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Defending the West

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January 11, 2001

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California Desert District
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Re: Errata in Comments on Cadiz Project

Dear Messrs. Safely and Williams:

I am writing to inform you of a couple of errata that have been brought to my attention in the comments submitted by the Western Environmental Law Center on January 8, 2001.

First, the list of organizations making up the coalition on whose behalf the comments were submitted inadvertently included one organization that had not reviewed and signed onto the comments and failed to include three organizations that did. Clean Water Action should not have been included, and the following three organizations should have been included: Center for Community Action and Environmental Justice, California Citizens Against Toxics, and Desert Citizens Against Pollution.

Second, figure 11 was inadvertently left out of the figures attached to Dr. John Bredehoeft's report, which is the first attachment to Law Center's comments.

Enclosed with this letter is a copy of figure 11 from Dr. Bredehoeft's report and a revised page 1 of the Law Center's comments with a corrected list of the organizations making up the coalition on whose behalf the comments are submitted.

Please incorporate these corrections into the comments. Should you have any questions regarding these corrections, I can be reached at the telephone number in the margin. Thank you for your attention to this matter.

Very truly yours,

Simeon Herskovits

Enclosures

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Comments of

the Western Environmental Law Center

on the

Draft Environmental Impact Report/Environmental Impact Statement and Supplement to the Draft Environmental Impact Report/Environmental Impact Statement

for the

Cadiz Groundwater Storage and Dry-Year Supply Program

Submitted: January 8, 2001

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I. INTRODUCTION

A. The Commenters

The Western Environmental Law Center submits these comments on behalf of a coalition of citizens organizations that are opposed to the Cadiz Groundwater Storage and Dry-Year Supply Program, including: Sierra Club, National Parks Conservation Association, Defenders of Wildlife, Wilderness Society, California Wilderness Coalition, Desert Survivors, Desert Citizens Against Pollution, California Citizens Against Toxics, Southern California Watershed Alliance, California Watershed Network, Butte Environmental Council, Valley Water Protection Association, Center for Biological Diversity, Center for Community Action and Environmental Justice, and Citizens for the Chuckwalla Valley. G42-1

The commenters request that these comments, and all attachments be included as part of the administrative record. The commenters further request that all documents, articles, and reports cited in these comments and attached expert testimony be included as part of the administrative record of this action. See County of Suffolk v. Secretary of Interior, 562 F.2d 1368, 1384, n.9 (2d Cir. 1977) (addressing scope of NEPA administrative record), cert. denied, 437 U.S. 1064 (1978); Silva v. Lynn, 482 F.2d 1282 (1st Cir. 1973) (same); see also Thompson v. United States Dep't of Labor, 885 F.2d 551, 555 (9th Cir. 1989) (administrative record consists of all documents and materials directly or indirectly considered by agency and includes evidence contrary to agency's position).

B. Summary

The Cadiz Groundwater Storage and Dry-Year Supply Program (Cadiz Project or Project) is proposed to enhance the Metropolitan Water District of Southern California's (MWD's) water supply. The Project has two components. One is to store up to 1 million acre-feet of surplus Colorado River water in the groundwater system underlying the Cadiz and Fenner valleys in the Mojave Desert during years when that water is not needed, and extract that water as needed during dry years. The other component is a proposal to extract up to 2 million acre-feet of indigenous, or native, groundwater from that groundwater system for MWD's use during dry years. The Project would entail the construction of the following facilities: approximately 390 acres of spreading basins to allow the Colorado River water to percolate into the groundwater system; a well-field to extract water from the aquifer; monitoring wells and other monitoring equipment; and conveyance facilities to carry water 35 miles between the Colorado River Aqueduct (CRA) and the Project site, along with accompanying power lines. G42-2

The reviewing agencies (Agencies) are MWD and the United States Bureau of Land Management (BLM). MWD is the lead agency under the California Environmental Quality Act (CEQA), Cal. Pub. Resources Code § 21000 et seq., and BLM is the lead agency under the National Environmental Policy Act, 42 U.S.C. § 4321 et seq. BLM's involvement in the Project results from the fact that the conveyance facilities and accompanying power lines will require the grant of a right of way through BLM land between the CRA and the Project site. In order to G43-3

grant such a right of way, BLM must amend the California Desert Conservation Area Plan, which presently prohibits such a use of the land being crossed.

As explained in detail below, the proposed Cadiz Project poses a serious threat to the groundwater system underlying the whole of the Cadiz-Fenner basin and the surrounding environment. Among the harms likely to be caused by the Project are catastrophic depletion of the aquifer that could take centuries to be remedied. By substantially drawing down the aquifer, the Project also threatens to dry out the moist lake beds, or playas, of Bristol and Cadiz lakes. This would create a large area of dried out lake sediment with an enormous potential to generate harmful dust emissions on a significantly larger scale than Owens Lake, which ranks as one of the nation's most conspicuous environmental disasters. In addition, the draining of the aquifer could cause springs in the surrounding mountain ranges to dry up, spelling extinction for the local populations of bighorn sheep. Perhaps even more distressing, the vast area of fresh water spreading basins on the Cadiz Project site will be a major attraction for ravens and other birds that will prey on the fragile desert tortoise population in critical habitat areas within the basin. These are only some of the devastating potential environmental impacts from the Cadiz Project, impacts that in practical terms will be permanent and very expensive to even attempt to mitigate. G42-4

Neither the Draft Environmental Impact Report/Environmental Impact Statement (DEIR/S) nor the Supplement to the Draft Environmental Impact Report/Environmental Impact Statement (SEIR/S) adequately address these and other serious problems with the Cadiz Project. Indeed the DEIR/S and SEIR/S are woefully inadequate under CEQA, NEPA, and other state and federal laws. Among their most glaring deficiencies, the DEIR/S and SEIR/S are based on a patently deficient description of the Project and the physical conditions and environmental resources in its vicinity, a grossly inadequate assessment of the purpose and need for the Project, and a failure to examine the Project's feasibility and likely adverse environmental impacts. Rather than remedying any of these glaring deficiencies in the DEIR/S, the SEIR/S simply attempts to sidestep all substantive problems by proposing to defer the identification of problems and the decisions about how to deal with those problems to a future date and to unaccountable committees dominated by the Project's proponents under a vague and inadequate monitoring and management plan. In all these regards, the DEIR/S and SEIR/S fail to comply with NEPA and CEQA, and for all these reasons the Agencies should reject the proposed Cadiz Project. G42-5

II. THE AGENCIES HAVE FAILED TO COMPLY WITH THE CALIFORNIA ENVIRONMENTAL QUALITY ACT AND THE NATIONAL ENVIRONMENTAL POLICY ACT

A. The Legal Requirements of the National Environmental Policy Act.

"Section 101 of NEPA declares a broad national commitment to protecting and promoting environmental quality." Robertson v. Methow Valley Citizens Council, 490 U.S. 332, 348 (1989), citing 83 Stat. 852, 42 U.S.C. § 4331. "The sweeping policy goals announced in § 101 of NEPA are . . . realized through a set of 'action-forcing' procedures that require that agencies take G42-6

a "hard look' at environmental consequences.'" Id. at 350, citing Kleppe v. Sierra Club, 427 U.S. 390, 410 n.21 (1976). NEPA's main "action-forcing" procedure comes in the form an environmental impact statement ("EIS"), a detailed statement on environmental impacts that must be prepared before an agency undertakes any "major Federal action[] significantly affecting the quality of the human environment." NEPA § 102(2)(C), 42 U.S.C. § 4332(2)(C).

Thus, NEPA "ensures that the agency, in reaching its decision, will have available, and will carefully consider, detailed information concerning significant environmental impacts." Robertson v. Methow Valley Citizens Council, 490 U.S. 332, 349 (1989). See also Vermont Yankee Nuclear Power Corp. v. Natural Resources Defense Council, 435 U.S. 519, 553 (1978) ("NEPA places upon an agency the obligation to consider every significant aspect of the environmental impact of a proposed action"). "These procedural provisions of NEPA 'are designed to see that all federal agencies do in fact exercise the substantive discretion given them. These provisions are not highly flexible. Indeed, they establish a strict standard of compliance.'" Sierra Club v. Watkins, 808 F. Supp. 852, 859 (D.D.C. 1991), quoting Calvert Cliffs' Coordinating Comm., Inc. v. United States Atomic Energy Comm'n, 449 F.2d 1109, 1112 (D.C. Cir. 1971). G42-6

The Council on Environmental Quality ("CEQ") has promulgated regulations implementing NEPA that are binding on all federal agencies. 40 C.F.R. § 1500.3; Robertson v. Methow Valley Citizens Council, 490 U.S. at 354.

B. The Legal Requirements of the California Environmental Quality Act

"The California Environmental Quality Act, Cal. Pub. Resources Code § 21000 et seq., is a comprehensive scheme designed to provide long-term protection to the environment. In enacting CEQA, the Legislature declared its intention that all public agencies responsible for regulating activities affecting the environment give prime consideration to preventing environmental damage when carrying out their duties. CEQA is to be interpreted to afford the fullest possible protection to the environment within the reasonable scope of the statutory language." Mountain Lion Foundation v. Fish and Game Comm'n, 65 Cal.Rptr.2d 580, 584 (1997). G42-7

"The environmental impact report, with all its specificity and complexity, is the mechanism prescribed by CEQA to force informed decision making and to expose the decision-making process to public scrutiny. The EIR is, as the courts have said repeatedly, the 'heart of CEQA,' 'an environmental alarm bell,' and a 'document of accountability.' An EIR provides the public and responsible government agencies with detailed information on the potential environmental consequences of an agency's proposed decision." Planning and Conservation League v. Department of Water Resources, 100 Cal.Rptr.2d 173, 187-88 (Cal. App. 2000) (citations omitted).

The EIR serves not only to protect the environment but also to demonstrate to the public

that it is being protected. CEQA Guidelines § 15003(b). Thus, CEQA requires that the lead agency identify and disclose all of the significant environmental impacts of a proposed project. CEQA Guidelines § 15126.2. CEQA also requires the public agency to consider feasible alternatives to the project which would lessen any significant adverse environmental impact. Cal. Pub. Resources Code §§ 21002, 21081; Planning and Conservation League, 100 Cal.Rptr.2d at 188. G42-7

C. The DEIR/S and SEIR/S Fail to Adequately Evaluate the Purpose and Need for the Cadiz Project

As described below, the Assessment of purpose and need that underlies the DEIR/S and the SEIR/S is woefully inadequate and riddled with omissions and inconsistencies. G42-8

1. Conservation Measures

To begin with, neither the DEIR/S nor the SEIR/S provide sufficient specificity regarding what conservation measures have been, or reasonably can be expected to be, implemented, or how the MWD makes this assessment. Without this information it is not possible to assess the reasonableness of MWD's future demand premise. G42-9

Throughout the discussion of need and purpose, the DEIR/S betrays a bias in favor of obtaining additional water supply rather than aggressively pursuing additional available opportunities for increased conservation. The DEIR/S invokes the drought of 1987-1992 to show the need for improving MWD's supply reliability, and makes clear that improving supply reliability means essentially increasing supply. DEIR/S 2-3. In contrast, neither the DEIR/S or the SEIR/S acknowledges that such droughts make it just as clear that there is an even greater need for aggressive implementation of conservation in the desert region that makes up its service area. Similarly , MWD claims that its studies of dry-year demand show the need to enhance water storage and water transfers, but it fails to acknowledge the self-evident fact that the same studies show a similar need to enhance conservation. DEIR/S 2-6. G42-10

Another example is the contradiction between the assertion that adequate storage is needed to prevent and offset overdraft of groundwater basins and surface storage during droughts, DEIR/S 2-4, coupled with the failure to meaningfully address the high probability that the Cadiz Project is likely to result in a major overdraft of the groundwater basin underlying the Cadiz and Fenner valleys. The bias betrayed in this unbalanced consideration is also evident in the DEIR/S's failure to acknowledge that increased conservation measures also would protect against such overdraft of groundwater basins and surface storage, and would do so more sustainably than draining new basins. G42-11

Further, throughout the assessment of future water demand, MWD passively accepts projections of continued "rapid population growth and water demand increases" without any examination of the sustainability of this trend or the obvious opportunities to moderate this trend G42-12

through SCAG and SANDAG's regular periodic planning summits to set population, and other, goals. DEIR/S 2-6. For example, in its discussion of growth trends and water use, the DEIR/S offers no analysis of why inland households use so much more water than coastal ones (164 vs. 97 gpcd), whether this discrepancy is necessary, or whether it could be changed. DEIR/S 2-10. The purpose and need discussion does not explain how MWD's planning system accounts for implementation of conservation practices. DEIR/S 2-7. Thus the public and the ultimate decision-makers have no basis for assessing the adequacy of the consideration given to reasonably available additional conservation measures. G42-12

The credibility of the entire discussion of water usage patterns and expected future demands is undermined by the contradiction between the DEIR/S's assertion in one place that agricultural use accounts for only about 10% of the total demand in MWD's service area, DEIR/S 2-14, and the assertion elsewhere that increased summer irrigation use accounts for approximately 30% of the total annual use in MWD's service area, DEIR/S 2-10. G42-13

The assessment of future demand also is deficient because it gives no consideration to the opportunity to reduce consumption through the use of disincentives for unnecessary, wasteful "discretionary" water usage by higher income households. Rather, the DEIR/S just passively accepts such wasteful water use by the wealthy. Further, the DEIR/S passively and uncritically adopts unattributed projections that real incomes will outpace the price of water and therefore per capita water demand/consumption will increase. DEIR/S 2-10 to 2-11. G42-14

The discussion of current and projected water conservation measures is remarkably incomplete, again revealing inadequate consideration of this least environmentally harmful and most sustainable approach to avoiding future shortfalls. While MWD makes much of its conservation programs, the details reveal that there only have been significant efforts to implement two measures, low-flow toilets and low-flow showerheads. The details further reveal that MWD has advanced these measures through only one method, a program providing financial incentives to member agencies for implementing the measures. DEIR/S 2-11 to 2-12. G42-15

Although the DEIR/S claims that MWD has embarked on an "ambitious" and "aggressive" program of conservation measures, the detail indicates far more modest past and planned efforts. DEIR/S 2-12 to 2-13. This is astounding given the fact that MWD's service area lies in what naturally is a desert area, the economic and environmental costs of importing water, and the availability of significant additional feasible conservation measures. While the DEIR/S and SEIR/S fail to provide adequate information for an adequate assessment of MWD's past or planned efforts in conservation, what detail is provided undermines the assertions that conservation has been adequately explored or emphasized. G42-16

By way of illustration, the description reveals that MWD's conservation efforts to date have been limited to BMPs developed a decade ago, which boil down to the limited retrofitting of toilets and showers discussed above. Without any explanation or analysis the DEIR/S reports that MWD and its member agencies have decided not to look beyond these dated BMPs and not to G42-17

consider more aggressive implementation of available conservation measures. DEIR/S 2-12. There is a passing reference to "a number of potential" new BMPs, but again no meaningful information is provided about what measures these may apply to or what potential they have for additional conservation savings. The only measures discussed in any even remotely concrete fashion are the residential installation of low-flow toilets and showerheads. DEIR/S 2-12 to 2-13. G42-17

As noted in the comments concerning the Cadiz Project submitted by Frances Spivy-Weber, Executive Director of the Mono Lake Committee, even these limited measures have only been partially implemented, and the vast majority of installations have been in residential households. Although Los Angeles accounts for less than 25% of the land area and less than 50% of the population served by MWD, it accounts for substantially more than half of all low-flow toilets installed in MWD's service area. 2000 LADWP Urban Water Management Plan 12, 18. In contrast, MWD reports that only a paltry additional 600,000 low-flow toilets have been distributed throughout the remainder of its service area. 2000 MWD Urban Water Management Plan, III-3. This clearly indicates that there is an opportunity to promote more aggressive low-flow toilet installation to bring the entire region up to the standard set by Los Angeles. Because the DEIR/S and SEIR/S fail to address, with any specificity or concrete data, the opportunity to raise the level of water conservation through more aggressive installation of low-flow toilets, neither the public nor the Agencies can make an informed, reasoned decision about how much additional water this would save. Nonetheless, it would appear to be at least in excess of 66,000 acre-feet per year by 2020. See Comments on the Cadiz Project of Frances Spivy-Weber, Executive Director, Mono Lake Committee. G42-18

The same discrepancy in installation rates between Los Angeles and the rest of MWD's service area presumably holds true for low-flow showerheads. Again the discrepancy indicates a readily apparent opportunity to increase water conservation through more aggressive installation. However, because neither the DEIR/S or SEIR/S address this discrepancy or discuss the potential to more aggressively pursue installation of low-flow showerheads, neither the Agencies nor the public can have any confidence that the DEIR/S and SEIR/S are based on an accurate or even reasonable assessment of reasonably achievable additional water conservation supplies. G42-19

Further, the DEIR/S and SEIR/S fail to recognize, let alone adequately consider, potential savings from additional reasonably feasible conservation measures such as High Efficiency Clothes Washers and Landscape Evapotranspiration Controllers. These show high promise for increasing the amount of water saved in Southern California. The same is true of more aggressive distribution of low-flow toilets to commercial, industrial, and institutional outlets. Because most of these programs are in the pilot phase reliable precise figures for the amount of water that can be saved are not yet available. However, with marketing it is likely that they could yield savings higher than those from domestic low-flow toilets. See Comments on the Cadiz Project of Frances Spivy-Weber, Executive Director, Mono Lake Committee. G42-20

The DEIR/S claims that MWD has undertaken a number of studies regarding the G42-21

effectiveness of additional conservation actions, but nowhere provides any meaningful detail explaining what measures have been considered and how they were assessed. Thus there is no way for the public or the ultimate decision-makers for this Project to determine the thoroughness or reliability of any such studies, on which the DEIR/S's conclusory assertions about conservation measures are based. DEIR/S 2-12. G42-21

The only other future, or "projected" plans mentioned at all are three vaguely and cursorily described "programs" to support: some home water auditing to evaluate homeowners' water use; a leak detection program that is confusingly described but the development of which appears to be contingent on the results of a vaguely planned water distribution system audit; and a plan to develop a landscape water audit program and financial incentives to encourage member agencies to actually implement some such program. DEIR/S 2-13. These three so-called programs appear in fact to be merely elaborations on existing programs. (The DEIR/S also includes as a "program" a general statement of intent to continue assisting its member agencies in enforcing 1992 plumbing code provisions regarding low-flow toilets and showerheads, id., but such a vague statement of intent to help with the enforcement of extant cade provisions can not seriously be viewed as a new conservation program.) G42-22

For none of these ostensible "new" projected "programs" is any concrete or specific information provided. And nowhere else does the DEIR/S or the SEIR/S describe any new conservation programs MWD plans to implement or the potential savings from each such program. This superficial, incomplete discussion of available additional conservation opportunities clearly reflects a failure to seriously consider potential opportunities for additional conservation savings to reduce future growth in water demand. G42-23

In addition, the consideration of conservation measures is inadequate because it summarily rejects any form whatsoever of rationing on the basis of a conclusory assertion that it "is not a permanent measure and can have significant economic and social costs." Absolutely no information is provided to indicate what if any analysis of rationing was performed. Thus, it appears that absolutely no consideration has been given to such reasonably available measures as every third day watering of lawns, which have successfully been implemented in other metropolitan areas. National Park Service Comments on DEIR/S (DATE). Contrary to the assertion in the DEIR/S, such a limited form of "rationing" as every third day watering of lawns could easily be implemented on a permanent basis, would make eminent sense in a desert climate such as MWD's service area, and would likely yield significant additional conservation savings. The failure to consider such measures at all renders the need and purpose assessment of the DEIR/S and SEIR/S inadequate under CEQA and NEPA. G42-24

Because reasonably available additional conservation measures are not addressed at all, and because virtually no meaningfully detailed information is provided for the measures or plans that are mentioned, it is not possible to assess the basis for the DEIR/S conclusory projection of only 500,000 acre-feet in new conservation savings by 2020. The sense that conservation has not been thoroughly considered is also reinforced by the fact that figures for projected additional G42-25

conservation savings are not clearly attributed and are confusingly, and perhaps contradictorily, thrown out. For instance, while the DEIR/S mentions 500,000 acre-feet in new savings by 2020, in the same breath it defines the projected savings to be accomplished as 164,000 acre-feet per year. DEIR/S 2-14. This raises the question whether 500,000 acre-feet represents the total cumulative additional conservation savings over the next twenty years. That would be an appallingly low goal given the fact that, in its first significant effort at conservation, MWD has accomplished 560,000 acre-feet per year in savings over just nine years under BMPs developed a decade ago. DEIR/S 2-11. G42-25

In addition, the DEIR/S's assertions regarding reduction in per capita demand are inadequately explained and appear to be inconsistent. The DEIR/S claims that the "extension" of existing programs and the implementation of new programs will result in a 13% per capita reduction. There is no explanation of what portion of that 13% will be achieved merely through the continuation of existing programs and what will be achieved through new programs. Nor is this figure backed up with any meaningful data or analysis. These questions are begged by the DEIR/S's earlier assertion that the 560,000 acre-feet per year savings already achieved through existing programs represents a 13% per capita reduction. DEIR/S 2-11 to 2-12. It is patently inconsistent to claim that 560,000 acre-feet per year represents a 13% reduction from current or past consumption and then claim that 500,000 (or perhaps only 164,000) acre-feet per year represents a 13% reduction in the context of projected increased levels of demand 20 years in the future. G42-26

2. State Water Project Supply

A further deficiency in the assessment of need is that it is premised in part on inconsistent statements regarding MWD's water supply form the State Water Project (SWP). Despite the fact that MWD's portion of the current dependable supply from the SWP is 1.14 million acre-feet per year, the DEIR/S project MWD's current dry-year supplies available from the SWP to be only 450,000 acre-feet per year. The only basis for this substantially depressed estimate appears to be general statements that supplies could be less in a critical extended drought and that the SWRCB's current review of existing standards could reduce the amount of water available from the SWP. However, the DEIR/S follows this with an optimistic statement that MWD expects the resolution of SWP water supply problems in the long term. Thus, the estimate of 450,000 acre-feet per year does not appear to be reasonably related to the rest of the information provided regarding MWD's water supply from the SWP. DEIR/S 2-15 to 2-16. Rather, it appears to be contrived in order to inflate the final projection of need. G42-27

3. Water Recycling and Groundwater Recovery Programs:

The purpose and needs analysis also fails to adequately describe or address the opportunities to meet anticipated water demand through water recycling and groundwater recovery programs. Specifically, the DEIR/S and SEIR/S does not discuss the opportunities identified in the Southern California Comprehensive Water Reclamation and Reuse (CWRR) G42-28

Study, a 6-year comprehensive effort to identify regional water recycling systems. The study identified 34 regional projects and estimated that they have the potential to produce approximately 450,000 acre feet per year of new recycled water supply. Because these projects and the potential additional supply they represent are not considered in the purpose and need analysis underlying the DEIR/S and SEIR/S, neither the Agencies nor the public can make an informed decision regarding the actual need for the Cadiz Project. G42-28

4. Storage Potential of Southern California's Groundwater Basins

In addition, the DEIR/S and SEIR/S fail to adequately describe the available water storage potential of groundwater basins in southern California. Because the DEIR/S and SEIR/S fail even to accurately identify the full scope of storage potential, neither the Agencies nor the public can have any confidence that potentially more cost-effective and less environmentally harmful water storage alternatives have been considered. The Association of Groundwater Agencies' guide to conjunctive use of groundwater and surface water in Southern California documents over 21.5 million acre-feet of additional groundwater storage available in southern California groundwater basins, only one million of which comes from the Cadiz Valley. In other words, there are many places other than Cadiz that offer additional groundwater storage capacity, which could eliminate the need for extraction of indigenous groundwater from the Cadiz-Fenner Basin. Because these potential storage alternatives are not even recognized, let alone evaluated, in the DEIR/S or SEIR/S, it is not possible for the Agencies or the public to make an informed judgment as to whether the Cadiz Project represents a reasonable choice among available alternatives. G42-29

Most importantly, the analysis regarding projected storage supply is internally inconsistent and does not support the assessment of need on which the DEIR/S and SEIR/S are premised. In projecting the potential dry-year contribution from virtually all storage programs, the DEIR/S uniformly applies a three-year drought to the storage capacity of each project to arrive at approximately one third of the project's capacity as the estimate of dry-year yield. However, without any justification, the needs analysis suddenly deviates from this uniform approach when it comes to the Hayfield Valley and Cadiz projects. DEIR/S 2-22 to 2-26. G42-30

Without any explanation, the DEIR/S does not estimate the Hayfield Valley Project's dry-year yield as one third of that project's 1.1 million acre-feet storage capacity, which would be approximately 330,000 acre-feet per year. Rather, the DEIR/S assumes only 150,000 acre-feet per year as Hayfield Valley's potential dry-year yield. DEIR/S 2-25 to 2-26. This unjustified deviation from the methodology applied in the rest of the needs analysis is crucial to the needs assessment. If the same method of estimating dry-year supply were applied to the Hayfield Valley Project, that project's contribution to dry-year supply would result in a total dry-year supply from the Colorado River Resource Area of 604,000 acre-feet – 10,000 acre-feet higher than MWD's total target. This reveals that there is in fact no need for the additional Cadiz Project. By substituting this irrationally depressed figure for Hayfield Valley's potential dry-year supply, the DEIR/S improperly manufactures an apparent shortfall of 170,000 acre-feet. G42-31

Interestingly, the DEIR/S also deviates from its general methodology for estimating dry-year supply for the storage component of the Cadiz Project. Again without any justification, the needs analysis does not use 330,000 acre-feet, or one third of the Project's 1 million acre-feet storage capacity, as the Cadiz Project potential dry-year yield from storage. Rather, the discussion inexplicably assumes a yield of only 150,000 acre-feet and, thus, a remaining shortfall of 20,000 acre-feet. DEIR/S 2-26. This creates an apparent need for the component of the Cadiz Project that calls for extraction and transfer of indigenous groundwater. G42-32

Had the same methodology been applied to these two projects as was applied throughout the rest of the needs analysis, it would be clear that there is no need for the Cadiz Project and if there were it would be more than met by the storage component of the Cadiz Project alone. The lack of any justification for these deviations from the otherwise uniform methodology of estimating dry-year yield from projects was further underscored in Jack Safely's presentation at the December 18, 2000 public meeting, in which he reported that the Cadiz Project could withdraw up to 300,000 acre-feet per year during dry years. It thus appears that the estimated dry-year yield from the Hayfield Valley storage project was arbitrarily depressed in order to create the appearance of a need for the Cadiz Project, and that the same was done to the storage component of the Cadiz to create the appearance of a need for extraction of indigenous groundwater. This clearly renders the needs analysis underpinning the DEIR/S and SEIR/S fatally flawed under CEQA and NEPA. G42-33

5. Inadequate Consideration of Metropolitan Water District's Integrated Resource Planning Process

The DEIR/S and SEIR/S are largely premised on the information and analysis contained in the MWD's 1996 Integrated Water Resources Plan (IRP). However, the IRP is expected to be updated by mid-2001, and that updated version will reflect significant positive changes in regional water that have occurred since the 1996 IRP was prepared. In the absence of this updated report it is difficult, if not impossible, to make a reasoned judgment about how much water MWD will need over the next twenty or fifty years. G42-34

6. Inadequate Consideration of Imminent MWD Take or Pay Contracts with its Member Agencies

Over the next year, MWD will be negotiating 5-10 year contracts for water with each of its members. There will be tremendous incentive for members to reduce their dependence on MWD if they can do so cost-effectively through conservation and water recycling. The DEIR/S and SEIR/S fail to consider the potential impact of these imminent negotiations on the demand for additional water from MWD. Without some discussion, it is not possible to make a reasoned or informed judgment about what effect these negotiations will have on MWD's need for water over the next twenty years. G42-35

Both of the imminent updating of the IRP and negotiation of new water supply contracts

with member agencies illustrate why it is premature, at best, for MWD to enter into a long-term contract with Cadiz for water storage and transfer. G42-35

D. The DEIR/S and SEIR/S Fail to Adequately Describe the Cadiz Project and the Physical Conditions and Environmental Resources in its Vicinity

G42-36

A complete, adequate description of a proposed project and the physical conditions and environmental resources in the project vicinity is an essential component of an EIR/S. CEQA Guidelines §§ 15125, 15126.2, subd. (A); Cadiz Land Co. v. Rail Cycle, 99 Cal. Rptr.2d 378 (2000); County of Amador v. El Dorado County Water Agency, 76 Cal. App. 4th 931, 952 (1999).

1. Deficient Description of Recharge Rate

G42-37

The DEIR/S fails to adequately describe the Cadiz Project because it greatly overestimates the natural recharge rate of the groundwater system. It is commonly agreed that groundwater development, or extraction, must not exceed recharge if the development is to be sustainable. Accordingly, the estimate of recharge becomes critical in any analysis of how a groundwater system will perform. Because the estimate of recharge in the DEIS is in error, the predictions of system performance are also in error.

G42-38

The DEIR/S asserts that the annual recharge rate of the Cadiz and Fenner Valleys is in the range of 40,000 to 50,000 acre-feet per year and on that basis suggests that there will be little or no adverse impact on the groundwater system. However, the great weight of the pertinent technical literature shows that the estimate of annual recharge used in the DEIR/S is an order of magnitude too high. A more realistic recharge rate is almost certainly in the range of 5000 - 6000 acre-feet per year. The DEIR/S uses estimates made by GeoScience, a consultancy employed by Cadiz, Inc., which stands to be paid hundreds of millions of dollars if the Project is approved. Those estimates stand in stark contrast to and are an order of magnitude higher than the range of every other estimate of recharge in the Cadiz and Fenner Valley's groundwater system. In making this estimate, Cadiz's consultants used a watershed model that was designed for the County of San Bernardino to size stormwater facilities within the county. This model was not designed to estimate groundwater recharge and when used to do so, it greatly overestimated the recharge.

G42-39

Thus, one of the most basic premises of the Project is seriously flawed. Factoring a more realistic recharge rate into the analysis would make it clear that there will be drawdown of the groundwater and adverse impacts to the surrounding environment from the proposed Cadiz Project. A water budget, prepared by Dr. Bredehoeft, reflecting 50 years of operation of the Cadiz Project along the lines that were assumed by MWD in determining that the Cadiz Project was cost-effective and feasible as compared with other alternatives, shows that project operations would create an overdraft of 1,400,000 acre feet.

The over-estimate of the recharge rate is even more troubling considering the fact that there is evidence that the basin is already overdrafted. A 1996 study by Boyle Engineering concluded that water levels in the vicinity were declining due to existing pumping for irrigation of Cadiz's agricultural operations. Similarly, the court in Cadiz Land Company, Inc. v. Rail Cyle, L.P., 99 Cal. Rptr.2d 378, 389, 392 (Cal. App. 2000), indicated that the system underlying Cadiz is already in a state of overdraft. G42-40

Unlike the DEIR/S, the SEIR/S does not even address the issue of recharge rate. Instead it seeks to side step this fundamental issue by proposing a monitoring and management scheme premised on the notion that project operations would be modified to control adverse impacts as they are observed. This premise is fatally flawed in two regards. First, the future impacts of the Project simply cannot be projected with any accuracy without a sound estimate of the recharge. Second, by the time an adverse impact is detected by the monitoring system proposed on the SEIR/S, the groundwater system will be sufficiently perturbed that even stopping the extraction of groundwater completely will not ameliorate the impacts. The inadequacies of the mitigation and management plan are discussed further in subsequent sections. G42-41

2. Failure to Describe Terms and Conditions of Proposed Right of Way

The description of the Project in the DEIR/S and the SEIR/S is also inadequate because it does not describe/include any of the proposed content/substance of the terms and conditions of any rights of way that BLM plans to grant for the Project. These rights of way may contribute significantly to the Project impacts in part because they will cross through land in the California Desert Conservation Area that are classified as L under the CDCA Plan in order to protect its environmental and cultural values. G42-42

Consequently, the substance of the terms and conditions attached to such rights of way and the mechanisms for enforcement by BLM are a significant part of the picture that must be presented to the public as well as the Agencies to allow informed, reasoned decisions to be made regarding the Project's potential to cause adverse impacts to the environment and the potential effectiveness of proposed mitigation measures.

The failure to include the proposed terms and conditions and the provisions for BLM enforcement runs counter to the goal of both CEQA and NEPA to ensure informed decision-making before a Project is approved, and to reassure the public that the decision-makers have adequately considered the project's potential impacts and provided for their mitigation. Accordingly, the DEIR/S and SEIR/S are deficient under DEQA and NEPA, and the omitted terms and conditions must be included in a future EIR/S that is published for public review and comment.

