
New	Groundwater Treatment and Concentrate Disposal Site C - Location not determined at this time	$5,800,000	$5,505,600	$6,600,000	$7,400,000	$9,500,000	Estimated Capacity 2.5 MGD, Concentrate Disposal through Export Pipeline

Table 6-8: Low Priority Programs/Projects: 11 to 20 Years to Implementation

Program Type	Project Toolbox Elements	2002 Capital Costs	20-Year O&M Costs (2002 $)	2007 Capital Costs	2012 Capital Costs	2022 Capital Costs	Notes
New	Groundwater Treatment and Concentrate Disposal Site D - Location not determined at this time	Not Available	Not Available	Not Available	Not Available	Not Available	Location May Not Be Required
New	Groundwater Treatment and Concentrate Disposal Site E - Location not determined at this time	Not Available	Not Available	Not Available	Not Available	Not Available	Location May Not Be Required
Subtotal	Low Priority Projects with Estimates	$22,300,000	$11,814,100	$25,300,000	$28,500,000	$36,600,000	*Capital Cost Based on 95% Cost Estimate, In Operation November 2002

6.5.5 Cost Summary

Table 6-9 below is a summary of all of the projects with estimates. The Lessalt Surface Water Treatment Plant is not included in this summary because the project has been completed.

Table 6-9: Summary of Costs for Programs/Projects With Estimates

	2002 Capital Costs	20-Year O&M Costs (2002 $)	2007 Capital Costs	2012 Capital Costs	2022 Capital Costs
Subtotal - High Priority Projects with Estimates	$60,580,000	$19,246,660	$68,604,000	$77,330,000	$99,395,000
Subtotal - Medium Priority Projects with Estimates	$41,100,000	$33,836,500	$46,500,000	$52,700,000	$67,400,000
Subtotal - Low Priority Projects with Estimates	$22,300,000	$11,814,100	$25,300,000	$28,500,000	$36,600,000
Total - All Projects with Estimates	**$123,980,000**	**$64,897,260**	**$140,404,000**	**$158,530,000**	**$203,395,000**

Section 7: Program-Level Mitigation Measures for the GMP Update

Future projects implemented under the GWMP Update will incorporate the following program mitigation measures, as appropriate, to avoid or reduce potentially significant environmental impacts.

7.1 Air Quality

7.1.1 Dust Control Program

Prior to construction of evaporation ponds for groundwater treatment concentrate, an effective dust control program will be developed.

7.2 Biological Resources

7.2.1 Construction Impacts to Wetland Habitats

7.2.1.1 Avoidance and Minimization.

New projects will be designed, constructed, and operated in such a way as to avoid and/or minimize impacts to wetland habitats. If total avoidance is not possible, then wetland replacement will be completed.

7.2.1.2 Wetland Replacement.

The wetland habitat that will be lost under any new projects would be functionally replaced in conformance with mitigation requirements of the responsible regulatory agencies. In-kind (the same wetland type) and on-site replacement of lost wetland habitats will be done where possible.

The determination of wetland impacts and the subsequent location and design of potential mitigation sites would be determined by qualified biologists in coordination with resource agency personnel. Mitigation and habitat restoration plans would provide for the following:

a. Calculation and replacement of lost acreage and functions of wetland habitat

b. Location of restoration opportunities, complete with an analysis of the technical approach to create high quality wetlands.

c. Detailed plans will be prepared for wetland mitigation construction that includes excavation elevations, location of hydrologic connections, planting plans and soil amendments, if necessary. Maintenance and monitoring plans are to be prepared in consultation with a qualified habitat restoration specialist. Any mitigation wetlands will be monitored for a period of five years, during which the site will achieve the target jurisdictional acreage by Year 5. Specific performance criteria will be determined and monitored for site success. Monitoring reports will be provided annually to the appropriate resource agencies.

d. *Permits.* Prior to construction of any project element that may impact wetland habitats, the project proponent will apply for a Section 404 permit and Water Quality Certification from the U.S. Army Corps of Engineers and the Regional Water Quality Control Board. The project proponent will comply with the conditions of required permits.

7.2.2 Construction Impacts to Riparian Habitats

7.2.2.1 Avoidance and Minimization.

New projects will be designed, constructed, and operated in such a way as to avoid and/or minimize impacts to riparian habitats. If avoidance is not possible, then riparian habitat replacement will be required.

7.2.2.2 Riparian Habitat Replacement.

Permanent impacts to vegetation within riparian habitats are typically mitigated at ratios based on the quality of the habitat to be impacted. Due to the complex mosaic of habitats often found within riparian corridors, impacts are typically assessed based on three habitat quality categories, described below. This methodology ensures that, regardless of the type of habitat impacted, its relative value and time required to reestablish replacement habitat is taken into account in quantifying impacts and necessary mitigation. As a result, the impact quantities are not calculated by habitat type, but rather by habitat quality category.

The three habitat quality categories are:

High quality – Native overstory with continuous understory or occurring in dense thickets; dense native overstory with sparse, non-native or no understory; and native willow thicket.

Medium quality – Sparse native overstory with sparse, non-native or no understory, non-native overstory with native understory, and dense non-native overstory with sparse, non-native or no understory.

Lower quality – Sparse non-native overstory with sparse, non-native or no understory. In addition, any areas not included in medium or high quality categories that will be covered with riprap, gabions, etc. (e.g., ruderal habitat and bare ground).

Mitigation ratios of 3:1, 2:1, and 1:1 (replacement acres:lost acres) will generally be applied for impacts to high, medium and low-quality habitats, respectively.

The assessment of riparian impacts and the subsequent location and design of potential mitigation sites will be determined by qualified biologists in coordination with resource agency personnel. These plans will include the following:

a. A description of how the restoration will replace the lost acreage, functions, and values of riparian habitat.

b. Site specific restoration design with a complete analysis of the technical approach to create high quality riparian habitat. The design will include an implementation plan that details site grading, soil amendments, irrigation, planting list, floodplain connectivity, geomorphic conditions and anticipated wildlife use. Revegetation should use native species with seeds or cuttings collected on-site or locally. The restoration plan will also include an explanation of all required site maintenance. A monitoring plan will be developed that includes success criteria for all riparian plantings.

