

1976

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### Recommended Citation

Hennig, Richard A. and Olson, Janice Baumgart (1976) "The Colorado River Salinity Problem - Old Approaches to a New Issue," *Land & Water Law Review*: Vol. 11 : Iss. 2 , pp. 459 - 480.  
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## THE COLORADO RIVER SALINITY PROBLEM— OLD APPROACHES TO A NEW ISSUE\*

The Colorado River has historically had salinity concentrations higher than most other major rivers. The salinity level—the concentration of dissolved solids in the water<sup>1</sup>—generally increases as the river wends southward along its 1,400 mile course from its headwaters in the Rocky Mountains to the Gulf of California. Two processes account for this increase—salt loading and salt concentrating. Salt loading occurs when additional solids are added to the river, while salt concentrating results when water is removed so that the same amount of salts are suspended in a lesser quantity of water. These processes occur both naturally and as a result of man's activities.<sup>2</sup>

The climate of the Colorado River Basin is arid. As a result, there has not been the precipitation over time to leach the salts from the characteristically saline soils of the region. Thus, when land is put under cultivation and irrigated, these salts are picked up from the soil and added to the river in return flows. This process, known as salt loading, also occurs naturally as the water washes salts from the beds and banks of the river and its tributaries. Natural point sources, mainly saline springs, contribute additional salts to the river. Salt concentrating, the process whereby water is removed and salts are left behind, results from evaporation and transpiration and from man's depletions and consumptive uses of river water. Transbasin diversions in the Upper Basin, for example, remove pristine water that would otherwise dilute the more saline waters of the lower reaches of the river.

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\* This Comment was financed by The Water Resources Research Institute of The University of Wyoming.

1. Two measures of this concentration of dissolved solids are milligrams per liter (mg/l) and parts per million (ppm). The units of measurement are nearly equivalent up to concentrations of 7000 mg/l. See FLACK & HOWE, SALINITY IN WATER RESOURCES 28 n.1 (1974).
2. For a more detailed discussion, see, e.g., COLORADO RIVER BASIN SALINITY CONTROL FORUM, PROPOSED WATER QUALITY STANDARDS FOR SALINITY INCLUDING NUMERIC CRITERIA AND PLAN OF IMPLEMENTATION FOR SALINITY CONTROL—COLORADO RIVER SYSTEM 11 (June 1975) (hereinafter cited as FORUM PROPOSED STANDARDS FOR SALINITY); U.S. DEPT OF THE INTERIOR, QUALITY OF WATER—COLORADO RIVER BASIN 36 (Progress Report No. 7, Jan. 1975) (hereinafter cited as INTERIOR PROGRESS REPORT No. 7).

The overall level of salinity in the Colorado River has been increasing each year, largely as a result of man's activities in the basin. One estimate, for example, indicates that salinity at Imperial Dam tripled during the 50-year period ending in 1965,<sup>3</sup> and that the projected level for the year 2010 could be 50 percent higher than the 1965 level.<sup>4</sup> This projected level would pose a high hazard, according to Department of Agriculture standards, to irrigated crops.<sup>5</sup> While natural diffuse and point sources contribute roughly half of the salinity, irrigated agriculture is the principal source of man-caused salinity, accounting for approximately 37 percent of the total.<sup>6</sup>

Salinity usually begins to create problems for water users when the level of concentration exceeds 1,000 milligrams per liter (mg/l).<sup>7</sup> However, in that salinity per se does not pose hazards to human health, except in extreme concentrations, the problems created by salinity are chiefly economic,<sup>8</sup> and may include, for example, decreased crop yields on irrigated lands, increased treatment costs for municipal and industrial users, pipe corrosion, and decreased potability of drinking water.<sup>9</sup> In the ecological realm, increased salinity levels may adversely affect fish, wildlife, and natural vegetation.<sup>10</sup> In terms of dollars, it has been suggested that each one part per million increase in salinity imposes \$230,000 in additional costs and damages on downstream agricultural, industrial and municipal users.<sup>11</sup> The total cost to users in the basin is currently estimated at \$16,000,000 annually and

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3. Gardner & Stewart, *Agriculture and Salinity Control in the Colorado River Basin*, 15 NATURAL RESOURCES J. 63, 65 (1975).

4. *Id.* at 66.

5. *Id.* at 64, citing U.S. SALINITY LABORATORY, U.S. DEP'T OF AGRICULTURE, DIAGNOSIS AND IMPROVEMENT OF SALINE AND ALKALI SOILS 69-82 (USDA Agriculture Handbook No. 60, Feb. 1954).

6. Evans, *Salt Problem in the Colorado River*, 15 NATURAL RESOURCES J. 55, 56 (1975), citing U.S. DEP'T OF THE INTERIOR, COLORADO RIVER QUALITY IMPROVEMENT PROGRAM (1972); FORUM PROPOSED STANDARDS FOR SALINITY, at 13.

7. FLACK & HOWE, *supra* note 1, at 13.

8. *Id.*

9. *Id.*, citing U.S. ENVIRONMENTAL PROTECTION AGENCY, THE MINERAL QUALITY PROBLEM IN THE COLORADO RIVER BASIN (1971).

10. INTERIOR PROGRESS REPORT NO. 7, at 70.

11. Evans, *supra* note 6, at 56, citing COLORADO RIVER QUALITY IMPROVEMENT PROGRAM.

is projected at \$51,000,000 for the year 2010.<sup>12</sup> Roughly 80 percent of these costs is to irrigated agriculture.<sup>13</sup>

A major portion of the salinity problem on the Colorado River is thus one of upstream irrigators imposing costs on downstream irrigators. The river is used to irrigate 1,600,000 acres in the Upper Basin and roughly 800,000 acres in the Lower Basin;<sup>14</sup> in addition, 425,000 acres are irrigated from the river in Mexico.<sup>15</sup> In qualitative terms, however, utilization of Colorado River water for irrigation in the Lower Basin yields a gross crop income of about \$400 per acre,<sup>16</sup> while the Upper Basin yield per acre is probably less than \$100.<sup>17</sup> Across the international border, the irrigated agriculture industry supported by the river is of major import not only to the economy of the Mexicali Valley but also to the overall national economy of Mexico.<sup>18</sup>

