I Don't Know Why The Page Breaks Like This, But You Have Enclosed All of My Comments. I Have Not Included Those Pages That I did Not Change.

Pete

6. Water Recycling

Water recycling offers significant potential to improve water supply reliability for California, one of the primary objectives of the CALFED Program. Water recycling is a safe, reliable, and locally controlled water supply. Tertiary treated, disinfected recycled water is permitted for all non-potable uses in California through Title 22 of the California Code of Regulations. With the majority of the state's population in coastal areas, the majority of resulting wastewater flows are currently discharged to the ocean and rendered unavailable for reuse. If these flows are recycled, they can represent a new and somewhat drought-proof source of supply for water users.

Currently, the total agricultural and urban water use in the state is about 42 million acre-feet annually. Of this, the urban sector uses about 8.7 million acre-feet, nearly 70 percent of which is used in the urban coastal areas of California (DWR, 1997). In southern California, about 30 percent of this use goes directly to outdoor urban landscaping and does not generate a wastewater flow (MWD, 1996). In hotter inland areas, this percentage can increase to more than 60 percent (DWR, 1997). In coastal areas of the state, the remaining urban uses (indoor residential, commercial, industrial, and institutional) result in more than 2 million acre-feet of wastewater being treated and discharged annually (Bay Area Regional Water Recycling Program, 1997). Recycling of any portion of this

CALFED BAY-DELTA PROGRAM

D-047316

water constitutes a new water supply — a water supply that can be allocated to other beneficial uses.

By 2020, coastal areas' wastewater flows are expected to increase to over 3 million acre-feet annually, even considering significant levels of future urban water conservation. This can provide substantial opportunities for water recycling and help achieve CALFED Program objectives for water supply reliability, water quality and ecosystem restoration. Recycling creates a unique contribution to improved reliability by providing an additional source of water that is local rather than imported. Further, this source can be relatively resistant to drought, making it available when it is needed most. Perhaps most important, recycling often provides increased water for one beneficial use without reducing the water available for other beneficial uses. From a Bay-Delta perspective, recycling projects in export areas increase water supply without increasing Delta exports or reducing Delta outflow. Thus, water recycling projects can simultaneously help meet CALFED Program objectives for water supply reliability, water quality and ecosystem restoration. ~~by allowing increased export demands to be met without increased fish entrainment at the Delta export pumping plants. In other situations, recycled water may be used directly for environmental restoration purposes and to help reduce water quality impacts to inland waterways.~~

CALFED BAY-DELTA PROGRAM

Potential benefits of water recycling include:

D-047317

- Reduced demand for Delta exports
- Improved timing of diversions
- Increased carryover storage
- Reduced entrainment of fish
- Reduced discharges of treated wastewater to surface water
- Improved water quality
- Increased availability of Delta supplies for M&I, agricultural, environmental restoration purposes

New Water Supply vs. Total Water Recycling

~~In the urban coastal regions,~~Water recycling ~~of wastewater~~ increases total water supply by providing a new source of water previously "lost" to ~~a saline sink~~ the ocean, bays, estuaries and evaporation ponds. However, in other regions (and even in minor portions of coastal regions), recycling of current wastewater flows does not provide additional new water supply because the treated wastewater is already discharged into rivers, streams, and aquifers, where, in many cases, downstream users may depend on this flow (including the environment). It is important to distinguish

CALFED BAY-DELTA PROGRAM

D-047318

of this document.)

Many communities in the Sacramento and San Joaquin Valleys fall into this first category. For example, the Sacramento metropolitan area currently discharges most of its treated wastewater into the Sacramento River, downstream of Sacramento. This water is then ~~assumed as~~ part of the flow available in the Delta today. Therefore, the expanded use of recycled water by Sacramento would not contribute to CALFED's water reliability objective, it would, however, result in a positive contribution to CALFED's water quality and ecosystem restoration objectives.