E. The DEIR/S and SEIR/S Fail to Adequately Assess the Feasibility of the Cadiz Project G42-43

Consideration of feasibility is central to an adequate alternatives analysis under CEQA. See, e.g., Planning and Conservation League, 100 Cal.Rptr.2d at 192. However, neither the DEIR/S and the SEIR/S have adequately considered the feasibility of the Cadiz Project in several regards. G42-43

1. California Groundwater Rights Law

California has a correlative system of groundwater rights. All land owners overlying a common aquifer have the right to use the groundwater beneath their property. These "overlying rights" allow a land owner to take groundwater and make reasonable beneficial use of it on their property. Barstow v. Mojave Water Agency, 5 P.3d 853, 863 (Cal. 2000). As between overlying land owners, the rights are correlative. Therefore, in times of shortage each land owner is limited to her "reasonable share." City of Pasadena v. City of Alhambra, 207 P.2d 17, 29 (Cal. 1949). G42-44

If a groundwater supply contains "surplus water," this water may be appropriated by a private party and transported for use outside of the watershed or basin. Barstow, 5 P.3d at 863. However, "[p]roper overlying use . . . is paramount, and the right of an appropriator, being limited to the amount of the surplus, must yield to that of the overlying owner in the event of a shortage, unless the appropriator has gained prescriptive rights through the taking of nonsurplus waters."[1] City of Pasedena, 207 P.2d at 28-29. G42-45

Under California law, there is a surplus of water only when the basin is not overdrafted. The Supreme Court of California has defined overdraft in terms of the "safe-yield" of the basin. The safe-yield is the amount of water that can be withdrawn annually from a groundwater supply under a given set of conditions without causing a gradual lowering of the groundwater levels resulting eventually in depletion of the supply. City of Los Angeles v. City of San Fernando, 537 P.2d 1250 (Cal. 1975). However, the court has stated that withdrawals may exceed the safe-yield to the extent that the amount will create storage space for "temporary surplus" water normally wasted in wet years. Id. Thus, overdraft occurs and there is no surplus for appropriation when extractions exceed the net recharge rate of the aquifer plus any temporary surplus. G42-46

There have been prior findings that the groundwater system underlying Cadiz is already in a state of overdraft. As Dr. Bredehoeft notes, the 1996 Boyle study concluded that water levels in the vicinity were declining due to existing pumping for irrigation of Cadiz's agricultural operations. In addition, the court in Cadiz Land Company, Inc. v. Rail Cycle, L.P., 99 Cal. Rptr.2d 378, (Cal. App. 2000), observed that, "Although *the CPC and Board conclude the rechargeability of the aquifer water is relatively low and the aquifer is in overdraft*, without knowing the volume of water in the aquifer, it cannot be determined how soon depletion will occur." Id. at 392 (emphasis added). Thus, there is some evidence that there is an overdraft in the basin and that the county has previously recognized this fact. If this is the case, then Cadiz is G42-47

[1]Prescriptive rights are not at issue at this point because Cadiz has not yet begun to transport water out of the basin.

legally prohibited from exporting any indigenous groundwater from the basin to MWD. This would render the "transfer" portion of the Project infeasible.

G42-47

2. Federal Reserved Water Rights

The California Desert Protection Act reserves federal water rights sufficient to fulfill the purposes of the Act for each wilderness area designated by the Act. Pub. L. No. 103-433, § 706(a), 108 Stat. 4471 (1994). This includes five wilderness areas in the vicinity of the Project — Cadiz Dunes Wilderness Area, Clipper Mountains Wilderness Area, Old Woman Mountains Wilderness Area, Sheephole Valley Wilderness Area, Trilobite Wilderness Area. These reserved rights have a priority date of October 31, 1994. In addition the Act requires the Secretary of the Interior and all other officers of the United States to "take all steps necessary" to protect these rights. Id. § 706(b). Similarly, units of the National Park System, including Mojave National Preserve are federal reservations that implicitly have federal reserved rights as of the date of the reservation.

G42-48

These reservations include surface and groundwater. The NPS and BLM have jointly agreed to "participate in local government proceedings that authorize nonfederal parties to withdraw percolating groundwater where such withdrawals may impact water sources within their respective jurisdictions to which federally reserved water rights are attached." Principles Governing Federal Water Rights Under the California Desert Protection Act 2 (1995) (memorandum of understanding signed by representatives of NPS and BLM). In addition, NPS and BLM have agreed to "vigorously defend federally reserved water rights through the state of California process." Id. at 1. Therefore, NPS and BLM are obligated to defend surface and groundwater rights for both the Mojave National Preserve and the BLM wilderness areas.

G42-49

However, neither the draft or supplemental EIR/S have recognized the existence of federal reserved water rights in these areas or have addressed the impacts of a potential drawdown of the aquifer on these rights. There is no discussion of the impact on the natural storage basins underlying the Cadiz dunes. In addition, rather than addressing the impacts of the Project on springs in the Mojave National Preserve and the federally designated wilderness areas, the SEIR/S concludes that the potential impacts to springs are less than significant because the Management Plan contains a program for monitoring and preventing adverse impacts. However, as discussed previously, the actual impacts may take years to observe through monitoring and at that point, it will be to late to mitigate the effects.

G42-50

Further, the impact to reserved water rights in the national park units would violate the National Park Service's Organic Act, which provides for unimpairment of park resources. The National Park Service's Organic Act, in part, charges the Service to "conserve the scenery and natural and historic objects and the wildlife therein . . . in such manner and by such means as will leave them unimpaired for the enjoyment of future generations." All of the alternatives considered are likely to withdraw groundwater supplies to the detriment of the protection of park flora and fauna. The monitoring system in place to prevent such impacts from occurring is

G42-51

inadequate and the public land managers are not permitted to provide the oversight necessary to ensure the protection of federal resources. G42-51

3. The DEIR/S and SEIR/S Fail to Adequately Assess the Project's Cost-Effectiveness

Despite the fact that both the DEIR/S and the SEIR/S declare that the cost-effectiveness of water supply programs is a central concern of MWD, neither document contains an examination of the Project's cost-effectiveness. DEIR/S 2-1. Rather they merely assume that the Cadiz Project is a cost-effective program. SEIR/S 1-1. The complete failure to consider this fundamental issue undermines the DEIR/S's and SEIR/S's assumption of the Project's feasibility. While MWD documents relating to draft principles for the agreement with Cadiz, Inc. speak of a melded cost of approximately $205 per acre-foot of water from the Project, nowhere is the actual present cost per acre-foot to MWD analyzed. G42-52

As Professor Charles Howe, of the University of Colorado, shows in the attached analyses of the Project's basic costs, the actual cost to MWD for water from the Cadiz Project will be far higher than the indicated "melded cost." This is due in part to the fact that the Project is premised on a financial arrangement whereby MWD will provide half of the construction costs ($75 million) and payment for 500,000 acre-feet of indigenous water (approximately $115 million) up front before a drop of Colorado River water is stored and years before any indigenous water is anticipated to be extracted. G42-53

All of Professor's Howe's economic scenarios are distinctly conservative in at least two regards. First, all of them assume that MWD will in fact be able to extract the large volume of native groundwater that were projected in the DEIR/S and which were assumed for purposes of the cost-effectiveness and feasibility analyses of the project. Were the project to be prevented by the proposed monitoring and management plan from taking out as much native groundwater as has been assumed in the DEIR/S's and SEIR/S's feasibility assessment, the costs per acre-foot would, of course, go up dramatically. G42-54

Neither the DEIR/S or the SEIR/S discusses the substantial risk that $150 million will have to be sunk in construction costs for the Project and $115 million will be paid up front for indigenous groundwater that might not be extracted at all if the monitoring and management plan confirms the lower recharge rate that is supported by the vast majority of the technical literature. The failure to acknowledge and consider this risk is irrational and renders the feasibility assessment of the Project fatally deficient under CEQA and NEPA. G42-55

Second, Professor Howe's projections do not factor in the additional costs that will have to be incurred to treat the extracted groundwater for chromium 6 and arsenic under the new standards that have been recommended by California's Environmental Protection Agency's Office of Environmental Health Hazard Assessment and the U.S. EPA, respectively. While these recommended new standards may take a few years to be implemented, they certainly are a G42-56

reasonably foreseeable circumstance, or constraint, that will affect project operations and significantly raise the cost per acre foot of the water to MWD. This has significant implications for the cost-effectiveness, and thus the feasibility, of the Cadiz Project. But neither the SEIR/S or the DEIR/S even identify, let alone evaluate, these foreseeable developments early in the life of the Project or their implications for the Project. G42-56

Even without factoring in those additional foreseeable costs, the analyses that most closely approximate the storage and extraction pattern suggested by the DEIR/S and SEIR/S (namely substantial storage in early years followed by extraction in later years) generate costs ranging from approximately $361 to $785 per acre-foot, far in excess of the cost contemplated in the proposed principles of agreement. See Howe scenarios 1, 1_3, 1_7. G42-57

4. Interim Surplus Criteria for Colorado River Water

The pending Interim Surplus Criteria by the Secretary of Interior will govern how "surplus" water will be declared and diverted for use by the lower basin states (California, Nevada, and Arizona). If there are one or more dry years that lower the reservoirs (which currently is the case) California will receive surplus water, but it will be limited to municipal use and cannot be stored. Therefore, it is not at all certain that they will be able to store the water (or what quantities they would be able to store), undermining the justification for this project. Furthermore, the ISC are only in effect, if promulgated for the next 15 years, and thus 35 years of future storage are even more uncertain. G42-58

Neither the DEIR/S nor the SEIR/S makes any mention whatsoever of the pending Interim Surplus Criteria and the potential for those criteria to prevent storage of surplus Colorado River water. Without considering this reasonably foreseeable barrier to Cadiz Project operations, the Agencies and the public are unable to make a reasoned, informed determination regarding the Cadiz Project's feasibility, and thus its ability to fulfill its purported purpose.

5. Funding Requirements Under Water Quality Bond Issue

Neither the DEIR/S or the SEIR/S consider whether the Project complies with the requirement of section 79181 of the California Bond Issue that is a source of necessary public funds for the Project to be implemented. For instance, there has been no demonstration that the Project will in no way diminish either the quantity or quality of any other overlying landowner's groundwater supplies, as required by section 79181(a). Further, section 79181(b)(2) has the effect of expressly subordinating the extraction of groundwater for the Project to all other existing laws, including the California law and federal reserved water rights discussed above. Thus, the existence of conflicting rights or legal constraints under state and/or federal law regarding the native groundwater in this aquifer raises a serious potential barrier to the allocation of California bond money to this project, which the Agencies have failed to address. G42-59

6. Financial Viability of Cadiz, Inc. G42-60

The feasibility of the Cadiz Project is also thrown in doubt by the fact that the financial solvency of Cadiz, Inc. appears to be extremely tenuous. As shown in Cadiz's own SEC filings, including its 10K and 10Q filings, the company has a debt-equity ration of 84% debt to 16% equity. This demonstrates Cadiz's financial instability, as does the fact that the company has been losing money for some time now. This indicates that Cadiz's agricultural operations are unsuccessful and that the company is hoping to save itself with windfall profits from the Cadiz Project. This impression is reinforced by the fact that Cadiz has never taken any step to carry out its purported plan to expand its agricultural operations in the Cadiz Valley. Rather, since obtaining initial approval to extract water for that expansion in 1993, Cadiz has assiduously sought to export that water from the basin at great profit. G42-60

The Agencies should be hesitant to rely on such a financially unsound company to operate a Project that requires such substantial public investment up-front and that contains considerable unascertained risks of potentially expensive harmful environmental impacts. Certainly, Cadiz appears to be completely unable to bear any of the additional substantial costs that may necessarily be incurred to mitigate the Project's potential impacts. Because it does not contain any consideration of Cadiz's tenuous financial status, the Agencies' assessment of the Cadiz Project's feasibility is uninformed and unreasoned.

F. The DEIR/S and SEIR/S Fail to Consider a Reasonable Range of Alternatives to the Cadiz Project

The California Supreme Court has described the alternatives and mitigation sections as "the core" of an EIR. Citizens of Goleta Valley v. Board of Supervisors, 52 Cal.3d 553, 564 (1990). The DEIR must analyze alternatives to the proposed project. "[A]n EIR for any project subject to CEQA review must consider a reasonable range of alternatives to the project or to the location of the project." Id. at 566; CEQA Guidelines § 15126.6. "The lead agency is responsible for selecting a range of project alternatives for examination and must publicly disclose its reasoning for selecting those alternatives." CEQA Guidelines § 15126.6(a). The key is "whether the selection and discussion of alternatives fosters informed decisionmaking and *informed public participation*." Laurel Heights, 47 Cal.3d at 404 (emphasis in original). G42-61

CEQA also requires the public agency to consider feasible alternatives to the project which would lessen any significant adverse environmental impact. Cal. Pub. Resources Code § 21002, 21081; Planning and Conservation League, 100 Cal. Rptr.2d at 188. "It is the policy of the state that public agencies should not approve projects as proposed if there are feasible alternatives or feasible mitigation measures which would substantially lessen or avoid the significant environmental effects of such projects." Cal. Pub. Resources Code § 21002; CEQA Guidelines § 15021(a). The CEQA Guidelines specifically prohibit the lead agency from approving a project unless all feasible mitigation and project alternatives have been adopted. CEQA Guidelines § 15091 G42-62

The discussion of alternatives in the DEIR/S and SEIR/S fails to consider a reasonable range of alternatives to the Cadiz project. Thus, the discussion is inadequate for the purpose of providing for informed decision making. In addition, the alternatives discussed fail to avoid significant environmental effects, and therefore violate CEQA. As discussed above in the purpose and need section, the DEIR/S and SEIR/S have failed to include such reasonable alternatives as conservation, water recycling and groundwater recovery, and storage alternatives. Instead, all of the alternatives analyzed are just basic variations of the same project. This narrow focus does not constitute a reasonable range of alternatives. G42-63

In addition, the DEIR/S and SEIR/S fail to consider the Ward Valley alternative. Ward Valley has a storage capacity of 14 million acre feet and is 10 miles closer to the Colorado River Aqueduct than the Cadiz Project site. According to the technical feasibility report prepared for MWD in May 1998, a Ward Valley alternative would be comparable in pretty much all other respects. It was summarily disqualified because it was the proposed site for the low-level radioactive waste disposal site. But that proposal appears to be in the process of dying due to the fact that the proposed site is in an area that is sacred to local Indian tribes. Because it appears likely that the nuclear waste site for Ward Valley is in the process of being dropped, it is unreasonable for the Agencies to exclude it from their consideration of Colorado River water storage alternatives. G42-64

G. The DEIR/EIS and SEIR/EIS Fail to Evaluate Fully the Impacts of the Cadiz Project

Under NEPA, an agency must honestly address the various uncertainties surrounding the scientific evidence upon which it relies in its environmental evaluations. The agency has a duty to respond to credible opposing points of view, and it may not ignore reputable scientific opinion. See, e.g., Seattle Audubon Soc'y v. Espy, 998 F.2d 699, 704 (9th Cir. 1993); Public Service Co. v. Andrus, 825 F. Supp. 1483, 1496-99 (D. Idaho 1993); see also Sierra Club v. Watkins, 808 F. Supp. 852, 864-69 (D.D.C. 1991). An agency's NEPA analysis must expose scientific uncertainty regarding the risk of a proposed action and inform decisionmakers of the full range of responsible scientific opinion on the environmental effects of the proposed action. Friends of the Earth v. Hall, 693 F.Supp. 904, 926, 934 (W.D. Wash 1988). Also, federal agencies are responsible for overseeing and ensuring the accuracy of environmental impact statements produced by contractors. 40 C.F.R. § 1506.5(c). G42-65

The CEQA Guidelines provide that, in discussing the environmental effects of a project, the EIR must include "a sufficient degree of analysis to provide decision-makers with information which enables them to make a decision which intelligently takes account of environmental consequences." CEQA Guidelines § 15151. When the failure to include relevant information precludes informed decision-making and informed public participation, the certification of the EIR constitutes a prejudicial abuse of discretion. Id.; Kings County Farm Bureau v. City of Hanford, 221 Cal.App.3d 692, 712 (5th Dist. 1990). "Certification of an EIR which is legally deficient G42-66

because it fails to adequately address an issue constitutes a prejudicial abuse of discretion regardless of whether compliance would have resulted in a different outcome." Citizens to Preserve the Ojai v. County of Ventura, 176 Cal. App. 3d 421, 428 (1985). G42-66

"[T]he CEQA process demands that mitigation measures timely be set forth, that environmental information be complete and relevant, and that environmental decisions be made in an accountable arena." Oro Fino Gold Mining Corporation v. County of El Dorado, 225 Cal.App.3d 872, 884-885 (3d Dist. 1990). "Mitigation measures must be *fully* enforceable through permit conditions." CEQA Guidelines § 15126.4(a)(2) (emphasis added). G42-67

"Where several measures are available to mitigate an impact, each should be discussed and the basis for selecting a particular measure should be identified." CEQA Guidelines § 15126.4(a)(1)(B). "A legally adequate EIR must contain sufficient detail to help ensure the integrity of the process of decisionmaking by precluding stubborn problems or serious criticism from being swept under the rug." Kings County, 221 Cal.App.3d at 733. G42-68

An agency violates CEQA if it approves a project as proposed when there are feasible mitigation measures available that would substantially lessen any significant environmental effects of the project. Pub. Res. Code § 21002; CEQA Guidelines § 15021(a)(2). A finding of infeasibility cannot be supported simply because the alternative is more costly. "The fact that an alternative may be more expensive or less profitable is not sufficient to show that the alternative is financially infeasible. What is required is evidence that the additional costs or lost profitability are sufficiently severe as to render it impractical." Citizens of Goleta Valley v. Board of Supervisors, 197 Cal.App.3d 1167, 1181 (2d Dist. 1988). G42-69

1. The DEIR/S and SEIR/S Impermissibly Defer the Identification and Evaluation of Potential Environmental Impacts and the Measures to Mitigate Such Impacts

The Groundwater Monitoring and Management Plan (GMMP) proposed in the SEIR/S is inadequate because it impermissibly defers the identification and evaluation of environmental effects and potential environmental effects from the Project to some future date. Such a deferral is inconsistent with the reviewing agencies' duties under NEPA and CEQA. In addition, the GMMP is ineffective for several reasons. First, this approach taken does not take into account the long term response of the groundwater system to the Project. Second, the two committee procedure set up for addressing mitigation is fundamentally flawed. Finally, the proposed remedial actions are illusory. G42-70

a. Deferral of Environmental Analysis

Rather than address any of the potential environmental impacts of the Cadiz Project or modify the Project to eliminate or lessen those impacts, the Agencies have deferred any actual consideration of potential environmental impacts until they manifest themselves during the life of G42-71

the Project. The SEIR/S proposes that the fundamental issue of recharge rate be left unresolved and that potential impacts be addressed as they occur by two committees under a "monitoring and management plan." This deferral of actual consideration of environmental impacts and establishment of the critical issue of recharge violates CEQA and NEPA. G42-71

Deferring assessment of environmental impacts to a future date runs counter to the policy of CEQA that requires environmental review at the earliest feasible stage in the planning process. Cal. Pub. Resources Code § 21003.1; Sundstrom v. County of Mendocino, 248 Cal.Rptr. 352, 358 (Cal. App. 1988). Environmental problems should be considered at a point in the planning process "where genuine flexibility remains." Mount Sutro Defense Committee v. University of California, 143 Cal.Rptr. 365 (1978). Studies conducted after approval of a project will inevitably have a diminished influence on decision making and, even if subject to administrative approval, such studies are "analogous to the sort of post hoc rationalization of agency actions that has been repeatedly condemned in decisions construing CEQA." Sundstrom, 248 Cal.Rptr. at 358; No Oil, Inc. v. City of Los Angeles, 118 Cal.Rptr. 34 (1974). G42-72

Similarly, it is improper for a lead agency under CEQA to defer formulation of mitigation programs by simply requiring some other body to conduct future studies to determine if mitigation is necessary and feasible. Fairview Neighbors v. County of Ventura, 82 Cal.Rptr.2d 436 (1999). Therefore, the deferral of analysis of environmental impacts to the mitigation plan is not allowed under CEQA. G42-73

The postponement of gathering essential information for an evaluation of the Project's potential adverse impacts thwarts public review and also violates NEPA's fundamental commitment to "prevent or eliminate damage to the environment by focusing government and public attention of the environmental effects of proposed agency action." Marsh v. Oregon Natural Resources Council, 490 U.S. 360, 371 (1989). NEPA requires the federal agency to "consider every significant aspect of the environmental impact of a proposed action" Vermont Yankee Power Corp. v. Natural Resources Defense Council, 435 U.S. 519, 553 (1978), and to ensure "that the agency will inform the public that it has indeed considered environmental concerns in its decision making process." Baltimore Gas and Electric Company v. NRDC, 462 U.S. 87, 97 (1983). G42-74

NEPA requires that mitigation measures be reviewed in the NEPA process -- not in some future decision shielded from public scrutiny. "[O]mission of a reasonably complete discussion of possible mitigation measures would undermine the 'action-forcing' function of NEPA. Without such a discussion, neither the agency nor other interested groups and individuals can properly evaluate the severity of the adverse effects." Robertson v. Methow Valley Citizens Council, 490 U.S. 332, 353 (1989). Appellate Courts have explicitly struck down EISs that rely on unspecified future actions to mitigate or avoid environmental impacts. Oregon Nat. Resources Council v. Marsh, 52 F.3d 1485 (9th Cir. 1995) (Elk Creek Dam III); Oregon Nat. Resources Council v. Marsh, 832 F.2d 1489, 1493 (9th Cir. 1987) (Elk Creek Dam I), rev'd on other grounds, 490 U.S. 360 (1989); California v. Block, 690 F.2d 753 (9th Cir. 1982). G42-75

b. Long Term Effects

The persistent dynamic response of the groundwater system to drawdown has profound implications for the monitoring and management scheme proposed in the SEIR/S. Indeed, it strongly indicates that the monitoring and management system will not work. As discussed previously, the Project is estimated to result in an overdraft of 1,400,000 acre feet. Yet, there has been no analysis of the long term impacts on the groundwater system in the DEIR/S or SEIR/S. G42-76

The likely long-term response to the groundwater system to the proposed extraction of native groundwater has been analyzed by Dr. John Bredehoeft (study attached). He concludes that once the groundwater system is perturbed the effects of the perturbation from pumping will ripple outward though the system slowly with great persistence. The drawdown from pumping will migrate slowly outward from the area of the pumping wells and will continue to decline at some distance from the wells for many years, even after pumping has stopped. Thus, the adverse impacts will persist for well over a century even if groundwater extraction is stopped after 50 years or earlier. Consequently, even subtle indications of adverse impacts will not be observed for several decades. As a result, once an adverse impact to the system is observed by the proposed monitoring system, it will be too late to reverse the impact by stopping the pumping. G42-77

An analysis of the groundwater system's long term response to the proposed pumping, by Dr. Bredehoeft, reveals that the impacts from the drawdown will persist well beyond 100 years.

At 100 years the drawdown beneath Bristol Lake will be twice as severe as it was at year 50 when the Project is stopped. This drawdown will reduce or eliminate groundwater discharge from major parts of Bristol Lake, which will tend to dry out the lakebed and lead to increased generation of dust from the lake area. The drawdown from the Project operations will also cause the brine to move from under Bristol Lake toward the cone of depression and the project site. This will take time to occur because the cone of depression moves slowly outward from the Project, but once the brine starts moving it will be extremely difficult, if not impossible, to stop.

Thus, at a monitoring well halfway between the lake and the project site only a slight increase in dissolved solids will be observed after 30 years of project operations, and by year 50 when operations stop the water would still be useable. By 100 years, long after project operations and monitoring has stopped the concentration of dissolved solids will have risen to 7,500 mg/l, *and it will still be increasing.*

At a monitoring well near Danby there would be almost no drawdown after 40 years of project operations. When the project ends, after 50 years, the drawdown would only be about 3 feet. But, as Dr. Bredehoeft has illustrated, that is only the beginning. In 100 years, long after projected operations and monitoring have stopped, the drawdown will have more than tripled to 10 feet and the water level will still be continuing to decline. Thus, it is clear that at 100 years the

drawdown will be continuing to migrate up Fenner Valley to the north. G42-77

The slow migration of the drawdown from the Project may also impact springs in the surrounding mountains, with the Marble Mountains most likely to be impacted. These mountains are home to the largest population of bighorn sheep in this region of the Mojave, a population that plays a critical role in sustaining other small sheep populations in the surrounding mountain ranges. G42-78

In addition, even if the extraction is stopped, the drawdown beneath the northern part of Cadiz Lake in the vicinity of the Cadiz Dunes Wilderness Area will continue to increase for many years. The drawdown in this area will greatly reduce or eliminate groundwater discharge to the wilderness area. G42-79

The long term nature of the impacts also suggests that the early warning signs will be subtle. However, the considerable up front investment in the Project makes it unlikely that subtle early warning signs will be heeded.

The Cadiz Project entails a substantial investment of public funds to build the required facilities and for an up front advance payment by MWD to Cadiz, Inc. for 500,000 acre-feet of native groundwater before project operations have even commenced. All told, $150 million will have been invested in the construction of facilities and approximately $115 million will have been paid up front by MWD for future deliveries of extracted native groundwater. G42-80

Close monitoring of water levels and quality in the groundwater system may provide some early warning that the project is creating adverse environmental impacts even though these impacts may be impossible to stop. However, early warning signs of adverse impacts will be very subtle and small drawdowns due to the Project could easily be confused with impacts of nearby pumping or unusual climatic events. Because of the potential for long lasting effects, the Project would have to be halted very early on in order to prevent the significant adverse impacts discussed above. Given the enormous investment of funds necessary before project operations even begin, it is implausible to expect that the Cadiz Project would be shut down early in its life where indications of impacts are subtle.

c. Monitoring Committees

The SEIR/S sets up a system where mitigation decisions are made by two committees. SEIR/S 3-70 to 3-72. Before any action could be taken to remedy or mitigate an environmental impact, the first committee, the "Technical Review Team," would have to determine by consensus that such an impact had occurred or was beginning to occur. SEIR/S 3-70 to 3-71. Then, that committee would report to the second committee, the "Basin Management Group," which would consider whether to accept the first committee's report, whether to take any kind of remedial action, and what kind of remedial action to take. The second committee also is to reach its decisions by consensus. SEIR/S 3-71 to 3-72. This procedure alone would guarantee delay in recognizing and responding to any environmental harm caused by the Cadiz Project's depletion of G42-81

the aquifer. G42-81

Even worse, the make-up of the committees virtually guarantees that no meaningful remedial action would ever be taken. Both committees are to have representatives from Cadiz, the MWD, the County of San Bernardino, and the BLM. SEIR/S 3-70, 3-71. However, the BLM's role is limited to that of a passive observer. Thus, of the three voting members on each committee, two are wielded by the Project's proponents: Cadiz, the company with a direct financial interest in maximizing the amount of water that is extracted and sold to the MWD; and the MWD, which will have invested close to $200 million in the Project before operations even commence. The only voting member of each committee that will not have a financial interest in maximizing the extraction of native groundwater will be the County's representative, who will always be outnumbered. Thus, the committees that control the entire process of acknowledging environmental impacts and deciding how to respond to such impacts have been structured so as to favor continued extraction of indigenous groundwater. G42-82

d. Remedial Actions

For each potential impact that is recognized, but not analyzed, the monitoring and mitigation plan provides for the same four vaguely defined potential remedial actions. SEIR/S 3-51 to 3-68. These potential remedial actions are clearly illusory and will not provide for adequate mitigation. G42-83

One of the potential remedial actions would be moving the extraction wells. This action plainly would do nothing to alleviate the environmental impacts from depletion of the aquifer because the relocated wells would continue to extract water from the same aquifer. Although it might alleviate the immediate impacts in a particular area, this "solution" would just move the impacts to another area and would do nothing to mitigate against long term impacts. G42-84

Another potential remedial measure, which is consistently presented as the ultimate solution to any genuinely problematic impact, would be to pump Colorado River water into the aquifer. This purported solution plainly would be impossible under the terms of the proposed Project. By definition under the terms of the proposed Project, as long as there is "excess" Colorado River water available it will be stored in and withdrawn from the aquifer as needed. When there is not enough Colorado River water, then native groundwater will be extracted. Further, the draft and supplemental EIR/S both state that, starting in the near future and for the bulk of the Project's life, southern California will not have enough Colorado River water to satisfy its demands. It is under these circumstances that the extraction of native groundwater and the depletion of the aquifer and the harmful impacts from such depletion will occur. It is transparently disingenuous to suggest that in such a situation, where the MWD already has inadequate Colorado River water for its own needs, massive quantities of Colorado River water would be pumped into this desert groundwater basin at great cost. Again, deep in the life of the project, when the impacts will be the most apparent, the availability of surplus water for California is totally unpredictable and much less likely, given the expiration of the interim criteria and the G42-85

lower reservoir levels predicted in the ISC FEIS. G42-85

The other two potential remedial measures are, in fact, one: to reduce or halt extraction of native groundwater from the aquifer. Unlike simply moving the extraction wells around, this measure would at least slow or halt continued depletion of the aquifer. Although this measure is at least theoretically possible, it is not plausible that Cadiz and the MWD would vote to discontinue pumping unless they were legally compelled to do so, given their enormous up-front investment in the Project. Further, as the vast majority of the scientific studies make clear, the rate at which the aquifer would replenish itself is extremely slow. Thus, realistically, the best remedial action offered by the "monitoring and management plan" would do nothing better than allow nature to take centuries or millennia to reverse the harm caused by the project's depletion of the aquifer. (As an added note, even over the course of millennia, the aquifer will not be able to undo the effects of ground subsidence that may be caused by extracting so much native groundwater.) G42-86

Thus, it is clear that the so-called "monitoring and mitigation plan" is structured so as minimize the chance of harmful impacts being acknowledged, let alone responded to, and that the purported remedial measures that could be implemented are illusory. G42-87

2. The DEIR/S and SEIR/S Fail to Address Adequately Potential Impacts to the Aquifer/Groundwater Basin Underlying the Project

As discussed in previous sections, the DEIR/S and SEIR/S inadequately address the relevant recharge rate for the groundwater system. Thus, there is tremendous potential for drawdown of the aquifer, the effects of which will be felt throughout the area. For example, as discussed above, there may be brine movement toward the Project site. In addition, the water resources of surrounding wilderness areas, national park units, and mountain areas may be affected. The DEIR/S and SEIR/S fail to adequately address these impacts. G42-88

3. The DEIR/S and SEIR/S Fail to Adequately Evaluate Potential Impacts on Air Quality

As detailed in the attached review by Dr. John Gillies of the Desert Research Institute the DEIR/S and the SEIR/S do not contain sufficient data or analysis to allow critical decisions to be made regarding the potential impacts to air quality from the Cadiz Project. Critical areas of concern that have not been adequately addressed are: 1) the potential for drawdown of the brine layer beneath Bristol and Cadiz lakes that will lead to increased dust emissions; 2) the failure to consider the potential for dust emissions from the spreading basins; and 3) the failure to recognize that the impacts to sand and dune areas are likely to expand and result in sand blowing onto the playas of Cadiz and Danby lakes causing increased potential for dust emissions. G42-89

Further, the proposed monitoring system and mitigation measures are inadequate to accurately detect dust emission processes or mitigate such impacts because: 1) the instrumentation and measurements proposed are inadequate, 2) the time period for proposed monitoring is too short to reveal potential impacts or compliance with National Ambient Air Quality Standards, 3) the proposed plan for dealing with dust emissions, namely the assumed ability to manipulate the level of the brine layer, is completely ineffective as a dust control measure; 4) the management and monitoring program fails to explore other types of control strategies to mitigate the potential dust problem or to address the associated costs, and 5) the monitoring plan is insufficient to address the impacts on the Mojave National Preserve.

G42-90

a. Inadequacy of analysis of dust emissions

The DEIR/S and SEIR/S fail to adequately assess the potential for dust emissions from Bristol and Cadiz lakes caused by the Cadiz Project. For instance, an analysis of the surface sediment characteristics and the brine water chemistry of Bristol and Cadiz lakes is necessary for an understanding of the potential for the lake beds to become susceptible to dust emissions. However, there is no information regarding the chemical composition of the brine beneath Bristol and Cadiz lakes or the surface crust on the lake beds. Similarly, a comparison with conditions at Owens Lake, where the drying out of the lake bed has caused enormous dust emissions, would be the most logical method of ensuring better informed predictions regarding potential dust emissions form Bristol and Cadiz lakes, but no such comparison has been considered.

