ENGINEERING FEASIBILITY AND COST

No detailed engineering feasibility and cost study of the Alaska to California pipeline concept has yet been undertaken. Governor Walter Hickel of Alaska, a proponent of transferring some of his State's water to California, spoke in general terms about one concept for the pipeline at the OTA Los Angeles workshop. The Governor envisions a coastal subsea aqueduct beginning in southeast Alaska and extending approximately 1,400 miles to northern California. At that point the aqueduct would be routed inland to Lake Shasta, where the water would enter the State's distribution system. As currently envisioned, the pipeline would tap one or more of the rivers in southeast Alaska and divert approximately 4 million acre-feet of water annually. Most frequently mentioned to date have been the Stikine and Copper Rivers, although the governor notes that few data are currently available concerning the water resources of any of the region's rivers. Nevertheless, the proposed amount to be diverted would represent only a small fraction of the outflow of the area's rivers. In the Governor's concept, water would be diverted into the pipeline only at the mouth of a river, thus potentially minimizing environmental effects and avoiding the extra costs of building dams. To minimize construction costs, the Governor hopes that builders would be able to take advantage of advances in pipeline materials and innovative manufacturing techniques.

Although no detailed work on the Alaska-to-California pipeline concept has been done, some cursory work on engineering feasibility and cost has been performed by the Fluor Daniel Corp. At the request of the County of Los Angeles, but at no cost to the County, Fluor Daniel recently prepared an order-of-magnitude cast estimate.[2] The Fluor Daniel concept is modeled after the general scheme proposed by Governor Hickel, and is based on the use of proven technologies. The Fluor Daniel pipeline would consist of four 14-foot diameter steel and concrete subsea aqueducts. Land-based pumping stations to increase water head are envisioned at approximately 150-mile intervals. Other facilities would include intake and conditioning facilities in Alaska, and fuel handling, utilities, communications, maintenance and repair, and control facilities along the route.

Fluor estimated that a 2,000-mile version of its pipeline would cost on the order of $150 billion, exclusive of project financing costs, operating and maintenance costs, and taxes. A pro rata estimate for the cost of a shorter 1,400-mile pipeline would thus be roughly$110 billion. Costs per acre-foot of waste would be between $3,000 and $4,000. The Fluor Daniel analysis is preliminary, and Fluor has offered no detailed technical assumptions that could be used by OTA to evaluate its estimate. Several firms represented at the workshop noted that, in their view, the estimate was of the right order of magnitude. The ultimate cost of a pipeline could change considerably from the Fluor Daniel estimate. Many major engineering projects cost more than their original estimates.[3] One illustration is the Trans Alaska Pipeline. However, the use of another design or of different materials, as is advocated by some engineers, could potentially reduce the cost. Some participants at the workshop speculated that cost reductions to one-fourth of the estimate are possible.

The U.S. Department of the Interior's Bureau of Reclamation has done the most extensive analysis of the possibility of supplying large quantities of water to southern California by subsea pipeline. In 1975 the Bureau studied the feasibility of building a large undersea pipeline-the California Undersea Aqueduct—to transport 4 million acre-feet of water annually from the Klamath and Eel Rivers in northern California to various points in southern California. The study is now dated, but the concept evaluated still has relevance for the proposed Alaska-to-California pipeline. The Bureau's design called for an 800-mile undersea aqueduct consisting of 599 miles of fiber-reinforced plastic buoyant conduit, 122 miles of buried or partly buried concrete or steel pipe, 53 miles of undersea tunnels, 37 access chambers, 20 geological fault crossings, and 11 land-based pumping plants with forebay reservoirs.[4] The study was termed a reconnaissance

[2] Fluor Daniel Corp., "Alaska Water Pipeline Feasibility Study," presented to County of Los Angeles, August 1991.

[3] See, for example, E.W. Merrow, S.W. Chapel, and C. Worthing, *A Review of Cost Estimation in New Technologies* (Santa Monica, CA: The Rand Corp., 1979).

[4] U.S. Department of the Interior, Bureau of Reclamation, *California* Undersea Aqueduct Reconnaissance *Investigation*, Special report, January 1975, pp. 14-15.

investigation and was originally planned to be carried out in two phases lasting a total of 5.5 years and costing about $6.6 million (1991 dollars).[5] Phase 1 of the study consisted of the elaboration of a general plan and of basic route mapping, hydrodynamics, and marine geology studies to provide data for determiningg the engineering feasibility of the project. Phase 2 was to consist of engineering studies, designs and cost estimates, economic analyses, evaluation of alternative projects, and preparation of a final report. This second phase was not completed, in part due to more optimistic projections about future California water requirements that became available while the study was underway.

