

**Cost Allocation Procedures  
of the California State Water Project**

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Final Report

Prior drafts of this independent report have been provided to staffs of the Department of Finance, Department of Water Resources, Legislative Analyst's Office, and State Water Project Contractors for review. Subsequent comments have been considered in completing this report, but it has not been approved by any agency. Dr. Griffin can be reached at [ron@waterecon.com](mailto:ron@waterecon.com).

## Executive Summary

This report investigates the allocation of State Water Project (SWP) costs between contractors (for water deliveries) and the people of California (for recreation and enhanced fish and wildlife). Debate and studies of this topic encompass the distinguishable matters of cost *responsibility* and cost *allocation*. Cost responsibility is determined by public policy. Cost allocation is the technical task of dividing costs, within bounds established by cost responsibility directives. Some aspects of recent debate ask whether policy changes should be adopted to revise cost responsibilities for the SWP. These responsibility-oriented policy questions are not analyzed here although some pertinent considerations are identified.

Under current policy as framed by the Davis-Dolwig Act (1961) and related laws and implementation rules, there are firm requirements that the people of California are responsible for particular costs. These costs include the *separable* costs attributable to fish and wildlife enhancements and recreation. They also include a share of the *joint* costs of the SWP. All costs arising from water supply to contractors, power production, and the preservation of fish and wildlife are the responsibility of contractors. The methodology for performing cost allocation consistent with this policy remains largely dictated by the original Davis-Dolwig Act and rules of the early 1960's. Further methodological refinements were enacted by the Department of Water Resources (DWR) during the 1960's.

We find that the principles selected by the State 50 years ago provide a reasonable platform for conducting cost allocation. To a great extent these principles are consistent with accepted and recommended practice. Key among these principles is the *separable costs-remaining benefits* methodology. This method is well founded insofar as it is supportive of both efficiency and fairness ideals. California's adaptation of this methodology for the circumstances of the SWP is also sound. Should the State decide to alter cost responsibilities in the future, the in-place allocation methods can be revised to accommodate the change.

Implementation of this methodology by the DWR suffers some important shortcomings. As a result of the required method of cost allocation, allocated shares are strongly affected by the benefits anticipated from the SWP. Especially important are estimated benefits received by water contractors and those benefits associated with recreation and enhanced fish and wildlife. Reviewed procedures indicate that both categories of benefits have not been evaluated properly. Several problems are identified:

- Benefit-identifying practices are dominated by evaluations of alternative costs. Attention is lacking to willingness to pay (from the perspective of user values adjusted to represent the wholesale-like recreation and water products of the SWP).
- The range of evaluated alternatives is narrow – often emphasizing a particular downscaling of the SWP unit for which a benefit evaluation is being sought.
- In most cases, measures of willingness to pay for water supply were assumed to exceed alternative costs and to therefore be irrelevant and unneeded. The burden of justifying this assumption is unmet, and its veracity was questionable given the economic development and population of California fifty years ago. It is a more compelling assumption now.

- In the case of recreational benefits, the use of alternative costs is objectionable, as the posed alternatives are not likely to have been pursued in the absence of the SWP. Recreational benefits should be based solely on measures of willingness to pay.
- In the case of recreational benefits, estimating willingness to pay with the unit-day procedure is acceptable. The omission of nonuse values can be regarded as reasonable considering the age of the estimates. Although recreation days may have been overestimated originally, the value-per-day multiplier was probably underestimated, with the most likely combined effect being that recreation willingness to pay has been underestimated.

In the absence of fresh reestimations of project benefits, it is difficult to anticipate fully the consequences of removing these errors. However, there is some evidence that water supply benefits may have been overestimated and that recreational benefits may have been underestimated. Low confidence must be attached to each of these impressions at this time. Should these perceptions be verified by corrected benefit evaluations, the total SWP costs previously allocated to the people of California will be found to have been understated. This is a preliminary assessment that is unlikely to be constant over the life of the SWP, inferring that accurate cost shares for the first 25 years (such as 1961-1985) may differ sizably from those for the second 25 and the forthcoming 25.

# **Cost Allocation Procedures of the California State Water Project**

## **I. Introduction**

This report arises from the long-evolving issues surrounding implementation of the Davis-Dolwig Act of 1961. The focus of this report is upon the adequacy of cost allocation practices conducted by the California Department of Water Resources (DWR) in discharging its responsibilities to allocate State Water Project costs to the Project's many beneficiaries. Of special concern is the division of costs between the people of California and the water contractors of the State Water Project (SWP).

The following topics are addressed within the forthcoming sections of this report.

- Background information is assembled for describing the issues at hand and the tenor of this report (Part I).
- Acceptable practices of cost allocation are developed in a from-the-ground-up explanation of cost allocation's central objectives, principles, and methods (Part II).
- Cost allocation methods utilized for the SWP are identified through their relation to standard practices (Part III).
- With these elements in place, the adequacy of cost allocation practices performed for the SWP is reviewed, and prior commentary on these practices is reviewed as well (Part IV).
- The final portion of the report provides recommendations and extensions (Part V).

Within this report the related professional literature of cost allocation and water resource economics is utilized and referenced. A large volume of materials provides relevant information describing the Californian context of the SWP and the Davis-Dolwig challenge. Examined laws, rules, agency procedures, agency reports, interagency agreements, and water supply contracts pertinent to this review are partially listed in Appendix A.

### **I.1 Investigative Orientation**

Given the central issue at hand – whether SWP costs have been properly allocated between the people of California and contractors – and given the half century that has passed since initiating cost allocation policy for the Project, it is proper to ask whether cost allocation has been practiced "reasonably" during the life span of the Project. With the advances in economics that may have occurred, it is conceivable that a reasonable 1960's approach ceased to be reasonable at some point in time. A second matter influencing reasonableness is that continual analysis and reanalysis of cost allocations raise the overall costs of SWP administrative operations, potentially burdening all SWP beneficiaries in amounts not offset by the value of "better" cost allocations. That is, there is a tradeoff to be respected. Thirdly, it is quite possible that entirely reasonable, well informed, and unbiased people may arrive at differing opinions regarding best cost allocations. Where this possibility becomes elevated, for whatever reason(s), it may be appropriate to indicate a range of acceptable assessments. Thus, rather than attempting identification of a best cost allocation given what we know in 2011, it is advisable to ask whether SWP cost allocations have been reasonably performed during their

history.

A clear constraint in this pursuit is the limited available budget and time. Past cost allocations for the SWP likely involved many thousands of hours by analysts spread over multiple decades, so it is not realistic to revise cost allocations at this time.

## **I.2 Legislative Background**

The Davis-Dolwig Act of 1961 enlarged the State's approach to developing the recreational and environmental functions accompanying the SWP. The SWP was under design and construction at the time, in accordance with an initial Legislative appropriation in 1957<sup>1</sup> and more expansive directives set forth by the Burns-Porter Act of 1959.<sup>2</sup> The Burns-Porter Act had authorized the SWP with emphasis upon water supply development but also including recreational facilities, and the Burns-Porter Act provided for financial support for pursuing the considerable task of building multiple reservoirs and water conveyances. Also known as the California Water Resources Development Bond Act at the time, the Burns-Porter Act was ratified by voters in 1960.<sup>3</sup>

Building on the authorization and financing platform established by Burns-Porter, the Davis-Dolwig Act (a) directed the State's resource agencies to expand fish/wildlife/recreation functions for water projects in which the State participates and (b) indicated that the people of California would be responsible for the associated costs:

"providing for the enhancement of fish and wildlife and for recreation ... benefits all people of California and ... costs attributable to such enhancement ... should be borne by them."<sup>4</sup>

As a consequence, the Davis-Dolwig Act altered the design of many components of the SWP in such a way as to increase SWP expenditures:

"There shall be incorporated in the planning and construction of each project those features ... necessary or desirable for the preservation of fish and wildlife, and necessary or desirable to permit ... full utilization of the project for the enhancement of fish and wildlife and for recreational purposes to the extent that those features are consistent with other uses of the project, if any."<sup>5</sup>

Davis-Dolwig explicitly encouraged added land acquisitions and public works "to the extent possible" in pursuing these missions.<sup>6</sup>

With respect to the financial consequences of the Davis-Dolwig directives, the Act promulgates the following rules:<sup>7</sup>

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<sup>1</sup> California Department of Water Resources Bulletin No. 132-63, p. 20, 1963.

<sup>2</sup> California Department of Water Resources Bulletin No. 117, 1968.

<sup>3</sup> See Starr (2009) or <http://www.water.ca.gov/swp/docs/Timeline.pdf>.

<sup>4</sup> California Water Code §11900.

<sup>5</sup> California Water Code §11910.

<sup>6</sup> California Water Code §11911.

<sup>7</sup> California Water Code §§11912-11913.

- fish and wildlife *preservation* costs are assigned to water and/or power purposes,
- fish and wildlife *enhancement* costs are assigned to the General Fund and hence to the people of California, and
- recreation costs are assigned to the General Fund and hence to the people of California.

Furthermore, it is explicitly stated that the "nonreimbursable costs" (for fish and wildlife enhancement and recreation) "shall not be included in the prices, rates, and charges for water and power".<sup>8</sup>

Via these two major Acts and subsequent amendments, the Legislature and people of California directed the State's natural resource agencies – primarily the DWR – to design, build, and operate water control facilities, and to incorporate environmentally and recreationally oriented components within the overall SWP system. The other natural resource agencies, including the Department of Parks and Recreation, the Department of Fish and Game, and the Department of Boating and Waterways, were instructed by the Davis-Dolwig Act to collaborate in the performance of these duties.

### **I.3 Implementation Background**

In addition to construction and operation duties, the DWR was expected to enter into supply contracts as a wholesaler of water and power. As Legislative intent was that the DWR recoup SWP costs from beneficiaries, procedures for allocating costs were immediately required. Important directives were provided by the Governor's Contracting Principles (January 20, 1960). Introduced in the doctrines developed by these Principles were the ideas of a "Delta Pooling Concept" and a consequent base "Delta Water Rate," as well as "Transportation Rates" for individual segments of the California Aqueduct. Item 1 of the Contracting Principles stated that "Costs shall be allocated on the *separable costs-remaining benefits* basis for multipurpose development facilities and on a *proportionate use* basis, by areas, for transportation facilities (p. 1) [italics added]." As a consequence of the Governor's Principles, some degree of clarity over desired cost allocation methods was achieved, enabling the DWR to proceed with the development of contracts with user agencies.

The Governor's Principles went so far as to specify an "estimated" Delta Water Rate of \$3.50/acre-foot as well as transportation rates for 12 segments of the SWP, thereby laying further groundwork for resolving terms with potential contractors. "Contractors" refers to the many water authorities that entered long-term agreements to buy the water captured and transported by the SWP. These contractors, currently numbering 29 when the Department of Parks and Recreation is excluded, further process and transport SWP water to agricultural, municipal, and industrial customers. The \$3.50 Delta Water Rate was not to be disturbed until 1970, thereby providing a stability in costs desired by initial contractors. Yet, contract terms also provided for the retroactive revision of this rate once 1970 arrived.

Later in 1960 (November) the first contract was executed between the DWR and a contractor (Metropolitan Water District). More contracts followed. In August 1962 the "Standard Provisions for Water Supply Contract" was approved, and this document presented model contract terms as well as format and computational specifics. Contracts between the

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<sup>8</sup> California Water Code §11912.

DWR and the many clients of the SWP were prepared so as to align with and corroborate the cost-sharing intentions set out by the Davis-Dolwig Act. Bulletin 132-63 (1963) identified the initial contract with the Metropolitan Water District<sup>9</sup> as the "prototype contract" upon which all other contracts were modeled. Each of the two major charges, the Delta Water Charge and the Transportation Charge, was to be composed of three elements: a capital cost, a minimum operating cost, and a variable operating cost, with the three-part division of the Delta Water Rate postponed until after 1971.<sup>10</sup> Article 22(e) of the prototype contract and the "Standard Provisions ... Contract" affirms both cost allocation methods, separable costs-remaining benefits and proportionate use, first directed by the Governor's Principles.

Agency Order 6 (1963) identified the relative responsibilities of the three State resource departments in carrying out the Davis-Dolwig dimensions of the SWP. Among these agencies, the DWR was placed in the dominant decision-making position, with responsibilities that included overall planning, land acquisition, and preparing funding recommendations (including those relating to recreation and fish and wildlife enhancements). Moreover, it was established that the capital and operational costs incurred by resource agencies other than the DWR would be paid for and budgeted within those agencies (Bulletin 132-69 App. D, p. 5).

#### **I.4 Funding Sources and Shortfalls**

In following the procedures indicated above, the DWR began conducting cost allocations that resulted in annual funding requests to the Legislature commencing in 1967 (Bulletin 153-67, p. x). The DWR identifies three categories of cost allocations to recreation and fish and wildlife enhancement (primarily to recreation): (1) the specific costs of acquiring land and right-of-ways to develop as recreational facilities, and a portion of both (2) construction and (3) operational costs of providing joint-use facilities where recreation is one of the uses. Many of the SWP recreational facilities are operated and funded by other agencies (e.g. County of Los Angeles, California Department of Parks and Recreation, U.S. Forest Service), and these funding sources are not included in the allocation of Davis-Dolwig costs. Historical allocations to each recreation cost category are detailed in Table 1. Predictably, most land purchase and capital expenditures occurred during the early years of the project, whereas operational costs have generally increased over the span of the project as more facilities reached an operational stage.

From 1967 to 1997, the DWR requested specific reimbursements from the State for joint capital and land costs to recreation, including interest on prior unreimbursed requests. Bulletins 153-67 and 153-68 and Appendix D to Bulletins 132-69 to 132-97 enumerate these requests, which are compiled in Table 1. Forty percent of the combined requested amount was reported in 1979 when the California Aqueduct was allocated. Unexpectedly small or even negative requests can result from the DWR practice of periodically recalculating the complete project history as actual experiences replace projected experiences and as fresh projections are made. Such retroactive accounting adjustments, rescaling of planned facilities, and other revisions inject a degree of instability while also providing confidence that cost shares converge

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<sup>9</sup> The initial contract with MWD represented 75% of the 2.053 million acre feet initially contracted to twelve clients (B132-63, 1963, p. 160). At that time the planned capacity of the SWP was 4.0 million acre feet.

<sup>10</sup> The prototype contract later adopted a 1970 Delta Water Rate of \$6.65 and a 1971 Rate of \$7.24 (Article 22(b)).

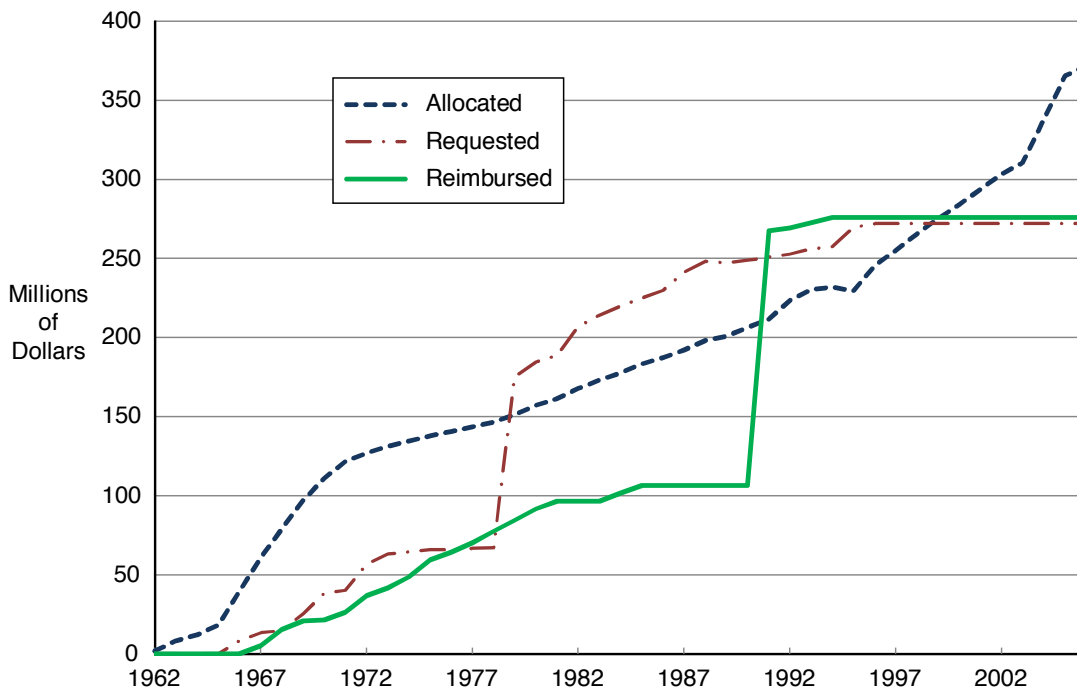
**Table 1. Allocations and Reimbursements to Recreation***(values in \$1,000s)*

Year	Recreation Allocations			Requested by DWR	State Reimbursements		
	Capital	Land	OMPR		Tidelands	Offsets	General Fund
1962	1,830	204	5	0	0	0	5
1963	5,344	711	14	0	0	0	14
1964	3,752	267	7	0	0	0	7
1965	4,423	1,682	34	0	0	0	34
1966	19,526	1,867	47	8,261	0	0	47
1967	18,963	1,853	57	5,250	5,000	0	57
1968	14,213	4,087	303	1,440	10,000	0	303
1969	11,626	6,027	401	10,600	5,000	0	401
1970	12,700	629	538	12,897	0	0	538
1971	9,775	48	614	1,731	5,000	0	65
1972	4,358	168	1,105	16,726	10,000	0	337
1973	2,796	78	1,363	6,247	5,000	0	0
1974	1,644	48	1,528	1,469	5,000	0	1,755
1975	1,397	143	1,823	1,133	8,000	0	3,037
1976	1,080	20	1,632	110	2,000	0	2,871
1977	1,380	25	1,559	1,030	5,000	0	853
1978	1,063	280	1,765	236	5,000	0	2,142
1979	1,791	692	1,780	108,252	5,000	0	2,025
1980	2,620	1,634	1,890	9,298	5,000	0	2,166
1981	2,258	106	1,870	4,166	5,000	0	0
1982	3,896	516	1,997	18,268	0	0	0
1983	2,714	54	2,719	6,989	0	0	0
1984	1,819	(81)	2,671	5,895	5,000	0	0
1985	1,058	(44)	4,826	5,181	5,000	0	0
1986	684	(15)	3,134	4,854	0	0	0
1987	861	6	3,973	11,379	0	0	0
1988	1,807	(14)	4,288	6,830	0	0	0
1989	1,782	(50)	878	(766)	0	0	0
1990	1,763	(23)	3,684	1,497	0	0	0
1991	2,179	(9)	3,262	1,985	0	160,958	0
1992	2,355	41	9,426	1,718	0	1,718	0
1993	2,433	10	4,533	3,350	0	3,480	0
1994	1,573	0	0	1,599	0	3,077	0
1995	1,767	0	(4,397)	12,079	0	0	0
1996	2,044	0	13,943	2,330	0	0	0
1997	1,544	361	7,864	0	0	0	0
1998	896	1,577	7,704	0	0	0	0
1999	872	498	8,536	0	0	0	0
2000	397	9	8,485	0	0	0	0
2001	713	10	8,992	0	0	0	0
2002	651	(3)	8,734	0	0	0	0
2003	399	0	7,044	0	0	0	0
2004	758	0	26,937	0	0	0	0
2005	26,630	615	0	0	0	0	0
2006	951	668	4,667	0	0	0	0
Total	185,083	24,693	162,235	272,033	90,000	169,234	16,657



upon accurate results as actual costs unfold over time.