7.2.2.3 Consolidation of Riparian Mitigation.

If multiple smaller impact areas occur, it would be beneficial to consolidate mitigation into a larger habitat restoration area. Larger riparian restoration areas would provide greater functions and values than numerous small mitigation sites. The location and design of potential mitigation sites will be determined by qualified restoration biologists in coordination with resource agency personnel.

7.2.2.4 Encroachment Into Riparian Buffer Zones.

If a new project element would be located within 100 feet of the edge of a riparian corridor, and has encroachment impacts, mitigation in the form of habitat replacement or a functional equivalent will be completed. Mitigation ratios will be determined by a qualified biologist and will be based upon the type of development proposed and the quality and extent of indirect impacts to the riparian habitat.

7.2.2.5 Permits

Prior to construction within the bed and banks of creeks, rivers, or lakes, the project proponent will apply for and obtain a Streambed Alteration Agreement from the California Department of Fish and Game.

7.2.3 Construction Impacts to Aquatic Habitat and Species

7.2.3.1 Implementation of Best Management Practices For Work in Stream Channels.

Implementation of Best Management Practices described below will reduce potential impacts to aquatic species to a less-than-significant level. The following recommendations by the California Department of Fish and Game must be followed, regardless of whether any watercourse within project element footprints are dewatered or not, in order to comply with proper mitigation measures:

a. No equipment will be operated in the live stream channel.

b. When work in a flowing stream is unavoidable, any stream flow shall be diverted around the work area by a barrier, temporary culvert or a new channel capable of permitting upstream and downstream fish movement.

c. Construction of the barrier or the new channel shall normally begin in the downstream area and continue in an upstream direction and the flow shall be diverted only when construction of the diversion is completed.

d. No debris, soil, silt, sand, bark, slash, sawdust, cement, concrete, washings, petroleum products or other organic or earthen material shall be allowed to enter into or be placed where it may be washed by rainfall or runoff into waters of the State.

7.2.4 Potential Construction Impacts to Hairless Popcorn-flower

7.2.4.1 Determine Presence/Absence.

Before implementing any new project elements that could impact vernal marsh habitats within the Bolsa, Pacheco and Hollister East Subbasins, blooming season surveys for the hairless popcorn-flower will be completed. Between March and May prior to construction, areas to be impacted within the Bolsa, Pacheco and Hollister East Subbasin will be surveyed for hairless popcorn flower. If the surveys are negative, no further mitigation is warranted. If hairless popcorn flower populations are found in the construction area, avoidance will be necessary.

7.2.4.2 Avoidance.

Project element(s) will be redesigned to avoid impacts to hairless popcorn flower populations. The changes in design will be approved by a qualified biologist to insure that no impacts to the population will occur. If avoidance is not possible, additional environmental review and development of site specific mitigation measures will be required.

7.2.5 Operational Impacts to Steelhead and Monterey Roach from Development or Redevelopment of High Quality Local Surface Water Supplies

7.2.5.1 Avoidance and Minimization

Prior to approval of a surface water diversion project by the Lead Agency, minimum flow requirements in Pacheco Creek, Arroyo De Las Viboras, and Arroyo Dos Picachos during critical winter and late spring periods will be established. Diversions will be designed so that they will not cause interference with steelhead migration or Monterey roach survival in Pacheco Creek or Arroyo Dos Picachos. The ability of the creek channels to convey modified flows with minimal scour or deposition will also be assessed.

Minimum flow requirements will be reviewed by appropriate state and federal water and resources agencies, including the State Water Resources Control Board, the California Department of Fish and Game, and National Marine Fisheries Service.

7.2.6 Construction Impacts to Steelhead

Steelhead could occur in the San Benito River, Pacheco Creek, and any other unobstructed tributary of the Pajaro River. Construction activities that will occur in stream habitat (e.g. those involving diversion structures) could directly impact steelhead. If channel diversions occur, steelhead could become stranded, and activities in channels could result in direct take of individuals. In addition, construction activities could result in degradation of water quality (e.g. through leaching cement altering stream pH or increasing sedimentation).

7.2.6.1 Construction Scheduling and Work in Channels Where Water is Present.

Construction in tributaries of the Pajaro River will be limited to the dry season (June 1 to October 31), when steelhead are least likely to be present. Most of the San Benito River and other tributaries are typically dry during this time period. If construction will occur in a live, flowing, stream channel, National Marine Fisheries Service (NMFS) will be consulted regarding measures necessary to prevent take. Because it is possible that juveniles could be moving downstream during any time of year, including the dry season, these measures should ensure that movement of steelhead is not prevented by any water diversion structures used during construction, regardless of when construction occurs. Ideally, the live stream channel will be maintained and protected (e.g. by a structure covering the channel, and coffer dams around construction areas). If the live channel cannot be maintained, water would be diverted through construction sites by way of an open ditch (rather than a pipe) connecting the portions of the channel immediately upstream and downstream from the site. This plastic-lined ditch should also be lined with cobble-sized stones to deter predation by making the steelhead less conspicuous as they pass through the channel. Water within this ditch should be at least 30 centimeters (12 inches) deep, and no impediments to movement, such as high drop structures, will be present.

7.2.6.2 Implement Hazardous Materials Spill Prevention and Best Management Practices.

A hazardous material spill prevention plan will be developed and implemented for any work in or adjacent to the Pajaro River or its tributaries. Hazardous materials will be stored in secured structures with secondary spill containment features. Refueling of construction equipment and vehicles will not occur within 300 feet of any water body or anywhere that spilled fuel could drain to a water body. The contractors will check and maintain equipment and vehicles daily to prevent leaks of fuels, lubricants, or other fluids. The implementation of Best Management Practices (see *Implementation of Best Management Practices for Work in Stream Channels*, above) will also be required.