In 1961 the salinity problem of the Colorado River came to the forefront when the salinity of water being delivered to Mexico was more than tripled as a result of the completion of a drainage canal constructed to dispose of briny subterranean water from the Yuma Mesa and Welton-Mohawk irrigation districts.<sup>19</sup> The principal source of this highly saline water has been traced to approximately 56 farms, consisting of roughly 27,000 acres within the two districts.<sup>20</sup> For a variety of political and economic reasons,<sup>21</sup> the Mexican response was swift and vehement.<sup>22</sup> Interim measures

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12. *Id.*

13. Gardner & Stewart, *supra* note 3, at 66.

14. INTERIOR PROGRESS REPORT No. 7, at 15.

15. FORUM PROPOSED STANDARDS FOR SALINITY, at 11.

16. INTERIOR PROGRESS REPORT No. 7, at 23.

17. Mann, *Conflict and Coalition: Political Variables Underlying Water Resource Development in the Upper Colorado River Basin*, 15 NATURAL RESOURCES J. 141, 161 (1975).

18. Furnish & Ladman, *The Colorado River Salinity Agreement of 1973 and the Mexicali Valley*, 15 NATURAL RESOURCES J. 83, 90 (1975); Salgado, *Principal Economic Aspects of the Problem of Salinity of the Colorado River*, 15 NATURAL RESOURCES J. 129, 130 (1975).

19. HUNDLEY, *DIVIDING THE WATERS: A CENTURY OF CONTROVERSY BETWEEN THE UNITED STATES AND MEXICO 172-73* (1966); Furnish & Ladman, *supra* note 18, at 89.

20. Martin, *Economic Magnitudes and Economic Alternatives in Lower Basin Use of Colorado River Water*, 15 NATURAL RESOURCES J. 229, 231 (1975).

21. HUNDLEY, *supra* note 19.

22. *Id.* at 173-76.

were eventually taken and temporary agreements negotiated.<sup>23</sup> Ultimately, a "permanent and definitive" solution was negotiated and signed by the two governments in 1973,<sup>24</sup> with the needed federal implementing legislation being enacted by the United States Congress the following year.<sup>25</sup>

While the salinity issue was first raised with respect to Mexico, it has become increasingly clear in recent years that salinity has become a problem for American water users on the lower reaches of the river as well.<sup>26</sup> Thus, salinity control now has a dual significance—first, a basin-wide control program is necessary if the United States is going to be able to comply with the agreement recently negotiated with Mexico; second, control is essential if American water users in the Lower Basin are going to avoid damages similar to those suffered by their neighbors in Mexico during the early 1960's. At present, salinity control efforts above Imperial Dam are being marshalled under the Federal Water Pollution Control Act Amendments of 1972<sup>27</sup> and the regulations promulgated thereunder by the Environmental Protection Agency.<sup>28</sup>

This Comment briefly surveys present and planned salinity control programs on the Colorado River with a view to identifying whether or not past patterns of policymaking and problem-solving evidenced with respect to development and allocation of the river are being carried over into the attempted management of the salinity problem. Emphasis is placed on identifying implications which may flow from the manner in which the salinity problem is being addressed, particularly in the area of federal-state relations.

23. Minute No. 218, March 22, 1965, [1970] 3 U.S.T. 2478, T.I.A.S. No. 6988. See text accompanying notes 38 to 40, *infra*. Minute No. 241, July 14, 1972, [1972] 2 U.S.T. 1286, T.I.A.S. No. 7404. See text accompanying note 41, *infra*. The "Minute" form is a record of the United States and Mexico International Boundary and Water Commission.

24. Minute No. 242, August 30, 1973, [1973] 2 U.S.T. 1968, T.I.A.S. No. 7708.

25. Colorado River Basin Salinity Control Act, Pub. L. No. 93-320, 88 Stat. 266 (1974) (codified at U.S.C. §§ 1571 to 1599 (Supp. IV, 1974)).

26. INTERIOR PROGRESS REPORT No. 7, at 70-72; Report of the President's Special Representative for Resolution of the Colorado River Salinity Problem with Mexico, 2 U.S. CODE CONG. & AD. NEWS, 93d Cong., 2d Sess. 3354, 3372 (1974).

27. 33 U.S.C. §§ 1251 to 1376 (Supp. IV, 1974).

28. 40 C.F.R. § 120.5 (1975).

INTERIM AND PERMANENT INTERNATIONAL SALINITY  
AGREEMENTS—WATER POLITICS AS USUAL

The politics which have molded the development of the Colorado River are well known and have been examined elsewhere.<sup>29</sup> The lynchpins of Colorado River politics are easily discernible: the primacy of the rural-reclamation and tiller-of-the-land ethic;<sup>30</sup> protection of vested private water rights;<sup>31</sup> protection of future local, state, and intra- and interbasin development potential;<sup>32</sup> and federal assumption of the lion's share of development costs on a nonrelational basis to benefits bestowed—particularly as relates to irrigated agriculture.<sup>33</sup> To be sure, the pattern warms the heart of

29. HUNDLEY, *WATER AND THE WEST: THE COLORADO RIVER COMPACT AND THE POLITICS OF WATER IN THE AMERICAN WEST* (1975); Mann, *supra* note 17. See also Mann, *Politics in the United States and the Salinity Problem of the Colorado River*, 15 *NATURAL RESOURCES J.* 113 (1975).

30. This primacy emerges clearly in Article IV of the Colorado River Compact:

(a) Inasmuch as the Colorado River has ceased to be navigable for commerce and the reservation of its waters for navigation would seriously limit the development of its basin, the use of its waters for purposes of navigation shall be subservient to the uses of such waters for domestic, agricultural, and power purposes. If the Congress shall not consent to this paragraph, the other provisions of this compact shall nevertheless remain binding.

(b) Subject to the provisions of this compact, water of the Colorado River System may be impounded and used for the generation of electrical power, but such impounding and use shall be subservient to the use and consumption of such water for agricultural and domestic purposes and shall not interfere with or prevent use for such dominant purposes.