Historical responses to DWR requests and the Davis-Dolwig "intent" include early direct payments from the General Fund, an apportionment of tideland oil and gas revenues from 1967 to 1985 pursuant to the Burns-Porter Act and its amendments, and a lump sum offset legislated by AB 1442 (1989) to address a large, accumulated indebtedness. General Fund appropriations are treated as project operating revenues, whereas tideland oil and gas revenues are treated as miscellaneous receipts. The "Tideland" column of Table 1 tracks oil and gas revenues as they are applied to capital expenditures from the California Water Fund. Both columns are compiled from the Project Financial Analysis page of Bulletin 132 (various editions). Legislative offsets are tracked as reimbursements to funds, as reported in Appendix D of Bulletin 132. Figure 1 illustrates the accumulated effects of the financial history depicted within Table 1. Here, it is seen that Davis-Dolwig payments have generally lagged allocations and requests. Eventually, the DWR suspended budget requests for Davis-Dolwig costs while continuing to allocate such SWP costs to recreation and enhanced fish and wildlife. Alternative funding sources have been under development, because it is not permissible for State Water Project Contractors (SWPCs) to pay these costs. Budget requests have been renewed in recent years.



**Figure 1. Cumulative Allocations, Requests, and Reimbursements, 1962-2006**

The relative weight of the Davis-Dolwig reimbursements within the SWP may be seen in Table 2. Payments from the SWPCs support the bulk of the SWP budget, whose two primary items are (i) operation, maintenance, power, and replacement costs and (ii) debt service on capital bonds. SWPC payments are compiled from Bulletin 132. Other sources of revenue include federal payments, interest from fund accounts, land sales, and ad hoc negotiations.

**Table 2. Major Revenue Flows and Charges for the SWP***(values in \$1,000s)*

Year	Revenue Sources			Principal Charges		Difference
	Contractors	State	Other	OMPR	Debt Service	
1962	1,024	5	41	130	0	940
1963	2,315	14	643	227	0	2,745
1964	2,550	7	32,908	222	5,507	29,736
1965	4,844	34	15,619	520	12,637	7,340
1966	8,357	47	29,408	651	19,115	18,046
1967	15,493	5,057	22,340	843	30,402	11,645
1968	31,155	10,303	4,283	10,474	31,776	3,491
1969	20,525	5,401	59,689	7,162	45,906	32,547
1970	50,113	538	30,001	12,101	53,637	14,914
1971	49,702	5,065	157,278	16,692	103,648	91,705
1972	76,092	10,337	138,175	23,604	83,512	117,488
1973	70,727	5,000	53,292	28,657	96,492	3,870
1974	74,876	6,755	48,196	32,443	94,608	2,776
1975	98,727	11,037	32,327	36,137	96,460	9,494
1976	105,300	4,871	(110,171)	43,987	92,500	(136,487)
1977	105,920	5,853	194,928	50,147	107,781	148,773
1978	107,794	7,142	36,851	56,686	107,802	(12,701)
1979	131,853	7,025	64,280	54,393	113,044	35,721
1980	139,781	7,166	39,652	64,520	114,431	7,648
1981	166,475	5,000	119,821	84,934	120,759	85,603
1982	309,932	0	48,858	92,665	143,094	123,031
1983	291,917	0	126,944	160,983	192,100	65,778
1984	415,006	5,000	38,496	279,090	171,895	7,517
1985	460,186	5,000	42,189	265,796	187,429	54,150
1986	355,681	0	137,399	242,365	186,773	63,942
1987	408,969	0	27,475	257,987	196,963	(18,506)
1988	443,939	0	40,868	142,434	201,889	140,484
1989	344,715	0	165,734	229,012	228,966	52,471
1990	429,433	0	86,743	267,167	208,308	40,701
1991	502,278	160,958	(118,601)	228,596	246,133	69,906
1992	504,358	1,718	49,165	297,399	205,852	51,990
1993	555,662	3,480	67,797	258,009	266,579	102,351
1994	361,551	3,077	(25,737)	0	333,546	5,345
1995	409,272	0	158,104	363,701	220,049	(16,374)
1996	575,109	0	36,870	231,548	307,305	73,126
1997	777,809	0	163,372	303,224	659,702	(21,745)
1998	565,514	0	82,843	296,964	260,766	90,627
1999	286,177	0	81,542	(2,653,084)	266,276	2,754,527
2000	485,859	0	221,746	3,292,630	85,172	(2,670,197)
2001	1,301,083	0	61,663	995,880	663,500	(296,634)
2002	917,560	0	(7,140)	262,638	261,301	386,481
2003	1,031,016	0	132,316	1,045,566	(26,622)	144,388
2004	292,275	0	502,857	177,999	(76,143)	693,276
2005	734,548	0	86,757	326,514	251,329	243,462
2006	940,821	0	98,647	734,972	262,652	41,844
Total	14,964,293	275,890	3,276,468	8,624,585	7,234,831	2,657,235

SWP expenses include Operations, Maintenance, Power, and Replacement (OMPR) costs, deposits to reserves, capital resources expenditures, and debt service (Bulletin 132-95, p. 221). The shift in emphasis from capital construction to operations over time is noticeable in the relative magnitudes of the two principal categories of SWP charges, annual OMPR and payments to bonds. OMPR charges can be zero or negative in a given year due to retroactive accounting adjustments. The difference between revenues (columns 1-3) and the two principal charges (columns 4 and 5) is given in the last column, and is attributable to various other sources or outlays (e.g. capital resources expenditures, deposits to reserves, and adjustments to contractors). Initial California Water Resources Development Bond Fund funding authorized in the Burns-Porter Act is not included in the table. From 1962 to 2006, State funds have accounted for only 1.5% of SWP revenues (in nominal terms).

## II. The Methodology of Cost Allocation

### II.1 Cost Allocation versus Cost Responsibility

The term "cost allocation" has commonly encompassed the dual objectives of *computing* cost allocations for user groups or purposes and *assigning responsibility* for these allocations to these groups/purposes. Yet, in the contemporary California SWP setting, it appears prudent to regard these two objectives as distinct matters. In particular, the State's demonstrated reluctance to annually fund the Davis-Dolwig mission implies a change in political preferences may have taken place. Perhaps these preferences are still evolving. It would be misdirected, in our opinion, to accommodate such changes in political preferences by modifying the technical side of cost allocation. Transparency can be improved by extracting as much guidance as is practical from the technical process of assigning costs to causative project elements, and separately rendering policy judgments about who should be responsible for which costs.

For this reason, this report invites stakeholders and decision makers to consider a two-part process in which the task of cost allocation refers only to the computational job of partitioning a project's total costs across the purposes and uses, based on economic principles. Such cost allocations must conform to policy selections that have defined cost responsibilities. Hence, decision making about cost responsibility resolves if and how cost allocation findings are to be used in paying a project's costs, which of course have to be funded in some fashion. In our view, questions of cost responsibility are more fundamental and must be resolved before cost allocations can be finalized. However, cost allocation can inform cost responsibility decision making in a preliminary manner, by indicating the consequences of different cost responsibilities.

The challenge of resolving cost responsibility is that it is affected by a number of social considerations. At the risk of inferring that the authors of this report possess legal or political expertise in noneconomic dimensions of SWP cost responsibility, these issues include the following challenges:<sup>11</sup>

- A literal reading of the Davis-Dolwig Act indicates that the people of California are fully responsible for all costs attributable to recreation and enhanced fish and wildlife forthcoming from the SWP. This intention has long been repeated in the many water supply contracts between the DWR and contractors. It has also been argued that this ideal predates the Davis-Dolwig Act within the legal code of California.
- Because the method of separable costs-remaining benefits was directed by the Governor's Principles in 1960, there is evident intent that the people of California would be responsible for their separately caused costs and a method-determined share of the SWP's joint costs. Although our reading of this document and related documents of the era suggests considerable clarity in interpretation, there may be contestable legal matters present.
- There is arguably an intrinsic policy conflict between the Davis-Dolwig mission to "maximize both fish and wildlife enhancement and recreation" assigned to the resource

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<sup>11</sup> These issues were brought to our attention, in the course of developing this report, by staff of the participating California agencies (Department of Finance, Legislative Analyst's Office, and the Department of Water Resources) and the state water contractors.

agencies and each Legislature's privilege to establish the California's annual State budget. In pursuing its Davis-Dolwig mandate the DWR makes ongoing decisions (licensed previously by the State) that are subsequently assigned to the people of California because of required cost allocation processes. Consequently, the DWR has sufficient authority, sans regular Legislative oversight, to resolve a small portion of the State's revenue requirements (presuming subsequent appropriations for these requests by the Legislature). While there may not be anything particularly novel about past policy decisions contributing to current tax burdens, this is such a case.

- Davis-Dolwig costs (for recreation and enhanced fish and wildlife) are first paid using State Water Resources Development System funds established by the Burns-Porter Act. Repayments entail legislative appropriations to restore these Development funds. Figure 1 illustrates the irregularity of repayments during the past thirty years. In the absence of repayments, solvency has been achieved only in the sense that Development funds are being depleted. Over the past two years, a proposal creating a permanent funding path, as well as limited structural reform to the Davis-Dolwig Act, has been forwarded with support from the Department of Finance and the Natural Resources Agency, but the proposal has not been adopted by the Legislature.<sup>12</sup> This proposal involves appropriations applying General Obligation Bond monies derived from Proposition 84 (2006) and utilizing some monies of the Harbors and Watercraft Revolving Fund. In considering this strategy, the Legislature required the DWR to contract for an independent review of the methodology for calculating the state's Davis-Dolwig obligations (the study reported here).
- Statutes such as the Davis-Dolwig can be modified, and the people of California possess this privilege. However, there are long-term bonds in place, backed by the revenue production capacity established by Davis-Dolwig and long-term contracts, that may impinge on opportunities to diverge from Davis-Dolwig in the short run. [We have not investigated options to replace existing bonds with newly issued ones, nor have we evaluated the constraints inherent to existing bonds.]
- If the Legislature forges new payment responsibilities whereby recreation and enhanced fish and wildlife costs are partially or wholly reassigned from the general public of the State of California to other parties (presumably to SWPCs as few other options are available), it may be reasonable for the people of California to anticipate decreases in the production of recreational and environmental project outputs from the SWP.
- The Burns-Porter and Davis-Dolwig Acts benefited multiple water-consuming sectors and multiple regions by combining the borrowing, organizational, and condemnation powers of the State in the interest of an interbasin-transfer water-supply mission that also generated flood control and other benefits. Presumably, the SWPCs received reasonable value from the State's actions on their behalf, a service for which they have been paying for many years.
- Some of the escalated difficulties with resolving cost allocations and funding Davis-Dolwig provisions are induced by recent State budget problems. These hardships induce new political reconciliations that may establish new paths whereby cost responsibility could be assigned differently than it has in the past.

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<sup>12</sup> Personal communications with Mark Andersen, DWR, Dec. 17, 2010, and Matt Almy, DOF, Jan. 6, 2011.

Thus, cost responsibility is inherently a policy question requiring resolution of these and other issues. Indeed, these matters may be regarded as paramount for funding past and continued operations of the SWP, and their importance may exceed that of cost allocation (the technical side). For the remainder of this assessment, the term "cost allocation" shall refer to technical aspects of assigning costs without presuming that these assignments constitute immutable political or legal impositions. The task of investigating policy departures from Davis-Dolwig and revised cost responsibilities is exterior to the work conducted here. Presently, the doctrines set forth by the Davis-Dolwig Act and associated rules and principles establish a relatively firm platform for conducting cost allocation.

## **II.2 The Principles of Cost Allocation**

The theory and practice of cost allocation (abbreviated as "c-a" in this section and the next) predates California application and was importantly advanced by prior federal attention. A pivotal juncture in the study of alternative c-a methods occurred with the operations of the federally established Tennessee Valley Authority (TVA) during the 1930's, and Ransmeier provided a useful compilation of TVA c-a methods in a well acknowledged book (1942). Other New Deal-era water projects throughout the country added impetus to the study of alternative c-a methods. California became exposed to c-a mainly through the experiences of water contractors participating in federal projects, e.g. the Central Valley Project. However, it is important to recognize that federal c-a procedure is neither legally prescribed within the U.S. nor is federal procedure an idealized, best-practice model, because there is a wide conceptual window for allocating water project costs in publicly appropriate manners, and federal water agencies are known to have bent their own guidelines in the interest of brokering project approvals (Miller 1987).

In the remainder of this section, the problem of c-a, the objectives of c-a, and the available methods and guidance are surveyed. The goal is to illuminate acceptable practice for the California SWP circumstance.

### *II.2a Cost Allocation's Central Challenge*

The prime problem addressed by c-a stems from the defining feature and advantage of multipurpose projects: application of a single enterprise to pursue multiple missions. When this single enterprise can produce multipurpose benefits less expensively than multiple single-purpose enterprises, some (perhaps all) of its costs occur as *joint costs* that are not attributable to any single purpose. If the project enterprise is to be solvent in the sense of collecting sufficient money to fund and undertake it, then all costs must be partitioned among interested parties and participants in some manner. The main difficulty here involves the sharing of joint costs. It is to each participant's advantage if joint costs are paid by other participants, making some form of bargaining or, conceivably, external subsidy necessary prior to project construction. If funding sources for these costs cannot be arranged, then the feasibility of an otherwise desirable project will be jeopardized.

Thus, c-a arises as a hurdle for project planners in an *ex ante* (preproject) sense. There are then two disparate reasons for planners to study benefits and costs prior to approving a water project (Ciriacy-Wantrup 1954, p. 118). First, there is a desire for the project to produce

more benefits than it exacts in costs, all things included.<sup>13</sup> This is the ordinary domain of cost-benefit analysis. Second, there is the matter of cost allocation and what costs will be incurred by different groups (and ultimately particular people). Both of these planning dimensions, cost-benefit analysis and cost allocation, have an interest in estimating a project's potential costs and benefits. Yet, the relevance and completeness of measurement differs between the two endeavors. Cost-benefit analysis strives to measure all of a proposed project's consequences (benefits and costs), with weak regard for the distribution of benefits or costs across groups/people. Cost allocation tends to emphasize *some* project costs and their distribution,<sup>14</sup> especially construction and operation costs. Cost allocation is interested in the distribution of project benefits only if c-a is performed in a benefit-sensitive manner. Some methods of c-a are not benefit-sensitive and therefore do not require any benefit information.

With respect to the present SWP context of c-a, emphasis is strongly upon ex post conditions. That is, the components of the SWP are now in place, so c-a procedures are no longer able to influence what is built. There are exceptions, however, such as issues surrounding the rehabilitation of Perris Dam due to its potential instability.<sup>15</sup> In ex post contexts, the matter of participation efficiency (discussed below) has reduced importance, inferring that some aspects of prior literature and practice are not fully applicable.

### *II.2b Criteria for Selecting Cost Allocation Methods*

Perhaps the most important observation to secure about cost allocation in a multipurpose-project context is this: cost allocation is underdetermined by economic principles. That is, economic principles cannot identify a specific cost allocation that is preferred over all others. While some reports and academic papers on the subject of c-a will say that the allocation of joint costs is an "arbitrary" element of c-a, this should be regarded as an overstatement. A more accurate position is that "there is no unique correct method" (James and Lee 1971, p. 538) and therefore no unique allocation of costs. Yet, some of the available c-a methods do have advantages over the others, and headway can be made with reference to specific objectives which may prefer certain c-a methods over others. Although it is possible to identify several social criteria that are useful to advance as cost allocations are considered, these objectives do not ordinarily result in a resolute set of cost allocations.

Therefore, while the application of reasonable objectives can narrow the field of acceptable allocations by identifying a range of allocations as acceptable and dismissing certain

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<sup>13</sup> This is a formalized guideline for federal water projects, as federal expenditures on a water project are discouraged unless it is expected that annualized benefits outweigh annualized costs (U.S. Water Resources Council 1983).

<sup>14</sup> Cost allocation attention is commonly devoted only to a project's financial requirements. For example, if construction of a project disturbs or eliminates particular recreational pursuits along a to-be-inundated waterway, those costs are usually disregarded in c-a, inferring that they are assigned to the original recreationists themselves.

<sup>15</sup> The Perris facility is currently operated at a reduced capacity. Any new project proposed to increase the usable capacity of Lake Perris invites a fresh, ex ante application of cost allocation. Without a suitable cost allocation agreement capable of covering costs, such a project cannot take place. It is arguable, however, that the Davis-Dolwig Act has already established the principles for allocating the costs of Lake Perris reconstruction, but it is still advisable for any proposed reconstruction to offer benefits in excess of costs. There are unresolved questions about whether reconstruction of Lake Perris has economic merit, yet the with/without principle of cost-benefit analysis needs to attend to a potentially costly "without" scenario, perhaps involving removal of the present dam.

allocations as disagreeable according to specific criteria, a wide range of candidate cost allocations will normally remain. At this juncture, faced with a spectrum of allocations regardable as "scientifically acceptable," a society will normally have to resort to considerations of "fairness" and "political acceptability" to further narrow the choice set and arrive at a single allocation of costs. Indeed, political acceptability can be used to trump other considerations, scientific or otherwise, in the determination of precise allocations, and this has occurred with sufficient frequency to encourage respect as a key element.