G42-91

The DEIR/S and SEIR/S also completely fail to address potential dust emissions from the Project's spreading basins. The DEIR/S makes the conclusory assertion that the spreading basins will not contribute significantly to dust emissions in the surrounding environment. In fact, as Dr. Gilles has explained for at least two reasons, there is a high probability of emissions from the spreading basins at levels significantly greater than the DEIR/S and SEIR/S suggest. First, the basins will regularly accumulate substantial amounts of sediment. The removal and handling and storage of these large amounts of fine-grained sediments would produce significant amounts of dust and raises concerns about how this material would be stored to prevent it become an additional source of dust.

G42-92

Thus, estimates for the sediment yield in the spreading basins are critical to determine the impacts on air quality based on the scale of the removal and handling operations and the actions required to safely store this material in a manner that does not leave it susceptible to entrainment by the wind. However, neither the DEIR/S or SEIR/S provide any estimate of the amount of sediment that would have to be removed from the spreading basins. Consequently, the assertion regarding the impact of its removal on air quality is highly speculative.

In addition, the statement in the DEIR/S, at 33, that the basins will not contribute higher levels of dust when they are not filled with water than the surrounding desert land is extremely dubious. This is so because the fine-grained sediment that will have accumulated on the surface of the basins will likely be inherently more susceptible to wind erosion and dust emissions than the

G42-93

surrounding desert lands that are characterized by a degree of surface armoring. The spreading basins also will be devoid of vegetation, which will make them more likely to omit dust at lower wind speeds than surrounding desert surfaces. These factors have not been addressed in either the DEIR/S or the SEIR/S and are directly at odds with the conclusory assertion in those documents that the basins will not emit significantly more dust than the surrounding desert. G42-93

Finally, it is clear from the DEIR/S that construction of the conveyance facilities for the Project will both temporarily and permanently disturb significant areas within the Cadiz Dunes. These sandy soil types are extremely sensitive to wind erosion and their disturbance can create significant degradation of the local and regional environments. There is a high probability that the disturbance will expand beyond the initial zone of disturbance as sand is blown by the winds. Because neither the DEIR/S nor the SEIR/S provide any information about what criteria were used or how they were applied to determine the size of disturbed sandy areas, neither the Agencies nor the public can have any certainty about the reliability of the estimates presented. G42-94

The disturbed sandy areas pose a second potential problem beyond the degradation of the dunes themselves. The disturbed sand will be susceptible to being blown onto the Cadiz and Danby lakebeds where it could cause significantly increased dust emissions. Both the DEIR/S and the SEIR/S completely fail to address this potential adverse impact to air quality.

b. Inadequacy of Monitoring Plan

The monitoring plan proposed in the SEIR/S is deficient because the mitigation measures are inadequate to accurately detect dust emissions or mitigate such impacts.

First, the proposed instrumentation for the monitoring network is plainly inadequate. As Dr. Gilles points out the proposed exclusive use of nephelometers would assure high levels of uncertainty in assessing particulate matter loading. Because compliance with air quality standards depends on actual measurement of particulate matter, the plan should use of instrumentation in accordance with Federal Reference Method, or accepted equivalent, to ensure that it adequately monitors relevant conditions on the playas. G42-95

In addition, the monitoring plan does not provide for any measurement of saltation activity on the lake beds. Yet saltation is the key component of the dust emission process, effectively driving most of the dust emissions. G42-96

Another deficiency of the air quality monitoring and management program is that it is proposed for approximately 5 years. This short time period makes no sense because data from the first five years of project operations will not reveal trends in air quality resulting from impacts of the Cadiz Project. The 5 year time period is too short to reveal potential project impacts for several reasons: 1) short-lived effects from the construction phase could be misconstrued as being representative of future conditions; 2) cyclical weather patterns such as the El-Nino- Southern Oscillation (ENSO), which can bring increased precipitation levels to the Mojave, may G42-97

temporarily ameliorate or mask Cadiz Project effects through several years; and, most importantly; 3) the long-term impacts of the drawdown of the brine layer beneath Bristol and Cadiz lakes that may result in increased dust emissions almost certainly will not manifest themselves until after the first 5 years of the Project. G42-97

Further, the limited corrective measures proposed in the SEIR/S to ameliorate potential impacts that lead to dust emissions are not adequate. None of the proposed mitigation measures can provide the means to control a weather driven process like dust emissions.

As Dr. Gilles points out, in order to use the brine layer to mitigate the dryness of the lakebeds and dust emissions, a management plan would have to be developed that would ensure the brine layer was effectively contributing sufficient moisture to the surface layer when the lakebeds were most susceptible to wild erosion. Gilles, at 4. This has not been done. Further, the brine layer cannot be effectively manipulated via the groundwater system to mitigate potential dust emissions because the groundwater system cannot respond quickly enough. Even if pumping were stopped or fresh water were pumped into the groundwater system, there almost certainly would be a time lag of months or years before the desired response in the brine layer could be expected. Thus, these measures plainly would not be effective in responding to weather conditions likely to cause increased dust emissions, which would require responses within hour or a few days at the longest. Moreover, given the demands for water extraction from the Project and the economics of maintaining the cost-effective water delivery schedule, it is implausible that thee corrective measures would be implemented. G42-98

Before the Cadiz Project is initiated, the Agencies must design concrete mitigation actions desired to minimize dust emissions from Cadiz and Bristol lakes. The actions presently being carried out at Owens Lake appear to be the best and most obvious model for appropriate measures to control dust emissions from the playas. The costs associated with an effective dust control system on a playa are quite substantial; the cost of a pilot system at Owens lake for a much smaller area that the potentially affected are of Bristol and Cadiz lakes is in the vicinity of $60 million. The DEIR/S and SEIR/S have failed to consider the large potential costs involved in developing and implementing an effective system for the management and control of potential dust emissions, or who will bear those costs. G42-99

Finally, the SEIR/S, at 3-11, recognizes that the air quality in the Mojave National Preserve is a critical resource. However, the monitoring under the plan is geared towards Joshua Tree National Park and not the Mojave National Preserve. This inconsistency in the monitoring and mitigation plan must be corrected. G42-100

Until these concerns are adequately addressed, the Agencies cannot make a reasoned, informed determination of the Cadiz Project's potential to cause significant adverse impacts to air quality and the potential future costs associated with the mitigation of those problems. G42-101

4. <u>The DEIR/S and SEIR/S Fail to Adequately Assess Impacts to the Desert</u> G42-102

Tortoise Population in the Vicinity of the Project

The draft and supplemental EIR/S fail to adequately address the impacts of the Project on the desert tortoise, a Federal and State listed endangered species, as discussed in the January 4, 2001 comments of Dr. Michael Connor, executive director, Desert Tortoise Preserve Committee. In addition, neither document adequately addresses the implications of § 7 and § 9 of the Endangered Species Act.

G42-102

Neither the draft or supplemental EIR/S mention the potential for increased predation of the desert tortoise due to the addition of water sources that will attract ravens. Ravens are a significant predator for juvenile tortoises. Desert Tortoise (Mojave Population) Recovery Plan 6 (1994). The Project will result in the addition of 390 acres of spreading basins in the project area. The Fish and Wildlife Service has recognized that "artificial sources of food and water help sustain more individuals during times of resource shortage." Id. at App. D, pg. 34. Thus, the addition of these water sources will lead to increased raven populations in the Project area. In addition, the recovery plan recognized that raven populations are already increasing in the Fenner Valley. Id. at App. F., pg. 11. The increase in raven populations and the resulting increased predation on juvenile tortoises is a significant impact that has not been addressed through the NEPA/CEQA process.

The supplemental EIR/S includes new proposals for construction of observation wells that are not evaluated for their impacts on the desert tortoise or its designated critical habitat. Many of the proposed observation wells are within or along the boundary of designated critical habitat. The proposed observation wells to the east of the spreading basin lie within the Chemehuevi Critical Habitat Unit. In addition, many of the observation wells proposed to the north of the basin lie in and along the Fenner Valley within the Piute-El Dorado Critical Habitat Unit of the Eastern Mojave Desert Tortoise Recovery Unit. The failure to consider the impacts on the desert tortoise is particularly troubling considering a recent survey by the U.S.G.S. in a study plot in the Fenner Valley. The survey indicated that the population of the desert tortoise has undergone a severe decline and only ten to fourteen percent of tortoises registered in prior surveys remained.

G42-103

5. The DEIR/S and SEIR/S Fail to Adequately Address Potential Impacts on Bighorn Sheep Populations in the Vicinity of the Project

The DEIR/S and SEIR/S contain inadequate consideration of potential impacts to bighorn sheep from the Project. Indeed, the DEIR/S considered only potential direct impacts to bighorn sheep from the construction of facilities for the Project and in the specific areas where these facilities would be located. The DEIR/S failed to acknowledge potential impacts from the Project drawdown of native groundwater on springs in the mountains with the vicinity of the Project. Consistent with that failure, the DEIR/S contained no discussion of how potential impacts to those springs will affect local populations of bighorn sheep.

G42-104

The SEIR/S nominally acknowledges the potential for impacts to the mountain springs but

defers any substantive discussion of such impacts or potential mitigation measures to ameliorate such impacts to some future date and to the committees that will implement the Monitoring and Management Plan. Thus, neither the DEIR/S or the SEIR/S actually considers the potential impacts to bighorn sheep from the Project's potential to lower or eliminate the water flow from surrounding mountain springs. G42-104

Surface water is extremely scarce in the Mojave Desert and consequently the bighorn sheep are heavily dependent for survival on the few existing springs in the mountains surrounding the Cadiz Project. Consequently, the potential impact of the Project on the groundwater system that supports those springs has significant implications for the bighorn sheep metapopulation in the region surrounding the Project site and possibly the adjacent metapopulation to the north.

As noted by Dr. Bredehoef, the mountain springs most likely to be impacted by the Project are those in the Marble Mountains. Dr. John Wehausen, of the white Mountain Research Station, has explained that the mountains surrounding the project site contain a system of interacting bighorn sheep populations that partially make up the South Central metapopulations. The largest of the populations in the Marble Mountains. This population plays a critical role in sustaining other local populations in the bighorn sheep metapopulation surrounding the Project site. G42-105

If the extraction of indigenous groundwater from the basin causes the springs in the surrounding mountain ranges to dry up, or greatly reduces their flow, bighorn sheep populations in those ranges can be expected initially to shrink to small numbers. The probability of extinction increases with declining populations size. Eventually, this is likely to head the collapse of at least this portion of the South Central Metapopulation of bighorn sheep in the Mojave Desert as the small local populations go extinct and are not recolonized because of the small number of total sheep in the region.

6. <u>The DEIR/S and SEIR/S Fail to Adequately Evaluate Potential Impacts on Wilderness Areas and Mojave National Preserve and Joshua Tree National Park</u>

If the drawdown of groundwater dries out the lake beds and causes large scale dust emissions, this is likely to cause dramatic adverse impacts to air quality in some or all of the five wilderness areas that surround the project site, the Mojave National Preserve, and possibly Joshua Tree National Park. The DEIR/S failed to acknowledge, let alone address, these potential air quality impacts. Although the SEIR/S contains a cursory mention that concerns have been expressed regarding such potential impacts, it too fails to engage in any substantive discussion of the nature and level of such impacts and the specific measures that would be implemented to mitigate them. Rather, the SEIR/S defers meaningful discussion of such potential air quality impacts and their mitigation to the future and delegates decisions regarding the likelihood, severity, and appropriate response to such impacts to the two committees that will be responsible for implementing the monitoring and management plan. This deferral and delegation by the Agencies violates both CEQA and NEPA and runs counter to those statutes' fundamental goal of G42-106

ensuring informed decision making by Agencies before a projects is implemented. G42-106

In addition, the Project is likely to cause impacts to water resources in these wilderness areas and park units as discussed above. G42-107

7. The DEIR/S and SEIR/S Fail to Adequately Address Potential Water Impacts Related to Water Quality

a. Inconsistencies in addressing water quality impacts

In discussing the water quality impacts to the native groundwater associated with introducing Colorado River water, the draft and supplemental EIR/S both state that the additional total dissolved solids (TDS) and perchlorate that will be added to groundwater will not have significant impacts because mixing will not occur and most of it will be pumped back out during extraction operations. DEIR/S, at 5-94, 5-95; SEIR/S, at 6-2, 6-3. However, the DEIR/S indicates that the quality of the indigenous groundwater will be improved for nitrate through mixing and dilution with the Colorado River water. DEIR/S, at 5-96. The documents fail to explain how mixing and dilution will occur with respect to pollutants that exist in lower levels in the Colorado River water than in the native groundwater, but will not occur for pollutants that exist in higher levels in the Colorado River water than in the native groundwater. G42-108

b. Required Report Concerning Waste Discharges to Groundwater under California's Porter-Cologne Water Quality Control Act

The Porter-Cologne Water Quality Control Act, CA Water Code §§ 13020-13983, requires any person discharging or proposing to discharge waste that could affect either surface or ground water quality to file a report with the appropriate Regional Water Quality Control Board. Id. §§ 13260, 13050(e). The Act defines waste as "sewage and any and all other waste substances, liquid, solid, gaseous, or radioactive, associated with human habitation, or of human or animal origin, or from any producing, manufacturing, or processing operation, including waste placed within containers of whatever nature prior to, and for purposes of, disposal." CA Water Code § 13050(d). G42-109

Because Colorado River Water contains substances that would be considered waste under the Porter-Cologne Act, MWD/Cadiz should be required to file a report with the Regional Board. The Cadiz Project will increase the TDS in the native groundwater in two ways. First, the infiltration of Colorado River water will dissolve salts in the upper parts of the unsaturated zone and transport them to the indigenous groundwater. DEIR/S, at 5-94; SEIR/S, at 6-2. Second, Colorado River water contains twice the concentration of TDS as native groundwater and is expected to contribute 1,015,532 tons of TDS over the life of the Project. DEIR/S, at 5-95, 5-96; SEIR/S, at 6-3. Finally, the Project would introduce perchlorate, found in Colorado River water, to the indigenous groundwater. DEIR/S, at 5-95; SEIR/S, at 6-3. Because the project will result in discharge of these wastes to groundwater of the state, MWD must file a report with the

Regional Board.

There is no evidence in either the draft or supplemental EIR/S that MWD has filed or intends to file this report. The section of the draft EIR/S that discusses permits and/or approvals does not mention this requirement and is therefore incomplete.

G42-109

c. The Project will lead to impermissible degradation of the water quality of native groundwater under the Porter-Cologne Act.

The Porter-Cologne Water Quality Control Act, CA Water Code §§ 13020-13983, establishes a coordinated statewide program of water quality control overseen by the State Water Resources Control Board and administered by nine regional boards. The Cadiz basin falls within Region 7—the Colorado River Basin. The Colorado River Basin Regional Water Quality Control Board has adopted a Water Quality Control Plan ("Basin Plan"). The proposed discharges of Colorado River water into the Cadiz basin violates this Plan and the policy of the State Water Resources Control Board.

The State Water Quality Control Board has adopted a policy, which has been incorporated in the Basin Plan, to protect waters that are of a better quality than required by existing policies. The resolution states:

G42-110

1. Whenever the existing quality of water is better than the quality established in policies as of the date on which such policies become effective, such existing high quality will be maintained until it has been demonstrated to the State that any change will be consistent with maximum benefit to the people of the State, will not unreasonably affect present and anticipated beneficial use of such water and will not result in water quality less than that prescribed in the policies.

2. Any activity which produces or may produce a waste or increased volume of concentration of waste and which discharges or proposes to discharge to existing high quality waters will be required to meet waste discharge requirements which will result in the best practicable treatment or control of the discharge necessary to assure that (a) a pollution or nuisance will not occur and (b) the highest water quality consistent with maximum benefit to the people of the State will be maintained.

State Water Resources Control Board, Resolution No. 68-16 (1968). In addition, the Basin Plan states that "[i]deally, the Regional Board's goal is to maintain the existing water quality of all nondegraded ground water basins." Basin Plan, at 3-9.

Thus, the State and Regional Boards have an obligation to protect high quality waters. It is clear that the native groundwater is of a higher quality with respect to TDS and perchlorate than the Colorado River water. Therefore, the Regional Board cannot allow the Project to cause degradation of the native groundwater source with respect to these wastes. In addition, the

Regional Board should impose waste discharge requirements that result in the best practical treatment or control. Neither the draft or supplemental EIR/S address the need to prevent degradation of the groundwater or the implementation of best practical treatment or control methods.

G42-110

H. The DEIR/S and SEIR/S Fail to Consider Cumulative Impacts

NEPA and the CEQ regulations require the discussion of cumulative impacts in EISs. 40 C.F.R. § 1508.7; Thompson v. Peterson, 753 F.2d 754-758 (9th Cir. 1985); LaFlamme v. Federal Energy Regulatory Comm'n, 852 F.2d 398, 402 (9th Cir. 1988) (individual project cannot be considered in isolation without considering the net impact that all projects in an area may have on the environment). The regulations define a "cumulative impact" as:

> The impact on the environment which results from the incremental impact of the action when added to past, present, and reasonably foreseeable future actions regardless of what agency (Federal or non-Federal) or person undertakes such other actions. Cumulative impacts can result from individually minor but collectively significant actions taking place over a period of time.

40 C.F.R. § 1508.7.

G42-111

The Ninth Circuit has held that 40 C.F.R. § 1508.7 requires an agency to "consider cumulative impacts of the proposed actions which supplement or aggravate the impacts of past, present, and reasonably foreseeable actions. Oregon Natural Resources Council v. Marsh, 832 F.2d 1489, 1497-98 (9th Cir. 1987), rev'd on other grounds, 109 S.Ct. 1851 (1989).

G42-112

The Fifth Circuit, in a well-cited opinion, set a five-prong standard for what constitutes a "meaningful cumulative effects study." Fritiofson v. Alexander, 772 F.2d 1225, 1245 (5th Cir. 1985); see also City of Carmel-By-The-Sea v. U.S. Dept. Of Transp., 95 F3d 892, 902 (9th Cir. 1996) (adopting the Fritiofson standard). The standard requires the EIS to identify:

1) the area in which effects of the proposed project will be felt;
2) the impacts that are expected in the area from the proposed project;
3) other actions — past, proposed, and reasonably foreseeable — that have had or are expected to have impacts in the same area;
4) the impacts or expected impacts from these other actions; and
5) the overall impact that can be expected if the individual impacts are allowed to accumulate.

City of Carmel-By-The-Sea, 95 F.3d at 902. The standard requires that "probable impacts be identified and considered." Fritiofson, 772 F.2d at 1245 n15.

G42-113

In this instance, the Agencies have failed completely to undertake a meaningful cumulative effects analysis because they have made no attempt to quantify the level of ground water used or needed to fulfill the purposes of the reservation on the wilderness areas or other BLM lands in the Project vicinity.

G42-114

In addition, the cumulative impacts discussion in both the DEIR/S and SEIR/S lacks meaningful detail regarding other reasonably foreseeable water uses on private land. They also fail to recognize or address the existence of significant paramount water rights in Chambless and the existing plans of the owner of Chambless Station to use those rights both to establish a local water company and residential complex. G42-115

I. The Recent Disclosure that the Indigenous Groundwater Contains Chromium 6 at Levels Greatly in Excess of Recommended State Health Levels Requires Preparation of a Supplemental EIR/S

The presence of chromium 6 in the indigenous groundwater at concentrations up to twenty times higher than the California OEHHA's recommended new standard was not disclosed at all in either the DEIR/S or SEIR/S. The revelation in November 2000 that the native groundwater contains chromium 6 at levels that may cause public health impacts and that are likely to require expensive treatment of the groundwater before it can be used by MWD's customers constitutes significant new information that requires the preparation of a further supplemental EIR/EIS under CEQA and NEPA. G42-116

Because its presence was not even recognized in the DEIR/S and SEIR/S, the potential health impacts from this chemicals have not been adequately addressed. Nor has there been any consideration of the additional costs for water treatment that is likely to become necessary within a few years, or who will bear those costs.

J. The Public Participation Process for Comment on the DEIR/EIS and SEIR/EIS Is Inadequate

The Public Participation Process for comment on the draft and supplemental EISs was inadequate to provide for meaningful public participation. The Cadiz Water Project presents complex and highly controversial issues of great public import. The complexity of the issues that the public must consider and comment on within the time period provided is shown by the fact that it took Cadiz, the BLM, the MWD, and other cooperating agencies over six months and approximately $600,000 to produce the SEIR/S. To provide the public with a reasonable opportunity to address these issues, the BLM should have provided the public with enough time to carefully consider the SEIR/S and to consult with people possessing the necessary expertise to independently evaluate the issues, particularly considering the fact that the public must do this without access to the awesome resources of Cadiz, the BLM, and the other state and federal agencies that contributed to the preparation of the SEIR/S. Thus, the public comment period should have been at least 90 days for the SEIR/S. G42-117

III. THE DEIR/S AND SEIR/S FAIL TO SATISFY THE REQUIREMENTS OF FLPMA

A. BLM has failed to consider adequate alternatives to the proposed right-of-way in violation of the Federal Land Policy Management Act.

The BLM has indicated that the draft and supplemental EIR/S are to provide the required environmental review of the decision to grant a right-of-way to MWD and to amend the California Desert Conservation Area Plan (CDCA Plan). However, this effort by the BLM is inadequate because it has failed to analyze adequate alternatives to the proposed right-of-way. G42-118

When amendment of a resource management plan under FLPMA requires the preparation of an EIS, the amending process is to follow the same procedure that is required for the initial preparation and approval of the plan. 43 C.F.R. § 1610.5-5. FLPMA requires that the BLM "consider the relative scarcity of the values involved and the availability of alternative means . . . and sites for realization of those values." 43 U.S.C. § 1712(c)(6). Thus, as a part of the planning procedure, the BLM must consider "all reasonable resource management alternatives . . . and several complete alternatives [must be] developed for detailed study." 43 C.F.R. § 1610.4-5. The plan must also "note any alternative identified and eliminated from detailed study and shall briefly discuss the reasons for their elimination." Id. G42-119

Additionally, "in order to minimize adverse environmental impacts and the proliferation of separate rights-of-way," the BLM has an obligation to "utiliz[e] rights-of-way in common . . . to the extent practical." 43 U.S.C. § 1763. The CDCA Plan also emphasizes the need to utilize existing utility corridors. The decision criteria include "minimiz[ing] the number of separate rights-of-way by utilizing existing rights-of-way" and "encourag[ing] joint use of corridors for . . . canals [and] pipelines." CDCA Plan, at 93. The Plan also indicates that BLM managers should "encourage the use of designated [utility] corridors." Id. at 95. Finally, the Plan requires that the BLM District Manager "determine if alternative locations within the DCA are available which would meet the applicant's needs without requiring . . an amendment to any Plan element." Id. at 121. G42-120

The draft and supplemental EIR/S contain no evidence that the BLM has considered an alternative that would allow construction within existing utility corridors or rights-of-way. The draft EIR/S concludes that the "BLM must consider an amendment to the CDCA Plan, since the various water conveyance alignments evaluated . . . do not fall within existing designated utility corridors." This forgone conclusion ignores the obligation of the BLM to consider a reasonable resource management alternatives, specifically alternatives that would fall within existing corridors or rights-of-way, which might avoid routes through sensitive Class L lands. At the very least, the BLM has an obligation to discuss why particular alternatives utilizing existing corridors or rights-of-way were not included for analysis in the EIR/S. G42-121

B. BLM has failed to adequately analyze the environmental impacts associated with granting of the right-of-way and amending the CDCA Plan in violation of FLPMA.

Under FLPMA, the BLM has an obligation to protect the environment when making G42-122

decisions about public lands. FLPMA requires the BLM to "provide for compliance with applicable pollution control laws, including State and Federal air, water, noise, or other pollution standards" when engaging in land use planning. 43 U.S.C. § 1712. The legislation authorizing the CDCA Plan indicates that the purpose of the section is "to provide for the immediate and future protection and administration of the public lands in the California desert within the framework of a program of multiple use and sustained yield, and the maintenance of environmental quality." Id. § 1781. Additionally, the CDCA Plan specifically requires the BLM District Manager to consider the environmental effects of amending a plan, CDCA Plan, at 121, and to "avoid sensitive resources wherever possible." Id. at 93.

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Congress has specifically recognized that the California Desert Conservation Area contains unique "historical, scenic, archeological, environmental, biological, cultural, scientific, educational, recreational, and economic resources" that must be protected. 43 U.S.C. § 1781. In addition, the California desert is an "ecosystem that is extremely fragile, easily scarred, and slowly healed." Id. These resources "including certain rare and endangered species of wildlife, plants, and fishes, and numerous archeological and historic sites, are seriously threatened by air pollution, inadequate Federal management authority, and pressures of increased use." Id. Thus, Congress required the BLM to engage in planning in order to protect these valuable resources.

G42-123

As discussed in the NEPA section of these comments, the BLM's analysis of the environmental impacts associated with granting the right-of-way and amending the CDCA Plan are inadequate. These inadequacies constitute a violation of FLPMA as well as NEPA. In addition, the DEIR/S and SEIR/S fail to avoid Class L lands, which under FLPMA are protected from "unnecessary or undue degradation" and "undue impairment" of their resources.

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C. BLM has failed to adequately evaluate the impact to adjacent wilderness areas in violation of FLPMA.

The CDCA Plan requires the BLM to "consider wilderness values" when making decisions about the Plan. CDCA Plan, at 93. As discussed in the NEPA/CEQA discussion, the draft and supplemental EIR/S have failed to adequately address the impacts to the wilderness areas in the vicinity of the Project. This failure is a violates the CDCA Plan as well as NEPA and CEQA.

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IV. CONCLUSION

As stated above, the DEIR/S and SEIR/S are lacking the kind of detailed description and analysis required under CEQA and NEPA. The Agencies must recognize the clear weight of expert opinion in the technical literature demonstrating that the extraction of native groundwater under the proposed Cadiz Project will exceed the natural rate of recharge and have significant impacts on the aquifer/groundwater system underlying the Project and its vicinity.

G42-126

The Agencies must acknowledge, discuss, and analyze these potential impacts, including

cumulative impacts in their Final EIS. In addition, the Agencies must comply with the requirements of the Endangered Species Act, the Porter Cologne Act, and the Federal Land Policy and Management Act before proceeding with any action.

G42-126

Dated: January 8, 2001

Submitted by

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ATTACHMENT TO
COMMENT LETTER
G42

COMMENTS ON DRAFT & SUPPLEMENTAL EIR/EIS

CADIZ GROUNDWATER STORAGE PROJECT
CADIZ & FENNER VALLEYS
SAN BERNARDINO COUNTY, CALIFORNIA

Prepared for: Western Environmental Law Center
Taos, New Mexico

Prepared by: John Bredehoeft, Ph.D.
December, 2000

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INTRODUCTION

The Cadiz Valley Groundwater Storage Project is proposed to serve three functions: 1) store water from the Colorado River Aqueduct during periods when water is available, and 2) pump both the stored water, 3) and pump a significant quantity of indigenous native groundwater from the Cadiz and Fenner Valleys when Colorado River water is deficient.

The project facilities consist of pipeline (approximately 35 miles long) through Cadiz Valley from the Colorado River Aqueduct, at least one pumping station for the pipeline, recharge ponds, a well field. The recharge ponds are used to infiltrate Colorado River water into the underlying alluvial aquifer where it is stored. The well field is used both to pump out stored water as well as the native groundwater in the area. The facilities are designed to recharge as much 145,000 acre-feet of water per year (ac-ft/yr). Similarly the well field is designed to pump 145,000 ac-ft/yr of groundwater.

G42-127

The project is proposed both to store water and pump groundwater. The proposal is to extract more groundwater than that which is stored. One scenario of development indicates the project will extract 1,700,000 acre-feet of groundwater in excess of the amount stored during a 50-year period. Under this scenario 1,100,000 acre-feet of Colorado River water will be stored during the 50-year period; however, the total groundwater extracted will be 2,800,000 acre-feet during the period.

The argument put forward in the Draft EIR/EIS is that the 1,700,000 acre-feet of indigenous groundwater pumped is somewhat less than the cumulative recharge to the aquifers in the area during the 50-year period of project operation, and therefore will have no adverse impacts on the groundwater system. The Draft EIR/EIS indicates that the annual recharge is in the range of 40,000 to 50,000 acre-feet per year. It is on this basis that the report suggests little or no adverse impact on the groundwater system. It is the analysis of the impacts of pumping the native groundwater that creates great concern.

In this report I will show that:

1. ***the estimate of annual recharge used in the Draft EIR/EIS is an order of magnitude too high-it is probably only 5,000-6,000 ac-ft/yr;***
2. ***using a more realistic recharge rate there will be adverse impacts to the groundwater system and the environment; and***
3. ***that once development has proceeded for a period of several decades simply stopping the project, as implied in the Supplemental EIR/EIR, will not halt the adverse environmental impacts-in other words, the groundwater system once perturbed has sufficient persistence that adverse impacts will persist well beyond 100 years, even though the project is stopped after 50 year or earliers.***

G42-128

THE GEOGRAPHIC/GEOLOGICAL SETTING

The Cadiz and Fenner Valleys are typical valleys within the Great Basin geographical province. The valleys are situated between mountain ranges. The mountain ranges are composed of older bedrock that ranges in age from PreCambrian through Mesozoic. The mountain ranges were uplifted by the basin and range tectonics of the region. The valleys are underlain by alluvial material that was eroded from the mountain ranges. Often the alluvial valley fill is quite thick, commonly in the more open parts of the valleys several thousand feet thick. The alluvial deposits beneath the valleys are good aquifers.

G42-129

The valleys and surrounding mountain ranges are often closed topographic basins; the closed topographic basins form closed watersheds. Precipitation that falls in the watershed remains in the watershed. The discharge of water from these closed watersheds occurs either as evaporation or as plant transpiration. This is a desert; the precipitation ranges from a low of the 3 to 4 inches per year in Cadiz Valley to a high of 11 to 12 inches in the higher parts of the Granite Mountains west of Fenner Valley.

Commonly a playa forms in the lowest parts of the valleys in the area. These playas are ephemeral lakes. During periods of unusually high rainfall the runoff from the surrounding area is sufficient that the playas become lakes for a period; however, these events are infrequent. Most times runoff from the surrounding mountains is insufficient to reach the playa. Typically the runoff from winter snowfall and from summer thunderstorms 1) evaporates, 2) is held in the shallow soil where the plants transpire the moisture, or 3) infiltrates to the underlying groundwater table (the ***water table***).

Freshwater is supplied to the playas either as surface runoff in infrequent runoff events, or by underlying groundwater flow. The water evaporates from the playa; as it evaporates it leaves behind dissolved salts. The salts buildup naturally over time in the groundwater associated with the playas. There is highly saline groundwater underlying both Bristol Lake Playa and Cadiz Lake Playa; under Bristol Lake the groundwater is 7 times higher in dissolved salt than seawater. There are commercial salt works associated with both these playas.

The Hydrology of Valleys in the Basin And Range

G42-130

Under natural conditions the alluvial aquifers that underlie the valleys are full of groundwater. These systems have existed for geologic time. There were periods of higher rainfall in the area during the Pliestocene ice ages. Under natural (virgin) conditions before any development the recharge to the aquifers is balanced by the discharge from the aquifers, or:

Recharge = Discharge (under virgin conditions)

As suggested above, the discharge from the aquifers occurs in many of the closed valleys in the Basin and Range as either evaporation from the playa, or from plants in the lower parts of the valleys that draw their water from the water table. (Plants that draw water from the water table are referred as ***phreatophytes.***) Common plants that draw groundwater from the water table are creosote bush, giant sage, and rabbit brush. Very few of these plants are present in Cadiz Valley; groundwater in this area is thought to discharge, before development, as evaporation from the local playas.

Pumping groundwater in one of these valleys constitutes an additional withdrawal from a system that was in the natural state in balance under virgin conditions. In order for such a groundwater system to reach a new equilibrium (a state indefinite ***sustainability***) two things must occur: 1) the pumping must increase the recharge, and/or 2) the pumping must decrease the discharge. Usually groundwater pumping has no impact on the recharge; recharge is determined by climatic conditions-precipitation, etc. On the other hand the pumping can decrease the discharge. For example, in Cadiz Valley pumping groundwater can lower the water table beneath Bristol Lake playa and either reduce or eliminate groundwater discharge there.