Colorado River Compact (Nov. 24, 1922), art. IV (a) (b), H.R. Doc. 605, 67th Cong., 4th Sess. 8-12 (1923), approved by U.S. Congress, December 21, 1928, Boulder Canyon Project Act, 43 U.S.C. § 617i (1970). See also Mann, *Politics in the United States and the Salinity Problem of the Colorado River*, *supra* note 29, at 114.

31. See, e.g., HUNDLEY, *supra* note 29, at 64-65, discussing the vesting in the states of complete control over water distribution. See also TRELEASE, *FEDERAL-STATE RELATIONS IN WATER LAW* [PB 203 600] 74-80 (1971).

32. This, of course, has been one of the chief concerns of the Upper Basin since early in this century. See generally HUNDLEY, *supra* note 29.

33. The construction costs of multipurpose water projects are allocated to the various purposes undertaken by the Reclamation Project Act of 1939, 43 U.S.C. § 485 (1970). Water users and power producers are to reimburse irrigation, power and municipal supply costs. However, the National Water Commission recently estimated that irrigators are reimbursing only 10% of the costs attributable to their water use.

A primary weakness of the Federal water resources development projects is that they have been heavily subsidized by the Federal Government; that is, by all the taxpayers of the Nation, to provide benefits for a few. The water users on some modern Federal Reclamation projects, for example, repay no more than 10 percent of the construction costs attributable to irrigation, the remaining cost being borne by the Federal Government in three ways: by not requiring the water users to reimburse the Treasury for the interest on the capital advanced for project construction, by permitting power revenues and sometimes other

a basin state politician, but it has become increasingly unsettling to economists<sup>34</sup> and leading water scholars.<sup>35</sup> Nonetheless, these interests have been consistently adhered to in addressing both quantitative and qualitative issues relative to the delivery of Colorado River water to Mexico. Thus, notwithstanding the flow of benefits nor the source of costs, both issues have been declared national or federal obligations<sup>36</sup>—which one economist reads as “a determination [on the part of the basin states] not to lose a single drop of water to Mexico no matter what it might cost the general taxpayer in the United States.”<sup>37</sup> This pattern emerges clear-

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nonirrigation revenues to be credited toward irrigation reimbursement, and by allocating an unduly large part of the costs to non-reimbursable purposes.

NATIONAL WATER COMMISSION, *WATER POLICIES FOR THE FUTURE* 128 (1973).

34. With respect to the salinity problem, see generally Gardner & Stewart, *supra* note 3, at 67; Kneese, *A Theoretical Analysis of Minute 242*, 15 *NATURAL RESOURCES J.* 135 (1975); Mann, *Politics in the United States and the Salinity Problem of the Colorado River*, *supra* note 29.
35. NATIONAL WATER COMMISSION, *supra* note 33.
36. Colorado River Basin Project Act, 43 U.S.C. § 1512 (1970); Colorado River Basin Salinity Control Act, 43 U.S.C. § 1595 (a) (1) (Supp. IV, 1974).
37. Kneese, *supra* note 34, at 139. This determination “not to lose a single drop of water to Mexico” is reminiscent of early United States international water law theory regarding the use of international rivers. In 1895, Attorney General Judson Harmon declared with respect to the Rio Grande River that an upper riparian nation was not accountable to the lower riparian. He denounced any Mexican attempt to arrest development in the United States by compelling American citizens to surrender “the use of a provision which nature had supplied, entirely within its own territory.” HUNDLEY, *supra* note 19, at 23.

In 1921 and 1922 following the creation of the Colorado River Commission, Mexican officials requested representation on the Commission. They were denied this request for the reason that only “domestic” affairs were being discussed. As the Colorado River Compact negotiations neared conclusion, the seven basin state commissioners, each fearful that a future treaty with Mexico would deplete his state’s share of the water, debated the wisdom of inserting a provision allocating a possible future treaty obligation between the two basins. They worried that such a provision would later be deemed an admission of Mexican rights. Herbert Hoover, the federal representative and chairman of the Commission, stated, “We do not believe they [the Mexicans] ever had any rights.” Quoted in HUNDLEY, *supra* note 29, at 204. The following, cautious provision was finally agreed upon:

(c) If, as a matter of international comity, the United States of America shall hereafter recognize in the United States of Mexico any right to the use of any waters of the Colorado River System, such waters shall be supplied first from the waters which are surplus over and above the aggregate of the quantities specified in paragraphs (a) and (b); and if such surplus shall prove insufficient for this purpose, then the burden of such deficiency shall be equally borne by the Upper Basin and the Lower Basin, and whenever necessary the States of the Upper Division shall deliver at Lee Ferry water to supply one-half of the deficiency so recognized in addition to that provided in paragraph (d).

Colorado River Compact (Nov. 24, 1922), art. III (c), H.R. Doc. 605, 67th Cong., 4th Sess. 8-12 (1923), approved by U.S. Congress, December 21, 1923, Boulder Canyon Project Act, 43 U.S.C. § 617l (1970).

ly from a brief examination of both the interim and permanent solutions to the Mexican-American Colorado River salinity dispute and from the programs being developed under the Federal Water Pollution Control Act Amendments of 1972.

### *Interim Measures*

The period 1962-1965 saw the United States government unilaterally taking certain temporary measures to reduce the salinity of Colorado River water being delivered to Mexico<sup>38</sup> and negotiating with the Mexican government in an attempt to reach a more definitive solution. These negotiations resulted in Minute 218,<sup>39</sup> which was a five year agreement that committed the United States to: (1) the construction of a canal that would allow the brine from the Welton-Mohawk area to be bypassed around Morelos Dam, the Mexican diversion point for the Mexicali Valley; (2) the construction of additional wells in the Welton-Mohawk district that would allow a more controlled and selective pumping of the subterranean brine; and (3) the release of 40,000 acre-feet of additional main stem water above Mexico's 1,500,000 acre-feet entitlement under the 1944 treaty to replace the unuseable Welton-Mohawk water that was being diverted around Morelos Dam. These actions were taken at a cost to the United States government of \$12,000,000.<sup>40</sup>

In 1972, Minute 241<sup>41</sup> replaced Minute 218 and required the continued diversion of Welton-Mohawk drainage and substitution of such waters with additional Colorado River water and water pumped from wells on the Yuma Mesa.