Setting aside political considerations, under the continued presumption that cost responsibility is decided after other objectives are used to illuminate consequences, what substantive criteria are available to compare alternative allocations? Where do they point? The following list attempts to incorporate and define key concerns.<sup>16</sup>

1. *Revenue sufficiency*: all costs are assigned to someone. This is both an ex ante and ex post consideration. In ex ante application, feasible cost allocations for a proposed project are those capable of covering all costs. Not only should there be a plan for allocating projected costs, but as large scale public works are notorious for cost overruns (Flyvbjerg, Bruzelius, and Rothengatter 2003), there should be a plan for allocating actual costs. Costs need not be allocated solely to project beneficiaries. Injecting various levels of subsidy is entirely consistent with revenue sufficiency, especially when it is intentional and transparent. Therefore, cost participation by outside interests (e.g. U.S. government) is consistent with revenue sufficiency. However, from a revenue sufficiency perspective it is disappointing to have a project financier left "holding the tab" when insufficient funds are collected to offset all costs.<sup>17</sup>

2. *Participation efficiency*: potential participants in a proposed multiuse project should be signaled so as to encourage participation efficiency. This is an ex ante concern. If a user group should be involved in a project because their prospective benefits exceed the added costs their participation causes, their assigned cost share should not dissuade their involvement. Similarly, if a user group should not be among project participants because its benefits are outweighed by the costs it causes for the project, then the cost allocation should lead this group to correctly decline participation. This consideration immediately indicates that benefit-insensitive c-a methods are deficient in ex ante applications. During the past few decades much of the academic literature pertaining to cost allocation addresses this matter by applying game theory to investigate alternative cost allocation arrangements for their effects upon project-supporting coalitions.

3. *Exit efficiency*: actual participants in an operating multipurpose project should be motivated to terminate their participation if and only if their participation benefits fall below the costs they impose on project operations. This is the ex post corollary to participation efficiency. It also suggests that worthy c-a methods should be benefit sensitive for the same reasons noted for participation efficiency.

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<sup>16</sup> This listing contains both original and standard elements, each of which is subjective and potentially challengeable. It is designed to be integrative with respect to prior literature. For traditional perspectives on c-a criteria, see Ransmeier (1942, pp. 220-21) and, especially, James and Lee (1971, p. 529).

<sup>17</sup> An exception would occur if the financier accepted some risk of revenue shortfall in return for the potential gains (e.g. profits) which could have arisen with more favorable outcomes.



4. *User pays*: project beneficiaries should make some contribution towards project costs. This is a normative position that stands as a generally agreeable, subjective doctrine. It is applicable in both ex ante and ex post contexts. Thus, in preproject application there is usually public sentiment that all user groups should agree to pay "something" towards forthcoming costs, but the criterion is not definitive in this regard. To a large extent, a "user pays" objective is supportive of most other criteria identified here while contributing less precision than those objectives. Because the other objectives are somewhat more specific than "user pays" without conflicting with it, there is some redundancy encountered when "user pays" is pursued during cost allocation practices.

5. *Benefit sharing*: project participants who make a cost contribution greater than their particularized costs of being clients of the project should receive some of the benefits produced by the project. That is, cost shares should not overwhelm received benefits for any group making use of the project. This too is a normative position of the same type as "user pays."

6. *Stability in cost allocations*: Year-to-year swings in cost allocations for any single group are potentially harmful as water users attempt to budget and plan their economic enterprises. Not only might surprising bills harm marginal enterprises by causing temporary insolvency and shutdowns, but farms and businesses must resolve investment plans and capital expenditures that are in tune with long-run supply costs. In situations where water is a sizable portion of production costs, long term commitments to particular technologies and other investments (e.g. equipment) may be frustrated or misled by vacillating cost allocations. Although a well functioning economy must include the entry, rise, decline, and exit of various entrepreneurial ventures, fluctuating cost allocations are to be avoided unless there is a strong social reason for sending an uncertainty-attentive and varying cost signal to project users.

7. *Low administration costs*: The process of establishing and revising (and debating) cost allocations represents a cost and loss to users of the project and the people of California. Projects such as the SWP are intended to produce gains for project beneficiaries, and such gains are eroded by both administration costs and continuing contention over cost sharing. Opportunities to reduce these costs should be sought out and implemented.

8. *Project product use efficiency*: cost allocations should not obstruct product pricing – for water, electricity, and recreation – that motivates efficient use of these project-produced goods. This pertains to ex post project outcomes. Costs allocated to project contractors and the general public of the State of California get passed to end users, with the result that prices to water and power consumers and others are impacted. Ideally, cost allocation and optimal pricing are rather independent pursuits, with the theoretical advice that optimal prices should guide resources to "highest and best" uses, as tends to be achieved when prices reflect marginal values but ignore fixed costs such as those heavily influencing cost allocation (Ciriacy-Wantrup 1954, pp. 122-23; Hirshleifer, De Haven, and Milliman 1960, pp. 93-94). Realistically however, pricing policies for project-produced goods are often quite sensitive to cost allocations, and these policies may be uninterested in fostering better product use efficiency as they are quite focused on recouping outlays by passing along costs to final users. Consequently, it cannot be claimed that any in-use c-a method supports product use efficiency. In some cases, other policies may be capable of correcting any problems caused when cost allocations do not lead to efficient prices, thereby excusing cost allocations from worry over

resource allocation signals.<sup>18</sup> Therefore, while the criterion of product use efficiency is socially important and often discussed outside of c-a investigations, this criterion may not yield valuable advice for selecting among various c-a methods. It is noted here for clarification of this point.

### II.3 Cost Allocation Methods and Guidance

Various methods for performing cost allocation have been listed and defined by prior literature. To a large extent, these lists do not exhaust the possibilities. Yet, they do indicate the range of possibilities and are therefore useful to consider. The James and Lee tabulation of 18 options is relatively exhaustive (1971, p. 533), but it includes methods yielding poor achievements relative to the other methods. Major c-a methods have been cataloged in multiple places, including one publication commissioned to enlighten the SWP's cost allocation issues (Gaines 1984). More recent compilations are rare, due to the virtual halt of new federal dam planning in the late 1970's and the reduced relevance of c-a as a consequence.

Because of the age and tradition-engrained nature of some conceptual components of c-a methods, there are aspects of certain methods which are no longer supportable. In the following subsections only the most noteworthy cost concepts and c-a methods are underscored.

#### II.3a Relevant Cost Concepts

An array of cost concepts are sometimes discussed when matters of c-a are under consideration. However, some of these turn out to be superfluous. Three project-level cost categories are paramount: total costs, separable costs, and joint costs.

- *Total costs* (T) are the entirety of outlays necessary for project completion and operations. This includes all construction, planning, operation, and overhead costs, among other things. The only omitted costs here might be nonfinancial losses associated with displacements caused by the project (e.g. preexisting recreational, historical, or archeological values). [Thought of another way, these nonfinancial costs are allocated to their users via noncompensation.]
- *Separable costs* ( $C_i$ ) are those costs that are clearly attributable to each specific project purpose where  $i=1$  (water supply), 2 (flood control), 3 (recreation), etc. exhaust the list of project purposes to which costs are allocated. Separable costs are identified by treating each purpose in turn as the marginal purpose. This involves envisioning the project's total costs inclusive of all purposes as compared to the total costs of an imagined project without a particular purpose. If  $T_{-i}$  is the total cost of a hypothetical project that includes all purposes except the  $i^{\text{th}}$  one, the separable costs of purpose  $i$  are given by  $C_i = T - T_{-i}$ . It is conceivable that one or more purposes have a negligible separable cost. Traditional discussions of the costs attributable to single purposes may discuss such concepts as *specific costs* (or *direct costs*), while acknowledging that these categories may understate separable costs (perhaps slightly) and are thus inferior concepts though they are simpler to estimate. It is conceivable that one or more purposes have a negligible separable cost. [In

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<sup>18</sup> An important example occurs when water rights to project-generated water, or some portion of those rights, are assigned to project participants.

some 1965 cases, SWP cost allocations employ specific costs instead of separable costs.] Therefore, with  $CC_i$  denoting a purpose's specific costs, it is always the case that  $CC_i \leq C_i$ .  $C_i - CC_i$  can be called nonspecific separable costs.

- *Joint costs (J)* are those costs that are not separable. These are the emphasized costs of c-a debates, because the allocation of separable costs is readily apparent whereas the allocation of joint costs is elusive. Definitionally,  $J = T - \sum C_i$ .

Time and nesting complications have been set aside thus far, but they can be acknowledged at this point:

- Each of the above three cost types will normally occur over multiple years, so the actual situation is that there are schedules of total costs, separable costs, and joint costs to consider in performing c-a. This challenge is manageable by separately conducting c-a for individual periods or by using present value formulations to condense a multiperiod schedule into single-period values.
- A multilocation project such as the SWP will normally possess multiple "units" (possibly called reaches, segments, subprojects, etc.) across which total costs, separable costs, and joint costs are uneven with respect to purposes. Consequently, it may be desirable to conduct c-a at the unit level. In some cases, there may be nested layers of joint costs as well. For example, some project costs may be separable to two purposes, as opposed to other purposes, and therefore be joint to the two purposes while not being joint with other purposes. Thus, there may be joint costs to be allocated at multiple levels. In this case, careful c-a methods may operate in a nested manner, requiring more careful attention than the simplified explanations provided here.

These two complications are largely set aside in the forthcoming conceptual discussion of c-a methods. They are, however, required elements for the application of these methods.

### *II.3b Cost Allocation Structure*

The task of cost allocation is to assign all costs, which in normal application means to assign to each purpose its separable costs and a share of joint costs. With each purpose's total allocation being  $A_i$  and its share of joint costs being  $s_i$  ( $0 \leq s_i \leq 1$ ), allocations are given by

$$A_i = C_i + s_i J. \quad \text{eq. (1)}$$

As long as it is required that shares sum to 1,  $\sum s_i = 1$ , allocation according to eq. (1) successfully allocates all costs and therefore satisfies the first criterion listed previously. That is,  $\sum A_i = T$ . Thus, the issue of emphasis for c-a is to resolve all of the  $s_i$ .

Eq. (1) is not supportive of some traditionally discussed c-a methods, but these have to be discarded as inconsistent with some of the eight criteria discussed above. Particular methods and their failings can be readily observed, yet this is unnecessary here because the majority of these older methods are not used by the DWR and are otherwise unsuitable as substitute methods.

Cost allocation methods can be separated into two classes: benefit insensitive and benefit sensitive. Benefit-insensitive methods divide costs among purposes using physical (not

economic) measures or simple notions of relative priority or equality. For example, if there are "I" total purposes served by a project, two basic options are to either allocate total costs or joint costs equally:

$$A_i = \frac{T}{I} \quad \text{or} \quad A_i = C_i + \frac{J}{I} .$$

These options fail to reliably support participation efficiency, exit efficiency, and benefit sharing because allocated costs may be less than costs caused by the purpose or the purpose's allocation may exceed its received benefit. As a consequence, these options and other benefit-insensitive options are significantly weakened in acceptability. The same conclusion often applies to benefit-insensitive allocations driven by physical measures of water flow or capacity reservations, which are directed for use by DWR (Governor's Principles, 1960). For example, the *Proportionate Use* method distributes either T or J on the basis of water *use* proportions or proportionate *capacity* to use/store/transport water. Because Proportionate Use formulae omit any consideration of benefits, there are few assurances that several of the goals noted previously will be satisfied. Yet, it may be possible for benefit-insensitive methods to approximate the results of benefit-sensitive methods in special circumstances, and this issue could be studied further as it is pertinent to the SWP scenario.<sup>19</sup>

Cost allocation methods which are benefit sensitive may be able to foster participation efficiency, exit efficiency, and benefit sharing. Yet, they also require estimation of each purpose's benefits in order to be applied, thereby adding to administration costs and detracting from that important objective. Participation and exit efficiency require that each purpose's allocation be at least as great as its separable costs ( $A_i \geq C_i$ ) and that the allocation be less than the purpose's received benefits ( $A_i \leq B_i$  where  $B_i$  is purpose i's project benefits). In combination, these goals bound the acceptable allocation above and below according to

$$C_i \leq A_i \leq B_i . \quad \text{eq. (2)}$$

When eq. (2) is satisfied by a c-a method, multiple social criteria are addressed, including participation and exit efficiency, benefit sharing, and user pays. However, this is as much resolution as can be definitively achieved by applying economic ideals. The range identified by eq. (2) may be small or large, depending on circumstances. Therefore, eq. (2) clearly indicates the underdetermined nature of advisable cost allocations.

### II.3c Benefit Measurement

Classical literature in cost allocation distinguishes a group's water use benefits (due to a project) and the sector's *alternative costs*, but in application these concepts may become confused. Alternative costs are those costs which, in the absence of the water project of emphasis, the group would actually incur in achieving an equivalent level of service. For example, in lieu of the SWP, a contractor might accomplish an equivalent water supply

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<sup>19</sup> Intuitively, if all SWPCs experience the same marginal value of water, after accounting for transportation cost disparities, it may be expected that cost allocation via proportionate use is the same as that obtained by separable costs-remaining benefits. Although such an equivalence of marginal water values may be unexpected, the marketing of water rights and similar entitlements, such as "Table A" water, does bring such marginal values into closer correspondence.

enhancement by building a single-purpose water project of its own. Other important alternatives address demand. For example, conservation may be encouraged or directed by many available policies, and further economic development can be dissuaded in water-scarce locales by many policy options.

If "alternative costs" can be adopted as a candidate measure for all groups' assessments of the "goodness" of a multipurpose project, then costs might be allocatable according to alternative costs, essentially as a measure of benefits. Thus, alternative costs are arguably "saved" by the multipurpose project, yet this argument is easily overextended.<sup>20</sup>

The modern perspective, with which SWP cost allocation may be conceptually compliant, is that alternative costs may easily misstate a purpose's benefits, because benefits cannot exceed aggregate "willingness to pay," theoretically represented by an area beneath the demand curve for the project output increment. In a water supply context such as the SWP, where unfinished and incompletely delivered water is the output to be valued, each water-using sector or contractor has a demand curve that is adjusted to wholesale demand by subtracting the value-adding marginal costs encountered by water supply authorities (SWPCs) from the final demand expressed by aggregated final consumers.

These two considerations, willingness to pay and alternative costs, are combined in the treatment of this report. They are embedded in the benefits measures, the  $B_i$ , introduced above, in keeping with contemporary visions of benefit measurement. Benefits cannot be greater than alternative costs in modern treatments of benefit evaluation. SWP-employed benefit measures claim to properly include both alternative cost and willingness to pay assessments. This is relevant in gauging the reasonableness of SWP procedures. In the case of c-a for the SWP, there are semantic differences emanating from the now-dated terminology of SWP bulletins. We henceforth employ the well accepted terms "willingness to pay" and "benefits" where the bulletins use, respectively, "benefits" and "justifiable costs."

### *II.3d Cost Allocation Methods*

The most widely embraced c-a method is a benefit-sensitive calculation called *separable costs-remaining benefits*, abbreviated SCRIB and pronounced "scrub." It is featured among the alternatives used by the DWR. Properly applied, the SCRIB procedure satisfies eqs. (1) and (2), and because summed shares equal 1, it fully allocates all costs. Shares are determined by allocating joint costs according to the portion of overall net benefits received by each purpose. Letting  $B_i$  again represent purpose  $i$ 's gross benefits (though net of everything external to the project) and letting  $B$  denote summed gross benefits, SCRIB shares are determined according to

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<sup>20</sup> Analytical procedures of federal water agencies during the 1930s-1960s era were prone to employ alternative costs as the measure of a project's benefits. This was an expedience attributable to both the weak economic methods then available and the structural bias favoring project construction maintained by reservoir-building agencies. Along the way, it became broadly recognized that alternative costs is useful information only when the posed alternative project would actually be constructed in lieu of the project. Properly conceived, the true benefits received by a project beneficiary are the lower amount of two things: the beneficiary's willingness to pay for the project-produced enhancement and the alternative costs of a separate and compelling project capable of providing the same enhancement (Eckstein 1958, pp. 52-3).

$$s_i^* = \frac{B_i - C_i}{\sum(B_i - C_i)} = \frac{B_i - C_i}{B - \sum C_i} . \quad \text{eq. (3)}$$

Equations (1) and (3) fully describe the SCRБ procedure in single-period, nonnested circumstances.

Post-TVA investigation of the SCRБ method identified SCRБ as the preferred means of c-a by federal authorities in the 1950's, without requiring it as the sole method<sup>21</sup> (U.S. Inter-Agency Committee on Water Resources 1958). Although the criteria discussed above do not include any specific notions of "fairness," there is an arguable degree of fairness intrinsic to SCRБ-obtained allocations insofar as they accomplish *user pays* and *benefit sharing* as well as *revenue sufficiency*, *participation efficiency*, and *exit efficiency*. Like all other c-a methods, SCRБ is not proficient in advancing *product use efficiency*, and this goal must remain the distinct task of other public policies, especially those pertaining to the pricing, marketability, or regulation of project-produced goods (e.g. water and recreation). Whether or not SCRБ allocations are *stable* allocations over time depends on the conduct of the method. Yet, if the determining factors – costs and benefits – are stable, the resultant allocations will be stable over time as well.

Lastly, SCRБ is not conducive to *low administration costs*. Because it is among the benefit-sensitive c-a methods, a large amount of information is required to perform the necessary computations. The primary elements are separable costs, joint costs, and separate benefits, all of which must be measured or estimated for each fiscally obliged project group. The problem of high administration costs is greatly amplified if cost allocations are periodically recomputed during the entirety of project life. The latter issue is not a unique attribute of the SCRБ methodology and may be averted by any c-a method by using a "once-and-done" approach.

Overall, no practiced method of cost allocation appears to have more positive features than does the SCRБ procedure.