A representative of the Bureau of Reclamation reviewed the Bureau's 1975 California Undersea Aqueduct study at the OTA workshop and discussed issues relevant to the current proposal to build an Alaska-to-California pipeline. One important observation made during this discussion was that a system to deliver water by subsea pipeline would be much more than just an undersea pipe: it would be a complex system that would probably require both subsea and shore-based components. For example, the Bureau's 1975 study noted that about 9 million acre-feet of storage on land in up to six new reservoirs would be desirable along the Aqueduct route so that constant flow could be maintained seasonally and through dry periods and so the pipeline size could be minimized.[6] Since seasonal variation of the outflow of Alaska's rivers is high, in part due to the fact that during the winter much water is stored in the form of snow in upland areas, storage reservoirs might be needed near the Alaska diversion site(s) and possibly elsewhere along the route. The Fluor Daniel cost estimates have not taken this possible need into account. The environmental impacts of the project would be much greater if new storage facilities were required.

Another important and still relevant point made by the Bureau's study is that building a pipeline on the continental shelf adjacent to the West Coast of North America would be a much more difficult and expensive task than building a similar pipeline on land. The ocean is a hostile environment, and proposed pipeline routes have not been well-characterized for engineering purposes. The Bureau did some preliminary investigations of such problems to be faced as crossing submarine canyons (e.g., the Monterey Canyon, which is as large as the Grand Canyon), coping with faulting and seismicity, and dealing with wave action in shallow areas, liquefaction of sediments, and turbidity currents. The Bureau noted that any future planning would require extensive research in all phases of oceanography, including marine biology and ecology, hydrodynamics, marine soils, marine geology, and materials.[7]

The Bureau of Reclamation estimated that construction costs for its 800-mile undersea aqueduct would be about $60 billion (updated to 1991 prices), not including costs for rights-of-way, interest during construction, or water distribution en route.[8] Doubling this figure to derive a very *rough estimate* of the cost of a pipeline twice as long, i.e., one comparable in length to the pipeline proposed by Governor Hickel, yields a cost that is essentially the same (given the enormous uncertainty attached to both estimates) as the cost estimated by the Fluor Daniel Corp. for its Alaska pipeline concept. The Bureau also calculated that the cost to build an onshore pipeline to transfer Klamath and Eel River water to southern California would be about half that of an offshore one.

It is important to emphasize that the ultimate cost of the pipeline is not known with any degree of certainty. The Bureau of Reclamation estimate is dated and, although the California Undersea Aqueduct is similar to the Alaska-to-California concept, it is not the same. Moreover, the Fluor Daniel estimate assumes the use of traditional concrete and steel pipeline materials. The most appropriate materials for the proposed pipeline have not been determined. Some engineers (in particular, several observers at OTA's Los Angeles workshop) believe that significant savings might be obtained by using newer composite materials and/or manufacturing techniques. General agreement could not be reached on this point at the workshop. In many cases new materials and techniques cost significantly more than conventional approaches. One engineer contended that technological breakthroughs that could

[5] Ibid., pp. 5-6.

[6] Ibid., p. 13.

[7] Ibid., p. ii.

[8] Ibid. pp. 117-119.

307-403 0 - 91 - 2 QL 3

result in significant savings in the future were not likely. Conversely, another contended that, using nontraditional materials, the cost of the pipeline could be dramatically reduced. In the absence of a sound, well-documented feasibility study, a reasonably accurate pipeline cost cannot be determined.

A much more detailed study would be required to determine the cost of building an undersea pipeline to within a reasonable degree of accuracy, and this would be a major and expensive undertaking in itself. To illustrate, the Panama Canal Alternatives Feasibility Study (a study to determine the cost of a new canal) was initially planned as a 5-year $20 million effort. It now appears that the study will cost between $30 and $35 million. Similarly, but perhaps more relevantly, the original feasibility and preliminary design studies for the 800-mile Trans Alaska Pipeline System (TAPS) cost about $450 million (in 1991 dollars).[9]

Several factors could make a feasibility study of the proposed water pipeline more complex than studies of TAPS:

- the offshore pipeline would cross major fault zones and submarine canyons and be subject to marine hazards not encountered on land,
- few offshore areas between southeast Alaska and northern California have been studied well,
- the pipeline would be about twice as long and carry roughly 45 times the volume of TAPS,
- the pipeline would pass through the coastal waters of four States and one foreign country, and
- public concerns about protecting the environment have increased considerably in the last two decades.