As wastewater flows increase with population growth, however, the incremental increase in flows may be available as a new water supply to be recycled for use in and around these inland areas. In other valley communities with less secure water supplies, recycling may be a very important way of reducing the need to obtain new water supplies. However, ~~current California water law is vague as to how to account for the actual effect on receiving waters and the responsibility for any compensatory releases.~~ the Water Code requires the owner of a wastewater treatment plant currently discharging treated wastewater into a natural water course to petition the State Water Resources Control Board (SWRCB) prior to ceasing the discharge and reclaiming the water for beneficial use. The SWRCB can permit such a change only if the petitioner establishes that the change will not operate to the

CALFED BAY-DELTA PROGRAM

injury of any legal user of that water.

The majority of the state's wastewater flow is generated in coastal areas and discharged to the ocean and San Francisco Baysaline sinks. Los Angeles, San Diego, and San Francisco are all examples. The recapture and recycling of their wastewater flowsfrom those regions could generate a new water supply in these regions and further CALFED water supply reliability, water quality and ecosystem restoration objectives.

A third type of wastewater discharge is to recharge/evaporation ponds. TMany cities in the Sacramento-San Joquin watershed, including the cities of Fresno and Bakersfield, use this technique. The wastewater is "disposed of" by percolating into the local aquifer or evaporating from the pond surfaces. Reducing the portion evaporating is infeasible since it would require covering the ponds or making them deeper to reduce the total surface area. The treated wastewater that percolates into the ground generally does so at a rate greater than the aquifer can convey it away from the ponds. This sometimes results in a groundwater "mounding" effect under the ponds. Recycling of mounding that is in excess of local groundwater needs may also be available as a new water supply. Yet the ultimate effect to the local hydrology may dictate that this is not always new water. Recycling of the portion of the discharge to the disposal ponds that evaporates would further CALFED water supply

CALFED BAY-DELTA PROGRAM

reliability, water quality and ecosystem restoration objectives. Recycling of the percolating component may or may not further these objectives.

For purposes of this analysis, evaluation of water recycling potential will be limited to the ability to further CALFED's water supply reliability objectives through water recycing in the state's three primary coastal areas, the San Francisco Bay Area, the Central Coast, and southern California. ~~Since the majority of the state's population resides in these areas and the majority of population growth is also expected here, excluding the Central Valley areas is not expected to significantly influence estimated recycling potential.~~ The ability to further CALFED's water quality and ecosystem restoration objectives through water recycling has not been analyzed. Similarly, the ability further CALFED water supply reliability, water quality and ecosystem restoration objectives through water recycling in the Central Valley has yet to be analyzed.

Understanding Water Recycling Opportunities

Water recycling is gaining in recognition as a viable supply source. More and more urban water agencies are analyzing and implementing water recycling projects for several different reasons,

depending on their local conditions. Current drivers include:

- increasingly stringent waste discharge requirements, which affect the timing and quantity of wastewater discharge as well as the type and level of treatment required prior to discharge (an example may include the California Toxics Rule, if implemented ~~similar to other statesas~~ proposed, it could favor more recycling),
- a need to secure more reliable sources of water to meet growing populations as other new supply alternatives become increasingly more difficult to find or implement,
- a need to offset physical or legislated reductions in some existing surface and groundwater sources (e.g., Endangered Species Act),
- in some instances, the local agencies are implementing integrated water resources planning ~~public policy~~ies that dictates ~~that it is the appropriate~~ local supply development actions to address ~~take to help protect the~~ environmental issues and enhance water supply reliability through the diversification local water resources available to the community.
- State Water Code provisions that define use of potable water for nonpotable purposes as a waste and unreasonable use.