Closely related to the SCRБ method is the Alternative Justifiable Expenditure (AJE) method. In spite of the disparate names of these two methods, they differ only in that the AJE method uses specific costs in lieu of separable costs in the computations. Because specific costs may understate separable costs, the latter being the more appropriate measure, the amount of joint costs to be allocated with AJE tends to be larger. Both methods, along with Proportionate Use method, have been applied by the DWR for the SWP though use of the AJE method is indicated to have been temporary.<sup>22</sup>

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<sup>21</sup> It should be recalled that federal agencies of that era were very pro-project, and having some flexibility in negotiating cost shares was more desirable than requiring a specific cost allocation method. Thus, the absence of a SCRБ mandate is likely to be more indicative of agencies' desire for political degrees of freedom than it is of actual disappointments in the SCRБ procedure.

<sup>22</sup> While SWP documents cited in this report claim to employ separable costs during the performance of cost allocation, we are not in a position to independently verify that a full complement of separable rather than specific costs were actually employed.

### III. Cost Allocation as Performed for the SWP

Firm implementation of the directives initiated by the Governor's Principles began documentation with the self-labelled "prototype" report, Bulletin 153-65 (1965, p. xvii). Although the Governor's Principles established the SCRIB method as the central approach to cost allocation, the Principles also imposed some constraints and admitted Proportionate Use for certain elements of the SWP. This forced some dissimilarities as compared to a pure SCRIB procedure, while leaving some unanswered matters for the DWR to resolve. Collectively, these idiosyncrasies as well as the DWR's additional departures from purist procedures infer that the SWP approach to cost allocation merits a distinctive label; here we will use SCRIB-C (California). The distinctions between SCRIB and SCRIB-C do not infer that the SWP cost allocation procedure is an unreasonable implementation of SCRIB, but these distinctions do invite inquiry. Also, we are mindful that the task of SWP analysts was not to follow a pure SCRIB method, but rather to follow the guidelines inaugurated by the Governor's Principles.<sup>23</sup>

#### III.1 Distinguishing Characteristics of SCRIB-C

Major features of SCRIB-C constituting departures from or extensions to conventional SCRIB procedures include the following many items.

##### SCRIB-C Features

- A. SCRIB is the directed procedure for conservation-side (water supply) costs; Proportionate Use is directed for transportation facilities (according to Governor's Principles).
- B. Costs are largely recovered through annual billings based on an annually recomputed Delta Water Rate and Transportation Charge (Governor's Principles). Thus, Delta water charges and transportation charges are the vehicles by which reimbursable joint costs and separable costs are recovered from contractors.
- C. Because of the imposed recovery of costs via two charges and because some physical components of the SWP serve both conservation and transportation functions, cost allocation for certain facilities involves a preliminary step. For initial Aqueduct segments, costs are first partitioned into two purposes (conservation and transportation) through application of the Proportionate Use method (Bulletin 153-65, pp. 24, 33). This step of cost allocation prefaces the other steps of SCRIB-C. In this way, costs for all facilities of the SWP and for all operations of these facilities are classified into the two exclusive parts.
- D. Across the multidecadal project period, schedules of capital costs and minimum operating costs (some already incurred and some projected) are leveled into an annualized equivalent<sup>24</sup>. A weighted average of actual bond interest rates is used in this discounting procedure (Bulletin 132-63, pp. 186-7). Based on anticipated issuances of final bonds in

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<sup>23</sup> We do not imagine that the Governor's Principles emerged from the Governor's office in an independent way, and their construction likely included heavy participation by agencies of the California government, especially the DWR, as well as legislators and potential contractors. Regardless of the design process, however, the executive nature of these Principles establishes directives that command consideration.

<sup>24</sup> The annualized equivalent is the amount of money, if paid each and every year, would have the same present value as the actual, uneven schedule of costs.

1985, the planning horizon for calculating annual equivalents extended to 2035, 75 years after 1960.

- E. Although Project-incurred costs change from year-to-year, as do benefits, SCRIB is not fully redone each year. Instead, previously determined cost shares, denoted as  $s_i$  in the formal development above and expressed as percentages by the DWR, are applied to the current year's annualized equivalent costs. These cost-sharing percentages are computed via the SCRIB-C method, using both known and projected benefits and costs at the time of computation.
- F. "Illustrative" cost share percentages for Aqueduct segments were originally computed (1965) using the Alternative Justifiable Expenditure procedure that is closely related to SCRIB. Here, specific costs substitute for separable costs, but the calculations are otherwise unaltered. Thereafter, in 1966 to 1980 determinations of cost shares for transportation facilities, the SCRIB-C method is used to determine share percentages for Aqueduct segments.
- G. Different cost shares are computed by the DWR and applied in cost allocation for different segments of the SWP. Table 3 identifies the year in which cost-allocating percentages were performed or reperformed for the seven divisions of the SWP. Costs of all these units were initially allocated (some tentatively) in 1965. For the early, smaller units of the SWP, these cost-allocating percentages were revised only once. Larger and later units had their percentages recalculated multiple times. No recalibrations of cost-allocating percentages (the  $s_i$ ) have been conducted since 1982.
- H. Davis-Dolwig allocations of the joint costs of the SWP involve two cost categories: capital costs and minimum operating costs occurring independently of the Project's water deliveries. A third category, variable operating costs, would accrue solely to water contractors were it not for relatively small water consumption occurring at locations such as SWP parks.<sup>25</sup> First computed and last computed SCRIB-C allocation percentages in each of the two cost categories and for each of the seven segments are shown in the lower portion of Table 3.
- I. Except for specific costs, Davis-Dolwig allocations attributable to enhanced fish and wildlife are not pursued separately in cost allocation procedures. Consequently, recreational benefit is the only Davis-Dolwig element directly represented in SCRIB-C tabulations, inferring that the general public is not asked to share SWP joint costs for any fish and wildlife enhancements except to the extent that (i) augmented recreational benefits might be implicitly increased by the presence of enhanced fish and wildlife outputs or (ii) such outputs may motivate additional recreational attendance at SWP sites.
- J. For those few facilities that are claimed to provide some measure of flood control, the DWR does not compute flood control benefits but relies on U.S. Army Corps of Engineers calculations of flood control benefits, which served as the basis for federal participation and agreed payments to the State (Bulletin 153-65, pp. 2, 51; Bulletin 132-73, App. D., p. 24).

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<sup>25</sup> According to the DWR, less than one-half of one percent of SWP variable costs are necessarily allocated to Davis-Dolwig costs as a consequence of this water consumption (Mark Andersen, personal communication, Dec. 17, 2010).



**Table 3. Original and Revised Cost Allocation Percentages**

Published Date	SWP Unit							Bulletin No.
	AV	FM	GV	DV	OR	A:D-DA	A:DA-T	
1965	✓	✓	✓	✓	✓	✓*	✓*	153-65
1/1966				✓		✓	✓	153-66
12/1966				✓		✓	✓	153-67
1970						✓		132-70‡
1971					✓			132-71‡
1973		✓		✓				132-73‡
1977						✓		132-77‡
1978					✓			132-78‡
1980							✓	132-80‡
1982			✓					132-82‡
Initial (1965) REFW %	100%	50.0%	94.9%	28.0%	0%	4.4%*	2.6%*	capital
	100%	50.0%	91.2%	74.0%	0%	8.0%*	9.7%*	minimum OMPR
Latest REFW %	100%	78.5%	99.0%	48.0%	2.9%	3.4%	5.7%	capital
	100%	100%	98.2%	44.9%	0.5%	3.3%	3.1%	minimum OMPR

"REFW" is Recreation and Enhanced Fish and Wildlife.

"OMPR" is operating, maintenance, power, and replacement (costs).

SWP Unit codes

AV= Antelope Valley (100% REFW, 100% nonreimbursable)

FM=Frenchman

GV=Grizzly Valley (Lake Davis)

OR=Oroville

DV=Del Valle

A:D-DA=California Aqueduct, Delta to Dos Amigos

A:DA-T=California Aqueduct, Dos Amigos to Termini

\* 1965 Aqueduct results are identified as "illustrative" in the cited Bulletin (p. 3) due to "preliminary" data.

‡ Presented in Appendix D of Bulletin 132 for the given year.

- K. Although the distribution of reimbursable transportation costs among SWPCs does not appear to have noteworthy implications for the total amount of nonreimbursable (Davis-Dolwig) costs, these distributions are conducted proportionately, utilizing more finely defined Project segments than the seven identified in Table 3.
- L. As SCRIB is a benefit-sensitive procedure, benefits for all Project purposes must be calculated. In the SWP case, these benefits are dominated by four purposes: recreation, flood control, municipal & industrial water use, and irrigation. Because benefit estimates are the lower of two values, (1) the willingness to pay of Project beneficiaries and (2) the cost of an equally beneficial alternative project, both assessments are required. Willingness to pay (WTP) projections for the four major Project purposes rely on the following approaches.
1. Recreation WTP is the product of the number of visitor days and an estimated unit day value (Bulletin 153-65, pp. 46-48). Both numbers are generated for multiple recreation types. In some cases, also counted is the revenue received by the SWP from concessionaires operating for-profit enterprises at SWP facilities.
  2. The DWR deferred to U.S. Army Corps of Engineers' calculations of flood control benefits as these computations were the given basis of Federal participation and cost sharing in the SWP (Bulletin 153-65, pp. 77-78).
  3. When its computation is attempted, WTP for municipal and industrial water supply appear to have been computed primarily with transactional evidence based on local entities' contracts with other water suppliers.
  4. WTP for irrigation water is presumed to be the increased agricultural profits enabled by irrigation as compared to preproject conditions, after adjusting for water conveyance costs from the SWP terminus to farm gates (Bulletin 153-65, pp. 44-45).
- M. As the true amount of benefits for any individual group of SWP users is the lower bound of two measures, willingness to pay and alternative costs, the DWR also attempts to estimate alternative costs for each of the six allocated units and each purpose. This intention is not a deviation from well executed SCRIB practice.
- N. The SCRIB-C procedure adds to the normal SCRIB method a step expanding the domain over which the  $s_i$  shares operate. Lines 10-12 of the 21 cost allocation tables (referenced previously by Table 3) conclude with the calculation of shares that are intended to allocate both joint costs and *nonspecific separable costs* (defined previously in section II.3a). Allocation of the latter item is not a usual result of SCRIB procedure, which would conclude at line 9, as is well acknowledged by the DWR (e.g. B132-77, App. D, p. 20). Recalling that specific costs are a subset of separable costs, the purer procedure is for each purpose to always pay their separable costs, whether specific or nonspecific. Ordinarily, no part of separable costs warrant allocation among purposes as they are already attributable to a single purpose. SCRIB-C expands the role of the  $s_i$  shares in order to increase their power in application.<sup>26</sup> By defining the  $s_i$  in this way, the DWR avoided estimation of separable costs in future years.

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<sup>26</sup> The cost allocation shares in line 9 of the cost allocation tables are usable for allocating joint costs only, whereas the line 12 shares are used to allocate both joint costs and nonspecific separable costs.

As a collective consequence of exercising these features, the SWPCs receive annual bills that include their portion of allocated joint costs (capital and minimum OMPR), their specific costs, and their assigned shares of variable operating costs. The simultaneously computed nonreimbursable costs are effectively everything else, that is, the net costs of running the SWP after contractor payments and power receipts are deducted.

Features A-N of SCRB-C form a cost allocation platform that can be critiqued on two levels. The first is composed of the conceptual directions themselves, i.e. the ideals set forth by A-N above. The second level is the actual conduct of cost allocation in pursuit of A-N, as documented by past DWR bulletins.

### **III.2 Reasonability of SCRB-C Concepts**

A point-by-point assessment of the distinctive features of SCRB-C is warranted in light of their influence on the nonreimbursable costs dispensed to the people of California.

#### Feature(s)

- A,B Structural dictates such as A and B are entirely within the purview of the people and their elected representatives. By sanctioning the SCRB method for water supply functions, several useful properties of cost allocation were secured. By straying from benefit-sensitive methods in the case of transportation functions, where Proportionate Use is directed, the results may sacrifice some positive properties while at the same time lowering administrative costs. In practice, the DWR retained a high degree of SCRB use for transportation facilities as discussed for feature F below.
- C The necessity of accounting for dual-mission storage/transport facilities is a consequence of feature B. Because execution of step C is a matter of engineering judgment and calculations pertaining to the use of facilities, it is not more deeply examinable here.
- D Conceptually, the use of an annual equivalent to allocate costs for water storage and conveyance is an appropriate approach. One issue is the fact that the utilized weighted bond rates implicitly incorporate a measure of inflation, whereas all of the other values used in the SCRB-C computational process appear to be inflationless.
- E The decisions to use projected benefit and cost streams to calculate cost-share percentages and to apply these percentages as fixed shares in future years represent interesting and more contestable administrative decisions, especially given the additional decision (feature G) to infrequently update these shares. By locking in these percentages and applying them annually, the DWR eliminated continual analysis of benefits, thereby reducing administrative costs, gaining some constancy for one element of the cost allocation process, and sacrificing accuracy. Thus, the tendency was to exercise a once-and-done procedure with respect to the assessment of benefits, while SWP costs were continuously tracked and assigned. Intended schedules for periodically recomputing shares were not followed.<sup>27</sup> Yet, it is also

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<sup>27</sup> See Table 2 of Bulletin 132-71 (App. D, p. 9), for one statement of the planned, periodic recomputation of cost sharing percentages. Published intentions were to review shares every five years.

true that cost share percentages were occasionally updated (recalling Table 3). Overall, the SCRB-C cost allocation method is much more attentive to costs than to benefits, because the former are constantly measured and allocated.

- F The DWR's use of the Alternative Justifiable Expenditure method is not accommodated by the Governor's Contracting Principles, but this is a trivial matter given the tentative nature of the 1965 Aqueduct cost share percentages and the subsequent switch to SCRB in 1966. Cost allocation for multipurpose facilities, as would commonly involve recreation, are directed to employ SCRB. Cost allocation for transportation functions, as would tend to support low and incidental recreational activity on Aqueduct segments without intermediate or terminal lakes, are to employ Proportionate Use.

Regarding the directed use of Proportionate Use, this method is applied to split costs between the Delta Water Rate and the Transportation charge (feature C above) and also to partition transportation costs among SWPCs (with only trivial relevance to nonreimbursables, i.e. feature K) (Bulletin 153-65, p. 32). However, there is some innovative interpretation of Governor-directed procedure at this juncture. Original DWR documents on this matter indicate that then-available directives were incomplete in specifying methods for certain aspects of necessary cost allocations (Bulletin 153-65, p. 26). As a consequence, some initiative was required of DWR administrators/analysts, and their decisions concluded in the SCRB method being selected for allocating transportation-associated costs between reimbursable and nonreimbursable purposes. Such a selection would appear reasonable in light of the general dependence on SCRB procedure elsewhere in the Governor's Principles, but there is nonetheless a contestable issue inherent to the DWR selection.

Whereas the Principles direct Proportionate Use where transportation is involved, this is problematic when recreation and water supply intermix. Because all transported water over-and-above conveyance losses (which are separately factored in minimum OMPR) is spoken for by the water supply purpose, including small amounts of water supply diverted for parks and wildlife refuges, thereby constituting 100% of aqueduct usage, what percentage of usage remains attributable to nonconsumptive<sup>28</sup> recreation? Arguably, recreation does benefit from transportation as some mechanism is needed to get water to intermediate and terminal lakes. Yet, direct recreational use of the aqueducts themselves is slight (and even dangerous to participants in many locations). Perhaps the implied yet unspoken vision of the Governor's Principles in directing Proportionate Use was that aqueduct cost sharing is completely achievable using Proportionate Use. That is, perhaps the vision was that conveyance-only facilities have no recreation function or that recreation has no transportation responsibility. Obviously, the same cannot be claimed for south-of-the-Delta lakes, so for the Proportionate Use approach to be implemented in this way it is necessary for downstream lakes, such as Perris and Pyramid, to be separately cost allocated. On the other hand, the Principles do

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<sup>28</sup> It is entirely reasonable for water consumption at public facilities of the SWP to be treated similarly to water supplied to SWPCs. At issue is whether transportation costs over-and-above that suggested by direct water consumption should be the source of nonreimbursable costs.

identify preliminary facilities and aqueduct reaches, going as far as tabulating estimated costs (p. 5), and in so doing the Principles appear to show that termini lakes were envisioned as components of specific aqueduct reaches, as opposed to separately allocated SWP units. Thus, there is some measure of guidance, albeit incomplete, present in the Principles, making it reasonable and necessary for the DWR to resolve additional details about the manner of cost allocation.

In our opinion, a more compelling approach to generating cost shares would have been to define downstream units/reaches that distinguished relatively pure transportation facilities as distinct from associated lakes. In this way, cost allocation for transportation could have been conducted by Proportionate Use, and south-of-the-Delta lakes could have been addressed by SCRIB, after accounting for transportation expenditures by water contractors in the SCRIB procedure. This approach would lower nonreimbursables for the aqueduct-only units (to align with water deliveries to park-type facilities) and increase nonreimbursable costs for lake units. This opinion does not, however, suffice to conclude that SCRIB-C is unreasonable, because there is adequate support in the Governor's Principles for the feature F approach selected by the DWR.

- G The infrequent updating of cost share percentages places additional importance on the quality of benefits measurements when they are performed. Because benefits are so infrequently studied, as compared to costs, and because these studies are now dated, errors of nontrivial magnitudes can be expected. Because benefit estimates are employed to calculate cost allocation shares expressed as a percentage, errors tend to be significant only in a relative sense. For example, if both municipal/industrial benefits and recreation benefits were underestimated by 50%, the effect on their resultant cost share percentages may be negligible.