While the above actions on the part of the United States, and the diversion past Morelos Dam by the Mexican government of additional Welton-Mohawk drainage without replacement by the United States, reduced the salinity of Colorado River water being delivered at Morelos Dam to a level which

38. Holburt, *International Problems of the Colorado River*, 15 NATURAL RESOURCES J. 11, 15 (1975).

39. Minute No. 218, March 22, 1965, [1970] 3 U.S.T. 2478, T.I.A.S. No. 6988.

40. Holburt, *supra* note 38, at 16.

41. Minute No. 241, July 14, 1972, [1972] 2 U.S.T. 1286, T.I.A.S. No. 7404.



the Mexican government believed acceptable for irrigation in the Mexicali Valley,<sup>42</sup> such water, nonetheless, was still significantly more saline than that being made available to American irrigators across the border.<sup>43</sup> Subsequent negotiations between the two governments focussed primarily upon this issue.

### *A Definitive and Permanent Solution*

For the United States, any agreement with respect to the salinity issue was, as a matter of policy, to be "based on dollars and not on water"<sup>44</sup> and was to in no way jeopardize future development of the basin.<sup>45</sup> This policy is readily apparent in the agreement incorporated into Minute 242, which was concluded by the two governments in 1973.<sup>46</sup> To achieve the agreed-upon solution of pegging the salinity level at Morelos Dam at a concentration not to exceed 115 parts per million more than the concentration at Imperial Dam,<sup>47</sup> the United States undertook major financial obligations. Firstly, a desalination plant is to be constructed to treat Welton-Mohawk drainage; estimated capital expenditures, to include appurtenant works, are \$98,000,000.<sup>48</sup> Annual operating expenses are estimated at \$10,000,000.<sup>49</sup> Secondly, an additional major capital expenditure to recoup water presently being lost to seepage is to be undertaken. While this savings may temporarily be used to meet delivery requirements to Mexico, the water ultimately belongs to California.<sup>50</sup> The cost of this project is estimated at \$22,000,000.<sup>51</sup> Thirdly, the United States government will provide nonreimbursable financial assistance for rehabilitation of

42. Holburt, *supra* note 38, at 18.

43. The average salinity of the water diverted at Morelos Dam for the year ending June 30, 1973, was 980 ppm, while that at Imperial Dam was 850 ppm. *Id.*

44. Statement of Mr. Herbert Brownell, the special negotiator appointed to obtain an agreement with Mexico, 69 DEP'T STATE BULL. 395-96 (Sept. 24, 1974), *quoted* in Mann, *supra* note 29, at 113.

45. *Id.*

46. Minute No. 242, August 30, 1973, [1973] 2 U.S.T. 1968, T.I.A.S. No. 7708.

47. Minute No. 242, ¶ 1(a), August 30, 1973, [1973] 2 U.S.T. 1968, T.I.A.S. No. 7708.

48. Letter from Stanton B. Anderson and John C. Whitaker to Gerald R. Ford, undated, 2 U.S. CODE CONG. & AD. NEWS, 93d Cong., 2d Sess. 3348-53 (1974).

49. *Id.*

50. Colorado River Basin Salinity Control Act, 43 U.S.C. § 1572(a) (Supp. IV, 1974).

51. Letter, *supra* note 48.

irrigated lands in the Mexicali Valley which suffered from the high salinity levels.<sup>52</sup> But, perhaps most significantly, the agreement can be taken as a commitment on the part of the United States to maintain salinity at the level which existed at the time agreement was reached.<sup>53</sup>

### *Politics as Usual*

The United States' approach to the resolution of the chaos created by the Welton-Mohawk drainage problem evidences the characteristics of Colorado River politics suggested above.

*Primacy of the rural-reclamation and tiller-of-the-land ethic.* While the very nature and technical complexity of the salinity problem augered against accurately allocating the costs of resolving the problem on a basin-wide basis, the immediate cause of the dramatic increase in salinity in 1961 was readily identifiable. Basic notions of fairness probably would preclude suggesting that the roughly 56 farms which were responsible for the increase in salinity ought to have absorbed the cost of the damage their drainage was inflicting on their neighbors across the border. Nonetheless, as one economist has suggested, "Back-of-the-envelope calculations indicate that it would have been far cheaper to buy the necessary water rights to send pure water to the Mexicali Valley than to implement the means actually chosen. . . ."<sup>54</sup> Approaching the question on a cost-comparison basis, another commentator calculated that the federal government could have purchased the offending farms themselves in from two to nine years for what the desalination project is expected to cost.<sup>55</sup> From a cost-benefit perspective, the same commentator estimated the annual cost of the agreed-upon project over a 50-year period at \$612 per acre,<sup>56</sup> or nearly twice the annual gross yield per acre.<sup>57</sup> While these analyses do not

52. Minute No. 242, ¶ 7, August 30, 1973, [1973] 2 U.S.T. 1968, T.I.A.S. No. 7708.

53. See, e.g., Statement of Mexican Foreign Minister Rabasa, August 30, 1973, quoted in Holburt, *supra* note 38, at 22.

54. Kneese, *supra* note 34, at 139.

55. Martin, *supra* note 20, at 236.

56. *Id.*

57. *Id.* at 231.

comprehend possible indirect costs, both economic and social,<sup>58</sup> that would have attended the alternatives suggested, they do suggest the federal government's continued deference to the agricultural sector.

*Protection of vested private water rights.* This characteristic manifests itself in several ways. As the preceding discussion suggests, the responsible private water users were protected against the costs their use imposed on downstream users. That the damage would have been actionable and resolved in favor of Mexico seems beyond serious question.<sup>59</sup> Furthermore, the federal government's approach in this instance suggests that users, particularly irrigators, will be protected from governmental interference that would affect the continuation of the particular use as it presently exists—that is, even with adequate reimbursement, the federal government evidences some reticence in moving a particular water right to a functionally different use, which, in this instance, would have been to a nonuse (although this admittedly would have benefitted other users, at least indirectly). Finally, and perhaps more indirectly, the “don't lose a drop to the Mexicans” approach suggests a disinclination to force reductions according to the states' prior appropriation systems.