7.2.6.3 Reduce Barriers to Movement.

The placement of diversion structures or other hardscape within and immediately adjacent to the low flow channel of any tributary could cause an impediment to migration for steelhead. Potential in-stream structures will be designed in such a way as to not encroach upon the low flow channel and be designed to avoid hardscape that could result in significant eddies within the low flow channel.

7.2.6.4 Consultation with National Marine Fisheries Service

Consultation with National Marine Fisheries Service will be completed for any new project activities that could affect steelhead such as dewatering creeks or rivers, or any in-stream construction.

7.2.7 Construction Impacts to Red-legged Frogs and Other Aquatic Species

7.2.7.1 Avoidance.

To the greatest extent feasible, construction of project elements will be planned to avoid habitat for aquatic species such as the red-legged frog. If construction will occur adjacent to habitat for aquatic species, impacts will be avoided through the following measures.

a. Prior to any construction activities, the boundaries of construction areas will be clearly delineated with orange plastic construction fencing to prevent workers or equipment from inadvertently straying from the construction area. All construction personnel, equipment, and vehicle movement shall be confined to designated construction areas and connecting roadways. Movement of construction and personal vehicles shall be prohibited outside designated construction areas or off established roadways.

b. Prior to the onset of any ground disturbing activities, exclusion fencing will be established around areas of potentially occupied habitat, as determined by a qualified biologist. Exclusion fencing will consist of silt-fencing or similar material at least 36 inches in height that is buried six inches in the ground to prevent incursion under the fence. Exclusion fencing may be installed at the base of the construction fencing described in A above. This fence will be surveyed each morning before construction, to verify that no frogs have entered the construction site.

c. Before any construction activities begin, a U.S. Fish and Wildlife Service approved biologist will conduct a training session with construction personnel to describe the California red-legged frog and its habitat, the specific measures being implemented to minimize effects to the species, and the boundaries of the construction area.

d. All food-related trash items will be enclosed in sealed containers and removed daily from a project site to discourage the concentration of potential predators in habitat potentially occupied by California red-legged frogs.

7.2.7.2 Implement Hazardous Materials Spill Prevention and Best Management Practices.

See *Implement Hazardous Material Spill Prevention and Implementation of Best Management Practices For Work in Stream Channels*, above)

7.2.7.3 Consultation with the USFWS

Take of California red-legged frogs is only permitted through consultation with the USFWS. Some project elements may involve a federal nexus and, therefore, Section 7 consultation will be required. Other project elements will lack a federal nexus, however, and take will only be authorized upon approval of a suitable Habitat Conservation Plan (HCP). The HCP will provide specific mitigation measures appropriate to the scale of take. Depending on the construction activities, these mitigation measures could range from presence of an on-site monitor to extensive habitat restoration. An HCP would be completed though consultation with the USFWS.

7.2.8 Construction Impacts to San Joaquin Kit Fox

7.2.8.1 Take Avoidance

Standard take-avoidance measures listed on the following pages will be implemented to avoid direct take of any individual kit fox that may wander onto the project site. To avoid direct take of any individual kit fox that may be present on a project site, preactivity surveys will be conducted if any habitat feature with the potential to be used by kit foxes (i.e. burrows, irrigation pipes, debris piles) is created or placed on site and is to be subsequently disturbed or moved. If kit foxes are detected, work in that area must cease and consultation with the USFWS is necessary to determine the appropriate course of action.

STANDARD RECOMMENDATIONS PUT FORTH BY UNITED STATES FISH AND WILDLIFE SERVICE FOR THE PROTECTION OF SAN JOAQUIN KIT FOX PRIOR TO OR DURING GROUND DISTURBANCE. 28 JUNE 1999.
Construction and Operational Requirements Habitat subject to permanent and temporary construction disturbances and other types of project-related disturbances should be minimized. Project designs should limit or cluster permanent project features to the smallest area possible while still permitting project goals to be achieved. To minimize temporary disturbances, all project-related vehicle traffic should be restricted to established roads, construction areas, and other designated areas. These areas should also be included in preconstruction surveys and, to the extent possible, should be established in locations disturbed by previous activities to prevent further impacts. 1. Project-related vehicles should observe a 20-mph speed limit in all project areas, except on county roads and State and Federal highways; this is particularly important at night when kit foxes are most active. To the extent possible, night-time construction should be minimized. Off-road traffic outside of designated project areas should be prohibited.

STANDARD RECOMMENDATIONS PUT FORTH BY UNITED STATES FISH AND WILDLIFE SERVICE FOR THE PROTECTION OF SAN JOAQUIN KIT FOX PRIOR TO OR DURING GROUND DISTURBANCE. 28 JUNE 1999.

2. To prevent inadvertent entrapment of kit foxes or other animals during the construction phase of a project, all excavated, steep-walled holes or trenches more than 2 feet deep should be covered at the close of each working day by plywood or similar materials, or provided with one or more escape ramps constructed of earth fill or wooden planks. Before such holes or trenches are filled, they should be thoroughly inspected for trapped animals. If at any time a trapped or injured kit fox is discovered, the procedures under number 13 of this section must be followed.

3. Kit foxes are attracted to den-like structures such as pipes and may enter stored pipe becoming trapped or injured. All construction pipes, culverts, or similar structures with a diameter of 4-inches or greater that are stored at a construction site for one or more overnight periods should be thoroughly inspected for kit foxes before the pipe is subsequently buried, capped, or otherwise used or moved in any way. If a kit fox is discovered inside a pipe, that section of pipe should not be moved until the Service has been consulted. If necessary, and under the direct supervision of the biologist, the pipe may be moved once to remove it from the path of construction activity, until the fox has escaped.

4. All food-related trash items such as wrappers, cans, bottles, and food scraps should be disposed of in closed containers and removed at least once a week from a construction or project site.

5. No firearms shall be allowed on the project site.

6. To prevent harassment, morality of kit foxes or destruction of dens by dogs or cats, no pets should be permitted on project sites.