Any new designs and/or materials that might be used would need to be thoroughly tested for durability, fracture characteristics, corrosion-resistance, marine fouling, etc. before a full-scale commitment to their use could be made. The optimal pipe size and numbers would need to be determined. It is also likely that some new construction techniques would be needed. Acquisition of oceanographic data needed for reasonable design, as well as testing of new materials, could take a decade or more. Options, such as basing pumping stations on the seafloor may be feasible, but the technical feasibility and costs of this concept have not been adequately investigated.

ALASKA WATER AVAILABILITY

There is no question that Alaska has an abundance of fresh water. However, it is less obvious how much, if any, of this water might be available for export. The State of Alaska has not conducted a comprehensive evaluation of water availability, but a few preliminary observations can be made.

It is conceivable that the northern end of a water pipeline could be as far north as Prince William Sound (where it has been roughly estimated that more fresh water is available than is carried by the Mississippi River), but a pipeline originating in southeast Alaska would be about 700 miles shorter and thus far more desirable economically. Many small rivers empty into the sea in southeast Alaska, but these have not been studied for their water resource potential or for the potential adverse impacts of diverting water from them.

Two sizable rivers that might support the volume of water exports proposed are the Copper and the Stikine. The Copper River enters the Gulf of Alaska just to the east of Prince William Sound. A pipeline originating at this point would be about 2,100 miles long. The Stikine River enters the sea near Wrangell, Alaska, some 700 miles further south, after flowing through the State for about 20 miles. Most of the river, however, lies in Canada, and thus its diversion could concern the Canadian Government. Of particular concern to Canada would be any effects of diversions on navigation of the river (the freedom of which was guaranteed by Article 26 of the Treaty of Washington, 1871) and any effects on fisheries (sockeye and chinook salmon are fished by both Canadian and American fishermen on the Stikine).[10] Also, British Columbia Hydro and Power Authority has been studying the potential of building several hydroelectric dams on the river. Although "BC Hydro' has no plans to divert any of the water, the presence of a dam would change the flow regime and affect the design of any subsea pipeline tapping the river.

---

[9] Marnie Isaacs, Aleyeska Pipeline Co., personal communication, June 21, 1990.

[10] William McQueen, solicitor for British Columbia Hydro and Power Authority, personal communication, Aug. 27, 1991.

The total amount of water available for export may be much less than that which actually enters the ocean. Before potential excess amounts can be determined, needs for other uses must be considered. The fishing industry is one of the most important in Alaska. The State's many streams support numerous species of fish important to the State's commercial and recreational fishing industries.[11] Virtually every stream and river in the State is used by fish for spawning, incubation, rearing, or migration or is habitat for wildlife. Only that water in excess of in-stream flow requirements for fish and wildlife is likely to be considered for export. A bill being considered by the Alaska State Legislature seeks to ensure this.[12] Although unproven, another consideration is the possibility that diversion of fresh water to the south may affect the Alaska Coastal Current and/or the temperature and salinity of the area's seawater, which in turn may affect marine life such as migrating salmon.[13] Whether the amount of diverted water would be sufficient to cause significant environmental impacts on freshwater or marine ecosystems is not known; however, it is an important question that would need to be answered as part of a pipeline feasibility analysis. Such concerns, whether those of Alaskans or of Canadians or others potentially affected, underscore the need for a thorough evaluation of possible problems associated with the diversion of large quantities of water.

It is worth noting that technically the State does not now have the authority to sell water.[14] This legal detail could be remedied by the Alaska legislature. However, opposition to exporting water could develop among fishing and environmental interests in the State. Although the Governor of Alaska is a strong supporter of the pipeline idea, the Alaska legislature has neither supported nor rejected it, and, in general the issue has not been widely discussed.