*Protection of future development potential.* In that this was a stated premise on which a negotiated settlement with Mexico was to be pursued, it requires little elaboration. Nonetheless, it is apparent that future development, particularly in the Upper Basin, will merely accelerate and exacerbate the salinity problem in the lower reaches of the river.<sup>60</sup> While the Upper Basin states can undoubtedly formulate an argu-

58. For example, if the farms were simply purchased by the federal government, the impact on the local community could be significant. Furthermore, there may be real value to maintaining production, even though subsidized, in anticipation of future demands for food. Finally, consider that there may well be institutional value in not having the federal government simply take over all aspects of the management of the river and attending operations. See Trelease, *Arizona v. California: Allocation of Water to People, States and Nation*, in KURLAND, *THE SUPREME COURT REVIEW* (1963).

59. See HUNDLEY, *supra* note 19, at 176. This was the conclusion reached by the Washington, D.C., law firm of Chapman and Friedman, which was retained by the government of Mexico.

60. INTERIOR PROGRESS REPORT No. 7, at 54-69, and Tables 18, 19, 20 at 192-95; Report of The President's Special Representative, *supra* note 26, at 3372.

ment that they have "vested rights" in planned development projects, as a result of past agreements, political understandings, etc., continued development and stabilization of the salinity problem seem, at this juncture, to be incompatible.<sup>61</sup>

*Federal assumption of costs.* The cost of the negotiated solution is to be born almost exclusively by the federal taxpayer<sup>62</sup>—without regard to the flow of benefits. To be sure, resolution of the dispute with Mexico over the salinity problem was in the national interest, particularly when viewed in the context of the international and Western hemispheric political climate during which the problem arose.<sup>63</sup> Realistically speaking, the full development of the basin would probably ultimately have led to friction with Mexico over water quality. Nonetheless, the drainage from a local irrigation project made possible largely with federal dollars<sup>64</sup> created a problem which is being resolved totally with federal dollars, and which, furthermore, is being used indirectly as justification for massive federal expenditures to resolve the salinity problem for the river as a whole.<sup>65</sup>

### *Engineering Over Economics*

A final observation is appropriate. The Mexican-American salinity agreement evidences the preference for engineering solutions to what are admittedly very complex questions. But engineering solutions have a tendency to be significantly more expensive than originally estimated, have long lead times which are susceptible to repeated delay, and, when based on new technology, tend to be sometimes less than successful. However, the engineering approach has the obvious advantage of avoiding what one observer refers to

61. *Id.* The National Commission on Water Quality concluded that "Although concern over salinity is widespread, interest in development projects still dominates water resource attitudes, and the institutional structure reflects this dominance." NATIONAL COMMISSION ON WATER QUALITY, STAFF DRAFT REPORT VI-56 (Nov. 1975).

62. Colorado River Basin Salinity Control Act, 43 U.S.C. §§ 1571I, 1572(b) (Supp. IV, 1974).

63. HUNDLEY, *supra* note 19, at 175, 177.

64. *Id.* at 173; 43 U.S.C. § 613 (1970).

65. See generally FORUM PROPOSED STANDARDS FOR SALINITY; Mann, *Politics in The United States and the Salinity Problem of The Colorado River*, *supra* note 29, at 121-28. See also Colorado River Basin Salinity Control Act, 43 U.S.C. §§ 1591 to 1599 (Supp. IV, 1974).

as the "tough questions"<sup>66</sup> and of avoiding disturbing the delicate house of cards upon which the relative harmony of competing interests in the Colorado River Basin has been constructed.

#### SALINITY CONTROL ABOVE IMPERIAL DAM— CONTINUED DEVELOPMENT AND MORE FEDERAL DOLLARS

The cost to the federal government of obtaining congressional approval of the implementing legislation necessary to effectuate the details of the agreement reached with the Mexican government in Minute 242 was an immediate authorization of \$125,000,000 in upstream salinity control projects.<sup>67</sup> While there appears to be little question that on the American side the negotiators of Minute 242 proceeded on the assumption that an upstream salinity control program was a certainty,<sup>68</sup> the legislation proposed by the executive branch<sup>69</sup> envisioned that upstream salinity would be dealt with principally under the Federal Water Pollution Control Act Amendments of 1972.<sup>70</sup> This presumably would have facilitated a more thorough analysis of both the problem and potential solutions prior to the undertaking of any major programs.<sup>71</sup> The legislation proposed and supported by the basin states was designed to protect basin interests and to place the financial burden of present and future projects on the general taxpayer.<sup>72</sup> The basin states were successful on both counts.<sup>73</sup>

#### *Legal Framework for Salinity Control*

The institutional structure and attending legal framework which governs the allocation of Colorado River water—

66. Mann, *supra* note 17, at 168.

67. Colorado River Basin Salinity Control Act, 43 U.S.C. § 1598(a) (Supp. IV, 1974).

68. Furnish & Ladman, *supra* note 18, at 104.

69. H.R. 12834, 93d Cong., 2d Sess. (1974). See also Executive Communications, 2 U.S. CODE CONG. & AD. NEWS, 93d Cong., 2d Sess. 3339-53 (1974).

70. 33 U.S.C. §§ 1251 to 1376 (Supp. IV, 1974).