7. Use of rodenticides and herbicides in project areas should be restricted. This is necessary to prevent primary or secondary poisoning of kit foxes and the depletion of prey populations on which they depend. All uses of such compounds should observe label and other restrictions mandated by the U.S. Environmental Protection Agency, California Department of Food and Agriculture, and other State and Federal legislation, as well as additional project-related restrictions deemed necessary by the Service. If rodent control must be conducted, zinc phosphate should be used because of proven lower risk to kit fox.

8. A representative shall be appointed by the project proponent who will be the contact source for any employee or contractor who might inadvertently kill or injure a kit fox or who finds a dead, injured or entrapped individual. The representative will be identified during the employee education program. The representative's name and telephone number shall be provided to the Service.

STANDARD RECOMMENDATIONS PUT FORTH BY UNITED STATES FISH AND WILDLIFE SERVICE FOR THE PROTECTION OF SAN JOAQUIN KIT FOX PRIOR TO OR DURING GROUND DISTURBANCE. 28 JUNE 1999.

9. An employee education program should be conducted for any project that has expected impacts to kit fox or other endangered species. The program should consist of a brief presentation by persons knowledgeable in kit fox biology and legislative protection to explain endangered species concerns to contractors, their employees, and military and agency personnel involved in the project. The program should include the following: a description of the San Joaquin kit fox and its habitat needs; a report of the occurrence of kit fox in the project area; and explanation of the status of the species and its protection under the Endangered Species Act; and a list of measures being taken to reduce impacts to the species during project construction and implementation. A fact sheet conveying this information should be prepared for distribution to the above-mentioned people and anyone else who may enter the project site.

10. Upon completion of the project, all areas subject to temporary ground disturbances, including storage and staging areas, temporary roads, pipeline corridors, etc. should be re-contoured if necessary, and revegetated to promote restoration of the area to pre-project conditions. An area subject of "temporary" disturbance means any area that is disturbed during the project, but that after project completion will not be subject to further disturbance and has the potential to be revegetated. Appropriate methods and plant species used to revegetate such areas should be determined on a site-specific basis in consultation with the Service, California Department of Fish and Game (CDFG), and revegetation experts.

11. In the case of trapped animals, escape ramps or structures should be installed immediately to allow the animal(s) to escape, or the Service should be contacted for advice.

12. Any contractor, employee, or military or agency personnel who inadvertently kills or injures a San Joaquin kit fox shall immediately report the incident to their representative. This representative shall contact the CDFG immediately in case of a dead, injured or entrapped kit fox. The CDFG contact for immediate assistance is State Dispatch at (916) 445-0045. They will contact the local warden or biologist.

    The Sacramento Fish and Wildlife Office and CDFG will be notified in writing within three working days of the accidental death or injury to a San Joaquin kit fox during project related activities. Notification must include the date, time, and location of the incident or of the finding of a dead or injured animal and any other pertinent information. The Service contact is the Chief of the Division of Endangered Species, at the addresses and telephone numbers given below. The CDFG contact is Mr. Ron Schlorff as 1416-9th Street, Sacramento,

STANDARD RECOMMENDATIONS PUT FORTH BY UNITED STATES FISH AND WILDLIFE SERVICE FOR THE PROTECTION OF SAN JOAQUIN KIT FOX PRIOR TO OR DURING GROUND DISTURBANCE. 28 JUNE 1999.
California, (916) 654-4262.

7.2.9 Potential Construction Impacts to Vernal Pool Fairy Shrimp

Vernal pool fairy shrimp are reported to occur in San Benito County. Any construction that would directly impact vernal marsh habitat (including construction during the dry season) could negatively impact this species.

7.2.9.1 Avoid Habitat.

New projects should be designed, constructed, and operated in such a way as to avoid and/or minimize impacts to vernal marsh habitat. If construction is planned adjacent to vernal marsh habitat, prior to any construction activities, the boundaries of construction areas will be clearly delineated with orange plastic construction fencing to prevent workers or equipment from inadvertently straying from the construction area.

7.2.9.2 Protect Water Quality.

Refer to *Implement Hazardous Materials Spill Prevention,* above.

7.2.10 Construction Impacts to California Tiger Salamanders and Their Habitat

California tiger salamanders could occur in aquatic habitats, and in grassland and oak woodland habitats near aquatic habitat (including vernal marshes) in San Benito County. Construction activities in these habitats could impact California tiger salamanders. The following mitigation measures will reduce impacts to California tiger salamanders and their habitat to less-than-significant levels.

7.2.10.1 Determine Presence/Absence

Prior to construction, protocol-level surveys for California tiger salamanders will be conducted by a qualified biologist in any potential habitat for the species that could be affected by the Management Plan.

7.2.10.2 Avoidance.

Project elements that will impact California tiger salamanders or their habitat will be redesigned to avoid all impacts. If avoidance is not possible, then *Compensation for Habitat Loss* and consultation with CDFG will be necessary.

7.2.10.3 Compensation for Habitat Loss

Replacement of aquatic, wetland, and/or upland habitat that provides breeding or aestivation habitat for California tiger salamanders will provided commensurate with project impacts. Restoration of areas of temporary impacts will replace amphibian habitat impacted temporarily. Mitigation ratios to compensate for permanent impacts to aquatic, wetland and upland habitat must provide more than the existing breeding, foraging and aestivation habitat at the impact site and will be approved by CDFG.

7.2.11 Construction Impacts to Burrowing Owls and Burrowing Owl Habitat

Raptors, including owls, and their nests are protected under both federal and state laws, including the Migratory Bird Treaty Act and California Fish and Game Code section 3503.5. Burrowing Owls could occur in grassland habitat and margins of agricultural areas where ground squirrels are present. Construction-related disturbance during the breeding season could result in the incidental loss of fertile eggs or nestlings or otherwise lead to nest abandonment. Disturbance that causes nest abandonment and/or loss of reproductive effort is considered take by CDFG.

