# Clean Water in California: What is it Worth?

*by*

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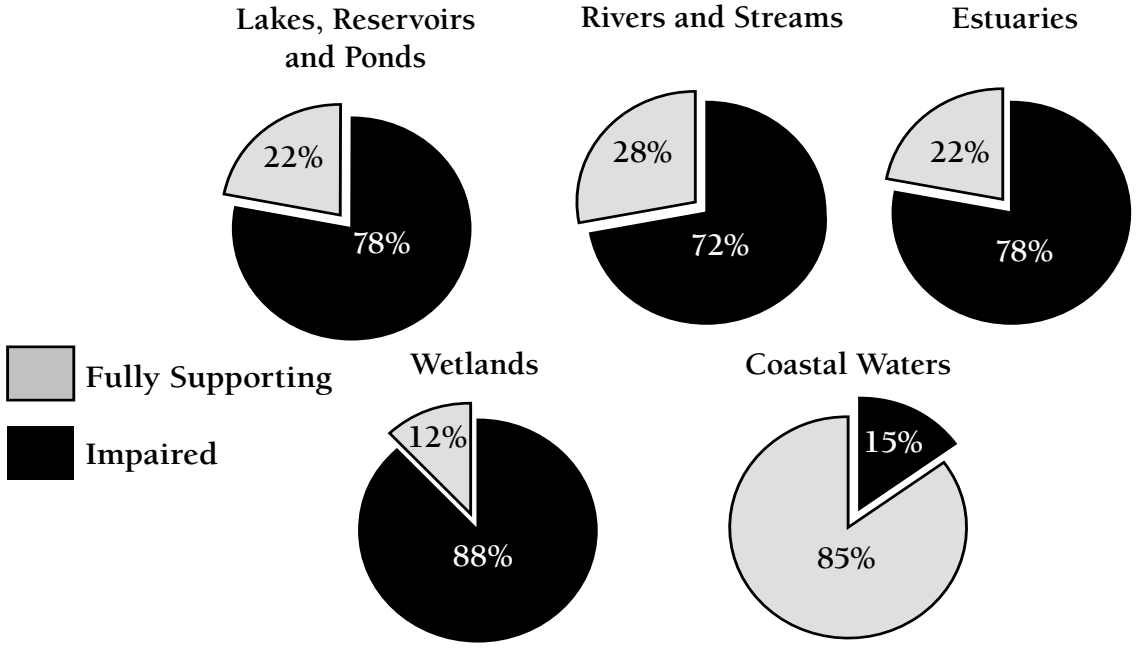
California has been, and continues to be, a magnet for population and industrial growth. The problems this poses for environmental quality have been well-documented, particularly for air pollution. For example, efforts by both California and federal regulators to reduce the growth in emissions from automobiles and, more recently, heavy trucks and sport utility vehicles, have been widely publicized in print and broadcast media.

Less well-publicized, perhaps, are the problems California experiences with water quality. While many specific (or "point") sources of water pollution have been identified and are subject to regulation under the Clean Water Act, water quality problems persist and are severe in some localized areas. A main contributor to these problems is pollution that cannot be traced back to a specific source (often called "nonpoint" source pollution), which is principally caused by urban runoff, forestry activities and agriculture.