G42-130

In the parlance of the hydrogeologist, pumping can capture groundwater discharge. *In order for a groundwater system to be indefinitely **sustainable** the pumping must be balanced by an equal capture of discharge.* If the pumping exceeds the total amount of the natural discharge from the system the system cannot be brought into a new balanced state; in other words one will be mining groundwater-such a system is not indefinitely sustainable.

One rarely hears the discussion of groundwater sustainability put in terms of the capture of virgin discharge. The usual statement is that *pumping must not exceed the recharge (in order for the system to be sustainable)*. Remember from the discussion above the virgin rate of discharge in these systems equals the virgin rate of recharge. The statement *pumping must not exceed recharge* is a round about way of saying that the pumping must not exceed the virgin discharge-the presumption is that all the virgin discharge can be captured.

Nevada Groundwater Law

The Cadiz and Fenner Valleys are more like the closed Basin and Range Valleys in Nevada; they are untypical of much of the rest of California. For this reason it is worth looking at how Nevada treats groundwater in similar valleys.

G42-131

Nevada recognized in the early1900s that the water supply for many of the valleys within the state would have to come totally from groundwater. The Nevada decision was to attempt to make that the groundwater supply within these valleys sustainable. The discharge in many of the valleys in Nevada is similar to Cadiz Valley where the

groundwater discharge is by evaporation from the playas and from plants that tap the water table-the phreatophyte plants mentioned above. Nevada was willing to let the groundwater pumping capture both the evaporation and the groundwater that went to support the phreatophyte plants. This thinking led to the Nevada doctrine *that groundwater pumping must not exceed the recharge.*

As an aside, it has been difficult for the water managers in Nevada to administer this doctrine, even though it is codified by Nevada law, in places of heavy urbanization such as Las Vegas.

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Nevada has systematically surveyed the entire state in an effort to investigate the recharge in each of its many valleys. Many of the techniques of estimating recharge in the Basin and Range Province have stemmed from efforts in Nevada. One of the widely used methods of estimating recharge is the Maxey/Eakin Method. This is an empirical procedure devised by Burke Maxey and Tom Eakin (1949) working for the U.S. Geological Survey (USGS) in cooperation with the state of Nevada.

Even though the Maxey/Eakin Method is more than 50 years old it is still in widespread use. It applicability has been evaluated in recent years. Avon and Durbin (1994) published an evaluation of the method in which they showed that it gave good estimates of recharge for valleys in the Basin and Range. I will show below that the Maxey/Eakin Method along with other methods yield a much lower rate of recharge for Cadiz and Fenner Valleys than the method used in the Draft EIR/EIS.

VIRGIN RECHARGE IS OVERESTIMATED

As discussed above, whether a groundwater system can be brought into a state of indefinite sustainability depends upon whether the system can ultimately capture sufficient natural discharge to balance the pumping. I indicated that under virgin conditions, before development, in these systems the recharge is balanced by an equal amount of discharge. If a proposed development is much larger than the amount of potential discharge that can be captured the system will never be brought into a new equilibrium-one will be continuing to mine groundwater.

G42-132

Let's state these ideas in anther way. Remember the virgin recharge equals the virgin discharge. If the proposed development is much larger than the recharge (or in other words the virgin discharge since it is equal) one can never capture sufficient natural discharge to bring the system to a new balance. Therefore one hears the common statement the *development must not exceed the recharge if the development is to be sustainable.*

The estimate of recharge becomes critical in any analysis of how a groundwater system will perform. If the estimate of recharge is in error then predictions of system performance will also be in error. I wish to examine the various estimates of recharge for the Fenner and Cadiz Valleys that arose out of the Draft EIR/EIS and the comments on the document.

Draft EIR/EIS

The Draft EIR/EIS has estimates made by GeoScience (1999); these estimates range from 20,000 to 70,000 acre-feet per year. In the GeoScience model of the groundwater system they used an annual recharge rate of 50,000 ac-ft/yr; their analysis of impacts is based upon this number. In making this estimate GeoScience used a watershed model that was originally designed for the County of San Bernardino to size storm-water facilities within the county. This model when used to estimate groundwater recharge greatly overestimates the recharge.

G42-133

USGS (2000)

The USGS commented on the Draft EIR/EIS. In their comments they applied the Maxey/Eakin Method to estimate the recharge to the Fenner and Cadiz Valleys. They used two relationships for precipitation versus elevation. Using the two relationships they estimated the recharge using a modified Maxey/Eakin method as 2,550 and 11,800 ac-ft/yr.

G42-134

The USGS also pointed out that most of the recharge to Cadiz Valley must come through Fenner Gap. Several authors have estimated the amount of groundwater flowing through

G42-135

Fenner Gap by applying Darcy's Law. In their comments on the Draft Eir/Eis the USGS estimated the groundwater flow through the gap as ranging from 2,600 acre-feet per year to 4,300 acre-feet per year depending upon hydraulic conductivity one chooses. Friewald (1984) had estimated the groundwater flow through the gap as 270 acre-feet per year. P.E. LaMoreaux and Associates (1995) estimated the same flow at 3,700 acre-feet per year.

G42-135

Several investigators have shown that the accumulation salt in infiltrating groundwater when compared to the salt content of the associated precipitation can be used to independently estimate recharge rates (Dettinger1989; Wood and Sanford, 1995). The USGS indicated that the method had been misapplied in the Draft Eir/Eis Report; the application in the Draft Report violated a basic assumption of the method. Using the method correctly the USGS estimated the recharge to the area to range from 1,700 to 9,000 acre-feet per year.

G42-136

The USGS also suggested that the age of the water could be estimated from the Carbon-14 content of the water. They provided corrections to the Carbon-14 dates that indicated the local groundwater ranged in age from 5,500 to 10,600 years before present.

G42-137

Durbin (2000)

Durbin commented on the Draft Eir/Eis on behalf of San Bernardino County. He too indicated that the recharge used in the Draft Report was grossly overestimated. He applied the Maxey/Eakin Method and derived a recharge to the Fenner and Cadiz valleys of 5,000 acre-feet per year. Durbin also suggested that when the chloride method is correctly applied it yields a recharge of 2,000 acre-feet per year.

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Boyle Engineering Corp. (1996)

Boyle Engineering examined the drawdown associated with the pumping for irrigation of the Cadiz Land Co. They noted that water levels in the vicinity of the pumping were declining. They indicated that the decline could be attributed either to a change in climate or an overdraft of the local groundwater. They analyzed climate records in the area and showed that the decline was unlikely to be caused by a change in precipitation. The attributed the continuing decline in water levels to an overdraft of groundwater caused by the pumping. They stated: " *the data suggests strongly that the perennial yield of the Cadiz groundwater basin is less than 4,000 acre-feet per year.*" The pumping for irrigation by the Cadiz Land Co. has averaged 4,700 acre-feet per year; it has gone since 1984.

G42-139

Summary of the Recharge Estimates

Table 1 summarizes the various estimates of recharge to the Fenner/Cadiz Valleys.

Table 1. A summary of the recharge estimates.

Methodology/Author	Estimate (ac-ft/yr)
Watershed Runoff Model-MWD & BLM (1999)	20,000-70,000
(GeoScience Groundwater Model)	(50,000)
Maxey/Eakin Method	
USGS (2000)	2,550-11,200
Durbin (2000)	5,000
Fenner Gap Groundwater Flow	
Friewald (1984-USGS)	270
LaMoreaux (1995)	3,700
USGS (2000)	2,600-4,300
Chloride Method (correctly applied)	
USGS (2000)	1,700-9,000
Durbin (2000)	2,000
Drawdown Associated with Cadiz Land Co. pumping	
Boyle Engineering (1996)	4,000

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Looking at the data in Table 1 the only investigator that estimated the recharge as high as 50,000 acre-feet per year was GeoScience in their work reported in the Draft EIR/EIS Report. All the others using a variety of proven methods indicated that the annual recharge is less than approximately 10,000 acre-feet per year. While there is a range in the estimates the most probable value for the annual recharge is 5,000 to 6,000 acre-feet per year-an order of magnitude lower than that used in the Draft EIR/EIS.

The Supplemental EIR/EIS did not address this issue. It was side stepped by proposing a monitoring and control scheme. The idea is that the project operations would be modified to control adverse impacts as they were observed. This proposal has two fatal flaws:

1. The future impacts of the project cannot be projected at all accurately without a good estimate of the recharge,
2. By the time an adverse impact is detected by the monitoring the groundwater system will be sufficiently perturbed that even stopping the project will not ameliorate the impacts.

G42-141

THE IMPLICATIONS OF SMALLER RECHARGE

The implications of an order of magnitude lower rate of recharge are easy to see by examining a water budget for 50 years of operation of the Cadiz Project:

Table 2. Water budget for 50 years of operation of the Cadiz Project.

	Draft EIR/EIS	this report
Stored Colorado River water	1,100,000 ac-ft	1,100,000 ac-ft
Pumping of stored water	-1,100,000	-1,100,000
Pumping of native groundwater	-1,700,000	-1,700,000
Recharge	2,500,000 (50,000/yr)	300,000 (6,000/yr)
Total	800,000 ac-ft	-1,400,000 ac-ft

G42-142

One can see that if the recharge is 6,000 acre-feet per year the project creates a large overdraft of groundwater during 50 years of operation. At an annual recharge rate of 6,000 acre-feet per year the overdraft of 1,400,000 acre-feet would take 233 years to balance-assuming there was no other discharge from the system. There are other discharges from the basin-other pumping, and evaporation from Cadiz Lake that has not been impacted by the project. The simple budget analysis suggests that the impact of a more realistic recharge rate on the project will be long lived; and produce impacts that persists for several centuries, even though the project is stopped after 50 years. But this is not the entire story.

The dynamics of groundwater system response are unlike surface water reservoirs; groundwater systems, especially water table aquifers, respond slowly. Once the system is perturbed the effects of a perturbation, such as the impact of pumping, moves outward through the system slowly. The perturbations once started have great persistence; for example the drawdown associated with pumping a well migrates slowly outward from the pumping well. At some distance from the well water levels will continue to decline even though the pumping has been stopped.

G42-143

This slow but persistent dynamic response of groundwater systems has implications for the monitoring and control of such systems such as is proposed in the Supplement Draft EIR/EIS. I will show that the monitoring and implied control as proposed in the Supplemental Report is unlikely to work. The persistence in the dynamic response of a groundwater system resembles momentum; once perturbed the disturbance migrates slowly through the entire system. I will illustrate this phenomenon in the Fenner and

Cadiz Valleys below. I will show that once an adverse impact is observed by monitoring it will be too late reverse the impact by stopping the project. G42-143

I have made the assumption that halting the project is the ultimate remedial action. One could bring surface water from Colorado River Aqueduct and infiltrate it into the aquifer to restore the aquifer-for example, to refill the aquifer with fresh water. I consider such remedial action has highly unlikely. For this reason I consider only one remedial action-halting the project. One could envision halting the project at any time; I am presenting results only for stopping the project after 50 years. Many of my comments would be equally valid after 30-years of project operation; the impacts would be somewhat smaller. G42-144

Because the impacts of pumping and recharge on an aquifer happen slowly hydrogeologists are occupied by studying the dynamics of groundwater systems. The methodology most widely used to investigate the dynamics of groundwater systems are the flow and transport computer models. GeoScience used both a flow and a transport model to analyze the response of the system. Durbin (2000) in commenting on the Draft EIR/EIS Report also used a groundwater flow model to examine the impacts of the proposed project. I too am modeling the groundwater system much as Durbin did; I want to extend his analysis in time. The major difference in the three models is in the recharge rate used-Geoscience used a recharge rate of 50,000 ac-ft/year; Durbin (2000) used 5,000 ac-ft/yr, and I am using 6,000 ac-ft/yr. G42-145

Groundwater Flow Model of Cadiz and Fenner Valleys.

I first wish to model the entire alluvial aquifer that underlies Fenner and Cadiz Valleys. My model is much like Durbin's (2000) model. Both Durbin and I modeled a larger area than GeoScience. I do not think the difference in the area modeled plays a large role in the results. As suggested above, the major difference is in the recharge rate used in the several models. G42-146

The point of my model is not to provide a detailed analysis of the system that could be used to manage the aquifer; rather the point of my model is to indicate how the system will respond through time. The model is used in a feasibility type analysis to suggest the response of the aquifer. I start with a flow model to show the magnitude of the drawdown created by the project. Later I will introduce a solute transport model to investigate how the brine beneath Bristol Lake playa will move under the influence of the project. I am extending the model projections to 100 years, something neither GeoScience nor Durbin did.

I am using the model Bredehoeft (1990) that was published by the USGS. This model was benchmarked against the more widely used USGS model MODFLOW. All the various codes do essentially the same job of solving the appropriate mathematical equations. The choice of which flow or transport code to use is only a matter of personal

preference on the part of the analyst.

In order to model the aquifer I need to specify the aquifer properties and boundaries. The model area with my model grid superimposed is shown on Figure 1. I treat the mountain ranges that bound the valleys as impermeable. I adopted Durbin's (2000) transmissivity distribution-shown on Figure 2. I modeled groundwater in only the alluvial aquifers within the Fenner-Cadiz watershed-the area indicated on Figure 2. Table 3 lists the parameters in my flow model.

Table 3. Model parameters.

Grid	60 x 60	grid blocks are 1 mile square
Transmissivity		Figure 2 (initially from Durbin, 2000)
Specific yield	0.15	(effective porosity 0.15)
Mountain blocks		impermeable
Recharge	5,000 ac-ft/yr	distributed in Clipper Valley east of Granite Range
	1,000 ac-ft/yr	distributed in upper parts of Cadiz Valley
Cadiz Project		
Recharge	1,100,000 ac-ft in 50 years	
Pumping	2,800,000 ac-ft in 50 years	
Cadiz Land Co.		
Irrigation	0	irrigation terminated at start of project
Other pumping	0	no other pumping in area
Discharge	6,000 ac-ft/yr	distributed beneath Bristol and Cadiz Lake playas

G42-146

I have assumed that the irrigation by the Cadiz land Co. will cease once the project begins operation, and I have assumed that there is no other significant pumping in the area.

Under virgin conditions all the groundwater discharge from the model occurs as evaporation from Bristol Lake and Cadiz Lake playas. As drawdown occurs in the areas of the two lakes the model will try to reverse the groundwater flow and obtain recharge from the playas. I used a simple boundary condition to eliminate the evaporative discharge. As soon as the groundwater gradient is reversed, so that a cell that originally discharged is no longer discharging groundwater, the discharge boundary at this cell is eliminated.

Flow Model Results

G42-147

I calibrated the steady state model. The steady-state water levels in the model are presented in Figure 3. In calibrating the model I reduced Durbin's transmissivity values in Fenner Valley and Fenner Gap by 50%; otherwise I used the Durbin's (2000) values of transmissivity-see Figure 2.

Figure 4 shows the pattern of recharge and pumping used to model 50 years of project operation. I used the total storage an pumping of groundwater suggested by Scenario 2 in the Draft EIR/EIS. Figure 5 is a contour map of the drawdown after 50 years of operation; this result resembles that of Durbin (2000). I simulated stopping the project after 50 years of operation. I want to project the response of the groundwater system out to 100 years-50 years after the project is stopped. The long-term responses were not examined by the previous investigators or the by those who commented on the either the Draft or the Supplemental EIR/EIS.

G42-147

GROUNDWATER SYSTEM RESPONSE-100 YEARS

It is the response of the system after the project is stopped that shows the persistence of impacts. Figure 6 is a contour map of the drawdown at 100 years-50 years after the project is stopped. The system has recovered in the area of the project. The drawdown in this area at year 50 was more 200 feet now it is only approximately 50 feet. Figure 7 is a plot of drawdown near the project.

G42-148

Of greater interest are the drawdowns up Fenner Valley, and in the vicinity of Bristol Lake playa. At 100 years the 1-foot drawdown contour is several miles further north in Fenner Valley. Where the drawdown beneath Bristol Lake was 10 feet at 50 years it is now 20 feet at 100 years. (Remember we stopped the project after year 50.)

Figure 8 is a location map for three hypothetical observation wells: 1) a well directly beneath Bristol Lake, 2) well SCE 5 about halfway between the project and Bristol Lake, and a well near Danby in Fenner Valley. Figure 9 is a plot of the drawdown at each of these locations. Of interest is the well at Danby where the drawdown was only approximately 3 feet at 50 years, however the drawdown is more than 10 feet at 100 years, and is still continuing to decline. At observation well SCE-5 we have approximately 20 feet of recovery at 100 years from a maximum drawdown of 50 feet at 60 years.

Figure 7 is the drawdown immediately beneath the recharge pond and at 1 mile from the center of the recharge pond. The water levels beneath the facility recover, but the recovery at 100 years still leaves a drawdown beneath the facility of 50 feet. The 50 feet of remaining drawdown is largely the result of the large overdraft that the project imposes on the groundwater system. As suggested above, if the recharge to the Fenner/Cadiz valley is 5,000 to 6,000 ac-ft/yr the cone of depression will take several hundreds of years to totally refill after stopping the project.

Environmental Implications of Water Table Drawdown

G42-149

The environmental impacts of drawdown in the alluvial aquifers are hard to predict on the adjoining mountain ranges. The mountain ranges are composed of older bedrock that tends to be much less permeable. To the extent that the drawdown in the valleys migrates into the mountain ranges springs can be impacted in the mountains. Looking at the cone of depression created by the project the Marble Mountains will be most impacted, especially the southeast tip of the Marble range that forms the west side of Fenner Gap.

The drawdown also migrates up Fenner Valley. The drawdown is much smaller but there could be impacts on the Clipper Mountains.

The drawdown beneath the norther part of Cadiz Lake in the vicinity of the Cadiz Dunes

Wilderness Area ranges from 30 to 5 feet after 50 years, and increase in area by 100 years. The drawdown in this area will greatly reduce, or eliminate groundwater discharge to the wilderness area. Stopping the project after 50 years does not eliminate the drawdown or restore groundwater discharge at year 100-the impacts persist well beyond 100 years.

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The same impact is true for Bristol Lake. Drawdown under the lake is significant at 50 years and is larger to 100 years. This reduces or eliminates groundwater discharge under major parts of Bristol Lake. This has the tendency to dry out the lakebed. This in turn may lead to more dust from the lake area.

Brine Impacts

Beneath Bristol Lake is a body of highly saline groundwater. As drawdown occurs beneath the recharge facility the brine will move toward the cone of depression. The movement of the brine will be slow. It will take time to occur because the cone of depression moves slowly out from the project toward Bristol Lake. However once the brine starts moving it will be hard to stop. As we have seen, water levels beneath the lake continue to decline to 75 years; the water levels do not recover in 100 years-the cone of depression remains at 100 years-see Figures 6 and 7. Since the gradients are still toward the project brine will move in this direction. The movement of the brine is more difficult to predict since the brine is at its densest 7 time more concentrated than seawater.

G42-150

Even so we can use a solute transport groundwater model to investigate the motion of the brine beneath Bristol Lake. I used the USGS model MOC (Konikow and Bredehoeft, 1978) to project the movement of the brine. The MOC model does not take into account the differences in density between the brine and freshwater; the results are therefore only approximate. Even so, much of the water of interest has only modest concentrations of salt. In the more dilute regions of most interest the difference in groundwater flow velocity caused by differences in water density are small, and the MOC model will provide reasonable estimates of the brine movement.

Figure 10 is a plot of total dissolved solids at the observation well SCE 5. Changes in dissolved solids do not occur at this location until the project has operated for 30 years. The total dissolved solid content reaches 1,000 milligrams per liter (mg/l) at approximately year 50. From year 50 to year 100 the dissolved solids continue to increase, at year 100 they are approximately 7,500 mg/l. The dissolved solids are continuing to increase at year 100. Figure 11 is a contour map of the simulated Bristol Lake brine distribution at year 100. One can see that the brine has migrated toward the project from beneath the lake. Again, I would caution as stated above this simulation neglects the impact of the brine density on the groundwater flow and should only be considered approximate; however, it indicates the direction of continued brine movement.

INFEASIBILITY OF MONITORING & CONTROL

The Cadiz project entails a substantial investment in public funds to build the infrastructure-pipeline, pumping station, recharge basin, and well field. Monitoring the groundwater system by observing water levels and water quality will provide some early warning that the project operation is creating adverse environmental impacts. However as we have seen above the early warning signs are subtle, at best.

G42-151

The Supplemental EIR/EIS-Monitoring and Control

A number of individuals in commenting on the draft EIR/EIS suggested that the recharge indicated the Draft Report was much too large-approximately an order of magnitude too large. The Suplemental Draft EIR/EIS did not address this issue directly; a different tack was taken. The Supplemental Report proposed extensive monitoring with the idea that adjustments could be made to the project operation that would ameliorate adverse impacts.

G42-152

The idea put forward in the Supplemental REIR/EIS is that early signs of adverse impacts will trigger modifications in the project operations. Exactly how the operations will be changed is not specified; however one obvious option is to halt the project. The problem with this idea is that once the project has operated for several decades the groundwater system will be sufficiently perturbed that stopping the project will not stop the adverse impacts.

Once the groundwater system is perturbed that perturbation will work its way through the system at a rate dictated by the response time of the groundwater system. It is much like a freight train put into motion; once it has started moving it will difficult, if not impossible to stop the system from responding.

If one is sufficiently alert there will be subtle early warning signs of trouble ahead. However the early warning will sufficiently obscure as to not halt the project. As suggested above, once the project has operated for several decades it will be impossible to halt the adverse impacts even if the project is stopped. Let me try to illustrate my point with results from the modeling.

Water Levels in Selected Observation Wells

G42-153

Using the groundwater flow model I projected the drawdown at several observation wells to illustrate the point about the difficulty associated with monitoring and control of the Cadiz Project. Consider for example the drawdown in Fenner Valley as observed in the observation well near Danby-see Figure 9. This well has almost no drawdown in 40 years of project operation. The drawdown is approximately 3 feet in 50 years, but this is only the beginning. The drawdown is 10 feet in 100 years, 50 years after the project was shut

down, and the drawdown at Danby is continuing to decline. At 100 years the drawdown is continuing to migrate up Fenner Valley to the north.

The monitoring situation is a bit clearer beneath Bristol Lake-see Figure 9. There is no decline in the water table beneath the center of the lake out to 20 years. By 30 years the drawdown is approximately 7 feet and by 50 years it is approximately 12 feet. Again this is only the beginning, the drawdown goes to 20 feet in 80 years and remains at 20 feet to 100 years. Even though the project was stopped after year 50, there is virtually no recovery in water levels beneath the lake in 100 years.

G42-153

Water Quality in Observation Well SCE 5

I ran the groundwater transport model to simulate the movement of the brine beneath Bristol Lake. Observation well SCE 5 is situated approximately halfway from the proposed project and Bristol Lake playa-see Figure 8. The total dissolved solids, as observed in this observation well, are plotted in Figure 10 above. Notice that the dissolved solids start to increase slightly in year 30. By year 45 it increases to 1,000 milligrams per liter (mg/l); by year 50 the concentration is 1,300 mg/l. This water is still useable; but again this is only the beginning. The concentration increases to more than 7,500 mg/l by 100 years, and it is still increasing.

G42-154

The point shown especially by the brine movement is that we would have to halt the project very early on in order for there not to be a very significant degradation in water quality at this location. I selected only one location to make my point, but this is not an isolated location; the degradation in water quality between Bristol Lake and the project will be widespread and continuing out to at least 100 years. The groundwater flow into the cone of depression will still be significant at 100 years.. The groundwater flow from the region of Bristol Lake will bring with it brine from beneath the lake.

CONCLUSIONS

There are several conclusions to be drawn from this analysis:

1. The Draft EIR/EIS overestimated the recharge by approximately an order of magnitude. The recharge rather than being 50,000 ac-ft/yr is approximately 5,000-6,000 ac-ft/yr. G42-155
2. Pumping native groundwater at rates proposed in the project will create a large overdraft on the system. If the recharge is as suggested above, approximately 6,000 ac-ft/yr, the overdraft in 50 years of project operation will be of the order of 1,400,000 acre-feet. The overdraft will take 233 years to balance without any other pumping or natural discharge from the system. G42-156
3. The large overdraft creates a deep cone of depression that creates adverse environmental impacts-large and widespread water table drawdown, and a movement of brine from beneath Bristol Lake toward the project. G42-157
4. Although the project is terminated after 50 years of operation the impacts on the groundwater system will persist well beyond 100 years. In many locations the largest impacts of project operation will occur well after the project is stopped. G42-158

I have looked at what might be viewed as a worst-case scenario-the project operates for 50 years and then is terminated. The impacts of the project are larger after 50 years of operation. For example, the drawdown associated with the project will persist and at more distant locations be larger after the project is stopped. The same ideas apply to shorter periods of project operation. Stopping the project after several decades of operation will create adverse impacts well after the project is stopped. G42-159

The early warning signs of adverse impacts will be subtle in many, if not most, of the monitoring. For example, small drawdowns due to the project can be obscured by the impacts of nearby pumping or unusual climatic events. Imagine trying to identify an impact of the project in the monitoring well at Danby; this well only starts to have a project impact at year 40. Even so, the drawdown at Danby is more than 10 feet at year 100. G42-160

Even though the Supplemental EIR/EIS suggests otherwise, it will be difficult to stop the Cadiz Project that took a major public investment when the warning signals are subtle. Stopping the project does not stop to the adverse impacts. Again, once the groundwater system is perturbed significantly the impacts will migrate slowly through the system at a rate dictated by the physics of groundwater response. G42-161

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Figure 1.
Geologic Map
showing model area and grid.

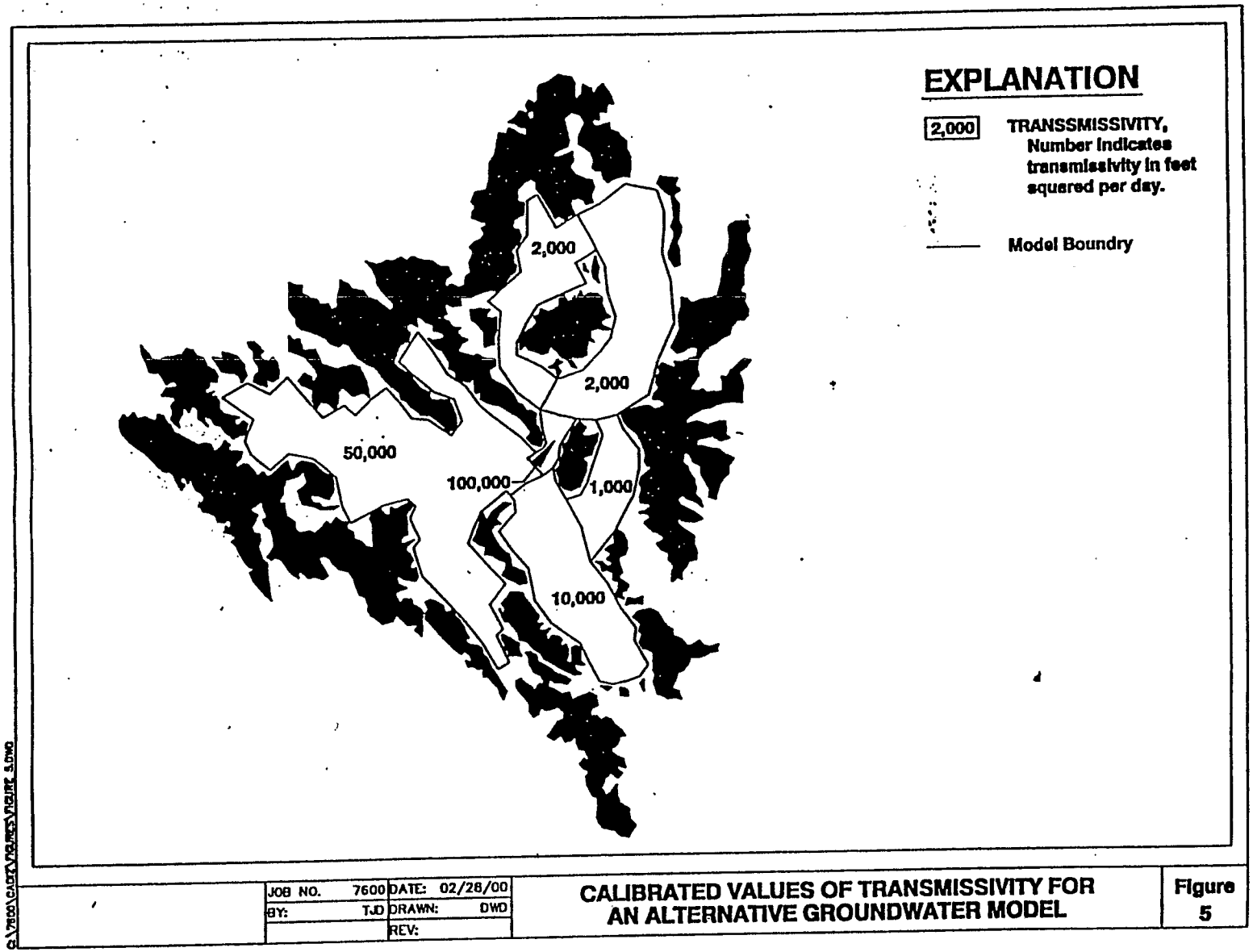

Figure 2. Transmissivity distribution map (from Durbin, 2000).