For projects in grassland habitat that could result in permanently displacement of burrowing owls (i.e., installation of evaporation ponds, constructed wetlands, or percolation ponds), protocol burrowing owl surveys will be conducted between April 15 and July 25. If burrowing owls are observed during surveys, the extent of burrowing owl habitat on the site will be delineated by a qualified ornithologist. Avoidance and/or habitat mitigation measures will be incorporated in future projects, as appropriate.

7.2.11.1 Avoidance

Preconstruction surveys for Burrowing Owls will be completed in conformance with CDFG protocols, no more than 30 days prior to the start of construction in grassland habitat and margins of agricultural areas where habitat for Burrowing Owls is present. If no Burrowing Owls were located during these surveys, no additional action would be warranted. However, if breeding or resident owls were located on, or immediately adjacent to, the site, the project could be reconfigured to avoid impacts or buffer zones will be established and/or resident owls will be relocated, as described below. For projects that would permanently displace burrowing owl populations, habitat replacement could be required.

7.2.11.2 Buffer Zones

A 250-foot buffer, within which no new activity will be permissible, will be maintained between project activities and any nesting Burrowing Owls. This protected area will remain in effect until August 31, or at the CDFG's discretion and based upon monitoring evidence, until the young owls are foraging independently.

7.2.11.3 Relocation

If construction will directly impact occupied burrows, eviction outside the nesting season may be permitted pending evaluation of eviction plans and receipt of formal written approval from the CDFG authorizing the eviction. No burrowing owls will be evicted from burrows during the nesting season (February 1 through August 31).

7.2.11.4 Habitat Replacement

For projects that would permanently impact occupied, burrowing owl habitat, habitat replacement may be required as part of a habitat mitigation plan and mitigation agreement with the California Department of Fish and Game. Habitat replacement could include protection of the habitat replacement area in perpetuity by a conservation easement or fee title acquisition. Burrowing owl replacement habitat (for projects in northern San Benito County) should be identified within the northern San Benito County or southern Santa Clara County area.

7.2.12 Construction Impacts to Large Nesting Colonies of Tricolored Blackbirds

Large Tricolored Blackbirds nesting colonies are present in wetland habitats in northern San Benito County. This species could be impacted by construction activities during the nesting season (March 1 to July 1). Construction close to active colonies could result in desertion of nests.

7.2.12.1 Preconstruction Surveys and Avoidance

Prior to construction during the breeding season (March 1 to July 1) within 250 feet of potential nesting habitat for Tricolored Blackbirds (wetland habitat with tall vegetation nearby), preconstruction surveys will be conducted. If Tricolored Blackbirds are present, construction will be delayed until after the breeding season.

7.2.13 Tree Belt Plantings

7.2.13.1 Avoidance

Invasive, exotic tree species will not be used in tree belt plantings. Examples of invasive species include tree of heaven (*Ailanthus altissima*) and blue gum (*Eucalyptus globulus*). Tree selections will be made in consultation with the County of San Benito Agricultural Commissioner.

7.2.13.2 Consideration of Native Tree Species for Tree Belt Plantings

As a part of site specific planning, the use of tree species native to the project vicinity will be considered and compared with the water-removing capacity of other suitable species. If native trees are used, they should be propagated from trees in the local area.

7.2.14 Groundwater Pumping for Water Level Management

7.2.14.1 Determination of Groundwater Conditions and Presence/Absence of Wetland Habitats Within the Zone of Influence

Prior to initiating a groundwater pumping program, an evaluation that includes the following information and analyses, at minimum, would be prepared.

a. Identification of the physical location of the groundwater level management area.

b. Identification of the quantity and timing of proposed groundwater pumping and resulting changes in groundwater levels and flows to creeks.

c. Proposed disposal/disposition of pumped groundwater.

d. Identification of existing wetland, aquatic and riparian habitats within the groundwater level management area and within the zone of influence of proposed pumping.

e. Identification of potential areas of wetland, aquatic and riparian habitats that could be impacted by proposed groundwater pumping.

f. Identification of the water quality of pumped groundwater, including general mineral constituents (major anions and cations), TDS, nitrate, pesticides and other organic compounds, inorganic persistent and bioaccumulative toxic substances (including boron and some metals) pH, and temperature.

g. Identification of any special status species populations, such as steelhead, Monterey roach, red-legged frog or California tiger salamanders, that occupy standing water, wetlands or aquatic habitats within the groundwater level management area and within the zone of influence of the proposed pumping.

7.2.14.2 Avoidance and Minimization of Potential Impacts to Wetland, Aquatic and Riparian Habitats

Groundwater Pumping Programs will conform to the following conditions:

a. Planned reductions in groundwater levels will only impact developed habitats; or

b. Impacts to wetland, aquatic and riparian habitats are relatively small (less than one acre) and would be off-set by habitat replacement in the immediate vicinity of the impact; and

c. The pumping activity will be designed to avoid impacts to special-status species dependent on wetland, aquatic or riparian habitats (*e.g.*, steelhead, Monterey roach, red-legged frog or California tiger salamanders) or these impacts are mitigated, such as through the implementation of an approved Habitat Conservation Plan.

d. The pumping activity will be designed to avoid substantial water quality impacts to aquatic and riparian habitats including, but not limited to, adverse effects on dissolved oxygen, nitrate, or bioaccumulative toxic substance concentrations.

7.2.15 Constructed Wetlands

A water quality and wildlife monitoring program will be established and implemented for new constructed wetlands designed to treat or polish agricultural and/or storm water runoff. Prior to construction, a baseline survey for special status species populations will be conducted on the site. Annual surveys, at the appropriate times of year, will be conducted by a qualified biologist for the first five years of operation. The surveys will address, at minimum, observed changes in population and use of the constructed wetlands by special status species and any management recommendations. Management of the constructed wetlands will be adapted to avoid identified impacts to wildlife using the constructed wetlands.