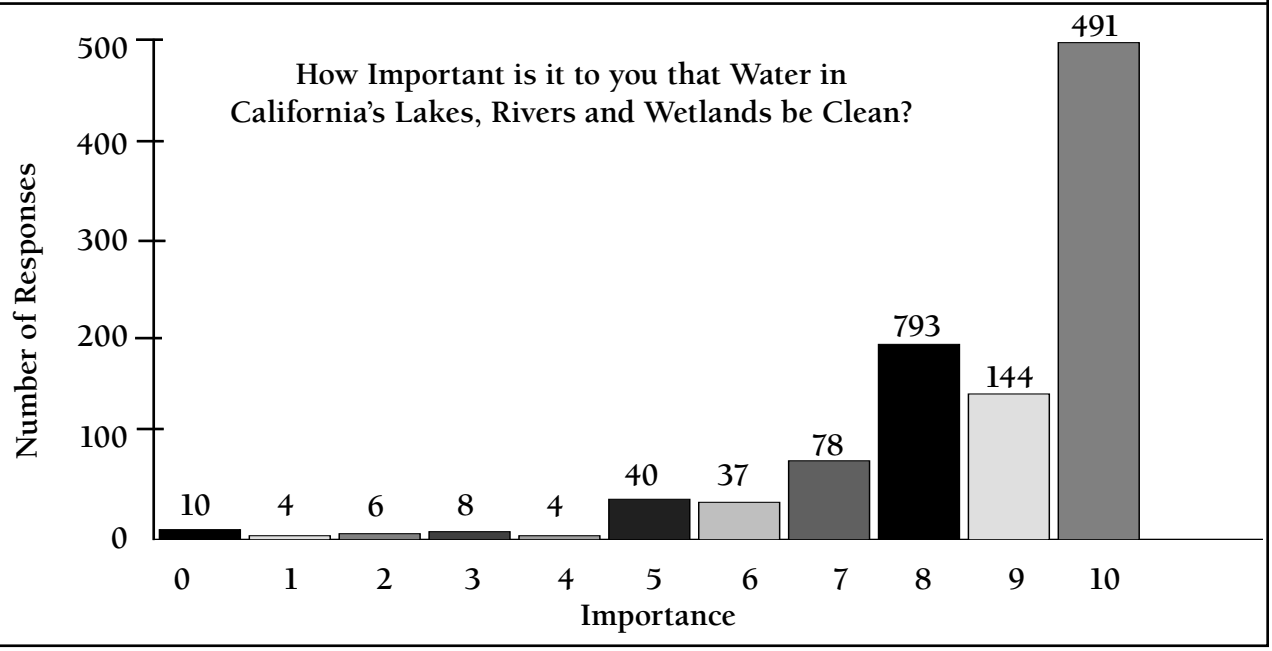
To help address these problems, water quality objectives are established for each water body within the state, including rivers, streams, lakes and reservoirs, ponds, estuaries, wetlands, beaches and other coastal areas. The California State Water Resources Control Board, the principal state agency with responsibility for managing water quality, has identified specific uses of water for each water body. These "beneficial uses" of water (26 in all) range

**Figure 1. Water Quality Status of Surveyed California Water Bodies**




"Fully Supporting" water bodies currently supports all basic uses designated for them.
"Impaired" water does not support one or more of their basic uses.
Basic uses include support for aquatic life, contact (swimming) and non-contact (boating) recreation, drinking supply, agricultural use and fish consumption.

**Figure 2. Respondents' Ratings of the Importance of Clean Water**




from use in agriculture and ranching to navigation, hydropower, support of habitat and ecosystems, recreation and drinking water supply. Naturally, not all beneficial uses occur at every water body.

Every other year California, like other states, reports to the United States Environmental Protection Agency (EPA) on the quality of waters throughout the state. This comprehensive report identifies which water bodies in the state meet the water-quality objectives established for them, and which do not. Water bodies are considered ***impaired*** if one or more beneficial uses established for them cannot be supported due to the presence of pollutants such as bacteria, chemicals, metals, oil and grease or trash. According to the latest report in 2000, over three-quarters of the state's estuaries, wetlands, streams and lakes are designated as impaired (Figure 1).

While designation as impaired does not indicate the severity of water quality problems at specific water bodies, the high proportions of impairment suggest that maintaining and improving water quality is an important problem in much of the state. Only coastal waters are relatively free from impairment, though coastal water quality is also a problem periodically in Southern California.

California citizens benefit from having better water quality because beneficial uses of different water bodies are restored in the improvement process, and these generate value for both firms and individuals. But making those improvements can be expensive, whether because of the need to retrofit storm drains, forego some uses of environmentally sensitive land or to build new water-treatment facilities. Ultimately, publicly funded projects such as these are paid for by the people. The operative question, then, in deciding how far California should go to improve its water quality is "how much?": What is the right level of water quality to seek?

One of the necessary pieces of information to answer this question is how much the people of California value water quality improvements. Unfortunately, relatively little information is available on this important topic, so we conducted a survey of the California public during the fall of 2000.

Since so little is known about the value of improved water quality in California, the survey was designed to provide some information on the "big picture" question: what would it be worth to Californians to have all impairments to water quality removed from all water bodies? The value of such a comprehensive program of improving water

quality would represent an upper bound to the value of other smaller projects that focus on a subset of water bodies or that do not fully remove impairments. A random sample of 2,000 California households was mailed a packet containing an eight-page booklet, a cover letter explaining the purpose of the survey and seeking the household's assistance, and a postage-paid return envelope. The survey was conducted following the principles of the Total Design Method (Dillman, Don A., *Mail and Telephone Surveys: The Total Design Method,* New York: John Wiley and Sons, 1978). This method included early versions of the survey shown to experts in resource valuation and water quality engineering, four focus groups, a pre-test, and three mailings plus a reminder postcard in the survey itself. The response rate, measured as the percentage of deliverable surveys returned, was just over 60 percent.