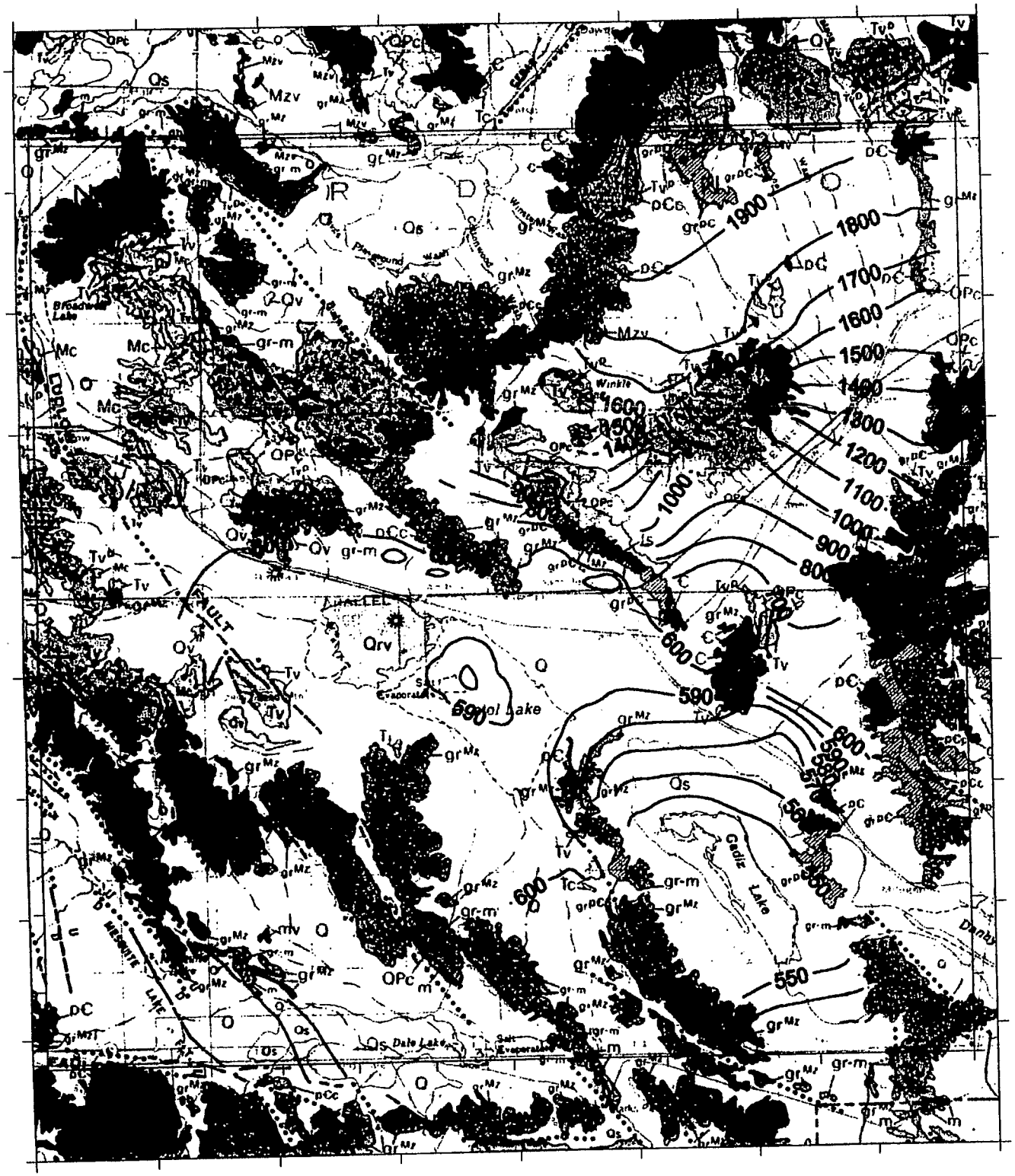

Figure 3.
Simulated initial head (ft)

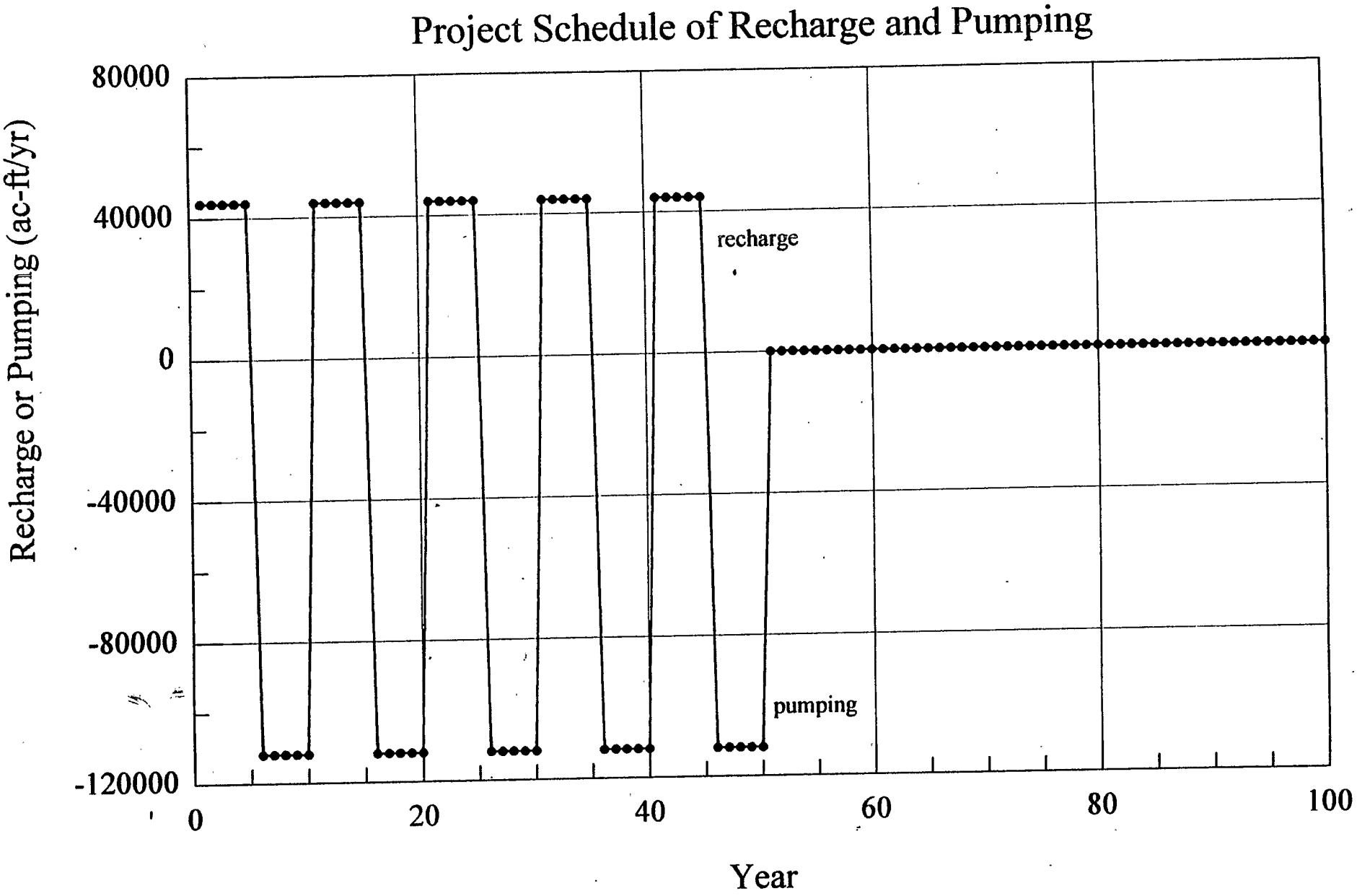

Figure 4. Pattern of recharge and pumping during project operation.

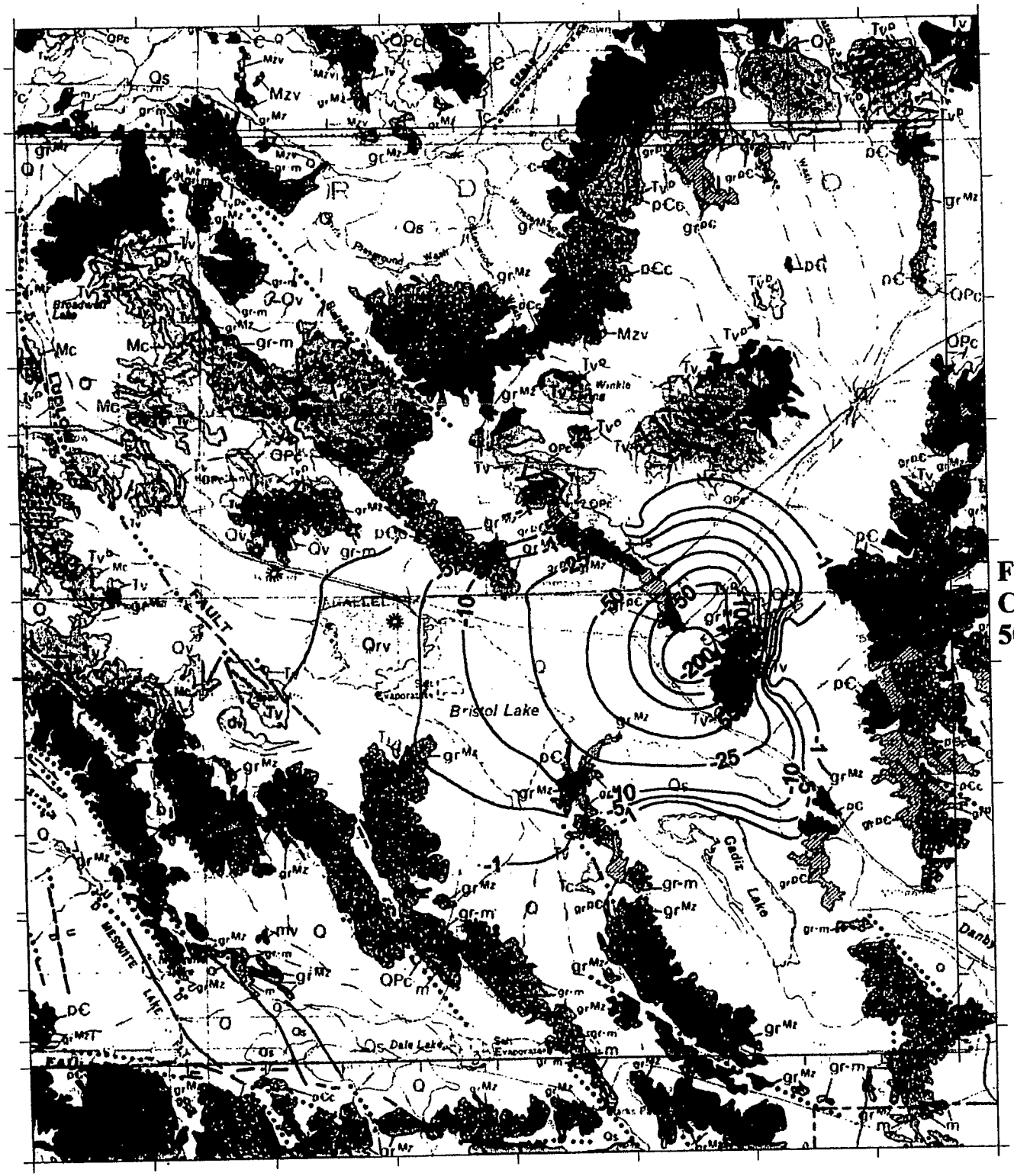

Figure 5.
Computed drawdown (ft)
50 years of project operation

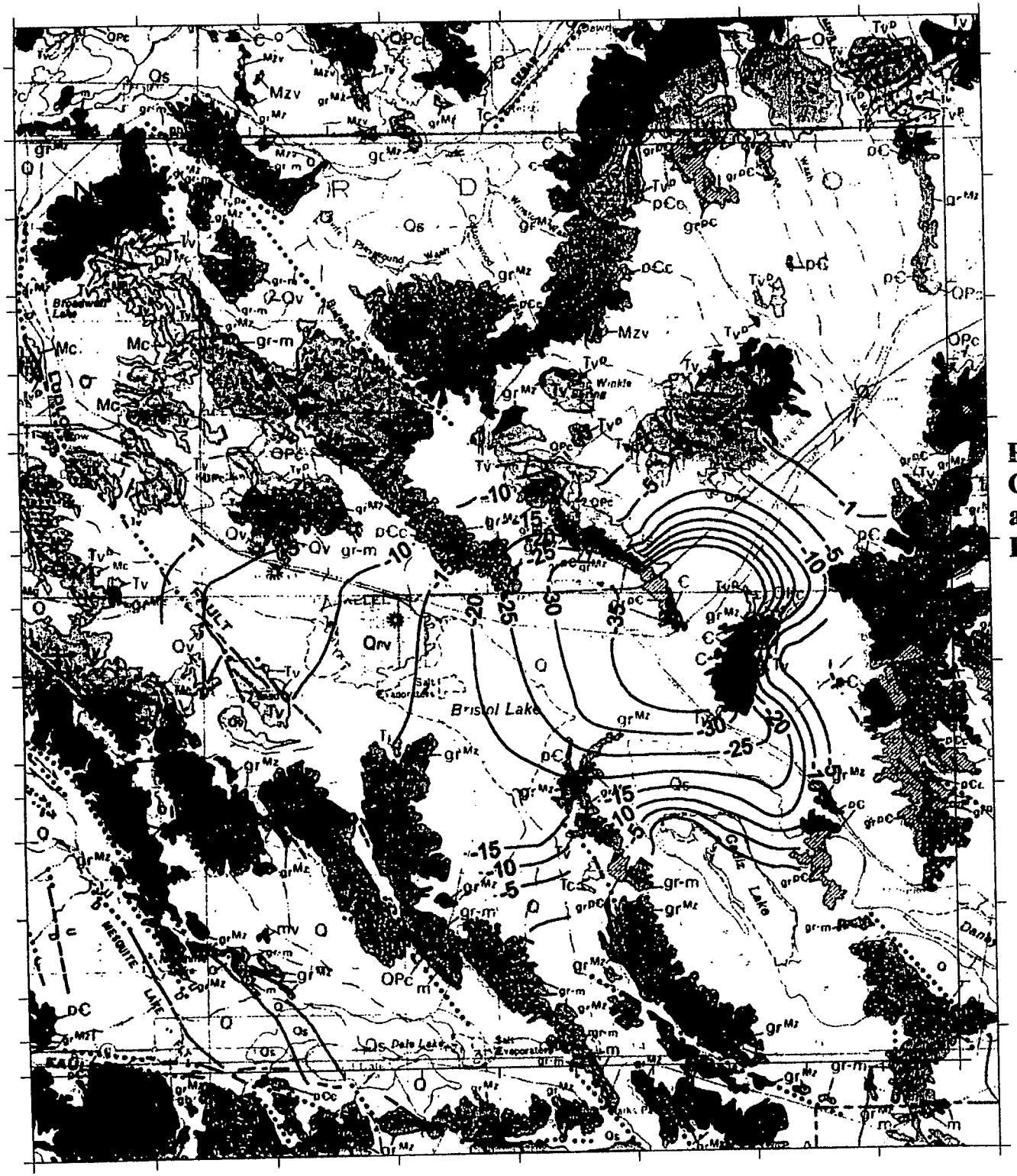

Figure 6.
Computed drawdown (ft)
at year 100
Project halted after year 50

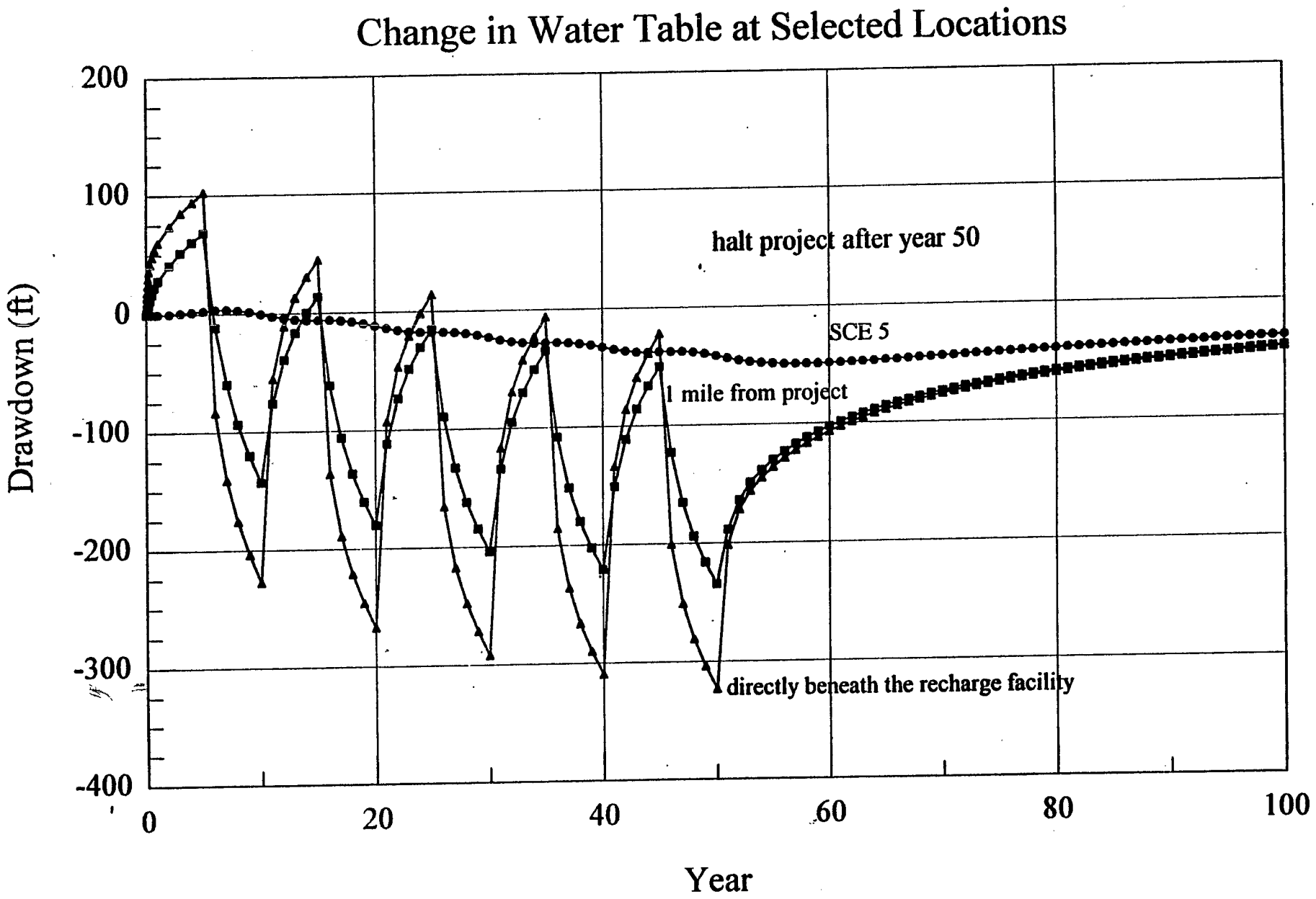

Figure 7. Computed drawdown near the project.

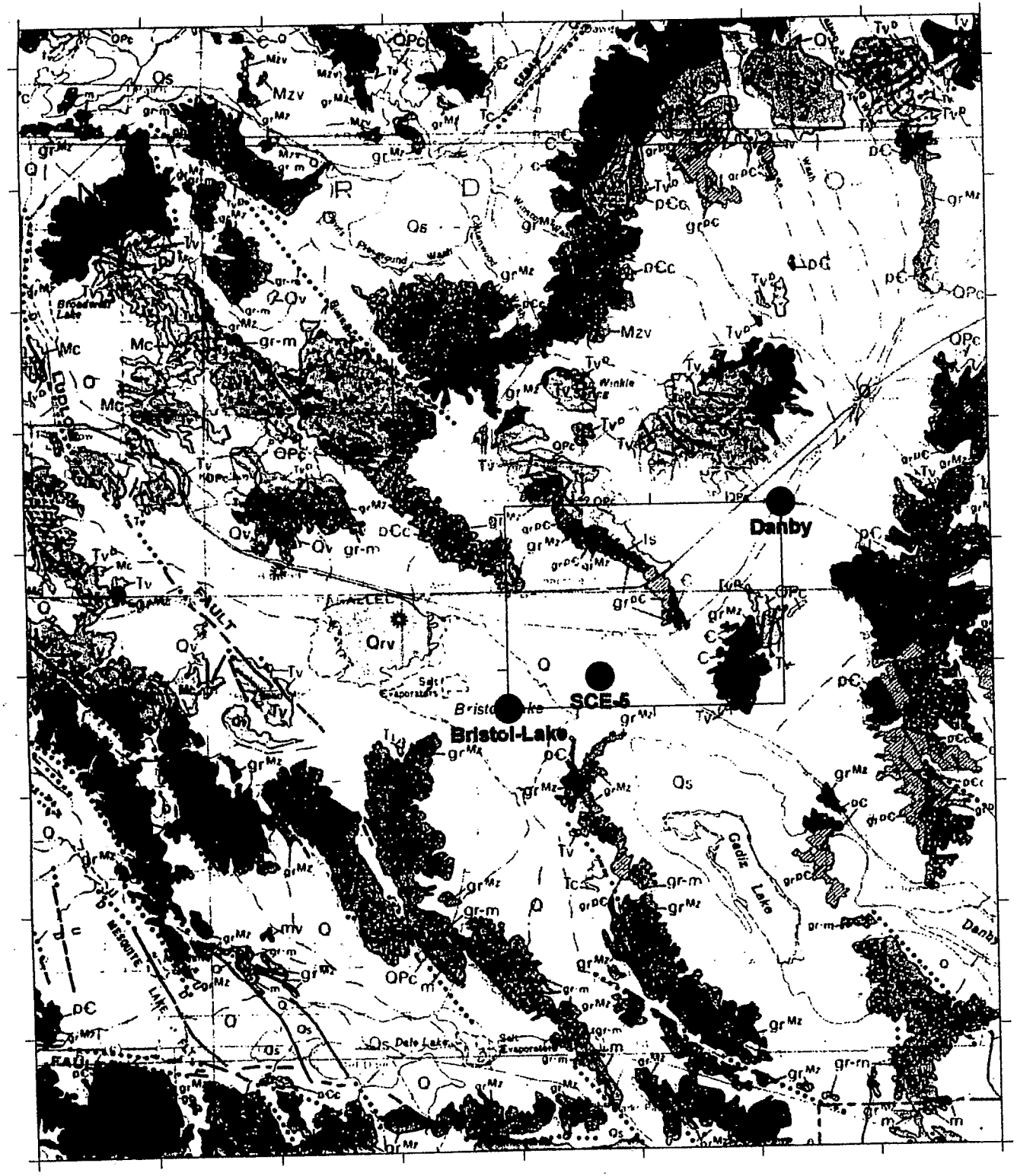

Figure 8.
Location map of three hypothetical observation wells.

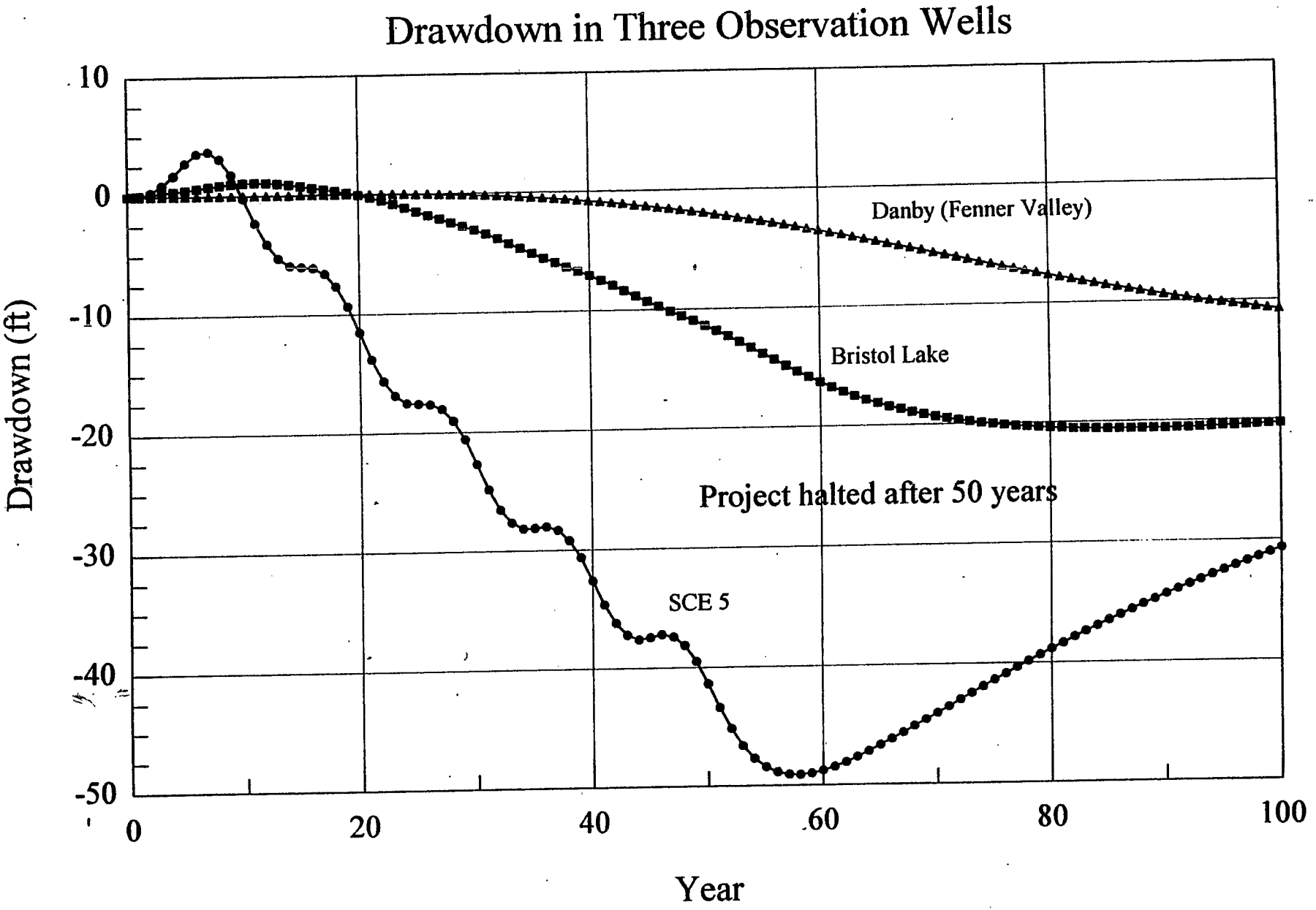

Figure 9. Computed drawdown in three hypothetical observation wells.

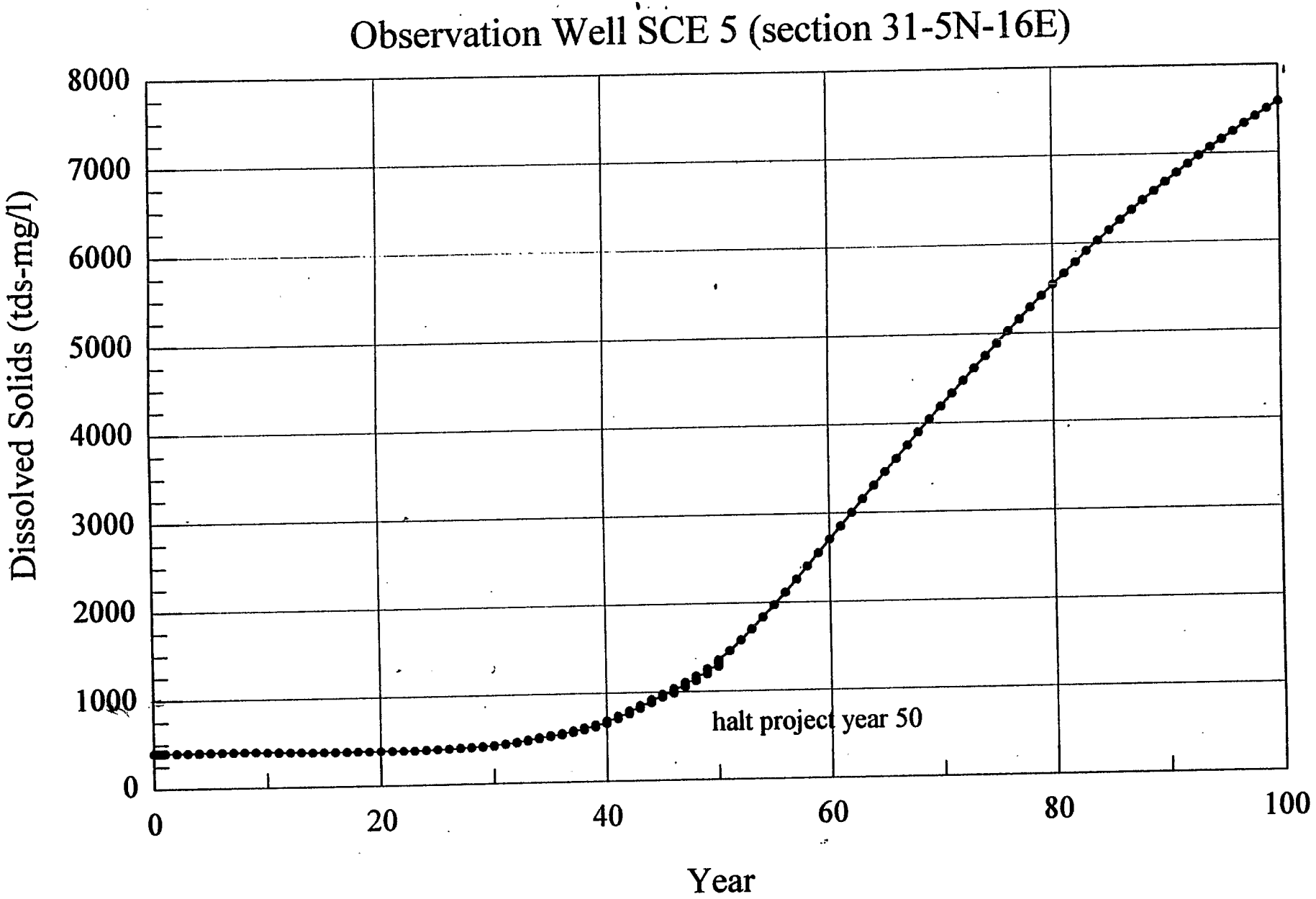

Figure 10. Computed plot of TDS in observatiion well SCE 5

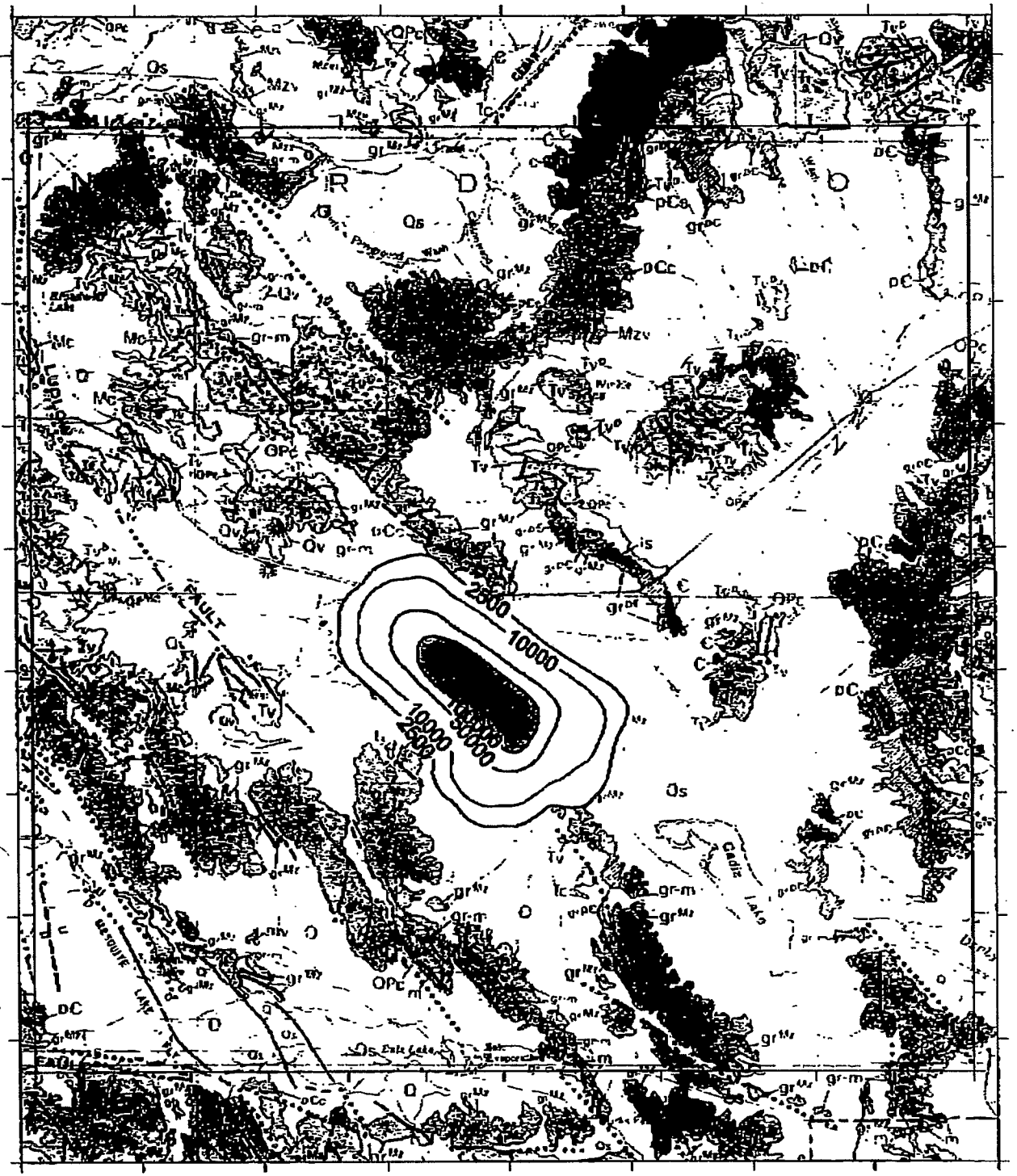

Figure 11.
Simulated Brine Distribution from Bristol Lake at year 100
Project Halted after year 50
Contours in TDS (mg/l)

ATTACHMENT TO COMMENT LETTER G42

Review of the Draft Environmental Impact Report/Environmental Impact Statement and Supplement to the Draft EIR/EIS (SCH. No 99021039)

Cadiz Groundwater Storage and Dry-Year Supply Program

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January 7, 2001

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Review

The Cadiz Groundwater Storage and Dry-Year Supply Program (the Cadiz Project) has been proposed as a means to store Colorado River water imported from the Colorado River Aqueduct in the groundwater basins underlying a portion of the Cadiz and Fenner valleys in California's Mojave desert. The mixed source water would then be extracted to provide water to the customers of the Metropolitan Water District of Southern California.