Water quality of constructed wetlands will be assessed as described under *Water Quality of Constructed Wetlands.*

7.3 Construction Impacts

7.3.1 Dust Abatement Program

For new projects that exceed the threshold limits established by the Monterey Bay Unified Air Pollution Control District (currently 2.2 acres of disturbance, or 82 lb/day), a dust abatement program will be implemented in accordance with Air Pollution Control District requirements.

7.3.2 Noise Control of Construction Equipment

Construction equipment will be adequately muffled and maintained. Construction near sensitive noise receptors, such as residences, schools, medical facilities, libraries, churches, day care centers, and convalescent homes will be limited to weekdays (Monday-Friday) during daylight hours, between 7 A.M. and 6 P.M., except under emergency conditions.

7.3.3 Permitting of Well Drilling Operations

Well drilling operations will obtain necessary well permits and conform to specifications that include, at minimum, proper disposal of drilling fluids, proper disposal and/or treatment of water produced during well development and pumping tests, and site clean-up at the end of the project.

7.4 Cultural Resources

7.4.1 Project Site-Specific Archive and Literature Search

A site-specific archive and literature search would be conducted for project sites once they have been selected for construction. An archaeological and architectural field inventory of areas not previous surveyed would also be completed. Appropriate recordation or supplements to existing documentation would be placed on file with the California Historical Resources Information System, Northwest Information Center at California State University Sonoma, Rohnert Park.

7.4.2 Implementation of Measures to Avoid or Reduce Impacts

For cultural resources identified as eligible for the National Register of Historic Places/California Register of Historical Resources, measures to avoid or reduce impacts to a less-than-significant level would be implemented. Preferred mitigation is avoidance of areas of recorded or known significant or potentially significant cultural resources. Mitigation measures would include:

- Mitigation monitoring by a Professional Archaeologist of archaeologically sensitive areas during ground disturbing construction;
- Formal training of construction personnel to recognize, report and avoid cultural resources;
- The flagging and/or fencing of recorded cultural resources within 100 feet of a project for avoidance and protection;
- Construction contract language discussing the potential for significant subsurface archaeological resources and protocols for dealing with unexpected discoveries; and,
- The requirements for the identification, evaluation and treatment of significant unexpected discoveries in accordance with regulatory requirements.

7.4.3 Notification If Significant Cultural Materials Are Encountered

In the event any significant cultural materials are encountered, all construction within a radius of 100 feet of the find would be halted, the District Manager of the San Benito County Water District and appropriate City or County Planning Department personnel would be notified, and the archaeologist will examine the find and make appropriate recommendations regarding the significance of the find and the appropriate mitigation. Recommendations could include collection, recordation, and analysis of any significant cultural materials.

7.4.4 Notification if Human Skeletal Remains Are Encountered

In the event that human skeletal remains are encountered, the County Coroner will be notified immediately. Upon determination by the County Coroner that the remains are Native American, the coroner shall contact the California Native American Heritage Commission, pursuant to subdivision (c) of section 7050.5 of the Health and Safety Code and the County Coordinator of Indian Affairs. No further disturbance of the site may be made except as authorized by the County Coordinator of Indian Affairs in accordance with the provisions of State law and the Health and Safety Code. The District Manager of the San Benito County Water District and appropriate City or County Planning Department personnel will also be notified immediately, as appropriate, if human skeletal remains are found during development.

7.5 Energy

7.5.1 Energy Efficiency and Water Conservation

Energy and water conservation techniques and energy efficiency will be incorporated in all new building and equipment design and procurement, orientation and construction.

7.6 Geology and Seismicity

7.6.1 Design-Level Geotechnical Study And/Or Soil Foundation Report

A design-level geotechnical study and/or soil foundation report will be completed to develop specific design criteria for new projects that include the installation of structures, foundations, pipelines, or levees. Geotechnical studies will include site-specific evaluations of soil conditions, fault creep, ground shaking and the potential for liquefaction and lateral spreading. Mitigation measures to reduce geologic and seismic hazards to an acceptable level of risk will be included in new projects.

7.6.2 Post-Seismic Event Functionality for Critical Facilities

Critical facilities, such as water and wastewater treatment facilities and domestic water lines, will be designed and located in a manner that maximizes their ability to remain functional after a major earthquake.

7.6.3 Erosion Control Measures

Measures to minimize erosion, including grading during the dry season and reseeding of disturbed areas, will be incorporated in new water management or water treatment projects that require grading and/or tree removal. Erosion and sedimentation control practices are listed in Program Mitigation Measure 7.7.3.1 under *Hydrology and Water Quality.*

7.7 Hydrology and Water Quality

7.7.1 Flooding Impacts

7.7.1.1 Conformance to FEMA Flood Program Requirements and Local Floodplain Ordinance

At a minimum, all proposed GWMP facilities will conform will conform to FEMA Flood Program requirements and the appropriate local floodplain ordinance. Pipelines shall be buried, with excess spoils disposed of outside of the 100-year floodplain and pump stations shall be sited outside of the floodplain.

7.7.1.2 Flood analysis

A flood analysis will be completed as a part of the design of any constructed wetlands or other project elements located within the 100-year floodplain. The flood analysis will address, at minimum, flood conveyance, potential increases in flood elevation, and any impacts to neighboring properties. Measures to avoid flooding impacts will be included in the final design of project elements. Berm heights of constructed wetlands or other facilities shall be sufficient to provide adequate freeboard above the 100-year flood event, and the outside surface of the berms shall be covered with riprap or other material to prevent erosion during peak flow events.

7.7.1.3 Avoidance

Groundwater pumping programs for groundwater level management will suspend discharge to the Pajaro River, the San Benito River, or their tributaries when high water and near flooding conditions are present locally or in the Pajaro Valley.

7.7.2 Surface Water and Groundwater Hydrology

7.7.2.1 Avoidance and Minimization

Refer to *Operational Impacts to Steelhead from Development or Redevelopment of High Quality Local Surface Water Supplies*, above.