CALIFORNIA'S PROJECTED WATER DEMAND

One of the most important factors on which construction of a subsea pipeline from Alaska (or implementation of other water import options) will depend is the future demand for water. The State and regional water professionals invited to OTA's workshop, as well as other water experts with whom OTA has spoken, believe that for the foreseeable future they will be able to "develop" adequate supplies of water to meet the State's demands from sources existing within the State. In the next decade alone, the State Department of Water Resources expects to be able to develop 1 million acre-feet of water.[15] Drought and continued population growth[16] are or will stress the ability of the State to manage water, but such stresses have given rise to some creative thinking and have made options that may previously have appeared too expensive or otherwise unnecessary more feasible now.

In terms of absolute supplies, California still has an abundance of water. Thus, even after evaporation and transpiration by native trees, brush, and other vegetation is taken into account, 71 million acre-feet of surface water drains from the land *in an average year* (an additional 6 million acre-feet is contributed by Oregon streams and the Colorado River). It will not be possible to develop all theoretically available supplies for urban or agricultural needs. Nevertheless, untapped but potentially usable sources of water exist in the State. Rather than lack of water (in average years), the problem and the challenge for California seems to be transporting the available water in the State to where it is most needed, allocating available supplies among competing users (i.e., between agriculture and urban uses), and using water more efficiently. Political, economic, environ-

11Mary Lu Harle, "Appropriation of Instream Flows in Alaska," in L.J. McDonnell, T.A. Rice, and S.J. Shupe (eds.), *Instream Flow Protection in the West*, Natural Resources Law Center, University of Colorado School of Law, 1989.

12House Bill No. 355, introduced by representative Cliff Davidson, May 21, 1991.

13Tom Royer, University of Alaska, Fairbanks, personal communication, July 1, 1991. See also "Hickel's Proposed Water pipeline Could Upset Ecosystem" *The Anchorage Times, Sunday,* July 9, 1991, p. B3.

14Gary Gustafson, former Director, Division of Land and Water Management, Alaska Department of Natural Resources, personal communication, June 20, 1991.

15Carlos Madrid, District Chief, California Department of Water Resources, statement at OTA workshop, Los Angeles, CA, Aug. 14, 1991.

16In 1987, the California Department of Water Resources estimated that California would have a population of 36.3 million people by 2010 (Up from 26 million in 1985). It now appears possible that the State's population will reach this number by the turn of the century. Most of this population growth will take place in urban centers, which currently account for about 17 percent of the State's water use. State of California, Department of Water Resources, *California Water: Looking to the Future*, Bulletin 160-87, November 1987, p. 6.

mental, and demographic considerations combine to complicate development of acceptable water policy.

In 1987 the State Department of Water Resources projected that net State water use by 2010 would be 35.6 million acre-feet annually (it was 34.2 million in 1985). Further, the State estimated that all but 0.4 million acre-feet of the projected amount needed could be supplied by 2010 by already identified sources.[17] A number of supply-enhancing and demand-reducing options are under development and/or investigation to ensure that the projected demand is satisfied in 2010 and beyond. To date, water imports from outside the State have not figured in the planning process (nor have transfers from untapped rivers in northern California). Similarly, the Metropolitan Water District of Southern California (MWD) estimated in 1990 that the total of existing and potential supplies (potential supplies include certain projects underway to reduce projected shortages) *in average years* to its southern California users would exceed demand in 2010 by about 1 percent, or 0.38 million acre-feet.[18] For *drought years,* projections indicate that demand could exceed supply in southern California by from 0.08 to 0.41 million acre-feet per year.[19] As is the case at the State level, many options are now being considered to increase the amount of water available. MWD believes that there are sufficient resources within California to meet its future water needs. Whether future needs are met will depend in part on statewide cooperation.[20]

Estimating California's future water needs is no simple task: estimates entail many assumptions, including for example, future prices for water, the amount of acreage that will be devoted to agriculture, what kinds of crops will be grown, how much water will be required to maintain water quality and to provide for wildlife and recreation needs, what the future population of the State will be, and how important conservation measures will be. Agriculture accounts for over 80 percent of the total amount of water used in California. Agricultural water use projections assume that a certain amount of acreage will be devoted to growing a particular crop (e.g., cotton). It is essential to understand that changes in agricultural practices (e.g., in the amounts or types of crops grown or methods of irrigation) could greatly reduce the future amount of water needed.

Although urban water use makes up only about 17 percent of California's water demand, the population of California's cities is expected to continue growing. In this sector also, more attention to water conservation could lower estimates of future needs.