CALFED BAY-DELTA PROGRAM

However, the potential for water recycling is currently limited by local considerations of cost-

effectiveness. Generally, the local agencies' assessment of the economic viability of a water recycling project is limited to internal costs and benefits only. CALFED is in a position to improve the potential of water recycling by improving the visibility of the statewide benefits of water recycling and developing programs to assist with the funding of those projects offering a cost-effective means of achieving CALFED objectives. ~~many impediments such as insufficient funding and the high cost of recycling, inter-jurisdictional issues (e.g., rights to wastewater resources), public acceptance of recycled water, and complex permitting and regulatory compliance processes that may be discouraging to some local agencies.~~

One of the more daunting impediments to water recycling noted by urban water agencies has been cost. The CALFED Program approach to water use efficiency (see Section 2) is based on cost-effectiveness. The CALFED Program proposes to encourage local water suppliers to analyze all options for reducing the mismatch between supply and demand. Further, through the actions detailed in Section 2, CALFED agencies will help water suppliers implement appropriate options starting with the least expensive. This is anticipated to result in identification of feasible recycling projects.

CALFED BAY-DELTA PROGRAM

In the past, many agencies have found that there are several options for meeting demand that are less expensive than water recycling. This is supported by findings of the Bureau of Reclamation *Least-*

Cost CVP Yield Increase Plan (DOI, 1995). However, this study did not attempt to evaluate the statewide water supply reliability, water quality and ecosystem restoration benefits attributable to water recycling.

When water transfers are available as a source, they often provide the least expensive increment of additional water supply. Careful avoidance or mitigation of third party impacts associated with water transfers can add to the cost, but transfers may still be a least-cost alternative. It should be noted, though, that many transfers are conducted on a year-to-year basis, while water recycling provides a long-term supply. Difficulties in conveying water from a "seller" to a "buyer", especially if it involves the Delta, can also reduce the reliability of transfers as an effective water supply option. Water recycling can effectively enhance the water transfer market by making additional supplies available for transfer. The Water Code provides that a water right holder that has reduced its use of water as a result of the use of recycled water is free to transfer that water pursuant to state laws governing the transfer of water rights.

CALFED BAY-DELTA PROGRAM

For many agencies, water conservation measures also can be and have been implemented at a lower unit cost than recycling (see urban conservation costs outlined in Section 5). Despite the extensive implementation of conservation measures that has occurred over the last decade, CALFED estimates

that the potential for additional water conservation in the urban sector remains substantial — over 1.5 MAF. However, even with full implementation of cost-effective water conservation measures CALFED is projecting shortages in supply. Aggressive implementation water conservation measures and additional water recycling will be needed to effectively reduce the mismatch between Bay-Delta water supplies and the current and projected beneficial uses dependent on the Bay-Delta system.

Thus, recycling projects are usually evaluated only in comparison to new supply development. The drivers listed previously as well as the shrinking opportunities for additional supply projects (with their impacts and the need to avoid or mitigate these impacts), are driving up the cost of new supply projects and making recycling more competitive. Still, there are several factors that can make new supply development more attractive to local water suppliers. In the past, many new supply projects have been planned, financed, and built by regional, state, or federal agencies so local suppliers are relieved of the initial burdens of project development (though local agencies may pay this back overtime through contractual arrangements). Like large storage projects, water recycling projects improve local water supply reliability and help meet CALFED Program objectives. Much as they have done for traditional water supply development, it may be appropriate for CALFED agencies to assume a planning and financing assistance role for recycling projects that help fulfill one or more CALFED objectives; ~~much as they have done for traditional water supply development~~.

CALFED BAY-DELTA PROGRAM

Impediments to water recycling also make it very difficult to project future levels of recycling. In particular, the inter-jurisdictional nature of water recycling makes projections complex and difficult. For example, one agency may secure raw water supplies for a region and deliver water to customers, while another agency may treat wastewater; who is responsible for any recycled water? Water supply from a recycled project may need to move across agency boundaries in order to be delivered to customers. In addition, recycled water supplies in an area may be greater than demand in that area, resulting in recycled water that must be conveyed to another area if customers can be identified. Again, crossing agency boundaries and inter-jurisdictional cooperation are imperative to achieving significantly increased levels of water recycling. CALFED could effectively address these institutional planning issues by providing technical and financial planning assistance for local planning efforts. CALFED's assurances program could include policies designed to encourage coordination of water recycling planning among water and wastewater agencies and ensure thorough examination of water recycling opportunities throughout the state. For example, each potential source of recycled water, the water suppliers (wholesale and retail) could be required to prepare a water recycling plan(s) in coordination with wastewater utilities representing source(s) of recycled water potentially available to the water suppliers.