**Table 1. Monthly Surcharge Threshold Levels**

| Variable | Mean | Lowest | Highest |
|---|---|---|---|
| **Initial surcharge** | **$41** | **$20** | **$60** |
| *(If yes to initial)* **High surcharge** | **$73** | **$50** | **$90** |
| *(If no to initial)* **Low surcharge** | **$16** | **$5** | **$30** |

The survey consisted of three parts: a few general attitudinal questions about the environment, the questions on willingness to fund water quality improvement programs, and a few demographic questions that permit us to adjust for non-response and extrapolate sample results to California.

Most people rated environmental quality generally, and clean water in particular, as highly important. Figure 2, which is typical, shows that 48 percent (491 of 1015) rated the importance of clean water as 10 on a scale of 10, and 82 percent rated it at least 8 on a scale of 10.

However, a bottom-line measure of how much importance people attach to clean water is how much they're willing to pay for it. "Willingness to pay" is the standard measure of economic value, both in market settings and for non-marketed goods such as water quality improvements. To gauge this, the central part of the survey described programs that would remove impairment to California's water bodies, funded by a surcharge on the monthly water bill of each business and household. People were asked a simple yes-no question: would they pay a specified surcharge to fully remove impairment to California's sources of water? They were reminded that what they agreed to pay would reduce their monthly budget available to spend on other items, and that they should tell their own willingness to pay rather than what they thought a fair price would be. The surcharges we specified were varied across households, for statistical reasons.

The advantage of a simple yes-no question for paying for a program is that it is relatively easy to answer. However, it is not very precise. To make the information on a household's willingness to pay more precise, the initial surcharge question was followed by a second question to gather a little more information. Those who said "yes" to the initial surcharge were then asked whether they would pay a higher surcharge (the "High Surcharge"), while those who said "no" to the initial surcharge were asked whether they would pay a lower surcharge (the "Low Surcharge"). These values also varied randomly across households. The mean values of the surcharges used are given in Table 1.

The responses to the surcharge questions were analyzed in statistical models that allowed the household's income, education level and degree of environmental concern to influence their willingness to pay a monthly surcharge. The environmental concern variable is the sum of the ratings on two questions tracked in the California Field Poll, each ranging from 1 to 4, with 4 signifying the greatest environmental concern.

Each of these factors was highly significant statistically and had a positive effect on household willingness to pay. Based on these results, the average monthly household willingness to pay to remove all impairments to California water bodies was $23 for the sample, with a margin of error of plus or minus $8.80 for 95 percent confidence; that is, we are 95 percent confident that the true willingness to pay lies with the range of $23 - 8.80 and $23 + $8.80, or $14.20-$31.80. The effect of an additional $10,000 in household income is an increase

of $2.08 per month, and similarly, an increase of one year of education by the respondent increases household willingness to pay by a little over $2 per month. An increase in the environmental concern index of 1 point, comparable to going from somewhat concerned" to "extremely concerned" on one of the environment questions, increases household willingness to pay by $10 per month.

**Table 2. Characteristics of the Sample Compared with the California Population**

| Variable | Household Income ($/year) | Years of Education | Environmental Concern Index (Range 2-8) |
|---|---|---|---|
| Sample Mean | $70,600 | 15.2 | 7.0 |
| Population Mean | $47,700 | 12.9 | 6.9 |

*Calculated from U.S. Bureau of Census data for 1990 Census, 1997 Census data and 1997 California Field Poll results.*

**Table 3. Estimates of Willingness to Pay for the Average California Household and in Total**

| Willingness to Pay | Estimate |
|---|---|
| Per household, monthly | $15.46 |
| Total Statewide, annually | $2.24 billion |

Due to the importance of income, education and environmental attitude to household willingness to pay, differences in these variables between the sample and the population of all California households need to be accounted for in developing a statewide estimate of willingness to pay. The differences between the sample and the state as a whole are summarized in Table 2, which shows that the sample has considerably higher household income and more years of education than the average household across the state. The level of environmental concern in the sample is only slightly higher than for the state as a whole.

When the adjustments for differences in income, education and concern were made, the estimate of willingness to pay for the average California household dropped from $23/month to $15.46/month (Table 3). Considering that the preliminary estimates from the 2000 census indicate that there are approximately 12.1 million households in California, this translates to an aggregate willingness to pay of some $2.24 billion per year to remove impairments to water quality from all California water bodies.

## Interested in More on Economic Values of Water?

You can read the full report that describes the survey and more detail about the results just presented by either sending a request to *ARE Update*, or by downloading it online from http://www.agecon. ucdavis.edu/Faculty/Doug.L/Larson.html. Also, we have been collecting information from the published literature on the economic values of water for the 26 beneficial uses designated by the State Water Resources Control Board. The data base now consists of some 2,034 unique value estimates, and is available online at http://buvd.ucdavis.edu. The alpha version of this data base, in Microsoft Access, will be revised based on comments by users, so be sure to let us know if you have suggestions for improvement (a form for doing this is also online).

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