MEETING FUTURE NEEDS FOR WATER

As the above suggests, California will need to continue developing its water resources and/or will need to use existing supplies differently if current growth continues as expected-especially if the State is to be prepared in the future for increased demand in drought years. A number of different options have been identified by State and local water authorities, some of which are currently being implemented. Some of these include:

1. ''water marketing,'
2. waste water reclamation,
3. water conservation,
4. conventional reservoir development,
5. canal lining,
6. conjunctive use of ground water and surface water,
7. water banking,
8. system interconnections,
9. desalination, and
10. tanker imports.[21]

OTA has not conducted a detailed analysis of the ultimate potential of these options or of their costs. However, a few observations about some of these options underscores the belief of many State water authorities that California will be able to meet its future water demands without resorting to large-scale interbasin transfers of water.

---

[17] Ibid., p. 41.

[18] Ibid. See especially ch. 5, "Meeting Future Needs for Water." See also Metropolitan Water District of Southern California, *The Regional Urban Water Management Plan for the Metropolitan Water District of Southern California, November* 1990.

[19] The lower figure is based on normal demand, the higher on above-normal demand. Above-normal demands result from higher-than-average temperatures and lower-than-average rainfall. Demands may be lower during severe droughts due to implementation of short-term water conservation and increased public awareness.

[20] Don Adams, Director of Resources, Metropolitan Water District of Southern California, personal communication, June 25, 1991.

[21] State of California, Department of Water Resources, op. cit., p. 39. See also ''Approximate Water Cost Comparison,'' document prepared for OTA workshop by Metropolitan Water District of Southern California, July 17, 1991.

Water Marketing

Water marketing refers to the sale of water or water rights from one user to another. Water marketing would tend to shift water use from agricultural to urban areas, i.e., to areas with greater purchasing power. The seller would benefit by making a profit on the water sold, the buyer by obtaining additional supplies, possibly at lower rates than for other supply options. There appears to be significant potential for water marketing, if legal and institutional barriers can be removed. The creation of water markets will promote efficiency, but potential third-party impacts of all transfers will also have to be taken into account.

Waste water Reclamation

There appears to be significant additional potential for reclaiming, treating, and reusing low-quality water that would otherwise be disposed of. Reclaimed water can be used in such applications as irrigation, industrial cooling, landscape watering, and toilet flushing. The high-quality water now being used for such purposes could be shifted to potable uses. Investigators are also looking into the potential for using advanced treatment methods to reclaim water for drinking. Groundwater replenishment is one of the most efficient uses of reclaimed water, allowing large amounts of wastewater to be reused at a relatively modest cost. The Department of Water Resources notes that statewide use of reclaimed water could reach 500,000 acre-feet per year by 2010.[22]

Conservation

There is considerable potential in both the urban and agricultural sectors in California for using water more efficiently. Conservation can be promoted by technological means; through pricing and regulations; and through public education. Urban areas may use water more efficiently, for example, by retrofitting toilets with ultra-low-volume models or by charging higher rates as more water is used. Conservation options in the agricultural sector may be even more important, given the much larger amount of water that is used to grow crops and the highly subsidized rates charged to farmers. Technical options to respond to higher water prices include using more efficient irrigation methods, controlling seepage, reducing evaporation, and managing vegetation in and near surface water.

Conventional Reservoirs

There are few opportunities for building new reservoirs within the State. One, the Los Banes Grandes, has been proposed for development in central California. The reservoir would be used to store excess water pumped south from the Sacramento-San Joaquin Delta through the California Aqueduct during wet months. It would probably be designed to store about 1.75 million acre-feet of water, which could be used when needed. This capacity would make available about 250,000 extra acre-feet of dependable supply. MWD estimates this could be accomplished at a cost per acre-foot of $300 to $400. Another option being considered is the enlargement of Shasta Reservoir.

Canal Lining

Some water is lost by leakage through unlined canals, so lining canals would enable water savings. The Metropolitan Water District hopes that by paying for the lining of 68 miles of the All-American and Coachella Canals in the Imperial Valley, it can conserve at least 100,000 acre-feet of agricultural water annually, which would then be available to urban areas. MWD estimates it can accomplish the lining of these two canals for about $175 per acre-foot per year.