71. See generally Executive Communications, *supra* note 69.

72. Furnish & Ladman, *supra* note 18, at 102. See also H.R. 12165, 93d Cong., 2d Sess. (1974).

73. Pub. L. No. 93-320, 88 Stat. 266 (1974) (codified at U.S.C. §§ 1571 to 1599 (Supp. IV, 1974)).

the quantity issues—is not congruent with that which appears to be developing with respect to salinity—the water quality issues. As has been suggested elsewhere, the allocation system operates at four levels—international, interregional, interstate, and intrastate<sup>74</sup>—and is comprised of a composite of treaties, statutes, compacts, administrative regulations and rulings, contracts and court decisions. The emerging structure and legal framework for salinity control is presently much simpler, and, as of yet, principally federal in character. Under the Water Quality Act of 1965, the states were required to adopt water quality standards applicable to interstate waters within their boundaries by 1967.<sup>75</sup> The standards subsequently adopted by the basin states did not embrace salinity.<sup>76</sup> The Federal Water Pollution Control Act Amendments of 1972,<sup>77</sup> as interpreted by the Environmental Protection Agency (EPA), quite explicitly required that salinity standards for the Colorado River be adopted by the states.<sup>78</sup> The basin states' response was to form the "Colorado River Basin Salinity Control Forum" to facilitate development of the required criteria.<sup>79</sup> The Forum's proposals have been released<sup>80</sup> and adopted by each of the seven basin states.<sup>81</sup> Finally, Title II of the legislation implementing Minute 242 authorized four specific programs of salinity control and further study of additional projects.<sup>82</sup>

### *The Forum Plan*

When it became clear under EPA's interpretation of the Federal Water Pollution Control Act Amendments of

74. Weatherford & Jacoby, *Impact of Energy Development on the Law of the Colorado River*, 15 NATURAL RESOURCES J. 171, 175 (1975). See also Meyers, *The Colorado River*, 19 STAN. L. REV. 1 (1966).

75. Water Quality Act of 1965, Pub. L. No. 89-234, § 5, 79 Stat. 234.

76. INTERIOR PROGRESS REPORT No. 7, at 3.

77. 33 U.S.C. § 1313 (Supp. IV, 1974).

78. 40 C.F.R. § 120.5 (1975).

79. The Forum was entered into in November, 1973.

80. FORUM PROPOSED STANDARDS FOR SALINITY.

81. All seven basin states have adopted the FORUM PROPOSED STANDARDS FOR SALINITY, as modified by SUPPLEMENT, INCLUDING MODIFICATIONS TO PROPOSED WATER QUALITY STANDARDS FOR SALINITY INCLUDING NUMERIC CRITERIA AND PLAN OF IMPLEMENTATION FOR SALINITY CONTROL, COLORADO RIVER SYSTEM (Aug. 26, 1975). Colorado, however, is not in procedural compliance with the federal requirements. The salinity standards proposed by the basin states have been published in the Federal Register by EPA for public comment. Formal approving action by EPA will commence after public comments have been received. 41 Fed. Reg. 13656 (1976).

82. 43 U.S.C. §§ 1592, 1593 (Supp. IV, 1974).

1972 that the basin states would be required to adopt numeric criteria for salinity control in the Colorado River,<sup>83</sup> the seven basin states formed the Colorado River Basin Salinity Control Forum.<sup>84</sup> The position adopted by the states at the time of formation of the Forum was:

The appropriate objective of the [Colorado River Salinity Control] project is the maintenance of salinity at or below levels found in the lower main stem as of April 1972, while the Upper Basin States continue to develop their compact-apportioned waters.

The seven States concur in the goal of compliance with the adopted criteria by July 1983, with the understanding . . . that the criteria will not be used to delay or interfere with any State's development of its compact-apportionment. . . .<sup>85</sup>

The Forum's proposed plan was issued in June, 1975, and restates that such plan is predicated upon the principle that "each of the states has the right to use the water to which it is entitled under the 'Law of the River'."<sup>86</sup>

### *Full Future Development a Prerequisite*

There is no evidence that planned future development projects have been reconsidered.<sup>87</sup> However, it is clear that future development will adversely and directly affect the salinity problem. As the Upper Basin develops toward full usage of its allocation under the 1922 Colorado River Compact, the result will be increased salt concentrating due to evaporation, transpiration, or incorporation into product, and the return of the effluent by point or nonpoint discharges, as well as increased salt loading, primarily as a result of the irrigation of significant amounts of new land. This development is planned even though current projections estimate that flow augmentation will be needed by 1990 to meet

83. 33 U.S.C. § 1313 (Supp. IV, 1974); 40 C.F.R. § 120.5 (1975).

84. FORUM PROPOSED STANDARDS FOR SALINITY, at 3-10.

85. Statement of Position Adopted by Basin States on November 9, 1973, *quoted* in FORUM PROPOSED STANDARDS FOR SALINITY, at D-1, D-2.

86. FORUM PROPOSED STANDARDS FOR SALINITY, at 63.

87. Rather, such projects are being "reformulated" to reduce salinity. *Id.* at 82.

the Mexican Treaty obligations.<sup>88</sup> Table I summarizes current estimates of the effects of planned development projects on both quantity and quality.

TABLE I<sup>89</sup>  
ADDITIONAL DEPLETIONS 1972 TO 2000  
AND  
EFFECT ON SALINITY LEVELS AT IMPERIAL DAM

	Year 1980		Year 1990		Year 2000	
	New Depletions (1000 af)	New Irrigations (acres)	New Depletions (1000 af)	New Irrigations (acres)	New Depletions (1000 af)	New Irrigations (acres)
UPPER BASIN	751	44,540	2,254	250,460	2,803	302,760
LOWER BASIN	275	51,329	-61	65,775	-61	69,775
TOTAL	1,026	95,869	2,193	316,235	2,742	372,535
ESTIMATED SALINITY AT IMPERIAL DAM*	963 ppm		1,182 ppm		1,250 ppm	

\*Salinity levels include the estimated reductions attributable to the four projects authorized by Pub. L. No. 93-320, although funds have yet to be appropriated for these projects; and assumes that salt loading of four tons per acre occurs on newly irrigated lands.

Pursuant to the regulations promulgated by the EPA,<sup>90</sup> and as incorporated into the Forum's proposed plan,<sup>91</sup> the goal is to maintain the salinity level at Imperial Dam at 879 mg/l. As Table I above illustrates, this goal will be exceeded prior to 1980, if the planned development projects are in fact completed as scheduled, unless major salinity control programs, in addition to the four projects previously authorized, are implemented. This situation provides the basin states with their principal argument for authorization of the 12 additional projects identified, but not approved, in the Colorado River Basin Salinity Control Act of 1974.<sup>92</sup>

88. INTERIOR PROGRESS REPORT No. 7, at 69.

89. *Id.* This table is a composite of Tables 18, 19, 20, at 192-95.