7.7.3 In-Basin Water Banking

7.7.3.1 Aquifer Storage and Recovery

Treatment in accordance with the State of California's Surface Water Treatment Regulation will be implemented prior to injection or following recovery of surface water before any domestic use of that water occurs.

7.7.3.2 Groundwater Levels

Groundwater level increases from In-Basin Water Banking, including operation of aquifer storage and recovery wells, will not be allowed within 30 feet of the ground surface, or levels that could impact the operation of septic wastewater disposal systems.

7.7.4 Impacts to Water Quality from Evaporation and Trucking of Salts

7.7.4.1 Avoidance

An impermeable barrier, that will prevent saline water from percolating into the groundwater, will be provided beneath any evaporation ponds for concentrate from groundwater demineralization or treatment.

Adequate freeboard to contain a 100-year storm event and drainage will be provided in evaporation ponds to prevent runoff from reaching surface waters.

7.7.5 Construction Impacts

7.7.5.1 Construction BMPs

Contractors shall be required to implement Best Management Practices (BMPs) for construction activities. The BMPs include measures guiding the management and operation of construction sites to control and minimize the potential contribution of pollutants to storm runoff from these areas. These measures address procedures for controlling erosion and sedimentation and managing all aspects of the construction process to ensure control of potential water pollution sources. Erosion and sedimentation control practices typically include:

- limiting construction to the dry-weather months;
- installation of silt fencing and/or straw wattle;
- soils stabilization;
- revegetation; and
- runoff control to limit increases in sediment in storm water runoff (e.g., straw bales, silt fences, check dams, geofabrics, drainage swales, and sand bag dikes).

7.7.5.2 Restriction On Stream Channel Construction Scheduling

Construction activities within stream channels (i.e., diversion structures on local streams) shall be confined to the dry, summer season in order to minimize adverse impacts to local water quality.

7.7.6 Water Conservation

7.7.6.1 Promote Water Conservation

Promote water conservation through public education and encouraging use of drought tolerant landscaping and water-saving appliances and irrigation techniques, as described in the current Hollister Area Urban Water Management Plan and San Benito County Water Conservation Plan.

7.7.7 Water Quality of Constructed Wetlands

7.7.7.1 Characterization of Water to Be Treated/Polished

As part of the design process for constructed wetlands, the following water quality and environmental characteristics will be addressed:

a. Potential impacts on receiving waters. The potential impacts to receiving surface water and groundwater will be assessed based upon the projected quality and quantity of water to be discharged from the constructed wetlands and the existing and projected quality of receiving waters. Conformance with Central Coast Regional Water Quality Control Board discharge requirements and the Central Coast Basin Water Quality Control Plan surface water quality objectives will be required.

b. Water quality and quantity of the subject water. The quality of the agricultural drainage waters to be treated in constructed wetlands will be assessed as a part of the wetland design process. Constituents to be assessed include, but are not limited to, general mineral constituents (major anions and cations), TDS, nitrate, pesticides and other organic compounds, and inorganic persistent and bioaccumulative toxic substances, including boron and some metals.

c. Water quality and quantity of water to be discharged from the constructed wetland(s) The level of treatment or polishing will be estimated based upon the proposed configuration of the ponds, detention time of water prior to discharge, the amount of water in the wetland system, and proposed plant species in the wetlands.

7.7.7.2 Water Quality Monitoring of Constructed Wetlands

Water quality in constructed wetlands (including, but not limited to salinity, pesticides, and metals) will be monitored as required by the Central Coast Regional Water Quality Control Board. Results of water quality analyses will be provided to the California Department of Fish and Game upon request.

7.8 Land Use (Agricultural Resources and Airport Safety)

7.8.1 Site/Project Design to Minimize Impacts to Prime Farmland and Farmland of Statewide Importance

Site and project design will be used to minimize direct and indirect impacts to Prime Farmland and Farmland of Statewide Importance. Large ponds or facilities for evaporation of concentrate from groundwater treatment will not be sited on Prime Farmland or Farmland of Statewide Importance. Constructed wetlands for polishing of agricultural drainage or storm water and tree belt plantings will be sited to avoid substantial impacts to Prime Farmland or Farmland of Statewide Importance. A substantial impact would be a net impact to 10 acres or more.

Potential land use conflicts with agricultural operations from new project elements, such as modifying access to fields for farm equipment or reducing necessary land use buffers, will be avoided.

7.8.2 Site/Project Design to Avoid Aviation Safety Impacts

Proposed new or expanded wastewater treatment facilities, constructed wetlands and other uses that have the potential to attract wildlife potentially hazardous to aircraft in the vicinity of the Hollister Municipal Airport will consult with the FAA and the San Benito County Airport Land Use Commission to ensure that the facility will be compatible with existing, as well as future, airport operations.

7.9 Noise and Land Use Compatibility

7.9.1 Minimize Nuisance of Noise Generating Equipment

Noise generating equipment, such as pumps and compressors, will be designed to avoid causing a nuisance or disturbance to nearby sensitive receptors, defined as residences, schools, medical facilities, libraries, churches, day care centers, and convalescent homes.

Noise levels at the property line will conform to the following guidelines, developed from federal and state standards:

Noise Standards for Noise Generating Equipment Hourly Equivalent (Leq)		
	Noise Level in Decibels at Property Line	
	7 AM - 7 PM	**7 PM - 7 AM**
Noise generating equipment adjacent to or effecting a property used or zoned for residential or other defined sensitive purposes	60	50
Noise generating equipment adjacent to a property used or zoned for commercial purposes	65	65
Noise generating equipment adjacent to a property used or zoned for industrial or other than commercial or residential purposes or defined sensitive uses.	75	75

dBA = decibels, A-weighted scale

In addition, future projects with noise generating equipment will be sited and designed so that noise levels, using the 24-hour Day-Night Level (DNL) descriptor, will not exceed 60 dBA DNL in outdoor activity areas for noise sensitive uses. Noise levels will be reduced by incorporating noise reduction technology (acoustical treatments) such as acoustical enclosures and mufflers.