CALFED BAY-DELTA PROGRAM

Other impediments to water recycling include public and market perceptions. Local project sponsors are regularly called upon to defend the need for water recycling. Examples of this include public concern regarding the safeguard of potable supplies and perceptions that recycled water could adversely affect the quality of current water supplies. In addition, some agricultural commodity buyers have disallowed the use of recycled water on certain crops, primarily because of concerns about the public ~~perception of the end product~~willingness to purchase food crops grown with recycled water. ~~Many of t~~These perceptions persist despite the unwavering support of the conservative~~are inadvertently supported~~ by Department of Health Services for use of recycled water on agriculture and other settings offering an equivalent or greater potential for public contact. ~~Rules regarding where and how recycled water can be used, though these are undergoing change and~~ adaptation. Overcoming these public perceptions is a necessary prerequisite to achieve the ultimate water recycling potential identified herein. Public education is an important effort where CALFED can provide a leadership role. CALFED and the CALFED agencies could improve the understanding and acceptance of water recycling through their individual and collective public outreach efforts. To ensure a high degree of public confidence in water recycling, CALFED should provide funding to support ongoing public education programs and research and development of improved water recycling methods.

CALFED BAY-DELTA PROGRAM

Impediments to the implementation of recycling projects may require vigorous efforts by CALFED agencies to make these projects feasible. The water recycling assistance programs of CALFED and the CALFED agencies will require much additional refinement and input from stakeholders to maximize program effectiveness. Only through additional innovation and assistance will California be able to realize a significant increase in the use of recycled water. These actions are discussed in detail in Section 2 of this document.

Determining Water Recycling Potential

Water recycling is and will continue to be an important element of California's water management approachstrategy. To emphasize this importance, the legislature, in 1991, adopted goals for the beneficial use of recycled water to include achieving 700,000 acre-foot per year of recycling by the year 2000, and 1 million acre-feet per year by 2010 (Cal. Water Code Section 13577). Currently, just under 500,000 acre-feet of urban water recycling occurs or is under construction in the state, with more projects being completed over the next several years (DWR, 1997).

CALFED BAY/DELTA PROGRAM

Regional Water Recycling Studies

About 2.1 million acre-feet of treated wastewater is discharged by urban California into the Pacific Ocean and San Francisco Bay (Bay Area Regional Water Recycling Program, 1997). As populations continue to increase, the amount of discharge will also rise, potentially reaching more than 3 million acre-feet by 2020. As identified in Section 2 under the Water Recycling Approach *Action 4*, the CALFED Program seeks to identify and encourage regional water recycling opportunities that maximize reuse at minimum cost.

Currently, two regional water recycling studies are underway. The Bay Area Regional Water Recycling Program (BARWRP), previously referred to as the Central California Regional Water Recycling Project(CCRWRP), is in its second phase of feasibility analysis. The Southern California Comprehensive Water Reclamation and Reuse Study (SCCWRRS) is also in its second phase of feasibility analysis, to identify means of maximizing use of recycled water in Southern California. The goal of these studies is to identify regional recycling systems and develop potential capital projects through comprehensive planning processes.

CALFED BAY-DELTA PROGRAM

Since both programs are still in their development stages, clear estimates of water recycling potential are not yet fully available. Also unknown is the overlap that may exist between the regional recycling

or regional level, and storing recycled water for later use.