90. 40 C.F.R. § 120.5 (c) (2) (ii) (1975).

91. FORUM PROPOSED STANDARDS FOR SALINITY, at i.

92. *Id.* See 43 U.S.C. § 1593(a) (1) (Supp. IV, 1974).



A "back-of-the-envelope" cost-benefit analysis of the four projects authorized in 1974 illustrates the arguably questionable economic feasibility of such projects.

TABLE II<sup>93</sup>  
ESTIMATED COSTS OF  
SALINITY CONTROL PROJECTS

	COSTS			BENEFITS	
	Capital	Annual Operating	Annual Depletion of Water (acre-feet)	Annual Reduction in Costs for Downstream Users	Reduction in Salinity Level at Imperial Dam (ppm)
Paradox Valley	\$16,000,000	\$350,000	5,800	\$3,680,000	-16
Grand Valley Basin	59,000,000	None	None	4,370,000	-19
Crystal Geyser	500,000	None	150	69,000	- 0.3
Las Vegas Wash	No Estimate	No Estimate	No Estimate	No Estimate	-13

These costs are 75 percent nonreimbursable; the reimbursable portion is to be paid out of the Upper and Lower Basin Development Funds,<sup>94</sup> which derive their revenues from surplus payments from federal power projects.<sup>95</sup> Thus, while upstream irrigators, who are responsible for 75 percent of the man-caused salinity, are relieved of financial responsibility for the costs they impose on downstream users, downstream irrigators, who receive 80 percent of the benefit (since they suffer 80 percent of the damages of salinity) from improvements in the quality of water, enjoy such benefits cost-free.

93. INTERIOR PROGRESS REPORT No. 7, at 73-90. Cf. the basin states' view, FORUM PROPOSED STANDARDS FOR SALINITY, at 102. However, the cost of water development projects has been consistently underestimated, and sometimes by factors of more than two. Mann, *supra* note 17, at 160-61; see also 6 ENVIRONMENT REPORTER CURRENT DEVELOPMENTS 1327 (1975). In that the engineering technology involved in the salinity projects is new and untried, one could anticipate significant cost overruns which would, of course, weigh the cost-benefit analyses even further against the economic feasibility of construction.

94. 43 U.S.C. § 1595 (Supp. IV, 1974).

95. 43 U.S.C. §§ 618, 620, 1543 (1970).

*Federal-State Responsibilities*

The Forum plan envisages the below-listed major elements:

1. Prompt construction and operation of the initial four salinity control units authorized by Section 202, Title II of Pub. L. No. 93-320 [43 U.S.C. § 1592 (Supp. IV, 1974)].
2. Construction of the twelve units listed in Section 203(a) (1), Title II of Pub. L. No. 93-320 [43 U.S.C. § 1593 (Supp. IV, 1974)], or their equivalents after receipt of favorable planning reports.
3. The placing of effluent limitations, principally under the National Pollution Discharge Elimination System (NPDES) permit program provided for in Section 402 of Pub. L. No. 92-500 [33 U.S.C. § 1342 (Supp. IV, 1974)] on *industrial discharges*.
4. The *reformulation* of previously authorized, but unconstructed, federal water projects to reduce the salt loading effect of return flows.

The plan also contemplates the use of saline waters for *industrial* purposes wherever practicable, programs by water users to cope with the river's high salinity, improvements in irrigation systems and management to reduce salt pickup, studies of means to minimize salinity in municipal discharges, and studies of future possible salinity control programs. (emphasis added)<sup>96</sup>

The states clearly envisage federal responsibility for all major projects, to include construction and operation of salinity control units, while the states focus on implementation of permit systems, planning, and education.<sup>97</sup> The principal responsibility which the states wish to impose on the federal government is financial.<sup>98</sup>

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96. FORUM PROPOSED STANDARDS FOR SALINITY, at 63-64.

97. *Id.* at 66-92.

98. *Id.* at 108, 110.

*The Pattern Continues*

The coordinated approach of the federal and basin states governments to salinity control above Imperial Dam evidences the characteristics of Colorado River politics discussed above.<sup>99</sup>

*Primacy of the rural-reclamation and tiller-of-the-land ethic.* To the extent that estimates can be made of the use of future depletions in the Upper Basin that will be facilitated by planned projects, the primacy of the agricultural ethic is being eroded to some degree. Anticipated energy and energy-related industrial development will make significant demands on Upper Basin water.<sup>100</sup> Furthermore, municipalities in the Upper Basin will continue to exert increasing demands for water.<sup>101</sup> Nonetheless, current estimates envisage the development of 302,760 acres of new irrigated lands by 2010, or more than double the existing irrigated lands for the entire basin. Much of this development will be accomplished by federally funded water projects, while projects to control the salinity impacts of these programs will also be federally funded. The lion's share of the reimbursable costs allocated to these projects will probably continue to be borne by power users. Thus, to a large degree, irrigated agriculture enjoys the benefits of water use on a cost-free or at least subsidized basis, while at the same time escaping financial responsibility for the costs it imposes.

*Protection of vested private water rights.* The basin states' approach to salinity control is conditioned on federal recognition of the "Law of the River," which includes private rights. Presently existing rights are insulated from the true economic costs inherent in the right and are protected functionally in the sense that new demands will be satisfied to some degree from future developments and augmentation. The probable result is that economically marginal uses of water will be preserved.

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99. See text accompanying notes 29 to 33, *supra*.