The infrequent updating added a measure of stability to a dimension of the cost allocation process, and this may have been regarded as desirable by the DWR and SWP contractors. It may also be noteworthy that cost allocations for contractors ultimately shaped specific water charges upon individual irrigators, households, and businesses, thereby having effects on profitability and consumer welfare which would tend to be capitalized into land and perhaps building values.<sup>29</sup>

- H Capital costs and minimum operating costs both qualify as forms of fixed costs which are independent of variable operating costs. It is reasonable to emphasize these costs in identifying nonreimbursable costs. The decision to not assign any variable joint costs to the nonreimbursable category, except those stemming from actual water consumption, appears reasonable as well. Most importantly, the nonwater, variable operating costs of recreation sites are the responsibilities of lessee/operators such as the Department of Parks and Recreation, as well as local and federal agencies, and are separately incurred by these agencies in accordance with the founding SWP rules and agency assignments of the 1960's. However, where recreation-only variable costs are paid using SWP funds, these costs

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<sup>29</sup> An implication is that any advantages secured long ago by water-using groups would have been captured by landowners and developers of all forms. As many of these properties have changed hands, there are very limited opportunities to recoup undercharges or refund overcharges from/to the affected parties.

constitute specific and separable costs chargeable to nonreimbursables. A challenging operational consequence of this arrangement is that it motivates operators to favor SWP payment of recreation-specific costs.<sup>30</sup>

- I The decision to not measure the benefits of fish and wildlife enhancements (beyond what may already be embedded in recreational values) and incorporate this enhancement value in the procedure is a slight departure from Davis-Dolwig directives. A consequence is that the amount of SWP costs allocated to the people of California may be understated. This departure avoids the troublesome and contentious analytical difficulty of distinguishing between preservations and enhancements, one of which is reimbursable and the other not. It also dodges a potential overlap and double-counting issue when a portion of recreation is attributable to the enhanced presence of fish and wildlife. Thus, this feature can be regarded as reasonable from an administrative cost perspective.
- J Reliance on federally determined calculations of flood control benefits is quite acceptable given Corps expertise in and sponsorship of flood control.
- K The distribution of reimbursable costs among contractors should not affect the amount of nonreimbursable costs.
- L At the conceptual level, the SCRB-C proposed utilization of WTP estimates and alternative cost estimates is appropriate. Whether the estimation procedures for WTP are appropriately conducted is an important matter considered in a forthcoming section (III.3) where significant weaknesses are identified.
- M With respect to the use of alternative costs as an upper bound upon received benefits, this is conceptually correct, yet the "alternative" being costed must be both capable of providing equivalent service to the SWP unit *and* expected to be actually undertaken in lieu of the SWP. SCRB-C implementation is criticized later for its visualization of alternatives, because some of the alternatives are merely a scaled-down SWP. For example, it is doubtful that a modified aqueduct would be among the approaches selected by SWP beneficiaries in the absence of the SWP. More detailed discussion of these problems is conducted in the Implementation investigation of section III.3 below.
- N The use of cost share percentages to allocate nonspecific separable costs, as well as joint costs, is a time-saver for year-to-year administrative operations. Although this augmentation of normal SCRB procedure introduces a potential source of inaccuracy when resulting cost shares are applied in future years, a clear direction of any introduced bias – either favoring water supply clients or public sector clients – is not immediately evident. Still, it can be observed in the DWR's cost allocation tables, the most recent of which are reproduced in the forthcoming section, most nonspecific separable costs occur for the water supply purpose. Therefore, there is a possibility that bias, of currently undetermined direction, is introduced by feature N.

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<sup>30</sup> When operators can cause operational recreation-specific costs to be paid from SWP funds, perhaps through successful negotiation with the DWR or delay in addressing particular problems (such as damaged or depreciated facilities), they win some measure of relief for their own budgets while transferring operational costs "off-budget" to Davis-Dolwig nonreimbursables.

Yet, if the totality of joint costs, specific and nonspecific separable costs, and the distributions of separable costs remain in similar relation to one another over time, feature N would not be the source of a notable problem.

### **III.3 Reasonability of SCRB-C Implementation: Benefit Measurement**

Given the platform of cost allocation established by SCRB-C, the next logical set of inquiries pertain to the actual practices used to complete this procedure. Because of the exhaustive effort carried out each year in monitoring SWP costs and given that these costs are heavily reviewed by SWPCs, it is difficult to justify additional examination of the cost side of the ledger. Therefore, the next sections emphasize the practices used to develop the "Benefits" which are determined in the third row of each tabulated cost share computation (21 tables) referenced by Table 3. [Again, contemporary terminology will be used here, largely because the SWP bulletins use the "benefits" label incorrectly.] Thus, the first three lines of the SWP cost share tables refer to willingness to pay, alternative costs, and benefits, respectively.

The benefit measures of SCRB-C were assessed many years ago and were infrequently redetermined. These are not decidedly negative observations, in light of the administrative costs that they averted. Yet, because these SWP benefits are as important as SWP costs in obtaining the cost-sharing percentages that are subsequently employed to allocate costs every year, it is appropriate to concentrate further inquiry into the past practices of estimating benefits. Does available evidence support a finding that these evaluations were well performed (at the time)? Are there discernible biases or inadequacies in the reported benefit evaluations? Can we develop conclusions about whether this work should have been updated more often or more recently or differently?

#### *III.3a Adjusting for Final Willingness to Pay*

As indicated in part II, the full willingness to pay accruing to final consumers of the SWP's outputs are not entirely creditable to the SWP. This point applies to all water-associated beneficiaries of the SWP. The SWP water received by an irrigator has enhanced usability due to its transport to the farm by a SWPC, and this contractor experiences costs in moving this water from the SWP turnout/terminus to the farm. The SWP water received by a household is enhanced similarly by transport, treatment, pressurization, etc., all of which involve costs for water utilities and contractors. Likewise, recreational experiences at a SWP lake generate consumer welfare that is the collaborative result of the lake, in "raw" form, complemented by the recreational enhancements built around/in/on the lake as well as activities such as policing and educational programs. To properly assess only the value of water or water bodies, analysts must either (i) subtract all value-adding costs from the final consumer values of the commodity being assessed (e.g. irrigation water or a recreational experience) or (ii) apply an assessment technique that somehow targets the value of the unfinished commodity directly.

Therefore, the potential reasons for wanting to know the expenses experienced by a SWPC or a park operator are quite limited in the case of benefit-sensitive cost allocation methods. The prime reason is that we do not wish to credit the SWP for benefits that were created by the value-adding operations of other agencies. As long as procedures are cautious in this regard, overstatement of willingness to pay can be avoided. In principle, this complication appears to have been well recognized by DWR analysts (e.g. Bulletin 153-65, p. 43).

Implications for the cost allocation of the joint costs of the SWP are as follows. First, the goal is mainly to allocate SWP's joint costs. Revenue sources for the operations of other agencies constitute an important topic in other budgetary ways, yet this matter is not germane to the cost-allocation task under investigation here. Second, the benefits attributable to the SWP can be overestimated if care is not exercised. Third, whereas the water supply operations of the SWP are confined to raw water storage and conveyance (but not transport to final consumers), there are a few instances in which the DWR has undertaken recreation-enhancing expenses (e.g. building a boat ramp). In these isolated cases, SCRB-based cost allocation can still proceed by estimating wholesale recreation values and treating the recreation-enhancing expenses as specific costs.

### *III.3b Assessing Recreation Willingness to Pay*

The methods employed by the DWR to estimate the WTP of recreational elements of the SWP are most fully discussed in Appendix D of Bulletin 132-70 (pp. 20-22). Recreational WTP is assumed equal to the product of annual recreation days and a "benefit unit rate" corresponding to a presumed dollar value per day of recreating. Occasionally, receipts from concessionaires are included (as they should be) although these tend to be small relative to total recreation WTP. Considerable recreational use has been made of SWP facilities since 1970, so we now have the advantage of replacing projections of visitor use with observed participation, or at least better informed estimates. Table 4 presents such estimates for the years 1974 to 2006 (Bulletins 132). Total use is dominated by visitation at a few larger lakes, especially Castaic, Silverwood, and Perris Lakes in the Southern Division; Lake Del Valle; and Oroville and Frenchman Lakes in the Oroville Division. Recreation use at these major lakes is illustrated in Figure 2. It is interesting to note that the visitation levels reported in 2006 are similar to those reported in 1974, suggesting the absence of a strong trend.

Whereas the disparity between the early projections of facility use and later estimates based on observation, such as those in Table 4, has generated attention from prior reviewers (see section IV below), less attention has been paid to the other half of the WTP equation, the value-per-day multiplier. SCRB-C practice is to assign a value to a day of recreation at each subunit between \$0.50 and \$2.50 to reflect qualities of the experience, such as variety of activity, facility maintenance, ecological, and water surface fluctuation considerations. The method for assigning unit values was sharpened from 5-point scoring to 100-point scoring with WTP estimation of the California Aqueduct and the Southern Division, although the interval from \$0.50 to \$2.50 continued to be used (Bulletin 132-80, App. D, p. 20). The 100-point method was sustained with the revision of the Grizzly Valley/Lake Davis cost shares (Bulletin 132-82, App. D, p. 23), which was the last to be completed by DWR. The stated range of \$0.50-2.50 notwithstanding, some unit values apparently run as high as \$4.00 daily, for hunting waterfowl at Clifton Court Forebay in the Delta Division (Bulletin 132-77, App. D, p. 23).

Internal concern has been expressed that the unit values are low relative to "accepted" values (Bulletin 132-79, p. 15). DWR unit values should only be compared cautiously to published estimates of "retail" recreation values, however, because the structure of recreation facility management within the SWP is such that the Project largely provides a "wholesale" recreation experience upon which other state departments and federal, county, municipal, and private entities build and maintain parks. The unimproved experience corresponds to a level of



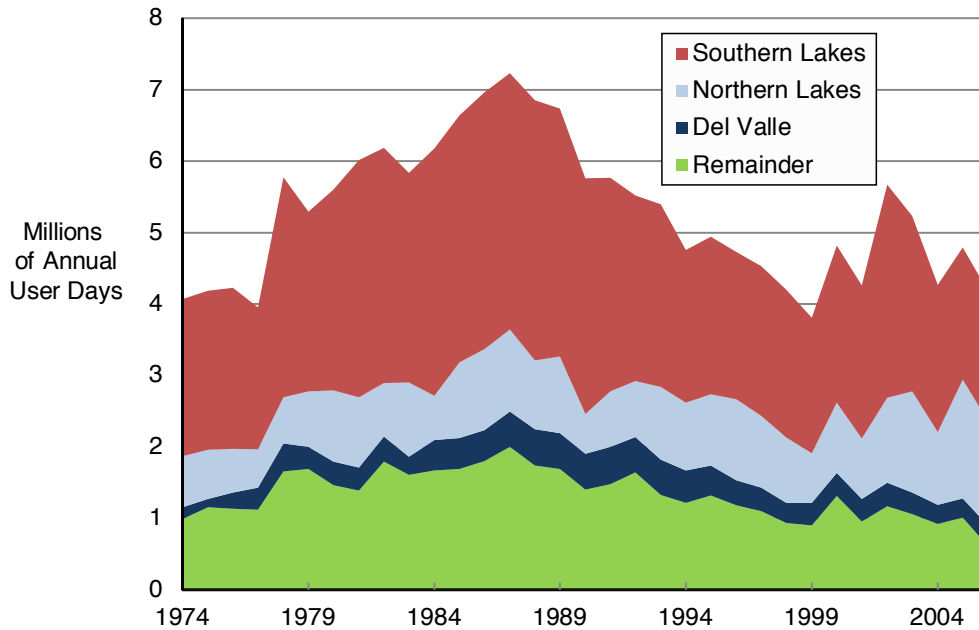
**Table 4. Use of Recreational Facilities by Division**  
(1,000s of recreational days)

Year	Oroville	Delta	San Luis	San Joaquin	Southern	All
1974	1,149.3	187.1	399.5	12.6	2,318.3	4,066.8
1975	1,058.0	138.2	449.2	23.8	2,512.9	4,182.1
1976	941.6	250.7	382.4	26.8	2,626.8	4,228.3
1977	810.8	333.4	426.2	25.4	2,355.6	3,951.4
1978	982.8	440.2	779.3	30.6	3,540.4	5,773.3
1979	1,325.4	378.3	747.7	31.0	2,811.5	5,293.9
1980	1,409.4	391.8	732.6	18.5	3,046.6	5,598.9
1981	1,480.1	381.4	650.8	22.9	3,481.8	6,017.0
1982	1,349.6	416.3	763.8	24.7	3,633.2	6,187.6
1983	1,465.6	337.5	730.0	11.1	3,292.0	5,836.2
1984	1,096.5	504.1	808.8	14.1	3,753.4	6,176.9
1985	1,559.5	504.1	808.8	14.1	3,753.4	6,639.9
1986	1,723.3	506.8	828.7	13.3	3,891.9	6,964.0
1987	1,762.3	609.7	876.6	16.3	3,964.0	7,228.9
1988	1,332.0	606.7	885.1	19.4	4,011.5	6,854.7
1989	1,451.0	591.3	902.4	17.3	3,776.3	6,738.3
1990	873.5	575.0	735.2	23.7	3,552.7	5,760.1
1991	1,111.8	592.3	654.9	16.5	3,393.2	5,768.7
1992	1,070.9	572.8	733.5	16.5	3,126.9	5,520.6
1993	1,332.0	563.4	601.0	23.2	2,875.9	5,395.5
1994	1,274.9	504.3	605.5	7.3	2,361.3	4,753.3
1995	1,317.4	481.2	615.1	16.2	2,514.3	4,944.2
1996	1,441.5	402.4	506.0	11.8	2,364.8	4,726.5
1997	1,243.3	359.0	499.0	9.9	2,421.4	4,532.6
1998	1,105.9	327.7	496.5	9.9	2,260.1	4,200.1
1999	908.3	351.5	428.4	9.4	2,111.2	3,808.8
2000	1,197.2	359.2	858.2	10.5	2,393.6	4,818.7
2001	1,060.7	349.7	547.5	10.8	2,289.1	4,257.8
2002	1,396.0	368.0	714.4	9.8	3,184.6	5,672.8
2003	1,622.8	327.2	709.3	12.1	2,558.6	5,230.0
2004	1,224.7	309.5	555.0	12.5	2,167.0	4,268.7
2005	1,962.0	308.9	555.0	12.5	1,952.1	4,790.5
2006	1,655.2	333.8	196.7	12.5	1,989.1	4,187.3
Total	42,695.3	13,663.5	21,183.1	547.0	96,285.5	174,374

service appropriate for many of the activities envisioned by SWP planners, including "camping, picnicking, fishing, hunting, water contact sports, boating, and sightseeing";<sup>31</sup> but it would be inaccurate to credit the SWP for all benefits to, say, boat fishers if the Department of Boating and Waterways supplied the ramp, the Department of Fish and Game supplied the fish stock, and the Department of Parks and Recreation supplied the parking lot.

A previous SCRB review has compared the adopted range of visitor-day values to values reported in a contemporary study (CH2M-Hill 2007). For basic, wholesalerecreation activities such as walking and sightseeing, the contemporary visitor-day values of \$25.70 (walking) to \$30.70 (sightseeing; from Kaval and Loomis 2003) correspond to \$4.77 – 5.70 in 1969 dollars, still above the \$0.50 – 2.50 scale. Research specific to the San Joaquin wetlands estimates use benefits per visit of \$126 – 159 (1989 dollars) for fishing, hunting, and wildlife viewing (Creel and Loomis 1992). A recent survey of nonmarket valuations of recreation in national parks reports a mean estimate of \$32 per day for hiking, \$48 for hunting, and \$54 for

<sup>31</sup> California Water Code §11910.5.



**Figure 2. Recreation Use at Major Lakes, 1974-2006**

sightseeing (all 2006 dollars; Kaval 2007). This evidence tends to support the contention that the adopted unit values were somewhat low at the time of their adoption. Continuing to assume a benefit range of \$0.50 – 2.50 per visit today may be unreasonably low after accounting for inflation, yet this should not be an issue if nonrecreation benefits are also measured in a 1960's base year.

More problematic from the perspective of valuation, the scope of recreation demand has increased in recent years. At the current level of the SWP's facility development, visitors can fly model airplanes; learn to dive, kayak, or lifeguard; volunteer or join a club; or even dogsled. These and other opportunities can make use of the built infrastructure, like an aquatic adventure camp or a campground with horse facilities, or can rely on natural attributes of the land, like an interesting bird population or a scenic overlook. Some retail experiences are provided by the DWR directly, such as the visitor centers. Events held on SWP facilities, such as July 4th firework shows and youth camps, have social value to the community that is linked with, but not limited to, recreation. Although the explosion in recreation diversity and environmentalism makes accounting for recreational benefits more complicated, it also puts dated benefits estimates at risk of no longer reflecting the complete preferences of the people.

By including water surface reliability as a factor in the benefit unit value of each facility, the DWR has recognized that surface level can influence the benefits to waterborne recreation. Depending on conditions, DWR may minimize fluctuations of water surface level, even though recreation is subordinate to the other project purposes that determine lake levels. A more sophisticated model could tie estimated use values directly to expected or experienced lake levels. For example, research in the Sacramento area has found annual recreation values of additional lake volume between \$6/acre-foot at Pine Flat Reservoir and \$600/acre-foot at Success Lake (Ward et al. 1996). Creel and Loomis (1992) estimated a recreation value of

additional water in the San Joaquin wetlands at \$303/acre-foot. Other research on Walker Lake, Nevada, found that a drop in lake level of one foot corresponded to an annual loss of \$11.60 to \$18.54 in annual value per recreationist (Eiswerth et al. 2000). Also, because facilities can become congested, excess or peak demand could reduce the value of marginal use. Conversely, if a visitor is willing to wait in line on a congested day and pay the necessary entrance fees, it is plausible that the same visitor would value the same park far above the price of admission on an off-peak day. Recreation values could be further refined to reflect seasonal peaks and intraweek congestion.

The existence of SWP facilities may even have value to those who will never visit one. In the language of the Davis-Dolwig Act, recreation "benefits all of the people of California", not just site visitors.<sup>32</sup> SWP facilities have nonuse values (Walsh, Loomis, and Gillman 1984) simply because some nonusers could become visitors in the future (option value), because nonusers can have positive feelings about natural ecosystems (existence value), and because of the desire to leave a natural environment to our descendants (bequest value). Research from the Cascade Mountains in Washington estimates a value of \$0.28 annually to each resident of Washington for the existence of hiking trails (Englin and Shonkwiler 1995). Research from the Trinity River in California estimates a value to recreationists of \$23.01 per month, with a value to nonusers of \$5.40 per month (Douglas and Taylor 1999). Nonuse values will be higher for unique or irreplaceable elements of ecosystems (Walsh, Loomis, and Gillman 1984). Although the SWP replaced a natural ecosystem with a built one, it is reasonable to expect that some nonuse values are produced by particular aspects of the new ecosystem.