Conjunctive Use of Groundwater and Surface Water

One proposal under consideration, for example, would be to allow southern California to use some surface water from the Sacramento Valley in drought years. To replace this water in the Sacramento area, local groundwater would be pumped. Sacramento Valley groundwater basins would be recharged naturally in wet years, when southern California would not need the additional surface water.

Water Banking

As a result of excess capacity in some groundwater basins, e.g., the Kern Basin, surplus water in wet years may be stored for use during dry years. Thus, in wet years, surplus water from the Delta, for example, can be pumped to the Kern Basin for

[22] State of California, op. cit., footnote 16, p. 54.

storage. In drought periods the "banked' water can be pumped out again and used as necessary. The Metropolitan Water District estimates that water from the California Water Bank costs about $315 per acre-foot delivered to southern California.

System Interconnections

A more complete linking of the various components of the State aqueduct system would make possible a high degree of water sharing between agencies. The goal of such linkages, like that of conjunctive use, is to make storage and surplus supplies available to water-short regions of the State and thus defer construction involving more costly sources.

Desalination

There is potential for desalination in California, but while less costly than the Alaska pipeline option, it is still a very expensive water supply alternative. More and more coastal cities are giving it serious consideration. Santa Barbara, for example, has recently decided to build a $40 million desalination plant to provide 7,500 acre-feet of water per year to the city. The costs per acre-foot for this water are estimated to be approximately $1,400, if capital costs are amortized over 20 years.[23] Some more current estimates suggest that large-scale desalination may soon be possible for less than this amount. Desalination of brackish water, for which there is much potential, may be possible for about $500 per acre-foot, according to the MWD. Desalination drawbacks include intensive use of energy and the need to dispose the brine produced.

Water Import by Tanker

Several California coastal cities have considered importing water by tanker. Costs, like those for pipelines, would vary depending on distance traveled and quantity of water transported. An entrepreneur, Sun Belt Water, Inc., has estimated that costs would be in the range of $1,500 to $2,000 per acre-foot for long-term contracts of 30,000 acre-feet or more.[24] Smaller quantities would be much more expensive. Rather than use tankers, some have suggested that large nylon fabric bags could be filled with water and towed by tug to southern California. A Canadian company has calculated that this would be much less expensive than tankering, although OTA is unaware of any independent analysis of this concept.[25] Both tankering and desalination options have the advantage over a pipeline that the building and/or operation of facilities can be adjusted to closely match water supply with demand, i.e., by increasing or decreasing the number of tankers or by either adding desalination capacity or shutting down a desalination plant.

The Subsea Pipeline Option

As noted above, if one uses Fluor Daniel's very rough estimates for the Alaska-to-California subsea pipeline, the cost per acre-foot for water delivered to Lake Shasta would be between $3,000 and $4,000, depending on pipeline length. At these costs, the water delivered by this pipeline would be much more expensive than any of the other options currently being considered or implemented by State and regional water authorities or being promoted by various entrepreneurs. Many options for developing additional supplies are still available in the $300 to $500 per acre-foot range. Moreover, highly subsidized water is still available to some of the State's farmers for a fraction of the cost to supply it (sometimes below $lOper acre-foot, and such prices have not changed in 40 years). Some changes to water contracts that could affect water demand seem likely in the future.[26] The comparable current MWD wholesale price for treated water is $261 per acre-foot.[27]

If the cost of the subsea pipeline could be reduced by 50 to 75 percent from the Fluor Daniel estimate, the water it would deliver would still be very expensive, but might be competitive with other currently expensive options (e.g., other interregional transfer proposals and desalination). If such reductions were technically possible, factors other than cost will become increasingly important, and the

[23] Harriet Miller, City Council Member, City of Santa Barbara, Testimony before the Senate Environment and Public Works Committee on S.481, the Water Research Act of 1991, July 23, 1991.

[24] Rich Shuler, Sun Belt Water, Inc., personal communication, Sept. 18, 1991.

[25] Jim Cran, Medusa Corp., Calgary, Canada, personal communication, August 1991. Such bags might be capable of carrying 1,6(K) acre-feet of water.

[26] See, for example, HR 2684, the "Reclamation Projects Authorization and Adjustment Act of 1991." This bill was introduced June 19, 1991 by Representative George Miller of California. Title XXV addresses the cost of subsidized agricultural water.

[27] The average retail price paid by southern Californians is about $500 per acre-foot.