7.9.2 Noise Analysis for Existing and Future Conditions Near Noise Sensitive Receptors

A noise analysis that addresses existing and future conditions will be completed by a qualified acoustical consultant prior to the approval of noise generating projects located in the vicinity of noise sensitive receptors. The noise analysis will identify measures required to conform with the noise guidelines listed in Program Mitigation Measure 7.9.1.

7.10 Visual and Aesthetic Resources

7.10.1 Design of New Projects for Compatibility With Nearby Development

New projects will be designed to be compatible with the mass and scale of nearby development. Structures, such as water treatment facilities, will incorporate design features that reflect the character of nearby development.

7.10.2 Avoid Blocking View on Designated Scenic Roadways/Highways

New projects will be designed to avoid blocking views from State of California designated scenic roadways or highway corridors.

7.10.3 Avoid Substantial Alteration of View on Designated Scenic Roadways/Highways

New percolation ponds, evaporation ponds, and emergency storage facilities will be designed and sited to avoid substantially altering views from State of California designated scenic roadways or highway corridors. Landscaping and berms will be used to limit views of evaporation ponds.

7.10.4 Avoid Substantial New Light/Glare on Surrounding Land Uses

Lighting and building materials at new facilities will be designed to avoid the generation of substantial new light or glare on surrounding land uses.

Section 8: Water Management Strategies and Project Elements for Future Study

In addition to the project elements previously discussed in this management plan, there are several water management issues and possible projects that warrant study in the future.

Although not currently at a critical level, the buildup of salts in the groundwater basin is of concern in the long-term. Almost all agricultural, domestic and municipal and industrial uses increase water salinity. Crop evapotranspiration concentrates salts, and various forms of salt inputs (i.e., fertilization, infiltration of treated wastewater) increase the salinity of groundwater. In addition, salts are transported into the basin with CVP surface water and groundwater outflow from the basin is limited by the hydrogeologic characteristics of the groundwater basin. Several of the water quality management strategies and projects identified for further study address concerns regarding long-term salt buildup in the groundwater basin.

The strategies and projects described in this section are not currently included as management tools in the GWP Update but may be studied in the future. Inclusion of the Out-of-Basin Export projects outlined below in the GMP Update and their implementation below would require appropriate environmental review.

8.1 Out-of-Basin Export

One broad area for future study is the Out-of-Basin Export of wastewater effluent, groundwater treatment concentrate, agricultural drainage runoff, and/or pumped groundwater for salt management. Two different options for Out-of-Basin Export that have been identified for further study are: discharge to the San Benito River or Pajaro River; and an export pipeline to the City of Watsonville's ocean outfall.

8.1.1 River Discharge

Several waste streams could discharge to either the San Benito River or Pajaro River as part of a water quality management program for the groundwater basin. Exporting water containing various concentrations of salts from the groundwater basin in San Benito County to downstream surface waters and groundwater in the Pajaro Valley could have a range of beneficial and adverse effects. Future study of this option will need to address and model, at a minimum, the following water quality and environmental characteristics:

- water quality and quantity of the subject water to be discharged (wastewater effluent, groundwater treatment concentrate, agricultural drainage runoff, and/or pumped groundwater) including general mineral constituents (major anions and cations), nitrate, boron, pesticides, and metals (inorganic persistent and bioaccumulative toxic substances).

- water quality and flows in the Pajaro River and the effect of implementation of River Discharge on downstream surface water and groundwater.
- the potential for pharmaceutical residues from wastewater to be introduced into surface water, groundwater or Monterey Bay.
- the potential for trihalomethane in wastewater effluent streams from water treatment.
- thermal effects of river discharge.
- potential impacts from river discharge on downstream flooding, salt balance in the Pajaro Valley, breaching of the sand bar at the mouth of Pajaro River, steelhead, tidewater goby, and other special status species populations, and water quality and wildlife populations in the Pajaro River and Pajaro River Lagoon.
- potential impacts to Prime Farmland and agricultural resources in the Pajaro Valley, including potential impacts on agricultural productivity from increased salinity.
- conformance with Central Coast Regional Water Quality Control Board discharge requirements and the Central Coast Basin Water Quality Control Plan surface water quality objectives.
- options for storing water when discharge to the river was prohibited or otherwise limited would also need to be identified and the environmental effects of water storage evaluated.

The Pajaro River has been identified as an impaired water body for nutrients, sediments, and fecal coliform by the Regional Water Quality Control Board and is therefore undergoing a process to collect data and meet with stakeholders to establish a Total Mass Daily Loading (TMDL) for the parameters of concern. This data, and possibly additional data for the purpose of assessing potential impacts on the Pajaro River and groundwater basin, could be used to assess impacts of any future River Discharge project element.

8.1.2 Export Pipeline

An export pipeline could be routed from Hollister or the San Juan Valley to the City of Watsonville's ocean outfall. Like River Discharge, this possible project element would require extensive modeling of the water quality and quantity of water to be discharged. Conformance with the discharge permit requirements of the Watsonville ocean outfall and alternative methods for disposing or storing water in the event the ocean outfall was temporarily unavailable for use would need to be thoroughly investigated along with the potential impacts to the water quality of Monterey Bay.

Potential avoidance and mitigation measures for impacts to biological resources, including direct impacts to riparian habitat at creek crossings, and potential seismic hazards are potential areas of study for any future pipeline routes. Construction of a new pipeline to Watsonville will require a number of creek crossings and could impact areas of sensitive habitat. The pipeline would also cross several earthquake faults to the west of the San Juan Valley.

8.2 Concentrate Disposal Strategy

There are a number of strategies that could be employed to dispose of concentrate from demineralization/desalting processes. Since treatment of groundwater for municipal and industrial use has been identified as a high priority, it would be prudent to better define a number of issues, including: the quantity of concentrate that would require disposal; the availability of methodologies to achieve higher concentrations, thereby reducing the volume to be disposed of; and the current and future costs of disposal.

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VI. COPIES OF COMMENT LETTERS