To some extent, high existence and bequest values are reflected separately in the various preservation activities performed by the SWP, which are considered "reimbursable" because they preserve rather than enhance fish and wildlife. On the other hand, enhancement might occur when the SWP creates new riparian habitat by introducing bodies of water where there were none. The operational distinction is a matter of discretion in some senses. In its cost-allocation practices the DWR has traditionally downplayed fish and wildlife enhancement values relative to recreation as noted with feature I of SCRB-C. WTP for fish and wildlife enhancement is claimed to be implicit to the recreation unit values (Appendix D, Bulletin 132-80, p. 20). In a more refined model, some fish and wildlife enhancement WTP could be explicitly attributed to SWP deliveries.

Recreational WTP is estimated to be proportional to visitation in SCRB-C. Projected use patterns may have been as accurate as any 50-year projection could be. The allocations could be revised by replacing projections with the observed record, but such a revision would rest heavily on the unit benefit constants, which are probably low. Also, the method excludes the class of nonuse values, which may be a substantial contribution to total value. Due to a number of omissions, some underestimation, and no clearcut evidence of overestimation outside of originally projected user days, we suspect that the WTP estimates used in SCRB-C allocations are lower than the best estimates that would be produced by customary economic methods.

### *III.3c Replicating the Cost Allocation Tables*

After applying the unit-day values to arrive at an annualized level of WTP, the results are

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<sup>32</sup> California Water Code §11900.

to be entered in the first line of the 21 tables referenced by Table 3. In Tables 5A and 5B we replicate as spreadsheets the most recent cost allocation tables for the six jointly used units of the SWP. Three units appear in each table, and the tables include a column for the original line number as well. Also included is a column for variable names to provide a firm linkage to the conceptual development initiated in part II above. Because Tables 5A and 5B are actual spreadsheets, there is no rounding error to be magnified by successive calculations. Yet, in the original tables there is some rounding error introduced, perhaps attributable to the truncation of digits. Consequently, there are occasional discrepancies to be seen when one closely compares Tables 5A and 5B to the original tables. These differences are largely confined to the lower portions of the table. Such rounding errors are not discussed further here.

To aid interpretation of Tables 5A and 5B, informational inputs to the computational process are enclosed by dashed lines, and the completed share percentages are highlighted in grey. All entries external to dashed lines are calculated internally, using input values as described in the Line Index to Table 5 (which is strongly indebted to a similar listing accompanying the original tables). Some of the criticizable elements of these tables are encircled to assist forthcoming discussion.

Line 3 (Benefits) is obtained as the lower amount of the two values above it (WTP and alternative costs). Therefore, these latter two values have a strong influence on the final outcomes (lines 12a and 12b) of the SCRB-C process. Examining the WTP and alternative cost values for each unit and each purpose, troublesome observations emerge, leading to some disappointments in the implementation of SCRB-C. These issues will be explained in the immediately following sections.

Because the line 3 minimums take on the value of either WTP or alternative costs, the other value becomes irrelevant henceforth. For recreation, WTP is the applied value for all units except Frenchman and Grizzly Valley. For water supply benefits, alternative costs is the applied value for all units except Frenchman and Grizzly Valley. Thus, the common situation is that recreation alternative costs are used along with the given water supply WTP to compute cost shares for the recreation dominated upper Feather units. Oppositely, for the more costly, water-supply dominated units of Table 5B, recreation WTP is applied along with alternative costs for water supply. These observations offer some direction about which values and valuation procedures are deserving of greater attention in the forthcoming sections.

### *III.3d Assessing Willingness to Pay for Water Supply*

An implication of the SCRB procedure is that the computed nonreimbursable expenditures depend in part on the estimated benefits for reimbursable purposes, and vice versa. Water supply is the only purpose other than recreation that is allocated in five of the six joint use units. By 2006, the SWP had delivered 118.7 million acre-feet of water, including 67.3 million acre-feet of Table A contracted water supply. Annual historical deliveries are documented in Table 9-5 of Bulletin 132-07, pp. 181-182. Just as in the recreational case, water supply WTP by end users cannot be fully attributed to the SWP, since important services such as treatment and transmission are provided by the contractors.

The DWR distinguishes WTP for water supply according to end use, either agricultural or municipal/industrial. Water supply WTP is assumed to be agricultural for Frenchman, local municipal for Grizzly Valley, and largely municipal/industrial for Oroville and both Aqueduct

**Table 5A. Most Recent Cost Share Calculations for Grizzly Valley, Frenchman, and Del Valle Units**

(values in \$1,000s)

Original Line No.	Allocation Concept ‡	Frenchman (1973)			Grizzly Valley (1982)			Del Valle (1973)			
		Water	Rec.	Total	Water	Rec.	Total	Water	Flood	Rec.	Total
1	WTP	\$35.8	\$655.1	\$690.9	\$3.29	\$688.53	\$691.82	\$479	\$528	\$1,675	\$2,682
2	alt. cost	\$150.6	\$351.7	\$502.3	\$96.77	\$452.30	\$549.08	\$479	\$1,266	\$1,779	\$3,524
3	B <sub>i</sub>	\$35.8	\$351.7	\$387.5	\$3.29	\$452.30	\$455.59	\$479	\$528	\$1,675	\$2,682
4		\$35.8	\$236.9	\$272.7	\$0.00	\$355.53	\$355.53	\$204	\$211	\$596	\$1,011
4a	C <sub>i</sub>	\$35.8	\$109.6	\$145.4	\$0.00	\$250.64	\$250.64	\$191	\$188	\$218	\$597
4b	C <sub>i</sub>	\$0	\$127.3	\$127.3	\$0.00	\$104.89	\$104.89	\$13	\$23	\$378	\$414
5	B <sub>i</sub> – C <sub>i</sub>	\$0	\$114.8	\$114.8	\$3.29	\$96.77	\$100.07	\$275	\$317	\$1,079	\$1,671
6		0.0%	100.0%	100.0%	3.3%	96.7%	100.0%	16.5%	19.0%	64.6%	100.0%
7		\$0	\$114.8	\$114.8	\$3.18	\$93.59	\$96.77	\$186	\$214	\$728	\$1,128
7a	s <sub>i</sub> *J, J	\$0	\$73.1	\$73.1	\$2.73	\$80.29	\$83.03	\$172	\$198	\$675	\$1,046
7b	s <sub>i</sub> *J, J	\$0	\$41.7	\$41.7	\$0.45	\$13.30	\$13.75	\$13	\$16	\$53	\$82
8		\$35.8	\$351.7	\$387.5	\$33.45	\$449.12	\$482.57	\$390	\$425	\$1,324	\$2,139
8a	A <sub>i</sub> , T	\$35.8	\$182.7	\$218.5	\$31.28	\$330.93	\$362.21	\$363	\$386	\$893	\$1,643
8b	A <sub>i</sub> , T	\$0.0	\$169.0	\$169.0	\$2.17	\$118.19	\$120.36	\$26	\$39	\$431	\$496
9		9.2%	90.8%	100.0%	6.9%	93.1%	100.0%	18.2%	19.9%	61.9%	100.0%
9a		16.4%	83.6%	100.0%	8.6%	91.4%	100.0%	22.1%	23.5%	54.4%	100.0%
9b		0.0%	100.0%	100.0%	1.8%	98.2%	100.0%	5.3%	7.8%	86.9%	100.0%
10		\$0	\$179.4	\$179.4	\$30.26	\$163.64	\$193.90	\$0	\$0	\$580	\$580
10a	CC <sub>i</sub>	\$0	\$52.1	\$52.1	\$28.55	\$69.88	\$98.43	\$0	\$0	\$202	\$202
10b	CC <sub>i</sub>	\$0	\$127.3	\$127.3	\$1.72	\$93.75	\$95.47	\$0	\$0	\$378	\$378
11		\$35.8	\$172.3	\$208.1	\$3.18	\$285.48	\$288.67	\$390	\$425	\$744	\$1,559
11a	A <sub>i</sub> – CC <sub>i</sub>	\$35.8	\$130.6	\$166.4	\$2.73	\$261.05	\$263.78	\$363	\$386	\$691	\$1,441
11b	A <sub>i</sub> – CC <sub>i</sub>	\$0.0	\$41.7	\$41.7	\$0.45	\$24.43	\$24.89	\$26	\$39	\$53	\$118
12		17.2%	82.8%	100.0%	1.1%	98.9%	100.0%	25.0%	27.3%	47.7%	100.0%
12a	S <sub>i</sub>	21.5%	78.5%	100.0%	1.0%	99.0%	100.0%	25.2%	26.8%	48.0%	100.0%
12b	S <sub>i</sub>	0.0%	100.0%	100.0%	1.8%	98.2%	100.0%	22.5%	32.7%	44.9%	100.0%

**Tables 5A and 5B Footnotes and Legend**

‡ Where there are two entries in the Allocation Concept column separated by a comma, the first applies to the individual purpose columns and the second to the Total columns.

† 11b for the Delta to Dos Amigos Aqueduct (Water and Rec.) is computed differently than it is for other project segments as discussed in section III.3f of this report. 10b and 10c are subtracted from 8b.

Spreadsheet inputs enclosed by dashed lines; all other entries are internally calculated within the spreadsheet.

Primary SCRB-C result (also shown in Table 3).

Boxed area for Grizzly Valley includes specific transportation costs of \$28,546 (capital) and \$1,717 (min OMPR) in addition to allocated joints costs.

**Table 5B. Most Recent Cost Share Calculations for Oroville and Aqueduct Units**

(values in \$1,000s)

Original Line No.	Allocation Concept ‡	Oroville (1978)			California Aqueduct: Delta to Dos Amigos (1977)			California Aqueduct: Dos Amigos to Termini (1980)		
		Water	Rec.	Total	Water†	Rec.†	Total	Water	Rec.	Total
1	WTP	\$64,717	\$2,741	\$67,458	\$50,773	\$1,696	\$52,469	173,033	12,525	\$185,558
2	alt. cost	\$29,846	\$14,405	\$44,251	\$20,570	\$2,464	\$23,034	102,965	25,812	\$128,777
3	B <sub>i</sub>	\$29,846	\$2,741	\$32,587	\$20,570	\$1,696	\$22,266	\$102,965	\$12,525	\$115,490
4		\$17,581	\$2,140	\$19,721	\$19,078	\$972	\$20,050	\$84,262	\$7,109	\$91,371
4a	C <sub>i</sub>	\$13,281	\$1,074	\$14,355	\$12,274	\$354	\$12,628	50,979	2,778	\$53,757
4b	C <sub>i</sub>	\$4,300	\$1,066	\$5,366	\$6,804	\$618	\$7,422	12,336	4,072	\$16,408
4c	C <sub>i</sub>							\$20,947	259	\$21,206
5	B <sub>i</sub> – C <sub>i</sub>	\$12,265	\$601	\$12,866	\$1,492	\$724	\$2,216	\$18,703	\$5,416	\$24,119
6		95.3%	4.7%	100.0%	67.3%	32.7%	100.0%	77.5%	22.5%	100.0%
7		\$11,692	\$573	\$12,265	\$1,005	\$487	\$1,492	\$14,503	\$4,200	\$18,703
7a	s <sub>i</sub> *J, J	\$11,390	\$558	\$11,948	\$870	\$422	\$1,292	\$12,955	\$3,752	\$16,707
7b	s <sub>i</sub> *J, J	\$302	\$15	\$317	\$135	\$65	\$200	\$1,548	\$448	\$1,996
8		\$29,273	\$2,713	\$31,986	\$20,083	\$1,459	\$21,542	\$98,765	\$11,309	\$110,074
8a	A <sub>i</sub> , T	\$24,671	\$1,632	\$26,303	\$13,144	\$776	\$13,920	\$63,934	\$6,530	\$70,464
8b	A <sub>i</sub> , T	\$4,602	\$1,081	\$5,683	\$6,939	\$683	\$7,622	\$13,884	\$4,520	\$18,404
8c	A <sub>i</sub> , T							\$20,947	\$259	\$21,206
9		91.5%	8.5%	100.0%	93.2%	6.8%	100.0%	89.7%	10.3%	100.0%
9a		93.8%	6.2%	100.0%	94.4%	5.6%	100.0%	90.7%	9.3%	100.0%
9b		81.0%	19.0%	100.0%	91.0%	9.0%	100.0%	75.4%	24.6%	100.0%
9c								98.8%	1.2%	100.0%
10		\$7,065	\$2,140	\$9,205	\$3,133	\$866	\$3,999	\$21,756	\$7,032	\$28,788
10a	CC <sub>i</sub>	\$5,637	\$1,074	\$6,711	\$0	\$313	\$313	\$807	\$2,701	\$3,508
10b	CC <sub>i</sub>	\$1,428	\$1,066	\$2,494	\$0	\$518	\$518	\$2	\$4,072	\$4,074
10c	CC <sub>i</sub>				\$3,133	\$35	\$3,168	\$20,947	\$259	\$21,206
11		\$22,208	\$573	\$22,781	\$16,950	\$593	\$17,543	\$77,009	\$4,277	\$81,286
11a	A <sub>i</sub> – CC <sub>i</sub>	\$19,034	\$558	\$19,592	\$13,144	\$463	\$13,607	\$63,127	\$3,829	\$66,956
11b†	A <sub>i</sub> – CC <sub>i</sub>	\$3,174	\$15	\$3,189	\$6,939	\$165	\$7,104	\$13,882	\$448	\$14,330
12		97.5%	2.5%	100.0%	96.6%	3.4%	100.0%	94.7%	5.3%	100.0%
12a	s <sub>i</sub>	97.2%	2.8%	100.0%	96.6%	3.4%	100.0%	94.3%	5.7%	100.0%
12b	s <sub>i</sub>	99.5%	0.5%	100.0%	97.7%	2.3%	100.0%	96.9%	3.1%	100.0%

**Tables 5A and 5B line by line index**

(original label given parenthetically)

1. Willingness to Pay (Benefits), estimated.
2. Alternative Costs, input by costing a hypothetical alternative.
3. Benefits (Justifiable Costs), the lesser of (1) and (2).
4. Separable Costs, the difference in project costs with and without the purpose.
5. Remaining Benefits (Remaining Justifiable Costs), (3) less (4).
6. Percent Distribution of Remaining Benefits, proportional to (5).
7. Remaining Joint Costs, total project costs less separable costs, distributed according to (6).
8. Total Allocated Project Costs and Total Project Costs.
9. Percent Distribution of Total Project Costs, proportional to (8).
10. Specific Costs, generally a subset of (4) but including ad hoc offsets.
11. Allocated Costs of Features Jointly Used, (8) less (10).
12. Percent Distribution of Costs of Features Jointly Used, proportional to (11).

**"a," "b," and "c" designations**

- a. Attributed to capital expenditures
- b. Attributed to minimum OMP&R expenditures
- c. Attributed to variable OMP&R expenditures

units. Water supply WTP for Del Valle is not estimated. Instead, water supply benefits are set equal to water supply alternative costs for Del Valle (Bulletin 132-73, App. D, pp. 22-23). This misuse of economics methodology is apparent in the redundancy in Table 5A between Lines 1 and 2 of the Del Valle Water column. Alternative costs should not be listed in Line 1, because they have a reserved role in Line 2 and confusion between WTP and alternative costs should be avoided. When analysts assume that WTP exceeds alternative costs, and that WTP evaluations are therefore unnecessary, Line 1 entries should be empty to avoid misrepresentation. Also, all comparisons of alternative costs meant to discover the least-cost alternative should be preliminary to completion of Line 2.

For the Frenchman unit, water supplied to agriculture is valued at the net increase in returns to farmers resulting from applying SWP water minus local transmission costs. The discussion and tabulation of B132-73 (App. D, p. 30) appears to infer that a 3,000 acre-foot increment in average annual water supply produces approximately \$360,000 in decadal water supply benefits. This approximates \$12/acre-foot/year. This is conceptually and empirically reasonable.

In the Grizzly Valley case where a specific town is the water supply beneficiary, water supply benefits are estimated at \$46/acre-foot times the projected volume of deliveries over a 50-year horizon (Bulletin 132-82, App. D, p. 22). The valuation is said to result from the "vendability" or "saleability" of water in this locale (Bulletin 153-65, p. 67; Bulletin 132-82, App. D, p. 21). This is a conceptually valid and otherwise acceptable value of domestic water although, as with recreation, some accuracy may be lost by the constant value-per-unit assumption.

For the three large and costly units allocated within Table 5B, WTP for municipal/industrial water supply is based on the costs of exercising other water supply options, especially desalination (Bulletin 132-70, App. D, p. 19). This is actually an alternative cost measure, not WTP, despite the repeated claim that the estimates are bounded by WTP. This is unfortunate methodology. The calculations underlying the Line 1 water supply entries of Table 5B are dominated by the alternative costs of desalinating water for Southern California, effectively assuming that (i) these deliveries of water must be provided by some means, if not the SWP, and (ii) desalination is the least expensive option among all available supplyside and demandside strategies. These aspects of municipal/industrial water supply evaluation have not been improved since the original cost allocations of the SWP. It is explained that an "extremely precise estimate of benefits is not warranted" for the Oroville Division or the California Aqueduct (App. D, Bulletins 132-70, p. 25f; 132-71, p. 19f), because alternative costs are so low relative to WTP. The statement presumes an estimate of WTP that is never generated.

Because evidence of WTP for significant water supply beneficiaries of the SWP is absent, there are unresolved issues. It can always be presumed that annualized WTP is so high as to be irrelevant, but WTP can also be quite low early in M&I planning horizons due to low levels of demand relative to the water supplies already secured (pre-SWP) and the discounting that must be performed upon future WTP estimates. Based on the absence of evidence provided by reviewed documents, the assumption of irrelevantly high WTP is not well supported.

In responding to our concerns about the substitution of alternative costs for WTP and the omission of true WTP, DWR staff makes the important argument that WTP must have been

higher than water supply's alternative costs: why else would the SWPCs be willing parties to the water supply contracts? We also find this point to be consoling. Yet, it is not fully convincing of irrelevantly high WTP for water supply. Historically, water agencies such as the SWPCs have not been constrained to making economically optimal commitments. Western water agencies have tended to follow politically styled "business" models. As a consequence, least-cost strategies are not always pursued or adopted; predispositions favoring water supply development have been common; and agency behaviors are often not indicative of the economic merits of an action.