100. Weatherford & Jacoby, *supra* note 74, at 171-75; see also INTERIOR PROGRESS REPORT No. 7, at 54-59.

101. *Id.*

*Protection of future development potential.* The basin states have not only attempted to protect future development, they have in coordination with the federal government adopted a policy of development first, quality control second. Both the EPA regulations<sup>102</sup> and the Forum plan<sup>103</sup> only require that control measures "be included in the plan" and impliedly approve projects where development will precede completion of salinity control measures.<sup>104</sup>

*Federal assumption of costs.* As discussed above, the federal government will assume the lion's share of the financial burden, while reimbursable costs will be assumed principally by power users. Furthermore, it is not unlikely that a significant portion of the moneys required for the improvement of irrigation techniques, research, education, etc. will directly or indirectly come from the federal treasury.

*Engineering over economics.* Massive engineering projects are planned to attack the natural sources of salinity. To be sure, the engineering feasibility of some of these projects is highly questionable—a fact admitted even by their proponents<sup>105</sup>—while the economic considerations, while being far from simple, stand on less than firm evidence of favorable cost-benefit analyses. At the same time, technical understanding of how to cope with the principal source of man-caused salinity—irrigation—remains cloudy at best. Nonetheless, massive engineering projects to reduce naturally occurring salinity are propounded while plans proceed to double the irrigated lands in the basin. It is conceivable that the taxpayer might be better off merely paying higher food prices directly, rather than through what ultimately amounts to a massive subsidization of irrigated agriculture. Whether or not that is the case, the question merits examination.

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102. 40 C.F.R. § 120.5 (c) (2) (iv) (1975).

103. FORUM PROPOSED STANDARDS FOR SALINITY, at ii-iii.

104. See the conclusions of the National Commission on Water Quality, *supra* note 61.

105. INTERIOR PROGRESS REPORT No. 7, at 73-111.

SALINITY AND FEDERALIZATION  
OF THE RIVER

As Dean Trelease observed upon reviewing *Arizona v. California*,<sup>106</sup> the question is no longer one of federal authority but rather whether the federal government will exercise such authority. While this observation was directed at the question of quantity, it would seem even more appropriate to issues of salinity control.<sup>107</sup> Given that the states view the reduction of the salinity of water being delivered to Mexico as a federal responsibility,<sup>108</sup> and that the principal effort to cope with the problem above Imperial Dam is being fueled by the EPA under the requirements of the Federal Water Pollution Control Act Amendments of 1972,<sup>109</sup> it can be argued that the absence of greater federal intrusion is presently largely a function of the lack of any significant articulated opposition to water politics as usual in the Colorado River Basin.

As one political observer has noted, the only significant opposition to Colorado River politics has come from environmental interests.<sup>110</sup> The spectre of opposition to massive federal expenditures for salinity control is at least nominally suggested by a court challenge to an EPA exemption from the NPDES permit system of certain agricultural lands.<sup>111</sup> Whether such opposition, either on environmental or fiscal grounds, will manifest itself sufficiently to spur any rethinking of future development projects or of planned salinity control projects is entirely speculative. What is apparent, however, is that development without salinity control will merely rekindle the salinity problem with the Mexican government. The lower basin states may well find themselves in an unexpected and informal coalition with the Mexicans as Upper Basin development impacts upon them much in the same manner as the Welton-Mohawk District impacted upon

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106. Trelease, *supra* note 58, at 203-05.

107. See text accompanying note 74, *supra*.

108. See generally FORUM PROPOSED STANDARDS FOR SALINITY.

109. 33 U.S.C. §§ 1251 to 1376 (Supp. IV, 1974).

110. Mann, *supra* note 17, at 147-48; Mann, *Politics in the United States and the Salinity Problem of the Colorado River*, *supra* note 29, at 119.

111. Natural Resources Defense Council v. Train, 7 E.R.C. 1881 (1975).

the Mexicans in 1961. The potential for interbasin conflict is manifest—and materialization of such prolonged conflict could well provide an additional spur to increased federal intrusion, as it did in the prolonged Arizona-California dispute.

### CONCLUSIONS

The prolonged interbasin and interstate battles over the development and the allocation of the waters of the Colorado River are very recent history, as is the negotiation of the 1944 Treaty allocating water to Mexico. The salinity problem has rekindled the Mexican-American dispute and although an agreement appears to have brought calm upon the international border, it is questionable if that agreement ought to be labeled “permanent and definitive”. Just as there remains the very real potential for future disputes at the border over salinity, salinity could likewise rekindle a major interbasin dispute. The success of on-going efforts to resolve the salinity problem of the Colorado River will be determinative of whether or not such disputes will materialize.

This Comment has briefly surveyed the general outline of the approaches which have been formulated to resolve the growing salinity problem faced by both Mexican and American users of Colorado River water. The conclusions are neither original nor surprising—it's politics as usual on the river, and the engineers are having a greater say in the matter than are the economists. What is new, however, is the complexity of the problem and the vast amount of resources which will be required, first to understand it, and second, to solve it. The federal government appears to be leading the way.

Federal leadership and federal assumption of the lion's share of financial responsibility very early on clearly suggest greater federal influence over the long haul. Whereas a significant portion of the “Law of the River” with respect to allocation and use of the waters of the Colorado River is

state law, the legal framework which appears to be emerging with respect to quality is largely federal law. In the long term, however, it is not clear that two separate legal frameworks can be maintained—one for allocation and use, and one for quality. Available quantity directly affects quality, and quality directly affects use. Thus, one can reasonably propound the proposition that salinity may well spur further “federalization” of the Law of the River in toto.

The massive flow of federal dollars, past, present, and anticipated, into the Colorado River Basin is in large part a subsidization of irrigated agriculture. While this pattern of federal spending may be justified by a variety of larger considerations, both regional and national, these considerations are not being articulated and are thus susceptible to attack not only by other competitors for federal dollars, but also by other segments of the agricultural industry.

On-going and anticipated changes in the structure of the economy of the Colorado River Basin may also have direct and profound impacts upon issues of Colorado River water quantity and quality. Expansion of municipal, industrial and energy-related uses of water and contraction of the amount of water devoted to irrigated agriculture has a direct effect on the salinity problem. Different uses can withstand different levels of salinity and contribute to salinity in varying degrees. Finally, different uses may well contribute to quality problems other than salinity.

Thus, this Comment not only queries the approaches which have been formulated to address the salinity problem, it also asks if the proper questions have been raised.

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