G42-162

A review of the Draft Environmental Impact Report/Environmental Impact Statement and Supplement to the Draft EIR/EIS (SCH. No 99021039) Cadiz Groundwater Storage and Dry-Year Supply Program was undertaken to specifically evaluate the potential for this project to impact upon the air quality environment in this region of the Mojave desert. Air quality will be affected by the construction, maintenance, and by long-term impacts on the environment brought about by this project.
This review foremost raises questions concerning potential adverse impacts to the air quality, and in particular mineral dust contributions to particulate matter loading. This report identifies components in the EIR/EIS and its supplement where there appears to be insufficient data to allow critical decisions to be made regarding the potential levels of impact to the air quality environment that could be brought about by the Cadiz Project and its proposed management plan.

Specifically, there is a lack of information concerning the following aspects of the project and management plan, which may have greater environmental degradation effects beyond the claims of the EIR/EIS and its supplement:

The potential impacts of drawdown of the brine layer below Bristol and Cadiz Dry Lakes on dust emissions.

The discussion in the draft EIR/EIS and its supplement recognize that the brine water under Bristol and Cadiz Lakes is hydraulically connected with the freshwater aquifer adjacent to the lakes. The freshwater aquifer would be directly impacted by the Cadiz project. Information presented in the EIR/EIS estimates that drawdowns of between 10" and 25" are possible under the dry lakes during the lifetime of the project (EIR/EIS pgs. 5-100 to 5-103). These estimates of drawdown levels are also disputed; see Bredehoeft (2000) for a more detailed account of this potential impact created by the Cadiz Project. The lakebeds can respond to the lowering of the brine layer in several ways. However, sufficient knowledge is lacking to be certain which response may occur. If near-surface brine water sustains the salt-crusted surface, a drawdown of this magnitude might cause its destabilization making it increasingly susceptible to entrainment by the wind. This would result in an increase in dust emissions. The actual response of the surface to a lowering of the brine layer is not known at this time.

G42-163

The response of the surface crust will depend in part on its composition as well as the dissolved load in the brine water. For example, at Owens Lake, CA, the surface crust becomes extremely susceptible to entrainment by the wind when hydration of the sodium carbonates and similar salts occurs, creating highly erodible conditions on the lakebed surface. If the playa crusts in question are sodium chloride or some other salt that does not effloresce in a hydrated state, then altering the groundwater may not change its

inherent susceptibility to wind erosion. An analysis and comparison of the surface sediment characteristics and the brine water chemistry of Bristol and Cadiz lakes to Owens Lake conditions would allow for a better understanding of the potential for Bristol and Cadiz lakes to become more susceptible to dust emissions. G42-163

Even if the salt crust does not change its chemistry or its physical structure as a result of drawdown it must still be noted that any drying of the surface will result in the potential for increased wind erosion and dust emissions. Reducing water content in the pore spaces of the sediments increases the susceptibility to entrainment by wind. The loss of moisture from the surface sediments may also result in an increase in the amount of loose sand-sized particles that were once held in place by moisture. If large amounts of loose sand become available it will upon mobilization by the wind provide the most effective mechanism for liberating dust from the surface. G42-164

Potential impacts to air quality due to dust mobilization at Bristol and Cadiz dry lakes.

The monitoring plan to measure groundwater levels beneath the lake, soil moisture, evapotranspiration, wind speed, and wind direction at the lake surfaces described in the supplement to the EIR/EIS (pg. 6-10) is necessary and would have to be in place during the lifetime of the project to provide the information required to maintain an effective management strategy for the control of dust emissions. The drawdown of the brine layer is not projected to occur until 15 years into the project (EIR/EIS Fig. 5-15, pg. 5-104). In addition to the environmental parameters that have been identified in the supplement to the EIR/EIS (pg. 6-11) a recommendation is made here to include measurements of the saltation activity on the lakebed. G42-165

Saltation, the bouncing of sand-sized particles as they are moved by the wind is the key component of the dust emission process. The saltating particles effectively drive most of the dust emission process as they impact upon the surface, ejecting fine grained particles as they do so and also abrading dust-sized particles from larger particles. If more sand-sized particles become available for transport by wind due to a drying out of the surface, dust emissions from the lake surfaces can increase. The amount of dust injected into the air-stream during saltation scales approximately to the third power of the horizontal saltation flux (Shao *et al.*, 1993). An increase in the supply of sand that is susceptible to entrainment by wind will result in increased dust emissions. G42-166

Saltation activity can be monitored with commercially available instrumentation. The SENSIT, an instrument designed to measure saltation activity should be an integral part of an instrumentation network designed to monitor dust emissions from the dry lakebeds. The Great Basin Unified Air Pollution Control District, Bishop, CA, uses these instruments extensively to monitor saltation activity on Owens Lake, CA. They use the saltation activity data to infer the magnitude of the PM10 flux from Owens Lake. It offers a direct indication that the dust is being generated locally and is not being transported from more distant sources. A network of SENSITs on the lakebeds would provide an effective method to monitor on-lake saltation and dust emission activity through time and over the space occupied by the lakebeds. G42-167

The corrective measures proposed to ameliorate Cadiz-project impacts that lead to G42-168

dust emissions from Bristol and Cadiz lakes are not adequate to deal with the short time scales associated with dust emission processes. The proposed mitigation activities include one or more of the following options: 1) reduction in pumping from project wells, b) revision of pumping locations within the project wellfield, c) stoppage of groundwater extraction for a duration necessary to correct the predicted impact, or d) delivery of Colorado River water, if available, to the project spreading basins. None of these actions can provide the means to control a synoptically (weather) driven process like dust emissions. If it is dry and winds exceed the threshold value required for entrainment, dust emissions are likely to occur if there is a supply of available materials. Forecasting the occurrence of such an event beyond the scale of 24 to 48 seems unlikely. The brine groundwater system cannot respond to increased additions of Colorado river water in the project spreading basins, or by reduced pumping in the wellfields by rising to the surface (or near enough to the surface) to increase moisture content to levels sufficient to bind particles together in a time frame that could halt the dust emission process effectively. G42-168

A probabilistic approach could offer a better opportunity to use the brine layer as an effective control measure. This would be based on an understanding of the dust climatology of the area and the responsiveness of the brine layer to manipulation via increased water delivery to the spreading basins and/or decreased groundwater extraction. A management plan would have to be developed that would ensure the brine layer was effectively contributing sufficient moisture to the surface layer during periods when the lakebeds were most susceptible to wind erosion. This would most likely occur during periods of the year with the highest wind speeds and the greatest likelihood for dry surface conditions. The response of the brine layer to manipulation via the fresh groundwater system likely involves time lags on the order of weeks, months or years, but definitely not hours or a few days. The manipulation of the level of the brine layer to meet the requirement that the surface be resistant to wind erosion during the periods of highest erosive conditions (e.g., high winds, low humidity) may be at odds with the demands for the extraction of water and the logistics of managing a profitable water delivery schedule. G42-169

Before initiation of the Cadiz Project, further consideration must be given to mitigative actions that are designed to ensure dust emissions from Cadiz and Bristol lakes do not exceed levels of compliance for Federal and State air quality standards. At this time the actions being carried out at Owens Lake, CA, serve as a model for the development of control measures and a management plan for controlling dust emissions from a playa in order to meet Federal and State air quality standards. Key control methods being tested at Owens Lake, CA include the addition of water to the surface sediments using shallow flooding techniques, and the establishment of vegetation to control dust emissions. Both methods require the use of a readily available supply of water. The costs associated with a dust control system on a playa are not inconsequential. Who would bear the costs of such a system should be considered in the context of the Cadiz Project. G42-170

Air quality analyses related to mobilization of lakebed dust.

The views expressed by the NPS concerning the monitoring of air quality to determine degradation of the visibility and air quality in Critical Resource Areas are also G42-171

supported in this review. This review also levels several criticisms at the proposed monitoring plan in general. Two deficiencies are noted in particular. The first deficiency is in the proposed instrumentation for the monitoring network. The second deficiency is the plan to operate an air quality monitoring network for only a limited time span compared with the life of the project and with respect to the time frame in which air quality impacts may occur. G42-171

The EIR/EIS proposes the establishment of an air quality monitoring network consisting of four sites (Refer to Fig. 3-4 EIR/EIS Supplement) with meteorological instruments to measure wind speed and direction, light scattering with nephelometers, and digital cameras. The use of open-air nephelometers can be useful to provide an indication that dust emissions are occurring. However, the exclusive use of open-air nephelometers to estimate particulate matter loading from dust emissions that may originate from Bristol and Cadiz lakes is questionable. The nephelometer is an instrument that provides a measure of light-scattering. This measurement is dependent on the amount, size distribution, and scattering coefficient of aerosols in suspension. The units of light scattering (inverse megameters) can be converted to a mass concentration making assumptions for particle shape, size, and composition. This method of assessing particulate matter loading has high levels of uncertainty associated with it due to the assumptions made with respect to the properties of the suspended aerosol. It is recommended in this review that a Federal Reference Method (FRM) or accepted equivalent method be used to measure PM10 at the monitoring sites in addition to the measurement for light scattering. The actual measurement of particulate matter concentration is the basis for determining compliance with air quality standards, not a measure inferred from an indirect method. Collocation of the instruments does present the opportunity to calibrate the more cost-effective nephelometer instrument to a mass based standard. If a calibration relationship is established it may be feasible to remove the FRM instrument at some later time from the monitoring network. In addition, there is a need for measuring saltation activity on the lake, this is a key process affecting dust emissions and will provide data that clearly indicates wind erosion and dust emissions are occurring on the lakebeds. Please refer to the above discussion on potential impacts to air quality due to dust mobilization at Bristol and Cadiz dry lakes regarding monitoring of saltation activity on the lakebeds. G42-172

The EIR/EIS and its supplement propose an initial air-quality monitoring program of approximately 5 years. There seems little foresight in having a five-year air quality monitoring program for a project expected to last 50 years. In the first five years of the monitoring program the data would not reveal trends in air quality that result from impacts caused by the Cadiz project. This time period is too short to reveal potential project impacts for several reasons: 1) short-lived effects from the construction phase could be misconstrued as being representative of future conditions, 2) cyclical weather patterns such as the El Niño-Southern Oscillation (ENSO), which can bring increased precipitation levels to the Mojave, may ameliorate or mask Cadiz Project effects through several years, and 3) long-term impacts from the drawdown of the brine layer beneath Bristol and Cadiz Lakes that may result in increased dust emissions may not manifest themselves until after G42-173

the first five years of the project.

Potential for emissions from the spreading basins.

The EIR/EIS states during operations of the Cadiz Project, there would be occasions during annual periods of maintenance of the spreading basins when localized PM10 emissions would exceed standards (pg. ES 33). In addition, the report states that when the spreading basins are not undergoing maintenance, and are not being used for water recharge they would not contribute at levels significantly different from those of the surrounding desert environment. Two arguments can be raised to question the veracity of these claims. There is a high probability of emissions at levels significantly greater than the EIR/EIS and its supplement suggest.

The size of an individual spreading basin cell is reported to be 10-15 acres in size with the dimensions described as approximately 400'1,700 to 2,100'. This is an area of between 680,000 to. 840,000 square feet. No information is provided in the EIR/EIS or its supplement as to the amount of sediment that can be expected to be deposited annually in a cell. Conservatively estimating a deposition of only a fraction of an inch (e.g., 0.0254" [1 mm]) of silt and clay material and assuming an average cell area of 760,000 square feet, would result in the need to remove 2,493 cubic feet of silt and clay material from each cell. Assuming 40 cells are in operation then each a total of 99,712 cubic feet of silt and clay material would be removed from the spreading basins. Assuming a bulk density of 93 lbs/ft3, the mass of this material would 4,637 tons. If the deposition of atmospheric dust is taken into account the total amount would be 4,672 tons. The contribution from atmospheric fallout is based on an average deposition rate of 0.002 lbs/ft2 for this area (M. Reheis, pers. comm.). The removal and handling of 4,672 tons of silt and clay material could result in the release of significant amounts of PM10. This could be estimated with an emission inventory approach using emission factor values from AP-42 the U.S. EPA's emission inventory guidebook, and estimates of the activity levels required to remove and handle this material. It is recognized here that actually removing 0.0254" of sediment from a spreading basin is not feasible. There will more likely be a critical deposit thickness that would necessitate maintenance to remove it. Assuming that the critical thickness for maintenance is 0.25" of sediment, the total volume of sediment increases to 638,400 ft3, or a mass of almost 30,000 tons. The handling and storage of this amount of fine-grained sediments would produce significant amounts of dust and raises questions concerning its storage such that it would not represent an additional source of dust.

The storage of this material is of considerable importance. Once it has been removed from the spreading basins it will be in a loose disaggregated state and highly susceptible to entrainment by wind. Estimates of the amount of sediment that would have to be removed from the spreading basins are not provided in the EIR/EIS or its supplement, and so the impact of its removal on air quality is highly speculative. However, it must be recognized that even a conservative estimate of only 0.0254" of deposit yields a considerable amount of sediment when the total area of the spreading basins is taken into consideration. Estimates for the sediment yield in the spreading basins are critical to determine the impact on the air quality environment based on the scale of the

G42-173

G42-174

G42-175

removal and handling operations and the actions required to safely store this material in a manner that does not leave it susceptible to entrainment by the wind. G42-175

The EIR/EIS supplement also states that the spreading basins would not contribute to PM10 levels any more than the surrounding open desert land (pg. ES-33). However, there are critical differences between spreading basin surfaces and typical Mojave desert surfaces. G42-176

Typical Mojave desert surfaces will have attained some degree of armoring of the surface over time due to the winnowing of loose erodible material, the formation of a desert pavement, or through the establishment of cryptogamic crusts (i.e., crusts of biologic origin). All these processes result in a reduction in the susceptibility of the surface to wind erosion. The settling basins will be areas where fine-grained materials sediment onto the underlying surface and subsequently dries out when the basins are not being utilized. Depending on the textural quality of the material and its ability to form a durable crust, these smooth surfaces of fine-grained material may be inherently more susceptible to wind erosion and dust emissions than the surrounding deserts. In addition due to the fine-grained texture of the material it will be a much richer source of dust-sized particles than the surrounding desert soils. G42-177

The settling basins will be devoid of vegetation and will be subjected to the full force of the wind unlike the surrounding desert environment that has a sparse vegetative cover. Research has shown that even a sparse cover of plants can be extremely effective in controlling wind erosion and dust emissions (Gillies *et al.*, 2000). Plant cover between 6-19% can significantly reduce or eliminate wind erosion depending on the species, the size of the plants, and their distribution (Gillies *et al.* 2000). Without vegetation on the surface the spreading basins may begin to emit dust at lower wind speeds than the surrounding desert surfaces due to a lack of protection from the wind and because of their fine-grained nature.

Disturbance of the Cadiz Dunes.

The EIR/EIS states that due to the construction of the conveyance pipeline, for which three alternative routes are proposed, sensitive dune sands and sand deposits will be temporarily and permanently disturbed. Depending on the routing for the pipeline between 130 to 177.8 acres and 16.5 to 35.2 acres of dunes and sand fields will be temporarily and permanently disturbed, respectively. The disturbance of these soil types that are extremely sensitive to erosion by the wind can create a potentially significant degradation of the local and regional environment. The reasons for this are twofold. Upon initiation of a disturbance in a sand dune community there is a high degree of probability that the disturbance will expand beyond the zone of impact as the sand is transported by the wind along the dominant wind direction vectors. There are many well-documented cases of dune disturbances expanding in areal extent following localized impacts (e.g., Lancaster, 1986; Jungerius and van der Muelen, 1989). How the EIR/EIS has determined what proportions of the dunes and sand fields will be temporarily disturbed or what criteria were applied to determine the size (and hence containment area) of permanently disturbed sandy areas is not provided, and therefore subject to considerable uncertainty. G42-178

The disturbed sand areas present a second potential problem beyond the immediate degradation of the dune areas themselves. The mobilized sand can become available for transport onto the Cadiz and Danby dry lakebeds where it may cause increased dust emissions as it is transported across the lakebed surfaces. According to the climate data presented in the supplement to the EIR/EIS (Figure 2-8, 2-9, pgs. 215-216), there exists significant opportunity for winds above the threshold for sand-sized particles (typically around 15 mph measured at 30 feet above the surface) to transport it onto the lakebeds of Cadiz and Danby. The project weather station wind velocity and wind frequency data (Fig. 2-8) shows NE winds occur up to 25% of the time at speeds often in excess of 10 mph. Winds of this magnitude and from this direction could move sand out of the Cadiz dune area, especially if disturbed by the alternative conveyance alignment for the pipeline and onto Cadiz dry lake. Other wind directions that would be problematic for this conveyance alignment would be from the north through to the east. If the eastern alternative were to be chosen, almost 2 miles of quaternary dune sands would be disturbed that could potentially be transported by winds from the west onto Danby dry lake. Westerly winds are the prevailing wind direction according to data presented in Figs. 2-8 and 2-9 of the supplement to the draft EIR/EIS. Should disruption of the sands in the vicinity of the pipeline lead to the transport of this sand onto the dry lakebeds there is an increased potential for dust emissions to occur from those surfaces.

G42-179

Conclusions

In summary, there appears to be critical areas in the draft EIR/EIS and its supplement that do not adequately address the potential affects of the Cadiz project on air quality impacts at the local and regional scale. There is insufficient data in the draft EIR/EIS and its supplement to make the claims within the documents that the Cadiz project will have minimal or no impact on air quality for the points discussed above. Critical areas of concerns include: 1) the potential for drawdown of the brine layer beneath Bristol and Cadiz lakes could result in an increase in wind erosion processes and dust emissions, 2) the management plan for dealing with this potential problem, that is the expected ability to manipulate the level of the brine layer, is totally ineffective as a dust control measure in light of the water delivery requirements, 3) other types of control strategies to mitigate the potential dust emission problem and the associated costs have not been adequately explored, 4) the proposed monitoring network is insufficient to determine long term affects on air quality and for determining compliance with National Ambient Air Quality Standards, 5) the potential for dust emissions from the unused spreading basins has been understated, and 6) impacts to the sand and dune areas may result in transport of the sand by the wind onto Cadiz and Danby dry lakes resulting in increased potential for dust emissions.

G42-180

For the above stated reasons, the draft EIR/EIS and its supplement do not adequately address the potential impacts of the Cadiz Project on air quality in this region of the Mojave desert. Until these concerns are addressed, this project carries a high degree of uncertainty in terms of its potential to impact the air quality environment and the potential future costs associated with the mitigation of these problem.

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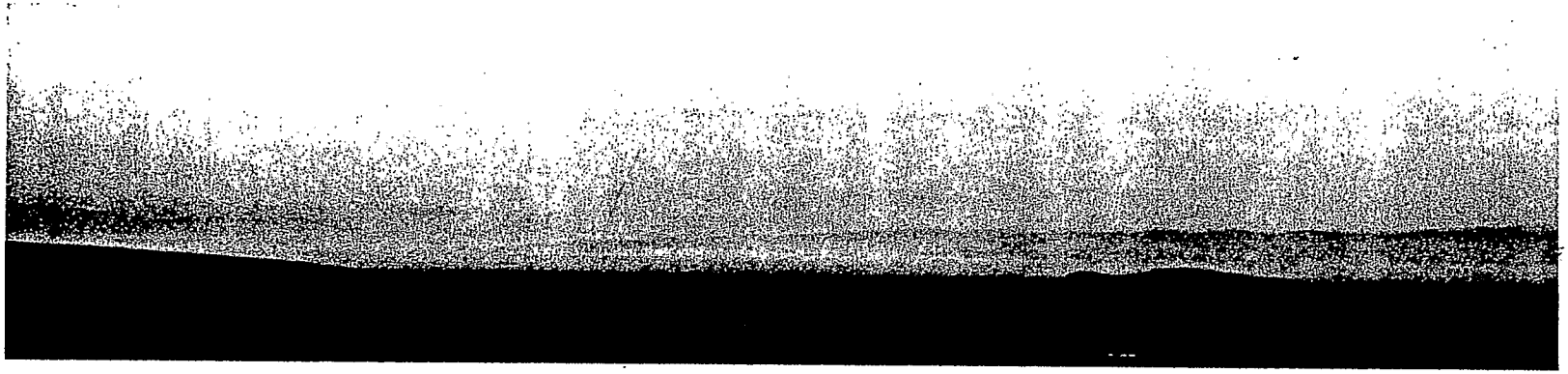

Review of the Draft EIR/EIS and Supplement for the Cadiz Groundwater Storage and Dry-Year Supply Program

Dr. John A. Gillies, Assistant Research Professor
Division of Atmospheric Sciences
Desert Research Institute, Reno, NV

Critical Issues

- The potential impacts of drawdown of the brine layer below Bristol and Cadiz Dry Lakes on dust emissions.

What is the response of the lakebed surface?

1. The salt-crusted surfaces might destabilize making them increasingly susceptible to entrainment by the wind.
2. Any drying of the surface will result in the potential for increased wind erosion and dust emissions.

G42-181

Critical Issues (cont.)

- Potential impacts to air quality due to dust mobilization at Bristol and Cadiz dry lakes.

1. Monitoring would be necessary for the lifetime of the Cadiz project as effects may not be significant until later in the project.
2. None of the proposed actions can provide the means to control a weather-driven short time-scale process like dust emissions.

G42-182

Critical Issues (cont.)

- Air quality analyses related to mobilization of lakebed dust.

1. The exclusive use of open-air nephelometers to estimate particulate matter loading from dust emissions that may originate from Bristol and Cadiz lakes is inadequate, requires FRM (or equivalent) for PM.
2. Requires on-lakebed monitoring of saltation.
3. Requires monitoring through life of the project.

G42-183

Critical Issues (cont.)

- Potential for emissions from the spreading basins.

The emissions of PM_{10} (dust) from the spreading basins is greater than suggested in the EIR/EIS.

1. How much is the annual sediment production? A 0.04" (1 mm) thick layer represents 4,637 tons of fine-grained silts and clays.
2. The material in the dry spreading basins is more susceptible to wind erosion and at much higher emission rates than the native Mojave desert soils.

G42-104

Desert Tortoise Preserve
Committee, Inc.

James Williams
Bureau of Land Management
Desert District Office
6221 Box Springs Blvd
Riverside, CA 92507

ATTACHMENT TO
COMMENT LETTER
G42

January 4, 2001

Dear Mr. Williams:

Re: Proposed Cadiz Groundwater Storage Project

I am the Executive Director of the Desert Tortoise Preserve Committee, a nonprofit organization that has been devoted to promoting the welfare of the desert tortoise, *Gopherus agassizii*, and its habitat throughout its range in the desert Southwest since 1974. On behalf of the Committee and other tortoise interest groups such as the Desert Tortoise Council that I represent on the Bureau of Land Management's desert planning efforts, I thank you for providing this additional opportunity to review and provide comment on the proposed Cadiz Groundwater Storage Project. As you will see below, we are deeply concerned that the Supplemental Draft EIR/EIS includes new proposals that may have significant negative environmental impacts on both the desert tortoise and its designated critical habitat. These impacts are not addressed in the Supplement or in the original Draft EIR/EIS.

G42-
185

Page 1-4 of the Supplement states, the "Supplement to the Draft EIR/EIS is focused on water resources and related air quality issues" and further "The Draft EIR/EIS addressed issues such as potential effects on endangered species, wildlife habitat, and cultural resources; these issues are not revisited in this Supplement." These statements are of concern in and of themselves; since by implication any relevant new data on other affected resources has been ignored. In particular, a new federally-funded study has determined that local desert tortoise populations have undergone a recent decline of such magnitude that we feel that a complete reevaluation of the potential impacts of the project to this resource may be warranted. Of even greater concern, however, is that the Supplement to the Draft EIR/EIS includes new proposed actions such as the construction of a series of "observation wells" that are not evaluated for their environmental impacts on the tortoise or its designated critical habitat.

G42-
186

Although the Cadiz landholdings lie immediately adjacent to designated desert tortoise critical habitat (in fact according to Figure 3-5, Cadiz owns Section 5 of T5N R15E which was designated as critical habitat in the February 8, 1994 determination) neither the original Draft EIR/EIS nor the Supplement include a single map depicting critical habitat boundaries. If this had been done, it would have been quite clear that most of the newly proposed locations for the observation wells are within or along the boundary of designated critical habitat.

G42-
187

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Desert Tortoise Preserve Committee, Inc.

Nowhere in the Supplement are the direct or indirect environmental impacts to the tortoise or its critical habitat of these newly proposed constructions addressed. Indeed, a footnote on page 3-29 states "Installation of any new monitoring facilities would be subject to approval by the applicable regulatory agencies." This is troubling in that the EIR/EIS process appears to have failed to evaluate both the specific impacts of certain proposed actions and the cumulative impacts of the project to a Federal- and state-listed species.

G42-187

The proposed actions will impact on critical habitat in two separate desert tortoise recovery units. The proposed spreading basins and those production wells northeast of the basins lie on the southwestern edge of the Chemehuevi critical habitat unit (CHU), which is part of the Northern Colorado Desert Tortoise Recovery Unit. The proposed observation wells to the east of the spreading basin lie within the Chemehuevi CHU. In addition, many of the observation wells proposed to the north of the basin lie in and along the Fenner Valley within the Piute-El Dorado CHU of the Eastern Mojave Desert Tortoise Recovery Unit.

G42-188

The Fenner Valley forms a significant link between the Chemehuevi and Piute-El Dorado critical habitat units. In the Fenner Valley lies the Goffs Permanent Study Plot, which was established in 1977 for the Bureau of Land Management and is one of 15 plots in the California desert where tortoise populations have been surveyed every 4 years or so. This site was surveyed in spring 2000 by a team led by Dr. Kristin Berry of the U.S. Geological Survey. The survey results were widely publicized and were featured in several newspaper articles (e.g. Los Angeles Times, 7/16/00; San Bernardino Sun 8/14/00). According to a July 2000 report of the survey, the population has undergone a severe decline and only 10-14% of tortoises registered in prior surveys remain.

G42-189

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The Fish and Wildlife Service's 1994 *Desert Tortoise (Mojave Population) Recovery Plan*, notes that predation by ravens may significantly impact on recruitment of juvenile tortoises, that raven populations are increasing in the Fenner Valley (Appendix F, page 11) and that "artificial sources of food and water help sustain more individuals during times of resource shortage" (Appendix D, page 34). Clearly, now that the local tortoise population has crashed, recruitment of juvenile tortoises is at premium if recovery is to occur. However, according to the Draft EIR/EIS, the proposed spreading basins will provide a new water source for birds (page 5-164). We were pleased to see that the original Draft EIR/EIS included a series of proposed mitigations for impacts to non-critical tortoise habitat caused by construction of 35 miles of pipeline. However, the ongoing impact to the tortoise afforded by subsidizing one of its known predators by providing a ready source of water for ravens was not considered in the original EIR/EIS. Given that new data shows a major decline in the local tortoise population, appropriate mitigations must be provided to offset this impact.

G42-190

Desert Tortoise Preserve
Committee, Inc.

According to page ES-3 of the Draft EIR/EIS the purpose of the EIR/EIS is to provide "a detailed project description and an analysis which fully evaluates the potential environmental impacts and mitigation measures for the proposed project. CEQA and NEPA specifically require that an EIR/EIS identify any potential adverse impacts determined to be significant after mitigation." Clearly, given the issues we have identified above, this purpose has not yet been fulfilled and the EIR/EIS process is incomplete since the proposed actions have not been fully evaluated for their impacts on the threatened desert tortoise and its habitat. Obviously, appropriate mitigations cannot be developed without this evaluation.

G42-191

Again, we thank you for providing the opportunity to comment on the Supplemental Draft EIR/EIS and we look forward to seeing your response. If we can be of any additional information or assistance please feel free to contact me by telephone at (909) 683-3872 or by e-mail at <dtpc@pacbell.net>.

G42-192

Sincerely,

Michael J. Connor

Michael J. Connor, Ph.D.
Executive Director

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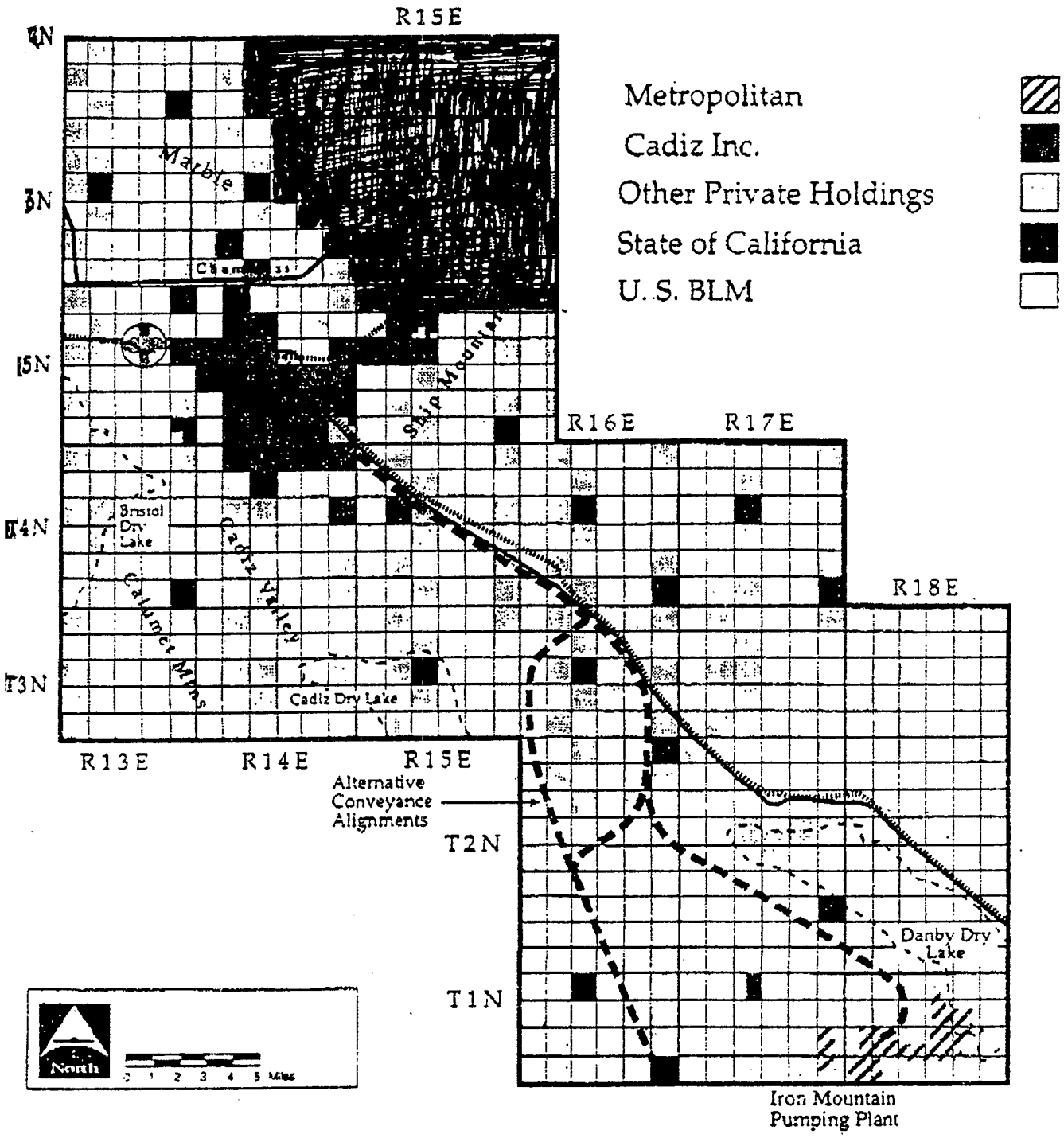


Figure 5.2-1

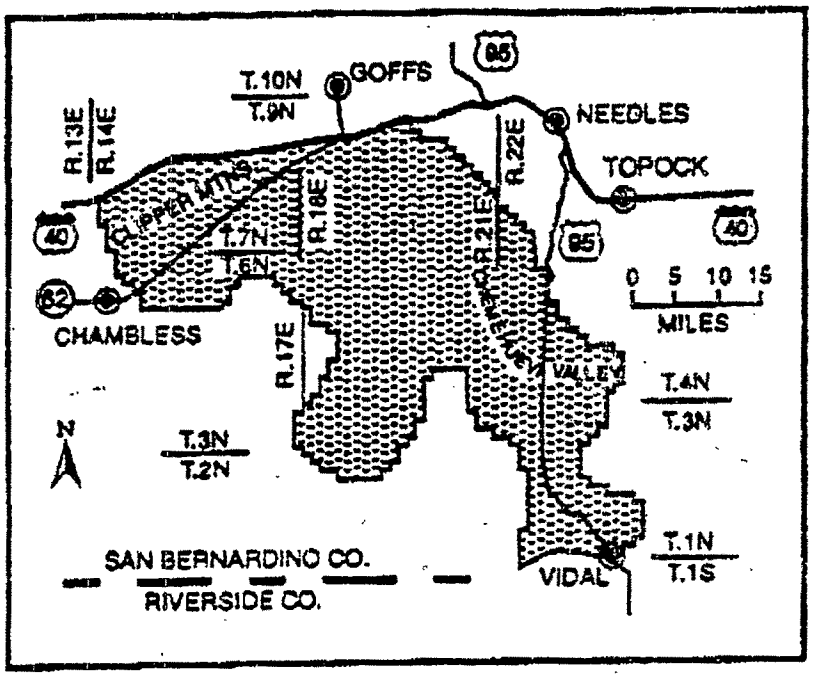
Cadiz Groundwater Storage & Dry-Year Supply Program
EIR/EIS

Land Ownership in Relation to the Cadiz Project Facilities

OCATION
MAP

F

CHEMEHUEVI



2/8/94

6. Chemehuevi Unit. San Bernardino County. From Bureau of Land Management Maps: Sheep Hole Mts. 1978, Parker 1979, Needles 1978, and Amboy 1991. (Index map location F).