In sum, we believe that the assumption of irrelevant water supply WTP is reasonable at present levels of California development, but it is questionable for the early period of the SWP. Older cost shares were built upon a basis that makes the older accuracy of this assumption important. Moreover, when analyses are not using WTP by assumption, all aspects and implications of this assumption should be presented accurately.

### *III.3e Development of Alternative Costs*

In light of the above findings, for the six cost-allocated units of Tables 5A and 5B only the two lesser units (Grizzly Valley and Frenchman) are provided legitimate WTP measures for water supply. Benefits to water supply are determined in the other cases by a comparison of alternative costs. For the most part, the entries of Line 2 are the alternative costs of a reconfigured, single-purposed SWP facility, and the water supply entries of Line 1 are the alternative costs of a different option. An important distinction gets lost along the way: the "alternative costs" entered in Line 2 of Table 5 should be the cost of the least expensive alternative, whether a reservoir, a desalination activity, leased water rights, or even a demand management measure. The cheapest alternative should then be bounded by a WTP measure such as the one used for Grizzly Valley and Frenchman. Estimates of WTP for municipal water supply may be derived from an aggregate demand correspondence, many of which have been estimated (Dalhuisen et al. 2003) while exercising valuation procedures that have been long available (James and Lee 1971; Griffin 1990, 2006). More detailed modeling that embeds both alternative facilities and economic visions of demand is also a practical approach for identifying benefits.

What is actually entered in Line 2, seemingly for all purposes and all units, is the cost of a hypothetical, reconfigured SWP facility. In some cases these reconfigurations may involve new facilities to be used in concert with rescaled SWP infrastructure, but for the most part the alternative being costed is a somewhat smaller, single-purpose SWP facility.

As another lost distinction, the alternative cost should involve a strategy expected to be employed in the absence of the SWP. So, in the absence of the recreational outputs of the Grizzly Valley Dam, would recreationists or the State actually build the same dam, only one foot lower, as is the proposed basis for the Line 2 alternative costs? Indeed, all of the recreational alternative cost constructs appear to hinge on ad hoc modifications to the constructed unit of the SWP. A more accurate vision is that the SWP was motivated by the water supply purpose, and recreation is an incidental result. It is then inappropriate to generate alternative cost estimates for recreation, because no recreation-only substitutes for the dams and aqueducts would actually be pursued in the absence of the SWP. In our opinion, the recreational Line 2 entries should be blank (nonzero and not limiting to benefit measures) for



recreation in all of the cost allocation tables.

### *III.3f Calculating Benefits*

The cost allocation calculated for each unit in Table 5 proceeds largely as anticipated, using the WTP and alternative cost estimates discussed above. This subsection notes some exceptions where procedures may have been applied in unexpected or seemingly inconsistent ways. Ultimate explanation for distinctive paths selected by the DWR are not sought in this report however.

First, the appearance of some incidental values within the SCRIB computations has not been uniform. Usually, transportation costs do not appear in the SCRIB allocation, but in Grizzly Valley, even though only the conservation portion of the unit has been subjected to SCRIB-C, specific costs to transportation facilities of \$30,263 are included in allocated costs in Line 8 and subtracted in Line 10. The percentage allocation proceeds without these specific costs, and WTP for water supply (Line 1) only includes a portion of total WTP attributable to conservation. The inclusion is therefore irrelevant, except from the perspective of transparency.

Similarly, the treatment of variable OMP&R varies across the two segments of the California Aqueduct. According to an explanatory note to us from the DWR:

"The OMP&R component[s] of the Total Allocated Project Costs...used in Row 8b are the total of both Variable OMP&R and Minimum OMP&R. To calculate the Minimum OMP&R for Allocated Costs of Features Jointly Used you have to take the OMP&R component of the Total Allocated Project Costs (Row 8b) and subtract both the Recreation OMP&R (Row 10b) and the Variable OMP&R (Row 10c). As ... noted the equation is  $8b - 10b - 10c$ . The difference between the two groups of reaches is that the Reaches from the Delta to Dos Amigos [Pumping Plant] have a combined OMP&R (Variable and Minimum) for the Total Allocated Project Costs whereas [for] the Reaches downstream of Dos Amigos ... the Total Allocated Project Costs are already separated into Minimum OMP&R and Variable OMP&R. With the variable costs removed the corrected Total Allocated Project Costs Percent Distribution can be correctly calculated."

Again, the allocation result is not affected, because variable OMP&R is not included in the SCRIB calculation in either case.

Treatment of the flood control purpose has also been inconsistent. Two units, Oroville and Del Valle, provide flood control benefits, and this is acknowledged in agreements with the United States government (1962 and 1966). Flood control costs are not allocated as are other costs in the Oroville allocation. Instead, SCRIB is performed after the federal share is subtracted. This procedure conforms to the Standard Provisions for Water Supply Contracts, which dictates "allocations to purposes the costs of which are to be paid by the United States shall be as determined by the United States" (DWR 1962, Article 22(e), p. 12). In contrast, the Del Valle allocation includes a flood control share of 26.8% (Bulletin 132-73, App. D), even though Bulletin 132-80 states, "this analysis assumes no further federal-state sharing of joint facilities [and therefore expects] no further payments...from the Federal Government" (p. 176).

A more problematic and cross-cutting idiosyncrasy is evident when comparing remaining benefits (Line 5) with total joint costs (Line 7). For five of the six allocations, the total of Line

7 is equal to one of the quantities in Line 5. These instances are encircled in Tables 5. Del Valle does not exhibit the characteristic, because it is the only unit with three project purposes allocated. The curiosity arises because the alternative cost for each purpose (Line 2) added to the separable costs for the other purpose (Line 4) is equal to total project costs in all five cases. This occurs by analytical assumption presuming that each purpose's best alternative is to go ahead with the project without the other purpose. Such a conception of alternative costs is rather circular as well as unimaginative with respect to legitimate alternatives.

In the Frenchman allocation (Table 5A), it is surprising to find that Lines 3 and 4 are equal for the water supply purpose. This means that the schedule of WTP for agricultural water users over 50 years is exactly equal to the cost difference of accommodating the water supply purpose at Frenchman Dam. Also surprising, total allocated project costs (Line 8) are equal to total benefits (Line 3). These peculiar values imply that neither purpose receives net benefits relative to a lake dedicated solely to recreation. In fact, had WTP been any lower, separable costs would have exceeded benefits for water supply, inferring that the water supply purpose should have been omitted from the project in the interest of participation efficiency.

SCRB-C allocations can only be as good as the input information. It appears that the allocation process could benefit from better compliance with economic practice and, especially, an improved calculation of alternative costs. In the Frenchman allocation (Table 5A), the results seem to serve a purpose extraneous to cost allocation. Whether this is by design or a series of happy coincidences is difficult to determine from the supporting material. Otherwise, alternative costs must appear only in Line 2, and must represent real lowest-cost alternatives to participating in the SWP.

## IV. Prior Critiques of Cost Allocation for the SWP

Decades of debate over the cost allocations required by the Davis-Dolwig Act has fostered other studies and critiques. Four professionally conducted reports stand out:

- 1979: California Department of Finance, *Review of Davis-Dolwig Allocation Methodology: Recreation Costs of State Water Project*, California Department of Water Resources;
- 1984: Raymond W. Gaines, *Review and Analysis of Cost Allocation Methods for the California State Water Project*;
- 2007: CH2M-Hill, *Review of the State Water Project Separable Costs Remaining Benefits (SCRB) Cost Allocation Methodology*; and
- 2009: California Legislative Analyst's Office, *Reforming Davis-Dolwig: Funding Recreation in the State Water Project*.

In the following sections, the major points from each of these reports are compiled and subsequently reconsidered in light of the findings and evaluations obtained above. After all four reports are summarized, their contributions are collectively considered in a separate section.

### IV.1 Department of Finance (1979)

By the late 1970's a considerable Davis-Dolwig debt had developed (Figure 1), affected strongly by completion of the California Aqueduct. Attention to this topic resulted in a Department of Finance (DOF) report investigating the DWR's cost allocation procedures. Relying on the Summary of the DOF report to condense and prioritize the issues as viewed by Finance, the following concerns are noted:

1. Cost allocation percentages calculated early in the SWP's history (see Table 3) were overly preliminary, and small changes in these percentages can influence Davis-Dolwig costs greatly when joint costs are large (pp. xii-xiii).
2. Allocated costs include estimates of future costs (p. xiii).
3. Recreational participation (visitor days) at SWP facilities was overestimated (p. xiii).
4. The DWR's application of cost allocation involves too much subjectivity (p. xiv).
5. The DWR's projections extend too far into the future to be reliable (p. xiv).
6. Resultant cost allocations are unstable insofar as they are highly sensitive to estimated recreational benefits and alternative costs (pp. xiv-xv).
7. The DOF recommends a unique and nonstandard concept for assessing water supply and recreational benefits (p. xv).

### IV.2 Gaines (1984)

Raymond Gaines (consultant) provided a federal-centric discussion of California's cost allocation procedures in that he appeared to regard federal procedure, such as that utilized by the U.S. Bureau of Reclamation, as a gold standard. Major points within the review included the following:

1. The DWR's execution of SCRB is not "simultaneous" and is unconventional as a result, as contrasted to federal practice, but the DWR's options are legally restricted in this regard by California rules (pp. 25, 26, 28).
2. Value-adding expenses such as external-to-SWP irrigation systems and park facilities are not properly taken into account, yet such corrections may have "little, or no effect" (p. 27).
3. Accounting for inflation could be better implemented (pp. 27-28).
4. Contrary to intentions restated in various Bulletin 132 Appendix D reports, very limited updating of the cost allocation percentages have been accomplished even though 5-year updates were planned (pp. 29-30).
5. The SWP practice of making retroactive revisions to cost allocations combined with the possibility of modified cost allocation percentages (when updated) can result in big billing swings that could be harmful to contract clients (pp. 30-31). Gaines recommends that the originally intended, 5-year update plan be followed to reduce this problem.

The Gaines report also weighs in on the disappointments registered in the 1979 DOF report as follows:

6. The report observes that the DOF takes issue with the errant visitor day projections utilized by the DWR, but does not give consideration to the presumed value of these days (p. 35).
7. Regarding the DOF complaint that the projection period is overly long, "In fact, the 50-year period is not too long, and indeed might be too short" (p. 36). "Of course reliable estimates cannot be made for such periods, but periodic updating and adjusting will eventually balance accounts" (p. 36).
8. The DOF recommended procedure for revising benefits measures (DOF-7 above) is ill advised (pp. 37-38).

In general Gaines does not find much agreement with the DOF findings or recommendations, and where he does find merit with a DOF finding, he recognizes that modifications of the DWR approach would be inconsistent with the DWR's legal directives.

### **CH2M-Hill (2007)**

The CH2M-Hill report was commissioned by the DWR to provide an evaluation of past cost allocations and to investigate the cost of developing contemporary cost shares with new analyses of various depths. Some restatements of historical cost-share tabulations, very similar to the original tables are also included. The recreated tables appear to be equivalent to the original cost allocation tables except for the use of a different monetary base year; hence the resulting cost share percentages are unaltered from the originals. The report is labelled as a "Draft Report" for undisclosed reasons, suggesting that the effort was terminated before finalization.

A portion of the report evaluates the 1979 objections raised in the Department of Finance report, and is generally dismissive of those criticisms and suggestions. The CH2M-Hill report does confirm the problem of overestimated recreation days but counters with the argument that the value of those days was underestimated. Yet, it is insinuated that retail-like recreational values are applicable in the SWP scenario, which is not the case for reasons noted in section III.

3a above. Overall, the report is quite supportive of the DWR's practices of cost allocation, but the report is difficult to cast as a truly independent evaluation given that a DWR administrator is identified as one of the report's coauthors (p. 32).

A useful product of the CH2M-Hill report is the finding that full recomputations and updating of cost allocations would be quite expensive, with expenses varying according to the depth of analysis. The costs of pursuing different types of updates are estimated, with more detailed analyses expected to require millions of dollars (p. 2).

#### **IV.4 Legislative Analyst's Office (2009)**

Much of the Legislative Analyst's Office (LAO) report (2009) expresses disappointments with the ongoing state of affairs stemming from the Davis-Dolwig Act, while lodging a few specific complaints that can be linked to the DWR's methods of cost allocation. Among the specific criticisms with a potential bearing upon SCRB-C are the following arguments.

1. The DWR charges more than recreation's specific costs ( $C_i$  in part II above), because a share of the SWP's joint costs are allocated to recreation (p. 6).
2. Operating costs incurred by the agency-operators of SWP recreation facilities are not the source of Davis-Dolwig costs (p. 6). These costs are paid by the agency-operators.
3. The DWR will, on occasion, pay specific costs for recreational operations, such as at Lake Oroville and Lake Perris, and in these cases the DWR will treat expenses as nonreimbursable by contractors (pp. 6-7).
4. Some SWP facilities are treated in cost allocation as if their purpose is primarily recreational (p. 7).
5. DWR's treatment of recreation at hydropower facilities as a nonreimbursable cost is erroneous because some of these costs qualify as regulatory compliance costs stemming from FERC relicensing (pp. 9-10).

As a consequence of the LAO's investigation, it is argued that the DWR overallocates costs to recreation (pp. 8-9). Other elements of the LAO report disagree with the DWR's presumed authority to make expenditures without Legislative oversight, and discuss the bond issuance problem consequent to underfunded Davis-Dolwig costs. Otherwise, much of the LAO report addresses matters of cost responsibility as opposed to cost allocation (see the beginning of part II above for this distinction).

#### **IV.5 State of the Reviews**

Given the assessments developed earlier in this report, attention may be focused upon the most noteworthy elements of the four reviews.

For the most part, the criticisms provided by the 1979 DOF report are not illuminating of either significant issues or useful modifications to cost allocation practice for the SWP. Where the DOF does emphasize a problematic element – the overprojections of recreation participation (DOF #3) – there is one-sidedness insofar as the assumed values of those recreation days appear to be a compensating factor that is equally deserving of attention. The latter observation is made by Gaines (#6), CH2M-Hill, and this report. Because of the

relatively modest day values used by DWR, there may be adequate compensation built into the procedure. Moreover, as was observed earlier, some omitted recreational and enhanced fish and wildlife values in the SWP methodology establish further offsets to any overestimation of recreation days.

Gaines's 1984 observations are relatively accurate, yet do not reveal significant deficiencies in the concepts or procedures applied by the DWR in allocating costs. When indicating that SCR-B-C is not like federal procedure (Gaines #1), Gaines is referring mainly to SCR-B-C feature C, which is really an artifact of the differing path established by the Governor's Principles. As noted above, this path is within government's purview. Furthermore, no real harms are imposed on costs allocation results by these Principles, when we reconsider the several objectives of cost allocation discussed earlier in this report. Gaines #2 produces some confusion for us, because we have developed the impression that external-to-SWP expenditures are properly perceived in the SCR-B-C procedure. Gaines #4, pertaining to the very limited updating of cost share percentages, is certainly echoed by our findings.

Regarding the CH2M-Hill contributions summarized above, unique criticisms of SCR-B-C were not prepared and were not the prime goal of the study. Yet, the report does build upon the Gaines observations about the accuracy of the DOF review, reaching conclusions about the merits of the DOF critique which we largely share. The CH2M-Hill report also develops approximate cost estimates for studies that recompute costs shares under various levels of scrutiny, obtaining results that range from \$10,000 to millions of dollars. This is a useful finding in that it reflects upon the desirability of reconstituting historical cost shares. As stated earlier, it was the general goal of the SWP to produce benefits for the people of California. Achievement of this goal is eroded by excess administration costs, so it is important to consider the cost of prospective efforts to recompute cost shares.

The 2009 LAO report lodges a couple of protests linkable to SCR-B-C, but is primarily concerned with the more expansive matter of cost responsibility. LAO #1 embraces the polar position that nonreimbursable (Davis-Dolwig) costs should be limited to specific costs. That is, it is argued that recreation and enhanced fish and wildlife purposes should not pay any of the SWP's joint costs. This argument can be entertained in dialogue over new paths for cost responsibility, but it is in opposition to the 1960 Governor's Principles due to the selection of SCR-B announced there. If non-SCR-B methods become feasible via modified policy, the LAO position (unshared joint costs) is almost admitted into feasibility by eq. (2) previously (part II above), yet it is a very staunch and novel perspective even if specific costs is upgraded to separable costs. LAO #2 observes that agency-operator (e.g. Department of Parks and Recreation) costs do not become Davis-Dolwig costs under past and current procedures, yet when SWP funds are employed for the same purposes, the resulting expenditures are treated by the DWR as Davis-Dolwig costs (LAO #3). These interpretations are true and are the normal, technical result of valid cost allocation procedure.

LAO #4 observes that some SWP facilities are cost allocated under the presumption that they have little water supply purpose. This is an accurate observation, and indeed the Antelope Unit has no costs allocated to water supply. Whether such facilities actually yield slight water supply benefits relative to their recreational benefits is a matter only weakly examinable here, for we are not qualified to address the engineering question of whether these Feather River units facilitate water supply purposes in an appreciable manner.

LAO #5 raises a primarily legal issue regarding the duty of hydropower operations with respect to associated recreational production. We believe this matter to be unresolvable by economic principles, but further commentary on the subject is included in part V below.

## V. Conclusions and Looking Forward

### V.1 Role of External-to-SWP State Expenditures

A general question posed for this investigation is "how state investments into recreation or fish and wildlife enhancements not funded by State Water Project Funds should be included into the department's methodology for calculating the public's share of recreation and fish and wildlife enhancement costs".<sup>33</sup> There are two facets of this question's answer to be highlighted.

1. The proper and most challenging objective of SWP cost allocation is to distribute the joint costs of the SWP. These are the costs caused collectively, essentially by all beneficiaries, and they are difficult to partition among user groups for this reason. The SWP's nonjoint (i.e. separable) costs are to be distributed too, but this task is more readily performed as separable costs are properly allocated to their causative single purpose. The expenditures made by other California natural resource agencies, in support of recreation, boating, fish, and wildlife activities at SWP facilities, are not in need of allocation. These expenditures do not constitute joint costs (with water supply). Moreover, these expenditures are already budgeted via ordinary governmental procedures, and there appear to be no advantages to be gained by shifting these expenses from the operating agencies' budgets to the Davis-Dolwig ledger.
2. The directed cost allocation procedures of the SWP require estimates of the net benefits enabled by the SWP. This requirement specifically includes recreational benefits (in the form of willingness to pay). The net recreational benefits enabled by the SWP are less than those received by final consumers, because of the value added to these recreational pursuits by various state, local, and national agencies. The costs of these agencies' activities can be applied in the computation of net SWP benefits, in the fashion described previously by sections III.3a-b. Alternatively, benefit estimation procedures can directly target the value of unenhanced recreational experiences. The latter approach appears to better describe the DWR process of assessing benefits given the modest daily values that were used.