Figure 6.1 generally illustrates how recycling treated wastewater provides a relatively constant supply source, while some customer demands, such as agricultural irrigation, are more cyclical. This timing mis-match limits the amount of recycled water that can be used by seasonal customers without a method to store supplies during non-peak periods. On the other hand, the peaking characteristics of the irrigation-based water recycling projects (seasonal demand typically is twice the annual average) helps relieve demand for Delta export in the crucial summer months, providing valuable relief to Delta operations. This factor can be especially important in a critically dry year.

WORK-IN-PROGRESS

Surface storage of recycled water has yet to occur at any significant level. A project being developed in San Diego will be the first to treat a significant quantity of wastewater and recycle it into San Diego's drinking water reservoir. There, the recycled water will blend with other untreated water and be conveyed to the water treatment facility and into the potable system. This project will recycle approximately 15,000 acre-feet of indirect potable reuse. Direct potable reuse is currently prohibited by State regulation. Other indirect potable reuse sites are under consideration in the BARWRP and SCCWRRS.

Use of other surface facilities to temporarily store recycled water will be limited by the capacity of the reservoirs and the distance from the recycling plant (i.e., reservoir sites may be distant and upslope from a treatment plant such that pumping the recycled water to the reservoir is very costly How does this point differ from the offstream reservoirs currently being considered by CALFED???).

CALFED BAY-DELTA PROGRAM

Lacking adequate storage or a distribution system which would allow a more diverse, widely distributed customer base to be included, the potential for water recycling may reach an upper limit of feasibility. For of this analysis, the No Action levels discussed below are assumed by CALFED to

"push" more fresh water toward the ocean, increasing the thickness of the barrier. However, there may be a practical limit to how far or how much of a barrier is necessary compared to the cost of providing a barrier. Thus, a practical consideration may constrain this use of recycled water.

Surface storage of recycled water has yet to occur at any significant level. A project being developed in San Diego will be the first to treat a significant quantity of wastewater and recycle it into San Diego's drinking water reservoir. There, the recycled water will blend with other untreated water and be conveyed to the water treatment facility and into the potable system. This project will recycle approximately 15,000 acre-feet of indirect potable reuse. Direct potable reuse is currently prohibited by State regulation. Other indirect potable reuse sites are under consideration in the BARWRP and SCCWRRS.

Use of other surface facilities to temporarily store recycled water will be limited by the capacity of the reservoirs and the distance from the recycling plant (i.e., reservoir sites may be distant and upslope from a treatment plant such that pumping the recycled water to the reservoir is very costly).

Lacking adequate storage or a distribution system which would allow a more diverse, widely distributed customer base to be included, the potential for water recycling may reach an upper limit of feasibility. For of this analysis, the No Action levels discussed below are assumed by CALFED to be that practical upper limit (e.g., 1.4 million acre-feet of total water recycling in 2020).

Available Data for Use in Estimating the No Action Level

As previously discussed in Section 2 of this document, under the *Water Recycling Approach*, the California Department of Water Resources, in partnership with the WateReuse Association of California, conducted a *Survey of Water Recycling Potential* in 1995-6 to help identify and quantify local agencies' plans for future water recycling (DWR, 1996). The survey, with 230 respondents, identified 1996 water recycling levels at over 450,000 acre-feet per year, and projected the potential for recycling at 1.49 million acre-feet annually by 2020. The respondents listed projects by stages of planning: *conceptual, feasibility study, preliminary design, final design, and under construction*. "Base" conditions include any current recycling projects (projects already in operation) plus all projects that were under construction at the time of the

Estimates of Current Water Recycling

Though the DWR survey identified about 450,000 acre-foot of existing urban recycling projects, another survey by the State Water Resources Control Board identifies only 355,000 acre-feet (SWRCB, 1998). Upon comparison of the two sources, it appears that the SWRCB summary has identified a much smaller amount of groundwater recharge from recycling. This accounts for about 80,000 acre-feet of the difference. Additional differences may be from recycling reported to DWR that is considered "non-reportable" by the SWRCB (i.e., in-plant service water, respondents including permitted levels rather than actual levels). The July 1998 SWRCB survey is still in draft. Revised values should be available shortly and may further clarify differences.