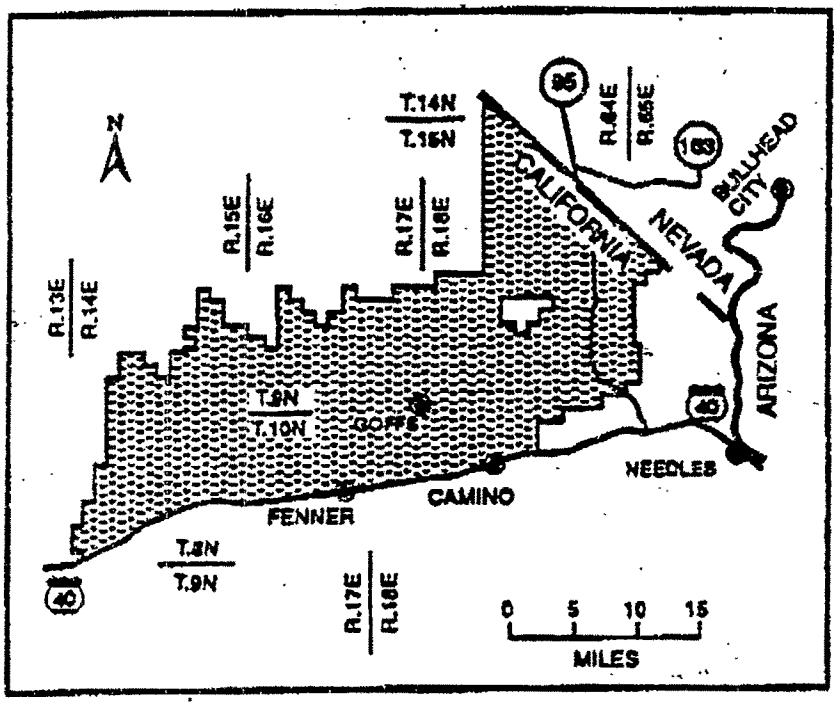
San Bernardino Meridian: T. 1 S., R. 22 E., that portion of secs. 3-5, lying northwesterly of the Atchison Topeka and Santa Fe Railroad; T. 1 S., R. 23 E., that portion of secs. 1-3 lying northerly of the Atchison Topeka and Santa Fe Railroad, except that portion of sec. 1, lying easterly of U.S. Highway 95; T. 1 N., R. 22 E., secs. 1-4, 9-16, 20-29, and 32-36, except that portion of secs. 34-36 lying southerly of the Atchison Topeka and Santa Fe Railroad; T. 1 N., R. 23 E., secs. 1-36, except that portion of secs. 31-34 lying southerly of Atchison Topeka and Santa Fe Railroad; T. 1 N., R. 24 E., secs. 4-9, 16-21, and 29-31; T. 2 N., R. 18 E., secs. 1-5, and 9-14; T. 2 N., R. 19 E., secs. 2-10, and 16-18; T. 2 N., R. 22 E., secs. 1-5, 8-16, 21-28, and 33-36; T. 2 N., R. 23 E., secs. 5-8, 17-21, and 26-36; T. 2 N., R. 24 E., secs. 31 and 32; T. 3 N., R. 17 E., secs. 12, 13, 24, and 25; T. 3 N., R. 18 E., secs. 1-36; T. 3 N., R. 19 E., secs. 1-35; T. 3 N., R. 20 E., secs. 5-8, 18, and 19; T. 3 N., R. 21 E., secs. 1-5, 9-16, 23, and 24; T. 3 N., R. 22 E., secs. 1-36 except sec. 31; T. 3 N., R. 23 E., secs. 2-11, 14-22, and 28-32; T. 4 N., R. 18 E., secs. 1, 2, 10-15, 21-28, and 32-36; T. 4 N., R. 19 E., secs. 1-36; T. 4 N., R. 20 E., secs. 1-12, 16-20, and 29-32; T. 4 N., R. 21 E., secs. 1-17, 20-29, and 32-36; T. 4 N., R. 22 E., secs. 1-36; T. 4 N., R. 23 E., secs. 1-35; T. 4 N. R. 24 E., Secs 6, 7, 18, and 19; T. 5 N., R. 15 E., secs. 1-6; T. 5 N., R. 16 E., secs. 4-6; T. 5 N., R. 18 E., secs. 1-6, 8-17, 22-26, 35, and 36; T. 5 N., R. 19 E., secs. 1-36; T. 5 N., R. 20 E., secs. 1-36; T. 5 N., R. 21 E., secs. 1-36; T. 5 N., R. 22 E., secs. 2-36; (Unsurveyed) T. 5 N., R. 23 E.; protracted secs. 19, and 29-33; T. 6 N., R. 14 E., secs. 1-3, 10-15, and 23-25; T. 6 N., R. 15 E., secs. 1-36; T. 6 N., R. 16 E., secs. 1-23, and 27-34; T. 6 N., R. 17 E., secs. 1-18, 22-26, and 36; T. 6 N., R. 18 E., secs. 1-36; T. 6 N., R. 19 E., secs. 1-36; T. 6 N., R. 20 E., secs. 1-36; T. 6 N., R. 21 E., secs. 1-36; T. 6 N., R. 22 E., secs. 3-10, 15-23, and 26-35; T. 7 N., R. 14 E., secs. 1-5, 8-17, 21-28, and [illegible] T. 7 N., R. 15 E., secs. 1-36; T. 7 N., R. 16 E., secs. 1-36; T. 7 N., R. 17 E., secs. 1-36; T. 7 N., R. 18 E., secs. 1-36; T. 7 N., R. 19 E., secs. 1-36; T. 7 N., R. 20 E., secs. 1-36; T. 7 N., R. 21 E., secs. 1-36; T. 7 N., R. 22 E., secs. 18-20, and 28-34; T. 8 N., R. 14 E., secs. 13, 23-28, and 31-36, except that portion of secs. 13, 23, 24, 26, 27, 28, 31, 32, and 33 lying northwesterly of Interstate Highway 40; T. 8 N., R. 15 E., secs. 9-36, except that portion of secs. 9-12, 17, and 18 lying northwesterly of Interstate Highway 40; T. 8 N., R. 16 E., secs. 1, 2, and 7-36, except that portion of secs. 1, 2, and 7-10 and 11 lying northerly of Interstate Highway 40; T. 8 N., R. 17 E., secs. 1-36, except that portion of secs. 1-6 lying northerly of Interstate Highway 40; T. 8 N., R. 18 E., secs. 1-36, except that portion of sec. 6 lying northerly of Interstate Highway 40; T. 8 N., R. 19 E., secs. 1-36; T. 8 N., R. 20 E., secs. 1-36; T. 8 N., R. 21 E., secs. 7, 17-21, and 27-35; T. 9 N., R. 18 E., that portion of secs. 31-36 lying southerly of Interstate Highway 40; T. 9 N., R. 19 E., secs. 23-29, 31-36, except that portion of secs. 23, 24, 26-29, 31, and 32 lying northerly of Interstate Highway 40; T. 9 N., R. 20 E., secs. 19, 20, and 29-33, except that portion of secs. 19 and 20 lying northerly of Interstate Highway 40 and E 1/2 S 1/2 sec. 27, SW 1/4 SW 1/4 sec. 26, and W 1/2 W 1/2 sec. 35..

[Insert Map 7 here]

LOCATION MAP

H

PIUTE-ELDORADO, CALIFORNIA



2/8/94

8. Piute-Eldorado Unit. San Bernardino County. From Bureau of Land Management Maps: Amboy 1991, Needles 1979, and Ivanpah 1979. (Index map location H).

San Bernardino Meridian; T. 8 N., R. 14 E., secs. 1-4, 8-17, 19-24, 26-30, 32, and 33, except that portion of secs. 13, 23, 24, 26-28, 32 and 33 lying southeasterly of Interstate Highway 40; T. 8 N., R. 15 E., secs. 1-12, 17, and 18, except that portion of secs. 1, 8-12, 17, and 18 lying southeasterly of Interstate Highway 40; T. 8 N., R. 16 E., secs. 1-10, except that portion of sections 1-3 and 6-10 lying southerly of Interstate Highway 40; T. 8 N., R. 17 E., that portion of secs. 1-6, lying northerly of Interstate Highway 40; T. 9 N., R. 14 E., secs. 1-3, 10-15, 22-28, and 33-36; T. 9 N., R. 15 E., secs. 1-36; T. 9 N., R. 16 E., secs. 1-36; T. 9 N., R. 17 E., secs. 1-36, except that portion of sec. 36 lying southerly of Interstate Highway 40; T. 9 N., R. 18 E., secs. 1-36, except that portion of secs. 31-36 lying southerly of Interstate Highway 40; T. 9 N., R. 19 E., secs. 1-24 and 26-32, except that portion of secs. 26-29, 31, and 32 lying southerly of Interstate Highway 40; T. 9 N., R. 20 E., secs. 3-8 and 17-20, except that portion of secs. 19 and 20 lying southerly of Interstate Highway 40; T. 10 N., R. 14 E., secs. 11-14, 22-27, and 34-36; T. 10 N., R. 15 E., secs. 1-3, 9-16, and 18-36; T. 10 N., R. 16 E., secs. 1-36; T. 10 N., R. 17 E., secs. 1-36; T. 10 N., R. 18 E., secs. 1-36; T. 10 N., R. 19 E., secs. 1-36; T. 10 N., R. 20 E., secs. 1-36; T. 10 N., R. 21 E., secs. 3-10, 15-22, and 28-31; T. 11 N., R. 15 E., secs. 9, 15, 16, 21, 22, 25-29, and 33-36; T. 11 N., R. 16 E., secs. 9, 15, 16, 21-23, 25-28, 31, and 33-36; T. 11 N., R. 17 E., secs. 8, 12-17, and 19-36; T. 11 N., R. 18 E., secs. 1-4 and 7-36; T. 11 N., R. 19 E., secs. 1-13, 18, 19, 23-27, and 29-36; T. 11 N., R. 20 E., secs. 1-11, 14-23, and 26-35; T. 12 N., R. 19 E., secs. 1-36; T. 12 N., R. 20 E., secs. 3-11 and 13-36; T. 12 N., R. 21 E., secs. 19, 30, and 31; T. 13 N., R. 19 E., secs. 3-11 and 13-36; T. 13 N., R. 20 E., secs. 19 and 29-33; T. 14 N., R. 19 E., secs. 19 and 29-33.

(Insert Map 9 here)

ATTACHMENT TO COMMENT LETTER G42

COMMENTS REGARDING POTENTIAL IMPACTS TO BIGHORN SHEEP FROM THE PROPOSED CADIZ GROUNDWATER STORAGE PROJECT

Prepared by

John Wehausen, Ph.D.
White Mountain Research Station

Surrounding the Cadiz Dry Lake Basin are numerous mountain ranges occupied by populations of bighorn sheep (*Ovis canadensis nelsoni*) that. The closest of these are part of one of several systems of interacting populations in California labeled the South Central Metapopulation (Torres et al. 1996) and include the Granite-Palen Mountains, Old Woman Mountains, Clipper Mountains, Marble Mountains, Granite Mountains, S. Bristol Mountains, Bullion Mountains, Sheephole/Calumet Mountains, and Coxcomb Mountains. The most recent population estimates for these ranges total about 300 sheep (Torres et al. 1996). Some of these populations have been the subject of intensive demographic research (Wehausen 1992). The largest current population among these ranges is in the Marble Mountains – a population that has been used as a source of reintroduction stock in desert mountain ranges of California (Bleich et al. 1990). The populations in the Old Woman and Marble Mountains both are currently recovering form a past disease problem that caused high lamb mortality (Wehausen 1992) and have the potential to become large populations (J. D. Wehausen, pers. comm.). Sheep from the Marble Mountains also have recently colonized the S. Bristol Mountains (Bleich et al. 1996), where a small population is showing steady growth (J. D. Wehausen, pers. comm.).

G42-193

Surface water is scarce in this region of the Mojave Desert and occurs as point sources. Where they occur in appropriate habitat, these springs are heavily utilized by bighorn sheep during the hot months to help maintain their water balance. Physiological studies concluded that surface

G42-194

water is essential for the survival of desert bighorn sheep during the heat of summer (Turner 1973). While it has been shown that under some circumstances desert bighorn sheep can survive in the absence of surface water (Krausman et al. 1985), such populations appear to survive only in small numbers. There are no documented cases of large populations of desert bighorn sheep persisting in the absence of surface water. This has potentially significant implications for bighorn the sheep metapopulation in the region surrounding Cadiz Dry Lake and possibly the adjacent one north of Interstate 40.

G42-194

Extinction probability increases with declining population size (Berger 1990, Wehausen 1999). Metapopulations persist only where colonization rates exceed extinction rates and larger populations that are temporally more stable can be important to metapopulation persistence as dominant sources of colonists (Gyllenberg 1997). The recent colonization of the S. Bristol Mountains by sheep from the Marble Mountains is an example. If the removal of ground water from this basin results in the disappearance of springs in surrounding mountain ranges, bighorn sheep populations in ranges that lose springs can be expected to shrink to small numbers initially. Eventually this is likely to lead to collapse of at least this portion of the South Central Metapopulation as these small populations go extinct and are not recolonized because of the small number of total sheep in the region and the associated low number of colonists to recolonize these ranges.

G42-195

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Wehausen, J. D. 1999. Rapid extinction of mountain sheep populations revisited. Conservation Biology 13:378-384.

attachment to comment Letter G-42

Description of Cost Analysis Scenarios of the MWD-Cadiz Project

Professor Charles W. Howe

University of Colorado-Boulder

January, 2001

In order to estimate costs per acre foot, we have relied on the financial terms stated in the "Principles for an Agreement Between the Metropolitan Water District of Southern California and Cadiz Land Company, Inc." as signed on 14 August, 1998. Two stylized scenarios have been used to estimate the cost per acre-foot of water likely to be provided by the Cadiz Groundwater Storage and Dry-Year Supply Program. Each scenario includes some simplifications from the technical details of the Project to facilitate calculations but each captures the main features of the Project. Each scenario is run with 3 different interest rates: 3%,5% and 7%.

G42-196

Scenario I corresponds most closely to "Operational Scenario 4" in Section 3 of the Draft EIR, i.e. early recharge and late recovery-stretching the construction and operation out over time. This scenario includes a 5 year construction period, a 10 year period of recharge at a net rate of recharge of 100,000 acre-feet per year, followed by 20 years of recharge recovery at a rate of 50,000 acre-feet per year which , in turn, is followed by 20 years of native water transfers at a rate of 100,000 acre-feet per year. Total water recovery is 3 million acre-feet.

G42-197

Scenario II corresponds most closely to "Operational Scenario 6", i.e. a 2 year construction period, early storage and much more rapid recovery of water than in Scenario I. It includes a 10 year period of recharge at 50,000 acre-feet per year, followed by 20 years of combined pumping, i.e. 50,000 acre-feet of recharged water plus 100,000 acre-feet of native water transfer. Total water recovery is 3 million acre-feet.

G42-198

Both scenario analyses are presented in Excel format. The captions used in

G42-199

3

that format are defined below. The base year for the analysis is 2001 and standard discounting at 3%, 5% and 7% is used to calculate present values of costs to MWD and quantities of water-as appropriate for economic cost analysis. Alternative discount rates are used to exhibit the sensitivity of estimated cost per acre-foot to the assumed interest rate.Constant dollars are assumed throughout. The items below correspond to the "Items" at the left margin of the report worksheets.

G42-199

1. MWD share of EIS costs is $2 million spread over 2 years and compounded to 2001.

2. MWD share of construction costs is $ 75 million, spread over 5 years in Scenario I and over 2 years in Scenario 2. Costs are discounted to year 2001.

3. Gross recharge is 110,000 acre-feet per year for years 2006-2015.

4. Net recharge is 100,000 acre-feet per year for those years.

5. The cumulative recharged groundwater stock increases to 1 million acre-feet at a rate of 100,000 acre-feet per year, then decreases by 50,000 acre-feet per year.

G42-200

6. Annual "put fees" of $50 per acre-foot are applied to the gross recharge.

7. Annual storage fees of $ 5 per acre-foot are applied to the recharged groundwater stock.

8. Annual "takes" of recharged groundwater are at a rate of 50,000 acre-feet per year for 20 years from 2016-2035.

9. "Take fees" of $40 per acre-foot are applied to the takes.

10. "Prepaid native water" refers to the first 500,000 acre-feet for which payment is made in part following regulatory approval and in part following completion of construction per the "Principles..." document.

11. It is assumed that native water will be extracted at a rate of 100,000 a.f. per year for 20 years, from year 2036 through 2055 in Scenario 1 or from 2016

through 2035 in Scenario 2.

12. Payments for native water, after the prepaid 500,000 a.f. have been extracted, are 95% of $230 or $ 218.50 per a.f., i.e. allowing a 5% discount per "Principles..".

13. An allowance for water quality improvement of $ 5 per a.f. of water recovered is counted as a cost to MWD.

14. Total water recovered is 3 million acre-feet in both scenarios.

15. Total "discounted water" recovered varies according to scenario and discount rate and runs from 312,000 a.f (Scenario 1 at 7 %) to I, 612,000 a.f (Scenario 2 at 3 %). Scenario II. The practice of discounting future physical quantities of water for cost analysis is necessary to distinguish the differences in the times of recovery. It can be shown to be consistent with standard methods of benefit-cost analysis and EPA's just released "Guidelines for Preparing Economic Analyses". A very simple example to illustrate the logic would be to consider 2 projects, each having a present value of costs of $ 100 and each producing 1 unit of water, the first yielding the water in year 2 and the second in year 20. Certainly no one would assert that the cost per a.f is the same for the two projects.

16. The cost analysis consists of discounting (compounding for the EIS costs) all cost items to year 2001 using a discount rates of 3%,5% and 7% (the value of the discount rate could be debated but a non-inflationary rate in this range for a public entity seems reasonable). That is, all cost values are multiplied by 1/(1.0r)*t i.e.1.0r raised to the power t for values occurring (t-1) years in the future from 2001.

17. The cost per acre-foot is calculated by dividing the present value of all costs by the discounted quantity of water yielded.

GH2-200

MWD_Cadiz_scenario1

Report Worksheet							
This sheet reports 2001 present values, where applicable							
ITEMS	**Rates**	**Totals**	1999	2000	2001	2002	2003
DISCOUNT RATE (1+r)	**1.05**						
Total EIS Cost (MWD Share), dollars		2,152,500.00	1,102,500.00	1,050,000.00	0.00	0.00	0.00
Total Construction Cost (MWD Share), dollars		68,189,257.56	0.00	0.00	15,000,000.00	14,285,714.29	13,605,442.18
Gross Recharge Rate/Year, acre-feet		1,100,000.00	0.00	0.00	0.00	0.00	0.00
Net Recharge Rate, acre-feet (includes "hydrologic loss")		1,000,000.00	0.00	0.00	0.00	0.00	0.00
Cumulative Recharged Groundwater Stock, acre-feet			0.00	0.00	0.00	0.00	0.00
Annual "Put" Fees, dollars per acre-foot	50.00	34,939,797.40	0.00	0.00	0.00	0.00	0.00
Annual Storage Fees, dollars per acre-foot	5.00	33,658,368.47	0.00	0.00	0.00	0.00	0.00
Annual "Takes" of Recharged Water, acre-feet		1,000,000.00	0.00	0.00	0.00	0.00	0.00
Annual "Take" Fees, dollars per acre-foot	40.00	12,588,526.14	0.00	0.00	0.00	0.00	0.00
"Prepaid" Native Water Taken, acre feet		500,000.00	0.00	0.00	0.00	0.00	0.00
Pymt for "Prepaid" Native Water (500,000 a-f: $110/a-f 2001, $120/a-f after const.)		102,011,569.99	0.00	0.00	55,000,000.00	0.00	0.00
Native Water Taken (non-prepaid), acre feet		1,500,000.00	0.00	0.00	0.00	0.00	0.00
Payments for Native Water (non-prepaid) @ 95%x$230=$218.50/af	218.50	33,826,091.81	0.00	0.00	0.00	0.00	0.00
Estimated Water Quality Allowance, dollars per a-f of water returned to CRA	5.00	2,759,686.54	0.00	0.00	0.00	0.00	0.00
Total Water Taken		3,000,000.00	0.00	0.00	0.00	0.00	0.00
Total Water Taken, discounted quantity		551,937.31	0.00	0.00	0.00	0.00	0.00
Total Cost to MWD, present value 2001		290,125,797.91	1,102,500.00	1,050,000.00	70,000,000.00	14,285,714.29	13,605,442.18
Cost per acre-foot of water taken, present value 2001		525.65					

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MWD_Cadiz_scenario1

2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
12,957,563.98	12,340,537.12	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	110,000.00	110,000.00	110,000.00	110,000.00	110,000.00	110,000.00	110,000.00	110,000.00	110,000.00	110,000.00	0.00
0.00	0.00	100,000.00	100,000.00	100,000.00	100,000.00	100,000.00	100,000.00	100,000.00	100,000.00	100,000.00	100,000.00	0.00
0.00	0.00	100,000.00	200,000.00	300,000.00	400,000.00	500,000.00	600,000.00	700,000.00	800,000.00	900,000.00	1,000,000.00	950,000.00
0.00	0.00	4,309,393.92	4,104,184.68	3,908,747.32	3,722,616.49	3,545,349.04	3,376,522.89	3,215,736.09	3,062,605.80	2,916,767.43	2,777,873.74	0.00
0.00	0.00	391,763.08	746,215.40	1,066,022.00	1,353,678.72	1,611,522.29	1,841,739.76	2,046,377.51	2,227,349.67	2,386,446.08	2,525,339.76	2,284,831.22
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	50,000.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	962,034.20
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	47,011,569.99	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	120,254.27
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	50,000.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	24,050.85
12,957,563.98	12,340,537.12	51,712,726.99	4,850,400.08	4,974,769.31	5,076,295.22	5,156,871.33	5,218,262.66	5,262,113.60	5,289,955.47	5,303,213.51	5,303,213.51	3,367,119.69

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MWD_Cadiz_scenario1

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2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
900,000.00	850,000.00	800,000.00	750,000.00	700,000.00	650,000.00	600,000.00	550,000.00	500,000.00	450,000.00	400,000.00	350,000.00	300,000.00	250,000.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2,061,501.85	1,854,260.92	1,662,082.62	1,484,002.34	1,319,113.19	1,166,562.69	1,025,549.61	895,321.09	775,169.78	664,431.24	562,481.47	468,734.56	382,640.46	303,682.90
50,000.00	50,000.00	50,000.00	50,000.00	50,000.00	50,000.00	50,000.00	50,000.00	50,000.00	50,000.00	50,000.00	50,000.00	50,000.00	50,000.00
916,223.04	872,593.38	831,041.31	791,467.91	753,778.97	717,884.73	683,699.74	651,142.61	620,135.82	590,605.54	562,481.47	535,696.64	510,187.27	485,892.64
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
114,527.88	109,074.17	103,880.16	98,933.49	94,222.37	89,735.59	85,462.47	81,392.83	77,516.98	73,825.69	70,310.18	66,962.08	63,773.41	60,736.58
50,000.00	50,000.00	50,000.00	50,000.00	50,000.00	50,000.00	50,000.00	50,000.00	50,000.00	50,000.00	50,000.00	50,000.00	50,000.00	50,000.00
22,905.58	21,814.83	20,776.03	19,786.70	18,844.47	17,947.12	17,092.49	16,278.57	15,503.40	14,765.14	14,062.04	13,392.42	12,754.68	12,147.32
3,092,252.77	2,835,928.47	2,597,004.09	2,374,403.74	2,167,114.53	1,974,183.01	1,794,711.82	1,627,856.53	1,472,822.57	1,328,862.47	1,195,273.12	1,071,393.28	956,601.14	850,312.12

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2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041	2042	2043	2044	2045
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
200,000.00	150,000.00	100,000.00	50,000.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
231,377.45	165,269.61	104,933.08	49,968.13	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
50,000.00	50,000.00	50,000.00	50,000.00	50,000.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
462,754.90	440,718.95	419,732.33	399,745.08	380,709.60	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	100,000.00	100,000.00	100,000.00	100,000.00	100,000.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	100,000.00	100,000.00	100,000.00	100,000.00	100,000.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	3,103,698.16	2,955,903.01	2,815,145.72	2,681,091.16	2,553,420.16
57,844.36	55,089.87	52,466.54	49,968.13	47,588.70	90,645.14	86,328.71	82,217.82	78,302.68	74,573.98	71,022.84	67,640.80	64,419.81	61,352.20	58,430.67
50,000.00	50,000.00	50,000.00	50,000.00	50,000.00	100,000.00	100,000.00	100,000.00	100,000.00	100,000.00	100,000.00	100,000.00	100,000.00	100,000.00	100,000.00
11,568.87	11,017.97	10,493.31	9,993.63	9,517.74	18,129.03	17,265.74	16,443.56	15,660.54	14,914.80	14,204.57	13,528.16	12,883.96	12,270.44	11,686.13
751,976.71	661,078.42	577,131.96	499,681.35	428,298.30	90,645.14	86,328.71	82,217.82	78,302.68	74,573.98	3,174,721.00	3,023,543.81	2,879,565.53	2,742,443.36	2,611,850.82

MWD_Cadiz_scenario1

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2046	2047	2048	2049	2050	2051	2052	2053	2054	2055
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
100,000.00	100,000.00	100,000.00	100,000.00	100,000.00	100,000.00	100,000.00	100,000.00	100,000.00	100,000.00
2,431,828.72	2,316,027.35	2,205,740.34	2,100,705.08	2,000,671.51	1,905,401.43	1,814,668.03	1,728,255.27	1,645,957.40	1,567,578.48
55,648.25	52,998.34	50,474.61	48,071.05	45,781.96	43,601.86	41,525.58	39,548.18	37,664.93	35,871.36
100,000.00	100,000.00	100,000.00	100,000.00	100,000.00	100,000.00	100,000.00	100,000.00	100,000.00	100,000.00
11,129.65	10,599.67	10,094.92	9,614.21	9,156.39	8,720.37	8,305.12	7,909.64	7,532.99	7,174.27
2,487,476.97	2,369,025.69	2,256,214.94	2,148,776.14	2,046,453.46	1,949,003.30	1,856,193.62	1,767,803.44	1,683,622.33	1,603,449.84

MWD_Cadiz_scenario1_3pct

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Report Worksheet							
This sheet reports 2001 present values, where applicable							
ITEMS	Rates	Totals	1999	2000	2001	2002	2003
DISCOUNT RATE (1+r)	1.03						
Total EIS Cost (MWD Share), dollars		2,090,900.00	1,060,900.00	1,030,000.00	0.00	0.00	0.00
Total Construction Cost (MWD Share), dollars		70,756,476.04	0.00	0.00	15,000,000.00	14,563,106.80	14,138,938.64
Gross Recharge Rate/Year, acre-feet		1,100,000.00	0.00	0.00	0.00	0.00	0.00
Net Recharge Rate, acre-feet (includes "hydrologic loss")		1,000,000.00	0.00	0.00	0.00	0.00	0.00
Cumulative Recharged Groundwater Stock, acre-feet			0.00	0.00	0.00	0.00	0.00
Annual "Put" Fees, dollars per acre-foot	50.00	41,684,361.05	0.00	0.00	0.00	0.00	0.00
Annual Storage Fees, dollars per acre-foot	5.00	45,682,095.96	0.00	0.00	0.00	0.00	0.00
Annual "Takes" of Recharged Water, acre-feet		1,000,000.00	0.00	0.00	0.00	0.00	0.00
Annual "Take" Fees, dollars per acre-foot	40.00	19,671,527.07	0.00	0.00	0.00	0.00	0.00
"Prepaid" Native Water Taken, acre feet		500,000.00	0.00	0.00	0.00	0.00	0.00
Pymt for "Prepaid" Native Water (500,000 a-f: $110/a-f 2001, $120/a-f after const.)		106,756,527.06	0.00	0.00	55,000,000.00	0.00	0.00
Native Water Taken (non-prepaid), acre feet		1,500,000.00	0.00	0.00	0.00	0.00	0.00
Payments for Native Water (non-prepaid) @ 95%x$230=$218.50/af	218.50	82,362,380.58	0.00	0.00	0.00	0.00	0.00
Estimated Water Quality Allowance, dollars per a-f of water returned to CRA	5.00	5,181,852.78	0.00	0.00	0.00	0.00	0.00
Total Water Taken		3,000,000.00	0.00	0.00	0.00	0.00	0.00
Total Water Taken, discounted quantity		1,036,370.56	0.00	0.00	0.00	0.00	0.00
Total Cost to MWD, present value 2001		374,186,120.55	1,060,900.00	1,030,000.00	70,000,000.00	14,563,106.80	14,138,938.64
Cost per acre-foot of water taken, present value 2001		361.05					

MWD_Cadiz_scenario1_3pct

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2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
13,727,124.89	13,327,305.72	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	110,000.00	110,000.00	110,000.00	110,000.00	110,000.00	110,000.00	110,000.00	110,000.00	110,000.00	110,000.00	0.00
0.00	0.00	100,000.00	100,000.00	100,000.00	100,000.00	100,000.00	100,000.00	100,000.00	100,000.00	100,000.00	100,000.00	0.00
0.00	0.00	100,000.00	200,000.00	300,000.00	400,000.00	500,000.00	600,000.00	700,000.00	800,000.00	900,000.00	1,000,000.00	950,000.00
0.00	0.00	4,744,348.31	4,606,163.41	4,472,003.31	4,341,750.79	4,215,292.03	4,092,516.53	3,973,317.02	3,857,589.34	3,745,232.37	3,636,147.93	0.00
0.00	0.00	431,304.39	837,484.26	1,219,637.27	1,578,818.47	1,916,041.83	2,232,281.74	2,528,474.47	2,805,519.52	3,064,281.03	3,305,589.03	3,048,844.25
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	50,000.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1,283,723.89
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	51,756,527.06	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	160,465.49
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	50,000.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	32,093.10
13,727,124.89	13,327,305.72	56,932,179.77	5,443,647.67	5,691,640.58	5,920,569.26	6,131,333.86	6,324,798.28	6,501,791.49	6,663,108.86	6,809,513.40	6,941,736.96	4,493,033.63

MWD_Cadiz_scenario1_3pct

G42-202

2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
900,000.00	850,000.00	800,000.00	750,000.00	700,000.00	650,000.00	600,000.00	550,000.00	500,000.00	450,000.00	400,000.00	350,000.00	300,000.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2,804,251.23	2,571,319.89	2,349,578.43	2,138,572.60	1,937,865.14	1,747,035.15	1,565,677.50	1,393,402.31	1,229,834.34	1,074,612.53	927,389.45	787,830.85	655,615.13
50,000.00	50,000.00	50,000.00	50,000.00	50,000.00	50,000.00	50,000.00	50,000.00	50,000.00	50,000.00	50,000.00	50,000.00	50,000.00
1,246,333.88	1,210,032.89	1,174,789.22	1,140,572.05	1,107,351.51	1,075,098.55	1,043,785.00	1,013,383.50	983,867.47	955,211.14	927,389.45	900,378.11	874,153.51
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
155,791.73	151,254.11	146,848.65	142,571.51	138,418.94	134,387.32	130,473.13	126,672.94	122,983.43	119,401.39	115,923.68	112,547.26	109,269.19
50,000.00	50,000.00	50,000.00	50,000.00	50,000.00	50,000.00	50,000.00	50,000.00	50,000.00	50,000.00	50,000.00	50,000.00	50,000.00
31,158.35	30,250.82	29,369.73	28,514.30	27,683.79	26,877.46	26,094.63	25,334.59	24,596.69	23,880.28	23,184.74	22,509.45	21,853.84
4,206,376.84	3,932,606.90	3,671,216.30	3,421,716.16	3,183,635.59	2,956,521.02	2,739,935.63	2,533,458.74	2,336,685.25	2,149,225.06	1,970,702.59	1,800,756.22	1,639,037.82