However, at the currently available depth of analyses there is little empirical evidence that the gross value of SWP recreation to all participants completely exceeds the expenditures being made by supporting agencies at all levels (local, state, national). Although it appears reasonable to conjecture that these expenditures together with the Davis-Dolwig costs of the SWP generate net benefits for the people of California, this remains an open question. Because specific agency activities, such as those conducted by the Department of Parks and Recreation, do not require justification via economically styled benefit-cost analyses,<sup>34</sup> it is feasible that the costs of these activities overwhelm the consumer-side benefits of SWP recreation. Were this to occur at a specific location or for a specific recreation type, agency decisions external to the DWR would have the power to eliminate particular SWP recreational benefits.

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<sup>33</sup> Item 3860-401, Chapter 712, California Statutes of 2010 (Senate Bill 870).

<sup>34</sup> This observation should not be interpreted as favoring such benefit-cost tests for the Department's decision making.



At present, we do not possess the empirical studies necessary to render an ironclad conclusion on this issue, yet we do believe that the previous (1965-1982) SWP cost allocations tended to be conservative in the unit day values that were employed. Also, there are numerous recreational types of a more specialized nature that were not separately valued even though their respective values can be expected to be higher (e.g. diving, camping on floating platforms, tournament fishing), and nonuse values of all types were ignored in cost allocation. Although recreation participation (days) was originally overprojected, otherwise the conservative approach to valuing these days and the valuation omissions just noted provide some confidence that recreation is not overvalued within the past cost allocation work performed by the DWR. Indeed, undervaluation is more probable.

Overall, the DWR's valuation of the SWP's recreational benefits does not appear to do an injustice to the State's other investments and continuing expenditures pertaining to SWP recreation and enhanced fish and wildlife. The DWR does not make explicit use of this expenditure information in conducting cost allocation, but the agency is not applying final consumer benefits that would require adjustments to account for other agencies' investments and expenditures.

## **V.2 Expanded Application of the Proportionate Use Method**

There is potential for expanding the application of the proportionate use method as noted in the earlier feature F critique (section III.2). [Additional details are provided there.] Doing so would economize on administration costs somewhat, by simplifying the computation of transportation charges for aqueduct-only segments. Also, in the case of transportation, it seems reasonable to allocate nonreimbursable costs on the basis of water consumption only and thereby treat the relatively minor aqueductside recreation as incidental and uncharged. Accomplishing this suggestion would involve treating termini and intermediate lakes as separate units (from the aqueduct) and as distinct cost allocations. However, this suggestion is not sufficient grounds for arguing that the past approach was unreasonable.

## **V.3 The FERC Question**

The DWR has proposed a comprehensive recreation management plan for the Oroville facilities with an estimated cost of \$435.6 million over 50 years (2005 dollars but not in present value terms; DWR 2006, App. A, p. 39). The proposed cost is almost equal to the total estimated capital cost of all existing Oroville facilities (Bulletin 132-78, App. D, p. 24). The DWR estimates that continued operation of existing facilities, without FERC-prompted additions, would cost \$295 million over the same period (DWR staff comments, Jan. 11, 2011). Hence, a large planned increase in expenditures is attributable to relicensing-associated items. This is not completely surprising, as the original 1957 license predates FERC environmental provisions (Roth 1993). The planned facilities are designed to confer recreation benefits and to conserve and enhance fish and wildlife, although the stimulus of the plan is hydropower.

The Feather River Hydroelectric Project (Oroville Facilities) was operated under FERC license P-2100 until 2008. It is currently operating under a temporary authorization pending a subsequent relicensing (FERC 2007). The standard provisions of a FERC relicense include requirements that the licensee (DWR) construct and operate facilities for conservation and development of fish and wildlife resources and recreation facilities, provide land for federal fish

and wildlife facilities if necessary, and grant public access to project waters (FERC Form L-5 1975). The DWR recreation plan addresses these regulatory requirements, thus contributing indirectly to the hydropower purpose, in addition to the obvious recreational benefits and wildlife preservation and enhancement.

Allocating the costs of the proposed improvements has become a contentious issue because (1) these costs are major expenses, and (2) the costs of recreational infrastructure have been traditionally treated within the cost allocation practices of the SWP as specific to the recreation purpose. SWP cost allocation treats "picnic tables, boat ramps, camp sites, and parking lots" as specific recreation features "which can be readily identified as serving one purpose [recreation] exclusively" (Bulletin 153-67, p. 65). Existing Oroville recreation facilities are considered nonreimbursable under the current allocations, accruing to the recreation purpose (Bulletin 132-71, App. D, p. 15). Opposing this position, LAO argues that FERC-related improvements should be considered reimbursable (2009, pp. 9-10).

The "FERC question" is whether the enlarged costs consequent to relicensing are indeed reimbursable. The position that they are nonreimbursable appears to be decisively supported by language in the Davis-Dolwig Act. In addition to the language from the Act observed in section I.2 previously, it is stated that

"There shall be incorporated in...each project those features that the department, after giving full consideration to any recommendation which may be made by...any federal agency, determines necessary or desirable to permit...full utilization of the project for...recreational purposes;"<sup>35</sup> and

"Costs incurred for...recreation...shall be nonreimbursable costs."<sup>36</sup>

The position also carries the weight of precedence, since recreation facilities have been classified as specific to the recreation purpose consistently over the history of the project.

The contrary position, that FERC-related recreation costs are reimbursable, is essentially a revised perspective on cost responsibility. The LAO report advances the opinion that, "If... recreation spending is required by a federal...agency, these regulatory costs should be considered a project cost and paid for by SWP contractors," and recommends revision of the Davis-Dolwig Act to specifically classify regulatory requirements as reimbursable (2009, p. 15). The result of this modification would be that FERC relicensing requirements are a consequence of power production and hence water supply, given that the SWP is a net consumer of power.

The DWR has expressed concern about the increased bond burden of charging additional capital costs to the SWPCs, as well as the feasibility of altering prior contractual agreements and bond-related obligations. Similarly, it is unclear how the Oroville plan would proceed if the State declined to bear the cost burden.

It may take a good deal of additional dialogue, as well as legal acumen not present in this report, to reconsider the larger matter of cost responsibility and whether it is in the State's best interests to revise cost responsibilities associated with relicensing.

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<sup>35</sup> California Water Code §11910.

<sup>36</sup> California Water Code §11912.

#### **V.4 Quality of Past Cost Allocation Efforts**

A great deal of the cost allocation precepts upon which Davis-Dolwig reimbursements have been based are entirely acceptable and reasonable, especially in light of the era in which this work commenced. Conceptually, most of the directions designed into the cost allocation computations are well formulated. Although there are certainly opportunities to nitpick about alternative directions which could have been taken, and we include some of that in this review, a reasoned respect for the importance of maintaining low administration costs counsels a general acceptance of the conceptual side of the SWP's cost allocation procedures. Problems that are more difficult to accept are the abandoned plan to regularly recompute costs shares and the apparent decision to never upgrade benefit assessment practices. Because there are implementation problems with the benefit calculations, it is significant that there has been ample time for improving the work and converging upon better founded cost shares. Yet, even when early cost sharing work was redone using new data, the benefit evaluation methods were not improved.

As the SCRB-C procedure is a benefit-sensitive approach to cost allocation, it can be expected that accumulated shortcomings in estimating benefits introduced errors among the cost share percentages that were the goals of the process. Had the final computations of cost shares conducted in the 1973-82 period utilized more contemporary methods as opposed to locking in the faulty benefits methodology selected in the mid-1960s, it might be possible to promote confidence about the share percentages that are in use today.

The most serious issues are rooted in the estimation of water supply benefits. These benefits were not investigated well and were only slightly evaluated beyond the application of alternative costs. The two upper Feather units received the only true willingness to pay examinations of water supply benefits. Otherwise, alternative costs of various types dominate the water supply benefits evaluation. Due to the manner of these alternatives' construction, they are not always compelling examples of least cost policies or projects that would actually be implemented in lieu of the SWP. In addition, some of the analysis is harmed by a few idiosyncratic assumptions that further challenge believability (sections III.3e-f above).

In the cases of recreation and enhanced fish and wildlife benefits, the estimation practices are better grounded where day values are used to obtain willingness to pay. In those instances where alternative costs are used as the basis for recreational benefits, the results are not very defensible due to the makeshift nature of the posed alternatives. Another, yet more modern matter involves omitted recreational values of various origins, primarily the valuation of specialized recreational types and the notion of nonuse values. Inclusion of these values has the potential to increase sizably the estimated benefits of the SWP to the people of California. Whether or not such inclusions are within the spirit of the Davis-Dolwig Act may be a matter to resolve prior to any further re-estimation efforts.

#### **V.5 Major Findings and Recommendations**

The methodological directions employed to allocate SWP costs are found to be reasonable by this investigation. This is a significant and comforting result. The implementation of this methodology is determined to be deficient. Deficiencies are concentrated upon practices used to estimate project benefits. Major problems are as follows:

- Benefit-identifying practices are dominated by evaluations of alternative costs. Attention to willingness to pay is lacking.
- The range of evaluated alternatives is narrow – often emphasizing a particular downscaling of the SWP unit for which a benefit evaluation is being sought.
- In most cases, measures of willingness to pay for water supply were assumed to exceed alternative costs and to therefore be irrelevant and unneeded. The burden of justifying this assumption is unmet, and its veracity was questionable given the State's economic development and population fifty years ago. It is a more compelling assumption now.
- In the case of recreational benefits, the use of alternative costs is objectionable, as the posed alternatives are not likely to have been pursued in the absence of the SWP. Recreational benefits should be based solely on measures of willingness to pay.
- In the case of recreational benefits, estimating willingness to pay with the unit-day procedure is acceptable. The omission of nonuse values can be regarded as reasonable considering the age of the estimates. Although recreation days may have been overestimated originally, the value-per-day multiplier was probably underestimated, with the most likely combined effect being that recreation willingness to pay has been underestimated.

In combination, these problems suggest that in-use cost allocation shares are inaccurate reflections of the intended methodology. The surveyed problems appear sufficiently momentous to infer very little confidence for in-use cost shares.

Faced with these major inferences about the potential accuracy of cost share percentages, the next logical questions are (1) "How far off are they?," (2) "In which directions should they be revised?," and (3) "What can be done about this?."

1. With available information it is impossible to ascertain the amount of error in existing cost allocation shares.
2. Directionally, there are weak indications that recreational benefits have been underestimated by past practice while water supply benefits may have been overestimated. To the extent that either of these suspicions is correct, current cost shares for SWPCs are too large and cost shares for the people of California are too small. This is a preliminary assessment that is unlikely to be constant over the life of the SWP, meaning that accurate cost shares for the first 25 years may differ sizably from those for the second 25 (and the forthcoming 25).
3. Options for addressing this problem within current cost responsibility assignments are wide, but two may merit greater attention.
  - a. One option is to reevaluate costs shares with a comprehensive, one-time study. Some guidance for the prospective costs of this study are generated by the 2007 CH2M-Hill report noted earlier (ranging from tens of thousands to several million dollars depending on breadth). A compelling approach may be to commission an independent project to finalize new benefit assessments for the SWP. A significant question for such an investigation is whether the goal should be to reexamine the evolution of historical (1965-2010) benefits or to emphasize contemporary/future levels of benefits. That is, should past cost shares be revised or just future shares?

- b. A second option is for all affected parties to find a sufficient level of satisfaction with existing cost shares, on the grounds that it will be expensive to obtain more accurate cost shares via a new study and it will be disruptive to realign longstanding financial flows with the results of that study. If such an agreement in principle can be reached, perhaps the State's annual contribution SWP costs can be stabilized, thereby simplifying the annual accounting used to prorate costs among contractors.

## Cited References

- California Department of Water Resources. *Settlement Agreement Recreation Management Plan*. March 2006.
- Ciriacy-Wantrup, S. V. "Cost Allocation in Relation to Western Water Policies." *Journal of Farm Economics* 36 (February 1954): 108-29.
- Creel, Michael, and John Loomis. "Recreation Value of Water to Wetlands in the San Joaquin Valley: Linked Multinomial Logit and Count Data Trip Frequency Models." *Water Resources Research* 28 (October 1992): 2597-2606.
- Dalhuisen, Jasper M., Raymond J. G. M. Florax, Henri L. F. de Groot, and Peter Nijkamp. "Price and Income Elasticities of Residential Water Demand: A Meta Analysis." *Land Economics* 79 (May 2003): 292-308.
- Douglas, Aaron J. and Jonathan G. Taylor. "The Economic Value of Trinity River Water." *Water Resources Development* 15 (1999): 309-322.
- Eckstein, Otto. *Water-Resource Development: The Economics of Project Evaluation*. Cambridge: Harvard University Press, 1958.
- Eiswerth, Mark E., Jeffrey Englin, Elizabeth Fadali, and W. Douglass Shaw. "The Value of Water Levels in Water-Based Recreation: A Pooled Revealed Preference/Contingent Behavior Model." *Water Resources Research* 36 (April 2000): 1079-1086.
- Englin, Jeffrey, and J.S. Shonkwiler. "Estimating Social Welfare Using Count Data Models: An Application to Long-Run Recreation Demand Under Conditions of Endogenous Stratification and Truncation." *The Review of Economics and Statistics* 77 (February 1995): 104-112.
- Federal Energy Regulatory Commission. *Notice of Authorization for Continued Project Operation*. February 2007.
- Federal Energy Regulatory Commission. *Terms and Conditions of License for Constructed Major Project Affecting Navigable Waters and Lands of the United States*. Form L-5, October 1975.
- Flyvbjerg, Bent, Nils Bruzelius, and Werner Rothengatter. *Megaprojects and Risk: An Anatomy of Ambition*. Cambridge: Cambridge University Press, 2003.
- Gaines, Raymond W. "Review and Analysis of Cost Allocation Methods: California State Water Project". 1984.
- Griffin, Ronald C. "Valuing Urban Water Acquisitions." *Water Resources Bulletin* 26 (October 1990): 219-25.
- Griffin, Ronald C. *Water Resource Economics: The Analysis of Scarcity, Policies, and Projects*. Cambridge, MA: The MIT Press, 2006.
- Hirshleifer, Jack, James C. De Haven, and Jerome W. Milliman. *Water Supply: Economics, Technology, and Policy*. Chicago: The University of Chicago Press, 1960.

- James, L. Douglas and Robert R. Lee. *Economics of Water Resources Planning*. New York: McGraw-Hill Book Company, 1971.
- Kaval, Pam. "Recreation Benefits of U.S. Parks." Hamilton NZ: University of Waikato, 2007.
- Kaval, Pam, and John Loomis. "Updated Outdoor Recreation Use Values with Emphasis on National Park Recreation." Fort Collins CO: Colorado State University, 2003.
- Loomis, John. "Balancing Public Trust Resources of Mono Lake and Los Angeles' Water Right: An Economic Approach." *Water Resources Research* 23 (August 1987): 1449-1456. Doi: 10.1029/WR023i008p01449.
- Miller, Jon R. "The Political Economy of Western Water Finance: Cost Allocation and the Bonneville Unit of the Central Utah Project." *American Journal of Agricultural Economics* 69 (May 1987): 303-10.
- Ransmeier, Joseph Sirera. *The Tennessee Valley Authority: A Case Study in the Economics of Multiple Purpose Stream Planning*. Nashville: Vanderbilt University Press, 1942.
- Roth, Elizabeth B. "1992 Ninth Circuit Environmental Review: Chapter: Environmental Considerations in Hydroelectric Licensing: *California v. FERC (Dynamo Pond)*." *Environmental Law* 23, 1993.
- Starr, Kevin. *Golden Dreams: California in an Age of Abundance, 1950-1963*. New York: Oxford University Press, 2009.
- U.S. Inter-Agency Committee on Water Resources. *Proposed Practices for Economic Analysis of River Basin Projects*. Washington, D.C.: U.S. Government Printing Office, 1958.
- U.S. Water Resources Council. *Economic and Environmental Principles and Guidelines for Water and Related Land Resource Implementation Studies*. Washington, D.C.: U.S. Government Printing Office, 1983.
- Walsh, Richard G., John B. Loomis, and Richard S. Gillman. "Valuing Option, Existence, and Bequest Demands for Wilderness." *Land Economics* 60 (February 1984): 14-29.
- Ward, Frank A., Brian A. Roach, and Jim E. Henderson. "The Economic Value of Water in Recreation: Evidence from the California Drought." *Water Resources Research* 32 (April 1996): 1075-1081.

## Appendix A

### Reviewed Davis-Dolwig Information and Documents

In the course of researching this report, more published information was reviewed than is listed here. However, to aid interested readers and future investigators, only the most pertinent resources are indicated below.

#### Laws

California Water Code Sections 233, 345, 346, 1243, 1257, 11900-11925, 12900-12944, 12581, 12582.

Assembly Bill No. 1442, 1989.

#### Other Rules and Guidelines

Governor's Contracting Principles, 1960.

Resources Agency Order No. 6, 1963.

Standard Provisions for Water Supply Contract, 1962.

#### Contracts and Agreements

Water Supply Contracts (Long-Term), with Amendments.

Agreements of Transfer 155564(1966), B50620(1971), 50123(1974), 50127(1974), 50201 (1977).

#### DWR Bulletins

Bulletin 117, 1968.

Bulletin 132, 1963-2007, including Appendix D bound separately, 1969-2001.

Bulletin 153, 1965-1968.

Bulletin 200, 1973.

#### Reviews of SWP Procedures

*Review of Davis-Dolwig Allocation Methodology*, Department of Finance, 1979.

*Review and Analysis of Cost Allocation Methods*, R.W. Gaines, 1984.

*Review of the State Water Project SCRB Cost Allocation Methodology*, CH2M-Hill, 2007 draft.

*Reforming Davis-Dolwig: Funding Recreation in the State Water Project*, Legislative Analyst's Office, 2009.