Greg - I THINK Difference IS Primarily "NEW" versus "TOTAL" Supply - THE SWRCB # = "New Water" whereas 450 Kacy = TOTAL recycling.

D-047332

under 1% No Action scenario

(CALFED assumes that only 75 percent of the difference between existing levels and the 615,000 acre-foot value shown in Table 6.2 is achieved. Most of this increment represents expansion to "build-out" capacity of existing recycling facilities, however, according to industry sources, it is unlikely more than 75 percent will actually be achieved [MacLaggan, 1998]). CALFED assumes this value to represent the incremental "Base" value. Figure 6.2 graphically displays CALFED's assumed relationship between the values in Table 6.2 and the assumed No Action level of recycling.

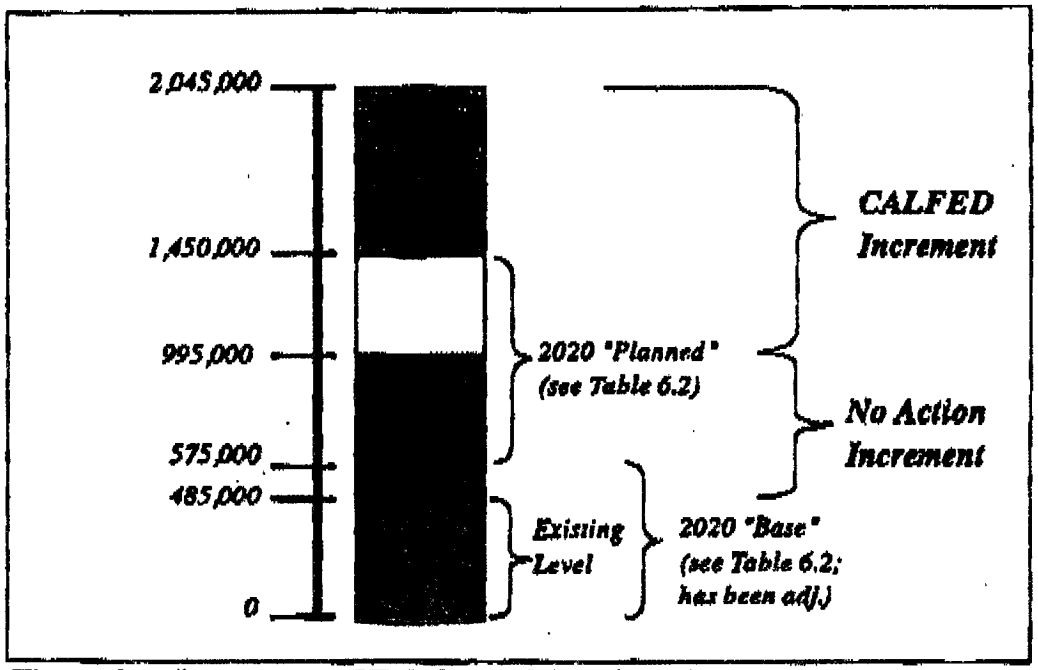

Figure 6.2 - Increments of Existing and Anticipated Water Recycling
(These values are used to derive No Action and CALFED recycling levels)

For purposes of this document, CALFED assumes that under the No Action condition 50 percent of the "Planned" values and the incremental "Base" value are fully implemented by 2020. Therefore, the No Action potential estimates that 510,000 acre-feet of additional recycling will occur (derived by taking 50 percent of 837,000 acre-feet from Table 6.2 and adding 75 percent of the incremental "Base" value of 615,000 acre-feet). Combined with existing levels, this would represent about 1.0 million acre-feet of annual wastewater recycling by 2020.

New water generated from the No Action recycling is estimated at 415,000 acre-feet (derived by taking 50 percent of 699,000 acre-feet from Table 6.2 plus 75 percent of the incremental "Base" recycling).

D-047333