MWD_Cadiz_scenario1_3pct

G42-202

2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041	2042	2043
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
250,000.00	200,000.00	150,000.00	100,000.00	50,000.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
530,432.95	411,986.76	299,990.36	194,168.52	94,256.56	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
50,000.00	50,000.00	50,000.00	50,000.00	50,000.00	50,000.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
848,692.72	823,973.52	799,974.29	776,674.07	754,052.49	732,089.80	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	100,000.00	100,000.00	100,000.00	100,000.00	100,000.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	100,000.00	100,000.00	100,000.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	6,698,266.97	6,503,171.82	6,313,759.05
106,086.59	102,996.69	99,996.79	97,084.26	94,256.56	91,511.22	177,691.70	172,516.21	167,491.47	162,613.08	157,876.77	153,278.42	148,814.00	144,479.61
50,000.00	50,000.00	50,000.00	50,000.00	50,000.00	50,000.00	100,000.00	100,000.00	100,000.00	100,000.00	100,000.00	100,000.00	100,000.00	100,000.00
21,217.32	20,599.34	19,999.36	19,416.85	18,851.31	18,302.24	35,538.34	34,503.24	33,498.29	32,522.62	31,575.35	30,655.68	29,762.80	28,895.92
1,485,212.27	1,338,956.97	1,199,961.44	1,067,926.84	942,565.62	823,601.02	177,691.70	172,516.21	167,491.47	162,613.08	157,876.77	6,851,545.39	6,651,985.82	6,458,238.66

G42-202

2044	2045	2046	2047	2048	2049	2050	2051	2052	2053	2054	2055
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
100,000.00	100,000.00	100,000.00	100,000.00	100,000.00	100,000.00	100,000.00	100,000.00	100,000.00	100,000.00	100,000.00	100,000.00
6,129,863.15	5,951,323.45	5,777,983.93	5,609,693.14	5,446,304.01	5,287,673.80	5,133,663.88	4,984,139.69	4,838,970.58	4,698,029.69	4,561,193.87	4,428,343.56
140,271.47	136,185.89	132,219.31	128,368.26	124,629.38	120,999.40	117,475.15	114,053.54	110,731.59	107,506.40	104,375.15	101,335.09
100,000.00	100,000.00	100,000.00	100,000.00	100,000.00	100,000.00	100,000.00	100,000.00	100,000.00	100,000.00	100,000.00	100,000.00
28,054.29	27,237.18	26,443.86	25,673.65	24,925.88	24,199.88	23,495.03	22,810.71	22,146.32	21,501.28	20,875.03	20,267.02
6,270,134.62	6,087,509.34	5,910,203.24	5,738,061.40	5,570,933.40	5,408,673.20	5,251,139.03	5,098,193.23	4,949,702.17	4,805,536.09	4,665,569.02	4,529,678.66

MWD_Cadiz_scenario1_7pct

G42-203

Report Worksheet							
This sheet reports 2001 present values, where applicable							
ITEMS	**Rates**	**Totals**	1999	2000	2001	2002	2003
DISCOUNT RATE (1+r)	**1.07**						
Total EIS Cost (MWD Share), dollars		2,214,900.00	1,144,900.00	1,070,000.00	0.00	0.00	0.00
Total Construction Cost (MWD Share), dollars		65,808,168.85	0.00	0.00	15,000,000.00	14,018,691.59	13,101,580.92
Gross Recharge Rate/Year, acre-feet		1,100,000.00	0.00	0.00	0.00	0.00	0.00
Net Recharge Rate, acre-feet (includes "hydrologic loss")		1,000,000.00	0.00	0.00	0.00	0.00	0.00
Cumulative Recharged Groundwater Stock, acre-feet			0.00	0.00	0.00	0.00	0.00
Annual "Put" Fees, dollars per acre-foot	50.00	29,470,412.01	0.00	0.00	0.00	0.00	0.00
Annual Storage Fees, dollars per acre-foot	5.00	25,251,893.31	0.00	0.00	0.00	0.00	0.00
Annual "Takes" of Recharged Water, acre-feet		1,000,000.00	0.00	0.00	0.00	0.00	0.00
Annual "Take" Fees, dollars per acre-foot	40.00	8,217,082.75	0.00	0.00	0.00	0.00	0.00
"Prepaid" Native Water Taken, acre feet		500,000.00	0.00	0.00	0.00	0.00	0.00
Pymt for "Prepaid" Native Water (500,000 a-f: $110/a-f 2001, $120/a-f after const.)		97,779,170.77	0.00	0.00	55,000,000.00	0.00	0.00
Native Water Taken (non-prepaid), acre feet		1,500,000.00	0.00	0.00	0.00	0.00	0.00
Payments for Native Water (non-prepaid) @ 95%x$230=$218.50/af	218.50	14,220,112.53	0.00	0.00	0.00	0.00	0.00
Estimated Water Quality Allowance, dollars per a-f of water returned to CRA	5.00	1,557,997.93	0.00	0.00	0.00	0.00	0.00
Total Water Taken		3,000,000.00	0.00	0.00	0.00	0.00	0.00
Total Water Taken, discounted quantity		311,599.59	0.00	0.00	0.00	0.00	0.00
Total Cost to MWD, present value 2001		244,519,738.14	1,144,900.00	1,070,000.00	70,000,000.00	14,018,691.59	13,101,580.92
Cost per acre-foot of water taken, present value 2001		784.72					

MWD_Cadiz_scenario1_7pct

G42-203

2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
12,244,468.15	11,443,428.18	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	110,000.00	110,000.00	110,000.00	110,000.00	110,000.00	110,000.00	110,000.00	110,000.00	110,000.00	110,000.00	0.00
0.00	0.00	100,000.00	100,000.00	100,000.00	100,000.00	100,000.00	100,000.00	100,000.00	100,000.00	100,000.00	100,000.00	0.00
0.00	0.00	100,000.00	200,000.00	300,000.00	400,000.00	500,000.00	600,000.00	700,000.00	800,000.00	900,000.00	1,000,000.00	950,000.00
0.00	0.00	3,921,423.99	3,664,882.23	3,425,123.58	3,201,050.08	2,991,635.58	2,795,921.11	2,613,010.38	2,442,065.78	2,282,304.46	2,132,994.83	0.00
0.00	0.00	356,493.09	666,342.22	934,124.61	1,164,018.21	1,359,834.36	1,525,047.88	1,662,824.79	1,776,047.84	1,867,340.02	1,939,086.21	1,721,618.59
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	50,000.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	724,892.04
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	42,779,170.77	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	90,611.50
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	50,000.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	18,122.30
12,244,468.15	11,443,428.18	47,057,087.85	4,331,224.45	4,359,248.19	4,365,068.28	4,351,469.94	4,320,968.98	4,275,835.17	4,218,113.61	4,149,644.48	4,072,081.03	2,537,122.14

MWD_Cadiz_scenario1_7pct

G42-203

2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
900,000.00	850,000.00	800,000.00	750,000.00	700,000.00	650,000.00	600,000.00	550,000.00	500,000.00	450,000.00	400,000.00	350,000.00	300,000.00	250,000.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1,524,305.69	1,345,441.16	1,183,455.67	1,036,906.25	904,466.51	784,917.53	677,139.50	580,103.93	492,866.55	414,560.65	344,390.99	281,628.14	225,603.32	175,703.52
50,000.00	50,000.00	50,000.00	50,000.00	50,000.00	50,000.00	50,000.00	50,000.00	50,000.00	50,000.00	50,000.00	50,000.00	50,000.00	50,000.00
677,469.20	633,148.78	591,727.83	553,016.67	516,838.01	483,026.17	451,426.33	421,893.77	394,293.24	368,498.36	344,390.99	321,860.73	300,804.42	281,125.63
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
84,683.65	79,143.60	73,965.98	69,127.08	64,604.75	60,378.27	56,428.29	52,736.72	49,286.65	46,062.29	43,048.87	40,232.59	37,600.55	35,140.70
50,000.00	50,000.00	50,000.00	50,000.00	50,000.00	50,000.00	50,000.00	50,000.00	50,000.00	50,000.00	50,000.00	50,000.00	50,000.00	50,000.00
16,936.73	15,828.72	14,793.20	13,825.42	12,920.95	12,075.65	11,285.66	10,547.34	9,857.33	9,212.46	8,609.77	8,046.52	7,520.11	7,028.14
2,286,458.54	2,057,733.54	1,849,149.48	1,659,050.00	1,485,909.27	1,328,321.98	1,184,994.12	1,054,734.42	936,446.44	829,121.30	731,830.85	643,721.47	564,008.30	491,969.85

MWD_Cadiz_scenario1_7pct

G42-203

2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041	2042	2043	2044	2045
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
200,000.00	150,000.00	100,000.00	50,000.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
131,367.12	92,079.76	57,370.56	26,808.67	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
50,000.00	50,000.00	50,000.00	50,000.00	50,000.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
262,734.23	245,546.01	229,482.26	214,469.40	200,438.69	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	100,000.00	100,000.00	100,000.00	100,000.00	100,000.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	100,000.00	100,000.00	100,000.00	100,000.00	100,000.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1,459,151.33	1,363,692.83	1,274,479.28	1,191,102.13	1,113,179.56
32,841.78	30,693.25	28,685.28	26,808.67	25,054.84	46,831.47	43,767.73	40,904.42	38,228.43	35,727.50	33,390.19	31,205.79	29,164.29	27,256.34	25,473.22
50,000.00	50,000.00	50,000.00	50,000.00	50,000.00	100,000.00	100,000.00	100,000.00	100,000.00	100,000.00	100,000.00	100,000.00	100,000.00	100,000.00	100,000.00
6,568.36	6,138.65	5,737.06	5,361.[illegible]	5,010.97	9,366.29	8,753.55	8,180.88	7,645.69	7,145.50	6,678.04	6,241.16	5,832.86	5,451.27	5,094.64
426,943.13	368,319.02	315,538.10	268,086.[illegible]	[illegible]53	46,831.47	43,767.73	40,904.42	38,228.43	35,727.50	1,492,541.52	1,394,898.61	1,303,643.56	1,218,358.47	1,138,652.78

2046	2047	2048	2049	2050	2051	2052	2053	2054	2055
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
100,000.00	100,000.00	100,000.00	100,000.00	100,000.00	100,000.00	100,000.00	100,000.00	100,000.00	100,000.00
1,040,354.73	972,294.14	908,686.11	849,239.36	793,681.64	741,758.54	693,232.28	647,880.64	605,495.92	565,884.04
23,806.74	22,249.29	20,793.73	19,433.39	18,162.05	16,973.88	15,863.44	14,825.64	13,855.74	12,949.29
100,000.00	100,000.00	100,000.00	100,000.00	100,000.00	100,000.00	100,000.00	100,000.00	100,000.00	100,000.00
4,761.35	4,449.86	4,158.75	3,886.68	3,632.41	3,394.78	3,172.69	2,965.13	2,771.15	2,589.86
1,064,161.47	994,543.43	929,479.84	868,672.75	811,843.69	758,732.42	709,095.72	662,706.28	619,351.67	578,833.33

MWD_Cadiz_scenario2

G42-204

Report Worksheet							
This sheet reports 2001 present values, where applicable							
ITEMS	Rates	Totals	1999	2000	2001	2002	2003
DISCOUNT RATE (1+r)	1.05						
Total EIS Cost (MWD Share), dollars		2,152,500.00	1,102,500.00	1,050,000.00	0.00	0.00	0.00
Total Construction Cost (MWD Share), dollars		73,214,285.71	0.00	0.00	37,500,000.00	35,714,285.71	0.00
Gross Recharge Rate/Year, acre-feet		1,100,000.00	0.00	0.00	0.00	0.00	110,000.00
Net Recharge Rate, acre-feet (includes "hydrologic loss")		1,000,000.00	0.00	0.00	0.00	0.00	100,000.00
Cumulative Recharged Groundwater Stock, acre-feet			0.00	0.00	0.00	0.00	100,000.00
Annual "Put" Fees, dollars per acre-foot	50.00	40,447,182.96	0.00	0.00	0.00	0.00	4,988,662.13
Annual Storage Fees, dollars per acre-foot	5.00	38,963,768.80	0.00	0.00	0.00	0.00	453,514.74
Annual "Takes" of Recharged Water, acre-feet		1,000,000.00	0.00	0.00	0.00	0.00	0.00
Annual "Take" Fees, dollars per acre-foot	40.00	14,572,792.57	0.00	0.00	0.00	0.00	0.00
"Prepaid" Native Water Taken, acre feet		500,000.00	0.00	0.00	0.00	0.00	0.00
Pymt for "Prepaid" Native Water (500,000 a-f: $110/a-f 2001, $120/a-f after const.)		109,421,768.71	0.00	0.00	55,000,000.00	0.00	54,421,768.71
Native Water Taken (non-prepaid), acre feet		1,500,000.00	0.00	0.00	0.00	0.00	0.00
Payments for Native Water (non-prepaid) @ 95%x$230=$218.50/af	218.50	103,897,644.57	0.00	0.00	0.00	0.00	0.00
Estimated Water Quality Allowance. dollars per a-f of water returned to CRA	5.00	5,464,797.21	0.00	0.00	0.00	0.00	0.00
Total Water Taken		3,000,000.00	0.00	0.00	0.00	0.00	0.00
Total Water Taken, discounted quantity		1,092,959.44	0.00	0.00	0.00	0.00	0.00
Total Cost to MWD, present value 2001		388,134,740.54	1,102,500.00	1,050,000.00	92,500,000.00	35,714,285.71	59,863,945.58
Cost per acre-foot of water taken, present value 2001		355.12					

MWD_Cadiz_scenario2

G42-204

2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
110,000.00	110,000.00	110,000.00	110,000.00	110,000.00	110,000.00	110,000.00	110,000.00	110,000.00	0.00	0.00	0.00	0.00
100,000.00	100,000.00	100,000.00	100,000.00	100,000.00	100,000.00	100,000.00	100,000.00	100,000.00	0.00	0.00	0.00	0.00
200,000.00	300,000.00	400,000.00	500,000.00	600,000.00	700,000.00	800,000.00	900,000.00	1,000,000.00	950,000.00	900,000.00	850,000.00	800,000.00
4,751,106.79	4,524,863.61	4,309,393.92	4,104,184.68	3,908,747.32	3,722,616.49	3,545,349.04	3,376,522.89	3,215,736.09	0.00	0.00	0.00	0.00
863,837.60	1,234,053.71	1,567,052.33	1,865,538.49	2,132,043.99	2,368,937.77	2,578,435.66	2,762,609.64	2,923,396.45	2,644,977.74	2,386,446.08	2,146,538.80	1,924,068.39
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	50,000.00	50,000.00	50,000.00	50,000.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1,113,674.84	1,060,642.70	1,010,135.91	962,034.20
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	100,000.00	100,000.00	100,000.00	100,000.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	417,628.06	397,741.01	378,800.96	360,762.82
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	150,000.00	150,000.00	150,000.00	150,000.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	83,525.61	79,548.20	75,760.19	72,152.56
5,614,944.39	5,758,917.32	5,876,446.25	5,969,723.17	6,040,791.31	6,091,554.26	6,123,784.70	6,139,132.54	6,139,132.54	4,176,280.64	3,844,829.79	3,535,475.67	3,246,865.41

MWD_Cadiz_scenario2

G42-204

2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
750,000.00	700,000.00	650,000.00	600,000.00	550,000.00	500,000.00	450,000.00	400,000.00	350,000.00	300,000.00	250,000.00	200,000.00	150,000.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1,717,918.21	1,527,038.41	1,350,442.13	1,187,201.87	1,036,446.08	897,355.91	769,162.21	651,142.61	542,618.84	442,954.16	351,550.92	267,848.32	191,320.23
50,000.00	50,000.00	50,000.00	50,000.00	50,000.00	50,000.00	50,000.00	50,000.00	50,000.00	50,000.00	50,000.00	50,000.00	50,000.00
916,223.04	872,593.38	831,041.31	791,467.91	753,778.97	717,884.73	683,699.74	651,142.61	620,135.82	590,605.54	562,481.47	535,696.64	510,187.27
100,000.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	100,000.00	100,000.00	100,000.00	100,000.00	100,000.00	100,000.00	100,000.00	100,000.00	100,000.00	100,000.00	100,000.00	100,000.00
0.00	9,533,082.62	9,079,126.31	8,646,786.96	8,235,035.20	7,842,890.67	7,469,419.68	7,113,733.03	6,774,983.84	6,452,365.56	6,145,110.06	5,852,485.77	5,573,795.97
343,583.64	327,222.52	311,640.49	296,800.47	282,667.11	269,206.77	256,387.40	244,178.48	232,550.93	221,477.08	210,930.55	200,886.24	191,320.23
150,000.00	150,000.00	150,000.00	150,000.00	150,000.00	150,000.00	150,000.00	150,000.00	150,000.00	150,000.00	150,000.00	150,000.00	150,000.00
68,716.73	65,444.50	62,328.10	59,360.09	56,533.42	53,841.35	51,277.48	48,835.70	46,510.19	44,295.42	42,186.11	40,177.25	38,264.05
2,977,724.89	12,259,936.92	11,572,250.24	10,922,257.21	10,307,927.36	9,727,338.08	9,178,669.04	8,660,196.73	8,170,289.44	7,707,402.34	7,270,073.00	6,856,916.97	6,466,623.70

MWD_Cadiz_scenario2

G42-204

2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041	2042	2043	2044	2045
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
100,000.00	50,000.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
121,473.16	57,844.36	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
50,000.00	50,000.00	50,000.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
485,892.64	462,754.90	440,718.95	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
100,000.00	100,000.00	100,000.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5,308,377.12	5,055,597.25	4,814,854.53	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
182,209.74	173,533.09	165,269.61	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
150,000.00	150,000.00	150,000.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
36,441.95	34,706.62	33,053.9[illegible]	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
6,097,952.66	5,749,729.60	5,420,843.[illegible]	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

MWD_Cadiz_scenario2

G42-204

2046	2047	2048	2049	2050	2051	2052	2053	2054	2055
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

MWD_Cadiz_scenario2_3pct

G42-205

Report Worksheet							
This sheet reports 2001 present values, where applicable							
ITEMS	Rates	Totals	1999	2000	2001	2002	2003
DISCOUNT RATE (1+r)	1.03						
Total EIS Cost (MWD Share), dollars		2,090,900.00	1,060,900.00	1,030,000.00	0.00	0.00	0.00
Total Construction Cost (MWD Share), dollars		73,907,766.99	0.00	0.00	37,500,000.00	36,407,766.99	0.00
Gross Recharge Rate/Year, acre-feet		1,100,000.00	0.00	0.00	0.00	0.00	110,000.00
Net Recharge Rate, acre-feet (includes "hydrologic loss")		1,000,000.00	0.00	0.00	0.00	0.00	100,000.00
Cumulative Recharged Groundwater Stock, acre-feet			0.00	0.00	0.00	0.00	100,000.00
Annual "Put" Fees, dollars per acre-foot	50.00	45,549,626.80	0.00	0.00	0.00	0.00	5,184,277.50
Annual Storage Fees, dollars per acre-foot	5.00	49,918,059.67	0.00	0.00	0.00	0.00	471,297.95
Annual "Takes" of Recharged Water, acre-feet		1,000,000.00	0.00	0.00	0.00	0.00	0.00
Annual "Take" Fees, dollars per acre-foot	40.00	21,495,608.76	0.00	0.00	0.00	0.00	0.00
"Prepaid" Native Water Taken, acre feet		500,000.00	0.00	0.00	0.00	0.00	0.00
Pymt for "Prepaid" Native Water (500,000 a-f: $110/a-f 2001, $120/a-f after const.)		111,555,754.55	0.00	0.00	55,000,000.00	0.00	56,555,754.55
Native Water Taken (non-prepaid), acre feet		1,500,000.00	0.00	0.00	0.00	0.00	0.00
Payments for Native Water (non-prepaid) @ 95%x$230=$218.50/af	218.50	162,549,283.34	0.00	0.00	0.00	0.00	0.00
Estimated Water Quality Allowance, dollars per a-f of water returned to CRA	5.00	8,060,853.29	0.00	0.00	0.00	0.00	0.00
Total Water Taken		3,000,000.00	0.00	0.00	0.00	0.00	0.00
Total Water Taken, discounted quantity		1,612,170.66	0.00	0.00	0.00	0.00	0.00
Total Cost to MWD, present value 2001		475,127,853.40	1,060,900.00	1,030,000.00	92,500,000.00	36,407,766.99	62,211,330.00
Cost per acre-foot of water taken, present value 2001		294.71					

MWD_Cadiz_scenario2_3pct

G42-205

2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
110,000.00	110,000.00	110,000.00	110,000.00	110,000.00	110,000.00	110,000.00	110,000.00	110,000.00	0.00	0.00	0.00	0.00
100,000.00	100,000.00	100,000.00	100,000.00	100,000.00	100,000.00	100,000.00	100,000.00	100,000.00	0.00	0.00	0.00	0.00
200,000.00	300,000.00	400,000.00	500,000.00	600,000.00	700,000.00	800,000.00	900,000.00	1,000,000.00	950,000.00	900,000.00	850,000.00	800,000.00
5,033,279.13	4,886,678.76	4,744,348.31	4,606,163.41	4,472,003.31	4,341,750.79	4,215,292.03	4,092,516.53	3,973,317.02	0.00	0.00	0.00	0.00
915,141.66	1,332,730.57	1,725,217.57	2,093,710.64	2,439,274.53	2,762,932.32	3,065,666.93	3,348,422.62	3,612,106.38	3,331,554.43	3,064,281.03	2,809,750.67	2,567,447.79
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	50,000.00	50,000.00	50,000.00	50,000.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1,402,759.76	1,361,902.68	1,322,235.61	1,283,723.89
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	100,000.00	100,000.00	100,000.00	100,000.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	526,034.91	510,713.50	495,838.35	481,396.46
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	150,000.00	150,000.00	150,000.00	150,000.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	105,206.98	102,142.70	99,167.67	96,279.29
5,948,420.79	6,219,409.34	6,469,565.88	6,699,874.05	6,911,277.85	7,104,683.11	7,280,958.96	7,440,939.15	7,585,423.40	5,260,349.10	4,936,897.21	4,627,824.64	4,332,568.14

MWD_Cadiz_scenario2_3pct

G42-205

2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
750,000.00	700,000.00	650,000.00	600,000.00	550,000.00	500,000.00	450,000.00	400,000.00	350,000.00	300,000.00	250,000.00	200,000.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2,336,876.02	2,117,557.56	1,909,032.47	1,710,858.08	1,522,608.32	1,343,873.19	1,174,258.13	1,013,383.50	860,884.04	716,408.35	579,618.41	450,189.06
50,000.00	50,000.00	50,000.00	50,000.00	50,000.00	50,000.00	50,000.00	50,000.00	50,000.00	50,000.00	50,000.00	50,000.00
1,246,333.88	1,210,032.89	1,174,789.22	1,140,572.05	1,107,351.51	1,075,098.55	1,043,785.00	1,013,383.50	983,867.47	955,211.14	927,389.45	900,378.11
100,000.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	100,000.00	100,000.00	100,000.00	100,000.00	100,000.00	100,000.00	100,000.00	100,000.00	100,000.00	100,000.00	100,000.00
0.00	13,219,609.34	12,834,572.18	12,460,749.69	12,097,815.23	11,745,451.68	11,403,351.14	11,071,214.70	10,748,752.14	10,435,681.69	10,131,729.79	9,836,630.87
467,375.20	453,762.33	440,545.96	427,714.52	415,256.82	403,161.96	391,419.38	380,018.81	368,950.30	358,204.18	347,771.05	337,641.79
150,000.00	150,000.00	150,000.00	150,000.00	150,000.00	150,000.00	150,000.00	150,000.00	150,000.00	150,000.00	150,000.00	150,000.00
93,475.04	90,752.47	88,109.19	85,542.90	83,051.36	80,632.39	78,283.88	76,003.76	73,790.06	71,640.84	69,554.21	67,528.36
4,050,585.10	17,000,962.13	16,358,939.82	15,739,894.34	15,143,031.88	14,567,585.38	14,012,813.65	13,478,000.51	12,962,453.95	12,465,505.36	11,986,508.70	11,524,839.83

MWD_Cadiz_scenario2_3pct

G42-205

2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041	2042	2043	2044
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
150,000.00	100,000.00	50,000.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
327,807.56	212,173.18	102,996.69	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
50,000.00	50,000.00	50,000.00	50,000.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
874,153.51	848,692.72	823,973.52	799,974.29	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
100,000.00	100,000.00	100,000.00	100,000.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
9,550,127.06	9,271,968.02	9,001,910.70	8,739,719.12	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
327,807.56	318,259.77	308,990.07	299,990.36	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
150,000.00	150,000.00	150,000.00	150,000.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
65,561.51	63,651.95	61,798.01	59,998.07	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
11,079,895.69	10,651,093.69	10,237,870.97	9,839,683.77	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

MWD_Cadiz_scenario2_3pct

G42-205

2045	2046	2047	2048	2049	2050	2051	2052	2053	2054	2055
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

MWD_Cadiz_scenario2_7pct

G42-206

Report Worksheet							
This sheet reports 2001 present values, where applicable							
ITEMS	Rates	Totals	1999	2000	2001	2002	2003
DISCOUNT RATE (1+r)	1.07						
Total EIS Cost (MWD Share), dollars		2,214,900.00	1,144,900.00	1,070,000.00	0.00	0.00	0.00
Total Construction Cost (MWD Share), dollars		72,546,728.97	0.00	0.00	37,500,000.00	35,046,728.97	0.00
Gross Recharge Rate/Year, acre-feet		1,100,000.00	0.00	0.00	0.00	0.00	110,000.00
Net Recharge Rate, acre-feet (includes "hydrologic loss")		1,000,000.00	0.00	0.00	0.00	0.00	100,000.00
Cumulative Recharged Groundwater Stock, acre-feet			0.00	0.00	0.00	0.00	100,000.00
Annual "Put" Fees, dollars per acre-foot	50.00	36,102,521.94	0.00	0.00	0.00	0.00	4,803,913.01
Annual Storage Fees, dollars per acre-foot	5.00	30,934,655.14	0.00	0.00	0.00	0.00	436,719.36
Annual "Takes" of Recharged Water, acre-feet		1,000,000.00	0.00	0.00	0.00	0.00	0.00
Annual "Take" Fees, dollars per acre-foot	40.00	10,066,279.71	0.00	0.00	0.00	0.00	0.00
"Prepaid" Native Water Taken, acre feet		500,000.00	0.00	0.00	0.00	0.00	0.00
Pymt for "Prepaid" Native Water (500,000 a-f: $110/a-f 2001, $120/a-f after const.)		107,406,323.70	0.00	0.00	55,000,000.00	0.00	52,406,323.70
Native Water Taken (non-prepaid), acre feet		1,500,000.00	0.00	0.00	0.00	0.00	0.00
Payments for Native Water (non-prepaid) @ 95%x$230=$218.50/af	218.50	67,410,868.08	0.00	0.00	0.00	0.00	0.00
Estimated Water Quality Allowance, dollars per a-f of water returned to CRA	5.00	3,774,854.89	0.00	0.00	0.00	0.00	0.00
Total Water Taken		3,000,000.00	0.00	0.00	0.00	0.00	0.00
Total Water Taken, discounted quantity		754,970.98	0.00	0.00	0.00	0.00	0.00
Total Cost to MWD, present value 2001		330,457,132.43	1,144,900.00	1,070,000.00	92,500,000.00	35,046,728.97	57,646,956.07
Cost per acre-foot of water taken, present value 2001		437.71					

MWD_Cadiz_scenario2_7pct

G42-206

2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
110,000.00	110,000.00	110,000.00	110,000.00	110,000.00	110,000.00	110,000.00	110,000.00	110,000.00	0.00	0.00	0.00	0.00
100,000.00	100,000.00	100,000.00	100,000.00	100,000.00	100,000.00	100,000.00	100,000.00	100,000.00	0.00	0.00	0.00	0.00
200,000.00	300,000.00	400,000.00	500,000.00	600,000.00	700,000.00	800,000.00	900,000.00	1,000,000.00	950,000.00	900,000.00	850,000.00	800,000.00
4,489,638.32	4,195,923.67	3,921,423.99	3,664,882.23	3,425,123.58	3,201,050.08	2,991,635.58	2,795,921.11	2,613,010.38	0.00	0.00	0.00	0.00
816,297.88	1,144,342.82	1,425,972.36	1,665,855.56	1,868,249.23	2,037,031.87	2,175,734.97	2,287,571.81	2,375,463.98	2,109,056.81	1,867,340.02	1,648,223.27	1,449,784.08
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	50,000.00	50,000.00	50,000.00	50,000.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	888,023.92	829,928.90	775,634.48	724,892.04
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	100,000.00	100,000.00	100,000.00	100,000.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	333,008.97	311,223.34	290,862.93	271,834.51
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	150,000.00	150,000.00	150,000.00	150,000.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	66,601.79	62,244.67	58,172.59	54,366.90
5,305,936.20	5,340,266.48	5,347,396.35	5,330,737.79	5,293,372.81	5,238,081.94	5,167,370.55	5,083,492.92	4,988,474.36	3,330,089.69	3,008,492.25	2,714,720.69	2,446,510.63

MWD_Cadiz_scenario2_7pct

G42-206

2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
750,000.00	700,000.00	650,000.00	600,000.00	550,000.00	500,000.00	450,000.00	400,000.00	350,000.00	300,000.00	250,000.00	200,000.00	150,000.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1,270,254.74	1,108,010.37	961,557.73	829,525.00	710,652.26	603,782.72	507,854.62	421,893.77	345,006.58	276,373.77	215,244.37	160,930.37	112,801.66
50,000.00	50,000.00	50,000.00	50,000.00	50,000.00	50,000.00	50,000.00	50,000.00	50,000.00	50,000.00	50,000.00	50,000.00	50,000.00
677,469.20	633,148.78	591,727.83	553,016.67	516,838.01	483,026.17	451,426.33	421,893.77	394,293.24	368,498.36	344,390.99	321,860.73	300,804.42
100,000.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	100,000.00	100,000.00	100,000.00	100,000.00	100,000.00	100,000.00	100,000.00	100,000.00	100,000.00	100,000.00	100,000.00	100,000.00
0.00	6,917,150.43	6,464,626.57	6,041,707.08	5,646,455.21	5,277,060.95	4,931,832.66	4,609,189.40	4,307,653.65	4,025,844.53	3,762,471.52	3,516,328.53	3,286,288.34
254,050.95	237,430.79	221,897.94	207,381.25	193,814.25	181,134.82	169,284.87	158,210.16	147,859.96	138,186.88	129,146.62	120,697.78	112,801.66
150,000.00	150,000.00	150,000.00	150,000.00	150,000.00	150,000.00	150,000.00	150,000.00	150,000.00	150,000.00	150,000.00	150,000.00	150,000.00
50,810.19	47,486.16	44,379.59	41,476.25	38,762.85	36,226.96	33,856.97	31,642.03	29,571.99	27,637.38	25,829.32	24,139.56	22,560.33
2,201,774.89	8,895,740.37	8,239,810.07	7,631,629.99	7,067,759.73	6,545,004.65	6,060,398.49	5,611,187.10	5,194,813.44	4,808,903.53	4,451,253.49	4,119,817.40	3,812,696.09

G42-206

2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041	2042	2043	2044	2045
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
100,000.00	50,000.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
70,281.41	32,841.78	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
50,000.00	50,000.00	50,000.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
281,125.63	262,734.23	245,546.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
100,000.00	100,000.00	100,000.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3,071,297.52	2,870,371.51	2,682,590.20	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
105,422.11	98,525.34	92,079.76	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
150,000.00	150,000.00	150,000.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
21,084.42	19,705.07	18,415.95	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3,528,126.67	3,264,472.86	3,020,215.96	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00